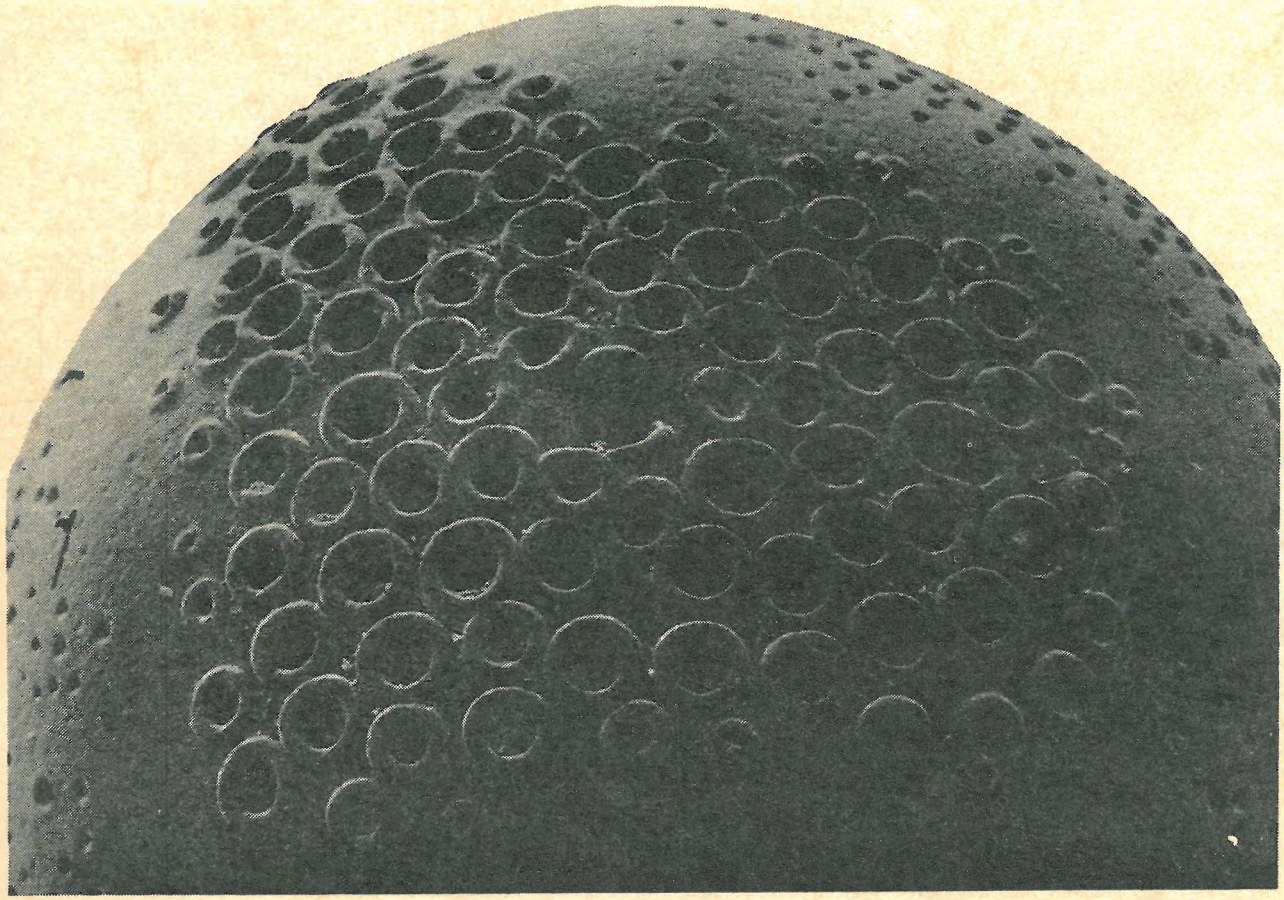
DISTRIBUTION PATTERNS AND TAXONOMY OF BENTHIC FORAMINIFERA IN THE LIZARD ISLAND REEF COMPLEX, NORTHERN GREAT BARRIER REEF, AUSTRALIA



2 **TAXONOMY**

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INTRODUCTION

Although I am aware of the fact that the species concept in Foraminifera should (and will be) subjected to a thorough re-evaluation in the (near) future, this species concept remained so far the cornerstone of biological taxonomy in general and foraminiferal taxonomy in particular. As long as no alternative models are born out of the creative works of biologists and palaeontologists, we will be obliged to deal with the "classical" systematics, "faute de mieux".

As far as this systematic survey of Lizard Island benthonic Foraminifera is concerned, I have tried to contribute to the understanding of relationships between foraminiferal "taxa" on one hand, and between the foraminiferal communities and their environment on the other (including substrates).

(Eco-)variability revealed to be very high in the study area. Traditional "species" cannot always be separated taxonomically, whereas in several cases gradational series leading from one variant to the other have been observed. Moreover, as morphological adaptations bound to light-depth-substrate variability are important, even on the relatively small scale of our study area (see Part 1), it results that, in many cases, the existing classical systematics cannot be applied in a satisfactory way. This is why I have been compelled to make a repeated use of slightly "unorthodox" taxonomic ways of presentation, as I remained anxious to show an observed reality rather than to weld my observations into the rigidity of strict taxonomic rules.

As a taxonomic framework, the foraminiferal classification proposed by LOEBLICH & TAPPAN (1964) (adapted auct. cit. 1974) has been adopted. In those cases where specific designations could no longer be reasonably used as such, I have tried, whenever possible, to conserve currently used species names as subspecific designations in order to avoid supplementary confusion and/or nomenclatural overcrowding; nevertheless, in spite of this position, I have not been able to avoid the creation of a limited number of "new" species, nor the introduction of a few new names as specific or subspecific designations.

A systematic comparison with type collections has not been carried out as this was practically impossible; determinations have mainly been controlled by means of illustrations and descriptions available in the literature.

Nevertheless, comparisons with material from several selected localities appeared very useful; these are : the Persian Gulf (peneroplids-coll. KEIJ); the Red Sea - the Gulf of Elat (coll. HOTTINGER); New Guinea (courtesy K. WOUTERS); Australia - other Great Barrier Reef localities (coll. MONTY); Barbuda - the Caribbean (coll. BRASIER); the Bahamas (coll. MONTY); the Mediterranean (coll. BLANC-VERNET).

Among the 227 species present in the Lizard Island samples, 4 were described as new, viz. Quinqueloculina montyi; Pyrgo lundgreni; Monspeliensina dubuissoni and Elphidium galeraensis.

1 New name has been introduced as a specific designation : Miliolinella albatrossi.

2 New names have been used herein as subspecific designations : Quinqueloculina oblonga segersi and Quinqueloculina oblonga lizardi.

The systematic comments on the taxa (species or subspecies) contain a synonymy list followed by the headings "Description", "Diagnostic Remarks and Distribution" and "Occurrence".
For new species the headings "Differential Generic Diagnosis", "Differential Specific Diagnosis", and indication of holo- and paratypes are added.

Synonymy lists do not claim completeness; in most cases only the more important works are mentioned, as well as those containing relevant illustrations. In the case of recently revised genera or species only the references of the revising author(s) have been indicated, together with (eventual) holotype reference, and some additional works. The following symbols and abbreviations have been used in the synonymy lists; they precede the species name, authors name, date, pages and figs. in the publication referred to; the complete references are to be found in the chapter "References" at the end of this work.

"+" = Holotype reference; "L" = Lectotype reference; "non" = indicates erroneous use of the name by the mentioned author; "pars" = means that only the (indicated) part of the reference fits the proposed designation; "?" = means that synonymy is uncertain for some reason (absence of, or poor illustration; poor description, ...);"E" indicates the emendation of the concerned taxon (species) by the author mentioned in the reference preceded by this symbol; "N" = Neotype reference; the abbreviation "cf" has been used in a few cases where only reference to, or illustration of the taxon referred to as "cf" in the specific designation, has been found.

The synonymy lists are followed by the heading "Description". A description has only been provided for the new species, and in a few cases where no sufficient description was available in the literature. In all other cases the reference(s) of the work(s) providing a description of the concerned taxon are given.

The heading "Diagnostic Remarks and Distribution" contains indications of the most characteristic diagnostic features, and an (eventual) discussion on variability, as well as the (known) distribution of the taxon (species) in the actual seas, oceans and (sub)recent deposits. The first appearance (geologic period) of the taxon has been indicated only where this could be done more or less safely and without entering into phyletic and/or stratigraphic arguments beyond the scope of this systematic review.

Under the heading "Occurrence" the distribution and relative frequency of the taxon in bio- and thanatocoenoses of Lizard Island sediments are concisely indicated. More detailed information on this subject is to be found in Part 1 of this study.

The heading "Differential Generic Diagnosis" (only for new species) provides a justification for the species being placed in the concerned genus (comparison with related genera); whereas the heading "Differential Specific Diagnosis" provides the same information at specific level.

Illustration of the discussed taxa is to be found in a separate volume, the "Atlas of Foraminifera", to which figure- and plate indications following the specific designation in the present volume refer.

Material (samples) is deposited in the Laboratory of C.A.P.S., State University of Liège, Dir. Dr. MONTY. A foraminiferal collection comprising representatives of different taxa is in my personal collection while the type material will be deposited in the collections of the Geological Institute of the University of Basel, Switzerland (Prof. Dr. L. HOTTINGER).

Order FORAMINIFERIDA EICHWALD, 1830

SUBORDER TEXTULARIINA DELAGE & HEROUARD, 1896

DUPERFAMILY AMMODISCACEA REUSS, 1862

Family SACCAMINIDAE BRADY, 1884

Subfamily PSAMMOSPHAERINAE HAECKEL, 1894

Genus Psammosphaera SCHULZE, 1875

Psammosphaera fusca SCHULZE, 1875

(Pl. 1, figs. 1-2, textfig. 1)

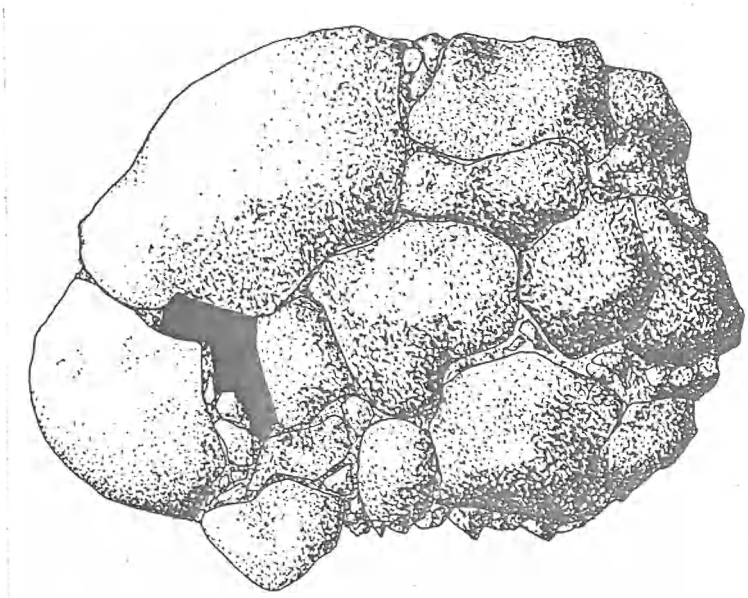
+ 1875 Psammosphaera fusca; - SCHULZE, p. 113, pl. 2, fig. 8.
1884 Psammosphaera fusca SCHULZE; - BRADY, p. 249, pl. 18, figs. 1-8.
1897 Psammosphaera fusca SCHULZE; - FLINT, p. 268, pl. 8, fig. 1.
1910 Psammosphaera fusca SCHULZE; - CUSHMAN, p. 35, figs. 25-28.
1960 Psammosphaera fusca SCHULZE; - BARKER (see ref. BRADY 1884).
1964 Psammosphaera fusca SCHULZE; - LOEBLICH & TAPPAN, p. C 195, fig. 110-1.
1979 Psammosphaera cf. P. fusca SCHULZE; - PEREIRA, pl. 2, figs. A-B.

Description : Test free, single-chambered, (sub)globular; wall firmly agglutinated, consisting of more or less rounded, rather coarse quartz grains cemented together by means of a cement containing smaller grains. Aperture indefinite.

Diagnostic Remarks and Distribution : The specimens in our material resemble the Atlantic specimens figured by LOEBLICH & TAPPAN (1964). Our specimens all show the same kind of rounded quartz grains of more or less equal relative dimensions. Some of the Lizard Island specimens show an irregular outline due to incorporation of larger grains in the test wall. In most specimens no definite aperture can be observed; in one specimen a small, irregular aperture, showing as a void between two or more grains could be demonstrated (see textfig. 1). Our specimens were all of them recorded alive, empty tests are completely absent (suggesting a fairly rapid disaggregation of the test wall after death).

Originally described from the North Pacific Ocean, the species has been recorded several times from Indopacific localities (H. ALLEN & EARLAND, 1915; PEREIRA, 1979).

Occurrence : Recorded alive exclusively. Extremely rare in intertidal environments and in the Perireefal Area; rare to common in the Lagoon.



Textfig. 1 : Psammosphaera fusca :

Specimen from the Coconut Fringing Reef Flat (L 254); the single specimen showing an aperture (black patch between the two larger grains on the left of the figure). Drawing made after a routine sketch (the specimen has been lost during manipulation before it could be photographed). Dimensions : same order of magnitude as the specimen figured on Pl. 1, fig. 1.

Superfamily LITUOLACEA de BLAINVILLE, 1925

Family HORMOSINIDAE HAECKEL, 1894

Subfamily REOPACINAE CUSHMAN, 1910

Genus Reophax MONTFORT, 1808

Reophax fusiformis (WILLIAMSON), 1858

(Pl. 1, figs. 3-6).

+ 1858 Proteonina fusiformis; - WILLIAMSON, p. 1, pl. 1, fig. 1.
1884 Reophax fusiformis (WILLIAMSON); - BRADY, p. 290, pl. 30, figs. 7-11.
1910 Proteonina fusiformis WILLIAMSON; - CUSHMAN, pt. 1, p. 41, fig. 39.
1959 Reophax fusiformis (WILLIAMSON); - GRAHAM & MILITANTE, p. 23, pl. 1, fig. 8.
1960 Reophax fusiformis (WILLIAMSON); - BARKER (see ref. BRADY 1884).
1960 Reophax scorpiurus MONTFORT; - HOFKER, p. 234, fig. 2.

Description : See WILLIAMSON, (1858).

Diagnostic Remarks and Distribution : Our specimens differ from the typical in that flaky or otherwise flattened calcareous fragments are frequently used to build up the test wall. Halimeda - fragments as well as foraminiferal test fragments are preferably used and these particles are of considerable relative dimensions; nevertheless, the general test morphology is respected in most cases and the overall shape of our Lizard Island specimens is well comparable to specimens described in the literature though there is some variation in the elongation of the test.

More or less constant features of our specimens are the obscured sutures (except perhaps for the last-formed one), and the excentric position of the aperture. No definite neck is present; the aperture is simply formed as an opening between the calcareous flakes, a little bit retouched by the animal using smaller grains to fill in the angles (see fig. 4c, pl. 1).

Sectioned specimens show the septa consisting of the same kind of thin calcareous flakes (being easily broken away during sectioning). Generally there is no trace of earlier septa and only the septum separating the last-formed and penultimate chamber can be detected (pl. 1, fig. 6). On the figured section (pl. 1, fig. 5), traces are visible of the protoplasm in the

last two formed chambers and of the narrow septal foramen through which the protoplasm flow is constricted; this specimen demonstrates the use of foraminiferal fragments (soritids, Amphistegina, miliolids) in its own test-wall fabric; the porous and chambered nature of these fragments might play a role in the animal's connections with the outside environment (compare with textulariid pseudopores).

This species seems to be widely distributed but not so often encountered; it has been recorded from the North Atlantic Ocean (BRADY, WILLIAMSON), the Mediterranean (HOFKER, 1960), the Indopacific (Philippines, Hawaii, Bonin Islands (CUSHMAN, 1910, GRAHAM & MILITANTE, 1959). The species is not recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare at several perireefal stations and at the Lagoon Entrance (L 120); living specimens as well as empty tests. Present, alive, in one sample of the Internal Platform (L 162).

Reophax scorpiurus MONTFORT, 1808
(Pl. 2, fig. 1a-b).

+ 1808 Reophax scorpiurus; - MONTFORT, p. 330, 83me genre.
1884 Reophax scorpiurus MONTFORT; - BRADY, p. 291, pl. 30, fig. 12.
1897 Reophax scorpiurus MONTFORT; - FLINT, p. 273, pl. 16, fig. 3; pl. 17, fig. 1.
1910 Reophax scorpiurus MONTFORT; - CUSHMAN, p. 83, fig. 114 (non fig. 116).
1937 Reophax scorpiurus MONTFORT; - CHAPMAN & PARR, p. 149.
1941 Reophax scorpiurus MONTFORT; - CHAPMAN, p. 191.
1944 Reophax scorpiurus MONTFORT; - CUSHMAN, p. 10, pl. 1, fig. 19.
1944 Reophax cf. pilulifer BRADY; - CUSHMAN, ibid., fig. 21.
1944b Reophax scorpiurus MONTFORT; - CUSHMAN & MOYER, p. 51, pl. 7, fig. 1.
1960 Reophax scorpiurus MONTFORT; - BARKER (see ref. BRADY 1884).
1964 Reophax scorpiurus MONTFORT; - LOEBLICH & TAPPAN, p. C 216, fig. 128-1.
1973 Reophax scorpiurus MONTFORT; - LANKFORD & PHLEGER, p. 127, pl. 1, fig. 2.

Description : Test free, elongate, slightly arcuate in the initial part of the test; three to five chambers increasing in size as added; sutures straight, horizontal, moderately constricted; aperture terminal, rounded, at the elongated and of the last chamber. Surface rough; wall agglutinated, with comparatively little cement; consisting of predominantly large, flattened or angular grains, mostly quartz (note crystal in the center of the wall of the last chamber, fig. 1a, pl. 2) and mica's.

Diagnostic Remarks and Distribution :

There has been a lot of confusion about this species; CUSHMAN (1910) summarized the situation which has not so much changed since then : "A review of the above synonymy will show that this specific name has been a sort of dumping ground for every irregular arenaceous foraminifer or worn tube which is not definitely coiled or not well characterised". For any further discussion about this species, see synonymy. As far as our Lizard specimens are concerned, we have attributed to this species only those agreeing with our description.

The species has been recorded from a great number of Atlantic and Indopacific localities, temperate as well as tropical, ranging from littoral to bathyal depths, but obviously only part of these records are concerned with the real, typical R. scorpiurus as it is described and pictured e.g. by FLINT (1897), LANKFORD & PHLEGER (1973).

The species might have a more or less cosmopolitic destribution in shallower waters. It is not mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; a few specimens, only empty tests, have been found in the Eastern and Northern Perireefal Area.

Family NOURIIDAE CHAPMAN & PARR, 1936

Genus Nouria HERON - ALLEN & EARLAND, 1914

Nouria harrisii HERON - ALLEN & EARLAND, 1914
(Pl. 2, figs. 2-3).

\+ 1914 Nouria harrisii:- HERON - ALLEN & EARLAND, p. 376, pl. 37, fig. 16-20.
1924 Nouria harrisii HERON - ALLEN & EARLAND; - CUSHMAN, 1924, p. 10, pl. 1, fig. 1.

Description : See H. ALLEN & EARLAND (1914).

Diagnostic Remarks and Distribution : Although we have only a few specimens at our disposal they are so characteristic that there can be hardly any doubt upon the determination. The polymorphinoid chamber arrangement can clearly be seen and excludes any confusion with the other sponge spicule-walled species Technitella legumen NORMAN (equally recorded by COLLINS (1958) from the Great Barrier Reef). The extension of some spicules from the base of the test backward from the aperture is equally visible in our figured specimens. The test is very fragile and easily breaks when dry; empty tests probably disintegrate very rapidly and are not encountered in the thanatocoenoses.

The species has been reported from several Indopacific localities but has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Extremely rare; only a few living specimens in some samples from the Perireefal Area.

Nouria polymorphinoides HERON - ALLEN & EARLAND, 1914
(Pl. 2, figs. 4-7).

\+ 1914 Nouria polymorphinoides;-HERON - ALLEN & EARLAND, p. 376, pl. 37, figs. 1-15.

1958 Nouria polymorphinoides HERON - ALLEN & EARLAND; COLLINS, p. 24.

L 1964 Nouria polymorphinoides HERON - ALLEN & EARLAND; LOEBLICH & TAPPAN, p. C220, fig. 132.

1973 Nouria polymorphinoides HERON - ALLEN & EARLAND; LANKFORD & PHLEGER, p. 123, pl. 3, fig. 1.

1974 Nouria polymorphinoides HERON - ALLEN & EARLAND; LUTZE, pl. 1, figs. 17-21.

1975 Nouria polymorphinoides HERON - ALLEN & EARLAND; SEIBOLD, p. 178, pl. 1, fig. 1.

1975 Nouria polymorphinoides HERON - ALLEN & EARLAND; WANTLAND, p. 385, fig. 13, d.

1977 Nouria polymorphinoides HERON - ALLEN & EARLAND; HAAKE, p. 66, pl. 2, fig. 5.

Description : See H. ALLEN & EARLAND, 1914 (part I - see also comments in part II, p. 615).

Diagnostic Remarks and Distribution : The same remark as that made by COLLINS (1958) about his Great Barrier Reef specimens is valid here : "specimens are elongate and built of large flaky calcareous fragments". The external surface is rather smooth (except for some irregular grains), in particular near the aperture where smaller grains are incorporated in the test wall. The sutures are obscured and the polymorphine chamber arrangement cannot easily be detected. Specimens are strongly compressed and the typical oval, sometimes slightly curved shape of the aperture is a constant feature. The chamber wall is relatively thin (though not transparant) and is easily broken. There is few variation in our Lizard specimens; they all resemble the lectotype figured by LOEBLICH & TAPPAN (1964) from the Kerimba Archipelago.

There seems to be an important variation in the degree of compression of the test of the species as it is described by various authors; the outline ranges from rounded to strongly flattened in peripheral view.

To what degree this species is related to Nouria textulariformis is difficult to find out as no characteristic representants of the latter species s.s. occur in our material.

The species is widely distributed in (sub)tropical shallow waters; it has been recorded from the Indopacific (Kerimba Archipelago, South India; Persian Gulf; Great Barrier Reef; Japan; California); from Belize Shelf (British Honduras), and from the Mediterranean (Adriatic Sea).

Occurrence : Rare to common in the Eastern Perireefal Area; living specimens as well as empty tests.

Nouria tenuis HADA, 1931
(Pl. 3, figs. 1a-c).

\+ 1931 Nouria tenuis; - HADA, p. 94, tf. 47 a-b.
1958 Nouria tenuis HADA; - COLLINS, p. 351.

Description : Our specimen shows the following features : a very flattened, leaf-like test upon which the nourioid chamber divisions can hardly be suspected as faint depressions; a thin, fragile test wall consisting of mineral grains (mica flakes and others), calcareous flakes ans sponge spicules; a sharp-edged periphery where sponge spicules are longitudinally concentrated and from which some spicules project backwards from the aperture; the oral top part of the test is almost perfectly semicircular, the aboral end more irregular; the aperture is a narrow fissure at the periphery between bundles of sponge spicules.

Diagnostic Remarks and Distribution : The single specimen found in our material corresponds completely to HADA's (1931) description and figuration; there cannot be any doubt upon its determination notwithstanding its scarcity.

The species has been recorded by COLLINS (1958) from the Great Barrier Reef; he too found only two specimens in one sample off Low Islands in a depth of about 10 fathoms. HADA's types are from Mutsu Bay, Japan. I was unable to find any further references to this species.

Occurrence : One single specimen, an empty test, at station L 81, Eastern Perireefal Area.

Nouria textulariformis HADA, subsp. armata COLLINS, 1958
(Pl. 3, figs. 2a-b).

+ 1958 Nouria textulariformis HADA, armata n. subsp.; - COLLINS, p. 352, pl. 1, fig. 11.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : The few specimens in our material show the typical feature of the subspecies : "sponge spicules built into the test and projecting at the periphery, directed backward from the aperture".

No other references to this species have been found except for COLLINS' (1958) record from the Great Barrier Reef. To what degree these specimens are related to N. polymorphinoides, or might be considered as ecovariants of the latter species, is not clear.

Occurrence : Only a few empty tests at station L 292 (North Point), at the foot of the fringing reef front.

Family LITUOLIDAE de BLAINVILLE, 1825

Subfamily HAPLOPHRAGMOINIDAE MAYNC, 1952

Genus Discammina LACROIX, 1932

Discammina compressa (GOES), 1882
(Pl. 3, figs. 3a-b).

+ 1882 Lituolina irregularis ROEMER var. Compressa; GOES p. 141, pl. XII, figs. 421-423.
1884 Haplophragmium emaciatum BRADY; - BRADY, p. 305, pl. XXXIII, figs. 26-28.
1897 Haplophragmium emaciatum BRADY; - FLINT, p. 276, pl. 19, fig. 5.
1910 Haplophragmoides emaciatum (BRADY); - CUSHMAN, p. 102, figs. 150-152.
1915 Haplophragmium compressum (GOES); - HERON - ALLEN & EARLAND, p. 613, pl. XLVI, figs. 20-21.
1932 Discammina compressa (GOES); - LACROIX, p. 15 fig.
1960 Discammina compressa (GOES); - BARKER (see ref. BRADY 1884).
1964 Discammina compressa (GOES); - LOEBLICH & TAPPAN, p. C226, fig. 136-10.

Description : See BRADY (1884).

Diagnostic Remarks and Distribution : Whether or not both the included types (H. emaciatum and D. compressa) represent one and the same species, is a question which has been abundantly discussed in the literature (see in particular LACROIX (1932), BARKER (1960), and LOEBLICH & TAPPAN (1964). Anyway, our Lizard specimens are perfectly referable to BRADY's (1884) and FLINT's (1897) figures. The strongly compressed test and the shape of the aperture (higher and narrower than in true Haplophragmoides) indicates that we are indeed dealing with a true Discammina, though we did no dissections to reveal the internal structure because of the lack of sufficient specimens. The inclusion of sponge spicules in the test wall, which can clearly be seen on our SEM-photographs, seems to be a constant feature of the emaciatum - form. If this form is ever revealed to be a distinct species, this should be called Discammina emaciata BRADY, to which our specimens would belong.

The species is widely distributed and has been recorded from the West Indies, Japan, Hawai, Midway(CUSHMAN 1910); Cuba, Brazil (FLINT 1897); Antarctic, Tasmania, New Zealand (CHAPMAN 1941).

The species is not mentioned by COLLINS (1958) from the Great Barrier Reef though it might be possible that some of his specimens of Haplophragmoides canariensis could belong here.

Occurrence : Rare; a few living specimens and empty tests in three perireefal and one deeper Patchreef Area samples.

Subfamily LITUOLINAE de BLAINVILLE, 1825

Genus Ammobaculites CUSHMAN, 1910

Ammobaculites sp. (TODD)
(Pl. 3, figs. 4a-b).

cf 1961 Ammobaculites sp.; - TODD, p. 177 (tab.), pl. 22, fig. 1.

Description : Test free, early portion very close planispirally coiled; later portion rectilinear, uncoiled, rounded in section; wall coarsely agglutinated; sutures obscured throughout, horizontal in rectilinear portion; moderately constricted; aperture rounded, terminal, on top of the slightly elongated apertural end of the last-formed chamber.

Diagnostic Remarks and Distribution : A few specimens of this species and genus have been found; to my knowledge they do not correspond to any other Ammobaculites - species described from the literature; they strongly resemble the specimen figured by TODD (1961) from the Gilbert Islands (lagoon Onotoa Atoll) though in our specimens the test wall is more coarsely agglutinated. Unfortunately this author does not provide in further details or description of the form.

Occurrence : A few specimens, some possibly alive, found in samples from the Lagoon, Sandy Shoal and Patchreef Area.

Subfamily PLACOPSILININAE RHUMBLER, 1913

Genus Haddonia CHAPMAN, 1898

Haddonia minor CHAPMAN, 1901
(Pl. 3, figs. 5a-b; pl. 4, figs. 1-5).

+ 1901 Haddonia minor; - CHAPMAN, p. 384, pl. 36, figs. 162.
1958 Haddonia minor CHAPMAN; - COLLINS, p. 352.

Description : See CHAPMAN (1901).

Diagnostic Remarks and Distribution : This is one of the exceptional attached species included in this study because of its persistent presence in the reef-flat sediments where it cannot be overlooked. In those sediments large, free, specimens occur; occasionally they are attached to different kinds of substrates (sand grains, Halimeda-,mollusc or other calcareous fragments). In the sediment the test seems free because it easily becomes loose from the substratum post mortem.

The species (very superficially) described by CHAPMAN (1901) as Haddonia minor differs from H. torresiensis in remaining smaller and possessing an initial triserial Verneuilina - stage (as to CHAPMAN) whereas the latter species should be more commonly enrolled in its initial stage.

Our Lizard Island specimens are highly variable in shape and dimensions; a great deal of them were preliminarily referred to some or other problematic textulariid until it became obvious (also with the help of the SEM) that we were dealing with the simpler (tri-) and biserial stages of H. minor; indeed, regularly formed biserial specimens are frequent whereas triserially-staged forms are less obvious; substrate-induced chamber deformations can be seen in these smaller specimens too (see e.g. fig. 5, pl. 3). In reaching the adult growth stages, the specimens become low-chambered uniserial; some show superficial resemblance to Clavulina (e.g. the specimen figs. 2a-b, pl. 4); their aperture(s) gradually change from narrow, U-shaped interiomarginal to large, curved, oval irregular (but always remaining in an either interiomarginal position (figs. 2-3, pl. 4) or in contact with the substrate (e.g. figs. 1 and 4, pl. 4). Completely full-grown specimens are very irregularly twisted, show rapid changes in growth directions and their shape is generally more radically determined by their substratum as they apparently fix themselves upon gradually larger calcareous fragments during their ontogeny (which, by the way, shows that their fixation is not so definitive as it is

the case with really encrusting forms). Specimens are mostly fixed upon the substrate by means of the apertural face, the aperture being in contact with the substrate, the initial test end remaining free; in case of a larger substrate, chamber growth then proceeds over it in an irregularly uniserial way and supplementary aperture(s) may remain open, ensuring a better contact with the substrate (see fig. 4, pl. 4).

Constant features of all specimens are the rounded grains of equal dimensions used in chamber construction, the coarse porosity of the chamber walls (similar to H. torresiensis), the typical yellowish-brown colour of the test and the absence of initially coiled growth stages.

CHAPMAN's types are from Funafuti Atoll; COLLINS (1958) mentions only one specimen (attributed with doubt), from shallow Great Barrier dredgings; in his reef-flat samples this species is apparently not represented.

Occurrence : Rare to common on the reef flats and in sediments partly derived from these (e.g. L 292). No living specimens have been encountered.

Family TEXTULARIIDAE EHRENBERG, 1838

Subfamily TEXTULARIINAE EHRENBERG, 1838

Note on the genera Textularia DEFRANCE, Textilina NØRVANG and Spiroplectammina CUSHMAN

NØRVANG (1966) revised the genus Textularia and created the new genus Textilina. For the first genus, he states that "According to the new, emended definition the genus Textularia exclusively comprises species with a planospiral initial end and imperforate walls". In this way he restricts the number of species in this genus to two, viz. T. sagittula and T. carinata. Most of the species formerly placed within Textularia were transferred to the new genus Textilina, differring from both Spiroplectammina and Textularia in having an adventitious chamber instead of an initial planospire and in the distinct perforation of the chamber wall. As I am not at all convinced of the validity of NØRVANG's argumentation as far as his emendation of the genus Textularia is concerned. I have maintained all the Lizard species of the Textularia-group under the generic name Textularia DEFRANCE; I feel the necessity of a larger-scale investigation of the interrelation between these textulariid genera, particularly because, first, in my opinion NØRVANG's emendation of the genus Textularia is insufficient; and, because

the problem of the initial planospire or adventitious chamber might be a trivial one as other elements such as generation change and the possibility of relation with Gaudryina (triserial initial end in some forms, already suggested by CUSHMAN in 1932) have not been taken in account by NØRVANG.

A glimpse of the complexity of this problem can be captured while examinating our Lizard Island specimens of Textularia porrecta; the presence of an initial planospire in this species was already suspected by H. ALLEN & EARLAND (1915) : "It is possible that some of the specimens had spiroplectine initial chambers but, owing to the texture and opacity of the shell, this feature is extremely difficult to diagnose with certainty".
This small initial planospire can be seen (or is suggested) on LE ROY's (1941) drawings as well as on LLOYD's (1966) figures of Miocene specimens from the Great Barrier Reef. But what happens ? Sectioned specimens from our Lizard Island material (without doubt representing the same species as the one figured by LE ROY and LLOYD) do not show any trace of an initial planospire, and moreover possess the same alveolar wall structure as the remainder of our Textularia's (See figs. 1a-c, pl. 8). Furthermore, even if NØRVANG's argumentation would be valid, I consider that his generic name Textilina, which includes almost every form traditionally referred to Textularia, is an unnecessary complication of nomenclature (which, in the case of Foraminifera, is already sufficiently obscure).

The article published by HALICZ and REISS (1979) on Textulariidae from the Gulf of Elat has been brought to my attention after I had already terminated the first version of these notes. The mentioned authors arrived, independantly, at conclusions identical to mine about the non-validity of the genus Textilina, basing themselves mainly upon SEM-observations of their Red Sea material and upon SEM-study of Spiroplectammina carinata (d' ORBIGNY) from the Miocene of the Vienna Basin. Their observed specimens, belonging to several species, all possess pseudopores, which confirms our observations on Lizard Island material. For full discussion, see HALICZ & REISS (op. cit.).

A final remark concerns the structure of Textularia (in the non-emended sense as it will be used from now on) as revealed by SEM-photographs of entire and sectioned specimens.

The state of knowledge (up to 1973) of agglutinated wall structure has been summarized by MURRAY (1973 b). I will not discuss here the nature of the cement (organic vs. mineralised) binding the detrital particles together, as this has not been investigated in our material (good TEM - replica would be needed for this purpose).

The alveoli, present in agglutinated chamber walls, are nowadays commonly called "pseudopores"; they are "branching and anastomosing, rounded to polygonal in section and blindly ending ... and lined by organic material. In many cases it had been observed that the inner organic layer of the chamber wall closes off the pseudopores from the chamber lumen". (HALICZ & REISS, 1979).

All species of the genus Textularia, represented at Lizard Island, show the same type of wall structure which can be summarised as follows : grains of different types, large and small, are cemented together by means of various amounts of cement secreted by the foraminifer; at the inner, smooth side of the chamber walls a regular pattern of rounded openings appears; these openings form the connections of a more or less labyrintic radial pseudopore system with the chamber lumen; inside the test walls (which may be of various thickness but are in most cases thicker than the non-porous septa), irregular cavities are formed by fusion of pseudopore branches. These cavities are always situated near the outer surface of the test wall and do not have any structural, direct connection with the exterior of the test though they sometimes are only separated from it by a very thin cement layer. These features are particularly well developed in T. pseudogramen and its ecovariant T. pseudogramen subsp.kerimbaensis (see pls. 8, 9, 10).

SEM-photographs reveal the presence of an organic lining covering the inner sides of the test wall, the septa and the pseudopore openings. It is only where this organic lining has been disturbed (preparation technique or natural processes) that the pseudopore openings can be seen. Thus the organic lining apparently does not cover the interior of the pseudopore system (see pls. 5 to 11).

Maximum frequencies of textulariids at Lizard Island occur in the Eastern Perireefal Area (see distribution tables and diagrams, Part 1). Empty tests are far more numerous than living specimens and among the latter, juveniles form the majority (these juveniles often are not specifically identifiable).

Genus Textularia DEFRANCE, 1824

Textularia agglutinans d'ORBIGNY, 1839
(Pl. 4, figs. 6-7).

+ 1839 Textularia agglutinans; - d'ORGIBNY, p. 144, pl. 1, figs. 17-18, 32-34.
1884 Textularia agglutinans d'ORBIGNY; - BRADY, p. 363, pl. XLIII, figs. 1-3.
1897 Textularia agglutinans d'ORBIGNY; - FLINT, p. 284, fig. 4 (only the specimen in the SW corner of the fig.)
1915 Textularia agglutinans d'ORBIGNY; - HERON - ALLEN & EARLAND, p. 626.
1949 Textularia agglutinans d'ORBIGNY; - SAID, p. 5, pl. 1, fig. 3.
1954 Textularia agglutinans d'ORBIGNY; - CUSHMAN, TODD & POST, p. 328, pl. 83, fig. 2.
1957 Textularia agglutinans d'ORBIGNY; - TODD, p. 286, pl. 85, fig. 2.
1959 Textularia agglutinans d'ORBIGNY; - GRAHAM & MILITANTE, p. 26, pl. 1, figs. 18-21.
1960 Textularia agglutinans d'ORBIGNY; - BARKER (see ref. BRADY 1880).
1964 Textularia agglutinans d'ORBIGNY; - ROCHA & UBALDO, p. 28, pl. 1, fig. 3.
non 1973 Textularia agglutinans d'ORBIGNY; - SEN GUPTA & SCHAFER, p. 361, pl. 1, fig. 1.
1974 Textilina agglutinans d'ORBIGNY;- LUTZE, p. 14, pl. 3, figs. 40-41.
1975 Textularia agglutinans d'ORBIGNY; - WANTLAND, p. 385, figs. 3h, 11G.
1979 Textilina agglutinans d'ORBIGNY; - PEREIRA, pl. 2, figs. J-P.

Description : See d'ORBIGNY, 1839; (see also BRADY, 1884).

Diagnostic Remarks and Distribution : In our Lizard Island material a number of characteristic specimens are present. I consider as belonging to this species only those forms which have a rounded periphery, are somewhat elongate and more or less V-shaped in lateral view, not much laterally compressed, have nearly straight horizontal, moderately constricted and relatively high chambers, of which the last one or last few ones are somewhat inflated. The number of chambers in adult specimens oscillates around 19-20. Our specimens generally have a rather rough test wall made up of relatively coarse and irregular grains (even small foraminifer tests and sponge spicules are included) but the general test outline corresponds well to BRADY's (1884) figures and in particular to fig. 2.

Not much cement is visible from the exterior. Sectioned specimens (pl. 4, fig. 7; pl. 5, figs. 1-2) show wall- and internal structure : the septa are curved in the initial stage but become more straight and oblique in later stages. Only megalospheric specimens have been met; they start with proloculus and adventitious chamber immediately followed by the biserial stage. Septal foramina connecting the chambers remain open throughout test development. The inner surface of the chamber walls is smooth; pseudopore openings can be seen. The section of the chamber wall shows pseudopores as well as remmants of the organic lining (e.g. fig. 1, pl. 5).

H. ALLEN & EARLAND (1915) already noted the numerous transitional forms occurring between T. agglutinans and other textulariids. Our Lizard Island material can only confirm the relation of the present species with T. foliacea : wall- and internal structures are the same, as is shown by SEM-photographs (see pls. 4-5-7); T. foliacea only differs from T. agglutinans in its lateral test compression, oblique sutures and septa and narrower aperture. LUTZE (1974) went as far as putting the two forms in synonymy but unfortunately confused T. foliacea and T. foliacea oceanica in his Persian Gulf monography; although I admit that T. agglutinans and T. foliacea (not T. foliacea oceanica) might be ecovariants of the same species, they form well-separated groupings in our Lizard material whereas few transitional specimens occur. Therefore I have kept the two forms separated.

The species seems to be widely distributed in both Atlantic and Indopacific (sub)tropical shelf seas. It has not been mentioned by COLLINS (1958) in his Great Barrier Reef monography.

Occurrence : Rare to common in the Northern and Eastern Perireefal Area; mostly empty tests. Sporadic occurrence in shallow backreef environments (Lagoon, Patchreef Area, Sandy Shoal, Internal Platform). Some questionable living juveniles have been met.

Textularia barkeri HOFKER
(Pl. 5, figs. 3-6).

1884 Textularia trochus d'ORBIGNY; - BRADY, p. 366, pl. 43, figs. 15-16-18.
1960 Textularia sp. nov.; - BARKER (see ref. BRADY, 1884).
+ 1978 Textularia barkeri; - HOFKER, p. 27, pl. 1, fig. 3.

Description : Test free, large (width up to 1 mm or even more); strongly flattened, low conical, much broader than high; outline broadly rounded (some specimens exhibit a slight lateral compression and angularity of the initial chambers); chambers not very numerous (generally not more than 15), low and broad, increasing rapidly in width as added; individual chamber walls slightly concave, bordered at the top of the chamber with a prominent rim which may be somewhat irregular; individual chamber periphery projecting outward in a pagode-like manner, causing the sutures to be slightly depressed; apertural end truncate, flattened to irregularly vaulted; aperture a low, slightly arched slit at the base of the last-formed chamber, occupying about two thirds of the width of the chamber, lying in a depression, bordered by a thin, faint lip; at both extremities of the aperture the last chamber proceeds further over the penultimate chamber; test wall finely to moderately grained, with much cement visible from the exterior, rather smoothly finished. Grains mostly rounded (sometimes sponge spicules are included).

In the initial part of the test the sutures are somewhat obscured, but there is no trace of a planospiral arrangement of the first chambers. Sectioned specimens (see pl. 5, figs. 5a-b, 6a-b) show flattened conical test outline, flattened to slightly curved septa and septal foramina remaining open throughout test development. Early chambers extremely flattened, early septa very thin and easily break away during sectioning. Chamber arrangement biserial throughout. Test wall very thin in the initial part of the test (explaining the almost constant lacking of the embryonic chambers in adult specimens - see figs. 3a-b, pl. 5) but thickening rapidly from the 6th-7th chamber onwards; wall of the last few formed chambers very thick and solid. Inner surface of the chambers smooth; pseudopore openings covered by organic lining (see fig. 5, pl. 5). Pseudopores can be seen in the chamber wall sections. At the joint of test wall and septum the test wall is thickest and apparently the pseudopore cavities are best developed there too (see figs. 5a-b, 6a, pl. 5).

Differential diagnosis : See comments by BARKER (1960), p. 88, and by HOFKER (1978), p. 27, about the relations between the present species and T. trochus d'ORBIGNY, T. trochus BRADY, T. pseudotrochus CUSHMAN, "Textulariella" barrettii, "Textularia" orbica. As BARKER states, the present species is obviously different from all these. Very likely this species has been included by several authors in the species T. pseudotrochus (compare e.g. GRAHAM & MILITANTE, p. 29, pl. 2, fig. 8).

The species is very probably restricted to the tropical Indopacific; BRADY's figured specimens are from off New Guinea. COLLINS (1958) mentions T. orbica from the Great Barrier Reef and I wonder if this designation would not comprise, at least partially, the present species.

Occurrence : Common in the Perireefal Area, living specimens as well as empty tests. Extremely rare in shallow backreef environments.

Textularia candeiana d'ORBIGNY, 1839
(Pl. 6, figs. 1-3).

+ 1839 Textularia candeiana; - d'ORBIGNY, p. 143, pl. 1, figs. 25-27.
1911 Textularia candeiana d'ORBIGNY; - CUSHMAN, pl. 2, p. 12, figs. 14-17.
1915 Textularia candeiana d'ORBIGNY; - HERON - ALLEN & EARLAND, p. 627, pl. 47, figs. 10-16.
1949 Textularia candeiana d'ORBIGNY; - SAID, p. 5, pl. 1, fig. 5.
1954 Textularia candeiana d'ORBIGNY; - CUSHMAN, TODD & POST; p. 329, pl. 83, fig. 3.
1954 Textularia candeiana d'ORBIGNY; - BANDY, p. 139, pl. 29, fig. 2.
1957 Textularia candeiana d'ORBIGNY; - TODD, p. 286, pl. 85, fig. 3.
1958 Textularia candeiana d'ORBIGNY; - COLLINS, p. 352.
1959 Textularia candeiana d'ORBIGNY; - GRAHAM & MILITANTE, p. 27, pl. 1, fig. 22.
1964 Textularia candeiana d'ORBIGNY; - ROCHA & UBALDO, p. 29, pl. 1, fig. 4.
1975 Textularia conica d'ORBIGNY; - WANTLAND, p. 385, figs. 71, 130.
1979 Textilina candeiana (d'ORBIGNY); - PEREIRA, pl. 2, fig. Q, pl. 3, figs. A-C.

Description : See CUSHMAN (1911).

Diagnostic Remarks and Distribution : Our specimens correspond very well with H.ALLEN & EARLAND's figures (1915).The species is characterised by a rapid inflation of the chambers, particularly of the two last-formed ones, these being semi-globular. The periphery is sharp-angular in the initial part of the test, rounded in the final part. The aperture is a low, broad slit at the base of the last chamber. The number of chambers in adult specimens is about 16-19. The rate of inflation of the last chamber is highly variable and the outline of this chamber may be somewhat irregular. The inflation of the last two-formed chambers is a feature which makes the form easily distinguishable from all other textulariids. T. semialata has a smoother surface, overhanging apertural lip and straighter, less depressed sutures.

The wall is rather roughly textured, though not so coarsely finished as T. agglutinans, T. foliacea or T. corrugata; the grains are mostly rounded. Sectioned specimens (pl. 6, figs. 2-3) show the chamber arrangement as biserial throughout, the curved and fragile septa, and the new very thick test walls. Pseudopores and - cavities can be seen in the test wall sections.

The species has been recorded from several Indopacific and Atlantic (West-Indies) tropical localities. It is recorded from the Atlantic Belize Shelf reefs by WANTLAND (1975) as T. conica (d'ORBIGNY), but the figured specimens (SEM-photographs) are very typical T. candeiana identical to our Lizard Island specimens. COLLINS (1958) mentions the species from the Great Barrier Reef but states that it is not well represented there. This might imply that it is more frequent in the previously poorly explored Northern Province of the Great Barrier Reef.

Occurrence : Frequent, mainly in the Eastern Perireefal Area. Living specimens (mostly juveniles) as well as empty tests.

Textularia corrugata HERON - ALLEN & EARLAND, 1915
(Pl. 6, figs. 4-6).

\+ 1915 Textularia conica d'ORBIGNY, var. corrugata; H. ALLEN & EARLAND, p. 629, pl. 47, figs. 24-27.

1932 Textularia corrugata H. ALLEN & EARLAND; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 12, pl. 3, figs. 2, 4.

cf. 1954 Textularia dupla TODD; - CUSHMAN, TODD & POST, p. 329, pl. 83, fig. 6.

1979 Textilina sp. 3; - PEREIRA, pl. 5, fig. H.

Description : See H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : Our specimens are very typically low-chambered and have nearly straight, horizontal sutures. The general outline corresponds very well with CUSHMAN's (1932) figures and is equilaterally triangular in lateral view; the test is laterally compressed, the apertural face flattened and somewhat irregular, and the periphery subacute. The test wall is very roughly textured except for the apertural face which is more smoothly finished. Abraded specimens rapidly lose their coarse-grained aspect (pl. 6, fig. 5). The aperture itself is a straight, narrow slit at the base of the last-formed chamber. A sectioned specimen (pl. 6, fig. 6) shows the septa as curved in the early-formed part of the test, and straight in the later-formed chambers, the chamber arrangement biserial throughout, the test wall solid and with pseudopores, whereas its inner surface shows a regular pore pattern (no organic lining visible).

The number of chambers in adult specimens is about 20. This species has apparently been confused with many textulariids by various authors; there is not much doubt about the identity of TODD's T. dupla with the present species; the only difference mentioned by TODD (1954) is the eventual finer texture of the wall in T. dupla ("... wall ... finely granular, somewhat rough on the surface"). This could be explained by ecovariability, or by the fact that this author had more abraded material at hand. Some forms shown by SAID (1949) might be variants of T. corrugata, particularly his T. aegyptica. Several references by various authors to T. conica might partially involve T. corrugata.

Notwithstanding the scarcity of references, we may safely agree that T. corrugata is widely distributed in Indopacific tropical reefal procinces. H. ALLEN & EARLAND's types are from the Kerimba Archipelago; CUSHMAN (1932) mentions the species from Fiji, Rongelap, the Marshall Islands, Guam, Ladrone Islands. The species has not been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare at some perireefal stations. Empty tests exclusively.

Textularia foliacea HERON - ALLEN & EARLAND, 1915
(Pl. 7, figs. 1-2).

+ 1915 Textularia foliacea; - HERON - ALLEN & EARLAND, p. 628, pl. 47, figs. 17-20.
1921 Textularia foliacea HERON - ALLEN & EARLAND; - CUSHMAN, p. 117, pl. 19, fig. 7.
1932 Textularia foliacea HERON - ALLEN & EARLAND; - CUSHMAN, p. 8, pl. 1, figs. 6-10.
1949 Textularia foliacea HERON - ALLEN & EARLAND; - SAID, p. 6, pl. 1, fig. 9.
1954 Textularia foliacea HERON - ALLEN & EARLAND; - CUSHMAN, TODD & POST, p. 329, pl. 83, fig. 7.
non 1956 Textularia foliacea HERON - ALLEN & EARLAND; - BHATIA, p. 17, pl. 1, fig. 1.
1957 Textularia foliacea HERON - ALLEN & EARLAND; - TODD, p. 286, pl. 85, fig. 5.
1958 Textularia foliacea HERON - ALLEN & EARLAND; - COLLINS, p. 353.
1959 Textularia foliacea HERON - ALLEN & EARLAND; - GRAHAM & MILITANTE, p. 28, pl. 2, fig. 3.
1979 Textilina foliacea (HERON - ALLEN & EARLAND); - PEREIRA, pl. 3, fig. D-H.

Description : See H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : Our specimens are fairly characteristic and correspond completely to H. ALLEN & EARLAND's description (1915), even in the test wall features (" ... composed of sand-grains and other adventitious substances firmly and nearly cemented together, but with a rough external surface"). Most of our specimens use very rough, angular and sharply pointed grains, small foraminifers and sponge spicules as building material, which often obscures the sutures. The very flattened and leaf-like shape of the test is a constant feature. Sectioned specimens (pl. 7, fig. 2) have the chamber arrangement being biserial throughout; in the last-formed part of the test the septa are curved as in T. agglutinans (compare with pl. 4, fig. 7, pl. 5, figs. 1-2). The test wall has pseudopores. An organic lining is partially preserved.

The relationship of the present species with T. agglutinans has been discussed on p. 16. Both forms indeed differ only in the degree of flattening of the test and obliqueness of the sutures and might eventually be considered as ecovariants (see LUTZE, 1974).

T. foliacea seems to be restricted to the Indopacific, no Atlantic localities have been recorded in the literature as far as I know. In nearly all the mentioned localities the species is rare to common but never abundant, and always occurs in smaller numbers than T. foliacea oceanica. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Common in the Perireefal Area, living specimens as well as empty tests. Rare in shallow backreef environments (Sandy Shoal, Patchreef Area, Lagoon).

Textularia foliacea H. ALLEN & EARLAND, subsp. oceanica CUSHMAN, 1932 (Pl. 7, figs. 3-4).

+ 1932 Textularia foliacea HERON - ALLEN & EARLAND, var. oceanica; CUSHMAN, pt. 1, p. 8, pl. 1, figs. 11-12.
1940 Textularia foliacea HERON - ALLEN & EARLAND, var. oceanica CUSHMAN; - LALICKER & MC CULLOCH, p. 128, pl. 14, figs. 12a-c.
1949 Textularia foliacea HERON - ALLEN & EARLAND, var. oceanica CUSHMAN; - SAID, p. 6, pl. 1, fig. 10.
1954 Textularia foliacea HERON - ALLEN & EARLAND, var. oceanica CUSHMAN; - CUSHMAN, TODD & POST, p. 329, pl. 83, fig. 8.
1959 Textularia foliacea HERON - ALLEN & EARLAND, var. oceanica CUSHMAN; - GRAHAM & MILITANTE, p. 28, pl. 2, figs. 5-6.

Description : See CUSHMAN (1932, etc.).

Diagnostic Remarks and Distribution : This is the most widely distributed arenaceous form in our Lizard Island material. The very robust subspecies differs from the main leaf-like, flattened species primarily in its rounded periphery, giving it the general appearance of T. agglutinans from which it differs in its larger dimensions (up to 1.5 mm), less coarse texture and more obliquely set sutures. Some specimens transitional between the present subspecies and T. foliacea are present in our material (see pl. 7, fig. 3); they show the same features as T. foliacea oceanica but are more laterally compressed and have a subsequent narrower aperture.

Sectioned specimens of typical T. foliacea oceanica (pl. 7, figs. 4c-4d) show a biserial chamber arrangement throughout, very obliquely set septa, a thick and solid test wall, pseudopores and an organic lining.

The subspecies seems to be restricted to the Indopacific. COLLINS (1958) does not mention it from the Great Barrier Reef.

Occurrence : Common to abundant in shallow backreef environments, rare in the Perireefal Area. Only empty tests.

Textularia porrecta BRADY, 1884
(Pl. 8, figs. 1-2).

+ 1884 Textularia agglutinans d'ORBIGNY, var. porrecta; - BRADY, p. 364, pl. 43, fig. 4.
1893 Textularia porrecta BRADY; - EGGER, p. 269, pl. 6, figs. 17-18.
1915 Textularia porrecta BRADY; - H. ALLEN & EARLAND, p. 627.
1941 a Textularia porrecta BRADY; - LE ROY, p. 19, pl. 2, figs. 62-63.
1944 b Textularia porrecta BRADY; - LE ROY, p. 75, pl. 1, figs. 5-6.
1958 Textularia porrecta BRADY; - COLLINS, p. 353.
1960 Textularia porrecta BRADY; - BARKER (see ref. BRADY 1884).
1966 Textularia porrecta BRADY; - LLOYD, p. 78, pl. 10, fig. 5.

Description : See BRADY (1884).

Diagnostic Remarks and Distribution : Our specimens agree with the above cited descriptions and figurations. The chambers are low; the sutures of the last chambers are not so obliquely set as mentioned by EGGER (1893). The tests are generally more smoothly finished in the initial part but the texture becomes coarser towards the final chambers; the sutures are rather straight and generally more deeply incised in the last formed part of the test. A constant feature is the pronounced vertical bilateral depression in the median portion of the test where the two vertical chamber-rows meet; this causes the test outline to be typically 8-shaped (see figs. 1b, 2b, pl. 8). Apertural face somewhat flattened, aperture a not very broad, curved slit at the base of the last-formed chamber.

The species never reaches large dimensions; our specimens generally are not larger than the size mentioned by EGGER (1893) (L 0;40 mm, B 0,15 mm) whereas the number of chambers in adult specimens oscillates around 25.

Sectioned specimens (see pl. 8, fig. 1) show the weakly curved septa and the very regular chamber arrangement as biserial throughout; there is no trace of an initial planospire (see note, p. 12) (this feature was suspected by H. ALLEN & EARLAND (1915) : "it is possible that some of the specimens had spiroplectine initial chambers but, owing to the texture and opacity of the shell, this feature is extremely difficult to diagnose with certainty"). The test wall is of moderate thickness in the initial as well as in the final part of the test. Pseudopores are present. The species uses much cement in the construction of its wall and the irregular pseudopore cavities are not obvious in this case. An organic lining is visible (see e.g. fig. 1e, pl. 8).

This species bears some resemblance to Textularia bulbosa HÖGLUND (as figured by LUTZE, 1974) but the number of chambers is lower and the chambers are higher in the latter species whereas the dimensions of both species are comparable; HÖGLUND's types (from the Gullmar Fjord) however are clearly different from our Lizard specimens.

The species has not been recorded often and seems to be restricted to the Indopacific; BRADY's types are from Torres strait, EGGER's from off Western Australia; H. ALLEN & EARLAND (1915) record it from East Africa (Kerimba) whereas it has been mentioned by COLLINS (1958) from the Great Barrier Reef. The specimens figured by CUSHMAN (1924) from Samoa (pl. 2, fig. 1; pl. 4, fig. 6) as Textularia sp. might perhaps be T. porrecta. The species has also been recorded from the Miocene of Indonesia (LE ROY, 1941, 1944) and the Great Barrier Reef (WRECK - HERON Ids.: LLOYD, 1966).

Occurrence : Present at several perireefal stations. Rare troughout. Only empty tests.

Textularia pseudogramen CHAPMAN & PARR, 1937.
(Pl. 8, figs. 3-4; pl. 9, fig. 1).

1884 Textularia gramen d'ORBIGNY; - BRADY, p. 365, pl. 43, figs. 9-10.
1921 Textularia gramen d'ORBIGNY; - CUSHMAN, p. 105, pl. 20, fig. 7.
1924 Textularia gramen d'ORBIGNY; - CUSHMAN, p. 15, pl. 1, figs. 7-8.
L 1937 Textularia pseudogramen; - CHAPMAN & PARR, p. 153 (figs. 9-10, pl. 43 of BRADY, 1884, designed as lectotypes).
1949 Textularia gramen d'ORBIGNY; - SAID, p. 7, pl. 1, fig. 11.
1954 Textularia conica d'ORBIGNY; - CUSHMAN, TODD & POST, p. 329, pl. 83, fig. 4.
1959 Textularia conica d'ORBIGNY; - GRAHAM & MILITANTE, p. 27, pl. 1, figs. 23-24.
cf 1973 Textularia schencki CUSHMAN & VALENTINE; - LANKFORD & PHLEGER, p. 128, pl. 1, figs. 13-14.
1974 Textilina pseudogramen (CHAPMAN & PARR); - LUTZE, p. 14, figs. 46-47; T. conica d'ORBIGNY : id, figs. 42-43.
1977 Textilina pseudogramen (CHAPMAN & PARR); - HAAKE, p. 66, pl. 1, figs. 4-11.
1979 Textilina pseudogramen (CHAPMAN & PARR); - PEREIRA, pl. 4, figs. H-Q; T. sp. aff. T. pseudogramen (CHAPMAN & PARR); id, pl. 5, figs. A-E.

Description : See CHAPMAN & PARR, p. 153 (1937).

Diagnostic Remarks and Distribution : This species, as it has been described by CHAPMAN & PARR, has raised a great deal of controverse and has frequently been confused with several other species of the "Textularia"-group (see synonymy). In their type description the authors state that the species has "acute margins" and that "the apertural end of the shell is obliquely truncated". Observing BRADY's type figures (1884 - lectotypes) we can see that the sutures are obliquely set and that one specimen (fig. 9) has a very flattened or even concave apertural face whereas in the other the last-formed chambers are slightly inflated. Several references to T. conica agree with the descriptions of T. pseudogramen and in particular include forms with an acute margin and slightly oblique sutures. Taking into account the (type) description and figures of T. conica (d'ORBIGNY, 1839, p. 143, figs. 19-20); BRADY (1884, pl. 43, figs. 13-14) we should actually restrict the designation T. conica to forms with a rounded periphery and nearly flush sutures (to what degree these forms would fall in synonymy with T. barkeri, T. trochus

and/or T. pseudotrochus is another question).

As to our Lizard material, we have restricted the name T. pseudogramen to forms comparable with BRADY's (1884) figures; most of our specimens more or less resemble BRADY's fig. 9 and, because of a lack of specimens referable to fig. 10, I doubt whether figs. 9 and 10 really represent the same species (fig. 10 perhaps showing a variant of T. foliacea oceanica).

The variability in our Lizard specimens is very high. The apertural face is generally less truncated than in BRADY's figured specimen (fig. 9), though somewhat irregular; the general aspect of the apertural view however is comparable with BRADY's fig.9b.Aperture straight, not very broad, bordered by a narrow rim and lying in a depression. Sutures not so obliquely set and slightly curved in most specimens. Test laterally compressed, with acute or subacute margins. Chamber walls varying from convex to convex-concave (concave parts near the margin of the test, at the base of the chambers, as in T. pseudogramen subsp. kerimbaensis).
In fact, all transitional stages exist between the present species s.s. as I have figured it on pls. 8 en 9, and what I call T. pseudogramen subsp. kerimbaensis as figured on pls. 9 and 10.

Hence, the present species needs redefinition; there is a gap between BRADY's (CHAPMAN & PARR's) lectotypes on one hand, and what has been called T. pseudogramen in the literature on the other; moreover both specimens chosen as lectotypes for the species are different from each other. A similar confused situation exists as far as SAID's Textularia kerimbaensis is concerned. I have shown here that both forms probably are only ecovariants of the same species, or at least closely allied forms (see further). In this work I have presented these forms under the names T. pseudogramen and T. pseudogramen subsp. kerimbaensis. It should be remembered that this is not a definitive solution and that all these related forms need to be thoroughly restudied on a broader biogeographical scale, and eventually renamed.

Typical T. pseudogramen, as figured on pl. 8, figs. 3 and 4, show net differences in apparent wall texture; some specimens are very smoothly finished (except for the abrasion signs - fig. 3) whereas others are coarsely textured throughout (fig. 4); nevertheless the texture (and other features) of the apertural faces are identical; moreover the specimen fig. 4 shows an external porosity of the test, which might indicate that the coarsely textured tests are only abraded. All specimens recorded alive were smooth-walled and were therefore initially indicated in the distribution- and frequency diagrams - part I - as Textularia kerimbaensis. The abraded parts

of the test wall in smoothly finished specimens clearly show a coarse-grained texture underneath (fig. 3).

Sectioned specimens of typical T. pseudogramen (pl. 9, fig. 1) reveal chamber arrangement (biserial throughout), regularly curved septa with upward nods just on top of the septal foramina (corresponding with the successive apertural rims), moderately thick lateral test walls, pseudopore system and organic lining. Apertural face and septa are not provided with these features and are secondarily cemented.

Statements about the distribution of the species are premature due to the widespread confusion with other taxa in the literature; nevertheless we can agree about its wide tropical Indopacific distribution and its presence in the West-Indies; it has also been recorded from the Mediterranean (HAAKE, 1977). COLLINS (1958) did not record it from the Great Barrier Reef but mentioned the presence of T. conica; as het did not figure any of these specimens we could presume that at least part of the forms he included in T. conica are T. pseudogramen.

Occurrence : Common in the Perireefal Area, living specimens as well as empty tests. Irregularly present in the Lagoon and shallow backreef environments (even upon the reef flats), occurring mainly as immature specimens.

Textularia pseudogramen CHAPMAN & PARR, subsp. kerimbaensis (SAID, 1949) (Pl. 9, figs. 2-3; pl. 10, fig. 1).

\+ 1949 Textularia kerimbaensis SAID; - SAID, New Name; p. 6, pl. 1, fig. 8.
non 1954 Textularia kerimbaensis SAID; - CUSHMAN, TODD & POST, p. 329, pl. 83, fig. 11.
1957 Textularia kerimbaensis SAID; - TODD, p. 286, pl. 85, fig. 11.
1958 Textularia kerimbaensis SAID; - COLLINS, p. 353.
1959 Textularia kerimbaensis SAID; - GRAHAM & MILITANTE, p. 28, pl. 2, figs. 5-6.
1979 Textilina kerimbaensis (SAID); - PEREIRA, pl. 4, figs. E-G.

Description : Test free, compressed, width varying, generally slightly less broad than high but some specimens as broad or broader than high; apertural face slightly rounded or sinuous, irregular, sometimes truncate; periphery subacute, irregularly serrate, sometimes almost keeled; chambers low, broad, strongly embracing, later ones becoming slightly inflated, concave above

the outer sutural sinuosity. Sutures depressed and sinuous; wall finely granular, smoothly finished, rough when abraded; aperture a low, slightly arched slit at the base of the last-formed chamber, lying in a depression of the apertural face and bordered by an inconspicuous rim.

Diagnostic Remarks and Distribution : Once more, the specific delimitations of this taxon are not clear at all and the greatest possible confusion reigns about the definition of this "species". SAID (1949) "renamed" H. ALLEN & EARLAND's T. corrugata but the animal he (poorly) illustrates is clearly different from this; I consider T. corrugata as a well established form which has nothing to do with neither T. pseudogramen nor T. pseudogramen subsp. kerimbaensis. The description I give of T. pseudogramen subsp. kerimbaensis corresponds with the taxon as it is generally referred to by most post-SAID authors (see synonymy); SAID (1949) himself did not judge it necessary to describe the "species" he renamed. Hence, the denomination T. kerimbaensis is completely invalid and should be rejected.

Under T. pseudogramen I have argued about the probability of both forms belonging to the same biological species; they may be considered as the end menmbers of a whole range of variable forms; for convenience I have maintained both existing names for the time being, but with the already mentioned restriction as to the need of renaming the species and its allies after a thorough broad-scoped revision.

The pseudopore system of T. pseudogramen subsp. kerimbaensis is illustrated in sectioned specimens and consists of an internal part where the alveoli are mostly radial (normal to the chamber lumen surface) and are at the origin of the regular porous pattern appearing on the inner side of the test wall (except where an organic lining is preserved, masking these openings); a middle part where the alveoli are fusing, irregular and conditioned by the cemented (coarse) grains, and an outer part consisting of extended cavities separated from the exterior of the test by a very thin cement layer only, which incorporates some flattened grains and which is easily abraded after the death of the animal. This abrasion probably starts already during the animal's life (see pls. 9-10). In T. pseudogramen subsp. kerimbaensis the septa are not so strongly curved as in typical T. pseudogramen; other internal features are perfectly corresponding, including the conservation of successive apertural rims as septal nods (see pl. 9, fig. 3b; pl. 10, fig. 1b; compare with pl. 9, figs. 1a, 1c).

Very characteristic external features of T. pseudogramen subsp. kerimbaensis are the sigmoidally curved sutures with chamber concavities just above the sutures near the test edges, these features being more explicit in the early than in the later chambers.

The variant T. pseudogramen subsp. kerimbaensis seems to be known from Indopacific localities only (tropical Pacific, Eastern Africa, Australia, the Philippines, Red Sea); the taxon has been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Common in the Perireefal Area, living specimens as well as empty tests. Rare in other environments. Isolated empty tests occur upon the reef flats.

Textularia semialata CUSHMAN, 1913
(Pl. 10, figs. 2-3).

+ 1913 Textularia semialata; - CUSHMAN (Proc. U.S.N. Mus. Bull., vol. 44), p. 634, pl. 80, figs. 6, 7.
1921 Textularia semialata CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4) p. 116, pl. 24, figs. 2-3.
1932 Textularia semialata CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 9, pl. 2, figs. 1-3.
1954 Textularia semialata CUSHMAN; - CUSHMAN, TODD & POST, p. 330, pl. 83, fig. 5.

Description : See CUSHMAN (1913, 1932).

Diagnostic Remarks and Distribution : Our specimens agree with CUSHMAN's descriptions. Characteristic features are the compressed test which may be somewhat angular in the early chambers, the rapid increase in width of the chambers, somewhat comparable to T. candeiana, the almost horizontal sutures, and particularly the very smooth finish of the test wall and the aperture with an overhanging lip; there is some variability in the shape of this lip and a distinct fold in the chamber wall is visible near the aperture.

Sectioned specimens (pl. 10, fig. 3) show the chamber arrangement (being biserial throughout), the curved septa and septal foramina, the relatively thin test wall with pseudopore system and well-visible pseudopore openings.

An organic lining is present and can been seen in the earliest-formed chambers (fig. 3c, pl. 10). The irregular cavities in the test wall are comparable to those shown in T. pseudogramen subsp. kerimbaensis and T. pseudogramen. Here also the external test porosity appears on those test areas most exposed to abrasion. The ratio cement - detrital particles is more in the favour of the cement in this species than in other textulariids which might explain the resistance of the tests to abrasion notwithstanding their thin walls.

CUSHMAN's types of this species are from the Philippines and further records are from the tropical Pacific. Amazingly, as far as I could find out this species has not been recorded since CUSHMAN's time. It has probably been put together with other textulariid species (such as T. candeiana) by successive authors. COLLINS (1958) did not mention the species from the Great Barrier Reef.

Occurrence : Rare; empty tests have been found at several perireefal stations, mainly in the N. and NE. area.

Family TROCHAMMINIDAE SCHWAGER, 1877

Subfamily TROCHAMMININAE SCHWAGER, 1877

Genus Trochammina PARKER & JONES, 1859

Trochammina squamata PARKER & JONES, 1860
(Pl. 10, figs. 4-6)

cf 1860 Trochammina squamata; - PARKER & JONES, p. 305.
cf 1884 Trochammina squamata PARKER & JONES; - BRADY, pl. 44, fig. 3.
cf 1960 Trochammina squamata PRAKER & JONES; - BARKER (see ref. BRADY 1884).
L 1964 Trochammina squamata PRAKER & JONES; - emend. HEDLEY, HURDLE & BURDETT, p. 419, pl. 1, fig. 1; pl. 3, figs. 1-3.
1974 Trochammina squamata PARKER & JONES; - LUTZE, p. 15, pl. 3, figs. 56-58.

Description : See HEDLEY, HURDLE & BURDETT (1964).

Diagnostic Remarks and Distribution : Our Lizard Island specimens correspond well with those figured by LUTZE (1974) from the Persian Gulf. The morphological variation from very flattened with nearly angular periphery, to slightly more inflated with ovate chamber outline, as mentioned by LUTZE, has been observed in our material.

Typical and constant features however are the planoconvex or convex-concave, weakly inflated test shape, the few chambers in the last whorl (generally 4), the strongly embracing last chamber occupying up to half of the circumference, the very oblique sutures on the spiral side, the low and broad, slightly curved interiomarginal aperture and the pseudochitinous inner lining visible through the (thin) test wall, particularly in the early whorls of the test where the embryonic chambers frequently are broken away.

The species is clearly different from T. sorosa(which is more inflated), T. pacifica (id.), and all other Pacific Trochamminidae; it is also very different from all (Atlantic) forms described by HÖGLUND (1947) as belonging to the "T. squamata group".

The species, as emended by HEDLEY, HURDLE & BURDETT, seems to have an exclusive Indopacific tropical distribution.

Occurrence : Living specimens as well as empty tests, mainly in the Perireefal Area in moderate numbers (mostly rare, common at a few stations). At Lizard Island the species hardly occurs in depths less than 10 m; it also lives in the Lagoon Entrance and occasionally empty tests are transported further down into the lagoon.

Genus Rotaliammina CUSHMAN, 1924

Rotaliammina chitinosa (COLLINS, 1958)
(Pl. 11, fig. 1)

cf 1915 Trochammina ochrea WILLIAMSON, var.; - HERON - ALLEN & EARLAND, p. 619, pl. XLVI, figs. 27-28.
1958 Trochammina chitinosa; - COLLINS, p. 354, pl. 1, figs. 12a, b, c.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : The few specimens in our Lizard Island material correspond completely to COLLINS's(1958) description. The brownish colour of the pseudochitinous walls shines through the thin agglutinated layer on the spiral side of the test whereas the concave umbilical side is entirely pseudochitinous. The test is almost completely involute on the umbilical side and only a small, deep, rounded umbilicus is left open. The sutures are slightly depressed on the spiral side but limbate on the umbilical side and show the characteristic feature mentioned by COLLINS :

"... consisting of whitish cement and ending in a bulb short of the umbilicus". As the features on the umbilical side are to be seen mainly as colour variations, they are better visible under the light microscope (and on COLLINS's drawing) than on SEM-photographs (whereupon they nevertheless appear).

Although none of the encountered specimens has been found attached to a substratum, they show the other characteristics of the genus Rotaliammina (thin flexible wall, obscure aperture which, on our figured specimen, might be either interiomarginal or situated near the peripheral edge of the last-formed chamber); the species has subsequently been transferred to this genus.

COLLINS's types of this species are from the Great Barrier Reef.

Occurrence : Extremely rare. Occurs in 3 samples : on the reef flat of the Windward Barrier, in the Lagoon Entrance and in the Eastern Perireefal Area. Living specimens are problematic.

Family ATAXOPHRAGMIIDAE SCHWAGER, 1877

Subfamily VERNEUILININAE CUSHMAN, 1911

Genus Gaudryina d'ORBIGNY, 1839

Gaudryina rugulosa CUSHMAN, 1932
(Pl. 11, figs. 2, 3).

1884 Textularia rugosa (REUSS); - BRADY, p. 363, pl. 42, figs. 23-24.
\+ 1932 Gaudryina rugulosa; - CUSHMAN, pt. 1, p. 15, pl. 4, figs. 1.
1937 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - CUSHMAN, p. 84, pl. 12, figs. 11-12.
1954 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - CUSHMAN, TODD & POST, p. 331, pl. 82, fig. 1.
1957 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - TODD, p. 286 (tab.), pl. 93, fig. 1.
1958 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - COLLINS, p. 355.
1959 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - GRAHAM & MILITANTE, p.30, pl. 1, fig. 11.
1960 Gaudryina (Siphogaudryina) rugulosa CUSHMAN; - BARKER (See ref. BRADY 1884).

Description : See CUSHMAN (1932).

Diagnostic Remarks and Distribution : This species is characterised by its large dimensions (some specimens attain a heigth of 2 mm and more). They all possess a subacute periphery but the degree of development of the lobes on the chamber walls is variable. As all our specimens are abraded and/or damaged, it is difficult to see whether these lobes on the chamber walls are weakly developed or have disappeared by abrasion (which can be seen in our figured specimen, pl. 11, fig. 3). The tests are very solid, thick-walled and apparently support a considerable degree of abrasion before they disintegrate.

On the specimen with broken-off last chambers (pl. 11, fig. 2), a test wall structure identical to the textulariid structure can be seen; it consists of radial pseudopores, causing a regular "pore" pattern on the inner side of the test wall. Only (strongly) abraded specimens seem to have a porous external surface (see e.g. fig. 2a, pl. 11). An organic lining has not been observed.

This is a typical Indopacific tropical species; it has been found by COLLINS (1958) in his Great Barrier Reef samples.

The subgenus Siphogaudryina has been put in synonymy with Gaudryina by LOEBLICH & TAPPAN (1964).

Occurrence : On the reef flats, rather rare. No living specimens have been encountered (the species has a very short annual growth period - HOTTINGER, 1983, personal communication) and all our specimens are worn and broken; some rare tests and/or fragments are transported towards the Perireefal Area.

Subfamily VALVULININAE BERTHELIN, 1880

Genus Clavulina d'ORBIGNY, 1826

Clavulina multicamerata CHAPMAN, 1907
(Pl. 11, fig. 4-6).

1884 Clavulina parisiensis d'ORBIGNY; - BRADY, pl. 48, figs. 17-18.
\+ 1907 Clavulina multicamerata; - CHAPMAN, p. 127, pl. IX, fig. 5.
1911 Clavulina parisiensis d'ORBIGNY; - CUSHMAN, p. 75, figs. 123-124.
non 1932 Clavulina multicamerata CHAPMAN; - PARR, p. 4, pl. 1, figs. 4-5.
1937 Clavulina multicamerata CHAPMAN; - CUSHMAN, p. 24, pl. 3, figs. 13-16.
1958 Clavulina multicamerata CHAPMAN; - COLLINS, p. 358.
1960 Clavulina multicamerata CHAPMAN; - BARKER (see ref. BRADY 1884).

Description : See CHAPMAN 1907.

Diagnostic Remarks and Distribution : Our specimens correspond well with BRADY's (1884) figures 17-18. These have been attributed to CHAPMAN's species by BARKER (1960), who mentions the fact that neither CHAPMAN, nor CUSHMAN (1937) refer to BRADY's figures. In his 1911 monography CUSHMAN simply takes over BRADY's drawings and identification without referring to CHAPMAN (1907).

The species is characterised by its cylindrical uniserial portion of the slender test, with high chambers, and deeply constricted sutures. In the youngest part of the test the chambers are cup-or trapeziumshaped in vertical section, which is a constant feature of our Lizard Island specimens (compare with BRADY's figure 17). The test wall is coarsely arenaceous and generally includes sponge spicules. The aperture in the uniserial portion has a moderately developed valvular tooth which is often damaged.

The species differs from C. communis (see e.g. PEREIRA 1979) in its generally smaller and shorter, more slender uniserial test portion, higher chambers of this portion, more deeply constricted sutures and simple apertural tooth (the latter species having a sigmoidal tooth - cf. PEREIRA's pl. 6,figs. K-N). The specimen figured by PARR (1932) as C. multicamerata does not belong to this species in my opinion but rather shows affinities with C. communis although its apertural face has not been figured.

The present species has a wide Indopacific distribution and has been recorded by COLLINS (1958) from the Great Barrier Reef. BRADY's figured specimens are from Torres Strait.

Occurrence : Rare to moderately common in the Perireefal Area and upon the reef flats where almost exclusively smaller specimens lacking the uniserial portion have been found.

Clavulina pacifica CUSHMAN, 1924.
(Pl. 11, figs. 7-8).

1884 Clavulina angularis d'ORBIGNY; - BRADY, p. 396, pl. 48, figs. 22-24.
+ 1924 Clavulina pacifica; - CUSHMAN, p. 22, pl. 6, figs. 7-11.
1932 Clavulina pacifica CUSHMAN; - CUSHMAN, pt. 1, p. 16, pl. 4, figs. 4-7-9.
1952 Clavulina pacifica CUSHMAN; - UCHIO, p. 151, pl. 6, fig. 4.
1954 Clavulina pacifica CUSHMAN; - CUSHMAN, TODD & POST, p. 332, pl. 83, fig. 19.
1957 Clavulina pacifica CUSHMAN; - TODD, p. 286 (tab.), pl. 85, fig. 9.
1958 Clavulina pacifica CUSHMAN; - COLLINS, p. 358.
1959 Clavulina pacifica CUSHMAN; - GRAHAM & MILITANTE, p. 32, pl. 2, fig. 17.
1960 Clavulina pacifica CUSHMAN; - BARKER (see ref. BRADY 1884).

Description : See CUSHMAN, 1924.

Diagnostic Remarks and Distribution : The specimens of this species occuring in our Lizard Island material correspond completely to CUSHMAN's (1924) types from Samoa. The transverse section of the uniserial part is triangular and the sutures are depressed and strongly curved. The apertural tooth is frequently damaged. CUSHMAN (1924) points to the difference between this species, C. tricarinata and C. angularis. Clavulina difformis (as e.g. figured by PEREIRA 1979, pl. 6, fig. Q; pl. 7, figs. A-E) differs from C. pacifica in showing a square or pentangular transverse section of the uniserial test portion and is more coarsely agglutinated.

Immature specimens of C. pacifica are equally present in our material; these mostly show only the triserial test portion and a sutural opening without a developed tooth (compare with CUSHMAN's (1924) fig. 10, pl. 6). Such immature specimens in our material can be distinguished from homologous forms of C. multicamerata by their more angular chamber shape throughout, even in the triserial portion of the test (compare figs. 4 and 7, pl. 11).

The species has a wide Indopacific distribution and has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests are rare to common in the Perireefal Area and in some deeper-water patchreef samples. Adults are mostly greyish or blackened, showing signs of diagenesis (indicative of relict sediments ?); no living specimens have been found, except for a few questionable juveniles.

Suborder MILIOLINA DELAGE & HEROUARD, 1896

Superfamily MILIOLACEA EHRENBERG, 1839

Family NUBECULARIIDAE JONES, 1875

Subfamily FISCHERININAE MILLETT, 1899

Genus Planispirinella WIESNER, 1931

Planispirinella exigua (BRADY, 1879)
(Pl. 12, figs. 1-2).

1879 Hauerina exigua; - BRADY, pt. 2, p. 267.
1884 Planispirina exigua BRADY; - BRADY, p. 196, pl. 12, figs. 1-4, text-figs. 5-6.
1931 Planispirinella exigua (BRADY); - WIESNER, p. 69.
1954 Planispirina exigua BRADY; - CUSHMAN, TODD & POST, p. 341, pl. 85, fig. 28.
1958 Planispirinella exigua (BRADY); - COLLINS, p. 374.
1959 Planispirinella exigua (BRADY); - GRAHAM & MILITANTE, p. 59, pl. 9, fig. 10.
1960 Planispirinella exigua BRADY; - BARKER (see ref. BRADY 1884).
1964 Planispirinella exigua (BRADY); - LOEBLICH & TAPPAN, p. C443, fig. 334, 7-9.

Description : See BRADY (1879).

Diagnostic Remarks and Distribution : Our Lizard Island specimens agree with BRADY's (1884) figured specimens and with the lectotype selected by LOEBLICH & TAPPAN (1964). The species has a wide Indopacific distribution and has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Only empty tests were collected at several perireefal stations and in a few lagoonal and patchreef samples.

Subfamily OPHTALMIDIINAE WIESNER, 1920

Genuw Edentostomina COLLINS, 1958.

Note on Edentostomina durrandii MILLETT, Quinqueloculina oblonga subsp. segersi (new name) and Edentostomina cultrata BRADY.

A special remark on these "species" is justified here because of the great confusion in literature on these Foraminifera which have been known under several names, the most recent ones being Massilina durrandii, Edentostomina durrandii, Pyrgo milletti, Edentostomina milletti.

In 1898, MILLETT figured a variety of miliolid specimens dredged from Northern Australia up to the Malay Archipelago and described them as follows : "Test broadly elliptical, much depressed, chambers few, periphery acute or carinate, sutures slightly excavated, aperture large, elliptical or fusiform, surrounded by a thickened lip, edentate"; he called them Miliolina durrandii. In 1917, CUSHMAN described the species Biloculina milletti (from China) as follows : "Test in front view broadly elliptical, in end view compressed, chambers biconvex, the periphery with a definitely developed thin carina, wall smooth except for occasional transverse ribs, usually indistinct. Aperture slightly produced, broadly elliptical, with a slightly thickened border joining the carina at its outer edge; the aperture with a small bifid tooth."; the specimen CUSHMAN figured does not differ much from those figured by MILLETT and the "bifid tooth" is hardly visible on the drawing. MILLETT's specimens attain a maximum length of 0,99 mm whereas CUSHMAN's are "up to 2 mm" (and consequently might be more full-grown than MILLETT's).

To complicate the story further, a number of Pacific taxa, sharing the following features have been recorded in the literature : they generally do not reach the maximum dimensions indicated for MILLETT's and CUSHMAN's "species" "durrandii" and "millettii"; they are more angular than carinate, have an apertural tooth, sinuous sutures and are triloculine. This "species" is generally referred to as Pyrgo milletti CUSHMAN and is put in synonymy with CUSHMAN's (1917)Biloculina milletti (see e.g. CUSHMAN, TODD & POST, 1954, p. 341, pl. 85, fig. 25; GRAHAM & MILITANTE, 1959, p. 40, pl. 4, fig. 7 (not 6 and 8)).

Summarising, I conclude that :

1) At least two species are represented in the references to MILLETT's (1898) and CUSHMAN's (1917) species : one is edentate, the other has a small, narrow apertural tooth.

2) The original descriptions of Miliolina durrandii MILLETT and Biloculina millettii CUSHMAN concern one and the same species (restriction made for MILLETT's fig. 7) which, very likely, is edentate (a revision of CUSHMAN's type material would be necessary); moreover misinterpretation about such an apertural tooth is possible because the periphery of the penultimate chamber remains visible through the (low) aperture and might be mistaken at first glance for a kind of toothlike apparatus through the binocular microscope (see e.g. fig. 2, pl. 13). Obviously the same species as shown e.g. by H. ALLEN & EARLAND (1915), pl. XLII, figs. 13, 14, 15 is concerned here; it should be called Edentostomina durrandii MILLETT according to the priority rule. We have figured SEM-photographs of a typical specimen from our material on figs. 1, 2, pl. 13.

3) The second species is the dentate, triloculine form generally referred to as Pyrgo milletti CUSHMAN (see above). In the Lizard Island material this form is well represented, and shows the narrow aperture with a single tooth, angular periphery, sinuous chambers and triloculine chamber arrangement as being constant features of the form. For reasons explained under Quinqueloculina oblonga, the "milletti"-form is to be considered as a variant of Q. oblonga; it somewhat resembles Q. oblonga subsp. transversestriata but lacks the characteristic transversal "ripples" of the latter subspecies, and is less compressed. I renamed this new subsp. Quinqueloculina oblonga subsp. segersi.

Edentostomina cultrata BRADY, though poorly represented in our material, is regarded here as a valid species as it possesses outstanding characteristics (compressed aperture at the "considerable extended apertural end of the test" - CUSHMAN, 1917; much compressed and carinate, triloculine test) distinguishing it from other Edentostomina's.

Edentostomina cultrata (BRADY, 1881)
(Pl. 12, figs. 3a-c).

+ 1881 Miliolina cultrata; - BRADY, p. 45.
1884 Miliolina cultrata BRADY; - BRADY, p. 161, pl. 5, figs. 1-2.
1917 Quinqueloculina cultrata (BRADY); - CUSHMAN (U.S.N.M. Bull. 71), pt. 6, p. 54, pl. 21, figs. 1a-b.
1953 Quinqueloculina cultrata (BRADY); - PARKER, PHLEGER & PEIRSON, p. 12, pl. 2, figs. 7(?)-8.
1958 Edentostomina cultrata (BRADY); - COLLINS, p. 371.
1959 Quinqueloculina cultrata (BRADY); - GRAHAM & MILITANTE, p. 44, pl. 5, figs. 8a-c.
1960 Quinqueloculina cultrata (BRADY); - BARKER (see ref. BRADY 1884).

Description : See BRADY, 1881.

Diagnostic Remarks and Distribution : See note, p. 37. This species has been reported by COLLINS (1958) from the Great Barrier Reef and seems to be present in Indopacific as well as Atlantic tropical shallow waters.

Occurrence : Extremely rare; only a few empty tests in three perireefal samples.

Edentostomina durrandii (MILLETT, 1898)
(Pl. 13, figs. 1-2).

+ 1898 Miliolina durrandii; - MILLETT, p. 268, pt. 1, pl. 6, figs. 7(?), 8-10.
1915 Miliolina durrandii MILLETT; - HERON - ALLEN & EARLAND, p. 565, pl. 42, figs. 11-12(?), 13-16.
1917 Biloculina milletti; - CUSHMAN, pt. 6, p. 81, pl. 34, figs. 4-5.
1957 Massilina cf. M. durrandii; - TODD, p. 286 (table), pl. 87, figs. 2a-b.
? 1958 Edentostomina durrandii(MILLETT);- COLLINS, p. 371.
1959 Pyrgo milletti(CUSHMAN);- GRAHAM & MILITANTE, p. 40, pl. 4, fig. 6(?), 8 (not 7).
? 1959 Quinqueloculina cultrata(BRADY);- GRAHAM & MILITANTE, p. 44, pl. 5, fig. 8a-c.

Description : See MILLETT (1898), CUSHMAN (1917) and notes p. 37.

Diagnostic Remarks and Distribution : See p. 37. This species seems to have an Indopacific distribution exclusively. Whether COLLINS's (1958) specimens recorded from the Great Barrier Reef are true E. durrandii could not be verified (he did not illustrate the species). Yet, it is probable that MILLETT's species is concerned here since COLLINS (1958) created the genus Edentostomina himself on Barrier Reef material.

One single costate specimen comparable with MILLETT's (1898) fig. 7 has been encountered in our Lizard Island samples; it might be a ecovariant of Q. oblonga subsp. segersi.

Occurrence : Typical E. durrandii are rare in our material, and have been found on the Internal Platform and in the Lagoon in shallow water. No living specimens have been encountered.

Edentostomina rupertiana (BRADY, 1879).
(Pl. 12, figs. 4-6)

+ 1879 Miliolina rupertiana; - BRADY, p. 46.
1884 Miliolina rupertiana BRADY; - BRADY, p. 178, pl. VII, figs. 7-12.
1915 Miliolina rupertiana BRADY; - HERON - ALLEN & EARLAND, p. 565.
1956 Triloculina aff. rupertiana (BRADY); - BHATIA, pt. 1, p. 19, pl. 2, figs. 4a-b.
1958 Edentostomina rupertiana (BRADY); - COLLINS, p. 371.
1959 Triloculina rupertiana (BRADY); - GRAHAM & MILITANTE, p. 56, pl. 8, figs. 10 a-b-c.
1960 Triloculina rupertiana (BRADY); - BARKER (see ref. BRADY 1884).
1979 Edentostomina rupertiana (BRADY); - PEREIRA, pl. 8, figs. D-E.

Description : See BRADY, 1879.

Diagnostic Remarks and Distribution : Several of our specimens are identical with the ones figured by BRADY (1884). As shown on pl. 12, fig. 4-6, the tests vary from narrow elongate to broadly ovate. Narrow tests are mostly biloculine, broader tests are mostly triloculine (pl. 12, fig. 5) or even quinqueloculine (pl. 12, fig. 6) in appearance. Longitudinal striae are more or less pronounced and are variable in density.

The species has been placed in the genus Edentostomina by COLLINS (1958). It seems to have a wide Indopacific distribution but has not been recorded that frequently. Dr. TODD wrote me that she "thought she had never had any T. rupertiana before, at least not as beautifully preserved as these", after examining some of our specimens (written communication - 1980).

The species has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Present at some Eastern Perireefal stations but always in small numbers. Empty tests as well as a few living ones.

Genus Wiesnerella CUSHMAN, 1933.

Wiesnerella auriculata (EGGER, 1893)
(Pl. 13, figs. 3-5).

+ 1893 Planispirina auriculata; - EGGER, pt. 2, p. 245, pl. 3, figs. 13-15.
1915 Planispirina auriculata EGGER; - HERON - ALLEN & EARLAND, p. 590, pl. 46, figs. 3-7.
1922 Planispirina auriculata EGGER; - CUSHMAN, p. 62, pl. 10, fig. 8.
1933 Wiesnerella auriculata (EGGER); - CUSHMAN, pt. 2, p. 33, fig. 8.
1954 Wiesnerella auriculata (EGGER); - CUSHMAN, TODD & POST, p. 341, pl. 85, fig. 30.
1957 Wiesnerella auriculata (EGGER); - TODD, p. 288 (table), pl. 88, figs. 10 a-b.
1958 Wiesnerella auriculata (EGGER); - COLLINS, p. 374.

Description : See EGGER, 1893.

Diagnostic Remarks and Distribution : Typical specimens are occasionally found in our material. The species is worldwide distributed in tropical shallow seas and reefal environments. Atlantic specimens from the Carribbean area are apparently identical with Indopacific ones. COLLINS (1958) records the species from the Great Barrier Reef and from the Miocene of Victoria (Australia).

Occurrence : Rare to common in the Perireefal Area and in one single patchreef sample.

Subfamily NODOBACULARIINAE CUSHMAN, 1927.

Genus Nubeculina CUSHMAN, 1924.

Nubeculina divaricata BRADY, var. advena CUSHMAN, 1924.
(Pl. 13, figs. 6-8).

+ 1924 Nubeculina divaricata BRADY, var. advena; - CUSHMAN, p. 53, pl. 19, figs. 1-4.
1966 Nubeculina divaricata advena CUSHMAN; - TODD, 1966, p. 129 (tab), pl. 17, fig. 2.

Description : See CUSHMAN (1924).

Diagnostic Remarks and Distribution : Our representatives of this apparently rarely found species correspond almost completely with CUSHMAN's description and illustrations; they only differ slightly from CUSHMAN's types in their peristome being less prominent; the "inwardly pointing teeth" are rather sharp-edged thickenings of the inner neck surface (see fig. 8c, pl. 13).

The species is not very selective in the use of detrital grains for construction of the test wall; adherent to the latter is a heterogenous assemblage of flaky and angular sand-grains, foraminiferal test fragments, bryozoans, mollusc fragments, alcyonarian spicules etc.; this assemblage reflects the sediment type of the environment.

This species has only been recorded so far from its type locality (Samoa) and from Guam. This is the first record from the Great Barrier Reef; the species has not been encountered by COLLINS (1958).

Occurrence : Present at several perireefal stations but always in small numbers. Only empty tests.

Genus Nodobacullariella CUSHMAN & HANZAWA, 1937.

Nodobacullariella japonica CUSHMAN & HANZAWA, 1937.
(Pl. 14, figs. 1-8).

1884 Spiroloculina (?) convexiuscula; - BRADY, p. 155, pl. 10, figs. 18-20.
1921 Spiroloculina (?) convexiuscula BRADY; - CUSHMAN, p. 409, pl. 82, fig. 4.
+ 1937 Nodobacullariella japonica; - CUSHMAN & HANZAWA, p. 42, pl. 5, figs. 9-11.
1944 a Spiroloculina (?) convexiuscula BRADY; - CUSHMAN & TODD, p. 74.
1944 b Nodobacullariella convexiuscula (BRADY); - CUSHMAN & TODD, p. 69, pl. 1, figs. 15-16.
1944 b Nodobacullariella japonica CUSHMAN & HANZAWA; - CUSHMAN & Todd, p. 72, pl. 12, fig. 2.
1944 b Nodobacullariella rustica; - CUSHMAN & TODD, p. 73, pl. 12, figs. 4-5.
1958 Nodobacullariella rustica CUSHMAN & TODD; - COLLINS, p. 373.
1960 Nodobacullariella convexiuscula (BRADY); - BARKER (see ref. BRADY 1884).
1964 Nodobacullariella japonica CUSHMAN & HANZAWA; - LOEBLICH & TAPPAN, p. C456, fig. 345-5.

Description : See CUSHMAN & HANZAWA (1937); see also BRADY (1884), CUSHMAN & TODD (1944b).

Diagnostic Remarks and Distribution : Our material of this species shows an impressive range of form variations and these include specimens that could be attributed respectively to Nodobacullariella convexiuscula, N. rustica and N. japonica. These variants all share the phenomenon that their apertural features too are highly variable; most of our smaller (juvenile) specimens (corresponding with the N. convexiuscula-N. rustica types) are slightly bilaterally asymmetrical, the chambers more embracing on one side of the test, and the aperture is often asymmetrically placed as in Wiesnerella or Vertebralina. Nevertheless, the early coil seems to be planispiral throughout, never becoming triloculine or quinqueloculine (that would link these forms to the genus Articulina). This phenomenon of asymmetry has barely been mentioned by CUSHMAN & HANZAWA (1937) when erecting their genus Nodobacullariella ("Test ... nearly or sometimes completely bilaterally symmetrical; ... aperture ... in the median position of the terminal face of the chamber ..."). Nevertheless, one of BRADY's (1884) figured types of N. convexiuscula clearly shows this asymmetric aperture (fig. 20).

The few full-grown specimens of N. japonica (see figs. 7, 8, pl. 14) that we have found in our Lizard Island material show in turn a quasi-symmetrical

aperture, are uncoiling and correspond with CUSHMAN's & HANZAWA's (1937) type description (though the penultimate suture of the specimen fig. 7, pl. 14, seems to be the remnant of an asymmetric aperture as in fig. 5, pl. 14). As these specimens have been found together with the smaller, not uncoiling specimens, and as all intermediate forms occur, we have concluded to the identity of the three discussed variants. We call the species N. japonica because this name is the only one representing the complete, full-grown state of the foraminifer in the traditional nomenclature. N. convexiuscula and N. rustica are both considered here as synonyms of N. japonica.

The species, with all its form variants, seems to be very close to the genus Wiesnerella on one hand, and Vertebralina on the other; in fact I do not see any reason for a continued separation of these genera as the three of them are more or less planispirally coiled and have a more or less asymmetric toothless aperture; at present I prefer to leave this matter untouched as a profound investigation of this group (Atlantic as well as Pacific species) would be needed, with observation of ecovariability, to answer this question.

N. convexiuscula and N. rustica have been described and reported from the Australia - Philippine area, whereas the type material of N. japonica is from the Pliocene (or Pleistocene) of the Ryukyu Islands. COLLINS (1958) mentions the species as N. rustica from the Great Barrier Reef.

Occurrence : Present in small numbers at several perireefal stations. Only empty tests. The large, uncoiling specimens occur, together with smaller ones as well as very large uncoiling Vertebralina striata, mainly at station L 81.

Genus Vertebralina d'ORBIGNY, 1826.

Vertebralina striata d'ORBIGNY, 1826.
(Pl. 14, figs. 9-11; pl. 15, fig. 1).

+ 1826 Vertebralina striata; - d'ORBIGNY, p. 283.
1858 Vertebralina striata d'ORBIGNY; - WILLIAMSON, p. 90, pl. 7, figs. 197-198.
1862 Vertebralina striata d'ORBIGNY; - CARPENTER, PARKER & JONES, p. 72, pl. 5, figs. 17-25.
1884 Vertebralina striata d'ORBIGNY; - BRADY, p. 187, pl. 12, figs. 14-16.
1898 Vertebralina striata d'ORBIGNY; - MILLETT, pt. 3, p. 607, pl. 13, fig. 1.
1921 Vertebralina striata d'ORBIGNY; - CUSHMAN, vol. 4, p. 414.
1929 Vertebralina striata d'ORBIGNY; - CUSHMAN, pt. 6, p. 96, pl. 22, fig. 6.
1932 Vertebralina striata d'ORBIGNY; - CUSHMAN, pt. 1, p. 73, pl. 16, figs. 8-10.
1944 b Vertebralina striata d'ORBIGNY; - CUSHMAN & TODD, p. 74, pl. 12, figs. 7-11.
1949 Vertebralina striata d'ORBIGNY; - SAID, p. 20, pl. 2, fig. 19.
1951 Vertebralina striata d'ORBIGNY; - ASANO, p. 2, fig. 5.
1957 Vertebralina striata d'ORBIGNY; - TODD, p. 288 (table), pl. 88, fig. 11.
1958 Vertebralina striata d'ORBIGNY; - COLLINS, p. 373.
1959 Vertebralina striata d'ORBIGNY; - GRAHAM & MILITANTE, p. 60, pl. 9, figs. 11-12.
1960 Vertebralina striata d'ORBIGNY; - BARKER (see ref. BRADY 1884).
1964 Vertebralina striata d'ORBIGNY; - LOEBLICH & TAPPAN, p. C456, fig. 346-2.
1979 Vertebralina striata d'ORBIGNY; - PEREIRA, pl. 9, figs. F-K.

Description : See d'ORBIGNY, 1826.

Diagnostic Remarks and Distribution : Our specimens correspond with the ones ones described and figured in the literature. They are rather constant in shape and show not that much variability except in the surface ornamentation which becomes irregular and somewhat reticulate in some large uncoiling specimens (pl. 15, fig. 1). A few specimens possessing a quasi symmetrical aperture have been encountered (fig. 10, pl. 14).

This species seems to have a worldwide distribution in tropical, subtropical and even temperate shelf seas. It has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Present in small numbers in all habitats, ranging from the reef flats to the Perireefal Area. Full-grown specimens are restricted to perireefal sediments. Living specimens are exceptional.

Family SORITIDAE EHRENBERG, 1839.

(N.B. The genera of the Soritidae have been arranged in order of increasing structural complexity).

Subfamily PENEROPLINAE SCHULTZE, 1854.

Genus Monalysidium CHAPMAN, 1900.

Monalysidium politum CHAPMAN, 1900.
(Pl. 15, figs. 2 a-d).

\+ 1900 Peneroplis (Monalysidium) polita; - CHAPMAN, p. 4, pl. 1, fig. 5.
1915 Monalysidium polita CHAPMAN; - HERON - ALLEN & EARLAND, p. 603, tf. 43G.
1933 Monalysidium politum CHAPMAN; - CUSHMAN, pt. 2, p. 63, pl. 19, figs. 8-9.
1954 Monalysidium politum CHAPMAN; - CUSHMAN, TODD & POST, p. 348, pl. 87, fig. 7.
1958 Monalysidium politum CHAPMAN; - COLLINS, p. 376.
1959 Monalysidium politum CHAPMAN; - GRAHAM & MILITANTE, p. 62, pl. 9, fig. 21.
1979 Monalysidium politum CHAPMAN; - PEREIRA, pl. 21, figs. F-M.

Description : See CHAPMAN (1900); see also notes by H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : Our specimens strongly resemble those figured by CHAPMAN, H. ALLEN & EARLAND, GRAHAM & MILITANTE, PEREIRA. However, the irregular growth forms (rapid increase and decrease of chamber volume) described by H. ALLEN & EARLAND & figured by PEREIRA (SEM-photographs) were not observed.

The systematic status of this species is somewhat obscure, though the sculpture of the test reminds us indeed of the Peneroplis decoration (pitted depressions between nonperforate ribs). No trace of an initial planospire has been observed; all records exclusively mention rectilinear or slightly arcuate tests with openings on both sides. Our specimens show a large, rounded aperture at one side of the test; this aperture has no pronounced peristome but shows slightly incised grooves at its circumference, the apertural face on the opposite side of the test hints at the relationship with Peneroplis and shows the typical pitted surface reminiscent of the latter genus; in the

middle stands an irregular aperture on a kind of pitted neck which is infolded at its top and forms flaps partially covering the aperture which is surrounded by a narrow, smooth peristome as in all Peneroplis-forms. The species apparently has a wide distribution in Indopacific coral-reef environments.

Occurrence : Present at several perireefal stations, in the Patchreef Area, the Sandy Shoal and the Lagoon, but always very rare. Not found alive.

Genus Peneroplis MONTFORT, 1808.

General note on the species of the genus Peneroplis : invalidation of the genus Spirolina ?

The recent species of the genera Peneroplis and "Spirolina" are known to display an enormous variability (see e.g. BLANC-Vernet (1969); ELLIS & MESSINA (Catalogue) : Nautilus (Lituus) arietinus BATSCH). The four "classical" species P. pertusus, P. planatus, S. acicularis and S. arietina share many fundamental characters whereas the variable morphology presents frequent intermediate stages.

SELLIER DE CIVRIEUX (1970) has shown that many of these variations, starting as a flat enrolled form which then develope successive or contiguous stages which may be rounded uniserial (as in S. acicularis), flattened (as in S. arietina), or yet completely arcuate (as in P. planatus), could be found in a single specimen. Similar observations have already been reported by DREYER (1898, in BHATIA 1956); CLARKE & KEIJ (1973) observed similar growth aberrations in Peneroplis planatus (which I could identify to the species level thanks to Dr. KEIJ's kindness : he sent me some material from the Persian Gulf). The authors state that a relation exists between the increase of these growth aberrations and abnormal salinities (50-70 %) in the sampled area (Southern Persian Gulf) and that "this growth aberration is probably a response to the great variability of the climate in these environments."

Our own observations on the Lizard Island material have led to the following conclusions which are discussed and illustrated hereafter :

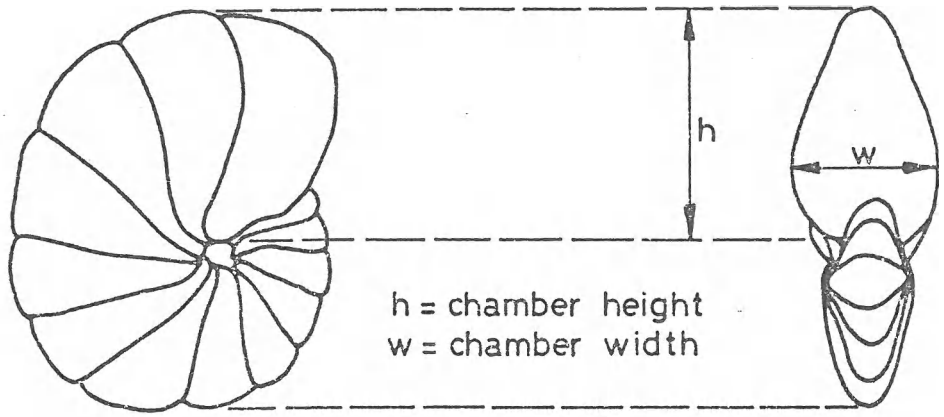
1) As our observations could not demonstrate any fundamental characteristic which would justify the maintenance of the forms acicularis and arietinus in a distinct genus, different from Peneroplis, I have placed them provisionally in the genus Peneroplis; future research will be needed to verify the exact systematic place of the fossil Spirolina - forms (e.g. S. cylindracea from the Eocene, type species of Spirolina; if such a research does not reveal important differences either, in my opinion the generic name Spirolina should be rejected and all Spirolina's should be placed in Peneroplis.
2) The four above mentioned "species" (P. pertusus, P. planatus, S. acicularis, S. arietina) are present in the Lizard Island material. I consider them as (eco)variants of one single species which I call Peneroplis pertusus (the denomination pertusus having datum priority over planatus whereas the classical P. pertusus may be considered as the central structural form from which the other variants can be derived). The names planatus, acicularis and arietinus have been conserved as subspecies names for convenience.

Structural analysis of Peneroplis pertusus and its variants :

The central structural form of the morphogroup, P. pertusus s.s., already shows a high degree of variability. In the classical view P. pertusus has been regarded as being involute and having a cribrate aperture, whereas the evolute, biumbilicate forms were considered as juvenile Spirolina's. Our observations on the abundant Peneroplis material in the Lizard Island samples forced us to conclude that such vieuws can no longer reasonably be maintained; indeed, all imaginable morphovariants occur, from small to big, evolute and involute, inflated or flattened last chamber, close-coiled, uncoiling or close-coiled with a tendency to uncoil. Aberrant forms such as described by CLARKE & KEIJ (1973) have however not been found in our material. Ecophenotypy, and particularly adaptation to the substrate, seems to be very important in this group, resulting in the following development tendencies :

- In Peneroplis pertusus s.s. we have maintained the planispiral, not flaring forms. This is, of course, an artificial grouping as no sharp boundary between flaring and not-flaring forms exists. Two types may be distinguished though all intermediates occur : involute, low- and broad-chambered forms on one hand and evolute low- and narrow-chambered forms on the other hand (N.B. the terms "chamber heighth" and "chamber width" have been used as illustrated

in textfig. 2 for spirally enrolled Foraminifera).



Textfig. 2

These forms are shown on pls. 15 and 16. The involute form generally has fewer chambers in the last whorl (8-10), has a broad and roughly triangular apertural face and its aperture is mostly cribrate. Surface ornamentation patterns are slightly varable : some specimens show single rows of larger, rounded pits (in the coiling direction), alternating with smooth areas in between; in this case the pits do not lie in depressions (see figs. 3a-c, pl. 15); other specimens show the more common pattern which is present in most other variants and which consists of irregularly scattered small pits lying in longitudinal grooves (depressions). The ornamentation of the apertural face however is the same in all variants : small, irregularly-formed and more or less elongated pits densely scattered over the surface and giving the latter a rough appearance. The apertural characteristics of this and other variants are discussed further on.

Sectioned specimens of this involute form (see figs. 4a-b, pl. 15) were invariably megalospheric and showed an embryonic apparatus composed of a globular proloculus followed by a narrow flexostyl of about half of the proloculus-circumference in length. The test is mostly made up of about three complete whorls and the successive apertures (becoming gradually more complex as the chambers are added - see further) are conserved as stolons. The total number of chambers in the figured section is 32. The septa are thick and solid at their base but are rapidly thinning towards the external test surface; the external chamber walls are thin and almost translucent. In this way a solid framework is formed, strengthening the entire test, but allowing thin test walls and much light penetrance.

The evolute form generally has more chambers in the last whorl (11-15) and is provided with a less triangular, more ovate apertural face; its aperture is often cribrate but may be single (fig. 2, pl. 16) and is, as a rule, less complex (see below). Surface ornamentation patterns are similar as described for the involute forms but the rows of larger pits are more commonly replaced by the smaller pits-in-grooves pattern (sometimes both types occur in one specimen, e.g. fig. 3, pl. 16). Sectioned specimens are megalospheric and show a structure identical with the involute specimens except for the more numerous chambers (fig. 4a, pl. 16 : 44 in three whorls, compare with fig. 4a, pl. 15).

- The name Peneroplis pertusus subsp. planatus covers the (mostly large) flaring forms, or those showing a tendency to become flaring. The boundary with P. pertusus s.s. on one hand, and with the arietina-forms on the other is not sharp. Adult specimens have a variable number of chambers in the last whorl (depending upon the rate of chamber flaring),but this number oscillates around 15-20. The surface ornamentation consists of the smaller pits-in-grooves pattern and the apertural face is equally finely pitted. Here the cribrate aperture of P. pertusus s.s. (particularly the one of the involute form) has developed into a row of more or less equal apertures, sometimes doubling, demonstrating the relationship with the Soritinae (see further). As far as the earlier whorls remain visible, the planatus-form seems to develop effectively most often from the involute pertusus s.s.-form.

Sectioned specimens (see fig. 4, pl. 17) are megalospheric and adult specimens generally consist of 3 tot 3,5 complete whorls; the structure of the test in the early whorls is identical with the one described for both pertusus s.s.-forms, including the globular proloculus with semicircular flexostyl. The complete number of chambers in the specimen fig. 4, pl. 17, is 42 which falls in the same order of magnitude as the evolute pertusus s.s.-forms. From the onset of the flaring chambers onwards (after about 2,5 whorls, on the left of the photograph fig. 4a, pl. 17), the septa are thickening whereas the chamber wall is thinning; in this way structural strength of the test and possibility of light penetrance are kept in balance. This septal thickening runs parallel with the increase of the number of stolons (relict-rows of successive apertures).

- The name Peneroplis pertusus subsp. acicularis covers the elongate, rapidly uncoiling forms with uniserial chamber portion consisting of numerous quasi-cylindrical chambers and provided with a single, quasi-circular aperture. The acicularis-variant seems to derive mainly from the involute

pertusus s.s.-form; the number of chambers in the last whorl of the planispiral test portion is about 8-9 whereas the uniserial test portion frequently counts 10-12 chambers or even more in adult specimens. In the Lizard Island material, two variants are present in the acicularis-form : a shallow-water (intertidal) form with stout and thick test wall and possessing a circular transverse section of the uniserial test portion as well as a circular aperture (see pl. 18, figs. 2a-f) and a deeper-water form (subtidal, leeward slope) with more slender, thinner, needlelike translucent test possessing a somewhat laterally compressed uniserial test portion as well as a somewhat ovate aperture (see pl. 19, figs. 1-2).

The intertidal form possesses the same pits - in-grooves pattern as described above; the apertural face is equally finely pitted. The sutures are more deeply incised in the uniserial test portion than in the planispiral one. Sectioned specimens (see pl. 18, figs. 2b-g) are all megalospheric; adult specimens generally consist of 1,5 to 2 complete whorls in the planispiral test portion. The section figs. 2b, c, g has 9 chambers in the uniserial test portion and 15 in the planispiral portion. The test wall remains thick throughout but as can be seen on fig. 2e, pl. 18, the ornamental pits are rather deep and reach as far as the middle of the test wall. The septa are thick near the periphery of the test but are rapidly thinning towards their center. Embryonic apparatus with flexostyl, septa and stolons in the planispiral part of the test are identical with the sections of other variants.The successive apertures are conserved as complex stolons in the septa (see fig. 2c, pl. 18) and remain of the simple, infolded type throughout (see below).

The subtidal form is in all respects identical with the intertidal from except for the already-mentioned externally-visible features; the ornamental pits are not as deep as in the intertidal form whereas the smooth areas between the pit-rows are larger; the sutures show a tendency to become somewhat limbate and are pit-less whereas the aperture generally shows less infoldings. These subtidal forms were initially suspected to represent the microspheric generation of the acicularis-form, but sections showed them to be megalospheric and are identical with the sections of the intertidal form. Adult specimens have 10-11 chambers in the uniserial test portion; the section illustrated on fig. 1d-g, pl. 19 possesses 13 chambers in the planispiral test portion; the test walls are extremely thin but the septa in the

uniserial test portion remain comparatively thick (see fig. 1d, pl. 19), in this way maintaining the structural strength-light penetrance balance in the same way as shown for the planatus-form.

- The name Peneroplis pertusus subsp. arietinus stands for the strongly compressed uncoiling variants. Transitional forms are numerous, particularly between the planatus- and the arietinus-subsp. (see pl. 21, fig. 1). This arietinus-variant seems to develop mainly from the evolute pertusus s.s. - morphotype (see e.g. fig. 3, pl. 19; fig. 2, pl. 20).

External features are comparable with the ones of the planatus-subsp., except for the uncoiling, non-flaring chambers and the generally biumbilicate test. Chambers in the uniserial test portion are generally not very numerous; the highest number counted was 5, in the specimen figured pl. 19, fig. 3 (where the final chambers show a tendency to be less compressed). On the contrary, chambers in the last whorl of the planispiral test portion are quite numerous (16-21). The aperture is generally of the planatus-type, though evidently not that elongate; mostly a double row of more or less 8-shaped apertures is present.

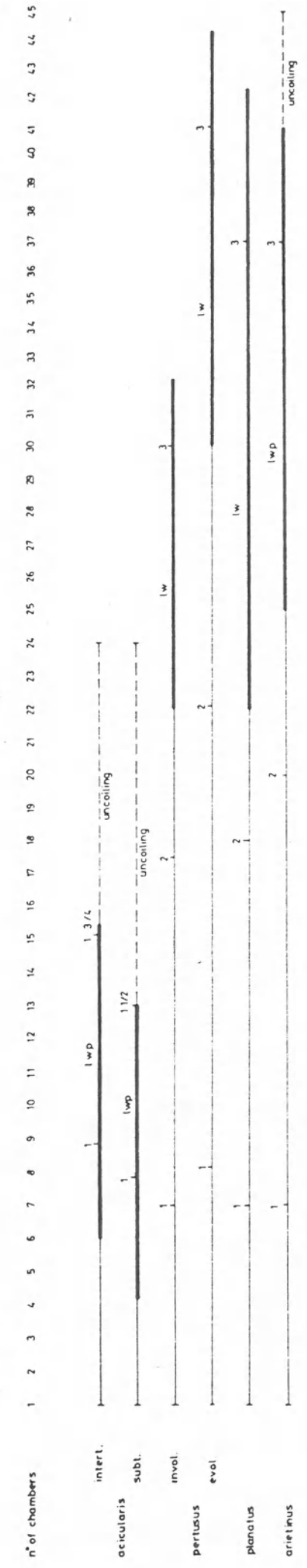
Sectioned specimens are megalospheric. Structural features including globular proloculus, flexostyl and stolons are identical with the formerly described sections of the other variants, except in the last, uncoiling test portion. The section fig. 4, pl. 20 shows three complete whorls in the planispiral test portion, and only two uncoiling chambers. The total number of chambers in this planispiral portion is 42. Test wall- and septal thickness are comparable with the same features in the planatus-type.

Summary and conclusions :

a) Summary of the most outstanding features of Peneroplis pertusus and its variants : see textfig. 3.
b) Relationship between Peneroplis pertusus-variants, based upon numerical data of table 1 : see textfig. 4.
c) Summary of the apertural development in the Peneroplis pertusus-variants : this development has been schematically illustrated in textfig. 5.

Textfig. 3 : Summary of the most outstanding features of Peneroplis pertusus and its variants.

	pertusus involute	pertusus evolute	planatus	acicularis intertid.	acicularis subtid.	arietinus
Number of chambers in last whorl (planispiral portion)	8 - 10	11 - 15	15 - 20	8 - 9	8 - 9	16 - 21
Total number of chambers in last whorl	------	-------	-------	± 18	± 20	20 - 22
Total number of chambers in planispiral portion, adult specimen (average)	32	44	42	15	13	42
Total number of chambers (complete test, adult specimen - average)	------	-------	-------	24	24	45
Number of whorls in planispiral test portion (adult specimen)	3	3	3 à 3,5	1,5 à 2	1,5 à 2	3 à 3,5
Nature of coiling	invol.	± evol.	invol. flaring	invol. uncoil.	invol. uncoil.	± evol.
Max. observed number of chambers in uniserial test portion				10	10 - 12	5
Marked lateral test compression		±	x		±	x
Nature of aperture	cribr.	cribr.or single	cribr. rows	single	single	cribr. rows



Textfig. 4 :
Relationship between Peneroplis pertusus - variants, based upon numerical data of textfig. 3.

Legend :

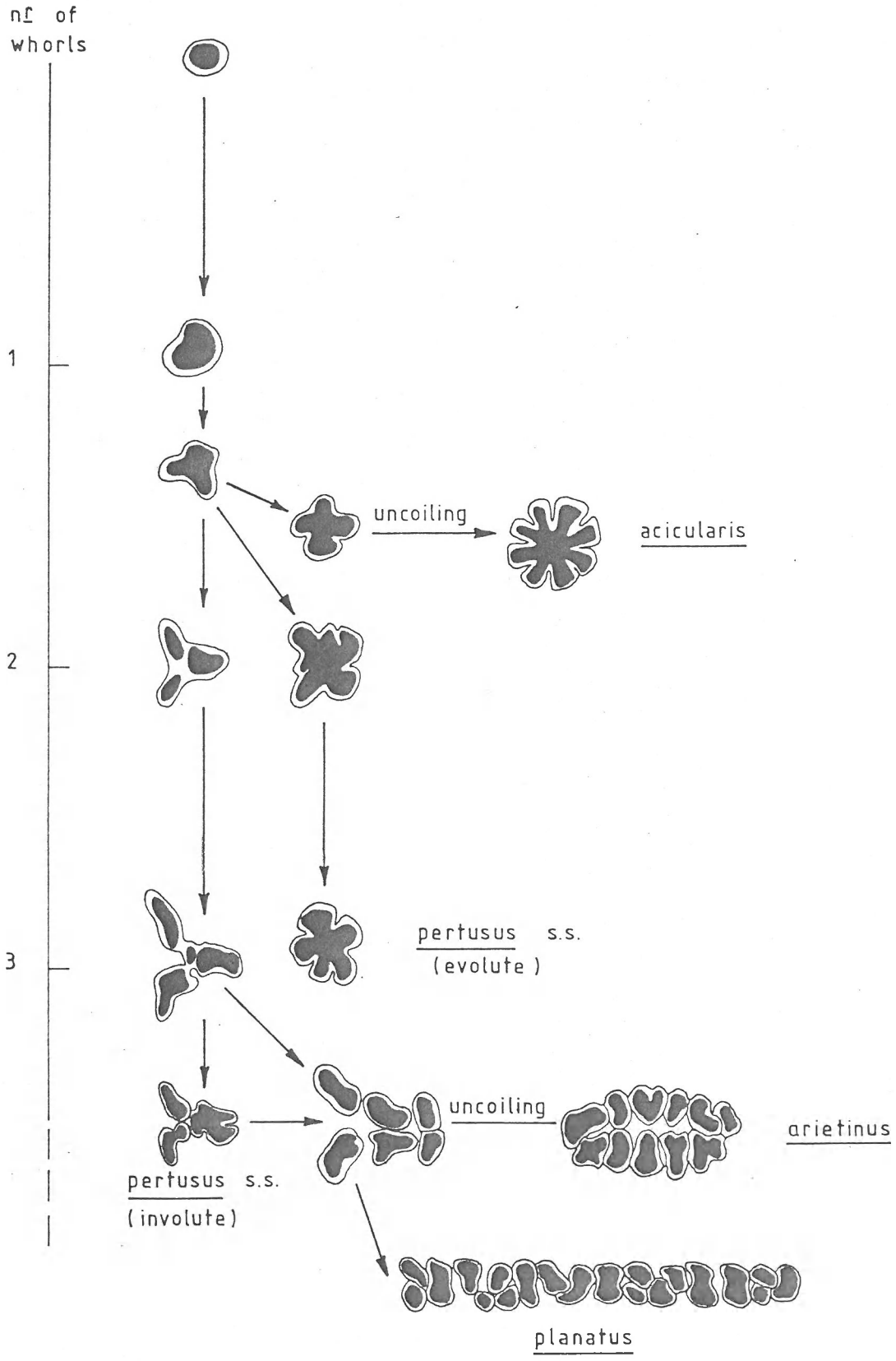
┌ 1 ┐ : length of line = average number of chambers in supposed full-grown tests. The figure above the line indicates the number of volutions.

┌------┐ : number of chambers in uncoiling test portion.

lw : number of chambers in last whorl.

lwp : number of chambers in last whorl of planispiral test portion.

(N.B. These values only express orders of magnitude, and should not be mistaken for statistically treated values).



Textfig. 5 : Summary of the apertural development in the Peneroplis pertusus - variants (Schematically).

The central apertural model is equal in all variants and consists of a rounded hole provided with a smooth collar (peristome). In the successive stages, the aperture becomes more and more complex by invagination of the peristome into the aperture (some evolute pertusus s.s.; acicularis); such invaginations may string parts of the aperture completely off, in this way causing a cribrate aperture to appear (pertusus s.s.) which may complicate itself by unidirectional repeating of this process (arietinus, planatus). For illustration : see SEM-photographs of sectioned specimens, pls. 15-20. No matter how complex the cribrate aperture, every hole is invariably surrounded by a more or less narrow peristome, a feature persisting in the more complexly structured Soritidae.

d) General conclusions : From the data discussed above, (textfigs. 3-5), the following general conclusions in respect to the development and relationship of the Peneroplis pertusus - variants can be drawn :

- Obviously the central form is the immature P. pertusus s.s., planispirally enrolled, evolute or involute with all intermediates occurring. The aperture, first a simple rounded hole with peristome, starts on being invaginated by the peristome and becoms clover-leaf formed after the completion of the first volution.

- After 1,5 volutions a first branching in the development is initiated and results in both types of the uncoiling acicularis-subsp. with its two variants; their aperture remains single and the continuing invagination-process results in a star-like pattern.

- Until the completion of the second volution not much differentiation occurs in the other variants except for the number of chambers oscillating slightly and for hardly noticeable differences in apertural development. It would be hard trying to distinguish between juvenile pertusus-tests in this stage as to the kind of variant they would yield in case of a continued development.

- From the beginning of the third volution onwards, the differentiation of the remaining variants starts on; under the strain of environmental conditions, a first variant, pertusus s.s. remains close to the central form (planispiral and with a not very complicated aperture which may be single or invaginated as in some evolute forms, or cribrate as in most involute specimens). A second variant flattens, increases its surface and as a result the cribrate aperture stretches out; after the third volution (or about

this point) the form uncoils and the arietinus-subsp. is completed. During the process of flattening and surface increase, a third variant, the planatus-subsp. increases its chamber surface more than any other and its chambers rapidly become flaring while it colonises the intertidal, reef-flat algal covers in great numbers. As a result of the outstretching of the apertural face, the single elements of the cribrate aperture become gradually arranged in a row of single, 8-shaped or doubled holes. The further evolution of these apertural features is to be found in the discoidal soritids which show a comparable but more complex apertural "ontogeny" (see below).

Peneroplis pertusus s.s. (FORSKÅL, 1775)
(pl. 15, figs. 3-4; pl. 16, figs. 1-4).

+ 1775 Nautilus pertusus; - FORSKÅL, p. 125.
1866 Peneroplis pertusus (FORSKÅL); - JONES, PARKER & BRADY, p. 99.
1884 Peneroplis pertusus (FORSKÅL); - BRADY, p. 204, pl. 13, figs. 16-17, 23.
1897 Peneroplis pertusus (FORSKÅL); - FLINT, p. 304, pl. 48, fig. 4.
1917 Peneroplis pertusus (FORSKÅL); - CUSHMAN, pt. 6, p. 86, pl. 36, figs. 1a-c; pl. 37, figs. 1-2, 6.
1921 Peneroplis pertusus (FORSKÅL); - CUSHMAN, vol. 4, p. 481.
1930 Peneroplis pertusus (FORSKÅL); - CUSHMAN, pt. 7, p. 35, pl. 12, figs. 3-6.
1957 Spirolina arietina (BATSCH); - TODD, p. 288 (tab.), pl. 89, figs. 2-4.
1958 Peneroplis pertusus (FORSKÅL); - COLLINS, p. 376.
1959 Peneroplis pertusus (FORSKÅL); - GRAHAM & MILITANTE, p. 62, pl. 9, figs. 23A-b.
1959 Spirolina arietina (BATSCH); - GRAHAM & MILITANTE, pl. 10, figs. 9, 11.
1977 Peneroplis pertusus (FORSKÅL); - LEVY, p. 399, pl. 1, fig. 11.
1979 Peneroplis pertusus (FORSKÅL); - PEREIRA, pl. 20, figs. A-H.

Description : See FORSKÅL (1775); JONES, PARKER & BRADY (1866) and note p. 47 etc.

Diagnostic Remarks and Distribution : See note, p. 47, etc.

Occurrence : Common to abundant in all habitats at Lizard Island; the species is present on the reef-flats together with planatus but does not seem to enter in competition with the latter subspecies in dwelling upon the upper parts of the thalli of the algal cover (see Part 1).

Peneroplis pertusus (FORSKÅL), subsp. planatus (FICHTEL & MOLL, 1798) (Pl. 17, figs. 1-4; pl. 18, fig. 1).

\+ 1798 Nautilus planatus; - FICHTEL & MOLL, p. 91, pl. 16, figs. a-i.
1884 Peneroplis planatus (FICHTEL & MOLL); - BRADY, p. 204, pl. 13, figs. 15a-b.
1917 Peneroplis pertusus (FORSKÅL), var. planatus (FICHTEL & MOLL); - CUSHMAN; pt. 6, p. 87, pl. 37, figs. 3a-b.
1921 a Peneroplis planatus (FICHTEL & MOLL); - CUSHMAN, pt. 4, p. 481.
1921 b Peneroplis planatus (FICHTEL & MOLL); - CUSHMAN, p. 75, pl. 18, fig. 9.
1930 Peneroplis planatus (FICHTEL & MOLL); - CUSHMAN, pt. 7, p. 39, pl. 14, figs. 6-7.
1933 Peneroplis planatus (FICHTEL & MOLL); - CUSHMAN, pt. 2, p. 61, pl. 19, figs. 1-3.
1949 Peneroplis planatus (FICHTEL & MOLL); - SAID, p. 24, pl. 2, fig. 38.
1958 Peneroplis planatus (FICHTEL & MOLL); - COLLINS, p. 375.
1959 Peneroplis planatus (FICHTEL & MOLL); - GRAHAM & MILITANTE, p. 63, pl. 10, figs. 1-4a-b.
1979 Peneroplis planatus (FICHTEL & MOLL); - PEREIRA, pl. 20, figs. J-P. (not Q); not pl. 21, figs. A-C.

Description : See FICHTEL & MOLL (1798), BRADY (1884) and note p. 47, etc.

Diagnostic Remarks and Distribution : See note, p. 47, etc.
This variant is widely distributed in Indopacific reefal areas; it has equally been reported from the Mediterranean and the Persian Gulf; COLLINS (1958) reports it from the Great Barrier Reef.

Occurrence : Common in all habitats at Lizard Island, except for the Lagoon. Living specimens are particularly abundant and are epiphytic upon coarser weeds on the reef-flats and -patches, and also upon the Halimeda-meadows in the Perireefal Area.

Peneroplis pertusus (FORSKÅL), subsp. acicularis (BATSCH, 1791).
(Pl. 18, figs. 2a-d, 3; pl. 19, figs. 1-2)

+ 1791 Nautilus (Lituus) acicularis; - BATSCH, pp. 3, 6, pl. 6, figs. 16a-b.
1804 Spirolinites cylindracea; - LAMARCK, vol. 5, p. 245; id, 1806, vol. 8, pl. 62, fig. 15.
1884 Peneroplis cylindraceus (LAMARCK); - BRADY, p. 205, pl. 13, figs. 20-21.
1921 Peneroplis cylindraceus (LAMARCK); - CUSHMAN, vol. 4, p. 483.
1930 Spirolina acicularis (BATSCH); - CUSHMAN, pt. 7, p. 42, pl. 15, figs. 1-3.
1933 Spirolina acicularis (BATSCH); - CUSHMAN, pt. 2, p. 63, pl. 19, figs. 6-7.
1954 Spirolina acicularis (BATSCH); - CUSHMAN, TODD & POST, p. 348, pl. 87, fig. 6.
1958 Spirolina cylindraceus (LAMARCK); - COLLINS, p. 376.
1959 Spirolina acicularis (BATSCH); - GRAHAM & MILITANTE, p. 64, pl. 10, figs. 7-8.
1960 Spirolina acicularis (BATSCH); - BARKER (see ref. BRADY 1884).
1979 Spirolina acicularis (BATSCH); - PEREIRA, pl. 21, fig. N.

Description : See BATSCH (1791), BRADY (1884), CUSHMAN (1921, 1930); see also note, p. 47, etc.

Diagnostic Remarks and Distribution : See note, p. 47, etc. The variant is widely distributed in Indopacific reefal areas and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests of the coarser intertidal form are rare and have been encountered mainly in the Lagoon and in the shallow backreef areas. Living specimens of the subtidal form were mainly encountered in Watson's Bay, at North Point and upon the Western Slope. This form seems to have a preference for finer sediments.

Peneroplis pertusus (FORSKÅL), subsp. arietinus (BATSCH, 1791)
(Pl. 19, figs. 3a-b; pl. 20, figs. 1-4; pl. 21, figs. 1a-b).

+ 1791 Nautilus (Lituus) arietinus; - BATSCH (part), p. 4, pl. 6, fig. 15c.
1865 Peneroplis arietinus (BATSCH); - PARKER, JONES & BRADY, vol. 16, p. 26, pl. 1, fig. 18.
1884 Peneroplis arietinus (BATSCH); - BRADY, p. 204, pl. 13, figs. 18-19-22.
1921 a Peneroplis arietinus (BATSCH); - CUSHMAN, vol. 4, p. 482.
1917 Peneroplis pertusus (FORSKÅL) var. arietinus (BATSCH); - CUSHMAN, pt. 6, p. 88, pl. 36, fig. 5.
1930 Spirolina arietina (BATSCH); - CUSHMAN, pt. 7, p. 43, pl. 15, figs. 4-5.
1933 Spirolina arietina (BATSCH); - CUSHMAN, pt. 2, p. 62, pl. 19, figs. 4-5.
1949 Spirolina arietina (BATSCH); - SAID, p. 24, pl. 2, figs. 35-39.
1954 Spirolina arietina (BATSCH); - CUSHMAN, TODD & POST, p. 348, pl. 87, figs. 4-5.
1957 Spirolina arietina BATSCH ; - TODD, p. 288 (table), pl. 89, figs. 2-4.
1958 Peneroplis arietinus (BATSCH); - COLLINS, p. 376.
1959 Spirolina arietina (BATSCH); - GRAHAM & MILITANTE, p. 64, pl. 10, fig. 10 (not 9 and 11).
1960 Spirolina arietina (BATSCH); - BARKER (see ref. BRADY 1884).
1979 Peneroplis arietinus (BATSCH); - PEREIRA, pl. 19, figs. N-P.

Description : See BATSCH (1791), PARKER, JONES & BRADY (1865) and note p. 47, etc.

Diagnostic Remarks and Distribution : See note, p. 47, etc. The variant is widely distributed in Indopacific coral reefs and has been reported by COLLINS (1958) from the Great Barrier Reef under the name Peneroplis arietinus.

Occurrence : This is the least common of the four pertusus - variants and has been encountered in small numbers at several perireefal stations and in one lagoonal and one patchreef sample. Living specimens have not been met.

Subfamily SORITINAE EHRENBERG, 1839.

Note on Sorites, Amphisorus and Marginopora.

The species of these genera have been classified here according to increasing order of complexity of the test structure. Up to the present day there is much confusion about these forms, as well for the exact determinations as for nomenclatorial designations; this confusion arises mainly because of the great variability of these forms and the insufficient structural understanding and analysis in existing literature.
Exact determination based upon externally visible features exclusively is only possible when the structural variants have first been thoroughly described, and this goal has not yet been completely achieved though good structural analyses of several of these taxa have already been delivered by e.g. LEHMANN (1961), HAMAOUI & BRUN (1974), HOTTINGER (1978); most of the structural elements of the Lizard Island representatives of this group can be referred to LEHMANN's descriptions.

Many nomenclatural problems arise around the least complexly structured forms and several genera (e.g. Puteolina, Sorites, Praesorites, Broeckina) are alternatively validated and invalidated by the authors (see discussions by HOFKER (1950-1952, 1971); MARIE (1958); LEHMANN (1961); SMOUT (1963); LEVY (1977); see particularly the review of genera by HAMAOUI & BRUN (1974).

I have maintained the Lizard Island representatives of this group in the genera Sorites, Amphisorus and Marginopora, following LEHMANN's (1961) designations with which I agree so far. The internal structure of the taxa has been checked by several sections which are illustrated (SEM-photographs) on pls 22-35. For extensive description of generic features and structural elements of these three genera, I refer to LEHMANN (1961). Nevertheless, though I have followed LEHMANN's systematics, I am aware of the fact that the final word in this matter has not yet been spoken; there are e.g. strong indications that more definitive solutions of the problems arising in the study of this complex foraminiferal group should be searched for in the direction of HOFKER's long denied trimorphism. At least in Sorites marginalis I have demonstrated the existance of such processes (see below) and they might be looked for in the other soritids as well; combined with thorough ecological and biological information they should lead to a more realistic and close-to-nature systematical and nomenclatural arrangement of these forms.

The entire group of recent and fossil Soritidae will be completely revised in the near future by Dr. HOTTINGER (personal communication, 1981).

- The genus Sorites, characterised by a single chamber layer, an embryonic apparatus consisting of proloculus and flexostyle, an (often reduced) spiral chamber series and a cyclical stage, is represented in our Lizard Island material by four species, viz. S. discoideus, S. orbitolitoides, S. marginalis and S. orbiculus (in increasing order of structural complexity). The first two of these, discoideus and orbitolitoides, are characterised by a relatively simple system of stolons, septa and septula, a relatively small embryonic apparatus even in the megalospheric (A) form and a well-developed spiral chamber series. These species have previously been placed in several genera (Puteolina, Broeckina, Praesorites) but as they show all the characteristics of the genus Sorites as described by LEHMANN, they have here been placed and maintained in this genus.

Sorites marginalis, a very controversial species, is only represented in our material by large discoidal A-forms (A_2 forms sensu HOFKER) with generally very large embryonic apparatus showing a proloculus and a large flexostyle, and an extremely reduced spiral chamber series; in some specimens the single marginal apertures are "bridged" and show a tendency to double obliquely (in an angle of 45°), thus hinting at a development towards an Amphisorus - like structure; the overall structure however is typically soritid.

Sorites orbiculus is characterised by its thick test, its embryonic apparatus (A-forms) provided with a well-developed flexostyle and in several cases the first chamber of the (obscured and reduced) spiral chamber series is somewhat enlarged, reminiscent of a differenciation towards Amphisorus and Marginopora; the marginal apertures are often doubled by peristomal bridges.

- The genus Amphisorus, characterised by its two chamber layers, its embryonic apparatus (A-forms) consisting of proloculus, flexostyle and "Vorhof" (circumambient segment) and its double row of marginal apertures which are elongate and displaced over the width of half a chamberlet, is represented in our material by the only known species of this genus, A. hemprichii. Generally the "Vorhof" in our specimens is smaller than in M. vertebralis but the variational extremes of both species touch each other in this respect.

- Finally the genus Marginopora is represented in our material by the variants of Marginopora vertebralis, the only known species of this genus

(M. laciniata and var. plicata being merely ill-defined variants of M. vertebralis). This species is characterised by its principal- and secondary chamber layers, its mostly large embryonic apparatus in the A-form, with flexostyle and often very large "Vorhof" embracing the entire circumference of the embryonic apparatus. Two main variants are present : the flat, regular form (Perireefal Area) comprising A and B-forms, and the irregular form (intertidal area) comprising only A-forms. Both forms possess the same internal structure and undoubtedly belong to the same species.

Genus Sorites EHRENBERG, 1839.

Sorites discoideus (FLINT, 1899)
(Pl. 21, figs. 2-3; pl. 22, figs. 1-2; pl. 23, fig. 1; pl. 24, fig. 1).

+ 1899 Peneroplis pertusus (FORSKÅL), var. discoideus; - FLINT, p. 304, pl. 49, figs. 1-2.
1930 Peneroplis discoideus FLINT; - CUSHMAN (Atl. Ocean), p. 41, pl. 15, figs. 6-8.
1930 Archaias discoideus (FLINT); - HOFKER, p. 147-148, pl. 56.
1935 Peneroplis discoideus FLINT; - BERMUDEZ, p. 191.
? 1959 Peneroplis discoideus FLINT; - GRAHAM & MILITANTE, p. 62, pl. 9, fig. 22.
1971 Puteolina discoidea (FLINT); - HOFKER, pt. 3, p. 48, pl. 82, figs. 2-3.
1973 Broeckina orbitolitoides (HOFKER); - BROOKS, pl. 8, figs. 14-15.
? 1974 Orbitolites (Sorites) orbitolitoides (HOFKER); - HAMAOUI & BRUN, p. 16, pl. 9, figs. 1-4; pl. 10, figs. 1-3; pl. 11, figs. 1-2.
1977 Broeckina discoidea (FLINT); - LEVY, p. 421, pl. 7, figs. 1-7.

Description : See FLINT (1899), HOFKER (1930), LEVY (1977).

Diagnostic Remarks and Distribution : This is one of the species traditionally placed by HOFKER (div. publ.) in his genus Puteolina, characterised by more or less involute coiling (this is partially true) and "perforate walls" (which is not true : the walls are pitted but not completely perforated). The discussion about the pitting of the wall in "Puteolina" might be of importance in future investigations of this group of (mostly Atlantic) soritids, in which HOFKER includes also Archaias and allied forms. However, the internal structure of discoideus is identical to the one of orbitolitoides;

the latter shows no pitting of the chamber walls, except for the margins and sutures. I do not deny that this pitting might have some supraspecific and even suprageneric importance in peneroplids and other soritids, but at present I can only notice the structural resemblance between discoideus and orbitolitoides, a fact equally observed by LEVY (1977) who has placed these forms in the (Cretaceous !) genus Broeckina (created by MUNIER-CHALMAS). Herewith I cannot agree, if only for the fact that the original description of this genus is very questionable and that it is at least partially covered by the later interpretations of the genera Praesorites, Puteolina and Sorites.

Consequently I have put the discoideus-species in the genus Sorites as it possesses the main characteristics of this genus as defined by LEHMANN; future research should clarify the real status of HOFKER's Puteolina.

The externally visible features are very characteristic. Shell thin : smooth, thin-walled but whitish-opaque in appearance. Septula not or hardly visible externally unless wetted (contrary to Orbitolitoides). Chambers somewhat embracing, early coil more or less involute. Test walls entirely and roughly pitted except for narrow, smooth areas near the sutures and around the apertures (without nevertheless becoming pronounced peristomes). Individual chamberlets not inflated in young specimens, slightly so in the last coils of adults.Last-formed annular chamber shows rounded periphery in the middle of which the single row of slightly oval apertures appears.

- The internally visible structural elements, as they appear in sectioned specimens, reveal the soritid structure as described by LEHMANN (1961). The embryonic apparatus of the A-form shows a somewhat oval, compressed proloculus followed by a narrow, rather straight flexostyle; this apparatus is sometimes situated out of the coiling plane (see pl. 23); it is followed by a peneropline-spiral chamber series consisting of up to 20 or more chambers before reaching the annular stage. The number of undivided (peneropline) chambers varies in A-forms from 2-3 tot 5-6 (indicative of trimorphism ?). The number of annular chambers is generally low (2 to 5) except for some relatively large specimens (see specimen fig. 1, pl. 23 where 24 annular chambers were counted). Microspheric or B-forms (see fig. 1, pl. 24) show essentially the same features except for the much larger initial coil, the small proloculus and the larger number of peneropline chambers (12-13); this figured B-form shows traces of broken-off breeding-chambers.

The species has up to now mostly been recorded from the Caribbean Sea; GRAHAM & MILITANTE (1959) record it from the Philippines. The present record

is the first one from the Great Barrier Reef. Our specimens are identical with the Bahaman ones described by LEVY (1977) and by HAMAOUI & BRUN (1974) and have been compared with material from Andros Island (coll. MONTY), a specimen of which has been shown on pl. 12, fig. 2, for comparison.

Occurrence : The species is rather rare in our Lizard Island samples; it occurs occasionally at some patchreef stations, in the backreef area of the Windward Barrier, on the Internal Platform and the Leeward Slope. Most specimens are dead and broken; in most patchreef localities only fragments are present. No living specimens have been encountered.

Sorites orbitolitoides (HOFKER, 1930)
(Pl. 24, fig. 2; pl. 25, fig. 1).

1884 Orbitolitoides marginalis LAMARCK; - BRADY, pl. 15, fig. 4.
1899 Orbitolitoides marginalis LAMARCK; - FLINT, p. 304, pl. 50, fig. 2; pl. 51, fig. 1.
\+ 1930 Praesorites orbitolitoides; - HOFKER, pt. 2, p. 149, pl. 55, figs. 8, 10, 11; pl. 57, figs. 1-5; pl. 61, figs. 3-14.
1930 Sorites marginalis (LAMARCK); - CUSHMAN, pt. 7, pl. 18, fig. 2.
1940 Sorites hofkeri; - LACROIX, p. 10.
1952 Orbitolites (Sorites) orbitolitoides (HOFKER); - HOFKER, pt. 2, p. 109.
1960 Sorites orbitolitoides (HOFKER); - BARKER (see ref. BRADY 1884).
e 1961 Sorites orbitolitoides (HOFKER); - LEHMANN, p. 645, pl. 10, figs. 1-5.
1971 Broeckina orbitolitoides (HOFKER); - BOCK e.a.; p. 35, pl. 13, fig. 15.
1973 Sorites marginalis (LAMARCK); - BROOKS, pl. 8, fig. 13, 16.
non 1977 Sorites orbitolitoides HOFKER; - HOTTINGER, p. 99, figs. 11B, 13, 30 A-C, 32A.
1977 Broeckina orbitolitoides (HOFKER); - LEVY, p. 423, pl. 7, figs. 8-14.

Description : See LEHMANN, 1961.

Diagnostic Remarks and Distribution : The generic status of this species is as controversial as that of the preceding species to which it is apparently closely allied. It has been successively placed in the genera Orbitolites, Praesorites, Sorites and Broeckina. LEHMANN (1961) placed the species in the genus Sorites and argues that it is certainly not a Praesorites (see LEHMANN op.cit. for full argumentation); LEVY (1977) placed the species in Broeckina

together with discoideus, thus ignoring LEHMANN's and HOTTINGER's work. LEHMANN revealed the Sorites-structure of the species. Our specimens, though rare, agree with his descriptions.

External features are the very thin translucent test (at least in our few, rare, immature tests) which is. Most of our specimens were alive and the protoplasm could clearly be seen through the test wall. The latter is smooth (not pitted), except for the apertural margin, sutures and "chamberlet sutures" which show a faint pitting. The individual chamberlets are somewhat inflated and are clearly visible from the exterior. The periphery is rounded and shows slightly oval apertures in the depressions facing the septula; the peristomes are hardly pronounced; where new chamberlets will be added in the next chamber, an aperture can be seen in the middle of the peripheral chamberlet wall, between the "normal" apertures (see fig. 1b, pl. 25).

The internal structure is comparable with the one of the discoideus-species and shows a globular proloculus and a well-developed flexostyle in the A-form whereas the number of peneropline chambers is relatively high (3 to 5 in our specimens). The spiral chamber series comprises ± 25 chambers; in most of our specimens the annular stage is not reached, except for a few ones showing 2-3 annular chambers (see fig. 1, pl. 25). All observed specimens were megalospheric. Stolons and septula are of the same simple type as in the discoideus-form.

- The species is apparently widely distributed in tropical coral-reef habitats. It has mainly been recorded from the West-Indies but BRADY's figured specimens from Honolulu reefs obviously belong to this species. The record from the Gulf of Elat by HOTTINGER (1977) is erroneous (HOTTINGER, personal communication 1981). The present record is the first one from the Great Barrier Reef.

Occurrence : Juvenile, living specimens are scarcely represented at a few patchreef stations.

Sorites marginalis (CARPENTER, 1856), sensu LEHMANN, 1961
(Pl. 25, fig. 2; pl. 26, figs. 1-2; pl. 27, fig. 1; textfigs. 4-5).

non 1816 Orbulites marginalis; - LAMARCK, vol. 2, p. 196.
1856 Orbitolites marginalis; - CARPENTER, p. 192.
1883 Orbitolites marginalis (LAMARCK); - CARPENTER, p. 560, fig. 1.
non 1884 Orbitolites marginalis (LAMARCK); - BRADY, p. 214, pl. 15, figs. 1-5.
? 1930 Sorites marginalis (LAMARCK); - CUSHMAN, (USNM Bull. 104), pt. 7, p. 49, pl. 18, figs. 1-4.
1940 Sorites hofkeri LACROIX; - LACROIX, pp. 10-12.
non 1947 Sorites marginalis (LAMARCK); - TODD, p. 288 (table), pl. 89, figs. 5-6.
1958 Sorites marginalis (LAMARCK); - COLLINS, p. 376.
e 1961 Sorites marginalis (CARPENTER); - LEHMANN, p. 643, pl. 8, figs. 9-10; pl. 9, figs. 1-6.
1963 "Orbitolites" carpenteri SMOUT; - SMOUT, p. 261, pl. 5, figs. 1-2.
non 1963 "Orbitolites" marginalis (LAMARCK); - SMOUT, p. 259, pl. 4, figs. 5-6.
1971 Orbitolites (Sorites) hofkeri (LACROIX); - HOFKER, p. 52, pl. 91, figs. 1-7.
non 1977 Sorites marginalis (LAMARCK); - LEVY, p. 426, pl. 8, figs. 1-10.

Description : See LEHMANN, 1961.

Diagnostic Remarks and Distribution : This is a very controversial and frequently misidentified species; established by CARPENTER, the species has subsequently been confused with almost all other discoidal soritids, until CARPENTER's species has been redefined and accurately described by LEHMANN (1961). LEVY (1977) confused several forms in his revision of recent Soritidae and in particular called S. marginalis, specimens which without doubt belong to the generally smaller species S. orbiculus.

One of the aspects of the confusion lies in the fact that this species undoubtedly shows tri- (of multi-?) morphism; combined with ecophenotypic variation, the species exhibits variational extremes which have been attributed to different species; there is e.g. no doubt that SMOUT's (1963) "O". carpenteri is nothing else than marginalis as described by CARPENTER and LEHMANN; whereas HOFKER himself admits (1971, p. 52) that carpenteri and LACROIX's hofkeri are identical.

Sorites marginalis, in the Perireefal Area frequently attaining dimensions between 0,5 and 1 cm or even more, is one of the three soritid species

(together with A. hemprichii and M. vertebralis), associated with the peri-reefal Halimeda-meadows and characterised by gigantism. Even larger S. marginalis (exceeding 1 cm), also associated with the same Halimeda environments occur in material collected off Eastern New Guinea (kindly put at my disposal by Dr. WOUTERS, R.I. Nat. sci., Brussels).

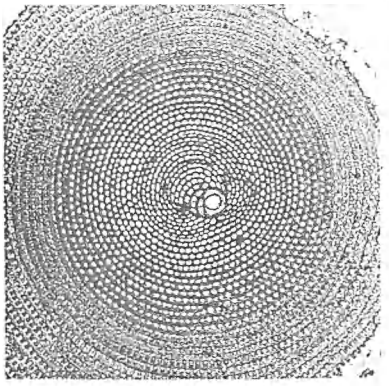
Externally the species is characterised by its large dimensions and very regular structure. The chamberlets are visible from the exterior and are somewhat inflated though less than in S. orbitolitoides; they are smaller than in S. orbiculus. The lateral chamber walls are very thin and rapidly disappear after the animal's death (greenhouse function). The central area of the test generally is strongly inflated as most of our specimens are A_2-forms possessing a fairly large embryonic apparatus. The periphery is rounded and the marginal apertures are mostly single, 8-shaped elongate and sometimes doubled under an angle of 45° (reminiscent of Amphisorus ! - see fig. 2e, pl. 26). The marginal surface is slightly pitted except for narrow areas around the apertures, which do not become pronounced peristomes however. Embryonic apparatus-walls and narrow areas near the sutures are pitted as in S. orbitolitoides; this pitting apparently rapidly disappears in abraded specimens.

The internal structure corresponds with the descriptions of LEHMANN. The thickened septa and thick and high septula with slightly thickened end are constant features in the three generations. The structure of the embryonic apparatus reveals the existence of a kind of trimorphism in this species. Nearly all the specimens collected during the 1975 mission are A_2-forms with very large, inflated embryonic apparatus which is much thicker than the remainder of the test. It consists of a rather thick-walled, globular to drop-like proloculus followed by a large, circular (in section) flexostyle which broadens towards its distal end in a peneropline, somewhat flaring way. There are no undivided (peneropline) chambers; the first spiral chamber is already divided into two or three chamberlets which are connected with the flexostyle by means of flattened, oval stolons lying in a slitlike depression of the flexostyle wall. The peneropline series is reduced here to the flexostyle itself. The next chambers rapidly broaden and the annular stage is reached after about 10 chambers. Due to the large dimensions, the annular stage counts numerous chambers (20 to 30 or more). No breeding chambers were observed in this form.

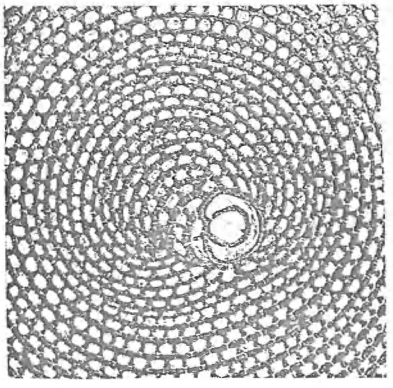
The A_1-forms are not represented in our 1975 material but have been found in the samples from the Lagoon taken during the "De Moor" expedition by

Dr. MONTY. These are apparently the same as those described by LEHMANN from Nai. The embryonic apparatus is smaller and less inflated; the shape of proloculus and flexostyle is the same as in the A_2-forms but they are smaller; the first spiral chamber is undivided or possesses one septulum; the spiral series itself is much longer than in the A_2-forms and comprises a series of 6-8 flaring chambers, after which stage the chambers rapidly broaden. The annular stage is reached after 10-12 chambers (see textfigs. 6-7).

The B-forms are extremely rare in our material; in fact only one specimen has been found; it is shown on fig. 2, pl. 26 and fig. 1, pl. 27; it has been sectioned but unfortunately the central area (being extremely thin) has been broken away during the manipulation of the section. The embryonal section is the same as described by LEHMANN (p. 645) and consists of a globular initial chamber followed by a peneropline chamber series; as to LEHMANN, the number of peneropline chambers is about 11. On the external view of the central test area (fig. 2b, pl. 26), the rather evolute spirally arranged peneropline-spiral chamber series can be seen.



Textfig. 6 : S. marginalis; A_1-form, aequatorial section of a specimen collected during the "DE MOOR" expedition in the Lagoon of Lizard Island.



Textfig. 7 : Same section as tf. 6, showing embryonic apparatus, spiral- and first annular chambers.

This is a typical Indopacific species and occurs apparently in great numbers in the relatively shallow shelf sediments. It seems to be present in the Atlantic tropical reefal areas but due to erroneous records its exact

geographical limits need yet to be established. The species has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Present in the Perireefal- and deeper Patchreef Area (below the 10 m isobath, except for L 102 (-6 m). Notwithstanding the narrow sampling mesh in the Lagoon, no large S. marginalis-specimens have been found there in the samples taken in 1975 (except for the Lagoon Entrance). However, several large specimens of the A_1-form have been encountered in the Lagoon sample L 7 taken during the "DE MOOR" expedition at about the same place as L 124.

Due to its large size, the species is always recorded as more or less rare. Thanatocoenose counts do not yield percentages of more than 3%. In working through sufficient quantities of sediment however the species may be considered not to be uncommon (see chapter "Methods", Part 1). The same remark is valuable for A. hemprichii, M. vertebralis, Alveolinella quoii and larger nummulitids. A better approach to the real thanatocoenose frequencies of these larger species is obtained by the fragment counts, represented upon the percentage diagrams pro sample (see Part 1, annex). Living specimens are occasionally encountered.

Sorites orbiculus EHRENBERG, 1839
(Pl. 27, fig. 2; pl. 28, figs. 1-2; pl. 29, fig. 1).

\+ 1839 Sorites orbiculus; - EHRENBERG, p. 134.
1852 Orbiculina complanata; - WILLIAMSON, p. 115.
1957 Marginopora vertebralis BLAINVILLE; - TODD, pl. 89, fig. 6.
e 1961 Sorites orbiculus EHRENBERG; - LEHMANN, p. 641, pl. 8, figs. 1-8; tf. 36.
1969 Sorites variabilis LACROIX; - BLANC - VERNET, p. 197, pl. 12, figs. 1-2.
1971 Orbitolites (Amphisorus) orbiculus FORSKÅL; - HOFKER, p. 51, pl. 88, figs. 1-3, 7.
1977 Sorites orbiculus EHRENBERG; - HOTTINGER, p. 94, figs. 9B, 30D, E, 32B.
1977 Sorites marginalis (LAMARCK); - LEVY, pl. 8, figs. 1-10.
1979 Sorites aff. S. marginalis (LAMARCK); - PEREIRA, pl. 22, figs. B, F, G, J, K.

Description : See LEHMANN (1961).

Diagnostic Remarks and Distribution : Our specimens are in full agreement with LEHMANN's (1961) descriptions. They are the same as HOTTINGER's (1977)

specimens from the Gulf of Elat.

Externally, the tests are characterised by their more or less irregular, substratum-conditioned shape. They can easily be distinguished from other soritids mentioned here by this feature and by their strongly oscillating, somewhat swollen sutures isolating the rather large and somewhat inflated chamberlets. The peripheral margin is flattened and depressed in front of the septula. The apertures are elongate to 8-shaped and surrounded by a pronounced peristome which may form a bridge separating the aperture in two partitions. Where new chamberlets will be added, single oval to rounded apertures are to be found in the middle of the peripheral wall between two main apertures (see fig. 1c, pl. 28). Notice the fact that the lateral chamber walls as well as the marginal wall are finely pitted, except where the suture meets the septulum-depression of the preceding chamber and a chalky, low, pit-less boss is formed (see e.g. fig. 1b, pl. 28). The external wall of the embryonic apparatus is densely covered with irregularly-formed, shallow pits, giving rise to a somewhat reticulate pattern (seen only at high magnification - fig. 1b, pl. 29).

The internal structure, as revealed by equatorial sections, is in agreement with Lehmann's (1961) descriptions; the most obvious features are the very short septula (causing e.g. the lobed periphery and the bended septum-roofs of the chamberlets); where the section cuts through the stolons, the septum-partitions show their typical bow-shape with upward nods at the extremities where the peristomes are cut (redeposited shell material).

There are no clear indications of trimorphism in our specimens though the phenomenon is not to be excluded in this species : indeed, the section showed by HOTTINGER (1977, fig. 32B, p. 98) seems to possess a relatively smaller embryonic apparatus and a longer spiral stage; as this is also the case with the sections showed by LEHMANN (1961) from Eubea and Aden (pl. VIII, figs. 2-5), I suggest that these forms represent the A_1-generation whereas our Lizard Island specimens would then represent the A_2-generation.

The A-forms possess an embryonic apparatus resembling the one of S. marginalis and consisting of a drop-shaped proloculus completely surrounded by a wide flexostyle; there is only one undivided peneropline chamber in the spiral system, immediately followed by a spiral chamber with several (4 to 5) chamberlets; in this way the undivided chamber starts playing the role, in a modest way, of the "Vorhof" (circumambient segment) as it can be seen in Amphisorus and Marginopora. This feature, together with the thick test and the tendency of aperture-doubling, makes S. orbiculus the most evolved

Sorites-species and places it near the borderline with Amphisorus, a genus which has gone only one step further : it has doubled its chamber layer.

No B-forms have been found so far.

The species seems to have a very wide distribution in Indopacific as well as Atlantic tropical and subtropical provinces but has apparently often been confused with other soritid species (erroneous determinations of LEVY (1977), TODD (1957), PEREIRA (1979) and several others). S. orbiculus seems to be the only soritid species present in the Mediterranean. LEHMANN's work provides a good base for the reckognition of the species. This is the first record of this species from the Great Barrier Reef.

Occurrence : Moderately represented at several reef-flat and patchreef stations, on the Sandy Shoal and the Internal Platform, living upon weeds (Halimeda etc.); empty tests are occasionally encountered in the Lagoon.

Genus Amphisorus EHRENBERG, 1839.

Amphisorus hemprichii EHRENBERG, 1839.
(Pl. 29, fig. 2; pl. 30, figs. 1-2; pl. 31, figs. 1-5; pl. 32, fig. 1).

\+ 1839 Amphisorus hemprichii; - EHRENBERG, p. 130.
1856 Orbitolites duplex; - CARPENTER, pp. 220-224.
1884 Orbitolites duplex CARPENTER; - BRADY, pl. 16, fig. 7.
1902 Sorites hemprichii (EHRENBERG); - DOUVILLE, p. 293.
1930 Orbitolites duplex CARPENTER; - HOFKER, pt. II, p. 155, pl. 57, figs. 5-7.
1949 Amphisorus duplex (CARPENTER); - SAID, p. 25, pl. 3, fig. 1.
? Amphisorus hemprichii EHRENBERG; - id, pl. 3, fig. 2.
1958 Amphisorus duplex (CARPENTER); - COLLINS, p. 376.
1959 Marginopora vertebralis QUOY & GAIMARD; - GRAHAM & MILITANTE, pl. 9, figs. 19, 20.
1960 "Orbitolites duplex" CARPENTER; - BARKER (see ref. BRADY 1884).
e 1961 Amphisorus hemprichii EHRENBERG; - LEHMANN, p. 649, pl. 10, figs. 6-9; pl. 11, figs. 1-5; tf. 40.
1963 "Orbitolites" duplex CARPENTER; - SMOUT, p. 262, pl. 4, figs. 3-5, 8.
1971 Orbitolites (Marginopora) duplex CARPENTER; - HOFKER, p. 52 etc., pl. 92, figs. 1-5.
1975 Amphisorus hemprichii EHRENBERG; - WANTLAND, p. 358, fig. 11c.

1977 Amphisorus hemprichii EHRENBERG; - HOTTINGER, p. 99, figs. 10, 22B, 31, 32C, 33A.

1977 Amphisorus hemprichii EHRENBERG; - LEVY, p. 428, pl. 8, figs. 11-17.

1979 Amphisorus hemprichii EHRENBERG; - PEREIRA, pl. 21, figs. P-Q, pl. 22, figs. L-M.

Description : See LEHMANN (1961).

Diagnostic Remarks and Distribution : Our specimens agree with LEHMANN's (1961) descriptions; HOTTINGER (1977) summarized the main diagnostic features, to which I do not have much to add. The tests are large, discoidal and the lateral walls of the chamberlets are frequently broken away by abrasion. Externally the species shows an angled, somewhat V-shaped margin and two chamber layers; opposite chamberlets are displaced by the length of half a chamberlet as are the corresponding apertures on the marginal face. The tests are relatively thin, though thicker than corresponding specimens of S. marginalis. The external wall of the proloculus as well as the chamberlet "sutures" and the outer marginal face (except the peristomes) are pitted, as in S. orbiculus; the same reticulate pattern on the embryonic apparatus is shown by the present form. The alternating apertures are mostly oval to 8-shaped and distorted, "wrenched" under an angle of 30° to 45° in respect to the axial direction (the same phenomenon as can be seen in S. marginalis and S. orbiculus).

The internal structure corresponds with LEHMANN's descriptions. According to HOFKER (1971) the species shows trimorphism but we do not have enough evidence in our material to confirm this; in the affirmative case, nearly all our specimens would belong to the A_2-generation with large embryonic apparatus (which again corresponds to the main trend in S. marginalis and flattened M. vertebralis, the two forms associated with A. hemprichii in the perireefal area). These megalospheric forms show a droplike proloculus followed by a broad flexostyle which, after half- or three quarters of a whorl directly opens up into the large deuteroconch or "Vorhof". This chamber is somewhat variable in shape and dimensions but is generally not completely enveloping protoconch + flexostyle as in M. vertebralis (in the specimen fig. 2, pl. 31 this is the case however). This "Vorhof" is connected with the first subannular chamber by means of a series of low, slit-like stolons (see fig. 12, pl. 30). Typical features visible on our figs.

are further the crosswise oblique stolon axes, the large annular passage and the "mushroom"-structure formed by chamberlet lumen and corresponding stolon (cf. LEHMANN, 1961).

Regenerated fragments and specimens are often found. Microspheric specimens have not been encountered though a fragment with breeding chambers, probably part of a B-form, is shown on pls. 31-32. These breeding chambers show very thin, translucent walls, irregular, scattered apertures and reduced septula, thus allowing the voluminous gamonts to occupy the complete test thickness.

The species is widely distributed in Indopacific tropical shelf seas. COLLINS (1958) listed "A. duplex" from the Great Barrier Reef; very likely at least part of his material belongs to A. hemprichii.

Occurrence : Large, discoidal A-forms, frequently empty and more or less abraded, are present in moderate numbers in the Perireefal Area and are identical with specimens from off New Guinea.

Genus Marginopora BLAINVILLE, 1830.

Marginopora vertebralis BLAINVILLE, 1830.
(Pl. 32, fig. 2; pl. 33, figs. 1-2; pl. 34, figs. 1-3; pl. 35, figs. 1- pl. 36, figs. 1-).

\+ 1830 Marginopora vertebralis QUOY & GAIMARD in DE BLAINVILLE, Vol. 6, p. 377.
1846 Marginopora vertebralis, var. plicata; - DANA, p. 706, pl. 9, fig. 9.
1850 Orbitolites complanata; - CARPENTER, p. 30.
1856 Orbiculina tonga; - WILLIAMSON in CARPENTER, vol. 146, p. 192.
1884 Orbitolites complanata LAMARCK, var. laciniata; - BRADY, p. 16, figs. 1-6, 8-11.
1930 Marginopora vertebralis QUOY & GAIMARD; - HOFKER, pt. 2, p. 160, pl. 57, Figs. 1-2; pl. 61, figs. 4-5; pl. 62, figs. 1-9, 11-12.
1933 Marginopora vertebralis QUOY & GAIMARD; - CUSHMAN, U.S.N.M. Bull. 161, pt. 2, p. 67, pl. 19, figs. 11-12.
1954 Marginopora vertebralis BLAINVILLE; - CUSHMAN, TODD & POST, p. 348, pl. 82, figs. 5-6.
1957 Marginopora vertebralis BLAINVILLE; - TODD, p. 288 (table), pl. 93, figs. 6-8.

non 1959 Marginopora vertebralis QUOY & GAIMARD; - GRAHAM & MILITANTE, p. 61, pl. 9, figs. 19-20.

1960 Marginopora vertebralis BLAINVILLE; - BARKER (see ref. BRADY 1884).

1961 Marginopora vertebralis QUOY & GAIMARD; - LEHMANN, p. 654, pl. 11, figs. 6-7; pl. 12, figs. 1-7.

1963 "Orbitolites" vertebralis QUOY & GAIMARD in BLAINVILLE, 1830 ; - SMOUT, p. 263, pl. 4, figs. 6-7. Id, var. plicata DANA 1848; p. 263, pl. 4, fig. 9.

1964 Marginopora vertebralis QUOY & GAIMARD in DE BLAINVILLE;-LOEBLICH & TAPPAN, p. C 498, fig. 385 - 3,4.

1965 Marginopora vertebralis QUOY & GAIMARD; - JELL, MAXWELL & McKELLAR, p. 277, pl. 44, fig. 1.

1971 Orbitolites (Marginopora) vertebralis QUOY & GAIMARD; - HOFKER, p. 53, pl. 93, figs. 1-5; pl. 94, figs. 1-6.

1972 Marginopora vertebralis QUOY & GAIMARD; - ROSS, pp. 181-192, figs. 1-27.

1979 Marginopora vertebralis QUOY & GAIMARD; - PEREIRA, pl. 22, figs. M-Q; pl. 23, figs. A-D.

Description : See LEHMANN (1961).

Diagnostic Remarks and Distribution : This is the largest and one of the most common foraminifers in our Lizard Island material. Two types can be discerned : one is regular, flattened, discoidal and relatively thin, and occurs exclusively in the Perireefal Area; the other is thicker and irregular, mostly folded or undulated, with twisted and doubled margins, frequently shows complex intergrowth patterns with other specimens, lives exclusively in intertidal environments (e.g. reef flats).

- The regular, flattened form : In this form, megalospheric as well as microspheric (rare !) specimens have been encountered. They often reach a large size (up to 1 cm and even more; largest specimens are about 2 cm in diameter !). The lateral walls (secondary chamber layer) are very thin (greenhouse function for algal symbionts) and are easily abraded; the walls of the embryonic apparatus are also thin and translucent; they are covered with the same reticulate pit-pattern as observed in S. orbiculus and A. hemprichii; this pitting is equally present upon the marginal walls of the last chamber, except upon the pronounced peristomes. The marginal face (megalospheric form) shows the typical irregular rows of apertures

lying in faint depressions, and the two rows of apertures generated by the secondary chamber layers and lying in the somewhat depressed lateral edges of the margin.

- The internal structure of the megalospheric, flat form has been described by LEHMANN (1961). The embryonic apparatus resembles that of A. hemprichii except for the "Vorhof" being much larger; this deuteroconch completely embraces the protoconch and the flexostyle (which is somewhat wider and shorter than in A. hemprichii) and is directly connected with the first annular chamber (as the peneropline- and spiral stages were lacking) by means of numerous stolons which are more rounded than in A. hemprichii. Contrary to the other discoidal soritids, the walls of protoconch and flexostyle are nearly straight from side to side of the test. Further characteristic features of the test structure are the appearance of a principal- and secondary chamber layer, the two annular passages, the complicated endoskeleton with crosswise-oblique stolon system, thick septa and pillar-like septula, and the rectangular chamberlets of the exoskeleton.

- The B-form is also large, flattened and shows no signs of folding or undulation in our material. This form is very rare (only 2 specimens have been encountered), and is associated with the flattened A-forms from the Perireefal Area. The early chamber arrangement is more or less visible from the exterior (see fig. 2e, pl. 33). The periphery is much narrower as in the A-forms; the two secondary chamber layers with their corresponding rows of rounded apertures are visible as well as the reduced principal chamber layer with only a double- or triple aperture row, more regularly lined than in the A-form. The internal structure of the B-form shows a globular proloculus followed by a peneropline stage of several chambers (10-12) and a spiral stage. Until the annular stage is reached, only an endoskeleton is present. (the septa and septula in this stage show, in aequatorial section, some resemblance to the image yielded by S. orbiculus). The structure of the annular chambers is principally the same as in the A-form, though the septa and pillars of the endoskeleton are somewhat finer, thinner and more regularly built. Annular passages are present (see figs. 2a, 2b, pl. 34).

- The irregular, thickened form : This form is exclusively megalospheric in our material. External features are essentially the same as mentioned for the flattened form, except for the thickness of the test which is rapidly increasing towards the edge; specimens have a more irregular appearance and

are mostly folded or have undulating and/or doubled margins (they are "plicated" or "laciniated"). Intergrowth of 2, three or even more specimens is frequent, particularly on the reef flats (this might have something to do with overcrowding - see Part 1).

The internal structure of this irregular, intertidal form is completely identical with the one of the flat form. The embryonic apparatus is mostly large (A_2-forms ?) and rapidly breaks away after death. No breeding chambers have been observed in our material.

The fact that our irregular forms are all megalospheric invalidates previous remarks by various authors concerning the "laciniata" and/or "plicata"-forms which are shown here not to be systematically B-forms (see remarks by e.g. HOFKER, 1971, p. 52, etc; LEHMANN, 1961, p. 655). Moreover, our rare B-forms are regular specimens, not plicated, which shows that the plication or lacination is due to environmental factors and is not or hardly influenced by the generation. The use of these names only increases confusion, hence I propose to drop them completely.

This single representative of the monospecific genus Marginopora has an exclusive Indopacific distribution; its exact geographical limits are yet to be established as there has been much confusion with other Soritids and in particular with Amphisorus hemprichii in the literature. M. vertebralis' distribution seems to parallel the distribution of tropical Pacific coral reefs but its presence in the Red Sea is unlikely; the species has not been encountered by HOTTINGER (1977) on the reefs in the Gulf of Elat. M. vertebralis is one of the most common larger Foraminifera in the Great Barrier Reef and has been reported by almost every naturalist who worked in the area.

Occurrence : Living specimens of the irregular type are abundant on the reef-flats and in the shallow backreef areas, including the Sandy Shoal, the Internal Platform and the Lagoon. Living specimens of the regular, flattened type are common in the Perireefal Area. Empty tests and fragmented remains of the irregular, intertidal form accumulate in several wind- and wave sorting areas on the beaches and form almost monospecific Marginopora-gravels. Large numbers of empty and fragmented tests of the regular, flattened form in the Perireefal Area, are associated with other Soritids and Halimeda-remains.

Test fragments of both M. vertebralis-types constitute a not neglectable share in the total foraminiferal sediment fraction larger than 75 microns

in most sedimentary environments at the Lizard Island reef complex (See procentual diagrams, Part 1, Annex).

Family MILIOLIDAE EHRENBERG, 1839.

Subfamily QUINQUELOCULININAE CUSHMAN, 1917.

Genus Quinqueloculina d'ORBIGNY, 1826.

Note on the Lizard Island representatives of the genus Quinqueloculina and allied forms.

This group is well represented at the lizard Island Reef Complex and yields high percentages in the thanatocoenosis counts. Species of the genus Quinqueloculina and related taxa have colonised all marine environments on modern reefs in general and at the Great Barrier Reef in particular. This highly interesting group has so far been insufficiently studied, from an ecologic as well as a systematic view point. Excellent studies on laboratory cultures (e.g. SCHNITKER, 1967) as well as in the field (BRASIER, 1972, 1975, 1976, etc.) demonstrate the enormous intraspecific variability, relative value of generic limits and ecological response to variable life circumstances existing in this foraminiferal group.

Several of these quinqueloculine "species" do not represent real biologic species but are merely ecophenotypic adaptations of other taxa. For convenience however I have in most cases maintained the classical taxonomy in this systematic review but it should be reminded that this is more or less artificial. For this reason I, somewhat reluctantly, admit the separation of the genera Triloculina and Miliolinella (and other genera showing modified apertural features) from Quinqueloculina but I reject, following LOEBLICH & TAPPAN (1964), the erection of subgenera like Lachlanella (VELLA, 1957) or any other subdivision based upon ecophenotypical morphologic variation, like apertural shape and position, tooth modifications, test compression etc.

Quinqueloculina anguina TERQUEM, var. arenata SAID, 1949.
(Pl. 37, figs. 1-5).

+ 1915 Miliolina anguina (TERQUEM) var. agglutinans WIESNER; - in H. ALLEN & EARLAND, pt. 2, p. 575.
1924 Quinqueloculina anguina TERQUEM, var. agglutinans WIESNER; - CUSHMAN, p. 60, pl. 22, figs. 5-6.
1932 Quinqueloculina anguina TERQUEM, var. agglutinans WIESNER; - CUSHMAN (U.S.N.M. Bull. 161), pt. 1, p. 18, pl. 5, figs. 1a-c.
1949 Quinqueloculina anguina TERQUEM, var. arenata; - SAID, New Name, p. 9, pl. 1, fig. 25.
1954 Quinqueloculina anguina TERQUEM, var. arenata SAID; - CUSHMAN, TODD & POST, p. 332, pl. 83, fig. 21.
1957 Quinqueloculina anguina TERQUEM, var. arenata SAID; - TODD, p. 286 (table), pl. 85, figs. 7a-b.
1958 Quinqueloculina anguina arenata SAID; - COLLINS, p. 358.
1959 Quinqueloculina anguina TERQUEM, var. arenata SAID; - GRAHAM & MILITANTE, p. 42, pl. 4, figs. 12-13a, b, c.

Description : See CUSHMAN (1924, 1932).

Diagnostic Remarks and Distribution : This species is easily discernable from other agglutinant quinqueloculinids by its long, slender shape, elongate neck with small aperture provided with an equally small, narrow bifid tooth, and prominent aboral end of the test. Some specimens are longitudinally distorted. Aberrant specimens showing inclusion of very large quartz grains in their test wall, or uncoiling ones are present, as well as specimens tending towards a spiroloculine coiling.
The species seems to have an exclusive Indopacific distribution in tropical coral-reef environments. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Mainly in the Perireefal Area where the species is common and where it has been found alive. Occurs also in the Lagoon and the Patch-reef Area.

Quinqueloculina bidentata d'ORBIGNY, subsp. subagglutinata ASANO, 1936. (Pl. 37, figs. 6a-c; pl. 38, figs. 1-5).

? 1839 Quinqueloculina agglutinans; - d'ORBIGNY, in DE LA SAGRA, Hist. Physiq. Pol. Nat. Cuba; Foraminifères, p. 195, pl. 12, figs. 11-13.

non 1839 Quinqueloculina bidentata; - d'ORBIGNY, id, figs. 18-20.

\+ 1936 Quinqueloculina subagglutinata; - ASANO, p. 620, pl. 32, fig. 1a-c.

1938 Quinqueloculina subagglutinata ASANO; - ASANO; p. 91, pl. 9, figs. 8, 9.

1951 Quinqueloculina subagglutinata ASANO; - ASANO, pt. 6, p. 7, figs. 46-48.

1957 Quinqueloculina agglutinans d'ORBIGNY; - TODD & BRONNIMANN, p. 27, pl. 3, fig. 4.

1957 Quinqueloculina agglutinans d'ORBIGNY; - TODD, p. 286 (table), pl. 85, fig. 6.

1959 Quinqueloculina agglutinans d'ORBIGNY; - GRAHAM & MILITANTE, p. 41, pl. 4, figs. 10a-c.

1979 Quinqueloculina cf. agglutinans d'ORBIGNY; - PEREIRA, pl. 9, figs. L-P.

Description : Test free, quinqueloculine, slightly longer than broad; periphery more or less rounded to oval in front view, subangular to truncate in end view; test thick, rather coarsely and irregularly encrusted with agglutinated material; distal end of last-formed chamber moderately prominent. Sutures distinct, depressed. Aperture small to medium-sized, rounded to slightly oval, hardly prominent, bordered by a faint, narrow, slightly reflexed rim; aperture provided with a small but distinctly bifid tooth. A second tooth-like thickening of the apertural rim is sometimes visible in the aperture on the opposite side of the bifid tooth (see fig. 6c, pl. 37).

Diagnostic Remarks and Distribution : The status of d'ORBIGNY's "Q. agglutinans" is obscured by the fact that this author mentions a crenulated apertural rim (which would place this species in the genus Dentostomina CARMAN, 1933; it would then be synonymous with D. bermudiana CARMAN, 1933, from Bermuda); nevertheless, d'ORBIGNY's drawings do not show this feature and are identical (or almost) to the Pacific subspecies under consideration here. Whether or not the crenulation of the peristome in Dentostomina is only an ecophenotypic adaptation of "agglutinans" (subagglutinata) remains a matter for future investigation.

Hence d'ORBIGNY's species needs to be redefined after thorough comparison of Pacific and Atlantic material. This is why I have preferred to use ASANO's name subagglutinata for the subspecies under considerarion here;

this Japanese Pliocene-to recent taxon indeed falls, in my opinion, in synonymy with the "classical" (smooth-rimmed) "agglutinans"; differences between them are minor; the Pacific subagglutinata perhaps possesses a somewhat more truncate periphery and is slightly more coarsely agglutinated than the Atlantic forms. I am fully aware of the criticism (formulated by biologists) that this is nomenclatorially not correct, but I prefer this provisory situation above any further confusion with ill-defined types.

The subagglutinata-subspecies is different from CUSHMAN's Q. agglutinata; the latter species, described from off Alaska, has a much smaller aperture with a low, broad bifid tooth.

The present subspecies is very close to the bidentata s.s. subspecies and differs from this only in its rounded aperture with broader tooth, more angular periphery and shorter and thicker test. The bidentata subspecies is provided with a typical laterally compressed "Lachlanella"-aperture (VELLA, 1957), is more slender and less coarsely agglutinated. The name bidentata has datum priority over subagglutinata and is hence used here as species s.s.-name.

The subagglutinata-subspecies differs from Siphonaperta crassa VELLA (New Zealand) in its apertural and test wall features, the latter species possessing a smaller aperture with single Siphonaperta-tooth and a test wall apparently built up of sharper, more angular grains.

The subagglutinata-subspecies seems to have a worldwide tropical reefal distribution similar to Q. bidentata. It has not been reported by COLLINS (1958) from the Great Barrier Reef but that author probably has lumped subagglutinata and bidentata together. ASANO's types are from the Japanese Pliocene.

Occurrence : Empty tests are rare in the Perireefal Area, at the Lagoon Entrance and in the Patchreef Area. Only a few living specimens at the Lagoon Entrance.

Quinqueloculina bidentata s.s. d'ORBIGNY, 1839.
(Pl. 38, figs. 4-6).

+ 1839 Quinqueloculina bidentata; - d'ORBIGNY, vol. 8, p. 197, pl. 12, figs. 18-20.
1921 Quinqueloculina bidentata d'ORBIGNY; - CUSHMAN, (U.S.N.M. Proc. vol. 59) p. 65, pl. 15, figs. 11-12.
1929 Quinqueloculina bidentata d'ORBIGNY; - CUSHMAN, pt. 6 (U.S.N.M. Bull. 104), pp. 22-23, pl. 1, figs. 2a-c.
1949 Quinqueloculina bidentata d'ORBIGNY; - SAID, p. 9, pl. 1, fig. 21.
non 1954 Quinqueloculina bidentata d'ORBIGNY; - CUSHMAN, TODD & POST, p. 332, pl. 83, figs. 31a-b.
1958 Quinqueloculina bidentata d'ORBIGNY; - COLLINS, p. 359.
1959 Quinqueloculina bidentata d'ORBIGNY; - GRAHAM & MILITANTE, p. 42, pl. 5, figs. 1-(?) 2.
1961 Quinqueloculina bidentata d'ORBIGNY; - TODD, p. 177 (table), pl. 22, fig. 2.
1966 Quinqueloculina agglutinans d'ORBIGNY; - TODD, p. I 30, pl. 17, fig. 8.
1979 Quinqueloculina cf Q. bidentata d'ORBIGNY; - PEREIRA, pl. 9, fig. Q; pl. 10, figs. A-D.

Description : See d'ORBIGNY, (1839); CUSHMAN, (1921).

Diagnostic Remarks and Distribution : See also notes under Q. bidentata subagglutinata.bidentata s.s.. Is more elongate and generally has a more pronounced truncate periphery than the subagglutinata-subspecies. The aperture is of a narrow "Lachlanella"-type and is provided with an elongate tooth which is not or hardly bifid at the tip. The test wall is less coarsely agglutinated than the one of the subagglutinata-subspecies. This species belongs to the "Lachlanella"-group, created by VELLA (1957) as a subgenus of Quinqueloculina but invalidated by LOEBLICH & TAPPAN (1964) (see note, p. 78).

In our material several specimens occur which at first glance resemble Q. (Lachlanella) cooki VELLA (1957, p. 25, pl. 5, figs. 82, 83, 87) but which in fact are nothing else than abraded bidentata s.s.-specimens (abraded to such an extent that the agglutinated outer test layer has been removed almost completely - See fig. 6a-b, pl. 38).

The bidentata-s.s. species has a cosmopolitan distribution in tropical

reefal environments. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare. Living specimens are common in L 124 (Lagoon) and occur in the Lagoon Entrance. Empty tests occur sporadically in patchreef samples, on the Sandy Shoal and at North Point (L 292).

Quinqueloculina berthelotiana d'ORBIGNY, 1839.
(Pl. 39, figs. 1-2).

\+ 1839 Quinqueloculina berthelotiana; - d'ORBIGNY; p. 142, pl. 3, figs. 25-27.
1958 Quinqueloculina berthelotiana d'ORBIGNY; - COLLINS, p. 359.
1958 Quinqueloculina derbyi; - TINOCO, p. 12, pl. 1, fig. 10; pl. 2, fig. 1.
1966 Quinqueloculina bosciana d'ORBIGNY; - TODD, p. 130, pl. 17.

Description : See d'ORBIGNY (1839).

Diagnostic Remarks and Distribution : Although I have found only a few specimens of this compressed and keeled species, these could easily be determinated due to the characteristic dichotomous branching of the chamber keels towards the aboral end. Our specimens show a triloculine chamber arrangement. This species provides an example of the morphogenetic process producing laterally compressed or keeled tests with the aperture not reaching the penultimate chamber wall, prominent aboral test end and mostly small, simple tooth; peculiarities which it shares with e.g. Q. poeyana carinata, Q. oblonga var., Q. quinquecarinata and some others.

This rarely reported species seems nevertheless to have a cosmopolitan distribution in shallow tropical and subtropical seas. It has been reported by COLLINS (1958) from the Great Barrier Reef. The specimen figured by TODD (1966) from Guam, under the name of Q. bosciana d'ORB, apparently belongs to the present species as well as the species described by TINOCO (1958) as Q. derbyi from "Quaternary sands", Olinda, Brasil.

Occurrence : Only a few empty tests in the Perireefal Area.

Quinqueloculina crassicarinata COLLINS, 1958.
(Pl. 39, figs. 3-5).

+ 1958 Quinqueloculina crassicarinata; - COLLINS, p. 359, pl. 2, fig. 6a-c.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens are identical with COLLINS's types from the Great Barrier Reef. By its prominent neck and typical sinuate chamber shape with prominent aboral end, this species is easily distinguishable from Q. lamarckiana and its variants.

Not much can be said about the distribution of this species as no references have been encountered in literature. Q. crassicarinata is probably restricted to Pacific tropical reefal environments.

Occurrence : Rare to moderately common in the Lagoon, the Patchreef Area and the Perireefal Area. Rare living specimens occur in the Perireefal Area exclusively.

Quinqueloculina curta CUSHMAN, 1917.
(Pl. 39, figs. 6-7; pl. 40, figs. 1-3).

+ 1917 Quinqueloculina disparilis var. curta; - CUSHMAN (U.S.N.M. Bull. 71, pt. 6-, p. 49, pl. 14, fig. 2, tf. 30.
1921 Quinqueloculina curta CUSHMAN; - CUSHMAN (U.S.N.M. Bull. 100, pt. 4), p. 426, pl. 100, figs. 1-2.
1924 Quinqueloculina disparilis d'ORBIGNY, var. curta CUSHMAN, - CUSHMAN, p. 60, pl. 22, figs. 7-8.
1931 Quinqueloculina curta CUSHMAN; - HADA, p. 80, tf. 33.
1951 Cribrolinoides curta (CUSHMAN); - ASANO, pt. 6, p. 9, figs. 63-64.
1956 Quinqueloculina curta CUSHMAN; - ASANO, p. 59, pl. 7, figs. 13a-b.
1959 Quinqueloculina curta CUSHMAN; - GRAHAM & MILITANTE, p. 44, pl. 5, figs. 9a-c.

Description : See CUSHMAN (1917, 1921).

Diagnostic Remarks and Distribution : This is once more a controversial species. In 1939, CUSHMAN & LEROY established the new genus Cribrolinoides (see also ASANO, 1956; LOEBLICH & TAPPAN, 1964) based upon particular

features of a Pliocene Malaysian species which they put in synonymy with Quinqueloculina disparilis var. curta CUSHMAN. This Cribrolinoides - genus is characterised by the complex apertural features of the type species and had even been transferred to the Family Nubeculariidae by LOEBLICH & TAPPAN (1964), because of its early cyclogyrine coil. ANGLADA & RANDRIANASOL (1971) transferred this genus tot the Family Miliolidae again, stating that the coiling was of a quinqueloculine type with an initial "Adelosina"-stage in the megalospheric form.

The specimens described and figured by the authors mentioned above do represent a species which I consider as different from CUSHMAN & LEROY's Cribrolinoides curta, the latter species indeed being (much) larger and more irregularly costate whereas the aperture is of a complex type. The recent Pacific species, originally described as Q. disparilis curta has a normal quinqueloculine aperture with bifid tooth and shows more or less developed costae, varying in width, in a median longitudinal area, of the chamber walls.

Our Lizard Island specimens belong to this recent Pacific type and are identical with the specimens figured e.g. by ASANO and GRAHAM & MILITANTE. The question whether Cribrolinoides curta is specifically and generically distinct, or an ecovariant of Quinqueloculina curta is not investigated. We have named our specimens Quinqueloculina curta, following ASANO, GRAHAM & MILITANTE; if the separation of the genus Cribrolinoides and its type species would later on show to be justified, this latter must rapidly be honoured with a new name to avoid further confusion with Quinqueloculina curta.

Quinqueloculina curta (sensu CUSHMAN 1917) seems to be restricted to Indo-pacific tropical and subtropical shallow seas. It has not been reported from the Great Barrier Reef by COLLINS (1958).

Occurrence : Q. curta seems to be a typical intertidal foraminifer and occurs in small numbers on the reef flats and in the shallow backreef environments. Occasionally empty tests are transported towards deeper bottoms. The species has not been found alive. It does not occur in the Lagoon.

Quinqueloculina distorquaeata CUSHMAN, 1954.
(Pl. 40, figs. 4-7).

1884 Miliolina undosa (KARRER); - BRADY, pl. 6, fig. 8 (not 6-7).
+ 1954 Quinqueloculina distorquaeata; - CUSHMAN, TODD & POST, p. 333, pl. 83, fig. 27.
1949 Quinqueloculina bradyana CUSHMAN; - SAID, p. 9, pl. 1, fig. 22.
1957 Quinqueloculina distorqaeata CUSHMAN; - TODD, p. 286 (table), pl. 86, fig. 8.
1959 Quinqueloculina bradyana CUSHMAN; - GRAHAM & MILITANTE, p. 43, pl. 5, fig. 5 (probably not 4).
1960 Quinqueloculina bradyana CUSHMAN; - SAID, p. 9, pl. 1, fig. 22.
1960 Quinqueloculina bradyana CUSHMAN; - BARKER (see ref. BRADY 1884).

Description : See CUSHMAN, TODD & POST (1954).

Diagnostic Remarks and Distribution : This species apparently has been confused several times with Q. bradyana as the definition of the latter species is rather obscure. CUSHMAN (1917) indeed figured a specimen with damaged apertural area as holotype of Q. bradyana and stated in his description that this aperture was variable in shape, with or without a neck. It is very likely that two species are included in CUSHMAN's description, the same two forms that have been figured by BRADY (1884 ; pl. 6, figs. 6-8) : BRADY's figs. 6-7 represent the true Q. bradyana possessing an extremely compressed "Lachlanella"-type aperture, whereas in my opinion BRADY's fig. 8 represents Q. distorquaeata, characterised by its sinuous, irregular keels, distorted chambers and small rounded aperture at the end of a short neck and provided with a strong T-shaped tooth with somewhat thickened lateral ends.

Our Lizard Island specimens agree with the description of CUSHMAN, TODD & POST of Q. distorquaeata. Typical Q. bradyana have not been encountered in our material.

Q. distorquaeata occurs widely in Indopacific reefal environments. Neither this species nor Q. bradyana have been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to common in all environments of the Lizard Island Reef Complex. Living specimens are not uncommon in the Perireefal Area.

Quinqueloculina granulocostata GERMERAAD, 1946.
(Pl. 41, figs. 1-6; pl. 42, figs. 1-2).

? 1826 Quinqueloculina ferrussacii; - d'ORBIGNY, p. 301.
1826 Quinqueloculina sulcata; - d'ORBIGNY, p. 301, n° 17. (nom. nud. - fide ELLIS & MESSINA, cataloque).
1884 Miliolina linnaeana (d'ORBIGNY); - BRADY, p. 174, pl. 6, figs. 15-20.
1900 Quinqueloculina sulcata d'ORBIGNY ; - FORNASINI, p. 364, tf. 9.
1924 Quinqueloculina bicostata d'ORBIGNY; - CUSHMAN, p. 62, pl. 23, figs. 1-2.
1924 Quinqueloculina undosa KARRER; - CUSHMAN, p. 62, pl. 23, figs. 3-4.
1924 Quinqueloculina polygona d'ORBIGNY, var.;- CUSHMAN, p. 63, pl. 24, figs. 5-6.
1932 Quinqueloculina sulcata d'ORBIGNY; - CUSHMAN (U.S.N.M. Bull. 161 pt. 1) p. 28, pl. 7, figs. 5-8.
1945 Quinqueloculina subpolygona; - PARR, p. 196, pl. 12, figs. 2a-c.
+ 1946 Quinqueloculina granulo-costata GERMERAAD; in RUTTEN & HOTZ, Geol. Pet. & Paleont. results (Geol. Central Seran) - Geol. n° 2, p. 63 (fide GRAHAM & MILITANTE, 1959).
? 1949 Quinqueloculina cf. ferrussacii d'ORBIGNY; - SAID, p. 10, pl. 1, fig. 31.
1949 Quinqueloculina sulcata d'ORBIGNY; - SAID, p. 11, pl. 1, fig. 20.
1954 Quinqueloculina bidentata d'ORBIGNY; - CUSHMAN, TODD & POST, p. 333, pl. 83, fig. 31 (not Q. cf. Q. ferrussacii d'ORB., id, pl. 83, fig. 30) (N.B. these authors probably reversed the legends of figs 30 and 31, pl. 83).
1957 Quinqueloculina sulcata - Q. ferrussacii gradational series; - TODD, p. 286 (tab.), pl. 86, figs. 3-6.
1957 Quinqueloculina (Lachlanella) rebeccae; - VELLA, p. 25, pl. 5, figs. 86, 93.
1958 Quinqueloculina sulcata d'ORBIGNY; - COLLINS, p. 361.
1959 Quinqueloculina granulocostata GERMERAAD; - GRAHAM & MILITANTE, p. 44, pl. 5, figs. 10a-b-c.
1960 Quinqueloculina granulocostata GERMERAAD; - BARKER (see ref. BRADY 1884).
1968 Quinqueloculina subpolygona PARR; - ALBANI, p. 99, pl. 7, figs. 12-14.
? 1973 Quinqueloculina sp. A; - BROOKS, pl. 7, figs. 1-2.
1979 Quinqueloculina granulocostata GERMERAAD; - PEREIRA, pl. 10, figs. H-Q.

Description : see d'ORBIGNY, (1826); GERMERAAD, (1946).

Diagnostic Remarks and Distribution : The nomenclatorial history of this highly variable species ought to be outlined briefly.

In 1865 d'ORBIGNY described Q. ferrussacii and Q. sulcata, the first species ill-defined, probably a fossil form from the Paris Basin, the second from the Red Sea but, according to ELLIS & MESSINA, a nomen nudum. FORNASINI (1900) published brief descriptions and drawings of these forms. TODD (1957) acknowledged the identity of both species as end members of a gradational series. BRADY (1884) figured some Pacific specimens and erroneously referred them to Miliolina linnaeana but obviously they fall within the gradational range of Q. ferrussacii - Q. sulcata (with some restrictions as to fig. 16, pl. 6). BRADY's figures were interpreted by GERMERAAD (1946) as a new species, Q. granulocostata.

Summarising, we can state that Q. ferrussacii - Q. sulcata - Q. granulocostata all fall within the variability range of one single species which we should preferrably continue to call Q. granulocostata as both d'ORBIGNY's (1826) species definitions are insufficient and/or suspect. Once more, I know that I am offensing the classical taxonomists' feelings by such a statement; the cleaning of the augiasstable of foraminiferal taxonomy nevertheless sometimes requires unorthodox methods.

The species varies from a narrow, elongated "sulcata"-type (often characterised by somewhat irregular but not curved, more or less blunt broad keels and a small aperture placed at the end of a short neck constricted at its base), via a broader "ferrussacii"-type (keels reduced to coarse costae, more sinuously curved chambers, larger aperture at the end of a broader, not constricted neck), towards a mostly large and stout "granulocostata" s.s.-type (reduced and/or irregular costae, thick test and narrow "Lachlanella"-type aperture). The latter morphological type includes several specimens which agree with VELLA's (1957) description of Q. rebeccae and PARR's (1945) description of Q. subpolygona; these species fall within the variability range of Q. granulocostata.

All the forms under consideration have been reported from Indopacific tropical reefal environments. Q. sulcata is listed by COLLINS (1958) from the Great Barrier Reef. Closely related specimens have been reported from the Atlantic (Caribbean) reefal province but further investigation would be needed to conclude about their eventual identity with the Indopacific Q. granulocostata.

Occurrence : Empty tests as well as occasional living specimens have been encountered in moderate numbers in all Lizard Island reefal environments. The large and stout granulocostata s.s.-specimens with Lachlanella-aperture apparently live in the coarser sediments on the reef flats and other intertidal- or shallow subtidal areas; their empty and often abraded tests are regularly encountered in the Perireefal Area where on the other hand the more fragile sulcata- and ferrussacii-specimens are frequently encountered alive.

Quinqueloculina lamarckiana s.s. d'ORBIGNY, 1839.
(Pl. 42, figs. 3-4).

+ 1839 Quinqueloculina lamarckiana; - d'ORBIGNY, p. 189, pl. 11, figs. 14-15.
1839 Quinqueloculina auberiana; - d'ORBIGNY, p. 193, pl. 12, figs. 1-3.
1884 Miliolina auberiana (d'ORBIGNY); - BRADY, pl. 5, figs. 8-9.
1884 Miliolina venusta KARRER; - BRADY, pl. 5, fig. 7.
1884 Miliolina cuvieriana (d'ORBIGNY); - BRADY, p. 162, pl. 5, fig. 12.
1932 Quinqueloculina lamarckiana d'ORBIGNY; - CUSHMAN, (U.S.N.M. Bull. 161, pt. 1), p. 24, pl. 6, fig. 2.
1949 Quinqueloculina lamarckiana d'ORBIGNY; - SAID, p. 10, pl. 1, fig. 28.
1956 Quinqueloculina lamarckiana d'ORBIGNY; - ASANO, p. 60, pl. 7, fig. 17; pl. 8, figs. 14-17; pl. 9, fig. 17.
1958 Quinqueloculina lamarckiana d'ORBIGNY; - COLLINS, p. 360.
1960 Quinqueloculina auberiana d'ORBIGNY; - BARKER (see ref. BRADY 1884), pl. 5, figs. 8-9.
1960 Quinqueloculina lamarckiana d'ORBIGNY; - BARKER (see ref. BRADY 1884), pl. 5, figs. 7, 12.
1978 Quinqueloculina cuvieriana d'ORBIGNY; - UBALDO & PALMEIRO, p. 93, pl. 2, figs. 13-14.
1979 Quinqueloculina lamarckiana d'ORBIGNY; - PEREIRA, pl. 11, figs. N-Q; pl. 12, figs. A-D.

Description : See d'ORBIGNY, (1839); CUSHMAN, (1932).

Diagnostic Remarks and Distribution : CUSHMAN (1922) placed Q. cuvieriana in the synonymy of Q. lamarckiana. SAID (1949) and subsequent workers

considered Q. auberiana as a synonym of Q. lamarckiana. Q. lamarckiana is highly variable particularly in respect to the rate of inflation of the test, its elongation, the development of keels (mostly the test is non-keeled but very sharp-angular) and to the lateral compression of the aperture. Otherwise the presence of these features, the absence of an apertural neck, the typical angularity of the test and the brilliant while luster of the empty shell and its non-prominent aboral end are constant characters and cause this species to be easily distinguished from Q. crassicarinata, Q. pittensis and Q. quinquecarinata. An ecovariant of this species, showing double-keeled chamber edges, has been described by COLLINS (1958) as Q. cuvieriana queenslandica (see below).

Q. lamarckiana seems to have an exclusive Indopacific tropical to subtropical distribution and has been reported from off Japan an from the Red Sea as well as from the Great Barrier Reef (COLLINS, 1958). ASANO (1956) stated that the species occurs frequently in the Japanese Neogene deposits.

Occurrence : The species has been occasionally encoutered in all environments of the Lizard Island Reef Complex, even on the reef flats, but it is most common in the Perireefal Area where it has been found alive in small to moderate numbers at several stations.

Quinqueloculina lamarckiana d'ORBIGNY, subsp. queenslandica COLLINS, 1958. (Pl. 42, figs. 5a-c).

1958 Quinqueloculina cuvieriana d'ORBIGNY, queenslandica; - COLLINS, p. 359, pl. 2, figs. 7a-c.

Description : See COLLINS, (1958).

Diagnostic Remarks and Distribution : This ecovariant resembles Q. lamarckiana perfectly well in every respect, except for the doubled, blunt and often only faintly marked keels at the chamber edges. This is apparently the intertidal or shallow-water variant of Q. lamarckiana (See Part 1). COLLINS's types are from the Great Barrier Reef.

Q. bicostoides VELLA (VELLA, 1957) is somewhat similar in shape but is provided with more pronounced, sharper and better separated keels.

Occurrence : Common on the reef flats and in all shallow backreef environments where living specimens occur. Empty tests are occasionally transported towards the Perireefal Area.

Quinqueloculina neostriatula THALMANN, 1950.
(Pl. 43, figs. 1-6).

1915 Miliolina undulata (d'ORBIGNY); - HERON - ALLEN & EARLAND, p. 573, pl. XLIII, figs. 5-8.

\+ 1932 Quinqueloculina striatula; - CUSHMAN (not Q. striatula DESHAYES, 1831) (U.S.N.M. Bull. 161), pt. 1, p. 27, pl. 7, figs. 3-4.

1950 Quinqueloculina striatula CUSHMAN; - SAID, p. 5, pl. 1, fig. 9.

1950 Quinqueloculina neostriatula; - THALMANN, p. 45 (new name for Q. striatula CUSHMAN, 1932 - homonym).

1954 Quinqueloculina neostriatula THALMANN; - CUSHMAN, TODD & POST, p. 333, pl. 83, fig. 28.

1957 Quinqueloculina neostriatula THALMANN; - TODD, p. 286 (tab.), pl. 85, fig. 19.

1958 Quinqueloculina neostriatula THALMANN; - COLLINS, p. 360.

1964 Quinqueloculina neostriatula THALMANN; - ROCHA & UBALDO, p. 37, pl. 2, fig. 2.

Description : See CUSHMAN (1932).

Diagnostic Remarks and Distribution : This is once more a species displaying a great deal of intraspecific variability. In shallow depths (intertidal environments) the chambers are rounded in cross-section whereas the specimens from deeper water possess an angled chamber periphery, even blunt keels in some extreme variants. The aperture is always broadly opened and crescentic, without peristome, and shows some variability in its width. The tooth varies in shape from low, broadly crescentic plate-like to very small, low bifid. Specimens are finely striate and do not have an apertural neck. The species is easily discernable from other striate or costate miliolids by its very distinctive apertural features.

Between the two mentioned ecovariants, all imaginable transitional stages are present whereas aberrant specimens showing growth irregularities or transverse undulations (compare H. ALLEN & EARLAND's figs.) are frequently encountered.

Q. neostriatula is a typical miliolid associated with Indopacific tropical reefal environments. Whether or not d'ORBIGNY's Miliolina undulata from the Mediterranean is the same species as Q. neostriatula is not clear.

The species has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Q. neostriatula is one of the most common species in our Lizard Island material. Specimens with rounded periphery are abundant on the reef flats, patch-reefs, Lagoon and Sandy Shoal whereas specimens with angled periphery predominate in the Perireefal Area. Living specimens are common in all environments. Specimens with rounded periphery from the intertidal environments are occasionally displaced into the deeper parts of the Lagoon and towards the Perireefal Area.

Note on Quinqueloculina oblonga and its variants :

This highly variable species is one of the most common miliolids in tropical reefal areas. Its variability in relation to its substrate has been discussed by BRASIER (1972, 1975a, 1975b, 1976) who demonstrated the variation of axial ratio's (a/c X 10) and of the apertural features in this and several other reefaf miliolids. Several of his findings are confirmed in our study (see also Part 1). Moreover I included in the species oblonga several morphological types which previously have been described as separate species belonging to the genera Quinqueloculina, Triloculina and even Pyrgo.

The different morphological types belonging to the oblonga-species and present in our Lizard Island material can be enumerated as follows, bearing in mind that separations of this kind are difficult to maintain in this case as the transitional- and aberrant forms are almost as frequent as the "typical" ones.

Q. oblonga s.s. has been arbitrarily chosen as the "central" form because all other subsp. can be derived from it by accentuation of its structural characteristics. It is elongate, quinque- to triloculine, is somewhat compressed and possesses a small, rounded to slightly compressed aperture with a small tooth. This subsp. provides variants of two types which have not

been treated separately :

1) Stouter, thicker, more rounded and irregularly-formed quinque- to triloculine tests showing a high degree of apertural variability and provided with a tooth which may be short and prominent or bifid and elongate, but always strongly developed. This variant mostly occurs in intertidal environments.
2) More ovate, shorter and somewhat stouter tests which are intermediate between oblonga s.s.and incisa.

Q. oblonga subsp. incisa is ovate in outline, possesses a rather fragile quinqueloculine test with deeply incised sutures and a semicircular aperture with a humble, triangular tooth.

Q. oblonga subsp. segersi (n.n.) is nothing else than the previously discussed "Miliolina millettii"(see under Edentostomina durrandii) and is, at Lizard Island, mainly intertidal and shallow subtidal. The tests are strongly compressed, are triloculine- to biloculine with angular to keeled periphery and compressed aperture, still provided with the characteristic short oblonga-tooth.

Q. oblonga subsp. transversestriata is the transversely striate, mostly triloculine variant of the previous subspecies; it has traditionally been described as Triloculina transversestriata.

Q. oblonga subsp. eburnea, is the elongate to shorter, rounded, mostly triloculine subspecies with extremely compressed, slitlike aperture provided with an elongate nonbifid tooth.

Q. oblonga subsp. lizardi (n.n.) resembles oblonga s.s. but possesses a pitted test surface.

BRASIER (1976) demonstrated this variability being ecologically bound, the narrow, elongated types being characteristic of his "vegetated sediment substrates" (sediments with high algal component, apparently corresponding with our sediment with algal coating - see Part 1), whereas the smooth, ovate forms dwell upon the phytal substrates. Further observations in this respect are to be found in Part 1.

Quinqueloculina oblonga s.s. (MONTAGU, 1803).
(Pl. 44, figs. 1-5).

+ 1803 Vermiculum oblongum; - MONTAGU, p. 522, pl. 14, fig. 9.
1878 Triloculina oblonga (MONTAGU); - TERQUEM, p. 58, pl. 5, figs. 22-24.
1884 Miliolina oblonga; - BRADY, vol. 9, p. 160, pl. 5, figs. 4a-b.
1897 Miliolina oblonga (MONTAGY); - FLINT, p. 297, pl. 43, fig. 3.
1917 Triloculina oblonga (MONTAGU); - CUSHMAN (U.S.N. Mus. Bull. 71), pt. 6, p. 69, pl. 26, figs. 3a-b (?), tf. 35.
1921 Triloculina oblonga (MONTAGU); - CUSHMAN, (U.S.N.Mus. Bull. 100), pt. 4, p. 459, pl. 92, fig. 3a-c.
1932 Triloculina oblonga (MONTAGU); - CUSHMAN (U.S.N. Mus. Bull. 161), pt. 1, p. 50, pl. 11, figs. 10a-c.
1949 Triloculina oblonga (MONTAGU); - SAID, p. 19, pl. 2, fig. 16.
1954 Triloculina cf. T. oblonga (MONTAGU); - CUSHMAN, TODD & POST, p. 339, pl. 85, figs. 5-7.
1956 Miliolinella oblonga (MONTAGU); - ASANO, p. 72, pl. 8, fig. 3.
1957 Triloculina oblonga (MONTAGU); - TODD & BRONNIMANN, p. 27, pl. 3, figs. 15-16.
1957 Triloculina cf. T. oblonga (MONTAGU); - TODD, p. 288 (tab.), pl. 86, figs. 12-13.
? 1958 Triloculina oblonga (MONTAGU); - COLLINS, p. 369.
1959 Triloculina oblonga MONTAGU; - GRAHAM & MILITANTE, p. 56, pl. 8, fig. 9 (fig. 8 = eburnea).
1960 Miliolinella (?) oblonga (MONTAGU); - BARKER (see ref. BRADY 1884).
1964 Triloculina oblonga (MONTAGU); - ROCHA & UBALDO, p. 41, pl. 2, figs. 11, 13.
1975 Triloculina sp.; - WANTLAND, p. 390, figs. 151-p.
1975 Quinqueloculina sp.; - WANTLAND, p. 389, figs. 15s-y.
1979 Triloculina oblonga (MONTAGU); - PEREIRA, pl. 16, figs. A-B.
1979 Triloculina oblonga (MONTAGU); - B. VERNET, CLAIREFOND, ORSOLINI, pls. 24 and 26 (o).

Description : See MONTAGU,(1803); CUSHMAN,(1917).

Diagnostic Remarks and Distribution : This is the central type from which the other ecovariants can be derived. Test elongate, mostly thin, slightly

compressed, translucent to whitish-opaque. Chambers strongly embracing (variation of this feature results in either quinque- or triloculine tests; mostly the tests are quinqueloculine though this may be hardly visible under the binocular microscope). Sutures slightly oblique and hardly depressed, nearly flush and curved towards the aboral test end. Aperture rounded to slightly compressed, mostly small, on top of the last-formed chamber (not reaching the chamber suture except in the stouter intertidal forms), and provided with a mostly modest tooth which is hardly bifid at the tip. As already stated on p. 92, two more variants of this subspecies occur in our material :

1) The stouter and thicker (intertidal) forms, characterised by a larger, rounded to keyhole-shaped aperture which, this time, reaches the ultimate suture and which is provided with a strongly developed, prominent tooth which may be bifid hook-shaped or form a solid triangular structure.
2) The more ovate tests forming the transition towards subsp. incisa.

Specimens transitional towards the hereafter described variants are included in this central form.

The present species with its variants is very characteristic in tropical reefal to subtropical environments and has a worldwide distribution in these areas though most references are from Indopacific regions. Comparable specimens have been recorded from the Mediterranean (Gulf of Gabès, by BLANC-VERNET e.a. (1979) whereas in Carribean coral reefs the species occupies the same niches as in Indopacific reeds (BRASIER). WANTLAND (1975) has left in open nomenclature some specimens from Belize Shelf, Honduras, clearly belonging to this species.

COLLINS (1958) recorded the species from the Great Barrier Reef; as he writes about "large rounded aperture" he might have included some T. subgranulata in his record.

Occurrence : Common to abundant in all habitats at Lizard Island, living specimens as well as empty tests. Specimens of the variant (1) are most frequent in intertidal areas (reef flats e.g.).

Quinqueloculina oblonga (MONTAGU), subsp. incisa VELLA, 1957.
(Pl. 45, figs. 1-2).

+ 1957 Quinqueloculina (Quinqueloculina) incisa; - VELLA, p. 24, pl. 6, figs. 118-121.

Description : See VELLA (1957).

Diagnostic Remarks and Distribution : The species described by VELLA (1957) as an authentical New Zealand species and which is characterised by an ovate outline, incised sutures and a particularly-shaped apertural tooth, might be synonymous with Q. oblonga at the species level; I treat it here as a subspecies of Q. oblonga. All intermediates between this variant and typical oblonga s.s. are present in our material. VELLA describes a tooth provided with an "arcuate platform", but this is nothing else than the slightly modified oblonga s.s.-tooth.

To what degree Q. laevigata d'ORBIGNY and Q. seminulum (LINNAEUS) are related to incisa is not clear and cannot be elucidated here as typical representants of these taxa lack in our material; nevertheless I have the feeling that incisa might probably be identical with seminulum; in this care the entire oblonga-seminulum range might belong to one single species, which opens interesting perspectives for paleoecological interpretations.

Occurrence : This is apparently a deeper-water variant. It occurs at the Lagoon Entrance and in deeper patchreef samples but most specimens are from the Perireefal Area. Occasionally living specimens are encountered.

Quinqueloculina oblonga (MONTAGU), subsp. segersi nom. nov.
(Pl. 45, figs. 4-5).

non 1898 Miliolina durrandii; - MILLETT, p. 268, pt. 1, pl. 6, figs. 7(?), 8-10.
pars 1917 Biloculina milletti; - CUSHMAN, pt. 6, p. 81, non pl. 34, figs. 4-5.

Derivatio Nominis : Named in honour of E. SEGERS, sedimentologist, together with whom I executed the 1975 mission to Lizard Island.

Description : See CUSHMAN (1917) (only description, not figs.).

Diagnostic Remarks and Distribution : See note p. 92, etc.; this is indeed the form referred to in the literature as Biloculina milletti or Pyrgo millettii and is nothing else than an extremely compressed triloculine oblonga-variant:the general features of Q.oblonga s.s. are respected, except for the somewhat more embracing chambers; if a plastically deformable oblonga-test would be submitted to lateral compression, a segersi-test would be the result. This is true for the aperture too; the apertural tooth is identical with the one of Q.oblonga s.s., though the aperture itself is compressed to almost slitlike.

This subspecies is widely distributed, at least in the Indopacific.

Occurrence : More or less the same as for oblonga s.s.. Highest frequencies of this form are to be found in shallow backreef areas (Patchreef Area). Living specimens are frequent, particularly in the Lagoon.

Quinqueloculina oblonga (MONTAGU) subsp. transversestriata (BRADY, 1881).
(Pl. 46, figs. 1-2).

\+ 1881 Miliolina transversestriata; - BRADY, vol. 21, p. 45.
1884 Miliolina transversestriata; - BRADY, p. 177, pl. 4, figs. 6a-c.
1915 Miliolina transversestriata BRADY; - H. ALLEN & EARLAND, p. 566, pl. 42, figs. 17-20.
1921 Triloculina transversestriata (BRADY); - CUSHMAN (U.S.N. Mus. Proc. 59, n° 2360), p. 70.
1929 Triloculina transversestriata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 5), p. 62, pl. 16, fig. 3.

1957 Triloculina transversestriata (BRADY); - TODD, p. 288 (tab), pl. 85, figs. 16a-b.
1958 Triloculina transversistriata (BRADY); - COLLINS, p. 370.
1959 Triloculina transversestriata (BRADY); - GRAHAM & MILITANTE, p. 57, pl. 8, figs. 13a-c.
1960 Triloculina transversestriata (BRADY); - BARKER (see ref. BRADY 1884).

Description : See BRADY (1881, 1884). (div. publ.).

Diagnostic Remarks and Distribution : This subsp. differs from the preceding one only in the transverse striation of the chamber walls; this "striation" consists of transverse undulations of the chamber walls and, as H. ALLEN & EARLAND (1915) as well as COLLINS (1958) already pointed out, is very variable; all intermediates between segersi and transversestriata occur. There is also some variation in test thickness and -elongation.

This subspecies is widely distributed in the Indopacific; BRADY's types are from Torres Strait.

Occurrence : Same as Q. oblonga segersi. Absent from the reef flats. Living specimens are occasionally encountered.

Quinqueloculina oblonga (MONTAGU), subsp. eburnea (d'ORBIGNY, 1839). (Pl. 46, figs. 3-5).

\+ 1839 Triloculina eburnea; - d'ORBIGNY, p. 180, pl. 10, figs. 21-23.
1909 Triloculina chrysostoma; - CHAPMAN, p. 322, pl. 13, figs. 8-10; pl. 14, fig. 1.
1940 Triloculina bermudezi; - ACOSTA, p. 37, pl. 4, figs. 1-5.
1957 Triloculina chrysostoma CHAPMAN; - VELLA, p. 28, pl. 5, figs. 97-99.
1959 Triloculina oblonga (MONTAGU); - GRAHAM & MILITANTE, p. 56, pl. 8, fig. 8.
1971 Biloculinella eburnea (d'ORBIGNY); - TODD & LOW, p. C 11, pl. 2, fig. 7.
1975 b Triloculina eburnea d'ORBIGNY; - BRASIER, p. 209 (tab).
1975 Triloculina bermudezi ACOSTA; - WANTLAND, p. 389, fig. 14n-s.
1978 Triloculina bermudezi ACOSTA; - UBALDO & OTERO, p. 97, pl. 2, figs. 26-27.

Description : See d'ORBIGNY (1839), CHAPMAN (1909), ACOSTA (1940).

Diagnostic Remarks and Distribution : This variant is characterised by an ovate to rounded outline, a hardly compressed test and a very narrow, slitlike, curved aperture on top of the last-formed chamber reaching the suture; a narrow, curved, elongate tooth almost completely filling up the aperture, ending in a broadly rounded, platelike structure. It is considered here as an extreme ecovariant of the species Q. oblonga. I have maintained the name eburnea, having priority over the names bermudezi and chrysostoma. Specimens transitional between typical Q. oblonga and the present subspecies are found in our material; such a specimen is illustrated by GRAHAM & MILITANTE (1959 , pl. 8, fig. 8). Representatives of this subspecies are mostly typically ovate to rounded; a specimen completely identical with Q. oblonga, except for the narrower aperture, is illustrated on pl. 46, figs. 5a-b.

T. bermudezi was described as "a more circular triloculine stage of Biloculinella eburnea (from the Bahamas)" as TODD & LOW (1971) state, whereas T. chrysostoma apparently differs from eburnea only in the broader, T-shaped tip of the apertural tooth. Or, as VELLA (1957) states : "eburnea is similar to chrysostoma, but differs in not having the aboral ends of the chambers swollen. The tooth seems broader, and, according to d'ORBIGNY, completely seals the aperture". I do consider both taxa to fall within the eburnea-oblonga variability range.

Summarizing, we can enumerate the different forms comprised in the oblonga-eburnea range as follows : the typical Q. oblonga s.s. is elongate and quinque - to triloculine; eburnea is generally more ovate and rounded, and mostly triloculine; "bermudezi" is ovate and mostly biloculine or triloculine.

The eburnea-subspecies is equally known from Indopacific as well as Atlantic localities, from tropical coral reefs to temperate and even subarctic waters (CHAPMAN, VELLA).

Occurrence : The eburnea-subspecies is less frequent in our material than oblonga s.s.; the distribution areas are the same but eburnea has a more scattered occurrence. As to BRASIER (1976), eburnea is a typical phytal substrate-dweller; according to our findings (see part 1) the separation between phytal and vegetation-covered sediment substrates cannot be held up so strictly and these habitats intergrade into each other to a great extent.

Quinqueloculina oblonga (MONTAGU) subsp. lizardi nov. subsp.
(Pl. 46, figs. 6a-b; pl. 47, fig. 1).

1979 Triloculina cf. T. oblonga; - PEREIRA, pl. 16, figs. C-D.

Derivatio Nominis : Named after our research locality, Lizard Island.

Description : This form is completely identical with subsp. oblonga s.s. except for the even and shallow pitting of the test surface.

Diagnostic Remarks and Distribution : The test surface is definitely pitted, and not perforated as PEREIRA (1979) mentions. These pits show up as shallow, rounded to irregularly elongate excavations into the smooth chamber walls; they form a rather dense pattern and disappear where the test shows signs of abrasion.

PEREIRA's (1979) illustration of this subspecies, from Eastern Africa, is the only reference I could find.

Occurrence : Rare; occurs only in a few perireefal samples.

Quinqueloculina pittensis ALBANI, 1974.
(Pl. 47, figs. 2-3).

+ 1974 Quinqueloculina pittensis; - ALBANI, p. 33, pl. 1, figs. 1-3.

Description : See ALBANI (1974).

Diagnostic Remarks and Distribution : Our Lizard Island specimens resemble almost perfectly ALBANI's figures except for the chamber shape being in most cases less subquadrate. This, however, may be an effect of abrasion of the tests. An indication of the degree of abrasion is also given by the agglutinated particles often being eroded away from the test wall and leaving only their "imprints". The very short neck with smooth peristome and small, T-shaped apertural tooth are constant features of the species. Fresh specimens are more or less finely agglutinated externally and frequently include tourmaline crystals or -fragments in this agglutinated layer; these specimens resemble Q. samoaensis as figured by CUSHMAN (1924), pl. 21, figs. 6-7 (type

material) though CUSHMAN's species apparently has a sharper, more prominent aboral test end and a slightly more pronounced neck. However, I do not exclude the possibility of both forms belonging to the same species and being simply ecovariants; it would be necessary to compare type material. In the affirmative case, Q. pittensis would fall into synonymy with CUSHMAN's Q. samoaensis (after removal of all erroneous records from the latter species). It is also possible that Q. pittensis only represents an artificial grouping of more or less abraded specimens of Q. samoaensis (ALBANI indeed does not mention any procedure of recognition of living forms and apparently only studied thanatocoenoses).

ALBANI's types were described from estuarine environments along the central Eastern coast of New South Wales (Australia).

Occurrence : Living specimens are rare; the species has been encountered on the reef flats as well as in the Perireefal Area (where empty test are common), and the Lagoon Entrance. The species is probably a vegetation-covered sediment dweller in intertidal as well as deeper subtidal environments. ALBANI states that it occurs always at depths less than 10 m but that it does not occur in shore samples in his material.

Quinqueloculina poeyana carinata ALBANI, 1974.
(Pl. 47, figs. 4-5).

+ 1974 Quinqueloculina poeyana carinata; - ALBANI, p. 35, pl. 1, figs. 4-6.

Description : See ALBANI (1974).

Diagnostic Remarks and Distribution : Our specimens agree with ALBANI's description and illustration; the only remark I would make concerns the periphery which, according to ALBANI, is "rounded but with a bladelike carina which runs longitudinally from the extended neck to the aboral end"; our specimens rather possess strongly compressed tests and the carina completes the sharp-edged shape of the periphery at least in smaller specimens; full-grown tests are generally more inflated, but these are rare.

Comparison of this species with Atlantic specimens from the Caribbean and the Bahamas (collections of BRASIER and MONTY) indeed revealed the constancy

of the absence of this lateral test compression in Atlantic Q. poeyana d'ORBIGNY and the justification of the creation of a new subspecies which, in Pacific reefal environments, apparently takes over the role of d'ORBIGNY's species.

ALBANI's types are from the same locality as Q. pittensis (New South Wales). No other records of this species have been met, though the form probably must have been included in other striate or costate miliolids by the authors.

Occurrence : Living specimens and empty tests are present in almost every habitat at Lizard Island but the species is particularly well represented in the shallow backreef areas (Patch-reefs, Lagoon, Sandy Shoal).

Quinqueloculina pseudoreticulata PARR, 1941.
(Pl. 47, figs. 6-7).

\+ 1994 Miliolina reticulata; - BRADY, p. 177, pl. 9, figs. 2-3.
n.n. 1941 Quinqueloculina pseudoreticulata; - PARR, p. 305.
1958 Quinqueloculina pseudoreticulata PARR; - COLLINS, p. 361.
1960 Quinqueloculina pseudoreticulata PARR; - BARKER (see ref. BRADY 1884).
1964 Quinqueloculina pseudoreticulata PARR; - ROCHA & UBALDO, p. 38, pl. II, fig. 7.
1968 Quinqueloculina pseudoreticulata PARR; - ALBANI, p. 98, pl. 7, figs. 18-20.

Description : See BRADY (1884), PARR (1941).

Diagnostic Remarks and Distribution : This species is somewhat variable in shape; in our material the chamber arrangement is always clearly quinqueloculine and the reticulate ornamentation pattern is very pronounced but the test varies from rounded in cross-section to compressed with subangular chambers; the variation is of the same type as described for Q. neostriatula. The aperture varies from rounded to elongated ("Lachlanella"-type) with a narrow tooth which is hardly bifid at the tip. The "Lachlanella" apertural type (upon a hardly noticeable short neck and with a narrow peristome) is the most frequent in our material. In general the Lizard Island specimens correspond rather well to BRADY's drawings except for this test compression. A feature which is shown on our SEM-photographs as well as upon BRADY's figures is the fading out of the ornamentation near the chamber sutures and,

on the opposite, the pronounced reticulate pattern in the central area between the sutures with a tendency of the ornamental ribs to start running longitudinally and, in some compressed specimens, to pass into a blunt keel.

This species has possibly been confused in the past with variants of Quinque-(Tri?) loculina kerimbatica (H. ALLEN & EARLAND), a much more irregularly shaped taxon which may also show a kind of reticulate pattern which is coarser and more irregular however than in Q. pseudoreticulata whereas the aperture is mostly small, rounded and placed at the end of a longer neck. Nothing definite about an eventual relationship of these species can be said as Q. kerimbatica is lacking in our Lizard Island material.

The species has exclusively been recorded from Australian waters. BRADY's types are from off New Guinea.

Occurrence : Living specimens and empty tests are common in the Perireefal Area. The species does not occur above the - 10 m isobath.

Quinqueloculina quinquecarinata COLLINS, 1958.
(Pl. 48, figs. 1-2).

+ 1958 Quinqueloculina quinquecarinata; - COLLINS, p. 360, pl. 2, figs. 8a-c.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens agree with COLLINS's (1958) description and figuration. This small, translucent form with white-opaque keels is easily recognisable notwithstanding its small dimensions.

No other references to this species have been encountered in the literature. COLLINS's types are from the Great Barrier Reef (off Low Isles).

It is a noticeable fact that I have met this species in samples from off the Northern coast of New Guinea (material by courtesy of Dr. K. WOUTERS, Brussels); these specimens were in all respects identic to those from the Barrier Reef material though most of them were consistently larger (adding about 1/3 of the mean length of Lizard Island specimens to their maximum dimension).

Occurrence : Empty tests are to be found in most habitats at Lizard Island, even upon the reef flats. The species reaches its highest frequencies however in the Perireefal Area where living specimens often occur; these latter are easily recognisable because of the translucent test walls through which the

coloured protoplasm can be observed.

Quinqueloculina tropicalis CUSHMAN, 1924.
(Pl. 48, figs. 3-4).

1884 Miliolina gracilis BRADY (not d'ORBIGNY); - BRADY, p. 160, pl. 5, figs. 3a-c.
\+ 1924 Quinqueloculina tropicalis; - CUSHMAN, p. 63, pl. 23, figs. 9-10.
1958 Quinqueloculina tropicalis CUSHMAN; - COLLINS, p. 361.
1960 Quinqueloculina tropicalis CUSHMAN; - BARKER (see ref. BRADY 1884).

Description : See CUSHMAN (1924), BRADY (1884).

Diagnostic Remarks and Distribution : Our specimens are in perfect accordance with CUSHMAN's description and illustrations, including the "granular, dull" surface and the apertural features. This rather small species is quite distinct from all other agglutinated miliolids by its very elongate form and thin, almost transparant test walls. At first sight it bears some resemblance to Miliammina fusca but the apertural features are clearly milioline and the test dissolves in acid.

This is a typical Indopacific shallow-water form; CUSHMAN's (1924) types are from Samoa; as to CUSHMAN, MILLETT (1898) notes that it is common in the Malay region; whereas BRADY's types are from off New Guinea. COLLINS (1958) reports the species from the Great Barrier Reef (shallow-water samples from Low and Turtle Ids.).

Occurrence : This species characterices the shallow backreef environments and is common in the Lagoon and the Patchreef Area; elsewhere it is extremely rare or completely absent.

Quinqueloculina montyi nova species
(Pl. 48, figs. 5-7).

Derivatio nominis : In honour of Dr. C. MONTY (University of Liege, Belgium) who supervised the research on Lizard Island sediments collected in 1967 and 1975.

Description : Test free, quinqueloculine, higher than broad (see axial ratios below). Test wall varying in thickness, translucent in juvenile specimens, white and opaque in adults; living and fresh tests are glossy, abraded specimens rapidly turn dull.

Test outline in lateral view ovate, without apertural neck and with slightly prominent aboral test end. Wall surface ornamented with 4 to 6 or more not very pronounced, low, rounded and sometimes anastomosing costae pro chamber, running more or less longitudinally and fading out near the aperture and the aboral test end where the surface is generally smooth. The general appearance of the ornamentation is in a median position between "striate" and "costate" and shows considerable variation in intensity as well as frequency of the costae (striae).

Aperture semicircular to circular, sometimes slightly laterally compressed, without nevertheless becoming of the subquadrate "Lachlanella"- type, and bordered by a narrow, smooth peristome and provided with a short bifid tooth.

The chambers are almost semicircular to slightly compressed in cross-section, resulting in depressed and often deeply incised sutures.

Differential diagnosis : This species is easily distinguishable from all smooth-walled quinqueloculinids by its clearly visible costae. Q. neostriatula is generally larger and broader and more distinctly, finely striate whereas the unornamented surface zones are larger than in Q.montyi;whose aperture is also differently shaped and relatively smaller. Quinqueloculina tenagos PARKER has a relatively smaller, differently shaped aperture and is more finely striate whereas the sutures are not so deeply incised. Q. montyi has no relation to any other costate form, like e.g. Q. granulocostata, this being larger, stouter, more elongate and having differently shaped chambers and aperture.

Holotype : Specimen figured on pl. 48, figs. 5a, b (L 100).

Dimensions and axial ratios : Dimensions of paratypes and hypotypes of different environments (Perireefal Area, Lagoon, Patchreef Area; 33 specimens altogether) are hereafter expressed in length of the a- and c-axes in microns; the axial ratio (ar = a/c x 10) is given also (it is reminded here that the a-axis is the max. width and the c-axis is the max. length of the miliolid test. Measuring method see BRASIER, 1976).

Environment	Sample No.	c (microns)	a (microns)	ar
Perireefal	L 50	280	180	6,4
Area (East)	L 56	360	240	6,6
	L 60	480	340	7
		440	300	6,8
		400	280	7
		500	380	7,6
		400	280	7
Eastern	L 100	440	280	6,3
Slope		540	400	7,4
		440	300	6,8
	L 108	360	260	7,2
		320	220	6,8
	L 110	360	260	7,2
Lagoon	L 121	400	260	6,5
		360	240	6,6
	L 123	320	180	5,6
		300	220	7,3
	L 129	440	200	4,5
	L 130	440	200	5,9
		320	240	7,5
	L 136	280	200	7,1
	L 139	380	300	7,8
		400	240	6
	L 151	280	160	5,7
		320	220	6,8
		280	180	6,4
Patch-reefs	L 153	300	220	7,3
		320	220	6,8
		320	200	6,2
		360	260	7,2
	L 154	320	220	6,8
	L 162	460	280	6
	L 278 d	340	260	7,6

The mean axial ratio of the measured specimens is 6,5 with extreme values of 4,5 (elongate, narrow test) and 7,8 (broadly ovate test). These values are in a position intermediate of typical phytal and vegetation-coated sediment substrates whereas the test features reflect this intermediate position. Q. montyi thus seems to be a very adaptive species which lives either in typical vegetation-coated sediment but also occasionally in coarser weeds (e.g. temporary Thalassia - blooms in the Sandy Shoal and Lagoon ?).

Occurrence : The species, as expected from the considerations given above, has been encountered alive in the circumstances reflecting those phytal or vegetation-coated sediment habitats (Patchreef Area, Lagoon, Sandy Shoal) where empty tests are common too. Empty tests are occasionally found in the Perireefal Area to where they apparently have been transported. They also occur in the backreef areas of the reef flats.
This species is a shallow-water indicator (see Part 1).

Genus Massilina SCHLUMBERGER, 1893.

Massilina corrugata COLLINS, 1958.
(Pl. 49, figs. 1-2).

+ 1958 Massilina corrugata; - COLLINS, p. 362, pl. 2, figs. 11-12.

(For synonymy of Quinqueloculina parkeri BRADY, see e.g. GRAHAM & MILITANTE (1959), p. 46 - publications of BRADY and CUSHMAN).

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : COLLINS (1958) states that "the quinqueloculine microspheric form at first sight resembles Quinqueloculina parkeri BRADY, but the periphery is truncate rather than acute as in the latter species". In our Lizard Island material M. corrugata displays a great deal of variability; specimens in perfect accordance with COLLINS' description and illustrations are most frequent but specimens with a more angular periphery, or partly subangular-partly truncate periphery occur. The transversal ridges are somewhat variable in frequency as well as in relief (abrasion).

As I cannot point out any significant difference between most of the figured

Q. parkeri in the literature on one hand, except for these peripheral features), and COLLINS's M. corrugata on the other, I wonder whether both forms should not be considered as ecovariants of the same species. This should then be called Massilina parkeri. We do not dispose of sufficient typical "parkeri"-specimens in our material since most specimens are referrable to the "corrugata"-species. I have grouped all these transverse-ridged specimens, provided with a somewhat "Lachlanella"-like aperture, under the name M. corrugata.

Occurrence : Rare in all environments. Most frequent in the Perireefal Area. Rare living tests are occasionally encountered.

Massilina inaequalis CUSHMAN, 1921.
(Pl. 49, figs. 3-5).

+ 1921 Massilina inaequalis; - CUSHMAN (Proc. U.S.N. Mus., vol. 59), p. 72, pl. 17, figs. 12-13.
1929 Massilina inaequalis CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 38, pl. 7, figs. 6a-c.
1932 Massilina inaequalis CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 32, pl. 8, figs. 6-7.
1959 Massilina inaequalis CUSHMAN; - PEREIRA, pl. 14, figs. P-Q.

Description : See CUSHMAN (1921).

Diagnostic Remarks and Distribution : Our specimens, though variable in shape, agree with CUSHMAN's description and illustration. The periphery is truncate, the chambers are almost rectangular in cross-section. The aperture is rounded to subangular (trapezium-shaped with rounded corners) and surrounded by a narrow peristome into which the peripheral costae end.

The aperture is always placed upon a short (to very short) neck; most of our specimens possess a double T-shaped apertural tooth; both teeth are placed opposite each other, the horizontal parts of the T's perfectly parallel. This feature has been illustrated by CUSHMAN (1917) in Spiroloculina communis and its variants and it points, together with the general appearance of the test which is reminiscent of square-edged Spiroloculina's such as S. communis, towards a close relationship of M. inaequalis with some of these Spiroloculina's.

There is a considerable variation in the elongation of the test, with extremes being very narrow and elongated or short and broad in lateral view (variability of axial ratios). Several specimens of smaller size have a quinqueloculine chamber arrangement but on larger shells the massiline development is fairly well visible.

M. inaequalis has exclusively (and not very often) been reported from Indo-pacific tropical reefal provinces. It has not been encountered by COLLINS (1958) in the Great Barrier Reef.

Occurrence : Rare on the reef flats, common in the Patchreef Area and the other shallow backreef environments where the species has frequently been found alive. Empty tests are occasionally transported towards deeper water (Lagoon, Leeward Slope and Perireefal Area).

Massilina subrugosa COLLINS, 1958.
(Pl. 49, figs. 6-7).

1915 Massilina secans d'ORBIGNY, var. rugosa H. ALLEN & EARLAND (not Massilina rugosa SIDEBOTTOM), p. 583, pl. 14, figs. 5-12).
+ 1958 Massilina subrugosa; - COLLINS, p. 361, pl. 2, fig. 9.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Although I have found only a few complete empty tests in our Lizard Island material, these specimens are perfectly referrable to COLLINS's species "... heavily built test, porcellaneous and coated with a thin layer of sandgrains except near the aperture, where the smooth white shell wall appears." The long, narrow, curved aperture with very elongate and narrow apertural single tooth is a typical feature of the species.

COLLINS's types are from the Great Barrier Reef.

Occurrence : Rare, scattered occurrence in the Perireefal Area and the shallow backreef environments (Lagoon, Sandy Shoal, Patchreef Area).
No living specimens have been encountered.

Genus Pseudomassilina LACROIX, 1938.

Pseudomassilina australis s.s. (CUSHMAN), 1932.
(Pl. 50, figs. 1-5; pl. 51, fig. 1).

1884 Massilina secans d'ORBIGNY; - BRADY, pl. 6, figs. 1-2.
1924 ? Massilina pacificiensis; - CUSHMAN, p. 66, pl. 24, figs. 1-2.
+ 1932 Massilina australis; - CUSHMAN (U.S.N.M. Bull. 161, pt. 1), p. 32, pl. 8, figs. 2a-b.
1938 Pseudomassilina australis (CUSHMAN); - LACROIX, p. 3.
1958 Pseudomassilina australis (CUSHMAN); - COLLINS, p. 363.
1960 Pseudomassilina australis (CUSHMAN); - BARKER (see ref. BRADY 1884).
1964 Pseudomassilina australis (CUSHMAN); - LOEBLICH & TAPPAN, p. C 463, figs. 352-1.

Description : See CUSHMAN (1932), LOEBLICH & TAPPAN (1964).

Diagnostic Remarks and Distribution : See also remarks by LACROIX (1938), COLLINS (1958), BARKER (1960). The species is characterised by its flattened test provided with "growth striae", finely pitted surface and loop-shaped curved aperture with lip and without tooth. The tests are variable in surface ornamentation; most often they have an almost smooth surface but irregular undulations (as in M. pacificiensis CUSHMAN, 1924) as well as oblique striae, reticulate patterns or oblique costae may appear. As I do not consider this ornamentation variability to possess any specific value (moreover all transition forms between these variants occur in our material), the reticulate and costate specimens are considered as ecovariants of P. australis but are here described separately for convenience (see below). A second variation lies in the thickness (b-axis); some specimens are thicker, more involute (almost quinqueloculine) than the typical evolute, complanate specimens of the present species.

P. australis and its variants are exclusively known from Indopacific tropical reef provinces and has been reported by COLLINS (1958) from the Great Barrier Reef. BRADY's (1884) figured specimens are from Torres Strait. CUSHMAN's (1932) types are from Rarotonga, Cook Islands (7 fathoms).

Occurrence : The smooth, weakly ornamented form of the present species (s.s.) is common in the thanatocoenoses at most of the perireefal stations; no living specimens have been encountered.

Pseudomassilina australis (CUSHMAN), subsp. reticulata (H. ALLEN & EARLAND), 1915.
(Pl. 51, figs. 2a-b).

+ 1915 Massilina secans, var. reticulata; - H. ALLEN & EARLAND, p. 582, pl. 45, figs. 1-4.
1938 Pseudomassilina australis (CUSHMAN), var. reticulata (H. ALLEN & EARLAND); - LACROIX, p. 6, fig. 4.
1959 Pseudomassilina australis (CUSHMAN), var. reticulata (H. ALLEN & EARLAND); - GRAHAM & MILITANTE, p. 39, pl. 3, figs. 22a-c.

Description : See H. ALLEN & EARLAND (1915), LACROIX (1938).

Diagnostic Remarks and Distribution : This designation covers the finely reticulate, strongly compressed variants of P. australis.
H. ALLEN & EARLAND's figured Kerimba specimens of this subspecies were originally described as variants of Massilina secans but LACROIX (1938) placed them in his newly created genus Pseudomassilina as they do not show any trace of a tooth and as they possess the typically pitted Pseudomassilina-test surface.

As the remaining features of this subspecies are identical with those of P. australis s.s., and as all transitional forms occur in our material, the present form is considered here as an (eco-?) variant of P. australis.

The distribution of this variant probably runs parallel with the one of P. australis s.s.; GRAHAM & MILITANTE report the taxon from the Philippines; COLLINS (1958) apparently included these reticulate specimens in P. australis and states that, obeying the rules of nomenclature, M. (Pseudomassilina) pacificiencis would have priority over the name P. australis in case of identity of the two taxa which is very likely the case. The name australis being in common use however, I would prefer not to change it for convenience, at present.

Occurrence : Rare; occurs together with P. australis s.s. in a few periree-fal samples. No living specimens have been encountered.

Pseudomassilina australis (CUSHMAN), subsp. macilenta (BRADY), 1884.
(Pl. 51, figs. 3-4).

+ 1884 Miliolina macilenta; - BRADY, p. 167, pl. 7, figs. 5-6.
1917 Quinqueloculina macilenta (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 55.
1924 Massilina macilenta (BRADY); - CUSHMAN, p. 64, pl. 24, figs. 3-4.
1932 Massilina macilenta (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 33, pl. 8, fig. 4.
1938 Pseudomassilina macilenta (BRADY); - LACROIX, p. 7.
1959 Pseudomassilina macilenta (BRADY); - GRAHAM & MILITANTE, p. 39, pl. 4, figs. 1a-b.
1960 Pseudomassilina macilenta (BRADY); - BARKER (see ref. BRADY 1884).

Description : See BRADY (1884), CUSHMAN (1924), LACROIX (1938).

Diagnostic Remarks and Distribution : This Pseudomassilina-species with somewhat oblique costae in different degrees of development is, except for this feature, identical with P.australis,and is regarded here as a(n) (eco)-variant of the latter species. Records of this taxon refer to a small species; most specimens in our material are indeed smaller than P. australis s.s., but some others reach the same dimensions as the latter species and are perfectly comparable. The macilenta-subspecies as described in the literature might be nothing but a juvenile form.

It is possible that the ornamentation variability in the present subspecies (reticulata and macilenta) is induced by substratum changes in the Perireefal Area.

P. australis subsp.macilenta is a typical Indopacific tropical reef inhabitant whose distribution area is the same as the one of P. australis s.s.; BRADY's types are from the Admirality Islands; further records are from Hawaii, New Guinea, Fiji, Levuka, Mokaujar Anchorage and from the Tonga Islands. COLLINS (1958) probably included this taxon in P. australis.

Occurrence : Empty tests are present at several perireefal stations but they are rare throughout. No living specimens have been encountered.

Genus Pyrgo DEFRANCE, 1824.

Pyrgo denticulata s.s. (BRADY 1884).
(Pl. 51, figs. 5-6; pl. 52, fig. 1).

+ 1884 Biloculina ringens (LAMARCK), var. denticulata; - BRADY, p. 143, pl. 3, fig. 4-5.
1917 Biloculina denticulata BRADY; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 80, pl. 33, figs. 1a-c.
1921 Biloculina denticulata BRADY; - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 476, pl. 98, figs. 3a-b.
1924 Biloculina denticulata BRADY; - CUSHMAN, p. 70.
1929 Pyrgo denticulata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 69, pl. 18, figs. 3-4.
1932 Pyrgo denticulata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 62, pl. 14, figs. 1-9.
1957 Pyrgo denticulata (BRADY); - TODD, p. 288 (table), pl. 88, figs. 7-8.
1958 Pyrgo denticulata (BRADY); - COLLINS, p. 371.
1959 Pyrgo denticulata (BRADY); - GRAHAM & MILITANTE, p. 39, pl. 4, figs. 2-3.
1960 Pyrgo denticulata (BRADY); - BARKER (see ref. BRADY 1884).
1977 Pyrgo denticulata (BRADY); - HUGHES, pl. 2, fig. 27.

Description : See BRADY (1884), CUSHMAN (1917).

Diagnostic Remarks and Distribution : Our specimens agree with BRADY's and CUSHMAN's descriptions and illustrations. Specimens with well-developed denticulations at the aboral test end occur as well as specimens upon which these features are hardly or not noticeable.

The present species has a worldwide distribution in coral reef areas. BRADY's types are from Honolulu reefs. The species has been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; isolated empty tests have been encountered at several perireefal stations.

Pyrgo denticulata (BRADY), subsp. striolata (BRADY), 1884.
(Pl. 52, figs. 2-5).

+ 1884 Biloculina ringens (LAMARCK), var. striolata; - BRADY, p. 143, pl. 3, figs. 7-8.
1917 Biloculina denticulata (BRADY), var. striolata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 80, pl. 33, figs. 2-3.
1921 Biloculina denticulata (BRADY), var. striolata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 477, pl. 98, figs. 2a-c.
1924 Biloculina denticulata (BRADY), var. striolata (BRADY); - CUSHMAN, p. 70.
1929 Pyrgo denticula (BRADY), var. striolata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 69, pl. 18, figs. 5a-c.
1932 Pyrgo denticulata (BRADY), var. striolata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 63, pl. 14, figs. 10-11.
1958 Pyrgo striolata (BRADY); - COLLINS, p. 371.
1959 Pyrgo denticulata (BRADY), var. striolata BRADY; - GRAHAM & MILITANTE, p. 40, pl. 4, figs. 4-5.
1960 Pyrgo denticulata (BRADY), var. striolata BRADY; - BARKER (see ref. BRADY 1884).

Description : See BRADY (1884), CUSHMAN (1917).

Diagnostic Remarks and Distribution : This subspecies resembles P. denticulata perfectly. The more or less pronounced striation is the only difference. As all intermediate specimens, from non-striate to striate, occur in our material, I tend to believe that denticulata and striolata are ecovariants in the same way as Pseudomassilina australis and its ornate variants. COLLINS (1958) apparently raised P. denticulata striolata to specific rank, a point of view which I do not share considering the preceding remark.

The subspecies has the same worldwide reefal distribution as P. denticulata. BRADY's types are from off New Guinea and from Torres Strait.

Occurrence : Rare; empty tests are present at several perireefal stations. No living specimens have been encountered.

Pyrgo lundgreni nova species.
(Pl. 52, figs. 6-8).

Derivatio nominis : Named in honour of Miss K. LUNDGREN from Stockholm, formerly employed by the Australian Museum.

Description : Test free, large (up to 1 mm or more), stout, subglobular, biloculine with strongly embracing last chamber. Test white, porcellaneous, smooth and glossy (occasionally some faint irregularities such as transversal ridges may appear upon the test). The three dimensions (a, b and c-axes) are about equal in length; the suture is straight, almost circular in lateral view, well-marked though hardly depressed.

Aperture large and high, mushroom-shaped, with a pronounced peristome. The apertural tooth is high, large and complex; in juvenile specimens it is narrow and bifid but in adult specimens growing in keyhole shape, somewhat comparable with the Flintina-aperture (see description by LOEBLICH & TAPPAN, 1964, p. C 461). These complex apertural features are slightly variable but always follow the same pattern; the sutural part of the aperture is narrow and supports the nondivided part of the tooth; then the aperture rapidly broadens to assume a subcircular shape whereas the tooth bifurcates into two branches linked again on top by a curved, plate-like structure expanding laterally beyond the basal part of the tooth and linked internally to the antepenultimate chamber surface (septum). As the basal part of the tooth is also linked internally to the previous septum as well as to the upper plate, a complex skeletal structure appears caused by the intergrowth of all these toothparts- and supports, leaving openings between them. Fig. 8, pl. 52 shows part of the ontogeny of the apertural structures in one broken specimen; these structures grow gradually more complex as they succeed each other when new chambers are added; every toothstructure is inverted in relation to the preceding one and these structures apparently consistently add to the strength of the whole test.

Differential Diagnosis : The apertural features of this species point to a relationship with Flintina (compare with Flintina bradyana as described by LOEBLICH & TAPPAN, 1964) although the chamber arrangement is never triloculine as in the latter genus. As I could not find any other Pyrgo, described in the literature, with a comparable complex apertural apparatus, the present species is easily distinguishable from all other Pyrgo's with subglobular tests; the species most resembling P. lundgreni are Pyrgo subpisum PARR and

P. subglobulus PARR (PARR, 1950), both of them having however completely differently shaped apertures (P. subglobulus is mentioned by COLLINS, 1958, from the Great Barrier Reef).

Holotype : The specimen illustrated on pl. 52, figs. 6a-b (sample L 63).

Dimensions and Axial Ratios : The dimensions of 14 specimens (holotype and paratypes) are hereafter given in length of the a- and c-axes in microns, followed by the axial ratios a/c x 10.

Environment	Sample n°	c-axis	a-axis	ar
Perireefal	L 63	1350	1350	10
Area	(holotype)	1450	1350	9,3
		800	700	8,7
		700	600	8,5
		1050	1050	10
		950	900	9,4
	L 65	900	850	9,4
		1100	950	8,6
		650	650	10
		650	600	9,2
		700	650	9,2
		550	500	9
		1050	1000	9,5
	L 86	500	450	9

Note that 5 of the 14 specimens are longer than 1 mm. The mean ar = 9,3 which indicates almost spherical tests.

Occurrence : Rare in the thanatocoenoses of the Eastern Perireefal Area. The species reaches its highest frequency in the area between Lizard Island and Sandbank Reef (Southern limit of the "megaripple area" - Halimeda mounds). No living specimens have been encountered.

Genus Spiroloculina d'ORBIGNY, 1826

Spiroloculina communis s.s. CUSHMAN & TODD, 1944.
(Pl. 53, figs. 1-3).

1884 Spiroloculina excavata BRADY (not d'ORBIGNY); - BRADY, p. 151, pl. 9, figs. 5-6.
1917 Spiroloculina grateloupi CUSHMAN (not d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 31, pl. 4, figs. 4-5.
1922 Spiroloculina grateloupi CUSHMAN (not d'ORBIGNY); - CUSHMAN, p. 59.
1929 Spiroloculina grateloupi CUSHMAN (not d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 40, pl. 8, fig. 1.
1932 Spiroloculina grateloupi CUSHMAN (not d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 4), p. 34, pl. 8, figs. 10-11.
+ 1944 Spiroloculina communis; - CUSHMAN & TODD, p. 63, pl. 9, figs. 4-5, 7-8.
1949 Spiroloculina communis CUSHMAN & TODD; - SAID, p. 14, pl. 1, fig. 37.
1951 Spiroloculina communis CUSHMAN & TODD; - ASANO, p. 13, figs. 87-88.
1954 Spiroloculina communis CUSHMAN & TODD; - CUSHMAN, TODD & POST, p. 335, pl. 84, fig. 13.
1958 Spiroloculina communis CUSHMAN & TODD; - COLLINS, p. 364.
1959 Spiroloculina communis CUSHMAN & TODD; - GRAHAM & MILITANTE, p. 51, pl. 6, figs. 15a-b.
1960 Spiroloculina communis CUSHMAN & TODD; - BARKER (see ref. BRADY 1884).
1979 Spiroloculina communis CUSHMAN & TODD; - PEREIRA, pl. 8, fig. K.
1973 Spiroloculina communis CUSHMAN & TODD; - BROOKS, pl. 6, fig. 9.

Description : See CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : This is the most common Spiroloculina in our Lizard Island material. CUSHMAN & TODD (1944) distinguish four varieties in the species; I did not try to reckognise these as the species is quite variable anyway. Only CUSHMAN's S. attenuata has been considered here as a distinct subspecies of S. communis (see below).

Constant features of the species are the angled periphery and the more or less concave test; the pronounced aboral test end, the more or less long neck and the circular to ovate aperture with a T-shaped, sometimes double tooth; the white, somewhat roughened wall surface. CUSHMAN & TODD (1944) themselves state that the species "... is extremely variable in size, relative length, breadth, and thickness, texture of the wall, and in the prominence of the early peripheral margins raised above the surface". The

varieties of S. communis described by these authors are : var. incisa (shorter and broader, numerous chambers); var. excisa (larger, more inflated test, commonly convex periphery) and var. polita (smooth polished surface, translucent in the central part of the chamber, deeply concave test). Several of our specimens could be referred to some of these "varieties", but as stated already, we did not make the separation as these different features obviously only reflect ecophenotypic variability (e.g. variation in thickness of the test wall which could reflect substratum changes - see BRASIER, 1976, and part 1 of this study).

Spiroloculina clara CUSHMAN might be a juvenile form of S. communis.

As to the distribution of the species, CUSHMAN & TODD (1944) already stated that it "appears to be the most common and widely distributed species of the Pacific" and they add that some specimens from the Caribbean appear to be the same species (Florida). BROOKS (1973) recorded the species from off Puerto Rico. The species has been reported by COLLINS (1958) as common in his Great Barrier Reef samples.

Occurrence : Rare to common at most perireefal stations. The species is absent from the reef flats and shoals where it is replaced by S. corrugata. Some rare living specimens have been encountered.

Spiroloculina communis CUSHMAN & TODD, subsp. attenuata CUSHMAN & TODD, 1944. (Pl. 53, figs. 4-5).

1924 Spiroloculina grateloupi CUSHMAN (not d'ORBIGNY), p. 54, pl. 20, figs. 3-4.

\+ 1944 Spiroloculina attenuata; - CUSHMAN & TODD, p. 67, pl. 9, figs. 23-25.

Description : See CUSHMAN (1924), CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : The long and slender, almost flat test is the only noticeable feature distinguishing attenuata from communis s.s.; as all intermediates occur in our material, from broad to narrow and from flattened to concave, this subspecies is regarded here as an ecovariant of S. communis. It has been treated here as a separate subspecies because of its persistent presence in several perireefal samples and because of its presence on the reef flats where S. communis s.s. does not occur.

Occurrence : See above.

Spiroloculina corrugata CUSHMAN & TODD, 1944.
(Pl. 54, figs. 1-3).

1921 Spiroloculina antillarum CUSHMAN (not d'ORBIGNY); - CUSHMAN (part) (U.S.N. Mus. Bull. 100, pt. 4), p. 407, pl. 81, fig. 4 (not pl. 83, fig. 4).

1924 Spiroloculina antillarum CUSHMAN (not d'ORBIGNY); - CUSHMAN, p. 55, pl. 20, fig. 1.

1932 Spiroloculina antillarum CUSHMAN (not d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 36 (not pl. 9, figs. 3-5).

1944 Spiroloculina antillarum d'ORBIGNY; - CUSHMAN, p. 44, pl. 6, figs. 28-32 (see this ref. for further synonymy of S. antillarum).

? 1944 Spiroloculina angulata CUSHMAN; - CUSHMAN & TODD, p. 50, pl. 7, figs. 18-22 (see this ref. for further synonymy of S. angulata).

1944 Spiroloculina scita CUSHMAN & TODD;-CUSHMANN & TODD, p. 60, pl. 1, fig. 14; pl. 8, figs. 20-21.

+ 1944 Spiroloculina corrugata; - CUSHMAN & TODD, p. 61, pl. 8, figs. 22-25.

1949 Spiroloculina corrugata CUSHMAN & TODD; - SAID, p. 15, pl. 1, fig. 33.

1951 Spiroloculina corrugata CUSHMAN & TODD; - ASANO, p. 13, figs. 91-92.

1954 Spiroloculina corrugata CUSHMAN & TODD; - CUSHMAN, TODD & POST, p. 355, pl. 84, figs. 17-18.

1957 Spiroloculina corrugata CUSHMAN & TODD; - TODD, p. 286 (table), pl. 87, figs. 7-8.

? 1958 Spiroloculina scita CUSHMAN & TODD; - COLLINS, p. 364.

1959 Spiroloculina corrugata CUSHMAN & TODD; - GRAHAM & MILITANTE, p. 51, pl. 7, figs. 1a-b.

1968 Spiroloculina antillarum d'ORBIGNY; - ALBANI, p. 97, pl. 7, fig. 21.

1979 Spiroloculina corrugata CUSHMAN & TODD; - PEREIRA, pl. 8, figs. L-M.

Description : See CUSHMAN (1921); CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : As to CUSHMAN & TODD (1944), typical representants of this species possess chambers with rounded transverse section, a "base extending in a bluntly angled projection", a cylindrical neck and fine longitudinal costae, "in general parallel to the periphery". Whether or not the Pacific S. corrugata and the Atlantic S. antillarum are conspecific is a question which should be solved in the future; here we do regard them as synonyms as the comparison with Atlantic material from the Bahama's (Andros Island, coll. MONTY) and from Barbuda (coll. BRASIER) reveals an overlap of the variability ranges of both taxa, strongly suggesting the antillarum and corrugata-forms being only ecovariants of the same biological species. Moreover, CUSHMAN & TODD (1944) state that S. corrugata differs from S. antillarum in the "much larger size, more numerous and finer costae, and the relatively thinner test", all of them features subject to variability due to changing conditions of substrate etc.

Comparable remarks could be made concerning S. angulata which is probably another ecovariant of S. corrugata.

S. scita may without doubt also be included in the S. corrugata - variability range; the differences between the two taxa reside only in the relative width of the test and the obliqueness of the costae; our corrugata - specimens vary from very narrow to large and wide, the costae vary from longitudinal via irregular to slightly oblique.

When considering S. antillarum as conspecific with S. corrugata, the species would have a cosmopolitan distribution in tropical reefal environments where it is generally slightly less common than S. communis; PARR (1932, p. 9) even recorded S. scita from Southern Australian waters; COLLINS (1958) does not mention S. corrugata from his Great Barrier Reef samples but writes about S. scita "being common in practically all the shallow-water samples", whereas he attributes these scita-forms to PARR's"S. antillarum".

Occurrence : Rare to common in most shallow intertidal- and backreef areas; the species lives in the algal covers of the reef-flats and the leeward reef-patches; occasional empty tests are transported towards deeper water.

Spiroloculina foveolata EGGER, 1893.
(Pl. 54, figs. 4-5).

+ 1893 Spiroloculina foveolata; - EGGER, p. 224, pl. 1, figs. 33-34.
1915 Spiroloculina grata TERQUEM, var. reticosa; - CHAPMAN, p. 7, pl. 1, fig. 2.
1915 Spiroloculina foveolata EGGER; - HERON - ALLEN & EARLAND, p. 553.
1918 Spiroloculina elegans CUSHMAN (not SILVESTRI); - CUSHMAN (C.I. Publ. 213), p. 290; pl. 96, figs. 1-2.
1921 Spiroloculina elegans CUSHMAN (not SILVESTRI); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 206, pl. 80, fig. 4.
1932 Spiroloculina antillarum d'ORBIGNY, var. reticosa; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 38, pl. 9, fig. 10.
1944 Spiroloculina foveolata EGGER; - CUSHMAN & TODD, p. 48, pl. 7, figs. 7-12.
1949 Spiroloculina foveolata EGGER; - SAID, p. 18, pl. 1, fig. 40.
1954 Spiroloculina foveolata EGGER; - CUSHMAN, TODD & POST, p. 335, pl. 84, fig. 14.
1957 Spiroloculina foveolata EGGER; - TODD, p. 286 (tab.), pl. 87, figs. 9a-b.
1958 Spiroloculina foveolata EGGER; - COLLINS, p. 364.
1979 Spiroloculina elegans CUSHMAN; - PEREIRA, pl. 8, figs. N-Q.

Description : See EGGER (1893), CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : Our specimens are typical representatives of this particular Spiroloculina with evenly pitted - to reticulate surface.

The species has an exclusive Indopacific distribution and apparently ranges from tropical reefal environments to subtropical end even temperate shelf seas (New Zealand). It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; occasional empty tests occur at several perireefal stations (also on the Western Slope and in the Lagoon). As the tests are very solidly built, they apparently are able to undergo considerable transport before they disintegrate.

Spiroloculina rugosa CUSHMAN & TODD,subsp.curvatura CUSHMAN & TODD, 1944.
(Pl. 54, figs. 6a-b).

+ 1944 Spiroloculina rugosa CUSHMAN & TODD, var. curvatura; CUSHMAN & TODD, p. 66, pl. 9, figs. 18-20.
1958 Spiroloculina rugosa curvatura CUSHMAN & TODD; COLLINS, p. 364.

Description : See CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : Only one characteristic specimen of this species and subsp. has been found in our material. CUSHMAN & TODD's types are from Samoa; the subsp. has also been reported from South Australia, the Great Barrier Reef (COLLINS, 1958) and the Red Sea.

Occurrence : Only one single empty test in sample L 108 (Leeward Slope).

Spiroloculina samoaensis s.s. CUSHMAN, 1924.
(Pl. 55, figs. 1-3).

+ 1924 Spiroloculina planissima (LAMARCK), var. samoaensis; - CUSHMAN, p. 58, pl. 21, figs. 9-10.
1932 Spiroloculina planissima (LAMARCK), var. samoaensis CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1); p. 39, pl. 10, fig. 1.
1944 Spiroloculina samoaensis CUSHMAN; - CUSHMAN & TODD, p. 56, figs. 8-10.

Description : See CUSHMAN (1924), CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : Typical specimens of this species have a strongly compressed test with a narrow, cylindrical neck, a whitish, glossy test wall provided with "fine raised costae, oblique and somewhat anastomosing, fusing at the margin" (CUSHMAN & TODD, 1944), and a truncate or double-keeled periphery. In fact, our specimens display a great variability in respect to this ornation as well as to the peripheral features; thus, we can consider the characteristic ornate and truncate-edged specimens to be at one side of the range which is closed by the nonornate, acute or truncate-edged specimens referrable to S.acescate, which is a form considered here, together with the nonornate, truncate-edged or keeled S. aperta,

as an ecovariant of S. samoaensis (see below). All intermediates occur in our material, such as specimens with hardly noticeable ornament and either truncate or sharp-edged periphery; some specimens even combine the features and show an acute periphery bifurcating into two keel-like edges. CUSHMAN's material may be partly pyritised, or filled with pyrite as he talks about "the costae black against the white background of the test" (1944, p. 57).

The types of this species are from Samoa. Further records are from many tropical Pacific localities (Fiji, Tonga, etc.).

Occurrence : Empty tests of the typical form together with variants are present in small numbers at several perireefal stations and occur occasionally in the shallow backreef environments (even in one reef-flat sample). Living specimens are extremely rare.

Spiroloculina samoaensis CUSHMAN, subsp. aperta CUSHMAN & TODD, 1944. (Pl. 55, figs. 4a-b).

1924 Spiroloculina canaliculata d'ORBIGNY; - CUSHMAN, p. 57, pl. 21, fig. 1.
+ 1944 Spiroloculina aperta; - CUSHMAN & TODD, p. 66, pl. 9, figs. 21, 22.
1958 Spiroloculina aperta CUSHMAN & TODD; - COLLINS, p. 363.

Description : See CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : This is the nonornate subspecies with "margins with a narrow, sharp keel", a feature also occurring in the typical S. samoaensis. CUSHMAN & TODD (1944) state that the taxon "differs from S. acescata CUSHMAN in being thinner and flatter, and in having the periphery truncate in both young and adult stages". As already stated, these features are highly environment-controlled and subsequently, the aperta-form is regarded here as an ecovariant of S. samoaensis. This variant occurs at the same localities as S. samoaensis s.s., plus Hawaii. CUSHMAN & TODD's types are from Samoa. COLLINS (1958) records the subspecies from the Great Barrier Reef as S. aperta.

Occurrence : Rare; occurs in a few perireefal samples.

Spiroloculina samoaensis CUSHMAN, subsp. acescata CUSHMAN, 1932.
(Pl. 55, figs. 5-6).

1915 Spiroloculina planissima (LAMARCK); - HERON - ALLEN & EARLAND, p. 556, pl. 41, figs. 1-5.

+ 1932 Spiroloculina grateloupi d'ORBIGNY, var. acescata; - CUSHMAN, (U.S.N. Mus. Bull. 161, pt. 1), p. 35, pl. 9, fig. 2.

1944 Spiroloculina acescata CUSHMAN; - CUSHMAN & TODD, p. 58, pl. 8, figs. 11-12.

1949 Spiroloculina acescata CUSHMAN; - SAID, p. 14, pl. 1, fig. 36.

1951 Spiroloculina acescata CUSHMAN; - ASANO, p. 12, figs. 81-82.

1954 Spiroloculina acescata CUSHMAN; - CUSHMAN, TODD & POST, p. 334.

1959 Spiroloculina acescata CUSHMAN; - GRAHAM & MILITANTE, p. 50, pl. 6, figs. 13a-b.

Description : See CUSHMAN (1932), CUSHMAN & TODD (1944).

Diagnostic Remarks and Distribution : This subspecies represents the strongly compressed, carinate variant of S. samoaensis. CUSHMAN & TODD (1944) stated that this taxon "in some respects resembles S. samoaensis but that species has a very different surface, the shape is broader and the form of the chambers different". It has already been explained that this subspecies is considered here as an ecovariant of S. samoaensis (see above).

CUSHMAN's types of this variant are from Fiji; SAID reported it from the Red Sea and ASANO found fossil specimens in Japan. COLLINS (1958) did not mention the variant under this name but we may consider that specimens of this subspecies are comprised in his S. aperta.

Occurrence : Present in a few perireefal samples and in one reef-flat sample. Rare.

Genus Spirosigmoilina PARR, 1942.

Spirosigmoilina parri COLLINS, 1958.
(Pl. 56, figs. 1-2).

+ 1958 Spirosigmoilina parri; - COLLINS, p. 365, pl. 3, figs. 2-3.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Some rare, isolated specimens of this small, translucent and fragile species have been found in our material. They otherwise agree with COLLINS's (1958) description and illustrations. SEM-photographs reveal them to possess a corrugated, roughened surface. COLLINS's types are from the Great Barrier Reef.

Occurrence : Very rare; empty tests at a few perireefal stations and in one patchreef- and one lagoonal sample.

Genus Triloculina d'ORBIGNY, 1826.

Triloculina costifera TERQUEM, 1878.
(Pl. 56, figs. 3a-b).

+ 1878 Triloculina costifera; - TERQUEM, p. 60, pl. 5, figs. 35a-b.
1959 Triloculina costifera TERQUEM; - GRAHAM & MILITANTE, p. 53, pl. 7, figs. 9a-c.
1977 Triloculina costifera TERQUEM; - HUGHES, pl. 2, figs. 30-32.

Description : See TERQUEM (1878).

Diagnostic Remarks and Distribution : Our rare specimens are identical with the ones figured by the authors mentioned above.

This species, first described from the Pliocene of Rhodos, seems to have a wide Indopacific distribution. It has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Very rare; only a few empty, damaged, tests have been encountered in the Perireefal Area, on the Sandy Shoal and in one sample from the reef flat of the Windward Barrier.

Triloculina earlandi CUSHMAN, TODD & POST, 1954.
(Pl. 56, figs. 4a-c).

1915 Miliolina terquemiana BRADY (pars); - H. ALLEN & EARLAND, p. 563, pl. 41, figs. 26-28 (not figs. 29-31).
+ 1954 Triloculina earlandi; - CUSHMAN, TODD & POST, p. 338, pl. 85, fig. 3.
1979 Triloculina (?) sp. 6; - PEREIRA, pl. 18, figs. D-G.

Description : See CUSHMAN, TODD & POST (1954).

Diagnostic Remarks and Distribution : Our specimens are in perfect accordance with H. ALLEN & EARLAND's illustrations and CUSHMAN, TODD & POST's description. This species might have been included in T. terquemiana by several authors, (as by H. ALLEN & EARLAND, 1915), which might explain the scarcity of its record in the literature.
This species probably has a wide Indopacific distribution but has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Living specimens as well as empty tests are rare to common in the shallow backreef environments. In one perireefal sample a few living specimens occur.

Triloculina irregularis (d'ORBIGNY), 1826.
(Pl. 57, figs. 1a-c).

+ 1826 Quinqueloculina irregularis; - d'ORBIGNY, vol. 7, p. 302.
1932 Triloculina irregularis (d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 54, pl. 12, figs. 2a-c.
1954 Triloculina irregularis (d'ORBIGNY); - CUSHMAN, TODD & POST, p. 338, pl. 85, figs. 12a-b.
1957 Triloculina irregularis (d'ORBIGNY); - TODD, p. 288 (table), pl. 86, figs. 2a-b.
1959 Triloculina irregularis (d'ORBIGNY); - GRAHAM & MILITANTE, p. 54, pl. 7, figs. 11a-c.
1979 Triloculina quadrilateralis (d'ORBIGNY); - PEREIRA, pl. 16, figs. E-J.

Description : See d'ORBIGNY (1826); CUSHMAN (1932).

Diagnostic Remarks and Distribution : Our specimens agree with CUSHMAN's (1932, etc.) description and illustrations. There is some variation in the length of the test but the latter is generally elongate, not "nearly circular in side view" as CUSHMAN (1932) states. Very characteristic features in our specimens are the slightly sigmoidally-reflexed costae (due to an increase of the test thickness near the aboral end), and the mostly strongly compressed, narrow aperture of the "Lachlanella"-type, provided with an elongate, bifid tooth (not single as in Massilina). There is probably a great deal of overlap between this species and d'ORBIGNY's T. quadrilateralis in the literature (see e.g. PEREIRA, 1979); the latter is mostly recorded from the Atlantic but both taxa might well fall within the variability range of one single species.

The geographical limits of this species are obscure; d'ORBIGNY's types are from the Mediterranean but as long as the relationship with T. quadrilateralis and eventual other truncate forms has not been cleared up, nothing definite can be said concerning the distribution of the species, except for its obvious presence in most Indopacific shallow reefal areas. It has not been reported from the Great Barrier Reef by COLLINS (1958).

Occurrence : Common in the intertidal and shallow subtidal environments at Lizard Island; the species occurs e.g. in the coarsely-graded drain-channels and sandpatches on the reef-flats; empty tests are occasionally transported towards the Perireefal Area (e.g. in front of the Coconut Fringing Reef Flat). Living specimens are extremely rare.

Triloculina bicarinata d'ORBIGNY, 1838.
(Pl. 57, figs. 2a-c).

\+ 1839 Triloculina bicarinata; - d'ORBIGNY, p. 158, pl. 10, figs. 18-20.
1922 Triloculina bicarinata d'ORBIGNY; - CUSHMAN, p. 76, pl. 12, fig. 7.
1926 Triloculina bicarinata d'ORBIGNY; - CUSHMAN, p. 83.
1929 Triloculina bicarinata d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 66, pl. 17, fig. 5.
1932 Triloculina bicarinata d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 60, pl. 13, figs. 6a-c.
1954 Triloculina cf. T. bicarinata d'ORBIGNY; - CUSHMAN, TODD & POST, p. 338, pl. 85, fig. 2.

1958 Triloculina bicarinata d'ORBIGNY; - COLLINS, p. 369.

? 1959 Triloculina sp.; - GRAHAM & MILITANTE, pl. 7, fig. 8.

? 1973 Triloculina bicarinata d'ORBIGNY; - BROOKS, pl. 6, figs. 11-12.

1975 Triloculina bicarinata d'ORBIGNY; - WANTLAND, p. 389, fig. 81.

Description : See d'ORBIGNY (1839); CUSHMAN (1922).

Diagnostic Remarks and Distribution : Our specimens agree with CUSHMAN's (1932, e.g.) illustrations; CUSHMAN's specimens from Fiji are more strongly and irregularly ornamented but this ornamentation seems to be environment-controlled; CUSHMAN (1932) himself agreed that "there is as usual a considerable degree of variation in size and arrangement of the reticulations ..." (p. 61). In fact, our specimens show a reticulate pattern as figured by CUSHMAN, TODD & POST in their 1954 paper. The taxon left in open nomenclature by GRAHAM & MILITANTE (fig. 8) is probably an atypical bicarinata though the chamber walls are hardly truncated in this specimen; the same statement can be made about WANTLAND's record from Belize Shelf, and BROOKS's from Porto Rico.

If these Indopacific records really concern d'ORBIGNY's Caribbean species, we should then conclude to the species' worldwide distribution in tropical coral reef environments. T. bicarinata has been listed by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests are rare to common in several shallow-water samples; the species seems to be the intertidal- to shallow subtidal counterpart of Q. pseudoreticulata which almost exclusively occurs in the deeper waters of the Perireefal Area. No living specimens have been met.

Triloculina linneiana s.s. d'ORBIGNY.
(Pl. 57, figs. 3-4).

+ 1839 Triloculina linneiana; - d'ORBIGNY, p. 172, pl. 9, figs. 11-13.

1917 Triloculina linneiana d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 72, figs. 4a-b.

1921 Triloculina linneiana d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 463.

1929 Triloculina linneiana d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 61, pl. 16, figs. 1-2.

1959 Triloculina linneiana d'ORBIGNY; - GRAHAM & MILITANTE, p. 55, pl. 8, figs. 7a-c.
1973 Triloculina linneiana d'ORBIGNY; - BROOKS, pl. 7, figs. 3-4.
1975 Triloculina linneiana d'ORBIGNY; - WANTLAND, p. 390, figs. 8n, 12m.

Description : See d'ORBIGNY (1839); CUSHMAN (1917).

Diagnostic Remarks and Distribution : Our specimens show the characteristic features of the species : chambers somewhat swollen near the aboral end of the test; chamber walls irregularly, more or less coarsely striate (except for the subgranulata subspecies); large, rounded to keyhole-shaped aperture without neck and with a pronounced peristome and strongly developed bifid tooth. Our specimens, as well as those in other Indopacific records, show the same range of variability as the Atlantic forms, with exception of the extremes. On one hand Atlantic specimens, showing a development of sharp longitudinal keels, a phenomenon occurring equally in material from Andros id., Bahama's (coll. MONTY), have been figured by e.g. BROOKS, 1973, whereas on the other hand the nonstriate subgranulata-subspecies seems to be as such absent from the Atlantic. Within one single reef system, Atlantic specimens may vary from finely irregularly striate to more strongly and regularly striate (WANTLAND, 1975, Belize Shelf) which is in accordance with the observed variability in our Lizard Island specimens.

This species thus seems to have a worldwide distribution in tropical coral-reef areas; COLLINS (1958) apparently overlooked it (though it is not that uncommon) in his Great Barrier Reef samples.

Occurrence : This species is to be found in the same environments as e.g. T. irregularis and also mainly occurs on the reef flats where it is rare to common. Living specimens have occasionally been encountered.

Triloculina linneiana d'ORBIGNY, subsp. subgranulata CUSHMAN, 1918. (Pl. 58, figs. 1-2).

+ 1918 Triloculina subgranulata; - CUSHMAN (Carnegie Inst. Publ. 218), p. 290, pl. 96, figs. 4a-c.
1959 Triloculina subgranulata CUSHMAN; - GRAHAM & MILITANTE, p. 56, pl. 8, figs. 11a-c.

Description : See CUSHMAN (1981).

Diagnostic Remarks and Distribution : As the absence of striation is the only feature distinguishing granulata from the linneiana s.s., and as moreover intermediate specimens, showing faint traces of irregular striation occur, I consider granulata as an ecovariant of T. linneiana; both variants partially occur in the same environment (reef flats and intertidal areas). Some slender specimens show resemblance to more strongly-built oblonga-variants (or, as GRAHAM & MILITANTE state : "there is a marked resemblance between many of our forms and specimens recorded by various authors as T. oblonga and T. laevigata"), but we dare not go so far as to put linneiana and oblonga in synonymy as a granulation of the wall similar to the one in the subgranulata-subspecies has not been observed in any oblonga-variant. This granulation easily develops into the irregular linneiana-striation, moreover the aperture is of a clearly different type). We may safely agree about at least a wide Indopacific distribution of this rarely reported taxon. Though CUSHMAN's types are from Murray Island, Great Barrier Reef, the subspecies has not been mentioned by COLLINS (1958).

Occurrence : Scattered; occurs mainly in the shallow backreef environments and is absent from deeper perireefal samples. No living specimens have been encountered.

Triloculina littoralis COLLINS, 1958.
(Pl. 58, figs. 3a-b).

+ Triloculina littoralis; - COLLINS, p. 369, pl. 3, figs. 12a-c.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens agree with COLLINS's description and illustrations; however I do not exclude the possibility of littoralis being only an ecovariant of Q. poeyana carinata though the scarcity of the material does not allow further comments in that sense.

Occurrence : Empty tests and a few living specimens occur in several samples from the shallow backreef environments. Virtually absent from the reef flats and the Perireefal Area.

Note on Triloculina trigonula (LAMARCK), 1804.

This species comprises T. trigonula s.s. and its three ecovariants (considered as such here) T. trigonula subsp. tricarinata, subsp. bertheliniana and subsp. terquemiana.

As these taxa (particularly trigonula s.s. and tricarinata) are so well-known, widely distributed and mentioned by the authors for almost two centuries, only a few of the most important works containing further synonymy are listed here.

Triloculina trigonula s.s. (LAMARCK), 1804.
(Pl. 58, figs. 4-6).

\+ 1804 Miliolina trigonula; - LAMARCK, p. 351, n° 3.
1884 Miliolites trigonula WILLIAMSON; - BRADY, p. 164, pl. 3, figs. 14-16.
1932 Triloculina trigonula (LAMARCK); - CUSHMAN (U.S.N.M. Bull. 161, pt. 1), p. 56, pl. 13, figs. 1a-b.
1960 Triloculina trigonula (LAMARCK); - BARKER (see ref. BRADY 1884).
1979 Triloculina trigonula (LAMARCK); - PEREIRA, pl. 17, figs. B-D;
Triloculina 1. aff. trigonula (LAMARCK); - id., pl. 17, figs. E-L.

Description : See LAMARCK (1804); CUSHMAN (1932).

Diagnostic Remarks and Distribution : This well-known species has been recorded from all over the world and from far into the Tertiary in the fossil record (LAMARCK's types are from the French Eocene); this does not mean however that its biology is understood; the species is highly variable and ranges on one hand into globular forms near to Pyrgo and related forms,on the other hand into subsp. tricarinata and its elongate relatives; I have the feeling that several "real" species might produce trigonula-like phenotypes along convergent lines, their plastic variants being forced into this subglobular form by a set of given environmental conditions.

Our Lizard Island specimens (as well as almost all other recorded trigonula's) are rounded and large in the extreme case, and none shows a neck development. Transitional specimens become more angular and generally more elongate, and grade into tricarinata and relatives.

Occurrence : Rare to common in all environments at Lizard Island, except for the reef flats where it is rare. Living specimens are seldom encountered.

Triloculina trigonula (LAMARCK), subsp. tricarinata d'ORBIGNY, 1826. (Pl. 59, figs. 1-3).

+ 1826 Triloculina tricarinata; - d'ORBIGNY, p. 299.
1884 Miliolina tricarinata (d'ORBIGNY); - BRADY, p. 165, pl. 3, figs. 17a-b.
1932 Triloculina tricarinata d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 56, pl. 13, figs. 3a-b.
1951 Triloculina tricarinata d'ORBIGNY; - ASANO, pt. 6, p. 17, figs. 114-115.
1957 Triloculina tricarinata d'ORBIGNY; - TODD, p. 288 (table), pl. 86, figs. 15a-b.
1958 Triloculina tricarinata d'ORBIGNY; - COLLINS, p. 370.
1959 Triloculina tricarinata d'ORBIGNY; - GRAHAM & MILITANTE, p. 57, pl. 8, figs. 14a-b.
1960 Triloculina tricarinata d'ORBIGNY; - BARKER (see ref. BRADY 1884).
1968 Triloculina tricarinata d'ORBIGNY; - ALBANI, p. 101.

Description : See d'ORBIGNY (1826), CUSHMAN (1932).

Diagnostic Remarks and Distribution : This subspecies is generally smaller than trigonula s.s. and is mostly definitely and sharply tricarinate though more or less angulated specimens form the transition to trigonula s.s.; these transitional specimens may or may not develop a short neck, whereas the typical tricarinata-forms are almost always provided with a neck; the aperture is rounded to slightly triangular. The tricarinata-subspecies shows some variation in its test elongation.

This cosmopolitan species has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Common to abundant in all environments at Lizard Island; living specimens are common.

Triloculina trigonula (LAMARCK), subsp. bertheliniana (BRADY), 1884. (Pl. 59, figs. 4a-b).

+ 1884 Miliolina bertheliniana; - BRADY, p. 166, pl. 114, figs. 2a-b.
1901 Miliolina tricarinata var. bertheliniana; - CHAPMAN, p. 174.
1915 Miliolina bertheliniana BRADY; - H. ALLEN & EARLAND, p. 563, pl. XLI, figs. 32-35.
1918 Triloculina bertheliniana (BRADY); - CUSHMAN (Carnegie Inst. Publ. n° 213), p. 290.
1932 Triloculina bertheliniana (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 60, pl. 13, fig. 5.
1932 Triloculina bertheliniana (BRADY); - PARR, p. 10, pl. 1, fig. 13.
1959 Triloculina bertheliniana (BRADY); - GRAHAM & MILITANTE, p. 53, pl. 7, figs. 7a-b.
1960 Triloculina bertheliniana (BRADY); - BARKER (see ref. BRADY 1884).
1958 Triloculina bertheliniana (BRADY); - COLLINS, p. 368.
1979 Triloculina bertheliniana (BRADY); - PEREIRA, pl. 15, figs. L-N.

Description : See BRADY (1884), CUSHMAN (1932).

Diagnostic Remarks and Distribution : This variant resembles trigonula s.s. in almost any respect, except for its reticulate test surface sculpture. Most specimens are provided with a low subtriangular aperture without a neck, whereas the test is most often bluntly angled as in trigonula s.s.

This subspecies seems to be restricted to the Indopacific and has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare, isolated and often abraded empty tests occur in all environments at Lizard Island. Most common on the reef flats.

Triloculina trigonula (LAMARCK), subsp. terquemiana (BRADY), 1884. (Pl. 59, figs. 5-6).

+ 1884 Miliolina terquemiana; - BRADY, p. 166, pl. 114, figs. 1a-b.
1915 Miliolina terquemiana BRADY; - H. ALLEN & EARLAND, p. 563, pl. 41, figs. 29-31.
1917 Triloculina terquemiana (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 72, pl. 27, figs. 2a-b.

1921 Triloculina terquemiana (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 458.
1951 Triloculina terquemiana (BRADY); - ASANO, pt. 6, p. 17, figs. 112-113.
1956 Triloculina terquemiana (BRADY); - ASANO, p. 76, pl. 8, fig. 7.
1958 Triloculina terquemiana (BRADY); - COLLINS, p. 370.
1959 Triloculina terquemiana (BRADY); - GRAHAM & MILITANTE, p. 57, pl. 8, figs. 12a-b.
1979 Triloculina terquemiana (BRADY); - PEREIRA, pl. 16, fig. Q; pl. 17, fig. A.
1960 Triloculina terquemiana (BRADY); - BARKER (see ref. BRADY 1884).

Description : See BRADY (1884), CUSHMAN (1917).

Diagnostic Remarks and Distribution : This subspecies resembles subsp. bertheliniana except for its striate instead of reticulate ornamentation pattern. Most specimens develop a short neck which is less prominent as in subsp. tricarinata, and the aperture is mostly somewhat compressed subtriangular with marked, elongate apertural tooth.

As T. trigonula bertheliniana, this subsp. is exclusively known from the Indopacific and has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to common on the reef flats and in the shallow backreef environments, living as well as dead. Absent from the Perireefal Area.

Subfamily MILIOLINELLINAE VELLA, 1957.

Genus Miliolinella WIESNER, 1931.

Miliolinella albatrossi new name.
(Pl. 60, figs. 1-3).

non 1884 Miliolina circularis (BORNEMANN), var. sublineata; - BRADY, p. 169, pl. 4, figs.7a-c.
1917 Triloculina circularis (BORNEMANN), var. sublineata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, part 6), p. 68, pl. 26, fig. 2.

1951 Miliolinella sublineata (BRADY); - ASANO, pt. 6, p. 10, figs. 70-72.
1956 Miliolinella sublineata (BRADY); - ASANO, p. 73, pl. 8, fig. 16.
1959 Miliolinella sp.; - GRAHAM & MILITANTE, p. 38, pl. 9, figs. 3-4a-c.
1960 Miliolinella circularis var. sublineata (BRADY); - HOFKER, p. 242, Beilage B, figs. 46-48.

Derivatio Nominis : This species has been figured for the first time by CUSHMAN (1917) whose specimens originated from "Albatross" Stations D 4807 and D 4900, off the Japanese coast.

Description : Test free, mostly triloculine in appearance, slightly laterally compressed and sometimes slightly angled at the periphery, almost circular (as long as broad, though there is some variation in the axial ratio), opaque, distinctly longitudinally striate; sutures slightly depressed, somewhat limbate, regularly curved. Aperture large, miliolinelline, broadly semicircular and bordered by a prominent, thin and translucent flaring peristome (trumpet-shape); aperture almost completely filled up by a thin, translucent, semicircular, sometimes slightly undulating concave flap.

Diagnostic Remarks and Distribution : Much of the confusion around this species has its origin in the interpretation of BRADY's (1884, fig. 7) figuration of what he called M. circularis var. sublineata which is clearly different from the present species (see below). Subsequent authors, even HOFKER (1860), followed CUSHMAN (1917) in his defectuous attribution (except for GRAHAM & MILITANTE, 1959 who left the form in open nomenclature).
The species figured by BRADY (1884) has been renamed later on by CUSHMAN, TODD & POST (1954) and has been called Hauerina milletti; it is a pity that CUSHMAN at this occasion did not correct his former erroneous attribution in respect to the striate Miliolinella. H.milletti also occurs in our material, is slightly smaller as a rule, is more inflated, translucent and very finely striate, has a cribrate aperture, belongs in the genus Miliola and has been called here Miliola sublineata (see below).

The present species seems to have a wide Indopacific distribution in tropical coral-reefs as well as in temperate waters; ASANO (1956) mentions it from the Japanese Pliocene. This is the first record of the species from the Great Barrier Reef.

Occurrence : Empty tests occur in small numbers at a few perireefal stations. No living specimens have been met.

Lectotype : Specimen figured Pl. 60, figs. 1a-b, station L 71.

Dimensions (in microns) of typical specimens :

	l (c)	b (a)	h (b)
Lectotype (L 71)	580	540	320
Paratypes (L 81)	560	440	260
	600	480	320
	540	500	280

Miliolinella baragwanathi (PARR), 1931.
(Pl. 60, figs. 4-5).

1915 Miliolina bicostata (d'ORBIGNY); - H. ALLEN & EARLAND, p. 572, pl. XLII, fig. 42-45.

cf. 1932 Triloculina oceanica; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 54, pl. 12, figs. 3a-c.

\+ 1945 Quinqueloculina baragwanathi; - PARR, p. 196, pl. 8, figs. 6a-c; pl. 12, fig. 3.

1959 Miliolinella baragwanathi (PARR); - GRAHAM & MILITANTE, p. 36, pl. 3, figs. 16a-c.

Description : See PARR (1945) and notes by H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : This is undoubtedly the species described by H. ALLEN & EARLAND (1915) as well as by PARR (1945), though the latter author by no means referred to the former; PARR (1945) thus created a new name (this being justified as d'ORBIGNY's name bicostata has been misused on a large scale) rather thas a new species. CUSHMAN's (1932) T. oceanica seems to be very close to the present species but might be a deeper-water ecovariant, differring from the present taxon by its smooth walls and coarse costae; if ever both forms would be revealed to represent the same species, the name baragwanathi should be dropped in favour of the name oceanica, according to the priority rule. Characteristic features of the present species are its large semicircular, somewhat compressed aperture (being partly filled up with a slightly elongate flap which gives the aperture a fish-mouth-like appearance), and its somewhat roughened test surface

in between the fine, smooth, prominent, rounded, slighly undulating costae. This rough surface consists of small chalky bosses between which very small, hardly visible pits appear. This scarcely reported species occurs in the Kerimba Archipelago, the Philippines and South Australia (PARR's types). CUSHMANS's oceanica is from the Paumotus. The species has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Has been encountered on the reef flats as well as in the Lagoon where living specimens occur in one sample. Rather rare.

Note on Miliolinella australis (PARR) and its variants.

The Atlantic and Indopacific variants of the smooth-walled, more or less rounded nonornate Miliolinella have been described under various names in the literature. As our Lizard Island material once more demonstrates the soft gliding of one variant into another, at least the Indopacific variants have been considered here as ecovariants of one single species; further research will be needed upon the Atlantic forms to verify their real status.

Moreover I express serious doubts as to the validity of the genus Parrina as our specimens of this "Parrina"-variant are shown here to be noting else than the end members of a gradational series starting with the regularly rounded miliolinelline specimens and ending with the irregularly formed Parrina-specimens, the latter being only labiosa-forms with a secondarily modified aperture.

This gradational series involves respectively the following "classical" species : Miliolinella australis, M. circularis (with possibly M. subrotunda and M. procera in synonymy), M. labiosa and Parrina bradyi.

Synonymy lists have been abbreviated. Since only the ecovariability of Indopacific forms is considered, I have chosen PARR's australis as the central type from which the remainder of the subspecies is to be derived. This is merely conventional; further research might reveal the necessity to rename the group altogether.

Miliolinella australis s.s. (PARR), 1932.
(Pl. 60, figs. 6-8).

1884 Miliolina subrotunda; - BRADY, vol. 9, pl. 5, figs. 10-11.
+ 1932 Quinqueloculina australis; - PARR, p. 7, pl. 1, figs. 8a-c.
1954 Miliolinella australis (PARR); - CUSHMAN, TODD & POST, p. 334, pl. 84, figs. 3-4.
1957 Miliolinella australis (PARR); - TODD, p. 286 tab., pl. 87, fig. 15.
1960 Miliolinella (?) australis (PARR); - BARKER (see ref. BRADY 1884).
1979 Miliolinella aff. M. australis (PARR); - PEREIRA, pl. 18, figs. H-K.

Description : See PARR (1932).

Diagnostic Remarks and Distribution : This is the regular, smooth, mostly quinqueloculine (to triloculine) central type; the test is somewhat compressed though an eventual tendency to form a broad keel in the early stages has not been observed in our material. The chambers are hardly embracing or inflated, this being the reason of the generally quinqueloculine aspect of the taxon. The aperture is mostly semicircular, "with a tooth of the same shape a little in front of the aperture" as PARR (1932, p. 7) states. Inflation of the chambers will give rise to the second variant under consideration, subsp. circularis (subrotunda).

The present variant has been described from Indopacific shallow-water localities exclusively and occurs in tropical coral-reefs as well as in temperate waters; PARR's types are from Tasmania, BRADY's (1844) figured specimens from Bass Strait.
This species (subsp.) has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Scattered occurrence in all habitats at Lizard Island. Rare to common. Living specimens are extremely rare.

Miliolinella australis (PARR), subsp. circularis (BORNEMANN), 1855.
(Pl. 61, figs. 1-3).

? 1803 Vermiculum subrotundum; - MONTAGU, p. 521.
+ 1855 Triloculina circularis; - BORNEMANN, p. 349, pl. 19, figs. 4a-c.
1884 Miliolina circularis (BORNEMAN); - BRADY, p. 169, pl. 4, figs. 3a-c; pl. 5, figs. 13-14.

1897 Miliolina circularis (BORNEMANN); - FLINT, p. 298, pl. 44, fig. 1.
1932 Triloculina circularis BORNEMANN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 52, pl. 11, figs. 11a-c (+ div. publ.).
1945 Triloculina circularis BORNEMANN; - PARR, p. 198.
1951 Miliolinella circularis (BORNEMANN); - ASANO, pt. 6, p. 9, figs. 65-67.
1956 Miliolinella circularis (BORNEMANN); - ASANO, p. 71, pl. 8, figs. 4, 8.
1958 Triloculina subrotunda (MONTAGU); - COLLINS, p. 370.
1959 Miliolinella circularis BORNEMANN; - GRAHAM & MILITANTE, p. 37, pl. 3, figs. 17-18a-c.
1960 Miliolinella subrotunda (MONTAGU); - BARKER (see ref. BRADY, 1884).
1964 Miliolinella subrotunda (MONTAGU); - LOEBLICH & TAPPAN, p. C 466, fig. 355 - 1,2.
1979 Miliolinella subrotunda (MONTAGU); - PEREIRA, pl. 18, figs. M-Q; pl. 19, fig. A.

Description : See BORNEMANN (1855), BRADY (1884), CUSHMAN (1932); see also comments by WIESNER (1912, 1931).

Diagnostic Remarks and Distribution : This is the more inflated subspecies which generally has a triloculine appearance as a result of the chambers being more embracing. Another result of the thickening of the test is the more elongated, sometimes slitlike shape of the aperture. All intermediates occur between typical australis and circularis. As already mentioned, M. subrotunda is considered here as a synonym of circularis, differing from the latter only in the degree of inflation and the subsequent embracing of the chambers. The aperture is variable in both taxa. Extremely broadened specimens form the intermediates between the present variant and subsp. labiosa.
Taking in account both circularis and subrotunda, this taxon shows a cosmopolitan distribution and occurs in tropical coral-reefs as well as in temperate and arctic waters. COLLINS (1958) mentioned T. subrotunda from the Great Barrier Reef but probably lumped together all the here considered variants under this name.

Occurrence : About the same as M. Australis s.s.; slightly more common. Living specimens are extremely rare except in one reef-flat sample (L 255 b, Windward Barrier).

Miliolinella australis (PARR), subsp. labiosa (d'ORBIGNY), 1839.
(Pl. 61, figs. 4-6).

+ 1839 Triloculina labiosa; - d'ORBIGNY, p. 178, pl. 10, figs. 12-14.
1884 Miliolina labiosa (d'ORBIGNY); - BRADY, p. 170, pl. 6, figs. 3-5.
1897 Miliolina labiosa (d'ORBIGNY); - FLINT, p. 299, pl. 45, fig. 3.
1932 Triloculina labiosa d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 53, pl. 11, figs. 12a-c (+ div. publ.).
1945 Triloculina labiosa d'ORBIGNY; - PARR, p. 198.
1950 Miliolinella labiosa (d'ORBIGNY); - SAID, p. 5, pl. 1, fig. 10.
1954 Triloculinella labiosa (d'ORBIGNY); - CUSHMAN, TODD & POST, p. 334, pl. 84, figs. 5-6.
1957 Triloculinella labiosa (d'ORBIGNY); - TODD, p. 286 tab., pl. 87, fig. 16.
1959 Miliolinella labiosa (d'ORBIGNY); - GRAHAM & MILITANTE, p. 37, pl. 9, figs. 1-2a-c.
1960 Miliolinella labiosa (d'ORBIGNY); - BARKER (see ref. BRADY 1884).
1968 Miliolinella labiosa (d'ORBIGNY); - ALBANI, p. 101.

Description : See d'ORBIGNY (1839); FLINT (1897); BRADY (1884); CUSHMAN (1932).

Diagnostic Remarks and Distribution : This is the subspecies we obtain when the process of chamber inflation and - deformation goes on; the test is broad and somewhat irregular; as CUSHMAN (1932) states, "surface largely composed of the two last-formed chambers". The aperture is slitlike to crescentiform, and in more irregular specimens the first signs appear of what in bradyi will become the rounded to irregular "Parrina" aperture. All intermediates between the present subspecies and subsp. bradyi occur in our material.
This subspecies seems to have a cosmopolitan distribution: d'ORBIGNY's types are from off Cuba. This variant has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : More or less the same as australis s.s., and circularis. Rahter rare.

Miliolinella australis (PARR), subsp. bradyi (MILLETT), 1898.
(Pl. 61, figs. 7a-b; pl. 62, figs. 1a-b).

1884 Nubecularia inflata BRADY (not TERQUEM); - BRADY, p. 135, pl. 1, figs. 5-8.

\+ 1898 Nubecularia bradyi; - MILLETT, p. 261, pl. 5, figs. 6a-b.

1917 Nubecularia bradyi MILLETT; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 41, pl. 8, figs. 4-5.

1931 Parrina bradyi (MILLETT); - CUSHMAN, p. 20.

1932 Parrina bradyi (MILLETT); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 74, pl. 17, figs. 1-4.

1954 Parrina bradyi (MILLETT); - CUSHMAN, TODD & POST, p. 342, pl. 85, figs. 31-34.

1957 Parrina bradyi (MILLETT); - TODD, p. 288 (tab), pl. 88, fig. 12.

1959 Parrina bradyi (MILLETT); - GRAHAM & MILITANTE, p. 59, pl. 9, fig. 9.

1960 Parrina bradyi (MILLETT); - BARKER, pl. 1, figs. 5-6; id. var. sufflata RHUMBLER; id. figs. 7-8.

1964 Parrina bradyi (MILLETT); - LOEBLICH & TAPPAN, p. C 478, fig. 365-7.

1979 Parrina bradyi (MILLETT); - PEREIRA, pl. 19, figs. J-M.

1981 Parrina bradyi (MILLETT); - VENEC-PEYRE & SALVAT, pl. III, fig. 2.

Description : See BRADY (1884), CUSHMAN (1931, 1932).

Diagnostic Remarks and Distribution : The genus Parrina has been created by CUSHMAN (1931) to cover these irregularly-coiling forms with very variable aperture. No author ever seems to have sought a connection between these Parrina-forms and Miliolinella though our material clearly demonstrates that the one can be derived from the other. Here we have in fact the extreme end-member of the Miliolinella australis - gradational series and it is not clear whether this variant is only formed in marginal intertidal stress-conditions (of fluctuating temperature and salinity e.g.), or that it is merely a substrate-conditioned form. It follows from these statements that, if future observations (on Atlantic material e.g.) confirm mine, the generic name Parrina should be dropped; or that, even better, a new terminology should be invented to describe and manipulate these ecophenotypic gradational series in a more adequate way than by means of the current systematics. Our specimens vary from broadly elongate to completely irregular forms; the apertural shape shows the transition from irregular miliolinelline to more

oval and finally multiple rounded, as in BRADY's (1884), figs. 5-6, pl. 1. Completely irregular specimens with chambers in a linear arrangement with multiple rounded, terminal apertures (as figured e.g. by LOEBLICH & TAPPAN, 1964; TODD, 1957) have not been observed in our material. Finally, CUSHMAN (1932) admits that "it is an extremely variable form, and assumes many shapes". The typical bradyi - subspecies seems to occur exclusively in the Indopacific, mainly in shallow reefal areas. Other, also very variable and possibly closely related forms, are described from the Atlantic (e.g. "Parrina" kegeli TINOCO).
The bradyi-variant has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Same as mentioned for the labiosa-variant. Absent from Lagoon and Patchreef Area. Living specimens occur only in one sample, from the Sandy Shoal.

Subfamily MILIOLINAE EHRENBERG, 1839.

Genus Ammomassilina CUSHMAN, 1933.

Ammomassilina alveoliniformis (MILLETT), 1898.
(Pl. 62, figs. 2-3).

1884 Spiroloculina asperula KARRER; - BRADY, pl. 8, fig. 13 (not figs. 11, 14).
\+ 1898 Massilina alveoliniformis; - MILLETT, p. 609, pl. 13, figs. 5-7.
1921 Massilina asperula (KARRER); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 447.
1922 Massilina alveoliniformis MILLETT; - CUSHMAN (Carnegie Inst. Publ. n° 311), p. 69.
1924 Massilina alveoliniformis MILLETT; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 14.
1929 Massilina alveoliniformis MILLETT; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 6), p. 39.
1933 Ammomassilina alveoliniformis (MILLETT); - CUSHMAN, p. 32, pl. 3, figs. 5a-b.
1956 Massilina alveoliniformis MILLETT; - ASANO, p. 65, pl. 7, fig. 11.
1957 Ammomassilina alveoliniformis (MILLETT); - TODD, p. 286 (tab), pl. 87, fig. 13.

1959 Ammomassilina alveoliniformis (MILLETT); - GRAHAM & MILITANTE, p. 33, pl. 3, figs. 1a-b.
1960 Ammomassilina alveoliniformis (MILLETT); - BARKER (see ref. BRADY 1884).
1964 Ammomassilina alveoliniformis (MILLETT); - LOEBLICH & TAPPAN, p. C 470, fig. 357 - 1.

Description : See BRADY (1884), MILLETT (1898), CUSHMAN (1921); see also notes by BARKER (1960).

Diagnostic Remarks and Distribution : Our specimens show the typical features of the genus and the species : milioline early chamber arrangement, later chambers in single plane,cribrate aperture (mostly damaged in our specimens). Schlumbergerina alveoliniformis seems to be a closely related species but lacks the single-plane chamber series. BRADY's figured specimens (figs. 11, 13, 14, pl. 8) apparently show three different taxa of which obviously only fig. 13 illustrates the true Indopacific A. alveoliniformis (See LACROIX, 1938; BARKER, 1960); this allows for the conclusion that the present species has an exclusive Indopacific distribution, the Atlantic taxa possessing a smaller and noncribrate aperture.

Occurrence : Rare; isolated, more or less abraded and broken empty tests occur at a few perireefal stations. A few living specimens have been encounterd in one single perireefal sample.

Genus Hauerina d'ORBIGNY, 1839.

Note on the species of the genera Hauerina and Pseudohauerina.

Great Barrier Reef species of Hauerina and related genera have been the subject of detailed study by PONDER (1972, 1975). His emended species descriptions are entirely followed in the present study as they match to a great extent with our material and observations. In 1972, PONDER created the genus Pseudohauerina and the three Barrier Reef-species he included in this genus are also present in our Lizard Island material.

For these reasons our comments upon these species are kept concise; for further details and extensive synonymy lists I refer to PONDER (1972, 1975).

Hauerina circinata BRADY, 1881, emend. PONDER, 1975.
(Pl. 62, figs. 4-7).

+ 1881 Hauerina circinata; - BRADY, p. 17.
1975 Hauerina circinata BRADY; - PONDER, p. 8, textfigs. 4-26.
Further synonymy : See PONDER (1975).

Description : See PONDER (1975).

Diagnostic Remarks and Distribution : Our specimens agree with PONDER's (1975) descriptions; H. diversa is regarded by this author as a junior synonym of circinata; it is also suggested that the Atlantic H. atlantica might be a subspecies of H. circinata, with H. bradyi being intermediate between the two. In case of validity of this supposition, the species may be considered to show a cosmopolitan distribution in tropical shallow water.

Occurrence : Empty tests are rare to common in the Perireefal Area; they generally are not fully developed into the large "Polisegmentina"-stage (though isolated specimens of that type occur in some samples, e.g. L 60, L 65, L 86) and more often remain in the smaller, more involute "diversa"-stage. Dubious fragments have been recorded in intertidal habitats, even on the reef flats (e.g. L 265 b - Southern Flat).
Living specimens are extremely rare. Contrary to PONDER's statement (1975, p. 13) that the species is "a shallow-water species preferring fine-grained sediments with a high terrigenous content", our samples reveal that the form is just as common in the badly sorted carbonate sediments of the Perireefal Area around Lizard Island.

Hauerina fragilissima (BRADY), 1884, emend. PONDER, 1975.
(Pl. 63, figs. 1-3).

+ 1884 Spiroloculina fragilissima; - BRADY, p. 149, pl. 9, figs. 12-14.
1975 Hauerina fragilissima (BRADY); - PONDER, p. 14, textfigs. 28-50.
Further synonymy : See PONDER (1975).

Description : See PONDER (1975).

Diagnostic Remarks and Distribution : Our rare specimens of this species fully agree with PONDER's description and figurations. It is to be noted that PONDER puts H. bradyi in synonymy with H. fragilissima, stating that "in North Queensland there is a complete gradation between H. fragilissima and H. bradyi". Ontogenetical development in fragilissima (with two chambers per whorl) tends to a chamber shortening in later stages, resulting in a three-chambered "bradyi"-stage. This fact could be verified in our material (see fig. 1, pl. 63); nevertheless H. fragilissima is always thinner and has narrower chambers when compared with the bradyi-form which would rather belong to the diversa-circinata group as also suggested by PONDER (1975) at another occasion.

This is a typical Indopacific species, common in tropical reefal areas but also occurring in temperate waters (Japan, New Zealand).

Occurrence : Rare, isolated empty tests of mainly small, juvenile specimens occur at a number of perireefal stations.

Hauerina pacifica CUSHMAN, 1917, emend. PONDER, 1975.
(Pl. 63, figs. 4-6).

\+ 1917 Hauerina pacifica; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 64, pl. 21, fig. 2.
1975 Hauerina pacifica CUSHMAN; -PONDER, p. 19, textfigs. 51-68.
Further synonymy : See PONDER (1975).

Description : See PONDER (1975).

Diagnostic Remarks and Distribution : Most of our pacifica-specimens show a quinqueloculine - to sigmoiline chamber arrangement and there is a smooth gradation in our material from specimens with rounded periphery (in transversal section), smooth test surface and evenly curved sutures towards specimens with angular test and crenulated carinae upon the earlier chamber-edges, near the sigmoidally-curved sutures.These variations all show the very characteristic subtriangular H. pacifica-aperture with trematophore, as described by PONDER (1975).

PONDER (1975) puts H. pacifica rugosa of COLLINS (1958), as well as CUSHMAN's H. serrata in synonymy with his emended H. pacifica.

The species has a wide Indopacific distribution and a problematic occurrence in the Mediterranean.

Occurrence : The species is characteristic for the shallow backreef environments (Lagoon, Sandy Shoal, Patchreef Area) where empty tests are common to abundant. Living specimens are rare.

Genus Pseudohauerina PONDER, 1972.

Pseudohauerina occidentalis involuta (CUSHMAN), 1946, emend. PONDER, 1972.
(Pl. 63, figs. 7a-b; pl. 64, figs. 1-2a-b).

\+ 1946 Hauerina involuta; - CUSHMAN, p. 13, pl. 2, figs. 25-28.
1972 Pseudohauerina occidentalis involuta CUSHMAN; - PONDER, p. 149, textfigs. 4, 7, 8, 9A, 11, 12A, 13A, 16.
Further synonymy : See PONDER (1972).

Description : See PONDER (1972).

Diagnostic Remarks and Distribution : Our specimens correspond with PONDER's description and most of them represent the compressed and involute variant ("Barrier Reef specimens" as PONDER calls them, p. 152).

As PONDER makes involuta a subspecies of P. occidentalis CUSHMAN, an Atlantic species, the latter may be considered to have a cosmopolitan distribution; the involuta-subspecies is restricted to the Indopacific however.

Occurrence : The subspecies is common in most perireefal samples; it also occurs in some patchreef - and lagoonal samples. Living specimens are regularly encountered.

Pseudohauerina howelli (BERMUDEZ), emend. PONDER, 1972.
(Pl. 64, figs. 3-4).

\+ 1935 Hauerina howelli; - BERMUDEZ, p. 166, pl. 12, figs. 6-7.
1972 Pseudohauerina howelli (BERMUDEZ); - PONDER, p. 154, textfigs. 9B, 12B, 13B, 19-22.
Further synonymy : See PONDER (1972).

Description : See PONDER (1972).

Diagnostic Remarks and Distribution : only a few small, not full-grown specimens of this strongly compressed species with crenulate periphery occur in our Lizard Island material.
This is a species with an exclusive Indopacific distribution (tropical coral-reef areas).

Occurrence : Rare; a few damaged tests are occasionally encounterd in some perireefal samples.

Genus Heterillina MUNIER-CHALMAS & SCHLUMBERGER in SCHLUMBERGER, 1905.

Heterillina cribrostoma (H. ALLEN & EARLAND), 1915.
(Pl. 64, figs. 6-7).

\+ 1915 Miliolina circularis BORNEMANN, var. cribrostoma; - H. ALLEN & EARLAND, p. 558, pl. 41, figs. 12-16.
1975 Heterillina cribrostoma (H. ALLEN & EARLAND); - WANTLAND, p. 391, figs. 8r, 14a-m.

Description : See H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : See also comments by WANTLAND (1975). The few specimens I have found in the Lizard Island material belong excusively to the rounded subglobular, smooth, triloculine type, no flattened specimens with substratum imprints (as shown by WANTLAND from Belize Reefs) have been met. The test shape seems to be strongly variable; thick and wide specimens occur as well as narrower, more elongate ones. The aperture assumes variable shapes but always consists of a somewhat protruding, bent trematophore perforated by numerous holes of approximately equal size.

The types of this rarely reported species are from the Kerimba Archipelago; WANTLAND (1975) reported the species from Belize Shelf, Honduras; the same author quotes a personal communication by LOGAN who reports the species from "an extensive hypersaline area of Shark Bay, Australia". COLLINS (1958) did not report the species from the Great Barrier Reef.

Occurrence : Extremely rare; some isolated empty, damaged tests have been encountered in a few perireefal samples. No living specimens have been met.

Genus Miliola LAMARCK, 1804.

Miliola sublineata (BRADY), 1884.
(Pl. 65, figs. 1-2).

\+ 1884 Miliolina circularis (BORNEMANN), var. sublineata; - BRADY, pl. 4, figs. 7a-c.
1898 Miliolina circularis (BORNEMANN), var. sublineata; - MILLETT, p. 501, pl. 11, figs. 4a-b.
non 1917 Triloculina circularis (BORNEMANN), var. sublineata (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 68, pl. 26, fig. 2.
1931 Miliolinella subrotunda (MONTAGU), var. sublineata (BRADY); - WIESNER, p. 108.
? 1934 Miliolina circularis var. sublineata BRADY; - EARLAND, p. 49.
? 1950 Triloculina sublineata (BRADY); - PARR, p. 295.
non 1951 Miliolinella sublineata (BRADY); - ASANO, pt. 6, p. 10, figs. 70-72.
1954 Hauerina milletti; - CUSHMAN, TODD & POST, p. 337, pl. 84, fig. 23.
non 1956 Miliolinella sublineata (BRADY); - ASANO, p. 73, pl. 8, fig. 16.
1957 Hauerina milletti CUSHMAN; - TODD, p. 286 (tab), pl. 88, fig. 4.
1960 Miliolinella sublineata (BRADY); - BARKER (see ref. BRADY 1884).
1975 Miliola sublineata (BRADY); - PONDER, p. 7.

Description : See BRADY (1884), MILLETT (1898), CUSHMAN, TODD & POST (1954).

Diagnostic Remarks and Distribution : This is a highly controversial species though it has frequently been encountered in the Indopacific by several authors. The reason for the confusion lies in the misinterpretation of BRADY's fig. 7, pl. 4 (1884); did BRADY illustrate a trematophore in the aperture, or not ? Most subsequent authors interpreted BRADY's drawing as showing a miliolinelline aperture with flap, rather than a cribrate aperture; in this way the road had been laid open for CUSHMAN's (1917) and ASANO's (1951, 1956) confusion of the present species with a striate Miliolinella.The latter has been renamed herein M.albatrossi.It resembles sublineata superficially though the latter is much more inflated, translucent, substriate and possesses a trematophore.

In 1954, CUSHMAN apparently corrected his 1917 error and discovered trematophore-equipped specimens in the Marshall Island samples; unfortunately he persisted in refusing to see that BRADY's fig. 7 DID show a very delicate trematophore, and created the new name milletti for these forms, as MILLETT had correctly shown trematophore-equipped specimens (1898) and as CUSHMAN was anxious to avoid further confusion with BRADY's denomination and illustrations.

In my opinion BRADY's drawings beautifully and correctly depict the species under consideration. Hence, the name milletti should be dropped and the name sublineata used as the first and only correct one available.

As to the generic status of this species, this is not easy a question to solve; the cribrate aperture is very delicate and fragile and generally limits itself to a perforate plate completely filling up the broadly arched, U-shaped aperture; this plate easily breaks away, leaving the U-shaped aperture open which has without doubt added to the confusion of previous authors. This is not the normal development of the hauerine aperture; I have thought for a moment to classify the species in Heterillina but PONDER (1975) has put it(probably correctly) in the genus Miliola, commenting upon "the resorption of the trematophore in all but the ultimate chamber" (1975, p. 7).

Notwithstanding the erroneous identifications we may safely agree about the wide Indopacific distribution of the species (tropical reefal areas). BRADY's types are from the Admirality Ids; the species has not been mentioned by COLLINS (1958).

Occurrence : Rare to moderately common in most perireefal and a few patch-reef samples. Living specimens are rare.

Genus Nevillina SIDEBOTTOM, 1905.

Nevillina coronata (MILLETT), 1898.
(Pl. 65, figs. 3a-b).

\+ 1898 Biloculina coronata; - MILLETT, pt. 1, p. 263, pl. 6, figs. 6a-c.
1905 Nevillina coronata (MILLETT); - SIDEBOTTEM; pt. 2, n° 11, p. 1, figs. 1-8.

1917 Nevillina coronata (MILLETT); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 84, pl. 35, figs. 2-5.

1921 Nevillina coronata (MILLETT); - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 480, pl. 99, fig. 1.

1945 Nevillina coronata (MILLETT); - PARR, p. 199, pl. 8, figs. 8a-b.

1959 Nevillina coronata (MILLETT); - GRAHAM & MILITANTE, p. 38, pl. 3, figs. 20a-b; 21.

1964 Nevillina coronata (MILLETT); - LOEBLICH & TAPPAN, p. C 472, fig. 359/6-8.

Description : See MILLETT (1898); SIDEBOTTEM (1905); LOEBLICH & TAPPAN (1964).

Diagnostic Remarks and Distribution : The rare specimens in our material correspond completely with the descriptions and illustrations of the authors. Contrary to GRAHAM & MILITANTE's (1959) comments ("fragile specimens"), ours are large and stout and not at all fragmented.

The species has a wide Indopacific distribution and seems to occur also in the Mediterranean. MILLETT's types are from off Sumatra.

Occurrence : A few empty tests have been found in one reef-flat-and in one patchreef sample.

Genus Schlumbergerina MUNIER-CHALMAS, 1882.

Schlumbergerina alveoliniformis BRADY, 1879.
(Pl. 65, figs. 4-5; pl. 66, figs. 1a-c).

+ 1879 Miliolina alveoliniformis; - BRADY, p. 268.

1884 Miliolina alveoliniformis; - BRADY, p. 181, pl. 8, figs. 15-20.

1917 Quinqueloculina alveoliniformis (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 43.

1921 Quinqueloculina alveoliniformis (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 443.

1924 Quinqueloculina alveoliniformis (BRADY); - CUSHMAN (Carnegie Inst. Publ. N° 342), p. 58, pl. 21, fig. 8.

1929 Schlumbergerina alveoliniformis (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 5), p. 36.

1932 Schlumbergerina alveoliniformis (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 29, pl. 8, fig. 1.

1957 Schlumbergerina alveoliniformis (BRADY); - TODD, p. 286 (tab), pl. 87, figs. 14a-b.

1959 Schlumbergerina alveoliniformis (BRADY); - GRAHAM & MILITANTE, p. 50, pl. 6, figs. 11a-b.

1960 Schlumbergerina alveoliniformis (BRADY); - BARKER (see ref. BRADY 1884).

Description : See BRADY (1879, 1884); CUSHMAN (1917).

Diagnostic Remarks and Distribution : Our specimens correspond with the descriptions and illustrations of the authors mentioned in the synonymy list. Generally 7-8 chambers are visible externally. As LOEBLICH & TAPPAN (1964) state : "Schlumbergerina differs from Ammomassilina in having chambers added in may planes, rather than in a single plane in the adult". Nevertheless I do consider the possibility of both alveoliniformis-forms being only ecovariants of the same species; I do not dispose of sufficient material to verify this statement.

Most records of this species are from the Indopacific though it seems to have a cosmopolitan distribution in tropical reefal areas. BRADY's types are from Pacific Islands.

Occurrence : Large and stout, but often abraded and/or damaged specimens occur occasionally at several perireefal stations and in the Patchreef Area (+ Internal Platform). Living specimens occur occasionally.

Genus Articulina d'ORBIGNY, 1826.

Articulina pacifica CUSHMAN, 1944.
(Pl. 66, figs. 2-3).

1884 Articulina sulcata; - BRADY (not REUSS), p. 183, pl. 12, figs. 12-13.

1915 Articulina sagra d'ORBIGNY; - H. ALLEN & EARLAND, p. 585, pl. 45, figs. 22-25.

1917 Articulina sulcata BRADY (not REUSS); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 58, pl. 22, figs. 5a-b.

1917 Articulina conico-articulata BATSCH; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 58, pl. 22, fig. 6.

1921 Articulina sagra d'ORBIGNY; - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 488.

1932 Articulina sulcata BRADY (not REUSS); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 1), p. 47, pl. 11, figs. 3-4.

+ 1944 c Articulina pacifica; - CUSHMAN, p. 17, pl. 14, figs. 14-18.

1954 Articulina pacifica CUSHMAN; - CUSHMAN, TODD & POST, p. 336, pl. 84, fig. 25.

1957 Articulina pacifica CUSHMAN; - TODD, p. 286 (tab.), pl. 87, fig. 11.

1958 Articulina pacifica CUSHMAN; - COLLINS, p. 365.

1958 Articulina sagra d'ORBIGNY; - COLLINS, p. 366, pl. 3, fig. 7.

1959 Articulina pacifica CUSHMAN; - GRAHAM & MILITANTE, p. 34, figs. 5-6.

1960 Articulina pacifica CUSHMAN; - BARKER, pl. 12, figs. 12, 13, 22 (not 23-24 ?).

1981 Articulina pacifica CUSHMAN; - VENEC-PEYRE & SALVAT, pl. III, fig. 4.

Description : See CUSHMAN (1944 c).

Diagnostic Remarks and Distribution : Our specimens correspond completely with CUSHMAN's (1944 c and div. publ.) description and illustrations. There is little discussion about this Pacific species which is slightly compressed but which has a rounded periphery, a well-developed milioline initial stage and numerous low costae (or is coarsely striate). This is obviously the species of which BRADY (1884) figured a juvenile specimen and which is illustrated by H. ALLEN & EARLAND (1915) as A. sagra.

A. pacifica is widely distributed in Indopacific tropical reefal areas; it is difficult to establish the relationship with the Atlantic A. sagra (which shows slight differences with A. pacifica at the level of striation, test compression and apertural shape) without thorough comparison with more (Atlantic) material, though the possibility exists that both taxa are only ecophenotypes of the same species. As far as COLLINS's (1958) description and drawing of A. sagra from the Great Barrier Reef is concerned, I consider the illustrated specimen to fall within the variation range of A. pacifica.

Occurrence : Empty tests are rare to common in the Perireefal- and the Patchreef Area; most specimens are not full-grown milioline megalospheric

tests lacking the uniserial stage; some rare fully-developed microspheric specimens, showing up to three uniserial chambers, occur occasionally (e.g. L 292). No living specimens have been met.

Articulina queenslandica COLLINS, 1958.
(Pl. 66, figs. 4-5).

+ 1958 Articulina queenslandica; - COLLINS, p. 366, pl. 3, figs. 8-10.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens agree with COLLINS's (1958) description and illustrations. The number of chambers in the spiroloculine (?) series varies from 1 tot 2 after the proloculus in our specimens. Characteristic specific features are the long, slender, somewhat curved shape of the test and the increasing number of low costae from the first to the last uniserial chamber, as well as the increase in heigth of the costae towards the oral end of each chamber.

Except for COLLINS's report of the species from the Great Barrier Reef, no other reference has been found in the literature. COLLINS's material was extremely reduced (he disposed of only three specimens !) though I agree with him that the particularities of the taxon seem to justify its status of new species.

Occurrence : A few empty tests have been encountered in some perireefal samples. Extremely rare.

Family ALVEOLINIDAE EHRENBERG, 1839.

Genus Alveolinella DOUVILLE, 1906.

Alveolinella quoyi (d'ORBIGNY), 1826.
(Pl. 66, figs. 6-7).

+ 1826 Alveolina quoii; - d'ORBIGNY, p. 307, pl. 17, figs. 11-13.
1861 Alveolina quoii d'ORBIGNY; - CARPENTER, PARKER & JONES, p. 99, pl. 8, figs. 13-15.

1884 Alveolina boscii (DEFRANCE); - BRADY, p. 222, pl. 17, figs. 7-12.
1917 Alveolina boscii (DEFRANCE); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 6), p. 98, pl. 39, fig. 3.
1920 Alveolina boscii (DEFRANCE); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 487, pl. 99, figs. 2-5.
1930 Alveolinella quoii (d'ORBIGNY); - HOFKER, pt. 2, p. 163, pl. 41, figs. 6-8; pl. 63 (Siboga).
1933 Alveolinella quoii (d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 68, pl. 19, fig. 10.
1937 Alveolinella quoii (d'ORBIGNY); - REICHEL, p. 115, textfigs. 25, 26, 27/VIII, pl. 11, fig. VIII.
1954 Alveolinella quoii (d'ORBGINY); - CUSHMAN, TODD & POST, p. 558, pl. 202, figs. 5-8.
1958 Alveolinella quoyi (d'ORBIGNY); - COLLINS, p. 377.
1959 Alveolinella quoii (d'ORBIGNY); - GRAHAM & MILITANTE, p. 65, pl. 10, fig. 12.
1960 Alveolinella quoyi (d'ORBIGNY); - BARKER (see ref. BRADY 1884).
1964 Alveolinella quoyi (d'ORBIGNY); - REICHEL (in LOEBLICH & TAPPAN, p. C 506, figs. 391/7-8; fig. 395/1).

Description : See HOFKER (1930); REICHEL (1964).

Diagnostic Remarks and Distribution : Our specimens correspond with the description and illustrations of HOFKER (1930), BRADY (1884), CUSHMAN (div. publ.) and REICHEL (1937, 1964). This large species is different from Borelis schlumbergeri, as illustrated by REICHEL (1937, 1964) and HOTTINGER (1977, p. 93, fig. 29A-H) in its internal structure. Externally, the apertures in several rows "with attics at top of uppermost ones" (REICHEL, 1964) clearly distinguish A. quoyi from B. schlumbergeri. In spite of minute observation of considerable numbers of specimens, no Borelis has been found in our Lizard Island material.

REICHEL states that Alveolinella lives in tropical seas at depths of 10 to 80 m. A. quoyi seems to have an exclusive Indopacific distribution; I observed large specimens of A. quoyi in sediments from off the Northern coast of New Guinea (material : courtesy K. WOUTERS, K.B.I.N., Brussels). COLLINS (1958) records the species from the Great Barrier Reef. In the Indian Ocean, HOTTINGER (1980) and MONTAGGIONI (1981) found A. quoyi on the Maledivan and Mascarene Islands respectively associated with Borelis ssp.

Occurrence : Empty tests are abundant and living specimens are common at most perireefal stations. This species makes up, together with larger soritids, amphisteginids and operculinids, an important part of the larger fraction of most of the coarse-grained and bimodal perireefal samples. Occasional empty tests and broken, abraded fragments are transported as high as the leeward Patchreef Area but these fragments seldom occur, in a determinable shape, in the beach sands.

Suborder ROTALIINA DELAGE & HEROUARD, 1896.

Superfamily NODOSARIACEA EHRENBERG, 1838.

Family NODOSARIIDAE EHRENBERG, 1838.

Subfamily NODOSARIINAE EHRENBERG, 1838.

Genus Nodosaria LAMARCK, 1812.

Nodosaria catesbyi d'ORBIGNY, 1839.
(Pl. 67, figs. 1a-c).

\+ 1839 Nodosaria catesbyi; - d'ORBIGNY, p. 16, pl. 1, figs. 8-10.
1931 Nodosaria catesbyi d'ORBIGNY; - CUSHMAN & PARKER, p. 7, pl. 3, figs. 3-4.
1949 Nodosaria catesbyi d'ORBIGNY; - SAID, p. 21, pl. 2, fig. 22.
1957 Nodosaria catesbyi d'ORBIGNY; - TODD & BRONNIMANN, p. 31, pl. 5, fig. 4.
1959 Nodosaria catesbyi d'ORBIGNY; - GRAHAM & MILITANTE, p. 69, pl. 10, figs. 24-25.

Description : See d'ORBIGNY (1839), CUSHMAN & PARKER (1931).

Diagnostic Remarks and Distribution : Our specimen is identical with the ones described and figured in the literature. The species has an apparently cosmopolitan distribution. The specimens reported by COLLINS (1958) as Nodosaria proxima SILVESTRI might belong to the present species which might belong to the genus Amphicoryna.

Occurrence : Only one single empty test has been encountered in sample L 84, and one questionable fragment in L 56, Eastern Perireefal Area.

Genus Lagena WALKER & JACOB in KANMACHER, 1798.

Lagena gracillima (SEGUENZA), 1862.
(Pl. 67, figs. 2a-b).

+ 1862 Amphorina gracillima; - SEGUENZA, diss. 2, p. 51, pl. 1, fig. 37.
1884 Lagena gracillima (SEGUENZA); - BRADY, p. 456, pl. 56, figs. 19 (?), 20-22, 24-26 (not 23, 27, 28).
1913 Lagena gracillima (SEGUENZA); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3, p. 11, pl. 1, fig. 4.
1923 Lagena gracillima (SEGUENZA); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 4), p. 23, pl. 4, fig. 5.
1948 Lagena gracillima (SEGUENZA); - SAID, p. 21, pl. 2, fig. 28.
1953 Lagena gracillima (SEGUENZA); - LOEBLICH & TAPPAN, p. 60, pl. 11, figs. 1-4.
1956 Lagena gracillima (SEGUENZA); - ASANO, p. 30 (pt. 1), pl. 5, figs. 11-13.
1958 Lagena gracillima (SEGUENZA); - COLLINS, p. 378.
1959 Lagena sulcata (WALKER & JACOB), var. distomapolita PARKER & JONES; - GRAHAM & MILITANTE, p. 68, pl. 10, fig. 19.
1960 Lagena gracillima (SEGUENZA); - BARKER (see ref. BRADY 1884 - see comments).

Description : See SEGUENZA (1862), BRADY (1884), CUSHMAN (1913), comments by BARKER (1960).

Diagnostic Remarks and Distribution : The definition of this species is confusioning; BRADY's figured specimens seem to belong to different species; as to CUSHMAN (1913 etc.), BRADY's figs. 27-28 would show L. elongata EHRENBERG; GRAHAM & MILITANTE's figured specimen is identical with ours but these authors claim the variant distomapolita to be different from L. gracillima.

This species seems to have a cosmopolitan distribution. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : A few empty tests at one single perireefal station.

Lagena laevis (MONTAGU), 1803.
(Pl. 67, figs. 3-4).

1784 Serpula (Lagena) laevis ovalis; - WALKER & BOYS, p. 3, pl. 1, fig. 9.
+ 1803 Vermiculum laeve; - MONTAGU, p. 524.
1848 Lagena laevis (MONTAGU); - WILLIAMSON, p. 12, pl. 1, figs. 1-2.
1884 Lagena laevis (MONTAGU); - BRADY, p. 455, pl. 56, figs. 7-14.
1913 Lagena laevis (MONTAGU); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3), p. 5, pl. 1, fig. 3; pl. 38, fig. 5.
1956 Lagena laevis (MONTAGU); - ASANO, p. 29, pl. 5, figs. 6-7.
1958 Lagena laevis (MONTAGU); - COLLINS, p. 378.
1959 Lagena laevis (MONTAGU); - GRAHAM & MILITANTE, p. 67, pl. 10, figs. 15-16.
1960 Lagena laevis (MONTAGU); - BARKER, pl. 56, figs. 7-9.
1979 Lagena laevis (MONTAGU); - PEREIRA, pl. 24, fig. P.

Description : See WALKER & BOYS (1784), WILLIAMSON (1848), BRADY (1884), CUSHMAN (1913).

Diagnostic Remarks and Distribution : There is a considerable variation in the degree of elongation of the test in our specimens.
The species seems to have a cosmopolitan distribution and has been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; some isolated empty tests were found at several peri-reefal stations.

Lagena strumosa REUSS, 1858.
(Pl. 67, figs. 5-6; pl. 68, fig. 1).

+ 1858 Lagena strumosa; - REUSS, Zeitschr. geol. Ges., p. 434 (fide ELLIS & MESSINA).
1863 Lagena strumosa REUSS; - REUSS, p. 328, pl. 4, fig. 49.
1913 Lagena striata (d'ORBIGNY), var. strumosa REUSS; - CUSHMAN (U.S.N. Mus. Bull. 71), pt. 3, p. 20, pl. 7, figs. 7-10.
1958 Lagena striata (d'ORBIGNY); - COLLINS, p. 379.
? 1959 Lagena sulcata (WALKER & JACOB), var. spicata CUSHMAN & McCULLOCH; - GRAHAM & MILITANTE, p. 68, pl. 10, fig. 20 (not fig. 21).

Description : See REUSS (1858, 1863); CUSHMAN (1913).

Diagnostic Remarks and Distribution : This species probably has often been confused with L. sulcata spicata but differs from the latter in its finer striation and annulated, often ornamented neck. Our specimens are all finely to prominently striate and always show a more or less stout basal spine (except the specimen figured on pl. 68, fig. 1). GRAHAM & MILITANTE's specimen fig. 20 is probably L. strumosa but the annulated neck is not clear on the figure. We have specimens in our material which are identical with these authors's fig.21 but these have nothing to do with L.strumosa and apparently are only single-chambered specimens of N. catesbyi.

SEM-photographs of several of our specimens revealed that the ornamentation patterns in this form are quite variable; some specimens show an almost smooth test surface (e.g. fig. 6, pl. 67); the feature which under the binocular microscope seemed to be an annulated neck shows up in reality as a whole array of ornamentation patterns of which some have been illustrated here; they range from almost smooth, slightly beaded (fig. 5, pl. 67), over annulated with longitudinal costae (fig. 6, pl. 67) to spirally-enrolled costae ("Archimedes-helix", fig. 1, pl. 68). Whether all these forms in reality belong to the same species or even genus in a biological sense is a question which cannot be answered here as very little biological research upon this group of foraminifera exists. The specimen on fig. 1, pl. 68 e.g. could eventually be considered to belong to L. striata s.s. but as it is an isolated case amidst our strumosa-specimens it has tentatively been classified under the latter name.

The specimens reported by COLLINS (1958) from the Great Barrier Reef as L. striata ("flask-shaped, finely striate specimens with an apiculate base and a produced annulate neck") obviously are L. strumosa. Further records are from off Japan, Midway and Guam (CUSHMAN, 1913).

Occurrence : Empty tests are rare to common in several perireefal samples; this species is the best represented nodosariid in our otherwise scarce material of this group. Living specimens occur in two samples.

Lagena sp. 1.
(Pl. 68, figs. 2a-c).

Remarks : The single specimen of this species encountered in our material

(from the Eastern Perireefal Area) is illustrated here. If it would have shown Fissurina-characteristics it could have been classified in the auriculata-group, but our specimen clearly shows a lagenid aperture.

Family VAGINULINIDAE REUSS, 1860.

Subfamily LENTICULININAE CHAPMAN, PARR & COLLINS, 1934.

Genus Lenticulina LAMARCK, 1804.

Lenticulina cf. L. australis PARR, 1950.
(Pl. 68, figs. 3a-b).

(?) + 1950 Lenticulina (Robulus) australis; - PARR, p. 322, pl. 11, figs. 7-8.

Description : See PARR (1950).

Diagnostic Remarks and Distribution : Our specimens correspond with PARR's description and illustrations, for the bluntly rounded peripheral edge, evenly recurved sutures and slightly depressed apertural face with a limbate margin on each side. On the other hand I express some doubt as to the attribution because our specimens have slightly fewer chambers in the last whorl (max. 7 instead of 8-9), because our (small) specimens are immature (PARR's types are up to 1-2 mm in diameter !) and because of the scarcity of the material.

Occurrence : Only two empty tests have been encountered in one perireefal sample.

Family POLYMORPHINIDAE d'ORBIGNY, 1839.

Subfamily POLYMORPHININAE d'ORBIGNY, 1839.

Genus Guttulina d'ORBIGNY, 1839.

Guttulina cf. G. irregularis (d'ORBIGNY), 1846.
(Pl. 68, figs. 4a-b).

+ 1846 Globulina irregularis; - d'ORBIGNY, p. 226, pl. 13, figs. 9-10.
1930 Guttulina irregularis (d'ORBIGNY); - CUSHMAN & OZAWA, p. 25, pl. 3, figs. 4, 5; pl. 7, figs. 1-2.
1937 Guttulina irregularis (d'ORBIGNY); - PARR & COLLINS, p. 192, pl. 12, fig. 2.
1953 b Guttulina irregularis (d'ORBIGNY); - ASANO, pl. 3, figs. 6a-b.
1980 Guttulina irregularis (d'ORBIGNY); - WILLEMS, p. 76 (pt. 2), pl. 6, fig. 7.

Description : See CUSHMAN & OZAWA (1930).

Diagnostic Remarks, Distribution and Occurrence : Only two empty, abraded tests in the Perireefal Area. They otherwise correspond with the literature descriptions and illustrations of the species.

This species appears in the European Lower Eocene (WILLEMS, 1980), in the Upper Eocene of New Zealand (PARR & COLLINS, 1937) and in the Japanese Miocene (ASANO, 1953). Recent specimens seem to be restricted to the Pacific (Australia, New Zealand) (PARR & COLLINS).

Family GLANDULINIDAE REUSS, 1860.

Subfamily GLANDULININAE REUSS, 1860.

Genus Glandulina d'ORBIGNY, 1839.

Glandulina laevigata (d'ORBIGNY), 1839.
(Pl. 68, figs. 5a-b).

+ 1839 Nodosaria (Glanduline) laevigata; - d'ORBIGNY, p. 252, pl. 10, figs. 4-5.
1930 Glandulina laevigata (d'ORBIGNY); - CUSHMAN & OZAWA, p. 143, pl. 40, figs. 1a-b.
1958 Glandulina laevigata (d'ORBIGNY); - COLLINS, p. 385.
1959 Glandulina laevigata (d'ORBIGNY); - GRAHAM & MILITANTE, p. 70, pl. 10, figs. 29a-b.
1974 Glandulina laevigata (d'ORBIGNY); - LUTZE, p. 20, pl. 5, fig. 75.
1980 Glandulina laevigata (d'ORBIGNY); - WILLEMS, p. 81, pl. 6, fig. 16.

Description : See d'ORBIGNY (1839, 1846); CUSHMAN & OZAWA (1930).

Diagnostic Remarks and Distribution : Our specimens correspond with the records from the literature and are very similar to the specimen figured by GRAHAM & MILITANTE (1959). It is to be noted that some of our specimens can hardly or not be distinguished from straight-sutured Pseudonodosaria (= ex-Rectoglandulina, LOEBLICH & TAPPAN), particularly when the aperture with the entosolenian tube is broken away.

This seldomly reported species seems today to have an exclusive Indopacific distribution, but it appears in the European Early Tertiary (fide WILLEMS, 1980). It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; some isolated and mostly abraded empty tests occur in two perireefal samples.

Subfamily OOLININAE LOEBLICH & TAPPAN, 1961.

Genus Oolina d'ORBIGNY, 1839.

Oolina cf. O. desmophora (RYMER JONES), 1872.
(Pl. 69, figs. 1a-b).

? + 1872 Lagena vulgaris var. desmophora; - RYMER JONES, p. 54, pl. XIX, figs. 23-24.
? 1884 Lagena desmophora RYMER JONES; - BRADY, p. 468, pl. LVIII, figs. 42-43.
1913 Lagena desmophora RYMER JONES; - CUSHMAN, p. 27, pl. XII, fig. 5; pl. XIII, fig. 3 (?).
? 1934 Lagena desmophora RYMER JONES; - EARLAND, p. 147, pl. 6, figs. 44-45.
? 1960 Oolina desmophora (RYMER JONES); - BARKER (see ref. BRADY 1884).
1979 Oolina desmophora (RYMER JONES); - PEREIRA, pl. 24, fig. E.

Description : See RYMER JONES (1872), CUSHMAN (1913).

Diagnostic Remarks, Distribution and Occurence : Only one single empty test in sample L 65 (Eastern Perireefal Area). See also comments by EARLAND (1934). There seems to be considerable confusion about the desmophora-

taxon and EARLAND (1934, p. 147) might be right to suggest that CUSHMAN's (1913) specimens could represent variants of L. striatopunctata to which our specimen and PEREIRA's (1979) could belong. This might also be the case of the taxon mentioned below as Oolina cf. O. spiralis. Clearly, these taxa need redefinition.

Oolina hexagona (WILLIAMSON), 1848.
(Pl. 69, figs. 3a-c).

+ 1848 Entosolenia squamosa MONTAGU, var. hexagona; - WILLIAMSON, pl. 2, fig. 23.
1858 Entosolenia squamosa MONTAGU, var. hexagona WILLIAMSON; - WILLIAMSON, pl. 1, fig. 32.
1884 Lagena hexagona (WILLIAMSON); - BRADY, p. 472, pl. LVIII, figs. 32, 33.
1950 Oolina hexagona (WILLIAMSON); - PARR, p. 304.
1956 Oolina hexagona (WILLIAMSON); - ASANO, p. 43.
1958 Oolina hexagona (WILLIAMSON); - COLLINS, p. 379.
1960 Oolina hexagona (WILLIAMSON); - BARKER (see ref. BRADY 1884).

Description : See WILLIAMSON (1848), BRADY (1884).

Diagnostic Remarks, Distribution and Occurrence : Only one single, though very characteristic empty test of this species has been found at station L 84 (Eastern Perireefal Area). This species has a wide Indopacific distribution and might even be a cosmopolite.

Oolina cf. O. spiralis (BRADY), 1884.
(Pl. 69, figs. 2a-b).

+ 1884 Lagena spiralis; - BRADY, pl. 114, fig. 9.
1960 Lagena (?) spiralis BRADY; - BARKER (see ref. BRADY 1884).

Description : See BRADY (1884).

Diagnostic Remarks, Distribution and Occurence : Only one single empty test in sample L 81 (Eastern Perireefal Area). See also comments under O. desmophora. BRADY's types are from Torres Strait. The species has not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Genus Fissurina REUSS, 1850.

Fissurina contusa PARR, 1945.
(Pl. 69, figs. 4a-b).

1884 Lagena castrensis (?) BRADY (non SCHWAGER); - BRADY, pl. 60, fig. 3.
+ 1945 Fissurina contusa; - PARR, p. 203, pl. 9, fig. 6.
1958 Fissurina contusa PARR; - COLLINS, p. 380.
1960 Fissurina contusa PARR, - BARKER (see ref. BRADY 1884).

Description : See PARR (1945).

Diagnostic Remarks, Distribution and Occurence : Only one specimen of this remarkable species has been found (L 81); it is completely identical with BRADY's fig. 3 (1884). It should not be confused with F. lacunata which is smaller, has more developed keels and whose aperture is placed upon a subtriangular apex.

The species probably has a wide Indopacific distribution, from temperate to tropical waters. PARR's types are from BASS Strait; BRADY's figured specimen is from Torres Strait. COLLINS (1958) recorded at least one specimen from the Great Barrier Reef.

Fissurina laevigata REUSS, 1850.
(Pl. 69, figs. 5a-b).

+ 1850 Fissurina laevigata; - REUSS, p. 366, etc.
1947 Fissurina laevigata REUSS; - PARR, p. 120, pl. 6, fig. 8.
1964 Fissurina laevigata REUSS; - LOEBLICH & TAPPAN, p. C 540, fig. 425/8.
1980 Fissurina laevigata REUSS; - WILLEMS, p. 84, pl. 6, fig. 21.

Description : See REUSS (1850), PARR (1945 b).

Diagnostic Remarks and Distribution : In our material a number of specimens occur which can be attributed to this smooth, compressed Fissurina with the aperture on top of a triangular apex and a subangular to angled periphery. This taxon might be an ecovariant of F. marginata.

REUSS's types are from the European Tertiary. The species has not been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests occur occasionally on the reef flats, in the Patch-reef Area and the Perireefal Area. A few living specimens have been encountered.

Fissurina marginata (WALKER & BOYS), 1784.
(Pl. 69, figs. 6a-b; pl. 70, figs. 1a-b).

\+ 1784 Serpula marginata; - WALKER & BOYS, p. 2, pl. 1, fig. 7 (fide ELLIS & MESSINA).
1958 Fissurina lucida (WILLIAMSON); - COLLINS, p. 381.
1964 Fissurina marginata (WALKER & BOYS); - LOEBLICH & TAPPAN, p. C 541, fig. 425/7.
? 1971 Fissurina marginata (WALKER & BOYS); - MURRAY, p. 97, pl. 39, figs. 4-6.
1979 Fissurina marginata (WALKER & BOYS) (LOEBLICH & TAPPAN); - PEREIRA, pl. 24, figs. K-L.
1980 Fissurina marginata (WALKER & BOYS); - WILLEMS, p. 84, pl. 6, fig. 22.

Description : See WALKER & BOYS (1784), MURRAY (?) (1971), fig. by LOEBLICH & TAPPAN (1964).

Diagnostic Remarks and Distribution : This seems to be a very variable species; the shape varies from ovate to rounded, the periphery from rounded to compressed with a blunt, rounded keel (sometimes hardly visible). The species has often been confused with other taxa such as F. laevigata; the specimen figured by LOEBLICH & TAPPAN (1964) is almost keelless and seems to have a rounded periphery, like most of our specimens and those figured by PEREIRA. This variability already existed in the Tertiary (WILLEMS, 1980). It is dubious whether MURRAY's (1971) figured species from the English Channel really belongs to this species; the test is indeed strongly compressed and flattened, with a prominent keel. COLLINS's (1958) specimens reported as F. lucida probably belong to the species under consideration here. Finally, I do not exclude the possibility of laevigata and marginata to be only ecovariants of the same species.

Occurrence : A few empty tests in three perireefal samples.

Fissurina marginato-perforata (SEGUENZA), 1880.
(Pl. 70, figs. 2a-d).

+ 1880 Lagena marginato-perforata; - SEGUENZA, p. 332, pl. 17, fig. 34.
1915 Lagena marginato-perforata SEGUENZA; - H. ALLEN & EARLAND, p. 664, pl. L, figs. 24-30.
1932 Lagena marginato-perforata SEGUENZA; - CUSHMAN, p. 19, pl. 4, figs. 13a-b; pl. 5, figs. 1a-b; pl. 6, figs. 1a-b.
1958 Fissurina marginato-perforata (SEGUENZA); - COLLINS, p. 381.
1979 Fissurina aff. F. marginato-perforata (SEGUENZA); - PEREIRA, pl. 24, fig. F.

Description : See SEGUENZA (1880); H. ALLEN & EARLAND (1915); CUSHMAN (1932).

Diagnostic Remarks and Distribution : Our specimens of this compressed, elongate, triple-keeled and evenly pitted (?) species with elevated aperture surrounded by an everted lip, are rather constant in shape and all correspond with H. ALLEN & EARLAND's triple-keeled species as figured on his fig. 24; they are identical with PEREIRA's figured specimens from East Africa. This species is easily distinguishable from F. lacunata and F. contusa by its elongate test, faint keels ("bridged" at the aboral test end), and prominent apertural lips.

SEM-Photographs of living specimens show bundles of organic (?) filaments in the "pits" at the test surface. As these filaments may be retracted pseudopodians, these photographs strongly suggest that the test surface openings are not "pits" but real perforations (pores) (see figs. 2c, d, pl. 70). These nodosariids clearly and urgently need much more biological research.

The distribution of this seldomly encountered species is uncertain but its presence in most Indopacific tropical reefal waters is highly probable. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Living specimens occur in one reef-flat sample whereas a few empty tests occur in one perireefal sample.

Fissurina orbignyana s.s. SEGUENZA, 1862.
(Pl. 70, figs. 3a-b).

1858 Entosolenia marginata (part); - WILLIAMSON (not L. marginata (WALKER & BOYS)),p. 9, pl. 1, figs. 19-20.

+ 1862 Fissurina orbignyana; - SEGUENZA, p. 66, pl. 2, figs. 24, 26.

1884 Lagena orbignyana (SEGUENZA); - BRADY, p. 484, pl. 59, figs. 1, 18, 24, 26.

1893 Lagena orbignyana (SEGUENZA); - EGGER, p. 333, pl. 10, figs. 89-91.

1897 Lagena orbignyana (SEGUENZA); - FLINT, p. 308, pl. 54, fig. 4.

1913 Lagena orbignyana (SEGUENZA); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3), p. 42, pl. 19, fig. 1.

1958 Fissurina orbignyana SEGUENZA; - COLLINS, p. 381.

1960 Fissurina orbignyana SEGUENZA; - BARKER (see ref. BRADY 1884).

1971 Fissurina orbignyana SEGUENZA; - MURRAY, p. 99, pl. 40, figs. 1-5.

1979 Fissurina cf. F. orbignyana SEGUENZA; - PEREIRA, pl. 25, figs. D-E.

Description : See SEGUENZA (1862); BRADY (1884); CUSHMAN (1913).

Diagnostic Remarks and Distribution : This rounded, tricarinate species shows a fairly constant shape. Several of its subspecies or variants have been described in the literature under various names, even different species have been created (of which F. lacunata and F. substriata are present in our material) but the probability of some or several of these being only ecovariants of F. orbignyana is high.

The species apparently has a wide Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to moderately common. Empty tests occur in the Perireefal Area and in one sample from the Internal Platform. Living specimens have not been encountered.

Fissurina orbignyana SEGUENZA, subsp. lacunata (BURROWS & HOLLAND), 1895.
(Pl. 70, figs. 4a-b).

1884 Lagena castrensis BRADY (not SCHWAGER); - BRADY, p. 485, pl. 60, figs. 1-2.

1893 Lagena castrensis BRADY (not SCHWAGER); - EGGER, p. 333, pl. 10, figs. 71-72.

1897 Lagena castrensis BRADY (not SCHWAGER); - FLINT, p. 308, pl. 54, fig. 5.

+ 1895 Lagena lacunata; - BURROWS & HOLLAND, in JONES, p. 205, pl. 7, fig. 12.

1912 Lagena orbignyana, var. lacunata; - SIDEBOTTOM, p. 416, pl. 19, figs. 16-18.

1913 Lagena orbignyana (SEGUENZA), var. lacunata BURROWS & HOLLAND; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3), p. 43, pl. 20, fig. 1.

1945 Fissurina lacunata (BURROWS & HOLLAND); - PARR, p. 203.

1958 Fissurina lacunata (BURROWS & HOLLAND); - COLLINS, p. 380.

1960 Fissurina lacunata (BURROWS & HOLLAND); - BARKER (see ref. BRADY 1884).

1979 Fissurina cf. F. lacunata (BURROWS & HOLLAND); - PEREIRA, pl. 24, figs. M-N.

Description : See BRADY (1884), CUSHMAN (1913).

Diagnostic Remarks and Distribution : The specific features of our specimens are rather constant and they correspond with the illustrations given in the literature, particularly with BRADY's (1884) figs. Only the pitting of the surface is somewhat irregular and is sometimes difficult to see due to abrasion of the tests. SIDEBOTTEM and CUSHMAN (1912, 1913) considered var. lacunata as a variant of F. orbignyana from which it may be distinguished by the pitting of its lateral test surfaces.
This interpretation is followed here; in fact all intermediates between F. orbignyana s.s. and subsp. lacunata occur in our material; orbignyana s.s.-specimens, showing a smooth surface under the binocular microscope, often appear slightly pitted under the SEM (e.g. the specimen illustrated on fig. 3, pl. 70).

The subspecies apparently has a wide Indopacific distribution; BRADY's figured specimen is from Raine Island. The subspecies has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : A few empty tests occur in two perireefal samples.

Fissurina cf. F. semistriata (UCHIO), 1950.
(Pl. 70, figs. 5a-b).

+ 1950 Entosolenia semistriata; - UCHIO (fide ELLIS & MESSINA).
1958 Fissurina semistriata UCHIO; - COLLINS, p. 381.

Description : See UCHIO (1950).

Diagnostic Remarks and Distribution : Our specimens differ from UCHIO's description and illustration in their more elevated (sometimes subtriangular) apertural apex and the interruption of the keels at the base of the test; in some specimens this base is slightly spinate. The number of basal costae is somewhat variable (mostly two longer ones and 3 to 4 shorter ones at each side of the test). The present species might be close to F. substriata (= "Lagena alveolata var. substriata BRADY", 1884, p. 488, pl. 60, fig. 34).

This is without doubt the species reported as F. semistriata by COLLINS (1958) from the Great Barrier Reef. UCHIO's types are from the Japanese Tertiary.

Occurrence : Rare; a few empty, mostly damaged, tests at some perireefal stations; also a few questionable (damaged) living specimens in one perireefal sample.

Genus Parafissurina PARR, 1945.

Parafissurina pseudauriculata (EARLAND), 1934.
(Pl. 71, figs. 1a-b).

+ 1934 Lagena pseudauriculata; - EARLAND, p. 158, pl. 7, figs. 7-8.

Description : See EARLAND (1934).

Diagnostic Remarks, Distribution and Occurrence : Only one single specimen of this Antarctic species has been found in our material; it corresponds however completely with EARLAND's (1934) description and illustrations, including the characteristic "umbonate" lenticular shape of the test. Aperture

and entosolenian tube are clearly parafissurine and resemble homologous features of P. malcomsoni (as figured e.g. by MURRAY, 1971, pl. 41, figs. 1-4); the latter species differs from pseudauriculata mainly in its more flattened test, broader carina and absence of basal "auricles".

Superfamily SPIRILLINACEA REUSS, 1862.

Family SPIRILLINIDAE REUSS, 1862.

Subfamily SPIRILLININAE REUSS, 1862.

Genus Spirillina EHRENBERG, 1843.

Spirillina vivipara EHRENBERG, 1843.
(Pl. 71, figs. 2, 3).

+ 1843 Spirillina vivipara; - EHRENBERG, p. 442, pl. 3, fig. 41.
1858 Spirillina perforata EHRENBERG; - WILLIAMSON, p. 92, pl. 7, fig. 202.
1857 Spirillina vivipara EHRENBERG; - PARKER & JONES, p. 284, pl. 11, fig. 46.
1884 Spirillina vivipara EHRENBERG; - BRADY, p. 630, pl. 85, figs. 1-4.
1915 Spirillina vivipara EHRENBERG; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 3, pl. 1, figs. 1-2.
1958 Spirillina vivipara EHRENBERG; - COLLINS, p. 399.
1960 Spirillina vivipara EHRENBERG; - BARKER (see ref. BRADY 1884).
1960 Spirillina vivipara EHRENBERG; - HOFKER, p. 252, fig. 109.
1964 Spirillina vivipara EHRENBERG; - LOEBLICH & TAPPAN, p. C 600, fig. 475/1, 2.
1968 Spirillina vivipara EHRENBERG; - ALBANI, p. 110.
1971 Spirillina vivipara EHRENBERG; - MURRAY, p. 145, pl. 60, figs. 1-2.
1974 Spirillina vivipara EHRENBERG; - LUTZE, p. 29, pl. 6, fig. 11.
1977 Spirillina vivipara EHRENBERG; - BUZAS, SMITH & BEEM, p. 93, pl. 6, figs. 4-6.
1979 Mychostomina revertens (RHUMBLER); - PEREIRA, pl. 35, fig. B.

Description : See EHRENBERG (1843); BRADY (1884), CUSHMAN (1915); MURRAY (1971).

Diagnostic Remarks and Distribution : See note under subsp. revertens. See also MYERS, 1936, for extensive comments upon the species. The typical vivipara is relatively flattened, has a planispiral evolute coil throughout and is coarsely punctate (pseudopores at dorsal side of the test, less on the opposite side).

This cosmopolitan species has been reported by COLLINS (1958) from the Great Barrier Reef, and by ALBANI (1968) from New South Wales (Australia).

Occurrence : Rare to common in all habitats at Lizard Island; living specimens as well as empty tests.

Spirillina vivipara EHRENBERG, subsp. revertens RHUMBLER.
(Pl. 71, figs. 4-5).

1884 Spirillina vivipara (pars); BRADY, pl. 85, fig. 5 (not 1-4).
+ 1906 Spirillina vivipara, var. revertens; - RHUMBLER, p. 32, pl. 2, figs. 8-10.
1915 Spirillina vivipara EHRENBERG, var. revertens RHUMBLER; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 4, pl. 1, figs. 3-6.
1954 Spirillina vivipara EHRENBERG, var. revertens RHUMBLER; - CUSHMAN, TODD & POST, p. 357, pl. 88, fig. 30.
1957 Spirillina vivipara EHRENBERG, var. revertens RHUMBLER; - TODD, p. 290 tab), pl. 90, fig. 2.
1960 Spirillina vivipara EHRENBERG, var. revertens RHUMBLER; - BARKER (see ref. BRADY 1884).
1964 Spirillina revertens RHUMBLER; - LOEBLICH & TAPPAN, p. C 600, figs. 475/3, 4.
1977 Mychostomina revertens (RHUMBLER); - BUZAS, SMITH & BEEM, p. 93, pl. 6, figs. 7-12.
1979 Mychostomina revertens (RHUMBLER); - PEREIRA, pl. 35, figs. A, C (not B).

Description : See RHUMBLER (1906), CUSHMAN (1915).

Diagnostic Remarks and Distribution : See note by LOEBLICH & TAPPAN (1964, p. C 600); their remarks can be summarized in the statement that the

"mychostomine" feature (recurved distal end of the spiral chamber) is probably only characteristic of the agamont generation of S. vivipara (see MYERS, 1936). Agreeing with this viewpoint I maintain a separation of the two variants at subspecies level (see introduction) but I reject the further use of the generic name Mychostomina.

The distribution of this variant apparently parallels the one of S. vivipara s.s. though it has not been reported as such from the Great Barrier Reef by COLLINS (1958).

Occurrence : The same as for S. vivipara s.s.

Spirillina sp. 1.
(Pl. 71, figs. 6a-b).

Remarks : One single test of this tiny Spirillina with a strongly flattened test provided with a sharp, spinose carina and radially oriented tubercles has been found at Stn. L 249 (Coconut Fringing Reef Flat). This might be a representant of McCULLOCH's species S. spinipapillata n.sp. (McCULLOCH, 1977, p. 273, pl. 110, figs. 8a-c) from the Eastern Pacific Ocean (Galapagos Ids.).

Spirillina sp. 2.
(Pl. 71, figs. 7a-b).

Remarks : One single, damaged test of this truncate, rapidly thickening, coarsely porous Spirillina has been found at Stn. L 122 (Lagoon). It might eventually be related to S. inaequalis BRADY.

Superfamily ROBERTINACEA REUSS, 1850.

Family ROBERTINIDAE REUSS, 1850.

Subfamily ALLIATININAE McGOWRAN, 1966.

Genus Alliatina TROELSEN, 1954.

Alliatina translucens (CUSHMAN), 1933.
(Pl. 71, figs. 8a-c; pl. 72, figs. 1a-c).

+ 1933 Nonionella translucens; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 45, pl. 11, figs. 2a-c.
1939 Nonionella translucens CUSHMAN; - CUSHMAN, p. 34, pl. 9, fig. 13.
? 1958 Cushmanella primitiva CUSHMAN & McCULLOCH; - COLLINS, p. 415.
1961 Alliatina translucens (CUSHMAN); - TODD, (p. 179 tab), pl. 23, figs. 2a-b.
? 1964 Alliatina excentrica di NAPOLI ALLIATA; - LOEBLICH & TAPPAN, p. C 778, fig. 641/2.
? 1977 Cushmanella (?) antarctica; - Mc CULLOCH, p. 378, pl. 161, figs. 10a-c.

Description : See CUSHMAN (1939); for generic features, see LOEBLICH & TAPPAN (1964).

Diagnostic Remarks and Distribution : CUSHMAN's (1939) description should be completed with the generic features of the genus Alliatina : very modest (and sometimes hardly noticeable in small specimens) supplementary chambers, better developed on the involute side of the test; some tests are almost symmetrical except for the uneven development of the supplementary chambers. The internal structure is similar (though slightly assymmetrical) to the one of Cushmanella and I really wonder whether this assymmetry (which is also translated by slight apertural variations, from small rounded to larger comma-shaped) suffises to separate these two genera. The few larger specimens in our material show a complication of the pattern of the supplementary chambers, as well as the appearance of a feature described by COLLINS (1958) as "irregular lobulate areas of clear shell substance which contrast with the finely-perforate character of the wall in general" (p. 415).

The distribution of the species is not known in detail but all records are from the Indopacific. Mc CULLOCH's (1977) C. antarctica is much alike our specimens, as well as the metatype of A. excentrica from the Italian Pliocene, as shown by LOEBLICH & TAPPAN (1964). Whether C. primitiva CUSHMAN & Mc CULLOCH is the same as the present form is dubious, but presumably at least part of COLLINS's (1958) material from the Great Barrier Reef reported under that name belongs to A. translucens (judging

from his accompanying remarks).

Occurrence : Rare; some isolated specimens occur at several perireefal and a few patchreef stations; one single specimen has been encountered in the backreef area, Windward Barrier (L 253).

Superfamily BULIMINACEA JONES, 1875.

Family BULIMINOIDIDAE SEIGLIE, 1970.

Genus Buliminoides CUSHMAN, 1911, emend. SEIGLIE, 1970.

Note on B. madagascariensis and its variants, subsp. parallela and subsp. spicata.

In 1969 and 1970, SEIGLIE published the emended descriptions of the genus Buliminoides which is clearly differentiated from Buliminella by its radially-striated aperture, plastogamic reproduction, and habitat : "Buliminoides lives in shallow-water reefs in areas of high wave activity and, therefore, in well-oxygenated waters whereas Buliminella lives generally on nutrient-rich muddy bottoms of the shelf ..." (SEIGLIE, 1970, p. 113). All the species of this group present in our material belong to Buliminoides; SEIGLIE also pointed out the relationship of this genus with the family Glabratellidae of which several species also occur in our material.

The greatest possible confusion exists as to the nomenclatural designations of several species belonging to Buliminoides. Most authors and apparently SEIGLIE himself too, apparently have underestimated the great variability exhibited by at least one species of this group, B. madagascariensis (as I call it).

In our material specimens occur which, in the traditional nomenclature, could be attributed resp. to B. parallela, B. madagascariensis (B. milletti) and B. madagascariensis var. spicata (= B. spicata of COLLINS). The differences between these variants reside in the height of the spire, the degree of chamber inflation (resulting in slender vs. thick tests) and bluntness of the initial spire which might be influenced by life cycle elements (schizonts vs. gamonts) and ecophenotypy. Moreover these variants share most fundamental characters : they are finely porous, have the same

kind of aperture (9-13 areal grooves around the aperture which might be broken open after plastogamy and may or may not be covered by a plastogamic plate) and the initial part of the test frequently exhibits the same rugosity, in small and narrow parallela-specimens as well as in the bigger and inflated spicata-specimens with initial spine; moreover all intermediates occur in our material.

For these reasons I consider these variants as being conspecific; d'ORBIGNY's specific name madagascariensis having date priority I have used this name for the species s.s., with the denominations parallela and spicata as variant names. The milletti-variant is considered herein to be synonymous with madagascariensis s.s. and consequently I have dropped that name. It should be noted that the parallela-variant is completely different, in generic and specific features, from Buliminella elegantissima, species with which it has frequently been confused in the past.

Buliminoides madagascariensis s.s. (d'ORBIGNY), 1826.
(Pl. 72, figs. 2-3).

\+ 1826 Bulimina madagascariensis; - d'ORBIGNY, vol. 7, p. 270.
1933 Buliminella milletti; - CUSHMAN, pt. 4, p. 78, pl. 8, figs. 5-6.
1942 Buliminella milletti CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 7, pl. 3, figs. 1-4.
1947 Buliminella milletti CUSHMAN; - CUSHMAN & PARKER, p. 69, pl. 17, figs. 20-21.
1947 Buliminella madagascariensis (d'ORBIGNY); - CUSHMAN & PARKER, p. 68, pl. 17, figs. 15-17.
1949 Buliminella madagascariensis (d'ORBIGNY); - SAID, p. 26, pl. 3, fig. 14.
1954 Buliminella milletti CUSHMAN; - CUSHMAN, TODD & POST, p. 349, pl. 87, figs. 14-15.
1956 Buliminella milletti CUSHMAN; - HOFKER, p. 44, pl. 4, figs. 3-4.
1957 Buliminella milletti CUSHMAN; - TODD, p. 290 (table), pl. 89, fig. 8.
1958 Buliminella milletti CUSHMAN; - COLLINS, p. 387.
1959 Buliminella milletti CUSHMAN; - GRAHAM & MILITANTE, p. 81, pl. 12, fig. 22.
1979 Buliminella elegantissima (d'ORBIGNY), var. compressa MILLETT; - PEREIRA, pl. 25, figs. F-J.
1979 Buliminoides madagascariensis (d'ORBIGNY); - PEREIRA, pl. 25, figs. K-Q; pl. 26, fig. A.

Description : See d'ORBIGNY (1826), CUSHMAN & PARKER (1947), SEIGLIE (1970).

Diagnostic Remarks and Distribution : This is the variant with moderately inflated chambers. CUSHMAN (1947) admits that B. madagascariensis is "very variable in shape"; the test "small, tapering in the microspheric form, almost cylindrical in the megalospheric". CUSHMAN's descriptions of B. milletti (1933, 1947) are not fundamentally different from the ones of B. madagascariensis and I consider both variants being conspecific (see note above). Variability range includes strongly inflated specimens with sharp or blunt initial end, resembling subsp. spicatus, whereas narrower specimens with broadly rounded initial end are near to B. paralella. Fresh or hardly abraded specimens very often exhibit a rugosity of the test consisting of small elongate nods scattered over the first one or two whorls.

In the classical concept, B. madagascariensis has almost exclusively been reported from the Indopacific but in our enlarged views the species may be considered to be cosmopolitan in shallow reefal areas.

Occurrence : Rare to common in most habitats at Lizard Island; the narrower specimens, together with the parallela-subspecies, are slightly more common in shallow and intertidal areas (reef-flats) whereas the more inflated, tapering specimens are more often encountered in the deeper Perireefal Area together with the spicatus-specimens. Living specimens are occasionally encountered.

Buliminoides madagascariensis (d'ORBIGNY), subsp. parallela (CUSHMAN & PARKER), 1931.
(Pl. 72, figs. 4a-b).

\+ 1931 Buliminella parallela; - CUSHMAN & PARKER, p. 13, pl. 3, figs. 15a-c.
1946 Buliminella parallela CUSHMAN & PARKER; - CUSHMAN & PARKER, p. 69, pl. 17, fig. 22.
1958 Buliminella sp. cf. parallela CUSHMAN & PARKER; - SEIGLIE, p. 114, textfigs. 13-14.

Description : See CUSHMAN & PARKER (1931, 1946); SEIGLIE (1970).

Diagnostic Remarks and Distribution : This is the narrow, elongate subspecies with weakly inflated chambers, almost parallel sides, small apertural face and mostly blunt initial end. This subspecies has originally been described from the South Atlantic and the Caribbean area; CUSHMAN (1947) however tentatively placed MILLETT's specimens from the Malay archipelago in synonymy with his B. parallela whereas COLLINS (1958) recognised similar specimens in his Great Barrier Reef samples.

Our specimens grade from typical parallela-specimens into broader, more strongly tapering madagascariensis-specimens; the same test rugosity as noted for the madagascariensis-variant is present in most of our specimens; in fact, some of our specimens more or less resemble the "smooth" variants of the Atlantic rugose species B. stainforthi SEIGLIE as figured by this author (SEIGLIE, 1970, p. 115, textfigs. 4-6).

Occurrence : Same as for the narrower madagascariensis-variants (see above); rare to common. Living specimens are occasionally encountered.

Buliminoides madagascariensis (d'ORBIGNY), subsp. spicatus (CUSHMAN & PARKER), 1942.
(Pl. 72, figs. 5a-b).

+ 1942 Buliminella madagascariensis (d'ORBIGNY), var. spicata CUSHMAN & PARKER, (in CUSHMAN) (U.S.N. Mus. Bull. 161, pt. 3), p. 8, pl. 3, figs. 5-6.
1946 Buliminella madagascariensis (d'ORBIGNY), var. spicata CUSHMAN & PARKER; - CUSHMAN & PARKER, p. 64, pl. 16, fig. 20.
1951 Buliminella madagascariensis (d'ORBIGNY), var. spicata CUSHMAN & PARKER; - HOFKER, p. 127 (Siboga, Pt. III), figs. 77-79.
1958 Buliminella spicata CUSHMAN & PARKER; - COLLINS, p. 388.
1959 Buliminella madagascariensis (d'ORBIGNY), var. spicata CUSHMAN & PARKER; - GRAHAM & MILITANTE, p. 81, pl. 12, fig. 21.
1977 Buliminella philippinensis; - Mc CULLOCH, p. 242, pl. 103, figs. 30a, a', b.

Description : See CUSHMAN & PARKER (1942, 1946), HOFKER (1951).

Diagnostic Remarks and Distribution : This is the strongly inflated, broad form with large grooved apertural face and initial spine (which is in fact the only distinguishing feature vs. inflated specimens of the madagascariensis s.s.-subspecies. Several of our specimens again show the above mentioned rugosity on the surface of the earlier whorls. Specimens with plastogamic plate are numerous.

The types of this form are from the Australian Oligocene; according to HOFKER (1951), the subspecies is also present in the Oligocene of the Netherlands. Recent records are exclusively from Indopacific reefal areas; the taxon has been recorded by COLLINS (1958) as B. spicata from the Great Barrier Reef. Mc CULLOCH's (1977) B. philippinensis (from the Philippines) is undoubtedly identical with the spicatus-subspecies though this author claims there are (minor) differences.

Occurrence : See occurrence of B. madagascariensis s.s.-specimens. Living specimens are occasionally encountered.

Buliminoides williamsonianus (BRADY), 1881.
(Pl. 72, figs. 6a-b).

+ 1881 Bulimina williamsoniana; - BRADY, p. 56.
1884 Bulimina williamsoniana BRADY; - BRADY, p. 408, pl. 51, figs. 16-17.
1900 Bulimina williamsoniana BRADY; - MILLETT, p. 279, pl. 2, figs. 8a-b.
1911 Buliminoides williamsoniana (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 2), p. 90, tfs. 144a-b.
1924 Buliminoides williamsoniana (BRADY); - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 25, pl. 7, figs. 3-4.
1942 Buliminoides williamsoniana (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 8, pl. 3, figs. 7-9.
1947 Buliminoides williamsoniana (BRADY); - CUSHMAN & PARKER, p. 70, pl. 17, figs. 23-24.
1951 Buliminoides williamsoni (BRADY); - HOFKER (Siboga, pt. III), p. 133, figs. 81-84.
1954 Buliminoides williamsoniana (BRADY); - CUSHMAN, TODD & POST, p. 290 (tab), pl. 89, fig. 9.
1958 Buliminoides williamsonianus (BRADY); - COLLINS, p. 388.

1959 Buliminoides williamsoniana (BRADY); - GRAHAM & MILITANTE, p. 82, pl. 12, fig. 23.

1960 Buliminoides williamsonianus (BRADY); - BARKER (see ref. BRADY 1884).

1964 Buliminoides williamsoniana (BRADY); - LOEBLICH & TAPPAN, p. C 544, fig. 426/8a, b.

1970 Buliminoides williamsoniana (BRADY); - SEIGLIE, p. 113, textfigs. 1-2.

Description : See BRADY (1881, 1884); CUSHMAN (1911); CUSHMAN & PARKER (1947); HOFKER (1951); SEIGLIE (1970).

Diagnostic Remarks and Distribution : Our specimens are in accordance with the descriptions and illustrations of the above mentioned authors. The bifurcating costae, as described by SEIGLIE (1970) are well visible and pronounced. Pre- as well as postplastogamic specimens are present.

This is a cosmopolitan species which has been mentioned for the first time from the Caribbean by SEIGLIE (1970). BRADY's (1881, 1884) types are from Torres Strait and the Admirality Islands.

Occurrence : Empty tests occur in small numbers in several perireefal samples. Living specimens are present in one single reef-flat sample.

Family BOLIVINITIDAE CUSHMAN, 1927.

Genus Bolivina d'ORBIGNY, 1839.

Bolivina compacta SIDEBOTTOM, 1905.
(Pl. 73, figs. 1-2).

\+ 1905 Bolivina robusta BRADY, var. compacta; - SIDEBOTTOM, p. 15, pl. 3, figs. 7a-b.

1911 Bolivina compacta (SIDEBOTTOM); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 2), p. 36, tfs. 58a-b.

1921 Bolivina compacta SIDEBOTTOM; - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 137, pl. 26, fig. 7.

1922 Bolivina compacta SIDEBOTTOM; - CUSHMAN (Carnegie Inst. Publ. n° 311), p. 26, pl. 1, fig. 10.

1924 Bolivina compacta SIDEBOTTOM; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 18, pl. 5, fig. 1.

1937 c Bolivina compacta SIDEBOTTOM; - CUSHMAN, p. 135, pl. 17, figs. 22-24.

1942 Bolivina compacta SIDEBOTTOM; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), pp. 20, 22-24, pl. 7, figs. 2-3.

1945 Bolivina compacta SIDEBOTTOM; - PARR, p. 206, pl. 9, fig. 8.

1951 Bolivina compacta SIDEBOTTOM; - HOFKER (Siboga, pt. III), p. 80, figs. 43-45.

1970 Bolivina compacta SIDEBOTTOM; - SLITER, p. 157, pl. 1, figs. 1-5; pl. 8, figs. 4-5; B. subexcavata CUSHMAN & WICKENDEN : id., p. 162, pl. 4, figs. 1-5.

? 1974 Bolivina persiensis; - LUTZE, p. 25, pl. 5, figs. 86-89; pl. 6, fig. 98.

1975 Bolivina persiensis LUTZE; - SEIBOLD, p. 186, pl. 1, fig. 16.

1977 Bolivina subexcavata CUSHMAN & WICKENDEN; - BUZAS, SMITH & BEEM, p. 76, pl. 2, figs. 23-26 (not 11-22).

1977 Bolivina cf. subexcavata CUSHMAN & WICKENDEN; - Mc CULLOCH, p. 259, pl. 108, fig. 2.

1979 Bolivina variabilis (WILLIAMSON); - PEREIRA, pl. 27, figs. C-E.

Description : See SIDEBOTTOM (1905); CUSHMAN (1911); HOFKER (1951).

Diagnostic Remarks and Distribution : Our specimens correspond to these authors's descriptions and illustrations but are very variable in shape and ornamentation. Constant features of the species are the elongate, tapering shape, the blunt initial end, the slightly inflated chambers, and particularly the rather coarse pores and the hardly depressed sutures "often covered with layers of secundary chalk, irregularly sawed at the initial border of the chambers around the pores" (HOFKER, 1951, p. 83). Our specimens vary from almost smooth to rather heavily ornamented by this secundary chalk; these ornamented specimens have been described under various names in the literature; very likely LUTZE's B. persiensis and PEREIRA's B. variabilis are nothing else than these ornamented B. compacta. SLITER (1970) illustrates intermediately ornamented forms (as B. compacta) and heavily ornamented ones (as B. subexcavata). Several reports of B. subexcavata apparently are referable to the present species (e.g. BUZAS, SMITH & BEEM, 1977, part; Mc CULLOCH, 1977).

Whether this species is a true Bolivina or not cannot be confirmed here; ultrastructural test studies would be required to verify this; as such investigations have neither been carried out for this species not for the

remainder of our Bolivinitidae I simply applied the current nomenclature in this and the following case.

B. compacta seems to have a worldwide distribution in tropical reefal areas and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests are rare to common in all habitats at Lizard Island (mainly in the Perireefal Area); living specimens have occasionally been encountered in intertidal and shallow backreef environments.

Bolivina rhomboidalis (MILLETT), 1899.
(Pl. 73, figs. 3-4).

+ 1899 Textularia rhomboidalis; - MILLETT, p. 559, pl. 7, fig. 4.
1905 Textularia rhomboidalis MILLETT; - SIDEBOTTOM, p. 8, pl. 2, fig. 2.
1922 Bolivina rhomboidalis (MILLETT); - CUSHMAN (Carnegie Inst. Publ. n° 311), p. 28.
1922 Bolivina rhomboidalis (MILLETT); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 2), p. 44.
1937 c Bolivina rhomboidalis (MILLETT); CUSHMAN, p. 138, pl. 18, fig. 7.
1954 Bolivina rhomboidalis (MILLETT); - CUSHMAN, TODD & POST, p. 353, pl. 87, figs. 41-42.
1957 Bolivina rhomboidalis (MILLETT); - TODD, p. 290 (tab.), pl. 89, fig. 18.
1958 Bolivina rhomboidalis (MILLETT); - COLLINS, p. 395.
1977 Bolivina rhomboidalis (MILLETT); - BUZAS, SMITH & BEEM, p. 74, pl. 2, figs. 3-4; ? Bolivina subexcavata CUSHMAN & WICKENDEN; - id., p. 76, pl. 2, figs. 15-18 (not 11-14, 19-26).

Description : See MILLETT (1899), CUSHMAN (1937 c); see notes by BUZAS, SMITH & BEEM (1977).

Diagnostic Remarks and Distribution : There is apparently much confusion in the literature about B. rhomboidalis, B. subexcavata and, to some extent, B. quadrilatera. Typical B. rhomboidalis-specimens possess a pronounced rhomboidal outline in transverse section but the shape is very variable and intergrades with B. subexcavata; the latter "species" however, being more or less symmetrical, is not represented in our material and in my opinion most of the specimens shown by BUZAS e.a. (1977) as B. subexcavata

should be called rhomboidalis. I do not exclude the possibility of both B. rhomboidalis and B. subexcavata being ecovariants of the same species. B. quadrilatera (see e.g. HOFKER, 1951, p. 102) differs from the present species by its apertural characteristics, sharper carinae, sharper initial test end sometimes provided with a spine, and more or less rectangular outline in transverse section.

Like B. compacta, the present species is cosmopolitan in tropical reefal as well as subtropical areas (e.g. the Mediterranean). MILLETT's types are from the Malay archipelago; COLLINS (1958) reports the species from the Great Barrier Reef.

Occurrence : Almost the same as for B. compacta; the species is most frequent in shallow backreef environments where living specimens are frequently encountered.

Bolivina spinea CUSHMAN, 1936.
(Pl. 73, figs. 5-6).

\+ 1936 Bolivina spinea; - CUSHMAN (Sp. Publ. n° 6, C.L. For. Res.), p. 58, pl. 8, figs. 11a-b.
1937 c Bolivina spinea CUSHMAN; - CUSHMAN, p. 131, pl. 16, fig. 26.
? 1951 Bolivina spinescens CUSHMAN; - HOFKER (Siboga, pt. III), p. 57, figs. 24a-d.
1957 Bolivina spinea CUSHMAN; - TODD, p. 290 (tab.), pl. 89, fig. 20.

Description : See CUSHMAN (1936, 1937 c).

Diagnostic Remarks and Distribution : Specimens in our materal show the characteristics of the species,are very often coarsely spinose, and are mostly provided with an initial spine. The test wall is finely to coarsely spinose, with the coarsest spines being placed near the broadest transverse section of each chamber and pointing in an aboral direction; the sutures however are always clearly visible and free of spines. The test is hardly compressed and the aperture is large; retral processes are obscured by the spine pattern but can often be observed at the sutures of the youngest chambers; this justifies the place of the present form in the genus Bolivina.

The types of CUSHMAN's B. spinescens differ considerably from the species under consideration here and show translucent, thin tests with only a restricted zone of short spines, or granularity at the chamber bases; these specimens do not have an initial spine either; HOFKER (1951) however shows several specimens which could be interpreted as being intermediate between B. spinescens and B. spinea; three of his figures (b, c, d) show an initial spine; though HOFKER calls these forms spinescens, I would rather be inclined to conclude as to the conspecificity of both B. spinescens and B. spinea, these being very likely only ecovariants of the same species.

CUSHMAN's types of B. spinea are from Fiji and all records are from the Indopacific whereas B. spinescens moreover has been recorded from the Caribbean. None of these taxa has been recorded by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests are rare to common in most environments at Lizard Island; frequencies are somewhat higher in the finer-graded sediments on the leeward slope and similar sediments. Living specimens are frequently encountered.

Genus Brizalina COSTA, 1856.

Note : ZWEIG-STRYKOWSKI & REISS (1975), in their Red Sea paper, subdivided the genus Brizalina into three subgenera, viz. B. (Brizalina), B. (Parabrizalina) and B. (Pseudobrizalina). Several species, formerly placed in genera such as Loxostomum or Rectobolivina, where shown to belong to either Para- or Pseudobrizalina. However as I continue to consider the systematics of the Bolivinitidae to be insufficiently understood I mentioned these subgenera in the text but I did not use them formally.

Brizalina pacifica (CUSHMAN & Mc CULLOCH), 1942.
(Pl. 74, figs. 1-2).

\+ 1942 Bifarina pacifica; - CUSHMAN & Mc CULLOCH, p. 225, pl. 28, fig. 20.
1973 Rectobolivina pacifica (CUSHMAN & Mc CULLOCH); - LANKFORD & PHLEGER, p. 126, pl. 4, fig. 2.
1974 Bolivina pacifica (CUSHMAN & Mc CULLOCH); - LUTZE (subsp. P 1), p. 24, pl. 5, figs. 78-80; pl. 6, figs. 96-97.

Description : See CUSHMAN & Mc CULLOCH, 1942.

Diagnostic Remarks and Distribution : Constant features of this species are the thickened, limbate, almost straight, slightly inclined sutures in the initial part of the test (the last-formed chambers however are somewhat inflated and show depressed sutures), and the coarse porosity throughout. The tests are somewhat (though not extremely) compressed. Test surface ornamentation such as vertical ridges is not (or hardly, in the initial chambers) developed. This species has been recorded under different generic names; specimens developing uniserial chambers, as shown by LANKFORD & PHLEGER (1973), are not present in our material, though a tendency towards an uniserial development (migration of the aperture toward an areal situation) could be noticed in some of our specimens. I do not think this is a real Rectobolivina; according to the terminology of ZWEIG-STRYKOWSKI & REISS (1975) this species should be classified in their new subgenus Brizalina (Parabrizalina).

Records of this species are from the Gulf of California and the Persian Gulf. This is the first record from the Great Barrier Reef.

Occurrence : Rare to common in all environments at Lizard Island. Living specimens are occasionally encountered.

Brizalina (?) striatula (CUSHMAN), 1922.
(Pl. 74, figs. 3-5).

+ 1922 Bolivina striatula; - CUSHMAN (Carnegie Inst. Publ. n° 311), p. 27, pl. 3, fig. 10.
1922 Bolivina striatula CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 3), p. 43.
1937 c Bolivina striatula CUSHMAN; - CUSHMAN, p. 154, pl. 18, figs. 30-31.
1942 Bolivina advena var. striatella CUSHMAN; - CUSHMAN & Mc CULLOCH, p. 187, pl. 21, figs. 7-11.
1947 Bolivina striatula CUSHMAN; - HÖGLUND, p. 266, pl. 24, fig. 4.
1954 Bolivina striatula CUSHMAN; - CUSHMAN, TODD & POST, p. 353, pl. 87, fig. 43.
1956 Bolivina striatula CUSHMAN; - HOFKER, p. 69, pl. 7, figs. 31-43.
1957 Bolivina striatula CUSHMAN; - TODD, p. 290 (tab), pl. 89, fig. 14.

1966 Brizalina semilineata; - BELFORD, p. 35, pl. 2, figs. 13-16.
1974 Bolivina striatula CUSHMAN; - LUTZE, p. 24, pl. 5, figs. 81-82; pl. 6, fig. 94.
1977 Bolivina striatula CUSHMAN; - BUZAS, SMITH & BEEM, pl. 2, figs. 5-10.
1979 Bolivina striatula CUSHMAN; - PEREIRA, pl. 26, figs. M-Q; pl. 27, figs. A-B.

Description : See CUSHMAN (1922, 1937 c).

Diagnostic Remarks and Distribution : Our specimens are fairly constant in shape. They are compressed, they have mostly an angular to subrounded periphery, they are prominently striate over the initial two-thirds of the test, and they are finely porous. The tests are translucent, thin-walled and at least in our material the last-formed chambers are frequently damaged.

This frequently recorded species seems to show a rather high degree of variability (length-width ratio, striation). All our specimens are biserial throughout and are tentatively placed here in the genus Brizalina; the "retral process"-effect which is sometimes visible externally may be just caused by the striation pattern. If this generic attribution proves to be justified, the species would fall into ZWEIG-STRYKOWSKI & REISS's subgenus B. (Brizalina) (although it is noticeable that BUZAS e.a. (1977) state that their Jamaican larger specimens show "a tendency for the final chamber to approach uniseriality" which would place the species into the subspecies Parabrizalina - or demonstrates the dangers of using such subgeneric concepts with regard to Foraminifera).

This species is apparently cosmopolitan; BELFORD's (1966) B. semilineata from the Pliocene of Papua and New Guinea obviously falls within the variation-range of B. striatula.

This species has, strangely enough, not been mentioned by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Highest frequencies are to be found in the Perireefal Area where empty tests as well as living specimens are present to common in most samples. Living specimens occur in three patchreef samples. The species is virtually absent from the coarse sediments of the shallow backreef areas but hardly occurs in the Lagoon either.

Brizalina convallaria (MILLETT), 1900.
(Pl. 74, figs. 6-8).

+ 1900 Bolivina convallaria; - MILLETT, p. 544, pl. 4, figs. 6a-b.
1915 Bolivina convallaria MILLETT; - H. ALLEN & EARLAND, p. 647.
1937 c Loxostoma convallaria (MILLETT); - CUSHMAN, p. 191, pl. 22, figs. 11-13.
1942 Loxostomum convallarium (MILLETT); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 37, pl. 10, figs. 6a-b.
1951 Bitubulogenerina convallaria (MILLETT); - HOFKER (Siboga, pt. 3), p. 181, figs. 115a-c.
1954 Loxostomum convallarium (MILLETT); - CUSHMAN, TODD & POST, p. 353, pl. 88, figs. 4-5.
1958 Loxostomum convallarium (MILLETT); - COLLINS, p. 395, pl. 5, fig. 2.
1959 Loxostomum convallarium (MILLETT); - GRAHAM & MILITANTE, p. 83, pl. 12, fig. 27.
1975 Brizalina (Pseudobrizalina) convallaria (MILLETT); - ZWEIG-STRYKOWSKI & REISS, p. 110, pl. 8, figs. 5-7.
1975 Bolivina durandii MILLETT; - SEIBOLD, p. 184, pl. 1, fig. 15.

Description : See MILLETT (1900), CUSHMAN (1937 c), ZWEIG-STRYKOWSKI & REISS (1975).

Diagnostic Remarks and Distribution : Two different variants are assembled here under the name convallaria; there seems to be a confusion between what is called Bolivina durandii MILLETT (by e.g. SEIBOLD, 1975) and "Loxostomum" convallarium (B. (Pseudobrizalina) convallaria (MILLETT)) by e.g. ZWEIG-STRYKOWSKY & REISS, 1975. The durandii-variant, as illustrated by SEIBOLD, is strongly flattened, is longitudinally costate (in the early test portion) to striate or smooth (in the later-formed chambers), shows few or no spines upon the chamber walls except for the lateral downward pointing end-spine of each chamber (in the later-formed chambers), has a strongly compressed, large, slitlike aperture and shows few, scattered, coarse pores. The convallaria-variant as described and illustrated by ZWEIG-STRYKOWSKY & REISS (1975) has a narrower overall shape, is less compressed and shows a slightly different ribs-and-spines pattern whereas its aperture is relatively larger and ovate-to rounded. The taxon described by HOFKER (1951) apparently shows features of both variants, viz. a

flattened "durandii"-like test but with a "convallaria"-like aperture (... "a more or less terminal opening") (HOFKER, 1951); the same is valid for the specimen illustrated by GRAHAM & MILITANTE (1959).

In our opinion and taking only the Lizard Island material into account, the two variants, present in our samples, represent the megalo- and microspheric generations of one species. The flattened variant with slitlike aperture has a much larger proloculus and fewer chambers for the same overall dimensions of the narrower, rounded variant with subrounded, terminal aperture, whereas the early-formed part in the latter variant shows the same or a similar costate pattern as in the first, compressed ("durandii"-) variant; the later-formed chambers in the narrower, less compressed variant show the same pore pattern as the flattened variant, consisting of few, relatively large, scattered pores whereas these chambers show strongly cut-off shoulders with downward pointing spines without definite costae, a feature typical of HOFKER's "Bitubulogenerina". The flattened ("durandii"-) variant (pl. 74, figs. 6a-b) represents the megalospheric generation whereas the elongate, less compressed variant (pl. 74, figs. 7a-c, 8) represents the microspheric generation. As none of the names "durandii" or "convallaria" had date priority over the other (both are created by MILLETT in 1900), I preferred the name convallaria for both variants in our material as this name is commonly used (by e.g. CUSHMAN and ZWEIG-STRYKOWSKY & REISS).

Several of the microspheric specimens in our material exhibit growth irregularities (growth direction changes).

According to ZWEIG-STRYKOWSKI & REISS (1975) this species should be classified in their subgenus B. (Pseudobrizalina).

Records are from Indopacific tropical reefal areas exclusively; COLLINS (1958) mentions the species from the Great Barrier Reef.

Occurrence : Present at several perireefal stations, rare. Occasionally encountered alive (e.g. in the Lagoon).

Genus Rectobolivina CUSHMAN, 1927.

Rectobolivina raphana (PARKER & JONES), 1865.
(Pl. 74, figs. 9-12).

+ 1865 Uvigerina (Sagrina) raphanus; - PARKER & JONES, p. 364, pl. 18, figs. 16-17.
1884 Sagrina raphanus PARKER & JONES; - BRADY, p. 585, pl. 75, figs. 21-24.
1913 Siphogenerina raphanus (PARKER & JONES); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3), p. 108, pl. 46, figs. 1-5; (+ div. publ. : 1921, 1922, 1924).
1942 Siphogenerina raphana (PARKER & JONES); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 55, pl. 15, figs. 6-9.
1949 Siphogenerina raphana (PARKER & JONES); - SAID, p. 34, pl. 3, fig. 26.
1950 Siphogenerina raphanus (PARKER & JONES); - ASANO, pt. 2; p. 14, figs. 56-57.
1951 Siphogenerina raphana (PARKER & JONES); - HOFKER (Siboga, pt. III), p. 233, figs. 155, 156.
1954 Siphogenerina raphana (PARKER & JONES); - CUSHMAN, TODD & POST , p. 356, pl. 88, figs. 23-24.
1956 Siphogenerina raphana (PARKER & JONES); - BHATIA, p. 21, pl. 1, figs. 6a-d.
1957 Siphogenerina raphana (PARKER & JONES); - TODD, p. 290 (tab.), pl. 89, figs. 12a-b.
1959 Siphogenerina raphanus (PARKER & JONES); - GRAHAM & MILITANTE, p. 87, pl. 13, fig. 8.
1960 Siphogenerina raphanus (PARKER & JONES); - BARKER (See ref. BRADY 1884).
L 1964 Rectobolivina raphana (PARKER & JONES); - LOEBLICH & TAPPAN, p. C 553, figs. 438/9-11; (?) Siphogenerina costata SCHLUMBERGER : - id, p. C 569, figs. 449/1-4.
1979 Rectobolivina raphana (PARKER & JONES); - PEREIRA, pl. 28, figs. A-E.

Description : See PARKER & JONES (1865); LOEBLICH & TAPPAN (1964) (lectotype).

Diagnostic Remarks and Distribution : See remarks by LOEBLICH & TAPPAN (1964), pp. C 553, C 569, on Rectobolivina raphana and Siphogenerina costata.

In the past these taxa have been alternatively considered to be conspecific or not; LOEBLICH & TAPPAN (1964) regard them as distinct species belonging to two different genera, Rectobolivina and Siphogenerina; these authors chose a lectotype for R. raphana, stating that specimens from the Indian Ocean type material show "up to 22 ribs and are either biserial in the early stage or uniserial troughout", whereas S. costata "has 5 or 6 costae, an early triserial microspheric stage, and a biserial early stage in the megalospheric form". Our Lizard Island specimens show an intermediate range of 7-8 to 12-13 longitudinal ribs and are mostly biserial in the early stage (costae are added in the younger chambers of larger specimens - see figs. 11-12, pl. 74). I have the feeling that the types of both R. raphana- and S. costata very likely only represent variational extremes of the same species although LOEBLICH & TAPPAN (1964) claim the contrary; the scarcity of our material does not permit any further conclusion. I provisionally maintained all Lizard Island specimens as Rectobolivina raphana. It should be noticed moreover that specimens belonging to the raphana-costata group have been listed in the literature under various names, such as Rectobolivina bifrons, Siphogenerina striata curta and possibly Siphogenerina paucicostata (e.g. Mc CULLOCH, 1977).

The geographical limits of the species are not clearly delimitated; the taxon might be cosmopolitan. Whether COLLINS's (1958) specimens listed as S. striata curta belong to the raphana-group is not obvious.

Occurrence : Rare; isolated specimens occur at several, mainly intertidal stations (reef flats). This is probably an intertidal species which is occasionally transported to the Perireefal Area. Living specimens have been met in one single patchreef sample (L 289).

Family BULIMINIDAE JONES, 1875.

Subfamily PAVONININAE EIMER & FICKERT, 1899.

Genus Mimosina MILLETT, 1900.

Mimosina echinata HERON-ALLEN & EARLAND, 1915.
(Pl. 75, figs. 1, 2).

+ 1915 Mimosina echinata; - H. ALLEN & EARLAND, p. 651, pl. 50, figs. 12-18.
1918 Mimosina echinata H. ALLEN & EARLAND; - SIDEBOTTOM, p. 128.
1945 Mimosina echinata H. ALLEN & EARLAND; - CUSHMAN, p. 44, pl. 7, figs. 20-22.
1958 Mimosina echinata H. ALLEN & EARLAND; - COLLINS, p. 391.

Description : See H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : Our specimens are in perfect accordance with H. ALLEN & EARLAND's (1915) description and figurations. The tests are small and fragile (the last-formed chamber is frequently broken away), and covered with coarse and finer spines as well as with low costae; the chamber walls are rather coarsely porous throughout.

This rarely reported species is apparently confined to Indopacific tropical to temperate shelf seas. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests are occasionally encountered in all habitats at Lizard Island; highest frequencies occur in the Perireefal Area. Living specimens are rare.

Genus Reussella GALLOWAY, 1933.

Reussella "simplex" (CUSHMAN), 1929.
(Pl. 75, figs. 3-5).

non 1929 Trimosina simplex; - CUSHMAN, p. 158, figs. 2a-b.
? 1942 Trimosina simplex CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 44, pl. 12, figs. 7a-b.
1945 Reussella simplex (CUSHMAN); - CUSHMAN, p. 40, pl. 7, figs. 5a-b.
? 1951 Reussella weberi; - HOFKER (Siboga, pt. III), p. 170, figs. 106-109.
1954 Reussella simplex (CUSHMAN); - CUSHMAN, TODD & POST, p. 354, pl. 88, figs. 1-2.
? 1956 Reussella weberi HOFKER; - HOFKER, p. 50 etc., pl. 5, fig. 3, diagr. 2; ? R. neapolitana HOFKER; id, p. 50 etc., pl. 5, fig. 2, diagr. 2.
1957 Reussella simplex (CUSHMAN); - TODD, p. 290 (tab), pl. 89, fig. 23.

? 1958 Reussella spinulosa (REUSS); - COLLINS, p. 390.

1959 Reussella aculeata CUSHMAN; - GRAHAM & MILITANTE, p. 85, pl. 13, fig. 2, 3 (?).

? 1973 Reussella pacifica CUSHMAN & Mc CULLOCH; - LANKFORD & PHLEGER, p. 127, pl. 4, fig. 13.

1975 Reussella simplex (CUSHMAN); - SEIBOLD, p. 187, pl. 4, fig. 6a-c.

1977 Reussella spinulosa (REUSS); - HAAKE, p. 69, pl. 2, fig. 20.

1979 Reussella simplex (CUSHMAN); - PEREIRA, pl. 29, figs. G-K.

Description : See CUSHMAN (1945); see notes by HOFKER (1951, 1956).

Diagnostic Remarks and Distribution : The systematics of the Reussella-group are highly obscure; the group urgently needs a complete restudy. The nomenclature creates confusion to such an extent that the currently used names lose all meaning. The situation has changed little since HOFKER's (1951, 1956) comments. This author distinguished several recent genera based mainly upon toothplate morphology, test robustness and -elongation, porosity and suture incision. In his 1956 paper (Santa-Cruz and Thatch-Islands) HOFKER hints at the close relationship and possible identity of R. simplex, R. aculeata and R. weberi, yet, at the same time creates two new recent species : R. mortensi and R. neapolitana, of which at least the Mediterranean R. neapolitana shows many similarities with the simplex-group. Many citations in literature of "R. spinulosa", (in reality a European Tertiary species) belong to some of the "species" quoted above. HOFKER continued to call R. weberi, the Pacific specimens called simplex by CUSHMAN and his Anglo-saxon followers.

Moreover Reussella aequa (CUSHMAN & Mc CULLOCH, 1948) seems to be identical with R. weberi HOFKER. Finally the types of CUSHMAN's (1929) Trimosina simplex have been demonstrated by LOEBLICH & TAPPAN (1962) not to belong to Reussella; these authors made T. simplex CUSHMAN the generotype of their newly created genus Fijiella (see also LOEBLICH & TAPPAN, 1964).

As this systematic survey is not the adequate occasion to solve the problem in a definitive way (a larger-scale comparative study of the entire group would be necessary for that purpose) I have tentatively conserved the name "simplex" for our Lizard Island Reussella's; this is only a temporary solution. Future research might reveal the necessity of using HOFKER's name Reussella weberi for our Lizard Island "simplex" specimens.

Our specimens vary in the robustness of the test and in the length of the spines whereas some specimens are more elongate and more irregularly-shaped than others. Abrasion obviously removes the spines, leaving only blunt chalky bosses. Fresh specimens are coarsely perforated (except for poreless zones near the sutures), they show a denticulate toothplate and are translucent.

The exact geographical limits cannot be given for the species (or group of species) (see discussions by HOFKER - 1951, 1956). COLLINS (1958) reports the taxon as R. spinulosa from the Great Barrier Reef, whereas the species reported as R. spinosissima by COLLINS might fall within the variation range of the simplex-group.

Occurrence : Rare to common in the shallow backreef areas of the reef complex; common to abundant in the Perireefal Area. Living specimens are frequently encountered.

Genus Trimosina CUSHMAN, 1927.

Trimosina milletti CUSHMAN, subsp. multispinata COLLINS, 1958.
(Pl. 75, figs. 6a, b; pl. 76, figs. 1-2).

\+ 1958 Trimosina milletti CUSHMAN, subsp. multispinata; - COLLINS, p. 391, pl. 4, fig. 12.
1974 Trimosina P 3; - LUTZE, p. 28, pl. 6, fig. 105.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens correspond completely with COLLINS's (1958) description and figuration. The "fringe of short spines on the lower margin of all the chambers, except the last 2 or 3" (COLLINS, p. 391) is a characteristic feature of this species.

The specimens figured and listed as Trimosina P 3 by LUTZE (1974) from the Persian Gulf obviously belong here.

Because of insufficient recording, the geographical limits of this subspecies cannot be determined; it might be confined to the Indopacific. COLLINS's types are from the Great Barrier Reef.

Occurrence : Rare; isolated empty tests occur occasionally at some peri-reefal- and patchreef-stations.

Family UVIGERINIDAE HAECKEL, 1894.

Genus Siphouvigerina PARR, 1950.

Siphouvigerina ampullacea (BRADY), 1884.
(Pl. 76, figs. 3-5).

+ 1884 Uvigerina asperula CZJZEK var. ampullacea; - BRADY, p. 579, pl. 75, figs. 10-11.
1897 Uvigerina asperula CZJZEK, var. ampullacea BRADY; - FLINT, p. 320, pl. 68, fig. 5.
1893 Uvigerina ampullacea BRADY; - EGGER, p. 313, pl. 9, fig. 37.
1913 Uvigerina ampullacea BRADY; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 3), p. 102, figs. 3a-b.
1921 Uvigerina ampullacea BRADY; - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 274, pl. 55, fig. 7.
1923 Uvigerina ampullacea BRADY; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 4), p. 162, pl. 42, figs. 5-6.
1942 Uvigerina ampullacea BRADY; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 46, pl. 13, figs. 2-6.
1949 Uvigerina ampullacea BRADY; - SAID, p. 31, pl. 3, fig. 21.
1951 Neouvigerina ampullacea BRADY; - HOFKER (Siboga, pt. III), p. 208, figs. 135-138.
1954 Uvigerina ampullacea BRADY; - CUSHMAN, TODD & POST, p. 355, pl. 84, fig. 19.
1959 Uvigerina ampullacea BRADY; - GRAHAM & MILITANTE, p. 89, pl. 13, fig. 11.
1960 Neouvigerina ampullacea (BRADY); - BARKER (see ref. BRADY, 1884).

Description : See BRADY (1884), CUSHMAN (1913), HOFKER (1951).

Diagnostic Remarks and Distribution : The name ampullacea is used here in the sense of HOFKER (1951) who recognised a great variability range in his specimens belonging to three generations. Specimens developing

uniserial chambers are not present in our material, and surface textures range from almost smooth, over finely hispid, to very coarsely granulated in one specimen (fig. 5, pl. 76). Test shapes range from more or less inflated to elongate; I am aware of the fact that several of our specimens could be attributed to different species if they were isolatedly considered; variational extremes indeed show specimens which appear to be related to S. asperula (as HOFKER, 1951, states : "B-generation : the shell showed relatively large spines which gave the shell the total aspect of Neouvigerina asperula") or S. interrupta (HOFKER : "A_2-generation : in fullgrown specimens two chambers may be added in uniserial arrangement, which gives the type of Neouvigerina interrupta"). All our specimens show the "spiral" toothplate typical for the species, described by HOFKER (1951). The possibility of S. ampullacea, S. asperula, S. interrupta and U. (S.?) proboscidea being ecophenotypic variants of one species is to be considered seriously. The scarcity of our material does not allow any further conclusion.

Occurrence : Rare; some isolated empty tests have been encountered at several perireefal stations. Living specimens are rare.

Genus Siphogenerina SCHLUMBERGER, 1883.

Siphogenerina virgula (BRADY), 1879.
(Pl. 77, figs. 1-3).

+ 1879 Sagrina virgula; - BRADY, p. 275, pl. 8, figs. 19-21.
1884 Sagrina virgula BRADY; - BRADY, p. 583, pl. 76, figs. 4-10.
1893 Siphogenerina (Sagrina) virgula (BRADY); - EGGER, p. 318, pl. 9, fig. 27.
1915 Sagrina virgula BRADY; - H. ALLEN & EARLAND, p. 676, pl. 51, figs. 4-5.
1924 Siphogenerina virgula (BRADY); - CUSHMAN, p. 29, pl. 8, figs. 3-4.
1942 Siphogenerina virgula (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 3), p. 52, pl. 15, figs. 2-3.
1949 Siphogenerina virgula (BRADY); - SAID, p. 34, pl. 3, fig. 25.
1951 Rectobolivina virgula (BRADY); - HOFKER (Siboga, Pt. III), p. 93, figs. 52a-h.
1958 Siphogenerina virgula (BRADY); - COLLINS, p. 392, pl. 4, figs. 13a-c.

1959 Siphogenerina (?) virgula (BRADY); - GRAHAM & MILITANTE, p. 88, pl. 13, fig. 9.
1960 Rectobolivina (?) virgula (BRADY); - BARKER (See ref. BRADY 1884).

Description : See BRADY (1879, 1884), CUSHMAN (1924), HOFKER (1951).

Diagnostic Remarks and Distribution : See also remarks by HOFKER (1958), COLLINS (1958), BARKER (1960). There is a great deal of uncertainty as to the generic attribution of this species which has been regarded by HOFKER as a true Rectobolivina (based upon the inner morphology-toothplate). COLLINS (1958) did not discern the rudimentary toothplate observed by HOFKER and rejected the latter author's generic attribution, at the same time hinting at the relationship with Siphonodosaria. Our material is rather scarce and for the time being I agree with COLLINS's statement that "it is perhaps best to retain this species in Siphogenerina pending further revision".

This species seems to be confined to the Indopacific and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to moderately common in the Eastern and Southern Perireefal Area. No living specimens have been met and the delicate spines on the apertural lip of each chamber are most often partly or completely broken away.

Superfamily DISCORBACEA EHRENBERG, 1838.

Family DISCORBIDAE EHRENBERG, 1838.

Subfamily CONORBININAE HOFKER, 1954 (nom. transl. REISS, 1963).

Genus Neoconorbina HOFKER, 1951.

Neoconorbina terquemi (RHEZAK), 1888.
(Pl. 77, figs. 9-11).

1876 Rosalina orbicularis; - TERQUEM, pt. 2, p. 166, pl. 9, figs. 4a-b.
1884 Discorbis orbicularis (TERQUEM); - BRADY, p. 647, pl. 88, figs. 4-8.

+ 1888 Discorbina terquemi; - RHEZAK, p. 228 (Geol. Reichsanst. Verh. Wien).
1893 Discorbina orbicularis (TERQUEM); - EGGER, p. 197, pl. 15, figs. 16-18, 76-78.
1915 Discorbis orbicularis (TERQUEM); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 16, tfs. 18a-c, pl. 11, figs. 1a-c.
1921 Discorbis orbicularis (TERQUEM); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 305.
1922 Discorbis orbicularis (TERQUEM); - CUSHMAN (Carnegie Inst. Publ. N° 311), p. 38, pl. 5, fig. 10.
1931 Discorbis orbicularis (TERQUEM); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 8), p. 27, pl. 6, figs. 3a-c.
1949 Discorbis orbicularis (TERQUEM); - BERMUDEZ, p. 239, pl. 15, figs. 31-33.
1949 Discorbis orbicularis (TERQUEM); - SAID, p. 35, pl. 3, fig. 35.
1951 Discopulvinulina orbicularis (TERQUEM); - ASANO, pt. 14, p. 6, figs. 41-43.
1953 Rosalina orbicularis TERQUEM; - BERMUDEZ, p. 34, pl. 3, figs. 5a-c.
1957 Discorbis orbicularis (TERQUEM); - TODD, p. 290 (tab), pl. 90, figs. 12a-c.
1958 Rosalina orbicularis TERQUEM; - COLLINS, p. 403.
1959 Rosalina terquemi (RHEZAK); - GRAHAM & MILITANTE, p. 98, pl. 14, figs. 13-14a-c.
1960 Neoconorbina terquemi (RHEZAK); - (et sp.) : BARKER (see ref. BRADY 1884).
1963 Conorbina terquemi (RHEZAK); - REISS, p. 58, pl. 5, fig. 15.
1964 Neoconorbina terquemi (RHEZAK); - LOEBLICH & TAPPAN, p. C 582, figs. 457/5a-c.
1971 Neoconorbina terquemi (RHEZAK); - HOFKER, p. 1, pl. 55, figs. 1-8.
1973 Neoconorbina terquemi (RHEZAK); - BROOKS, pl. 412, figs. 7-8.
1973 Neoconorbina sp. cf. N. terquemi (RHEZAK); - LANKFORD & PHLEGER, p. 123, pl. 4, fig. 23.
1975 Neoconorbina terquemi (RHEZAK); - LEVY e.a., p. 174, pl. 2, figs. 2-3.
1979 Neoconorbina terquemi (RHEZAK); - LEVY e.a., p. 76, pl. 4, figs. 42, 43, 46, 47.
1979 Neoconorbina terquemi (RHEZAK); - PEREIRA, pl. 31, figs. J-M.

Description : See TERQUEM (1876), BRADY (1884), RHEZAK (1888), CUSHMAN (1915).

Diagnostic Remarks and Distribution : Extensive comments upon the validity of the genus Neoconorbina are to be found in the literature (see e.g. HOFKER (1951), REISS (1963), LOEBLICH & TAPPAN (1964)). HOFKER (1951) created the genus but did not describe the terquemi (orbicularis)-species. Subsequently the genus Neoconorbina has been put in synonymy with Rosalina and Conorbina. Here I follow LOEBLICH & TAPPAN (1964) who stated that Neoconorbina is different from the above mentioned genera.

The species is apparently cosmopolitan in tropical shelf seas; it has been reported by COLLINS (1958) from the Great Barrier Reef, as Rosalina orbicularis.

Occurrence : Rare to common in all environments at Lizard Island. Living specimens are occasionally encountered.

Neoconorbina sp. aff. N. pacifica HOFKER, 1951.
(Pl. 77, figs. 4-8).

\+ 1951 Neoconorbina pacifica; - HOFKER (Siboga, Pt. III), p. 438, figs. 302, 303.

? 1951 Neoconorbina neapolitana n. sp.; - HOFKER, id., p. 438, figs. 300, 301.

Description : See HOFKER (1951).

Diagnostic Remarks and Distribution : In our material several specimens occur which are different from N. terquemi (see above). They agree almost perfectly with HOFKER's (1951) description and illustrations of his N. pacifica; our specimens however do not invariably possess a smooth ventral surface without deuteropores but on the contrary show a variability ranging from specimens with hardly visible ventral deuteropores (e.g. fig. 8, pl. 77) toward specimens with well-developed, coarse ventral deuteropores (e.g. fig. 7, pl. 77); the latter phenomenon is a characteristic feature of HOFKER's Mediterranean species N. neapolitana which does not seem that different from N. pacifica in shape and chamber arrangement. Our material procures conclusive evidence for ventral deuteropores not necessarily needing always to be present in one single species; even in a restricted area important variations may occur. This is why I hint at the possibility that pacifica and neapolitana possibly belonging to one and the same species; this should however be checked upon Mediterranean material.

Occurrence : Extremely rare in the intertidal- and shallow bachreef environments; rare to common in the Perireefal Area. Living specimens are extremely rare.

Subfamily BAGGINAE CUSHMAN, 1927.

Genus Cancris de MONTFORT, 1808.

Cancris auriculus (FICHTEL & MOLL), 1798.
(Pl. 78, figs. 1a-d).

+ 1798 Nautilus auricula var; - FICHTEL & MOLL, p. 108, pl. 20.
1826 Rotalia (Rotalie) brogniartii; - d'ORBIGNY, p. 273.
1903 Pulvinulina brogniartii (d'ORBIGNY); - MILLETT, p. 498, pl. 10, figs. 4a-c.
1921 Pulvinulina auricula (FICHTEL & MOLL); - CUSHMAN, (U.S.N. Mus. Bull. 100, vol. 4), p. 329, pl. 69, figs. 3a-c.
1942 Cancris auriculus (FICHTEL & MOLL); - CUSHMAN & TODD, pt. 4, p. 74, pl. 18, figs. 1-11; pl. 23, figs. 6a-c.
1946 Cancris auriculus (FICHTEL & MOLL); p. 14, pl. 3, figs. 12-14.
1949 Cancris auriculus (FICHTEL & MOLL); - SAID, p. 38, pl. 4, fig. 9.
1951 Cancris auriculus (FICHTEL & MOLL); - ASANO, pt. 14, p. 19, figs. 144-145.
1958 Cancris auriculus (FICHTEL & MOLL); - COLLINS, p. 408.
1959 Cancris auriculus (FICHTEL & MOLL); - GRAHAM & MILITANTE, p. 91, pl. 23, figs. 18a-b.
1964 Cancris auriculus (FICHTEL & MOLL); - LOEBLICH & TAPPAN, p. C 586, fig. 462/3a-c.
1971 Cancris auricula (FICHTEL & MOLL); - MURRAY, p. 137, pl. 57, figs. 1-7.
non 1973 Cancris auriculus (FICHTEL & MOLL); - LANKFORD & PHLEGER, p. 116, pl. 4, fig. 21.
1974 Cancris auriculus (FICHTEL & MOLL); - LUTZE, p. 29, pl. 6, figs. 108-109.
1979 Cancris auriculus (FICHTEL & MOLL); - PEREIRA, pl. 33, figs. E-F.

Description : See CUSHMAN (1921), CUSHMAN & TODD (1942).

Diagnostic Remarks and Distribution : The few specimens in our material correspond with the author's descriptions and figurations. LUTZE (1974) hints at the possibility of C. auriculus and C. oblonga being identical, which we cannot confirm here because of the lack of oblonga-specimens in our material. C. auriculus is clearly different, larger and more compressed than C. sagra with which it has sometimes been confused and which I observed in Atlantic material (coll. BRASIER, Caribbean, Barbuda; coll. MONTY, Bahamas).

C. auriculus is cosmopolitan and occurs in tropical, temperate and even subarctic shelf seas (e.g. the Barents Sea - MURRAY, 1971). The type material is from the Italian Pliocene. The species has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; isolated specimens (often alive !) are occasionally encountered at several perireefal stations, in one patchreef sample and at the Lagoon Entrance.

Subfamily DISCORBINAE EHRENBERG, 1838.

Genus Discorbis LAMARCK, 1804.

Discorbis mira CUSHMAN, 1922.
(Pl. 78, figs. 3-5).

1884 Discorbina turbo BRADY (not d'ORBIGNY); - BRADY, p. 642, pl. 87, figs. 8a-c.

1915 Discorbis turbo (d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 10, pl. 11, figs. 2a-c, tfs. 9a-c.

\+ 1922 Discorbis mira; - CUSHMAN (Carnegie Inst. Publ. n° 311), p. 39, pl. 6, figs. 10-11.

1931 Discorbis mira CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 8), p. 25, pl. 5, figs. 5-6.

1949 Discorbis mira CUSHMAN; - BERMUDEZ, p. 239, pl. 15, figs. 28-30.

1957 Discorbis mira CUSHMAN; - TODD, p. 278, 290 (tab), pl. 82, figs. 6a-c; pl. 90, figs. 5a-c.

1958 Discopulvinulina mira (CUSHMAN); - COLLINS, p. 403.

1959 Discorbis mirus CUSHMAN; - GRAHAM & MILITANTE, p. 93, pl. 13, figs. 23a-c.

1960 Discorbina (?) mira (CUSHMAN); - BARKER (see ref. BRADY 1884).
1964 Rotorbinella mira (CUSHMAN); - HOFKER, n° 21, p. 107, figs. 258-260.
1973 Discorbis mirus CUSHMAN; - BROOKS, pl. 10, figs. 1-2.
1973 Gavelinopsis sp. cf. G. mira (CUSHMAN); - LANKFORD & PHLEGER, p. 120, pl. 5, fig. 16.
1979 Discorbis mira CUSHMAN; - LEVY e.a., p. 73, pl. 2, figs. 20-25; pl. 3, figs. 26-31.
1979 Trochulina mira (CUSHMAN); - PEREIRA, pl. 30, figs. G-K.
1979 Discorbis mira CUSHMAN; - BLANC-VERNET e.a., pl. 22, figs. 14-15.

Description : See BRADY (1884), CUSHMAN (1922), LEVY e.a. (1979).

Diagnostic Remarks and Distribution : Here again the generic attribution of this species is somewhat doubtful; mira has been placed successively in the genera Discorbina, Discorbis, Rotorbinella, Trochulina, Discopulvinulina and Gavelinopsis. I personally tended to agree with LANKFORD & PHLEGER who placed the species in Gavelinopsis (an umbilical chalky knob is present in most specimens), but LEVY e.a. (1979) showed North Sea specimens of this species to be true Discorbis; this has been emphasized moreover by one of the co-authors of that paper (ROSSET-MOULINIER, oral communication, Hull symposium, 1980). The latter authors moreover contest the validity of the genera Trochulina and Rotorbinella whereas Discorbina has been put in synonymy with Discorbis by LOEBLICH & TAPPAN (1964).

D. mira is an apparently cosmopolitan species and occurs in Atlantic as well as in Indopacific tropical reefal areas and is also present in temperate shelfseas as well as in the Mediterranean. The species has been reported by COLLINS (1958) as Discopulvinulina mira from the Great Barrier Reef.

Occurrence : Highest frequencies of this species are to be found on Coconut Fringing Reef Flat where it is common (to abundant, e.g. L 249); on the other reef flats the species is considerably less frequent. The rather solid tests are often transported towards deeper bottoms after death (Patch-reefs, Perireefal Area).

Discorbis subvesicularis COLLINS, 1958.
(Pl. 78, figs. 6, 7; pl. 79, figs. 1, 2).

+ 1958 Discorbis subvesicularis; - COLLINS, p. 401, pl. 5, figs. 5a-c.
1979 Discorbis subvesicularis COLLINS; - PEREIRA, pl. 30, figs. C, D;
Discorbis sp. 1 : id, pl. 30, figs. E, F.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : See extensive comments by COLLINS (1958). This small species, belonging to the vesicularis-dimidiatus group has been described by COLLINS from the Great Barrier Reef; its presence on the Eastern African reefs (PEREIRA, 1979) hints at a possibly wide Indopacific distribution.

Occurrence : Scattered occurrence in most environments at Lizard Island; abundant in L 254 (backreef area, Windward Barrier). Living specimens are extremely rare.

Genus Gavelinopsis HOFKER, 1951.

Gavelinopsis sp. aff. G. lobatulus (PARR), 1950.
(Pl. 79, figs. 3-4).

+ 1884 Discorbina isabelleana (not Rosalina isabelleana d'ORBIGNY);- BRADY, p. 646, pl. LXXXVIII, fig. 1.
+ cf 1950 Discorbis lobatulus; - PARR, p. 354, pl. XIII, figs. 23-25.
? 1957 Gavelinopsis lobatulus(PARR);- VELLA, p. 36.
? 1958 Discopulvinulina lobatula(PARR);- COLLINS, p. 403.

Remarks : Specimens resembling PARR's (1950) species have been found in several perireefal samples. The periphery is carinate to subangular in the last-formed chambers, the dorsal sutures are limbate and strongly curved, the ventral ones are nearly straight to slightly curved. PARR states that his specimens (from off Tasmania) have mostly 5 chambers in the last coil but he depicts a specimen having 6 chambers in the last coil. Most of our specimens are provided with a distinct umbilical knob whereas

the aperture is bordered by a distinct hooked umbilical flap as in G. hamatus VELLA and G. campanulata (GALLOWAY & WISSLER) (as illustrated by LANKFORD & PHLEGER, 1973, pl. 5, figs. 13); PARR's illustration does not show these flaps and this author does not mention them either in his descriptions. Our specimens generally have 6 chambers in the last coil; the dorsal side of the test is very finely punctate (pores hardly visible at high magnification) whereas the ventral side is coarsely perforated. These are differences with G. campanulata which has 7-8 chambers in the last coil and a smooth ventral side; the latter species moreover is more strongly trochospirally coiled.

Our specimens belong without doubt to a Gavelinopsis-species; the specific attribution however is tentative.

G. lobatulus has been mentioned by COLLINS (1958) from the Great Barrier Reef.

Subfamily ROSALININAE REISS, 1963.

Genus Rosalina d'ORBIGNY, 1826.

Rosalina orientalis (CUSHMAN), 1925.
(Pl. 79, figs. 5-6).

1915 Discorbis globularis d'ORBIGNY (toothed variety); - H. ALLEN & EARLAND, p. 694, pl. LI, figs. 36-39.
+ 1925 Discorbis orientalis; - CUSHMAN, p. 130.
1958 Rosalina orientalis (CUSHMAN); - COLLINS, p. 404.
1979 Rosalina sp. 1; - PEREIRA, pl. 32, figs. D-E.

Description : See H. ALLEN & EARLAND (1915), CUSHMAN (1925).

Diagnostic Remarks and Distribution : See also notes by COLLINS (1958). Our specimens are variable in shape and test compression; the "non-tubulate blebs" (COLLINS, 1958) (tooth-like inwardly-pointing processes on the inner margin of the chambers in the umbilicus) are mostly well visible; this feature as well as the rounded chamber periphery discern the species from R. globularis and related species which generally show a flatter test and a more angled to almost carinate periphery.

This species apparently has a wide Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Common in all environments at Lizard Island; in intertidal areas the species reaches its highest frequencies (e.g. L 258 - Windward Barrier). Living specimens are commonly encountered.

Family EPONIDIDAE HOFKER, 1951.

Genus Neoeponides REISS, 1960.

Neoeponides sp. aff. N. berthelotianus (d'ORBIGNY), 1839.
(Pl. 81, figs. 1a-c).

+ 1839 Rotalina berthelotiana; - d'ORBIGNY, p. 130, pl. 1, figs. 31-33.
1884 Pulvinulina berthelotiana (d'ORBIGNY); - BRADY, p. 701, pl. 106, figs. 1a-c.
1960 Eponides berthelotianus (d'ORBIGNY); - BARKER (see ref. BRADY 1884).
1966 Neoeponides berthelotianus (d'ORBIGNY); - BELFORD, p. 117, pl. 17, figs. 1-6.
1977 Eponides berthelotianus (d'ORBIGNY); - HUGHES, pl. 3, figs. 85-87.

Description : See d'ORBIGNY (1839), BRADY (1884).

Diagnostic Remarks, Distribution and Occurrence : See also notes by BELFORD (1966). Only one single empty, abraded test of this heavily-built species with strongly thickened, limbate sutures on the ventral side, has been found in sample L 82 (Eastern Perireefal Area). I express some doubt as to the attribution because of the scarcity of the material and the bad state of conservation of the damaged test.

The species has been recorded from the Miocene deposits of New Guinea by BELFORD (1966); BRADY's (1884) figured specimen is also from New Guinea whereas HUGHES (1977) reports the species from the Solomon Ids.. COLLINS does not report it from the Great Barrier Reef.

Genus Poroeponides CUSHMAN, 1944.

Note : In our Lizard Island material this highly variable group shows at the same time : a) a complete variation range, from specimens without scattered openings on the apertural face (referable to E. repandus), via typical Poroeponides cribrorepandus (scattered openings restricted to the nonporous, subtriangular apertural face s.s.), to Poroeponides lateralis (openings scattered over the entire ventral side of the extended last-formed chamber).

b) a variability in diameter of these openings (from fine, hardly visible openings to large, coarse holes) and

c) another one in test robustness (from thin, flat, fragile tests - at least as far as the last few chambers are concerned - to solid, heavily-built specimens with strongly limbate sutures).

As these variabilities are obviously environment-controlled, I consider them as ecophenotypic variants of the same species. At the same occasion I would express doubts as to the validity of the genus Poroeponides as a genus distinct from Eponides, but as I am aware of the necessity of a thorough revision of the genera belonging to the Eponides-group I will leave this matter untouched.

Poroeponides lateralis (TERQUEM), subsp. cribrorepandus ASANO & UCHIO, 1951. (Pl 80, figs. 1-5).

+ 1951 Poroeponides cribrorepandus ASANO & UCHIO; - ASANO, pt. 14, p. 18, figs. 134-135.

1954 Poroeponides cribrorepandus ASANO & UCHIO; - CUSHMAN, TODD & POST, p. 360, pl. 89, figs. 24-25.

1957 Poroeponides cribrorepandus ASANO & UCHIO; - TODD, p. 290 (tab); pl. 93, figs. 9a-c.

1959 Poroeponides cribrorepandus ASANO & UCHIO; - GRAHAM & MILITANTE, p. 96, pl. 14, figs. 8a-c.

1973 Poroeponides cribrorepandus ASANO & UCHIO; - LANKFORD & PHLEGER, p. 125, pl. 4, fig. 25.

Description : See ASANO (1951).

Diagnostic Remarks and Distribution : See note, p. 203. This is the variant strongly resembling Eponides repandus (indeed, some specimens do not show a cribrate apertural face) though its sutures are generally more definitely limbate than in the latter species; specimens are often very solidly built. The resemblance with E. repandus has been observed by GRAHAM & MILITANTE (1959) too, in their Philippine study.

Occurrence : Specimens of this variant are present in all environments at Lizard Island but probably preferentially live on reef flats and intertidal high-energy environments; perireefal specimens are always abraded and seem to be derived from the formerly mentioned areas; moreover frequencies of empty tests are much higher in the intertidal areas than in the deeper-water environments. Living specimens of this variant occur in the Perireefal Area; they are always small and might be juveniles of subsp. lateralis s.s..

Poroeponides lateralis s.s. (TERQUEM), 1878.
(Pl. 80, figs. 6-7).

+ 1878 Rosalina lateralis; - TERQUEM, p. 25, pl. 2, figs. 11a-c.
1884 Pulvinulina lateralis (TERQUEM); - BRADY, p. 689, pl. 106, figs. 2-3.
1915 Pulvinulina lateralis (TERQUEM); - H. ALLEN & EARLAND, p. 714, pl. 53, figs. 6-11.
1921 Pulvinulina lateralis (TERQUEM); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 336, pl. 69, figs. 2a-c.
1944 Poroeponides lateralis (TERQUEM); - CUSHMAN, p. 34, pl. 4, figs. 23a-b.
1949 Poroeponides lateralis (TERQUEM); - SAID, p. 36, pl. 4, fig. 3.
1951 Poroeponides lateralis (TERQUEM); - ASANO, pt. 14, p. 18, figs. 136-137.
1952 Poroeponides lateralis (TERQUEM); - BERMUDEZ, p. 42, pl. 4, figs. 10 a-c.
1956 Poroeponides lateralis (TERQUEM); - BHATIA, p. 23, pl. 3, figs. 3-5.
1958 Poroeponides lateralis (TERQUEM); - COLLINS, p. 406.
1959 Poroeponides lateralis (TERQUEM); - GRAHAM & MILITANTE, p. 96, pl. 14, figs. 9a-c.
1960 Poroeponides lateralis (TERQUEM); - BARKER (see ref. BRADY 1884).
1964 Poroeponides lateralis (TERQUEM); - LOEBLICH & TAPPAN, p. C 683, fig. 546/5a-c.

Description : See TERQUEM (1878), BRADY (1884), CUSHMAN (1944).

Diagnostic Remarks and Distribution : See note, p. 203. This is the more flattened and fragile, mostly subtidal subspecies with openings scattered over the entire ventral side of the mostly elongated last-formed chamber. This phenomenon might be the result of secondary wall resorption as a function of reproductive processes; this should be verified in the future. Intermediates between this variant and cribrorepandus can however be found in our material.

Occurrence : Specimens of this variant have been found in deeper water (Perireefal Area); they are absent from the shallow- and/or turbulent intertidal areas such as patchreefs and reef-flats where lateralis is replaced by the stouter cribrorepandus.

Family GLABRATELLIDAE LOEBLICH & TAPPAN, 1964.

Note : The (recent) species belonging to the Glabratellidae are, in my opinion, insufficiently known and studied and their systematics confusing on generic as well as on specific level. The entire group needs to be thoroughly restudied from biological as well as palaeontological viewpoints. Particularly the generic subdivision of the group as reinstated by SEIGLIE & BERMUDEZ (1965 a, b) (see also LOEBLICH & TAPPAN, 1974) seems unsatisfactory to me as our Lizard Island material alone already shows the vagueness of generic limits and the (hitherto) undescribed variability of finer ventral structures (ribs and ornaments) in a single "genus" (e.g. Glabratella). Particularly the separation between the so-called genera Glabratella, Pileolina (reinstated by SEIGLIE & BERMUDEZ, 1965 !) and Angulodiscorbis is ill-defined and might be inexistant when ecovariability is taken into account. For all these reasons I have used the most current generic designations of the glabratellid species, but bearing in mind that I contest this nomenclature's eventual correspondance with a biological reality.

Genus Glabratella DORREEN, 1948.

Glabratella hexacamerata SEIGLIE & BERMUDEZ, 1965.
(Pl. 81, figs. 2-3).

+ 1965 Glabratella hexacamerata; - SEIGLIE & BERMUDEZ, p. 31, pl. 1, figs. 6-7.

Description : See SEIGLIE & BERMUDEZ (1965).

Diagnostic Remarks and Distribution : See note above; the few specimens at our disposal correspond with SEIGLIE & BERMUDEZ's description and figurations; the dorsal side is corrugated (irregularly hexagonal or pentagonal pits, somewhat as in several planctonic species); the ventral side is provided with (relatively few and broad) radial grooves enlarging towards the umbilicus. An aperture s.s. has not been observed.

This is the first Indopacific report of the species, though its relationship and eventual identity with G. globigeriniformis should be cleared up in the future.

Occurrence : Very rare; a few isolated empty tests have been encountered in the Lagoon, in the Patchreef Area and in one perireefal sample.

Glabratella (?) patelliformis (BRADY), 1884.
(Pl. 81, figs. 4-7; pl. 82, fig. 1).

+ 1884 Discorbina patelliformis; - BRADY, p. 647, pl. 88, figs. 3a-c; pl. 89, figs. 1a-c.
1915 Discorbis patelliformis (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 17, pl. 5, figs. 5a-c, tfs. 19a-c.
1952 Conorbella patelliformis (BRADY); - BERMUDEZ, p. 37, pl. 3, figs. 12a-c.
1958 Conorbella patelliformis (BRADY); - COLLINS, 1958.
1960 Pileolina (?) patelliformis (BRADY); - BARKER (see ref. BRADY 1884).
1965 Pileolina patelliformis (BRADY); - SEIGLIE & BERMUDEZ, p. 44, pl. 10, figs. 4a-b.
1979 Angulodiscorbis patelliformis (BRADY); - PEREIRA, pl 33, figs. N-Q; pl. 34, figs. A-D.

Description : See BRADY (1884), CUSHMAN (1915), SEIGLIE & BERMUDEZ (1965).

Diagnostic Remarks and Distribution : See note, p. 205; this species has successively been placed in the genera Discorbina, Discorbis, Conorbella,

Pileolina and Angulodiscorbis by previous authors. According to LOEBLICH & TAPPAN's criteria, the attribution to Angulodiscorbis (as did PEREIRA, 1979) would be correct but the problem then becomes : what are the essential differences between Pileolina (Glabratella) and Angulodiscorbis (without even mentioning Glabratellina !) (Our specimens of A. quadrangularis indeed do not show raised costae on the dorsal side - see below). This is why I have used the provisory generic denomination Glabratella, awaiting further study of the group.

Our Lizard Island specimens display a considerable variability in the heigth of the spire but are otherwise rather constant in shape; the aperturral face is entirely radially grooved; the interspace between the grooves shows concentrical constrictions, giving rise to a corrugated, bubbled pattern which is more explicit near the umbilicus; this groove-pattern continues (though much less explicit and hardly visible under the binocular microscope) upon the dorsal side of the test, masking the sutures. The periphery is slightly rounded to subangular (not keeled). In most cases (except postplastogamic specimens) the umbilical aperture can hardly or not be discerned. Plastogamic pairs are often encountered.

The species is a typical Indopacific one and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : This is a shallow-water species characterising the reef flats, Lagoon and patchreefs and their finer algal coatings where living specimens are common. Empty tests are occasionally transported towards deeper water.

Genus Angulodiscorbis UCHIO, 1952.

Angulodiscorbis quadrangularis UCHIO, 1952.
(Pl. 82, figs. 2-3).

\+ 1952 Angulodiscorbis quadrangularis; - UCHIO, p. 156, pl. 7, figs. 4a-c.
1964 Angulodiscorbis quadrangularis UCHIO; - LOEBLICH & TAPPAN, p. C 589, fig. 466.

Description : See UCHIO (1952).

Diagnostic Remarks and Distribution : See note, p. 205; our Lizard Island specimens are roughly pyramidally-shaped, except for the last few chambers which generally are more rounded in outline. The periphery is angular but there is no trace of a peripheral keel nor of ribs or costae on the dorsal side; the ventral side is grooved in exactly the same way as in G. patelliformis, species to which A. quadrangularis seems to be closely related anyhow.

UCHIO's types are from Japan; this species seems to be widely distributed in the Indopacific but has not been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : As for G. patelliformis, but quadrangularis is relatively rare at Lizard Island.

Family EPISTOMARIIDAE HOFKER, 1954.

Genus Epistomaroides UCHIO, 1952.

Note on Epistomaroides polystomelloides (PARKER & JONES) and Epistomaroides punctatus (SAID).

The systematical status of these species (or variants of one single species ?) is very complicated at present. See also notes and comments by H. ALLEN & EARLAND (1915), COLLINS (1958), LOEBLICH & TAPPAN (1964), HOFKER (1971). Specimens of E. polystomelloides have often erroneously been referred to several other species (e.g. to "Epistomaroides rimosus" (= Epistomaria rimosa) by GRAHAM & MILITANTE (1959)). Several authors have commented upon the great variability of Epistomaroides polystomelloides and upon the occasional presence of very large, heavily ornamented specimens from various localities (COLLINS, 1958). In my opinion, and taking only the Lizard Island material in account, it is obvious that the variability range of E. polystomelloides covers smaller, unornamented specimens (with simpler intraseptal cavities - see HOFKER, 1971) as well as larger specimens covered with exogenous growth, possessing more complex intraseptal cavities and well-developed sutural bridges. I consider SAID's E. punctatus to represent the first, unornamented variant of E. polystomelloides; both variants occur in our material though the more or less heavily ornamented specimens are largely predominant. Some intermediates occur as well. As a conclusion I would state (as I did in a first version of this text) that our Lizard Island material

provides sufficient evidence to consider E. polystomelloides and E. punctatus as ecovariants of the same species. As this is moreover only a confirmation of the views of LOEBLICH & TAPPAN (1964) who designated a lectotype for E. polystomelloides, illustrating two specimens from the same locality (Lord Howe Island, Australia) : the one unornamented ("punctatus"-variant, fig. 1) and the other heavily ornamented ("polystomelloides"-variant, fig. 2), there would have been no problem about the suppression of the name "punctatus" as a specific designation, as the name "polystomelloides"would have had date priority anyhow.

Nevertheless, HANSEN & RÖGL (1980) concluded about "Epistomaria punctata" SAID (1949) being identical with Anomalina punctulata d'ORBIGNY (1826). As a result of these investigations the name "polystomelloides" should no longer have systematic value and the lectotype designated by LOEBLICH & TAPPAN should be invalidated. As moreover the ornamented "polystomelloides"-variant is absent from the Gulf of Elat (HOTTINGER, 1983, personal communication) and possibly from the entire Red Sea, it seems necessary to put the entire Epistomaroides-problem in a broader context. As the nomenclatural problem has been presented to the ICZN (Internation Commission for Zoological Nomenclature) (see HANSEN & RÖGL, 1980) I have provisionally reintroduced both the current names polystomelloides and punctatus herein awaiting the results of the Commission work. It should be remembered that in all thanatocoenose counts and tables (Part 1) both variants are treated together as E. polystomelloides.

Epistomaroides polystomelloides s.s. (PARKER & JONES), 1865.
(Pl. 82, figs. 6-7).

(+) 1865 Discorbina polystomelloides; - PARKER & JONES, p. 421, pl. 19, fig. 8.
1884 Discorbina polystomelloides PARKER & JONES; - BRADY, p. 652, pl. 91, fig. 1.
1915 Discorbina polystomelloides PARKER & JONES; - H. ALLEN & EARLAND, p. 698, pl. LIII, figs. 19-23.
1954 Epistomaroides polystomelloides (PARKER & JONES); - CUSHMAN, TODD & POST, p. 360, pl. 89, fig. 26.
1957 Epistomaroides polystomelloides (PARKER & JONES); - TODD, p. 290 (tab), pl. 93, figs. 10a-c.

1958 Epistomaroides polystomelloides (PARKER & JONES); - COLLINS, p. 410.

1959 Epistomaroides rimosus (PARKER & JONES); - GRAHAM & MILITANTE, p. 94, pl. 14, figs. 4a-c.

1960 Epistomaroides polystomelloides (PARKER & JONES); - BARKER (see ref. BRADY 1884).

(L) 1964 Epistomaroides polystomelloides (PARKER & JONES); - LOEBLICH & TAPPAN, p. C 594, fig. 473/1-3.

1971 Epistomaroides polystomelloides (PARKER & JONES); - HOFKER, pt. III, p. 4, pl. 57, fig. 10a; figs. 11-14; pl. 58, figs. 1-3; pl. 76, figs. 2, 4.

Description : See PARKER & JONES (1865), BRADY (1884); see notes by LOEBLICH & TAPPAN (1964).

Diagnostic Remarks and Distribution : See note, p. 208. This is the more or less heavily ornamented variant of the polystomelloides-punctatus group. It has a wide Indopacific distribution. The original "type"material (PARKER & JONES, 1865) is from the Northern Great Barrier Reef; LOEBLICH & TAPPAN's "lectotype" is from Lord Howe Island, Australia. This variant has most often been reported from tropical reefal areas; it has also been reported from the Southern Australian Pliocene.

Occurrence of both variants of the polystomelloides-punctatus group together: Both variants occur in all environments at Lizard Island but highest frequencies (of empty tests) are to be noted in intertidal areas (e.g. reef flats, particularly Coconut Reef Flat). Living specimens are occasionally encountered; they are particularly numerous in sample L 77 (lower reef front terrace, Coconut Fringing Reef).

Epistomaroides polystomelloides (PARKER & JONES), subsp. punctatus (SAID), 1949.
(Pl. 82, figs. 4-5).

(+) 1949 Epistomaria punctata; - SAID, p. 37, pl. 4, fig. 23.

1971 Epistomaroides punctatus (SAID); - HOFKER, pt. III, p. 4, pl. 57, figs. 3-10, 10b; pl. 79, figs. 2, 4, 6.

1979 Epistomaroides punctata (SAID); - PEREIRA, pl. 34, figs. N-Q.

Description : See SAID (1949).

Diagnostic Remarks and Distribution : See note, p. 208.
This is the smooth, unornamented variant. Its distribution seems to be more widely extended in the Indopacific than that of the ornamented variant which might be totally absent from the entire Northern Province (Persian Gulf - Red Sea).

Occurrence : See above (E. polystomelloides s.s.).

Family SIPHONINIDAE CUSHMAN, 1927.

Genus Siphonina REUSS, 1850.

Siphonina tubulosa CUSHMAN, 1924.
(Pl. 83, figs. 2-4).

1884 Truncatulina reticulata (CZJZEK); - BRADY, p. 669, pl. 96, figs. 5-7.
1951 Siphonina reticulata (BRADY); - HOFKER, p. 369, fig. 251.
+ 1924 Siphonina tubulosa; - CUSHMAN (Carnegie Inst. Publ. 342), p. 40, pl. 13, figs. 1-2.
1954 Siphonina tubulosa CUSHMAN; - CUSHMAN, TODD & POST, p. 361, pl. 89, figs. 29-30.
1957 Siphonina tubulosa CUSHMAN; - TODD, p. 290 (tab), pl. 91, figs. 6a-c.
1958 Siphonina tubulosa CUSHMAN; - COLLINS, p. 413.
1960 Siphonina tubulosa CUSHMAN; - BARKER (see ref. BRADY 1884).
1979 Siphonina spp.; - PEREIRA, pl. 34, figs. G, J; Siphoninoides echinatus (BRADY); - id, pl. 34, fig. L (not fig. K).

Description : See CUSHMAN (1924).

Diagnostic Remarks and Distribution : Commenting upon S. reticulata (BRADY), HOFKER (1951, p. 369) believes that "that fossil form, together with many others, is only a geologic (geographic) variety of the living one, and that there is only one single species living now, as well in the Pacific as in the West Indian area". Further on, this author puts CUSHMAN's species

tubulosa, philippinensis and bradyana in synonymy with the fossil S. reticulata. As I have insufficient material at hand, no significant comments can be added hereto for the time being and therefore I have used CUSHMAN's name tubulosa for our Lizard Island specimens though I personally tend to believe that HOFKER's designation might be quite justified.

S. tubulosa has a wide Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef. If HOFKER's conclusions will turn out to be justified, then S. reticulata (including tubulosa) would have a cosmopolitan distribution; it already occurs in the Miocene.

Occurrence : Rare at several perireefal and one lagoonal station. Only empty tests.

Genus Siphoninoides CUSHMAN, 1927.

Siphoninoides echinatus (BRADY), 1879.
(Pl. 83, figs. 5-7; pl. 84, fig. 1).

\+ 1879 Planorbulina echinata; - BRADY, p. 283, pl. 8, figs. 31a-c.
1884 Truncatulina echinata (BRADY); - BRADY, p. 670, pl. 96, figs. 9-14.
1915 Truncatulina echinata (BRADY); - H. ALLEN & EARLAND, p. 711, pl. 53, fig. 1; - Truncatulina glabra; - id, p. 711, pl. LII, figs. 41-47.
1924 Siphonina echinata (BRADY); - CUSHMAN (Carnegie Inst. Publ. 342), p. 40, pl. 12, fig. 8.
1931 Siphoninoides echinatus (BRADY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 8), p. 71, pl. 14, figs. 6a-b.
1949 Siphoninoides echinatus (BRADY); - SAID, p. 38, pl. 4, fig. 6.
1957 Siphoninoides echinatus (BRADY); - TODD, p. 290 (tab), pl. 91, figs. 7a-b.
1958 Siphoninoides echinatus (BRADY); - COLLINS, p. 413; Siphoninoides glabrus (H. ALLEN & EARLAND); - id, p. 413.
1960 Siphoninoides echinatus (BRADY); - BARKER (see ref. BRADY 1884).
1979 Siphonina spp.; - PEREIRA, pl. 34, fig. H; Siphoninoides echinatus (BRADY); - id, pl. 34, fig. K.

Description : See BRADY (1879, 1884), CUSHMAN (1924).

Diagnostic Remarks and Distribution : In our material the typical coarsely spinose and punctate specimens occur as well as the smooth ("glabra") specimens and some intermediates. Consequently I decided to put S. glabrus in synonymy with echinatus as both forms apparently fall within the variation range of a single species.

This species has a wide Indopacific distribution and both S. echinatus and S. glabrus have been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; irregularly present in most environments at Lizard Island; absent from the Lagoon. Living specimens are extremely rare.

Family AMPHISTEGINIDAE CUSHMAN, 1927.

Genus Amphistegina d'ORBIGNY, 1826.

Note : The amphisteginids constitute a very important and well-represented group in our Lizard Island material and in tropical reefal areas in general. The systematics of this group have been extremely confuse (see e.g. BARKER, 1960) and specific attributions varied according to the personal tastes of the authors until, recently, LARSEN (e.a.) (see synonymies and references) cleared up at least the systematic position of the most important Indopacific amphisteginids as they appeared in the Red Sea (Gulf of Elat). LARSEN's descriptions cover the most important Indopacific species; most of these have been recognised in our material; I dit not take into account two of LARSEN's species : A. bicirculata and A. gibbosa. Some specimens of these species seem to be present in our material but these I have systematically included in A. lessonii because I had already finished most of my counts before I discovered LARSEN's publications; my determinations were in agreement with LARSEN's findings except for the bicirculata- and gibbosa-species which I had not separated in my material. Subsequent investigation however showed that these are rare in the Lizard Island samples anyway.

For extensive synonimies I refer to LARSEN (1976).

Amphistegina lessonii d'ORBIGNY, 1826, emend. LARSEN, 1976.
(Pl. 84, figs. 2-4).

+ 1826 Amphistegina lessonii; - d'ORBIGNY, p. 304 (Mod. N° 98).
1976 Amphistegina lessonii d'ORBIGNY; - LARSEN (emend.), p. 2, pl. 1, figs. 1-5; pl. 7, fig. 1; pl. 8, fig. 1.
1977 Amphistegina lessonii d'ORBIGNY; - LARSEN & DROOGER, fig. 1/2a-b.

Description : See LARSEN (1976).

Diagnostic Remarks and Distribution : See LARSEN (1976). This is the plano- to biconvex species which in our material always remains smaller and relatively more flattened than A. lobifera. The species is easily distinguishable from the other amphisteginids by the "alar prolongations complicating the sutural pattern on the spiral side" in adult specimens.

A. lessonii seems to have a cosmopolitan distribution in tropical reefal areas; the species is widely distributed throughout the Great Barrier Reef, as the "De MOOR"-expedition samples (coll. MONTY) indicate, though COLLINS (1958) only mentions "A. radiata, a designation which likely covers several other species as well".

Occurrence : A. lessonii is common to abundant in most perireefal samples, but is absent or extremely rare in intertidal samples. Living specimens are common; in one sample on the edge of the Patchreef Area (L 155), living specimens of both A. lessonii- and A. lobifera occur together; otherwise the limit between the habitats of both species is rather strict, at least at Lizard Island (see Part 1).

Amphistegina lobifera LARSEN, 1976.
(Pl. 84, figs. 5-6).

+ 1976 Amphistegina lobifera; - LARSEN, p. 4, pl. 3, figs. 1-5; pl. 7, fig. 3; pl. 8, fig. 3.
1977 Amphistegina lobifera LARSEN; - LARSEN & DROOGER, figs. 1/1a, b.

Description : See LARSEN (1976).

Diagnostic Remarks and Distribution : LARSEN's diagnosis "an Amphistegina with highly lobate sutures, supplementary chambers blurred by the lobes" is also perfectly suitable to our Lizard specimens; they are invariably thicker and more inflated than the lessonii-specimens. This is the species frequently referred to, in the past, as A. madagascariensis; it apparently has a wide Indopacific distribution and, according to LARSEN and to BLANC-VERNET, 1969, this species is the dominant Amphistegina in the Mediterranean. Whether it is present in the West-Indies or not, is not clear. Personal observations ("DE MOOR"-samples) showed that this species is abundant throughout the Great Barrier Reef.

Occurrence : A. lobifera is extremely abundant on the reef flats and in the shallow backreef environments (e.g. Patchreef Area). Living specimens occur over there in large numbers in the algal cover (see Part 1). Transported empty tests are frequently encountered in the Perireefal Area.

Amphistegina cf. papillosa SAID, 1949, emend. LARSEN, 1976.
(Pl. 84, figs. 7-9).

\+ 1949 Amphistegina radiata var. papillosa; - SAID, p. 39, pl. 4, fig. 12.
1976 Amphistegina papillosa SAID; - LARSEN (emend.), p. 8, pl. 4, figs. 1-5; pl. 7, fig. 4; pl. 8, fig. 4.
1977 Amphistegina papillosa SAID; - LARSEN & DROOGER, fig. 1/4 a, b.

Description : See SAID (1949), LARSEN (1976).

Diagnostic Remarks and Distribution : This papillate species can easily be distinguished from the other amphisteginids in our material. The species is always more flattened and never reaches the large dimensions of A. lessonii occurring in the same samples. Nevertheless some doubt concerning the attribution is to be expressed; typical A. papillosa are generally larger than our specimens and possess a much narrower marginal zone where the sutures (septa) are bent more sharply backwards. SAID's Red Sea types are from a depth of almost 1000 m; A. papillosa is in general a deeper-water species though HOTTINGER found typical A. papillosa in material from New Caledonia, - 50 m reef slope (personal communication, 1983). Our Lizard Island specimens,occurring in shelf depths of maximally - 40 m, might represent a shallower-water ecovariant of A. papillosa.

A. papillosa has a wide Indopacific distribution and occurs throughout the Great Barrier Reef ("DE MOOR"-samples), but has not been mentioned by COLLINS (1958).

Occurrence : This species is common in most perireefal samples but is slightly less frequent than the accompanying A. lessonii. It is completely absent from intertidal areas. Living specimens are common.

Amphistegina radiata (FICHTEL & MOLL), 1798, emend. LARSEN, 1976.
(Pl. 85, figs. 1-2).

\+ 1798 Nautilus radiatus; - FICHTEL & MOLL, p. 58, tab. 8, a-d.
1976 Amphistegina radiata(FICHTEL & MOLL);- LARSEN (emend.), p. 7, pl. 5, figs. 1-4; pl. 6, figs. 1-2; pl. 7, fig. 5; pl. 8, fig. 5.

Description : See LARSEN (1976).

Diagnostic Remarks and Distribution : This large, flattened species characterised by radial sutures sharply angled near the periphery and by its short interseptae, is easily distinguishable from the other amphisteginids occurring in our material.

The species apparently has a wide Indopacific distribution; LARSEN (1976) hints at the possible identity of this species with A. hauerina from the Vienna Basin. COLLINS (1958) mentions A. radiata from the Great Barrier Reef but, as already stated, it is not clear what taxa are meant by this author.

Occurrence : This species occurs occasionally in several perireefal samples; a few worn, empty tests have also been encountered in one lagoonal and one reef flat sample. Living specimens are rare; most of the empty tests are very large and show varying degrees of abrasion.

Family CIBICIDIDAE CUSHMAN; 1927.

Genus Planulina d'ORBIGNY, 1826.

Planulina plana BELFORD, 1966.
(Pl. 85, figs. 3-4).

+ 1966 Planulina plana; - BELFORD, p. 122, pl. 10, figs. 14-19.

Description : See BELFORD (1966).

Diagnostic Remarks and Distribution : Our specimens correspond fairly well with BELFORD's(1966)description and figurations though there is some variation in our material as to the curving and limbateness of the sutures and the evoluteness of the ventral side; the number of chambers in the last whorl indeed never exceeds 9, even in the larger specimens. In BELFORD's specimens the ventral pores are "fine, sparse and irregularly distributed, at first usually at periphery, later over entire ventral chamber wall, but not observed on all specimens ..."; our specimens are very finely porous over most of the ventral side. A great deal of our specimens show narrow areas of nonporous clear shall substance at the sutures, the periphery and the oral structures.

P. wuellersdorfi has more strongly curved sutures which are more strongly limbate; its ventral side is almost completely nonporous and entirely involute.

BELFORD's types are from the Mio-Pliocene of New Guinea and this author states that "several specimens referrable to this species are in a slide from "Challenger" station 185, at 155 fathoms, but the species was not figured by BRADY (1884)". Otherwise this species has not been reported from the Great Barrier Reef. GRAHAM & MILITANTE (1959) illustrate a specimen from the Philippines as Cibicides boueanus (ORBIGNY) (pl. 19, fig. 11) which might belong to the present species.

Occurrence : The species is rare to common in the Perireefal Area and occurs in some lagoonal samples. Living specimens are extremely rare.

Subfamily CIBICIDINAE CUSHMAN, 1927.

Genus Cibicides DE MONTFORT, 1808.

Cibicides cf. aravaensis PERELIS & REISS, 1975.
(Pl. 85, figs. 5-6).

+ 1975 Cibicides aravaensis; - PERELIS & REISS, p. 93, pl. 8, figs. 1-7; pl. 9, figs. 1-4; fig. 7.

Description : See PERELIS & REISS (1975).

Diagnostic Remarks and Distribution : The main characteristics of this species are the acute periphery, the "coarsely and uniformly perforated spiral side", the umbilical side "without or with only a few scattered pores"; an umbilical knob is present. In our material the thickness of the chalky knob is variable whereas it is sometimes not easy distinguishing this species from some variants of C. pseudolobatulus. As the pores of the spiral side are, as a rule, slightly coarser than those present in the type material, some doubt persists as to the attribution.

This species strongly resembles C. mabaheti SAID as well as C. "pseudoungeriana" CUSHMAN (as interpreted by authors) (for discussion : see PERELIS & REISS (1975), BELFORD (1966)) and finally I wonder whether all these are variants of the same species or not.

The types are from the Red Sea (Gulf of Elat).

Occurrence : Scattered; living specimens as well as empty tests occur in most environments, from reef flats to Perireefal Area.

Cibicides lobatulus (WALKER & JACOB), 1798.
(Pl. 85, fig. 7; pl. 86, figs. 1-4).

1975 Cibicides lobatulus (WALKER & JACOB); - PERELIS & REISS, p. 76, pl. 1, figs. 1-6.

For further, extensive synonymy : see PERELIS & REISS, 1975, p. 76.

Description : See e.g. CUSHMAN (div. publ.),HOFKER (1960) (See PERELIS & REISS, 1975).

Diagnostic Remarks and Distribution : See also PERELIS & REISS (1975). Specimens of this sessile species are often irregularly coiled in our material and show substratum-induced growth deformations. The species is characterised by its angular, lobulate periphery, few chambers in the last whorl (5-7) and completely involute "umbilical" side with shallow (if any) umbilicus (The umbilical side being the free, nonattached side

which structurally might be in reality the dorsal, "spiral" side). Large specimens often occur.

This cosmopolitan species occurs already in the European Tertiary and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : This species is particularly common in the Eastern Perireefal Area where the specimens live attached to the Halimeda-thalli. Elsewhere the species is absent or very rare. Living specimens are occasionally encountered.

Cibicides pseudolobatulus PERELIS & REISS, 1975.
(Pl. 86, figs. 5-6; pl. 87, figs. 1-2).

1975 Cibicides pseudolobatulus; - PERELIS & REISS, p. 77, pl. 4, figs. 1-7; fig. 3.

Description : See PERELIS & REISS (1975).

Diagnostic Remarks and Distribution : According to PERELIS & REISS, this species differs from C. lobatulus "in being smaller, in having a more regular general shape, smaller and irregularly distributed on the umbilical side perforation, as well as in having chambers which overlap in the umbilical area and do not meet in the areas around the umbilical depression ...". Juveniles of C. lobatulus are often difficult to distinguish from the present species.

The types of this species are from the Red Sea (Gulf of Elat).

Occurrence : Living specimens as well as empty tests are common in the Perireefal Area. Empty tests occur sporadically on the reef flats, in the Lagoon and in the Patchreef Area.

Genus Caribbeanella BERMUDEZ, 1952.

Caribbeanella elatensis PERELIS & REISS, 1975.
(Pl. 87, figs. 3-6).

+ 1975 Caribbeanella elatensis; - PERELIS & REISS, p. 94, pl. 11, figs. 1-7; pl. 12, figs. 1-6; fig. 9.

Further synonymy : See PERELIS & REISS, 1975.

Description : See PERELIS & REISS (1975).

Diagnostic Remarks and Distribution : This coarsely perforated species provided with secondary sutural apertures in marginal and dorsal position is very variable in shape in our material and apparently adapts itself to the substrate in the same way as C. lobatulus together with which it occurs. PERELIS & REISS (1975) stated that this species is identical with the variant figured as C. lobatulus by GRAHAM & MILITANTE (1959) from the Philippines, with which I can agree. This enhances the probability of C. elatensis having (at least) a wide Indopacific distribution.
This is the first record of this species from the Great Barrier Reef.

Occurrence : Parallel to the occurrence of C. lobatulus but less frequent. Living specimens are occasionally encountered. A few specimens occur in two patchreef samples.

Family PLANORBULINIDAE SCHWAGER, 1877.

Genus Planorbulina d'ORBIGNY, 1826.

Planorbulina acervalis BRADY, 1884.
(Pl. 88, figs. 1-3).

\+ 1884 Planorbulina acervalis; - BRADY, p. 657, pl. 92, fig. 4.
1897 Planorbulina acervalis BRADY; - FLINT, p. 328, pl. 72, fig. 7.
1915 Planorbulina acervalis BRADY; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 29, tf. 32, pl. 14, fig. 1.
1931 Planorbulina acervalis BRADY; - CUSHMAN (U.S.N. Mus. Bull. 104), pt. 8, p. 130, pl. 25, figs. 1a-b.
1949 Planorbulina acervalis BRADY; - SAID, p. 43, pl. 4, fig. 28.
1954 Planorbulina acervalis BRADY; - CUSHMAN, TODD & POST, p. 372, pl. 91, figs. 34-36.
1957 Planorbulina acervalis BRADY; - TODD, p. 279, 292 (tabs.), pl. 84, fig. 10; pl. 92, figs. 13a-b.
1958 Planorbulina acervalis BRADY; - COLLINS, p. 423.

1959 Planorbulina acervalis BRADY; - GRAHAM & MILITANTE, p. 118, pl. 19, figs. 16a, b.

1960 Planorbulina acervalis BRADY; - BARKER (see ref. BRADY, 1884).

1973 Planorbulina mediterranensis d'ORBIGNY; - BROOKS, p. 412, pl. 9, figs. 10, 15.

1973 Planorbulina acervalis BRADY; - LANKFORD & PHLEGER, p. 124, pl. 6, figs. 22-24.

1975 Planorbulina acervalis BRADY; - WANTLAND, p. 397, fig. 11 d.

1977 Planorbulinella acervalis(BRADY);- BUZAS, SMITH & BEEM, p. 100, pl. 7, figs. 19-21.

Description : See BRADY (1884), CUSHMAN (1915).

Diagnostic Remarks and Distribution : This encrusting species is easily distinguishable from other planorbulinids (planorbulinellids) by its often irregularly twisted planoconvex shape and rather irregular addition of chambers.

This species has a cosmopolitan distribution in tropical to temperate shelf seas and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to common; free specimens occur in all habitats at Lizard Island, except for the Lagoon.

Genus Planorbulinella CUSHMAN, 1927.

Planorbulinella larvata (PARKER & JONES), 1865.
(Pl. 88, figs. 4-5).

+ 1865 Planorbulina larvata; - PARKER & JONES, p. 379, pl. 19, figs. 3a-b.

1884 Planorbulina larvata PARKER & JONES; - BRADY, p. 658, pl. 92, figs. 5-6.

1915 Planorbulina larvata PARKER & JONES; - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 27, pl. 8, figs. 2a-c.

1924 Planorbulina larvata PARKER & JONES; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 37, pl. 11, fig. 5.

1927 Planorbulina larvata PARKER & JONES; - HOFKER (Siboga, pt. I), p. 6, pls. 1-2.

1927 Planorbulinella larvata (PARKER & JONES); - CUSHMAN , p. 96, pl. 20, figs. 9a-b.

1941 Planorbulinella larvata (PARKER & JONES); - LE ROY, pt. 1, p. 47, pl. 3, fig. 43; pt. 2, p. 89, pl. 5, fig. 39.

1949 Planorbulinella larvata (PARKER & JONES); - SAID, p. 44, pl. 4, fig. 27.

1957 Gypsina vesicularis (PARKER & JONES); - TODD, pl. 93, figs. 16 a, b (nog fig. 17).

1959 Planorbulinella larvata (PARKER & JONES); - GRAHAM & MILITANTE, p. 118, pl. 19, figs. 17 a, b.

1960 Planorbulinella larvata (PARKER & JONES); - BARKER (see ref. BRADY, 1884).

1964 Planorbulinella larvata (PARKER & JONES); - LOEBLICH & TAPPAN, p. C 694, fig. 563/1, 2.

1977 Planorbulinella larvata (PARKER & JONES); - THOMAS, pl. 1, figs. 1-2; pl. 2, figs. 3-4; textfig. 11/b; pl. 3, figs. 1-2.

Description : See PARKER & JONES (1865), CUSHMAN (1915).

Diagnostic Remarks and Distribution : THOMAS (1977), on the basis of biometrical data on dissected specimens from various localities, distinguishes two species, viz. P. larvata (PARKER & JONES) and P. elatensis THOMAS, which are hardly or not discernable on external features only, as the author admits. Therefore all our specimens have been grouped under the name larvata though the possibility of P. elatensis being present at the Great Barrier Reef remains to be checked.

P. larvata has a wide Indopacific distribution but has not been reported by COLLINS (1958) from the Great Barrier Reef; THOMAS (1977) states that P. elatensis has up to now exclusively been found in the Gulf of Elat, Red Sea (is this an endemic population within the larvata-group ?).

Occurrence : Rare; isolated empty tests have been encountered in all habitats at Lizard Island.

Family ACERVULINIDAE SCHULTZE, 1854.

Genus Gypsina CARTER, 1877.

Gypsina globulus (REUSS), 1847.
(Pl. 89, figs. 1-4).

+ 1847 Ceriopora globulus; - REUSS, p. 33, pl. 5, fig. 7.
1860 Orbitolina vesicularis; - PARKER & JONES, v.6, n° 5, p. 31.
1877 Gypsina vesicularis (PARKER & JONES); - CARTER, p. 173.
1884 Gypsina globulus (REUSS); - BRADY, p. 717, pl. 101, fig. 8; Gypsina vesicularis (PARKER & JONES); - id, pl. 101, figs. 9-12.
1921 Gypsina globulus (REUSS); - CUSHMAN (U.S.N. Mus. Bull. 100, pt. 4), p. 360.
1949 Gypsina globulus (REUSS); - SAID, p. 44, pl. 4, fig. 24.
1954 Gypsina globulus (REUSS); - CUSHMAN, TODD & POST, p. 373, pl. 91, fig. 39.
1957 Gypsina vesicularis (PARKER & JONES); - TODD, p. 292 (tab.), pl. 93, figs. 16, 17.
1958 Gypsina vesicularis (PARKER & JONES); - COLLINS, p. 424; Sphaerogypsina globulus (REUSS); - id, p. 424.
1959 Gypsina globulus (REUSS); - GRAHAM & MILITANTE, p. 117, pl. 19, fig. 15.
1960 Gypsina vesicularis (PARKER & JONES); Sphaerogypsina globulus (REUSS); - BARKER (see ref. BRADY 1884).
1964 Gypsina vesicularis (PARKER & JONES); - LOEBLICH & TAPPAN, p. C 694, figs. 567/1, 2; Sphaerogypsina globulus (REUSS); - id, p. C 698, figs. 569/1, 2.
? 1973 Gypsina vesicularis (PARKER & JONES); - BROOKS, pl. 8, fig. 10.
1975 Gypsina vesicularis (PARKER & JONES); - WANTLAND, p. 397, fig. 12 c.
1979 Gypsina vesicularis (PARKER & JONES); - PEREIRA, pl. 42, figs. F-H.
1979 Sphaerogypsina vesicularis (PARKER & JONES); - BLANC-VERNET, CLAIREFOND & ORSOLINI, pl. 23, fig. 7.

Description : See REUSS (1847), PARKER & JONES (1860).

Diagnostic Remarks and Distribution : See also LOEBLICH & TAPPAN (1964). The two taxa mentioned in the synonymy are the flattened to dome-shaped

vesicularis and the completely spherical globulus; the latter has been separated into a new genus, Sphaerogypsina, by GALLOWAY (1933), seperation which has been maintained by LOEBLICH & TAPPAN (1964).

Our Lizard Island specimens show all these variations (flattened, dome-shaped or irregular lenticular, spherical) and it is quite obvious that only one single species is concerned here; it shows an equal pattern of vesicular, subrounded to polygonal perforated chambers surrounded by imperforate rims which are linked to each other by short chalky bridges and which stand in relief upon an imperforate chalky mass. As a result I reject the genus Sphaerogypsina which is only a substratum-conditioned ecophenotypical variation within Gypsina (spherical growth around a nucleus instead of upon a flat substratum; the nepiont itself may act as a nucleus). The name globulus has been retained here as specific designation because of its datum priority over the name vesicularis.

This species, in its extended meaning, is cosmopolitan; it has been reported under both designations by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Isolated empty tests of the different shapes occur in all habitats at Lizard Island. No living specimens have been encountered. Most frequent in the Perireefal Area where living specimens also occur.

Family CYMBALOPORIDAE CUSHMAN, 1927.

Note : After redaction of this chapter, it has been brought to my attention that a very important thesis on Cymbaloporidae has been written by RÜCKERT-HILBIS in 1983, and that an illustrated summary of this thesis has appeared in Tübinger Micropal. Mitt. 1, 1-65, 8 pls. As it was too late for a convenient adaptation of the present chapter in my own thesis I have left my text unchanged here though I will try to review the chapter for future publication.

Genus Cymbaloporella CUSHMAN, 1927.

Cymbaloporella tabellaeformis (BRADY), 1884.
(Pl. 90, figs. 1-5).

+ 1884 Cymbalopora tabellaeformis; - BRADY, p. 637, pl. 102, figs. 15-18.
1893 Cymbalopora tabellaeformis BRADY; - EGGER, p. 382, pl. 18, figs. 54-55.
1924 Cymbalopora tabellaeformis BRADY; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 35, pl. 10, figs. 5-7.
1927 a Cymbaloporella tabellaeformis (BRADY); - CUSHMAN, p. 81, pl. 17, fig. 7.
1933 Cymbaloporella tabellaeformis (BRADY); - CUSHMAN (Cushman Lab. For.Res. Sp. Publ. N° 5), p. 252, pl. 32, figs. 16-17.
1949 Cymbaloporella tabellaeformis (BRADY); - SAID, p. 41, pl. 4, fig. 15.
1958 Cymbaloporella tabellaeformis (BRADY); - COLLINS, p. 419.
1959 Cymbaloporella tabellaeformis (BRADY); - GRAHAM & MILITANTE, p. 107, pl. 18; figs. 1a-c.
1960 Cymbaloporella tabellaeformis (BRADY); - BARKER (see ref. BRADY 1884).
1964 Cymbaloporella tabellaeformis (BRADY); - LOEBLICH & TAPPAN, p. C 699, fig. 570/2.
1979 Cymbaloporella tabellaeformis (BRADY); - PEREIRA, pl. 42, figs. J-M.

Description : See BRADY (1884).

Diagnostic Remarks and Distribution : This flattened to almost discoidal species shows numerous chambers, often partly broken away, on its ventral side. Smaller specimens are easily confused with larger Cymbaloporetta bradyi. This species apparently has an exclusive Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Isolated empty tests occur in reef-flat samples but the species is most frequent in the Perireefal Area, where living specimens are also present.

Genus Cymbaloporetta CUSHMAN, 1928.

Cymbaloporetta gr. bradyi (CUSHMAN).
(Pl. 91, figs. 1-6; pl. 92, figs. 1a-b).

Note : Under this heading are grouped all the specimens traditionally referred to as C. bradyi (CUSHMAN), Tretomphalus bulloides (d'ORBIGNY) and its variants.

Synonymy : For extensive synonymy up to 1959, I refer to GRAHAM & MILITANTE (1959), pp. 108-109.

1951 Cymbaloporetta bulloides (d'ORBIGNY); Cymbaloporetta bradyi (CUSHMAN); - HOFKER (Siboga, pt. III), p. 477 etc.; figs. 327, 328, 329, 331.

1958 Cymbaloporetta bradyi (CUSHMAN); Tretomphalus milletti (H. ALLEN & EARLAND); Tretomphalus planus CUSHMAN; Tretomphalus clarus CUSHMAN; - COLLINS, pp. 419-420.

1968 Cymbaloporetta bradyi (CUSHMAN); - ALBANI, p. 116, pl. 10, figs. 15, 17-19.

1971 Tretomphalus bulloides (d'ORBIGNY); T. bulloides, concinnus-forms; id, planus-form; id, grandis-form; id, milletti-form; - TODD, pp. 165-167, pl. 1.

1973 Cymbaloporetta sp. cf. C. milletti (H. ALLEN & EARLAND); - LANKFORD & PHLEGER, p. 118, pl. 6, figs. 7, 8.

1979 Cymbaloporetta bradyi (CUSHMAN); Cymbaloporetta sp. 1; Humprysella nyaliensis n. sp.; Naylorella milletti (H. ALLEN & EARLAND); - PEREIRA, pl. 42, figs. N-Q; pl. 43, figs. A-Q; pl. 44, figs. A-B.

Descriptions : See BRADY (1884), CUSHMAN (1915).

Diagnostic Remarks and Distribution : See comments by HOFKER (1951), TODD (1971). The "bradyi"-group is here composed of the bradyi s.s.-form (Cymbaloporettiform with most often 4 chambers entirely visible at the ventral side) and the "Tretomphalus"-forms (T. bulloides which is composed of the concinnus, planus, grandis- and milletti-forms, (morpho ?)-species that were considered by CUSHMAN (div. publ.) as distinct species and by TODD (1971) as variants of T. bulloides. Hofker however (1951) had already twenty years before TODD concluded to the identity of C. bradyi with Tretomphalus; within this group he distinguished only two species, viz. Cymbaloporetta bulloides and C. bradyi. The Tretomphalus-forms were considered by this author to be Cymbaloporetta's equipped with float chambers; he even went further in suggesting that C. tabellaeformis might be nothing else than a variant of C. bradyi. On p. 478 he states : "So I am convinced that the genera Cymbaloporella and Tretomphalus cannot be maintained any longer, and that in recent times only the genus Cymbaloporetta exists, Tretomphalus being only a reproductive stage of Cymbaloporetta, while Cymbaloporella is only one of the two forms of Cymbaloporetta bradyi".

For the sake of completeness I have to mention PEREIRA (1979) who, in his

PhD-thesis on Eastern African Foraminifera, distinguished not only the tabellaeformis- and bradyi-forms but apparently splitted the "Tretomphalus"-group further up into two new genera, Naylorella and Humprysella, and created the new species Humprysella nyaliensis. Unfortunately I was unable to consult the text of the thesis and disposed only of the plates, so I cannot add further comments upon this matter.

The large variability range shown by our Lizard Island material, as well as the presence of many intermediate specimens, convinced me of HOFKER's (1951) views being justificated. I have gone just one step further in considering the bulloides- and bradyi-forms to be conspecific whereas I maintained C. tabellaeformis as a separate species (due to the lack of sufficient specimens).

The biology of this group is not yet fully understood and further research should be carried out to get a better insight into the reproduction cycles and the formation of the float- and balloon chambers in this (these)species and form(s)). I tend to believe that there might be only two real Indopacific species existing in this group, viz. Cymbaloporetta bradyi with variants on one hand, and Cymbaloporetta squammosa on the other.

Occurrence : Variants of C. bradyi (s.s.) (without float chamber) are abundant to common in all habitats at Lizard Island and sometimes are almost the only specimens found alive in low-energy, secluded areas like the Lagoon and the Sandy Shoal (together with some small representants of the Ammonia-group). Variants of the "Tretomphalus"-form (with float chamber) are considerably less frequent and have not been encountered alive at the time of sampling, which yields an argument to HOFKER's opinion about these forms appearing only in certain stages of the reproduction cycle.

Cymbaloporetta squammosa (d'ORBIGNY), 1826.
(Pl. 92, figs. 2-4).

\+ 1826 Rotalia squammosa; - d'ORBIGNY, p. 272 (nomen nudum).
1839 Rosalina squammosa d'ORBIGNY; - d'ORBIGNY, p. 91, pl. 3, figs. 12-14.
1862 Cymbalopora poeyi (d'ORBIGNY); - CARPENTER, PARKER & JONES, p. 215, pl. 13, figs. 10-12.

1884 Cymbalopora poeyi (d'ORBIGNY); - BRADY, p. 636, pl. 102, figs. 13a-c.
1915 Cymbalopora poeyi (d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 5), p. 24; textfigs. 28a-c, pl. 10, figs. 1a-c; pl. 14, figs. 5a-c.
1922 Cymbalopora squammosa (d'ORBIGNY); - CUSHMAN (Carnegie Inst. Publ. N° 311), p. 41, pl. 6, figs. 4-6.
1928 Cymbaloporetta squammosa (d'ORBIGNY); - CUSHMAN (Contr. Cushm. Lab. For Res., vol. 4, pt. 1), p. 7.
1931 Cymbaloporetta squammosa (d'ORBIGNY); - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 8), p. 83, pl. 16, figs. 4a-c.
1949 Cymbaloporetta squammosa (d'ORBIGNY); - SAID, p. 40, pl. 4, figs. 14a-b.
1951 Cymbaloporetta squammosa (d'ORBIGNY); - HOFKER, p. 477 etc., fig. 330.
1954 Cymbaloporetta squammosa (d'ORBIGNY); - CUSHMAN, TODD & POST, p. 364, pl. 90, figs. 15-16.
1957 Cymbaloporetta squammosa (d'ORBIGNY); - TODD, p. 292 (tab.), pl. 91, figs. 10a-c.
1958 Cymbaloporetta squammosa (d'ORBIGNY); - COLLINS, p. 419.
1959 Cymbaloporetta squammosa (d'ORBIGNY); - GRAHAM & MILITANTE, p. 108, pl. 18, figs. 3a-c.
1964 Cymbaloporetta squammosa (d'ORBIGNY); - LOEBLICH & TAPPAN, p. C 701, fig. 570/3.
1975 Cymbaloporetta squammosa (d'ORBIGNY); - WANTLAND, p. 398, fig. 10m, n.
1977 Cymbaloporetta squammosa (d'ORBIGNY); - BUZAS, SMITH & BEEM, p. 101, pl. 8, figs. 1-3.

Description : See d'ORBIGNY (1826, 1839), CARPENTER e.a. (1862), BRADY (1884), CUSHMAN (1915).

Diagnostic Remarks and Distribution : See also notes by HOFKER (1951). This species, characterised by rather strongly developed secondary lamination, is easily distinguishable from other taxa of the group by this mentioned feature and by the umbilicus being closed by an irregularly formed chalky plate which may or may not be perforated by a rounded hole. Juvenile tests lack this feature and are easily confused with young bradyi-specimens. There are always four chambers entirely visible on the ventral side.

This species has a cosmopolitan distribution in tropical reefal areas and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Empty tests as well as living specimens are common to abundant in intertidal areas (mainly-reef-flats) and in the shallow-backreef environments. Empty tests are sometimes transported towards the Perireefal Area.

Superfamily ROTALIACEA EHRENBERG, 1839.

Family ROTALIIDAE EHRENBERG, 1839.

Subfamily ROTALIINAE EHRENBERG, 1839.

Genus Asterorotalia HOFKER, 1951.

Asterorotalia gaimardii (d'ORBIGNY), 1906.
(Pl. 92, figs. 5a-c; pl. 93, figs. 1-2).

1980 Asterorotalia gaimardii (d'ORBIGNY); - BILLMAN, HOTTINGER & OESTERLE, p. 98, pls. 21, 22; textfigs. 10, 21.

Further synonymy : See BILLMAN, HOTTINGER & OESTERLE (1980).

Description : See BILLMAN e.a. (1980).

Diagnostic Remarks and Distribution : See BILLMAN e.a. (1980). This "spineless Asterorotalia of large size, with heavy ornamentation" is represented in our material only by large, microspheric specimens with up to 14 chambers in the last whorl.

This species has an exclusive Indopacific distribution and appears in the late Pliocene (fide BILLMAN e.a.); it has been reported by COLLINS (1958, p. 414) from the Great Barrier Reef, as Streblus papillosus (BRADY).

Occurrence : Very rare; a few empty tests have been found in some reef-flat samples and two perireefal samples. It is not clear whether the perireefal specimens originate from intertidal areas (reef flats ?) or not. Only one single living specimen has been encountered.

Genus Pararotalia Y. LE CALVEZ, 1949.

Pararotalia venusta (BRADY).
(Pl. 93, figs. 3-6; pl. 94, fig. 1).

+ 1884 Rotalia venusta; - BRADY, p. 708, pl. 108, figs. 2a-c; Rotalia calcar (pars); id, pl. 108, figs. 4a-b (not fig. 3).
non 1893 Rotalina venusta (BRADY); - EGGER, p. 422, pl. 19, figs. 13-15.
1893 Rotalina dentata PARKER & JONES; - EGGER, p. 422, pl. 19, figs. 7-9.
1915 Rotalia venusta BRADY; - H. ALLEN & EARLAND, p. 720, pl. LIII, figs. 15-22.
1939 Calcarina venusta (BRADY); - FINLAY, p. 524.
1951 Rotalia ozawai; - ASANO, pt. 14, p. 15, figs. 115-117.
1951 Parrella venusta (BRADY); - HOFKER (Siboga, pt. III), p. 333, figs. 227, 228.
1958 Calcarina venusta (BRADY); - COLLINS, p. 418.
1959 "Rotalia" ozawai ASANO; - GRAHAM & MILITANTE, p. 100, pl. 15, figs. 6, 8.
? 1966 "Rotalia" awadi; - SOUAYA, p. 55, pl. 3, figs. 5a-b, 8.
1979 Pararotalia venusta (BRADY); - PEREIRA, pl. 36, figs. H, L, M.

Description : See BRADY (1884), ASANO (1951), HOFKER (1951).

Diagnostic Remarks and Distribution : Specimens in our material show the same kind of variation as described in the literature : some (mostly the larger ones) show a continuous, slightly lobulate periphery and correspond to BRADY's (1884) type-figures of venusta, whereas other (mostly smaller) specimens show short, sometimes hardly pronounced peripheral spines, one pro chamber; the latter are the variants referred by BRADY (1884, pl. 108, fig. 4) to either Calcarina calcar or young "Rotalina dentata PARKER & JONES". This spinose species has also been figured by EGGER (1893, "R. dentata") and has been reported by GRAHAM & MILITANTE (1959) in their Philippine samples, by HOFKER (1951) also from the Philippines, and by COLLINS (1958) from the Great Barrier Reef. HOFKER (1951) moreover suggests the possible identity of CUSHMAN's (1933) Eponides fijiana with the present species.

Constant features of all our specimens are the restricted number of chambers in the last whorl (6-8), the slightly curved sutures on the dorsal side and the general, finely granulose aspect of the test; on the dorsal side the characteristic poreless papillae (extending and fusing into irregular poreless ridges) are always present; the angular periphery shows a bluntly rounded granulose keel which, in larger specimens, continues upon the spiral suture. The ventral side shows straight sutures, deeply incised near the umbilicus which is filled up (completely or partly, or sometimes not at all) with chalky bosses which may fuse into a single irregular chalky knob. The ultimate (or last few) chamber(s) show indications of an umbilical chamber extension; in earlier chambers this feature is completely masked, due to secondary lamination.

The present species clearly shows characteristics intermediate between the genera Pararotalia and Calcarina; on one hand it is closely allied to recent species such as Pararotalia murrayi (H. ALLEN & EARLAND), on the other it shows affinities with Calcarina (Pararotalia ?) calcar; the latter species has recently been put again in the genus Calcarina by HOTTINGER and LEUTENEGGER (1980, p. 123), this attribution being based upon structural evidence; it is my opinion that calcarinid species such as calcar, may have evolved from venusta-like pararotaliid ancestors by a kind of "nepionic acceleration"; it would be worthwide to investigate the internal structure of venusta thoroughly and to compare it with the C. calcar-structure; in the mean time I hesitate to place the species in Calcarina as did FINLAY (1939).

R. ozawai ASANO, from the Japanese Pliocene, is obviously identical with venusta. Otherwise P. venusta has an exclusive Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef. If the awadi-variant (SOUAYA, 1966) is really conspecific, then P. venusta would already be present in the Arabian Miocene.

Occurrence : Empty tests occur in a few patchreef samples (Western Slope) but empty tests as well as living specimens are most frequent in the Perireefal Area.

(?) Genus Pseudorotalia REISS & MERLING, 1958.

Pseudorotalia (?) cf. schroeteriana (PARKER & JONES), 1862.
(Pl. 94, figs. 2-3).

+ 1980 Pseudorotalia schroeteriana (PARKER & JONES); - BILLMAN, HOTTINGER & OESTERLE, p. 103, pl. 27, figs. 1-5, 10-15; pl. 28; textfig. 23.

Further synonymy of P. schroeteriana : See BILLMAN, HOTTINGER & OESTERLE (1980).

Description of P. schroeteriana : See BILLMAN e.a. (1980), PARKER & JONES (1862), BRADY (1884).

Diagnostic Remarks, Distribution and Occurrence : This at Lizard Island scarcely represented species resembles Pseudorotalia schroeteriana in all respects (see BILLMAN e.a., 1980, for description and comments), except that our specimens do not show dorsal sutural canal openings. As a result our specimens cannot belong to a Pseudorotalia-species ! Further research upon this and other Barrier-Reef material should be carried out in the future. P. schroeteriana has an exclusive Indopacific distribution and appears in the latest Pliocene (fide BILLMAN e.a., 1980). COLLINS (1958) dit not report schroeteriana from the Great Barrier Reef.
Specimens occur in four reef-flat samples, one patchreef sample and one perireefal sample. Only one single, problematic living specimen has been found, on Coconut Fringing Reef flat.

Genus Ammonia BRUNNICH, 1772.

Ammonia convexa (COLLINS), 1958.
(Pl. 94, figs. 4-6).

+ 1958 Streblus convexus; - COLLINS, p. 414, pl. 5, figs. 10a-c.

Description : See COLLINS (1958).

Diagnostic Remarks and Distribution : Our specimens correspond completely with COLLINS's (1958) description and illustrations. Characteristic features are the number of chambers in the last whorl (up to 11 or even more), the straight ventral sutures "leaving a tapering groove which deepens towards the umbilicus" and the "large, flat-topped plug", partly filling the umbilicus. Some of our specimens show dorsal sutures being more straight than indicated for COLLINS's species.

This species seems to be closely related to the New Zealand species

Ammonia aoteanus FINLAY, the latter differring from COLLINS's species apparently only in the slightly more oblique sutures, the somewhat lower number of chambers in the last coil (generally not more than 9) and the absence of a large umbilical plug (only smaller umbilical bosses or pustules are eventually present).

COLLINS's types are from the Great Barrier Reef (reef-flats and shallow-water samples).

Occurrence : Living specimens as well as empty tests are common in the Patchreef Area and the Internal Platform. Empty tests, often strongly abraded and probably transported, are to be found in several perireefal samples.

The "tepida"-group.

The group denomination used here finds its origin in the multi-specific "species" Streblus tepidus, originally used as a subspecific name (subspecies of A. beccarii) and grouping the smaller, nonornate so-called beccarii-variants. During the last decade it has become clear that this "tepida"-denomination has been used in the past by most authors as a dumping ground for a lot of smaller rotaliids belonging to several different species and even genera. Some of these are present in our material, though a few are extremely rare. As a whole, the "tepida"-group is abundant to common in the Lizard Island material and these smaller rotaliids are often persistently found alive in shallow low-energy environments like the Lagoon, Sandy Shoal and Leeward Patchreef Area, together with representatives of Cymbaloporetta gr. bradyi.

No attempt has been made to procure more or less complete synonymy lists for these taxa, as it is very often impossible to know which ones exactly are involved under the denominations used by various authors, without consulting their collections. Only some occasional references are given.

Ammonia (?) tepida (CUSHMAN), 1926.
(Pl. 94, fig. 7; pl. 95, figs. 1-3).

1971 Streblus tepidus (CUSHMAN); - HOFKER, p. 23, pl. 68, figs. 16-23; textfig. 30, figs. 1-3.

? 1978 Ammonia catesbyana (d'ORBIGNY); - HOFKER, p. 57, pl. 9, fig. 3.

Remarks : The name of this species, probably (but not certainly) belonging to Ammonia, is used here in the sense of HOFKER (1971); specimens are characterised by a relatively low number of chambers in the last coil (6-7), an open umbilicus, subtriangular umbilical flanges laterally covered with small pustules, and a small primary aperture. There is/are no umbilical plug or knobs. The sutures are narrowing towards the periphery; the dorsal sutures are curved and depressed (last few chambers), limbate and flush in earlier whorls. The ventral sutures are almost straight to slightly curved, forming V-shaped grooves towards the umbilicus. On the dorsal side appear poreless subtriangular areas in the distal corner - formed by the intersection of chamber - and spiral suture on each chamber.
HOFKER's (1971) depicted forms have a somewhat more lobulate periphery and do not appear to have limbate sutures in the earlier whorls. The distinction made by HOFKER (1971) between this species and A. catesbyana is not very convincing and the specimen shown by this author in his 1978 volume (A. catesbyana) is almost identical with his (1971) tepida-specimens whereas he states that intermediate tests have been found.

This might be a cosmopolitan species; in our Lizard Island material it is common, frequently found alive and covers the majority of our specimens in the "tepida"-group. It is common to abundant in the Lagoon and shallow back-reef environments.

Ammonia (?) sp. aff. A. moroensis HOFKER, 1978.
(Pl. 95, figs. 4-5).

? 1978 Ammonia moroensis; - HOFKER, p. 58, pl. 9, fig. 5.

Remarks : In our material several specimens resembling this Indonesian deeper-water species have been found. The number of chambers in the last coil (8) is the same, as well as the small test with rounded margin, and the "pore fields leaving a small proximal part of the wall free" on the dorsal side. In our specimens the entire umbilical area is indeed filled up with chalky bosses.
HOFKER (1978) however states that his specimens have a strongly convex dorsal side and not so convex ventral one whereas our specimens show the

inverse phenomenon; further on, instead of "distinct rounded protoforamina at the straight radial sutures" we find straight sutures which rapidly enlarge towards the umbilicus and which are deeply incised; the umbilical flanges are V-shaped and possess poreless rims, widening towards the umbilicus. Finally, HOFKER reported his specimens from depths of 220 tot 615 m whereas our specimens occur in the Perireefal Area (max. depths 35-40 m).

Genus Monspeliensina GLACON & LYS, 1968.

Monspeliensina japonica (UCHIO), 1951.
(Pl. 95, figs. 6-7; pl. 96, figs. 1a-c).

\+ 1951 Pseudoeponides japonicus; - UCHIO, p. 190, textfig. 16.
1958 "Pseudoeponides" japonicus UCHIO; - HOFKER, p. 46, textfig. 1a-g.
non 1964 Pseudoeponides japonicus UCHIO; - LOEBLICH & TAPPAN, p. C 598, fig. 474/5a-c.

Description : See UCHIO (1951).

Diagnostic Remarks and Distribution : See also HOFKER (1958), LOEBLICH & TAPPAN (1964). This is an extremely controversial species which originally has been put in a controversial genus too (Pseudoeponides). The history of the controverse is as follows : in 1950 UCHIO described this species from the Japanese Plio-Pleistocene, creating at the same time the new genus Pseudoeponides for it. At about the same time, KUWANO (1950) described and illustrated the new species (and new subgenus) Epistomaria (Epistomariella) miurensis from the Japanese Pliocene. The latter species has been put in synonymy with japonica by OINOMIKADO (1951, fide HOFKER 1958) who has been followed in this attitude by subsequent authors, including LOEBLICH & TAPPAN (1964). Moreover LOEBLICH & TAPPAN's drawings were different from e.g. HOFKER's (1958) figures (who obtained his specimens directly from UCHIO - fide HOFKER 1958) as well as from UCHIO's descriptions, in that HOFKER's figures showed more inflated chambers and dorsal sutural openings whereas LOEBLICH & TAPPAN's (1964) figured specimen showed very oblique limbate dorsal sutures, not inflated chambers and sutural-areal dorsal openings. As a result, total confusion reigned as to the exact meaning of the name japonica.

The crucial point lies in the fact that UCHIO's japonicus and KUWANO's miurensis ARE NOT the same species. HOFKER (1958) figured the true japonica (with lobulate periphery, 5-6 chambers in the last whorl, somewhat less oblique, depressed, nonlimbate dorsal sutures, dorsal interiosutural supplementary apertures, inflated chambers and rounded, nonangular periphery, not completely closed umbilicus, umbilical flaps not fused) whereas the specimen figured by LOEBLICH & TAPPAN (1964) belongs to miurensis (with compressed, areal-sutural supplementary apertures and an umbilicus completely closed by the partially - or completely fused and grown together umbilical flaps, as in Cavarotalia - see also KUWANO's type figures (1950)).

HOFKER (1958) and REISS (1960) already hinted at the close affinity of japonica with the Rotaliids. In 1972, LAGA attributed pseudotepida from the Northern European Pliocene to the genus Monspeliensina and since then it has become clear that several Indopacific Plio-Pleistocene and Recent species also belong to this genus. In this way our japonica-specimens clearly show the Monspeliensina-characteristic of triangular canals connecting the ventral "protoforamina" with the dorsal sutural foramina (see also HOFKER's 1958 figures), whereas both taxa described by KUWANO (1950) as Epistomariella's, viz. miurensis and nakazatoensis, also show the external features of the genus Monspeliensina, genus first appearing in the European Miocene.

This is the first record of this Japanese Plio-Pleistocene species from Recent sediments, and from the Great Barrier Reef a fortiori.

Occurrence : Rare; isolated empty tests occur in some perireefal samples, and in one patchreef sample.

Monspeliensina dubuissoni n.sp.
(Pl. 96, figs. 2-5).

Derivatio Nominis : Named after the late Rector DUBUISSON of the State University of Liege, Belgium, who has been the realisator of the Belgian "DE MOOR"-expedition and the subsequent research upon Barrier Reef biology and geology at the State Universities of Liege and Ghent.

Description : Test free, calcareous, hyaline, trochospirally coiled, the spiral side generally more convex than the umbilical side (though there is considerable variation in this feature), periphery subangular in apertural view, slightly lobulate in spiral view.

Spiral side : Evolute,2,5 à 3,5 whorls visible, 7-8 chambers in the last coil. Sutures strongly oblique in last-formed coil, less so in earlier coils. Test wall dorsally finely punctate except for narrow poreless areas bordering the chamber sutures (not the spiral sutures). Sutures deeply grooved, the lateral walls of the grooves giving access to the dorsal supplementary sutural apertures. In the last coil the grooves comprise almost the entire suture but towards the umbo these grooves gradually become shorter and narrower, due to secondary lamination; near the umbo the test wall is almost flush, quite thick and translucent; the (mostly megalospheric) proloculus can be seen through the clear shell material; only small apertures remain open as remnants of the sutural grooves in the earliest coil.

Umbilical side : Involute, finely porous, 7-8 chambers visible; sutures slightly curved and grooved in the same way as upon the dorsal side; the grooves set on at a short but variable distance from the periphery, widen slightly and are closed again by the umbilical structures; the grooves are equally finely hispid inside, but in the largest specimens the sutural rims may become slightly beaded; umbilicus completely closed by fused umbilical chamber extensions (flying covers being no longer "flying" as they are firmly connected with each other and with the umbilical plug); umbilical plug variable in size; either very small and hardly noticeable, or large, prominent, flat-topped and consisting of clear shell material. Primary aperture very small, rounded, interiomarginal, bordered by a sigmoidally curved lip partially masking the aperture, forming an umbilical plate which grows over the edge of the umbilical plug and which is firmly connected with the preceding plates. Umbilical chamber extensions (plates) more or less fused; sometimes the protoforamina (sensu HOFKER) are clearly visible, sometimes they are almost completely masked and open up at the proximal end of the sutural groove.

Differential generic diagnosis : This species is easily distinguishable from all Ammonia, Rotalia and related genera by its dorsal sutural grooves-with-apertures. Cavarotalia has similar fused umbilical plates but has

no dorsal sutural openings. Most of the species attributed to the genera Pseudoeponides and Epistomaria (Epistomariella) are considered here as belonging to the genus Monspeliensina of which the species under condiseration shows all the characteristics (compare e.g. with the SEM-illustration of Monspeliensina pseudotepida (VAN VOORTHUYSEN) as figured by HUGHES & JENKINS, 1981, from the Cornwall Pliocene, showing astonishingly similar sutural and umbilical features).

Differential specific diagnosis : This species is easily distinguishable from M. japonica which shows more inflated chambers and which does not develop the narrow dorsal sutural grooves whereas its umbilical plates are not fused as in dubuissoni.M. miurensis KUWANO shows less chambers in the last coil, has limbate, not grooved dorsal sutures and characteristic infoldings at the bases of the umbilical plates where the "protoforamina" open up; this species moreover has no umbilical plug. M. nakazatoensis KUWANO has straighter dorsal, not grooved sutures whereas the umbilicus is not closed; the ventral sutures are apparently only slightly grooved, and there is no umbilical plug. "Rotalia" ketienzienensis angulata KUWANO is somewhat similar in general aspect of the test but does not seem to show dorsal sutural openings and therefore cannot be a Monspeliensina. There is no umbilical plug present either.

Occurrence : Rather rare; occurs in small numbers at several perireefal and a few patchreef stations. Some problematic living specimens have been encountered.

Holotype : Specimen figured upon pl. 96, figs. 5a-c (sample N° L 86).

Family CALCARINIDAE SCHWAGER, 1876.

Genus Calcarina d'ORBIGNY, 1826.

Note : Nomenclatural problems relating to calcarinid species present in the Lizard Island material.

Except for the extremely rare C. calcar, two calcarinid variants occur in large numbers in our Lizard Island material : one has an inflated lenticular

shape, is coarsely hispid and shows several (generally 8-10) short blunt spines which are sometimes bifurcating; the other shows a test which is somewhat comparable in shape and ornament but which is smaller and shows 3-4 long, stout spines. The first variant is BRADY's Calcarina hispida, the second one resembles CUSHMAN's (1924) Calcarina mayori (at least the long-spined specimens of this species). CUSHMAN (1924, p. 44) stated that his mayori-species "is more blunt spined and of a slightly heavier build on the reef itself ... and with much more slender spines in deeper water..."; i.e. the same kind of variation as displayed by our Lizard Island material. Both mayori-variants have been put in synonymy with C. spengleri (GMELIN) by HOTTINGER & LEUTENEGGER (1980).

Recently, HANSEN (1980) described and illustrated a neotype for Calcarina spengleri (GMELIN); his neotype and topotypes originated from coarse sand from the same Indonesian gastropod specimen as used by GMELIN as source of his type material. Not surprisingly, though not mentioned by HANSEN, is that this spengleri-neotype reveals to be exactly identical with BRADY's Calcarina hispida. As a result of the thorough emendation of C. spengleri by HANSEN, BRADY's C. hispida should be put in synonymy with spengleri which has datum priority.

Summarising, we can state that C. hispida as well as C. mayori are synonymous with Calcarina spengleri; it should be noted however that this spengleri-species is highly variable and ecologically (depth)-conditioned, as stated already by CUSHMAN (1924). The inflated, lenticular, coarsely hispid tests such as HANSEN's neotype and BRADY's hispida-specimens are the shallow, intertidal variants occurring, at Lizard Island (as well as on presumable almost every other Indopacific reef flat), abundantly upon the coarser weeds together with Baculogypsina, Amphistegina, etc.; whereas the smaller, long-spined ecovariants (such as figured by e.g. CUSHMAN, 1924, pl. 14, figs. 4-5, and by HOTTINGER & LEUTENEGGER, 1980, pl. 6, fig. 10 (11 = intermediate)) are less abundant at Lizard Island and occur exclusively in the Perireefal Area. The larger reef-flat tests are very solidly built and, as a result, suffer considerable abrasion; they are quasi indestructible and empty tests in all degrees of abrasion occur in the drain-channels (coarse sediments), backreef areas and beaches. These abraded tests, sometimes almost completely smoothened and rounded, apparently lie at the origin of a considerable amount of specific misinterpretations by numerous

authors in the past and have masked e.g. the spengleri-"hispida" relationship. It seems to me that the separation between the two spengleri-variants is not everywhere as clearcut as at Lizard Island; HOTTINGER & LEUTENEGGER's specimens from the Keij-Ids. (1980, pl. 6, figs. 1-9) apparently are rather strongly abraded, intermediate forms; the "spikes", characteristic for the "hispida"-variant, are almost completely removed by abrasion.

For ecological reasons I have maintained a nomenclatural separation within the spengleri-population; the denomination C. spengleri s.s. is confined to the short-spined reef-flat variants such as HANSEN's neotype; the intermediate and long-spined variants have been grouped as C. spengleri subsp. mayori CUSHMAN.

Calcarina calcar d'ORBIGNY, 1839.
(Pl. 97, figs. 1-2).

1826 Calcarina calcar; - d'ORBIGNY, p. 276, modèle n° 34.
\+ 1839 Calcarina calcar d'ORBIGNY; - d'ORBIGNY, pl. 5, figs. 22-24; p. 81.
1980 Calcarina calcar d'ORBIGNY; - HOTTINGER & LEUTENEGGER, p. 123, pl. 1, figs. 1-17.

Further synonymy : See HOTTINGER & LEUTENEGGER (1980).

Description : See d'ORBIGNY (1826); see notes by HOFKER (1970), HANSEN & REISS (1971), HANSEN (1980), HOTTINGER & LEUTENEGGER (1980).

Diagnostic Remarks, Distribution and Occurrence : The arguments for calcar to be included in the genus Calcarina (not Pararotalia) can be found in HOTTINGER & LEUTENEGGER (1980, p. 124) (see also comments under P. venusta, p. 246, etc.).

The species has an exclusive Indopacific distribution and has been recorded as common in the Great Barrier Reef by COLLINS (1958).

Rare at Lizard Island. A few empty tests and a number of fragments in the shallow backreef environments and on Coconut Reef flat.

Calcarina spengleri s.s. (GMELIN, 1791), emend. HANSEN, 1980.
(Pl. 97, figs. 3-5; pl. 98, figs. 1-2).

1884 Calcarina hispida; - BRADY, pl. 108, figs. 8-9.
1960 Tinoporus hispidus (BRADY); - BARKER, pl. 108, figs. 8-9.
1960 Calcarina spengleri (GMELIN); - TODD, pl. 10, figs. 1, 3, 4, 5 (part).
1965 Calcarina hispida BRADY; - JELL, MAXWELL & Mc KELLAR, p. 277, pl. 44, figs. 4a-b.
N 1980 Calcarina spengleri (GMELIN); - HANSEN, pl. 3, figs. 9a-c; pl. 4, figs. 1, 2; pl. 5, 6 (Neotype).

Further Synonymy : See HOTTINGER & LEUTENEGGER (1980). The mayori-references should be extracted from this list (see hereafter).

Description : See SPENGLER (1791), in HANSEN (1980).

Diagnostic Remarks and Distribution : See note, p. 238 ; see also HOTTINGER & LEUTENEGGER (pp. 123, 125). This is the inflated, coarsely hispid variant in complete agreement with HANSEN's neotype and with BRADY's types of "C. hispida". HOFKER (1970) placed this taxon in Pararotalia.
This subspecies has an exclusive Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef. TODD (1960) figured worn specimens from Onotoa Atoll, whereas JELL e.a. (1965) figured characteristic specimens from Heron Reef, Great Barrier Reef.

Occurrence : Common to abundant; living specimens occur in large numbers on the algal cover of the reef flats and shallow backreef areas (patch-reefs); empty and often heavily abraded tests form an important component of the coarse drain-channel sediments (which are often foraminiferites) and of sorted beach-sands (e.g. Coconut Beach). Abraded empty tests are often transported into the Perireefal Area. See Part I for further comments.

Calcarina spengleri (GMELIN), subsp. mayori CUSHMAN, 1924.
(Pl. 98, figs. 3-7).

+ 1924 Calcarina mayori; - CUSHMAN, p. 44, pl. 14, figs. 4-7. (figs. 6-7 are intermediate towards spengleri s.s.).

1927 Calcarina mayori CUSHMAN; (pars); - HOFKER (Siboga, Pt. 1), p. 44, pl. 20, figs. 3-5, 8, 11 (not figs. 1, 2, 6, 7, 9-10 (?), 12 (?)); these illustrations show intermediate specimens.

1954 Calcarina hispida BRADY; - CUSHMAN, TODD & POST, p. 363, pl. 90, figs. 9-12.

1959 Calcarina spengleri (GMELIN) (pars); - GRAHAM & MILITANTE, p. 107, pl. 17, figs. 8-13 (not figs. 9-12); intermediate specimens. Calcarina hispida BRADY; - id, p. 106, pl. 17, figs. 5 (intermediate), 6-7 (typical mayori).

1980 Calcarina spengleri GMELIN; - HOTTINGER & LEUTENEGGER, p. 124, pl. 6, figs. 1-9 : intermediate, abraded specimens; figs. 10-13 : young typical mayori specimens.

Description : See CUSHMAN (1924).

Diagnostic Remarks and Distribution : See note, p. 238. This is the smaller (at least in our material) deeper-water variant with few (mostly 4-5) longer spines and a less luxurious ornamentation. The subspecies is considered here as an ecovariant of C. spengleri. Specimens intermediate between the two variants are extremely rare in our material but those encountered in the literature are witheld in the synonymy list under mayori.

This subspecies is obviously confined to the Indopacific; CUSHMAN's type material (typical + intermediate forms) is from Samoa; his intermediate forms might originate from "outer edge of Aua reef", whereas his types and comparable specimens are from depths between 13-25 fathoms. This is the first record from the Great Barrier Reef.

Occurrence : This subspecies occurs exclusively in the Perireefal Area; living specimens are common.

Genus Baculogypsina SACCO, 1893.

Baculogypsina sphaerulata (PARKER & JONES), 1860.
(Pl. 99, figs. 2-3).

1957 Baculogypsina sphaerulata (PARKER & JONES); - TODD, p. 292 (tab), pl. 91, fig. 13.

1959 Baculogypsina sphaerulata (PARKER & JONES); - GRAHAM & MILITANTE, p. 105, pl. 17, fig. 1.

1961 Baculogypsina sphaerulata (PARKER & JONES); - TODD, p. 186, pl. 25, figs. 1-2.

1965 Baculogypsina sphaerulata (PARKER & JONES); - JELL, MAXWELL & Mc KELLAR, p. 278, pl. 44, fig. 6.

1980 Baculogypsina sphaerulata (PARKER & JONES); - HOTTINGER & LEUTENEGGER, p. 125, pl. 9, figs. 1-11.

Further synonymy : See HOTTINGER & LEUTENEGGER, 1980.

Description : See PARKER & JONES (1860).

Diagnostic Remarks and Distribution : See also HOTTINGER & LEUTENEGGER (1980). This well-known, easily recognisable species possesses an extremely solid test and 5-6 sharply pointed spines, which are partly or sometimes almost completely abraded in reef flat- or beach sediment specimens.

This species only occurs in the Indopacific and is an important component of Indopacific reef-flat epifauna's. Reports are numerous; from the Great Barrier Reef it has been reported by COLLINS (1958) and by JELL e.a. (Heron Reef).

Occurrence : Common to abundant upon the reef flats and the patchreefs; upon the algal covers most specimens are alive. Same habitat as e.g. Calcarina spengleri s.s. and Amphistegina lobifera. Abraded specimens (see e.g. TODD's illustrations, 1961) are often abundant in sorted drain-channel- and beach sands (see Part 1). Heavily abraded empty tests are sometimes transported as far as the Perireefal Area.

Genus Parrellina THALMANN, 1951.

(N.B. This genus has been tentatively placed in the family Calcarinidae by HOTTINGER & LEUTENEGGER, on the basis of structural analysis. For full discussion see the cited article (1980, p. 125)).

Parrellina hispidula (CUSHMAN), 1936.
(Pl. 99, figs. 5a-b; pl. 100, figs. 1a-c).

+ 1936 Elphidium hispidulum; - CUSHMAN, p. 83, pl. 14, fig. 13.
1958 Elphidium hispidulum CUSHMAN; - COLLINS, p. 420.
1968 Parrellina hispidula (CUSHMAN); - HOFKER, p. 31, pl. 11, figs. 1-7.
1980 Parrellina hispidula (CUSHMAN); - HOTTINGER & LEUTENEGGER, p. 125, pl. 8.

Description : See CUSHMAN (1936).

Diagnostic Remarks and Distribution : See also HOTTINGER & LEUTENEGGER (1980). Our specimens are completely identical with the fossil specimens figured by HOTTINGER e.a. (1980) from Borneo, including the absence of a primary foramen (contrary to CUSHMAN's description mentioning elphidiid small apertures).

This species has been reported rarely from Indopacific Pleisto-Holocene and recent sediments. CUSHMAN's types are from Albany Passage, Australia, whereas HOFKER's specimens are from Djakarta.

Occurrence : Empty tests as well as living specimens are occasionally to commonly encountered in the Lagoon, the Patchreef Area and the Perireefal Area. Dr. MONTY's "DE MOOR" samples from Lizard Island however showed this species to be more common in the Lagoon and adjacent intertidal areas at that time of sampling (1969). The length of the reproduction cycle is not known for this species but the mentioned occurrence peculiarities may be explained by seasonal "blooming".

Parrellina pacifica (COLLINS), 1958.
(Pl. 100, figs. 2-3).

1924 Polystomella milletti H. ALLEN & EARLAND; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 48, pl. 16, figs. 7-8.
1933 Elphidium milletti (H. ALLEN & EARLAND); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 49, pl. 11, figs. 8a-b.
+ 1958 Elphidium pacificum; - COLLINS, p. 421, pl. 5, fig. 13.

Description : See COLLINS (1958).

Diagnostic Remarks, Distribution and Occurrence : A few empty tests of this very corrugated species with lobulate periphery have been encountered in the Perireefal Area. Taking externally visible features in to account, this species has tentatively been placed in the genus Parrellina of which it shows all the characteristics. One single specimen, showing some short, blunt peripheral spines has been encountered, but has been lost during preparation for SEM.

The species has a solely Indopacific distribution; COLLINS's types are from the Great Barrier Reef.

Parrellina milletti (H. ALLEN & EARLAND), 1915.
(Pl. 100, figs. 4-5; pl. 101, figs. 1-2).

\+ 1915 Polystomella milletti; - H. ALLEN & EARLAND, p. 735, pl. 53, figs. 38-42.

non 1924 Polystomella milletti H. ALLEN & EARLAND; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 48, pl. 16, figs. 7-8. (= pacifica COLLINS).

pars 1939 Elphidium milletti (H. ALLEN & EARLAND); - CUSHMAN, p. 58, pl. 16, figs. 20-21 (not 22 = pacifica COLLINS).

non 1959 Elphidium milletti (H. ALLEN & EARLAND); - GRAHAM & MILITANTE, p. 75, pl. 11, figs. 14a-b. (= pacifica COLLINS).

pars ? 1979 Elphidium milletti (H. ALLEN & EARLAND); - PEREIRA, pl. 37, figs. K-L (not M ?).

Description : See H. ALLEN & EARLAND (1915).

Diagnostic Remarks and Distribution : This is a well-defined species, the meaning of which unfortunately has been obscured by CUSHMAN (div. publ.) who invariably included in milletti the species established in 1958 by COLLINS as E. pacificum, and who has been followed in this attitude by subsequent authors.

Some smaller, juvenile specimens in our material show at first sight a remarkable likeness with Elphidium guntheri as illustrated by e.g. HANSEN & LYKKE-ANDERSEN (1976, p. 12, pl. 8, figs. 10-12). These smaller specimens

are strongly papillate-hispid, show a rounded outline of the inflated test and slightly depressed umbilici filled up with papillae and spines. In lateral view 6-7 strongly developed, smooth ponticuli are visible pro chamber; between these ponticuli openings can be seen, somewhat resembling the elphidiid structure. Larger specimens however show a complication of the canal systems, reflected by the presence of openings scattered over the chamber walls towards the periphery; the ponticuli are enlarged by secondary lamination and the ponticuli of successive chambers join each other, forming the "chevron-like pattern" or create irregular reticulate structures. In later chambers the papillae may partly fuse, forming a pattern of bosses between which the openings of the canal system are scattered. The species has been placed in Parrellina because of the structural parallelism with P. hispidula, a species placed in Parrellina by HOTTINGER & LEUTENEGGER (1980).

P. milletti has been described and reported from several Eastern African localities and possibly has a wide Indopacific distribution. This is the first report from the Great Barrier Reef.

Occurrence : Rare; empty tests are occasionally encountered in several intertidal and shallow subtidal stations. The species apparently lives in intertidal habitats exclusively; empty tests are occasionally transported as far as the deeper Western slope.

Family ELPHIDIIDAE GALLOWAY, 1933.

Subfamily ELPHIDIINAE GALLOWAY, 1933.

Genus Haynesina BANNER & CULVER, 1978.

(N.B. The genus Haynesina has been placed here in the Elphidiidae following HAYNES, 1981).

Haynesina depressula (WALKER & JACOB), emend. (MURRAY), 1965.
(Pl. 101, figs. 3-6).

+ 1798 Nautilus depressulus; - WALKER & JACOB, p. 641, pl. 14, fig. 33.
1930 Nonion depressulum (WALKER & JACOB); - CUSHMAN, p. 3, pl. 1, fig. 3.
1965 Nonion depressulus (WALKER & JACOB); - (s.s.) MURRAY, pp. 148-149, pl. 25, figs. 6-7; pl. 26, figs. 7-8.
1971 Nonion depressulus (WALKER & JACOB); - MURRAY, p. 195, pl. 82, figs. 1-8.
N 1973 Nonion depressulus (WALKER & JACOB); - HAYNES, p. 209, 210, textfigs. 44 (1-3), pl. 22, figs. 8-11; pl. 29, fig. 9.
1976 Nonion depressulum (WALKER & JACOB); - HANSEN & LYKKE-ANDERSEN, p. 21, pl. 19, figs. 3-6.
1978 Haynesina depressula (WALKER & JACOB), emend. (MURRAY); - BANNER & CULVER, p. 200, pl. 10, figs. 1-8.

Description : See MURRAY (1965), HAYNES (1973), HANSEN e.a. (1976).

Diagnostic Remarks and Distribution : Our specimens are identical with those described in the literature; they generally show 8-9 chambers in the last coil, depressed and slightly curved sutures which are widening and granulated towards the umbilici, and widely opened, granulated umbilici. The test wall is smooth, finely perforated, and the periphery rounded. This species has been placed in the genus Haynesina by BANNER & CULVER (1978) and is known from European Quaternary and Recent deposits. Indopacific related forms are reported under various names (such as Nonion asterizans PARKER & JONES, etc.) but a more thorough investigation is needed to find out which species are really meant by these references. Our specimens cannot be distinguished from the European species.

COLLINS (1958) reported Nonion cf. depressulus (WALKER & JACOB) from the Great Barrier Reef (p. 398). It should be verified whether his and our specimens really represent the same species.

In our material a few specimens are present (see pl. 101, figs. 6a-d) which are virtually identical with a specimen figured by HANSEN e.a. (1976, pl. 19, figs. 7-12) and attributed to Nonion germanicum (EHRENBERG) (= Haynesina germanica (EHRENBERG)) by these authors; this variant has slightly narrower chambers, shows 11-12 chambers in the last coil, as well as umbilici and earlier sutures which are heavily smoothened and filled up with shell material by secondary lamination: otherwise it is identical with depressulum. It is believed here that our specimens as well as HANSEN e.a.'s are

different from real Haynesina germanica and possibly only represent a variant of depressulum. The scarcity of this variant in our material does not allow any further comments.

Occurrence : Rare to common in all environments except for the reef flats. Living specimens as well as empty tests. In the Eastern Perireefal Area numerous very small specimens are present; at first sight they could be mistaken for some or other small Astrononion but SEM-photographs (see figs. 3a-b, pl. 101) revealed them to be Haynesina. Whether or not these are true juveniles of H. depressula is a matter of future investigation but meanwhile they have been tentatively classified as such.

Genus Elphidium de MONTFORT, 1808.

Note : The work by HANSEN & LYKKE-ANDERSEN (1976) has been followed in this chapter; this results for our Lizard Island material in the suppression of the genera Cellanthus, Protelphidium and Cribroelphidium which the mentioned authors considered as synonyms of Elphidium (for full discussion see HANSEN e.a., 1976).

Elphidium gr. advenum (CUSHMAN).

Note : There is much confusion in the literature about E. advenum, as a result of the uncertainty over BRADY's type definitions (1884, Polystomella subnodosa MUNSTER, of BRADY). The entire advenum-group needs thorough revision as well as either selection of a lectotype or redefining of BRADY's (and/or CUSHMAN's) type material.

In our material, at least two variants have been grouped under this heading; they may represent two or three species perhaps belonging to two genera. The first one groups the more or less "typical" (see further) advenum-specimens; the second distinguished variant may possibly represent CUSHMAN's Ozawaia tongaensis.

Elphidium advenum s.s. (CUSHMAN), 1922
(Pl. 102, figs. 1-3).

Synonymy up to 1959 : see GRAHAM & MILITANTE 1959. Some selected and additional references are given hereafter.

1884 Polystomella subnodosa MUNSTER; - BRADY, p. 734, pl. 110, figs. 1a-b.
+ 1922 Polystomella advena; - CUSHMAN (Carnegie Inst. Publ. n) 311), p. 56, pl. 9, figs. 1a-b.
1939 Elphidium advenum (CUSHMAN); - CUSHMAN, p. 60, pl. 16, figs. 31-35; Elphidium advenum (CUSHMAN) var. depressulum CUSHMAN; - id, p. 61, pl. 17, fig. 1.
1957 Elphidiononion charlottensis; - VELLA, p. 38, pl. 9, figs. 187, 188.
1958 Elphidium advenum (CUSHMAN); - COLLINS, p. 420.
1959 Elphidium advena (CUSHMAN); - GRAHAM & MILITANTE, p. 73, pl. 11, figs. 7-8a, b.
1960 Elphidium advenum (CUSHMAN); - ASANO (Forams. Soyo-Maru, pt. 5), p. 195, pl. 22, figs. 3a-b, figs. 10a-b (= depressulum); - ? Elphidium advenum miyatense FUJITA; - Id, p. 197, pl. 22, figs. 1-2a-b.
1960 Elphidium advenum (CUSHMAN); - BARKER (see ref. BRADY 1884).
1967 Cribroelphidium charlottensis (VELLA); - HEDLEY, HURDLE & BURDETT, p. 50, figs. 3a, b.
1968 Elphidium advenum (CUSHMAN); - ALBANI, p. 111, pl. 10, fig. 6.
1975 Elphidium advenum (CUSHMAN); - WANTLAND, p. 395, fig. 6 t.
1979 Elphidium advenum (CUSHMAN); - PEREIRA, pl. 36, figs. P-Q.

Description : See CUSHMAN (1939); see also VELLA (1957, charlottensis).

Diagnostic Remarks and Distribution : This species is either very variable in shape or an artificial grouping of more than one species. The periphery is mostly sharply angular to carinate (though some specimens show a more rounded periphery and are in an intermediate position between advenum and poeyanum), and is non-lobulate except eventually at the level of the last few chambers. The number of chambers in the last coil varies between 12-16 (or even more). The sutures are slightly curved and the retral processes are well-marked. The umbilicus mostly shows a not perforated chalky knob of variable dimension; this plug is often (but not always) "surrounded by a low collar of shelly material" (VELLA, 1957) as in VELLA's E. charlottensis which is here considered as a synonym of advenum (N.B. VELLA apparently misinterpreted advenum stating that it "is distinguished by its depressed

umbilici and more inflated and rounded chambers" which only applies to CUSHMAN's depressulum - variant). A few specimens in our material show the characteristics of this depressulum - variant (with depressed umbilici without boss) or are in an intermediate position. Specimens of advenum s.s. are easily distinguishable from E. crispum which has a thicker, not translucent test, straighter sutures with larger retral processes and larger, prominent perforated umbilical bosses.

E. advenum s.s. has a cosmopolitan distribution in tropical shelf seas and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to common in all environments except for the reef flats; living specimens as well as empty tests. The species is particularly common in the Patchreef Area.

Ozawaia (?) sp. aff. O. tongaensis CUSHMAN, 1931.
(Pl. 102, figs. 4-6).

1904 Polystomella crispa MILLETT (not LINNE); - MILLETT, p. 603, pl. 11, fig. 2.

\+ 1931 Ozawaia tongaensis; - CUSHMAN, p. 80, pl. 10, figs. 7-10.

1933 Ozawaia tongaensis CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 53, pl. 12, figs. 10-12.

1939 Ozawaia tongaensis CUSHMAN; - CUSHMAN, p. 67, pl. 19, figs. 5-8.

1964 Ozawaia tongaensis CUSHMAN; - LOEBLICH & TAPPAN, p. C 640, figs. 510/3, 4.

Description : See CUSHMAN (1931).

Diagnostic Remarks and Distribution : A number of specimens occur in our material, which are tentatively attributed to this uncoiling elphidiid form. In fact, our specimens show all characteristics of the species tongaensis, but not the uncoiling such as figured by CUSHMAN from Tonga and Fiji. The specimens show curved, depressed sutures and short but very distinct retral processes, very characteristic open-ended ponticuli of last-formed chambers, (parafossette in terminology of HANSEN e.a., 1976), and a more or less angled to rounded periphery (in fact the distal peripheral end of each of the last few chambers in compressed but the proximal

part rounded). The earlier sutures are deeply incised but very narrow due to secondary lamination.

The identification is given with some reserve, and smaller specimens of this species are not easily distinguishable from smaller specimens of E. advenum s.s. and E. poeyanum. Therefore all these taxa have in Part I been treated together under E. gr. advenum.

O. tongaensis has been reported from the Malay archipelago and from Fiji and Tonga; this would be the first record of the genus and species from the Great Barrier Reef.

Occurrence : Present in small numbers in all environments at Lizard Island. Living specimens are rare.

Elphidium batavum HOFKER, 1968.
(Pl. 102, figs. 7a-b).

1933 Elphidium craticulatum (FICHTEL & MOLL); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 48, pl. 11, figs. 5a-b.
1939 Elphidium craticulatum (FICHTEL & MOLL); - CUSHMAN, pl. 15, fig. 17.
1968 Elphidium craticulatum (FICHTEL & MOLL); - ALBANI, p. 111, pl. 9, figs. 19-20.
+ 1968 Elphidium batavum; - HOFKER, p. 32, pl. 11, figs. 8-19.
1976 Elphidium craticulatum(FICHTEL & MOLL); - HANSEN & LYKKE-ANDERSEN, p. 7, pl. 2, figs. 3-9.

Description : See HOFKER (1968).

Diagnostic Remarks and Distribution : While I was first dealing with Lizard Island material I only distinguished two larger elphidiid species on the reef flats, viz. E. crispum and E. craticulatum. Later, closer investigation revealed the presence of a third, somewhat intermediate taxon, HOFKER's E. batavum. Both E. crispum and E. craticulatum show a great deal of variability and I feel slightly unsatisfied with HOFKER's new species. I am convinced of the necessity of a thorough comparative structural study of the three forms involved before deciding upon the creation of a new species.

The distribution of E. batavum seems to be parallel to the one of Pacific crispum and craticulatum. This is the first record from the Great Barrier Reef, though the specimen figured as craticulatum from New South Wales by ALBANI (1968) is obviously a batavum.
HANSEN's (e.a.) craticulatum-material from the Kei-islands apparently contains E. batavum as shown by his depicted specimen.

Occurrence : Same as for E. craticulatum but considerably less frequent. Living specimens are extremely rare.

Elphidium craticulatum (FICHTEL & MOLL), 1798.
(Pl. 102, fig. 8; pl. 103, figs. 1a-b).

\+ 1798 Nautilus craticulatus; - FICHTEL & MOLL, p. 51, pl. 5, figs. h-k.
1826 Polystomella craticulata (FICHTEL & MOLL); - d'ORBIGNY, p. 284.
1884 Polystomella craticulata (FICHTEL & MOLL); - BRADY, p. 739, pl. 110, figs. 16-17.
1893 Polystomella craticulata (FICHTEL & MOLL); - EGGER, p. 433, pl. 20, figs. 24-25.
1914 Polystomella craticulata (FICHTEL & MOLL); - CUSHMAN (U.S.N. Mus. Bull. 71, pt. 4), p. 34, pl. 19, figs. 4a-b.
1921 Polystomella craticulata (FICHTEL & MOLL); - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4, pp. 368-369.
1927 Polystomella craticulata (FICHTEL & MOLL); - HOFKER (Siboga, pt. 1), p. 56, pl. 27, figs. 1-4.
non 1933 Elphidium craticulatum (FICHTEL & MOLL); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 48, pl. 11, figs. 5a-b. (= batavum HOFKER).
pars 1939 Elphidium craticulatum (FICHTEL & MOLL); - CUSHMAN, p. 56, pl. 15, figs. 14-16 (not 17, = batavum HOFKER).
1959 Elphidium craticulatum (FICHTEL & MOLL); - ASANO, pt. 1, p. 7, figs. 36-37.
1958 Elphidium craticulatum (FICHTEL & MOLL); - COLLINS, p. 420.
1960 Elphidium craticulatum (FICHTEL & MOLL); - BARKER (see ref. BRADY 1884).
non 1968 Elphidium craticulatum (FICHTEL & MOLL); - ALBANI, p. 111, pl. 9, figs. 19-20. (= batavum HOFKER).
non 1976 Elphidium craticulatum (FICHTEL & MOLL); - HANSEN & LYKKE-ANDERSEN, p. 7, pl. 2, figs. 3-9. (= batavum HOFKER).

Description : See CUSHMAN (1939).

Diagnostic Remarks and Distribution : See also remarks under E. batavum HOFKER - see also HOFKER (1968). Typical representatives of this species show a subglobose lenticular test with numerous chambers and very large perforated umbilical areas filled up with clear shell material. In our material very large tests are often encountered; test diameters over 1 mm are common; the largest encountered specimen (L 98, heavily worn and encrusted by bryozoans) measures over half a cm (!).

The species has an exclusive Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef. E. craticulatum is the type species of the genus Cellanthus, genus invalidated by HANSEN & LYKKE-ANDERSEN (1976).

Occurrence : Present in all habitats at Lizard Island. Highest frequencies are in the Patchreef- and Perireefal Areas where living specimens (mostly smaller ones) are occasionally encountered.

Elphidium crispum (LINNE), 1758.
(Pl. 103, figs. 2-5).

Extensive synonymy up to 1959 : see e.g. GRAHAM & MILITANTE (1959).

Additional References :

1958 Elphidium crispum (LINNE); - COLLINS, p. 420.
1959 Elphidium crispum (LINNE); - GRAHAM & MILITANTE, p. 74, pl. 11, figs. 13 a, b.
1960 Elphidium crispum (LINNE); - ASANO, p. 197, pl. 22, figs. 6a-b.
1968 Elphidium crispum (LINNE); - ALBANI, p. 111, pl. 10, fig. 7.
1969 Elphidium crispum (LINNE); - BLANC-VERNET, p. 211, pl. 12, fig. 3/11.
1971 Elphidium crispum (LINNE); - MURRAY (Atlas), p. 155, pl. 64, figs. 1-6.
1976 Elphidium crispum (LINNAEUS); - HANSEN & LYKKE-ANDERSEN, p. 6, pl. 1, figs. 10-12; pl. 2, figs. 1-2.
1978 Elphidium crispum (LINNE); - UBALDO & OTERO, p. 111, pl. 5, figs. 7-8.
1979 Elphidium crispum (LINNE); - BLANC-VERNET, CLAIREFOND & ORSOLINI, pl. 22, fig. 11; pl. 24/Ec.

1979 Elphidium crispum (LINNAEUS); - PEREIRA, pl. 37, figs. D-F.
1980 Elphidium crispum (LINNE); - HOTTINGER & LEUTENEGGER, pl. 11, figs. 1-6.

Description : See CUSHMAN (1939).

Diagnostic Remarks and Distribution : See also remarks under E. batavum HOFKER - see also HOFKER (1968). Most specimens in our material are perfectly identical with the Mediterranean and Indopacific specimens illustrated by many authors. The periphery is angular and keeled, not lobulate; there are fewer chambers in the last coil (15-18 tot 20 max.) than counted in E. batavum (23-27) and E. craticulatum (numerous). The sutures are curved, the retral processes broad (occupying half to 2/3 of the chamber width), the depressions between the retral processes are finely hispid (papillate) as well as the apertural face. The umbilical bosses are relatively small but prominent in larger specimens and perforated by a few openings. In apertural view the test is trapeziform. Monstruosities often consisting of fused specimens occur upon the reef flats.

This is a well-known cosmopolitan species living in tropical as well as subtropical - to temperate shelf seas. It has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Present in all habitats at Lizard Island, but particularly abundant in intertidal areas (reef flats, patchreef area). Highest frequencies are on the Windward Barrier.

Elphidium jenseni CUSHMAN, 1924.
(Pl. 103, figs. 6a-b).

1904 Polystomella macella var.; - JENSEN, p. 817, pl. 23, fig. 4.
\+ 1924 Elphidium jenseni; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 49, pl. 16, figs. 4, 6.
1933 Elphidium jenseni CUSHMAN; - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 48, pl. 11, figs. 6-7.
1939 Elphidium jenseni CUSHMAN; - CUSHMAN, p. 62, pl. 17, figs. 14-15.
1953 Elphidium jenseni CUSHMAN; - ASANO, pt. 1, p. 9, figs. 48-49.

1954 Elphidium jenseni CUSHMAN; - CUSHMAN, TODD & POST, p. 346, pl. 86, fig. 32.
1960 Elphidium jenseni CUSHMAN; - ASANO, p. 199, pl. 22, figs. 5a-b.
1968 Elphidium jenseni CUSHMAN; - ALBANI, p. 112, pl. 10, fig. 8.

Description : See CUSHMAN (1924, 1939).

Diagnostic Remarks and Distribution : Our specimens agree with CUSHMAN's descriptions and illustrations. The tests are strongly compressed, the sutures curved, the retral processes elongate. There are no umbilical knobs.

The species is exclusively known from South Pacific shallow tropical waters. COLLINS (1958) did not report the species from the Great Barrier Reef but ALBANI (1968) reported it from New South Wales.

Occurrence : Rare; some isolated empty tests occur at several perireefal stations, one patchreef station and one reef-flat station.

Elphidium limbatum (CHAPMAN), 1909.
(Pl. 103, figs. 7a, b; pl. 104, fig. 1).

+ 1909 Polystomella macella (FICHTEL & MOLL), var. limbata; - CHAPMAN, p. 142, pl. 10, figs. 9a, b.
1932 Elphidium macellum (FICHTEL & MOLL), var. limbata (CHAPMAN); - CUSHMAN, p. 50, pl. 11, figs. 9a, b.
1939 Elphidium macellum (FICHTEL & MOLL), var. limbatum (CHAPMAN); - CUSHMAN, p. 52, pl. 14, fig. 5.
1958 Elphidium limbatum (CHAPMAN); - COLLINS, p. 421.
1979 Elphidium macellum (FICHTEL & MOLL) (part); - PEREIRA, pl. 37, fig. J (not figs. G-H).

Description : See CHAPMAN (1909).

Diagnostic Remarks and Distribution : This species, originally described as a subspecies of E. macellum by CHAPMAN (1909), has been elevated to specific rank by COLLINS (1958). There is apparently a great deal of confusion among authors as to the exact definition of the true E. macellum

although it is the type species of the genus Elphidium. For further discussion, see e.g. HANSEN e.a. (1976, p. 6). I cannot confirm whether E. limbatum is conspecific with E. macellum or not though it might be wise to separate (following COLLINS, 1958) the smaller recent Indopacific E. limbatum from the European fossil and subfossil E. macellum which is much more compressed, larger, less ornate and does not seem ever to show areal apertures. The recent Mediterranean specimen figured by HANSEN e.a. (1976, pl. 1) seems to show features intermediate between macellum and limbatum.

Our Lizard Island specimens invariably show a smooth lateral ridge upon each chamber wall; otherwise most tests are finely or more strongly papillate, particularly in the umbilical region and upon the earliest part of the last coil, below the primary apertures (as in E. macellum var. granulosum SIDEBOTTOM). A few specimens show areal apertures upon the apertural face, as mentioned by HOFKER (1971) for E. macellum from the Mediterranean. HANSEN e.a. (1976) however expressed doubts upon HOFKER's determinations as far as E. macellum is concerned; this entire macellum-problem should be more closely investigated in the future. The suppression of the genus Cribroelphidium by HANSEN e.a. (1976) seems justified as in our limbatum-material areal apertures may or may not be present in one single population.

CHAPMAN's types are from Victoria, Australia; CUSHMAN reported the species from Pacific Islands whereas COLLINS reported it from the Great Barrier Reef. PEREIRA's specimens are from Eastern African reefs; the species thus seems to have a wide Indopacific distribution and it should be investigated whether it is present in the Mediterranean or not.

Occurrence : Rare to common in all habitats at Lizard Island; living specimens are occasionally encountered.

Elphidium poeyanum (d'ORBIGNY), 1839.
(Pl. 104, figs. 2-3).

Extensive synonymy up to 1959 : See GRAHAM & MILITANTE (1959).

+ 1839 Polystomella poeyana; - d'ORBIGNY, p. 55, pl. 6, figs. 25-26.

1959 Elphidium poeyanum (d'ORBIGNY); - GRAHAM & MILITANTE, p. 75, pl. 11, figs. 15a, b.

1976 Elphidium poeyanum (d'ORBIGNY); - HANSEN & LYKKE-ANDERSEN, p. 13, pl. 9, figs. 9-12; pl. 10, figs. 1-5.

Description : See HANSEN & LYKKE-ANDERSEN (1976).

Diagnostic Remarks and Distribution : Characteristic features of this species are the weakly compressed test, the rounded, slightly lobulate periphery, the slightly depressed sutures with short but distinct retral processes, the slightly depressed umbilici. Our specimens are close to E. oceanicum which has been reported by COLLINS (1958) from the Great Barrier Reef, but lack the "irregularly raised pattern" in the umbilici, characteristic of the latter species. Both E. poeyanum and E. oceanicum might however be ecovariants of the same species. Finally the eventual relationship between poeyanum and advenum should be checked; E. advenum could eventually be considered as a compressed poeyanum.

E. poeyanum was HOFKER's (1951) type species of Elphidiononion.

E. poeyanum has a cosmopolitan distribution; COLLINS (1958) however did not mention the species from the Great Barrier Reef.

Occurrence : Present in small numbers in all habitats at Lizard Island, but highest frequencies are found in the shallow backreef areas. Living specimens are occasionally encountered.

Elphidium galeraensis n. sp.
(Pl. 104, figs. 4-6).

1959 Elphidium sp.; - GRAHAM & MILITANTE, p. 76, pl. 11, figs. 17-18a, b.

1974 Elphidium "aff. discoidale (ORBIGNY)"; - LUTZE, p. 32, pl. 8, figs. 122-125.

Derivatio Nominis : Named after the Mindoro area Puerto Galera, Philippines, where GRAHAM & MILITANTE's specimens of this species were collected.

Description : Test free, involute, moderately compressed, planispiral. 9-13 chambers in the last coil, mostly 11-12. Periphery in lateral view rounded to slightly lobulate at the level of the few last-formed chambers, in apertural view rounded. Test wall slightly translucent and smooth except for papillate-hispid areas in the oral area (upon the apertural face as well as the earliest part of the final coil), extending laterally towards the umbilici without reaching them. Apertural face flattened and forming a bluntly rounded angle with the lateral chamber walls. Aperture a row of small rounded - to slightly elongate holes at the base of the apertural face. Sutures slightly curved, nondepressed, flush with the test surface, except for the few last-formed ones which are slightly depressed. Retral processes about 12-13 pro suture at each side of the test; with short but marked ponticuli in the few last-formed sutures but gradually filled up with shell material due to secondary lamination in the earlier sutures where only alighments of small rounded holes remain. These ponticuli are obviously of the same forked type as illustrated by LUTZE (1974, pl. 8, fig. 125) but this feature is only visible upon the ponticuli of the last suture. (see pl. 104, fig. 4a, 6c). It is not clear whether the openings observed at the base of these ponticuli lead into the intraseptal space or, most probably, into the canal system. A detailed structural investigation should be carried out in the future. The umbilici are completely filled with shell material; only a series of somewhat larger holes around the umbilicus, aligned with the sutures, and a few holes in the central area of the umbilicus remain open and probably give access to an umbilical canal system.

Diagnostic Remarks and Distribution : This is without any doubt the species which LUTZE (1974) illustrated from the Persian Gulf. He was reluctant to put his species in synonymy with E. discoidale to which I can agree as there are several differences (see LUTZE 1974). However I consider E. discoidale as a poorly defined species anyway. The Miocene E. koeboeensis LEROY (see discussion in LUTZE, 1974, p. 32) indeed seems to be closely related, showing however much more prominent, swollen and smooth umbilical bosses; our galeraensis-species might perhaps have evolved from E. koeboeensis. The specimens left in open nomenclature and illustrated by GRAHAM & MILITANTE (1959) from Puerto Galera (Philippines) obviously belong to the present species.

Occurrence : Rare; empty tests and a few living specimens occur in several perireefal samples, in the Lagoon (L 124 !) and in the Patchreef Area.

Holotype : The specimen illustrated on Pl. 104, figs. 6a-d, from sample L 86.

Family NUMMULITIDAE de BLAINVILLE, 1825.

Subfamily NUMMULITINAE de BLAINVILLE, 1825.

Genus Operculina d'ORBIGNY, 1826.

Operculina ammonoides (GRONOVIUS), 1781.
(Pl. 105, figs. 1-3).

Extensive Synonymy : See HOTTINGER (1977a).

Additional References :

1959 Operculina ammonoides (GRONOVIUS); - GRAHAM & MILITANTE, p. 76, pl. 12, figs. 1-2a, b; Operculina complanata (DEFRANCE); - id, p. 77, pl. 12, figs. 3-5a, b.

1977 a Operculina ammonoides (GRONOVIUS); - HOTTINGER, p. 89, pl. 2, figs. A, B; pl. 3, figs. B-F; pl. 4-7; pl. 12, pl. 13; fig. B; pl. 14, figs. 1-4, 7-9; textfigs. 35 A-D, 36.

1977 b Operculina ammonoides (GRONOVIUS); - HOTTINGER, p. 100, figs. 7, 11, 12, 23, 24a, 25-28, 36B.

Description : See HOTTINGER (1977a).

Diagnostic Remarks and Distribution : See also HOTTINGER (1977a, p. 88, etc; 1977b, p. 100), FERMONT (1977, p. 111, etc.). The synonymy, structure and variability of this species have been discussed extensively by HOTTINGER (1977a). In our Lizard Island material mostly more or less evolute specimens are present though there is some variability in this feature; all the relatively rare completely involute forms belong to Nummulites cumingii (CARPENTER).

This species has an exclusive Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef (p. 425). A Miocene forerunner of O. ammonoides is known as O. bikiniensis COLE (fide HOTTINGER 1977a).

Occurrence : This large Operculina is one of the major constituants of the coarse fraction of most perireefal samples where it occurs in large numbers together with larger soritids, amphisteginids, Heterostegina, Alveolinella and Calcarina spengleri subsp. mayori. Living specimens are common to abundant.

Genus Nummulites LAMARCK, 1801.

Nummulites cumingii (CARPENTER), 1860.
(Pl. 105, figs. 4-6).

Extensive Synonymy : See HOTTINGER (1977a).

Additional References :

1959 Operculinella venosa (FICHTEL & MOLL); - GRAHAM & MILITANTE, p. 77, pl. 12, figs. 6-7a, b.

1977 a Nummulites cumingii (CARPENTER); - HOTTINGER, p. 122, pl. 10, figs. D-E; pl. 55-57; textfig. 51.

Description : See CARPENTER (1860), HOTTINGER (1977a).

Diagnostic Remarks and Distribution : See also HOTTINGER (1977a). Recently, the identity of Nautilus venosus FICHTEL & MOLL with N. cumingii seems to have been demonstrated by RÖGL (HOTTINGER, written communication).

In this case the species name should be changed into Nummulites venosus (FICHTEL & MOLL) according to the priority rule. As this change came to my knowledge after closure of my references, the name N. cumingii has been maintained in this thesis but the case will be revised for future publication. The tests in our material are completely involute and the marginal cord is thick and broad, well visible at the periphery of the test. The trabeculae are clearly visible.

HOTTINGER (1977a) stated that the species is exclusively known from the Indonesian - Philippine area but it is highly probable that at least part of the material reported by COLLINS (1958) from the Great Barrier Reef as Operculinella venosa (FICHTEL & MOLL) comprises N. cumingii; the latter species then would have a wide Indopacific distribution in tropical seas. HOTTINGER (1980) found the species also in the Maledivas.

Occurrence : Same as O. ammonoides but less frequent.

Subfamily CYCLOCLYPEINAE BUTSCHLI, 1880.

Genus Heterostegina d'ORBIGNY, 1826.

Heterostegina depressa d'ORBIGNY, 1826.
(Pl. 105, fig. 7-8).

Extensive Synonymy : See HOTTINGER (1977a).

Additional References :

1958 Heterostegina suborbicularis d'ORBIGNY; - COLLINS, p. 427.

1959 Heterostegina suborbicularis d'ORBIGNY; - GRAHAM & MILITANTE, p. 76, pl. 11, figs. 19-22a-b.

1965 Heterostegina sp.; - JELL, MAXWELL & Mc KELLAR, pl. 44, fig. 8.

1977 a Heterostegina depressa d'ORBIGNY; - HOTTINGER, p. 119, pl. 3, fig. A; pl. 10, fig. D; pl. 14, figs. 5, 6; pl. 52, figs. 5-8; pl. 53, 54; textfig. 50.

1977 b Heterostegina depressa d'ORBIGNY; - HOTTINGER, p. 102, figs. 24 B-E, 33 C-E, 34, 35 D, 36 C.

Description : See HOTTINGER (1977a).

Diagnostic Remarks and Distribution : See also HOTTINGER (1977a). Our specimens are completely identical with HOTTINGER's Red Sea specimens and show the same variability. The species is characterised by its thickened, involute test. HOTTINGER (1977b) stated that the species is distinguished from H. operculinoides HOFKER by "its involuteness, its higher number of

operculinoid septa and its tighter spiral growth". (H. operculinoides has been reported by COLLINS (1958) from the deeper waters - 200 m - of the continental shelf in the Great Barrier Reef area).

H. depressa has a wide Indopacific distribution in shallow to moderately deep tropical waters, and has been reported by COLLINS (1958) from the Great Barrier Reef; the species figured by JELL e.a. from Heron Reef is depressa without any doubt.

Occurrence : The species is present in two habitats at Lizard Island : in intertidal areas mostly smaller, somewhat more swollen variants occur whereas the larger, typical variants are rare to common in the Perireefal Area and the Patchreef Area. Living specimens are rare.

Family CAUCASINIDAE BYKOVA, 1959.

Subfamily FURSENKOININAE LOEBLICH & TAPPAN, 1961.

Genus Fursenkoina LOEBLICH & TAPPAN, 1961.

Fursenkoina pauciloculata (BRADY), 1884.
(Pl. 106, figs. 1-7).

+ 1884 Virgulina pauciloculata; - BRADY, p. 414, pl. 52, figs. 4, 5.
1893 Virgulina pauciloculata BRADY; - EGGER, p. 292, pl. 8, figs. 86-88, 94.
1921 Virgulina pauciloculata BRADY; - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 168.
1922 Virgulina pauciloculata BRADY; - CUSHMAN (U.S.N. Mus. Bull. 104, pt. 3), p. 121.
1937 Virgulina pauciloculata BRADY; - CUSHMAN (Virgulinidae), p. 25, pl. 4, figs. 1-6.
1951 Virgulina pauciloculata BRADY; - HOFKER (Siboga, pt. III), p. 247, figs. 164a-c.
1958 Virgulina pauciloculata BRADY; - COLLINS, p. 389.
1959 Virgulina schreibersiana CZJZEK; - GRAHAM & MILITANTE, p. 90, pl. 13, figs. 14a-b.
1960 Virgulina pauciloculata BRADY; - BARKER (see ref. BRADY 1884).

Description : See BRADY (1884), CUSHMAN (1937).

Diagnostic Remarks and Distribution : This rarely reported species is distinguishable from Virgulina (= Fursenkoina) schreibersiana by its much more elongate and enveloping last-formed chambers, often occupying almost the entire externally visible test surface. A basal spike may or may not be present.

In the past this species has apparently often been confused with variants of F. schreibersiana; I finally do not exclude the possibility of both pauciloculata- and schreibersiana to belong to the same species, but typical schreibersiana-specimens are not present in our material.

This species has a solely Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare; isolated empty tests occur in a few perireefal samples and one lagoonal sample. Living specimens are rare.

Genus Sigmavirgulina LOEBLICH & TAPPAN, 1957.

Sigmavirgulina tortuosa (BRADY), 1881.
(Pl. 106, figs. 8-9).

Extensive synonymy up to 1959 : see GRAHAM & MILITANTE (1959).

Additional references :

+ 1881 Bolivina tortuosa; - BRADY, p. 57.
1884 Bolivina tortuosa BRADY; - BRADY, p. 420, pl. 52, figs. 31-34.
1957 Sigmavirgulina tortuosa (BRADY); - LOEBLICH & TAPPAN, p. 227, pl. 73, figs. 1-2; textfig. 30.
1958 Bolivina tortuosa BRADY; - COLLINS, p. 395.
1959 Sigmavirgulina tortuosa (BRADY); - GRAHAM & MILITANTE, p. 87, pl. 13, figs. 6-7a, b.
1964 Sigmavirgulina tortuosa (BRADY); - LOEBLICH & TAPPAN, p. C 733, fig. 601/1-3.
1966 Sigmavirgulina tortuosa (BRADY); - BELFORD, p. 137, pl. 9, figs. 22-23.
1979 Bolivina tortuosa BRADY; - PEREIRA, pl. 28, figs. F-J.

Description : See BRADY (1881, 1884).

Diagnostic Remarks and Distribution : Our specimens are identical with BRADY's (1881, 1884) descriptions and illustrations. The chambers are "wrenched" along the length-axis of the test which is coarsely perforated and shows (often abraded) short spines in the early formed test portion.

This species has been transferred to the genus Sigmavirgulina by LOEBLICH & TAPPAN (1957). It has a solely Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Irregularly distributed in all environments (even upon the reef flats) at Lizard Island. Living specimens are rare.

Family LOXOSTOMIDAE LOEBLICH & TAPPAN, 1962.

(?) Genus Loxostomum EHRENBERG, 1854.

Loxostomum (?) limbatum (BRADY), 1881.
(Pl. 106, figs. 10-11).

Extensive Synonymy : See GRAHAM & MILITANTE (1959).

Selected and Additional References :

+ 1881 Bolivina limbata; - BRADY, p. 57.
1884 Bolivina limbata BRADY; - BRADY, p. 419, pl. 52, figs. 26-28.
1958 Loxostomum limbatum (BRADY); - COLLINS, p. 396.
1959 Loxostomum limbatum (BRADY); - GRAHAM & MILITANTE, p. 84, pl. 12, figs. 30-32a, b.
1960 Loxostomum limbatum (BRADY); - BARKER (See ref. BRADY 1884).
1966 Rectobolivina limbata (BRADY); - BELFORD, pl. 4, figs. 12-15; text-fig. 4/1.
1979 Loxostomina limbata (BRADY); - PEREIRA, pl. 28, figs. N-Q; pl. 29, fig. A.

Description : See BRADY (1881, 1884).

Diagnostic Remarks and Distribution : L. limbatum is a very variable species (several variants of it have been described separately e.g. by

CUSHMAN - div. publ.); most of our specimens show variable degrees of secondary lamination and are often more or less irregularly and faintly striate (see also remarks by BELFORD, 1966, p. 49); they are obviously of the same type as PEREIRA's (1979) specimens from Eastern African reefs. Some of our specimens strongly resemble CUSHMAN's Bolivina (= Loxostomum ?) mayori from Samoa, but the latter species should possibly be considered as a variant of L. limbatum.

Finally, I consider the attribution of the species to the genus Loxostomum only as tentative; the tests are indeed mostly not quadrate in section as would be required for a real Loxostomum but the remaining features, including the absence of an internal toothplate, hint at a close relationship with this genus anyhow.

L. limbatum seems to be restricted to Indopacific tropical areas; BRADY's types are from Honolulu and the Admirality Islands; BELFORD (1966) reported the species from the Mio-Pliocene of New Guinea; COLLINS (1958) reported L. limbatum as well as L. mayori from the Great Barrier Reef.

Occurrence : Rare to common in most perireefal samples; also present in a number of patchreef- and lagoonal samples. Living specimens are extremely rare.

Family CASSIDULINIDAE d'ORBIGNY, 1839.

Genus Globocassidulina VOLOSHINOVA, 1960.

Globocassidulina oriangulata BELFORD, 1966.
(Pl. 107, figs. 1a-c).

+ 1966 Globocassidulina oriangulata; - BELFORD, p. 148, pl. 25, figs. 1-5; textfigs. 16/13-14.

Description : See BELFORD (1966).

Diagnostic Remarks and Distribution : Our specimens are identical with BELFORD's types. This is a small species with a smooth globose test and smooth, slightly curved sutures; particularly the "trifid aperture with

large triangular lip at outer margin" (BELFORD, p. 148) is characteristic for the species.

BELFORD's types are form Miocene strata of New Guinea; no other references to this species have been found though, as BELFORD states, this species has probably been included in e.g. Cassidulina subglobosa by various authors.

Occurrence : Rare in a number of perireefal samples; moderately common in a few lagoonal-, one patchreef-, and one Sandy Shoal sample. Living specimens have not been encountered.

Superfamily NONIONACEA SCHULTZE, 1854.
(Nom. Transl. SUBBOTINA, 1959).

Family NONIONIDAE SCHULTZE, 1854.

Subfamily NONIONINAE SCHULTZE, 1854.

Genus Nonion de MONTFORT, 1808.

Note : In this chapter the genus Florilus de MONTFORT, 1808, has been considered as synonymous with Nonion, following HANSEN & LYKKE-ANDERSEN (1976; see op. cit. for full discussion, p. 30).

Nonion (?) gr. scaphum (FICHTEL & MOLL), 1798.
(Pl. 107, figs. 2-3).

Under this heading taxa have been assembled which resemble N. scaphum and Nonionella bradyi as depicted by BRADY, 1884, pl. 109 (designations of BARKER, 1960). Nonion scaphum is one of the species which are poorly defined by FICHTEL & MOLL (1798); many species have been attributed to scaphum by various authors and therefore I do not attempt to provide any synonymy list in this case. HANSEN & RÖGL (1980) state that "The latter name (Nonion scaphum (FICHTEL & MOLL), 1798) is a homonym of Nautilus scapha WULFEN, 1791, and no type material has been preserved".

Our specimens generally show a rounded periphery, a slightly lobulate symmetric to slightly asymmetric test. The chambers rapidly increase in heigth as added, though there is considerable variation in this feature. The apertural lip shows variable granulation. There are generally 9-10

chambers in the last coil. Some specimens have a less flaring test, are clearly assymmetrical and might belong to Nonionella bradyi CHAPMAN. A few tests show more chambers in the last coil (11-12), have slightly limbate sutures (at least the earlier-formed ones) and more granulated umbilici. These tests probably belong to a separate species but nothing more definite can be added because of the scarcity of the material.

All these variants have been treated together here, awaiting a thorough revision of "Nonion scaphum" and allied taxa, and a revision of recent Nonion in general which is urgently needed.

All specimens of the gr. scaphum in our material are confined to the Lagoon, the Perireefal Area, the Patchreef Area and the Sandy Shoal. COLLINS (1958) reported one specimen of "Nonion scapha" from the Great Barrier Reef.

Nonion subturgidum (CUSHMAN), 1924.
(Pl. 108, figs. 1-2).

+ 1924 Nonionina subturgida; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 47, pl. 16, fig. 2.
1933 Nonion subturgidum (CUSHMAN); - CUSHMAN (U.S.N. Mus. Bull. 161, pt. 2), p. 43, pl. 10, figs. 4-7.
1939 Nonion subturgidum (CUSHMAN); - CUSHMAN (Nonionidae),p. 25, pl. 6, figs. 29a-b.
1958 Nonion subturgidus (CUSHMAN); - COLLINS, p. 398.
1959 Nonion subturgidum (CUSHMAN); - GRAHAM & MILITANTE, p. 72, pl. 11, figs. 3a, b.
1966 Florilus subturgidus (CUSHMAN); - BELFORD, p. 158, pl. 31, figs. 13-15.

Description : See CUSHMAN (1924, 1939).

Diagnostic Remarks and Distribution : This striking species is easily distinguishable from other nonionids by its extremely elongate last-formed chambers; older descriptions often mention a last chamber comprising the entire test length but in our specimens mostly only about 5/6th of the test length is occupied by the last-formed chambers.Specimens are always completely symmetrical, have granulated umbilici and peristomal areas, and a rounded periphery.

This species is confined to the Indopacific; it has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare in several perireefal and lagoonal samples; empty tests as well as living specimens.

Genus Nonionella CUSHMAN, 1926.

Nonionella amplilabrata BELFORD, 1966.
(Pl. 108, figs. 3a-c).

+ 1966 Nonionella amplilabrata; - BELFORD, p. 159, pl. 31, figs. 16-20.

Description : See BELFORD (1966).

Diagnostic Remarks and Distribution : Our specimens, though rare, agree with BELFORD's description and illustrations, including the "large extension of final chamber, joining the suture between penultimate and last chamber in sharp angle" (BELFORD, 1966).

BELFORD's types are from the New Guinean Pliocene; the present record is the first one from the Great Barrier Reef and from Recent seas in general.

Occurrence : Very rare; occasional empty tests and a few living specimens have been found in several perireefal samples.

Family ANOMALINIDAE CUSHMAN, 1927.

Subfamily ANOMALININAE CUSHMAN, 1927.

Genus Heterolepa FRANZENAU, 1884.

Heterolepa praecincta (KARRER), 1868.
(Pl. 108, figs. 4a-b).

Extensive Synonymy : See BELFORD (1966).

Selected References :

+ 1868 Rotalia praecincta; - KARRER, pl. 5, fig. 7.
1884 Truncatulina praecincta (KARRER); - BRADY, p. 667, pl. 95, figs. 1-3.
1958 Cibicides praecinctus (KARRER); - COLLINS, p. 417.
1960 Cibicides praecinctus (KARRER); - BARKER (see ref. BRADY 1884).
1966 "Eponides" praecinctus (KARRER); - BELFORD, p. 125, pl. 16, figs. 1-6.
1974 Heterolepa praecincta (KARRER); - LUTZE, p. 38, pl. 9, figs. 142-144.

Description : See BRADY (1884).

Diagnostic Remarks and Distribution : This rather large, stout, coarsely porous species with thickened and raised sutures (few last ones excepted) has been attributed to several genera by various authors. FRANZENAU already in 1884 included praecincta in his newly established genus Heterolepa (fide LOEBLICH & TAPPAN, 1964), which is probably correct; LUTZE's (1974) Persian Gulf specimens are identical with our Lizard Island specimens; this author placed the species in Heterolepa again.

This species has a wide Indopacific distribution and has been reported by COLLINS (1958) from the Great Barrier Reef.

Occurrence : Rare to more or less common in several perireefal samples, empty tests as well as living specimens.

Subfamily ALMAENINAE MYATLYUK, 1959.

Genus Anomalinella CUSHMAN, 1927.

Anomalinella rostrata (BRADY), 1881.
(Pl. 109, figs. 1a-b).

+ 1881 Truncatulina rostrata; - BRADY, p. 65.
1884 Truncatulina rostrata BRADY; - BRADY, p. 668, pl. 94, figs. 6a-c.
1915 Truncatulina rostrata BRADY; - H. ALLEN & EARLAND, p. 709, pl. 52, figs. 33-36.
1921 Truncatulina rostrata BRADY, - CUSHMAN (U.S.N. Mus. Bull. 100, vol. 4), p. 321.

1924 Truncatulina rostrata BRADY; - CUSHMAN (Carnegie Inst. Publ. n° 342), p. 38, pl. 11, figs. 6-7.

1928 Anomalinella rostrata (BRADY); - CUSHMAN, p. 93.

1941 Anomalinella rostrata (BRADY); - LEROY, pt. 1, p. 46, pl. 3, figs. 99-100.

1944 Anomalinella rostrata (BRADY); - LEROY, pt. 2, p. 92, pl. 3, figs. 17-18.

1954 Anomalinella rostrata (BRADY); - CUSHMAN, TODD & POST, p. 371, pl. 91 fig. 24.

1957 Anomalinella rostrata (BRADY); - TODD, p. 279 (tab.), pl. 84, fig. 5.

1958 Anomalinella rostrata (BRADY); - COLLINS, p. 412.

1959 Anomalinella rostrata (BRADY); - GRAHAM & MILITANTE, p. 115, pl. 19, figs. 9a, b.

1960 Anomalinella rostrata (BRADY); - BARKER (see ref. BRADY 1884).

1966 Anomalinella rostrata (BRADY); - BELFORD, p. 185, pl. 33, figs. 9-13.

1979 Anomalinella rostrata (BRADY); - PEREIRA, pl. 44, figs. E-H.

Description : See BRADY (1884).

Diagnostic Remarks and Distribution : Our specimens are identical with the description and illustrations of BRADY (1884) and subsequent authors. Characteristic for the species are the coarse pores, the supplementary peripheral aperture and the earlier-formed sutures which are thickened by secondary lamination.

This easily recognisable species has a wide Indopacific distribution in tropical reefal areas and is known already from the Lower Miocene. BELFORD (1966) reported it from the New Guinean Miocene; COLLINS (1958) reported it from the Great Barrier Reef.

Occurrence : Rare; a few empty tests occur in samples from different environments, even from the reef flat of the Windward Barrier.

PLANCTONIC FORAMINIFERA

Planctonic Foraminifera have not been studied in detail in this work; they occur in most perireefal samples and their highest frequencies are reached in the Southeastern Perireefal Area; isolated tests occur in the Lagoon and the Patchreef Area. (Distribution : See Part 1). They have been counted together in the thanatocoenose counts under the heading "plancton". Major constituents are the species Globigerina bulloides d'ORBIGNY (see pl. 109, figs. 2-4) and Globigerinoides ruber (d'ORBIGNY) (see pl. 109, figs. 5-6).

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