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SCIENTIFIC REPORT OF THE BELGIAN EXPEDITION TO THE AUSTRALIAN GREAT BARRIER REEF, 1967

FORAMINIFERA :

I. SORITIDAE OF THE LIZARD ISLAND REEF COMPLEX A PRELIMINARY REPORT (*)

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(1 figure et 7 planches dans le texte)

RÉSUMÉ

L'auteur commente huit espèces de foraminifères appartenant à la Famille des *Soritidae*, représentés dans le système récifal de Lizard Island, Grande Barrière de Corail, Australie. La distribution de ces espèces est discutée et leur taxonomie commentée. Par ailleurs, l'auteur démontre que les deux variantes de *Marginopora*, les crénelés et les plats, appartiennent apparemment à la même espèce et suggère qu'on puisse abandonner la dénomination *Marginopora « laciniata »* (Brady).

ABSTRACT

The author comments on eight species belonging to the foraminiferal family *Soritidae* and occurring in or in the neighbourhood of the reefal system of Lizard Island, Great Barrier Reef, Australia. Distribution of these species is discussed and taxonomic notes are given for each of them. Structural evidence for considering the two *Marginopora*-variants as belonging to the same species is discussed, and the dropping the denomination *Marginopora « laciniata »* is proposed.

I. INTRODUCTION

a) **Generalities** : This paper deals with the foraminiferal material from some forty samples collected in the Lizard Island reef complex by a member of the belgian DE MOOR expedition, Dr. C. Monty. These samples range in depth from sea level (beach sand) to about 30 meters (shallow shelf sediments); they are surface-sediment samples taken by hand or by means of a small Van Veen-grab.

At this stage of my research on the Lizard Id material, no quantitative distributional patterns of living assemblages can really be plotted, as we have but little information about living-dead ratio's (no staining for the living forms was done on the field); also the Lizard samples do not cover *all* of the subdivisions of the reef complex (see sample network in figs 2 to 8), but most of them. Future field work will complete the sampling and fill in the gaps in personal observation.

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Nevertheless, in this preliminary note an attempt has been made to visualise the major trends of distribution of the *Soritidae* in a qualitative way and to provide systematical comments on the relevant species. Problems such as deciphering intraspecific variability as a product of ecophenotypic adaptation should be cleared up before undertaking the study of the dynamics of the foraminiferal communities of a given area and providing correct data about foraminiferal paleoecology in reef ecosystems. Observations and comments on taxonomy and morphology should be the first step in the foraminiferal actuopalaeontological study of a given area. This is what this paper deals with; forthcoming papers will consider other aspects of the Lizard Island foraminiferal communities, and will also systematically comment on other foraminiferal groups. Besides reporting and interpreting recent foraminiferal settings and distributions while questioning the classical systematics based on pure morphological features, this series of papers may help the palaeontologist and the palaeoecologist who are confronted with a « frozen » nature and must find clues to justify the significance of a given assemblage, or of a given morphological feature. Study of the present can give us indications as to « what means what » in terms of palaeoecology and palaeosystematics. From this point of vieuw the present paper is still far behind the goals we want to achieve and it should be read as a preliminary report.

The frequencies and distribution of the *Soritidae* discussed here, are shown in table I and must be considered merely as approximations. They are absolute frequencies, in other words they are a measure of the number of specimens of the considered species per gram of dry sample (see methods).

Care has been taken to illustrate every described foraminiferal form as accurately as possible, in order to complete the documentation published by Collins (1958).

A good summary of previous work on foraminifers of the Great Barrier Reef is found in Collins' monography (1958).

Jensen (1905) seems to be the only one to mention some foraminifera (from beach sands) of Lizard Island. He identified some 25 species among which the *Marginopora* form with irregular outline (« *Orbitolites complanata*, LamK., var. *laciniata*, Brady » as he states). Since Collins' work, only a few articles appeared dealing with the Great Barrier foraminifera. Ross (1972) studied the biology and the behaviour of *Marginopora* from some reefs off the Queensland coast near Innisfail and Bowen.

b) **Methods** are quite simple and can be summarized as follows : dried sediment samples were first quartiled by hand to obtain smaller quantities of a representative sample; these were then fractioned upon the 1000 μ, 250 μ and 63 μ sieves. Some very finely graded sediment samples, mainly from the shallow shelf surrounding the reef complex, were wet-sieved with distilled water by means of an apparatus set up in our laboratory by Segers, sedimentologist. All the foraminifera from a weighted granulometric fraction were then picked up under the binocular microscope and put in slides.

No flotation methods have been used upon fractions of 1000 μ and 250 μ for the well-known reason that many larger and worn foraminifera do not float neither in carbon tetrachlorid nor in tetrachloroaethylene. Upon the 63 μ fraction however, flotation by means of tetrachloroaethylene (Murray, 1969) has been carried out because I found out that the inconvenient reported above did not exist any more for these small forms, and some experimental tests showed that only very, very few foraminifera of this fraction remained on the bottom of the cup after flotation;

this justifies the use of this time-sparing method at least for the smallest but, in most cases, the richest of the three fractions.

c) **Lizard Island ; regional framework :** Lizard Island is situated in the northern part of the Great Barrier Reef, at 14°39′ lat. South, 145°28′ longit. East. It consists of two smaller and one larger granitic islands linked together by a reef complex; the whole is surrounded by a shallow shelf, from 20 to 30 meters deep. The main units of the complex are shown in fig. 1. I shall not insist upon the detailed description of the island and associated reef units, as this will be the subject of a separate note in preparation by Dr. C. Monty.

Fig. 1. — Lizard Island, the main reef units and sampling stations.

As can be seen on fig. 1, narrow fringing reefs coat the eastern coast of the island; they broaden toward the south and pass into a complex reef system, the principal divisions of which are, a reef ribbon between Palfrey and South islands, linked to Lizard by a windward barrier interrupted by a relatively narrow inlet which enables water masses to enter the lagoon; the lagoon approximates depths up to 12 m in its center whereas a sandy shoal shallows up immediately south of Lizard Island; it is limited eastward by a small mangrove. In the western part of the reef system stands an internal, protected platform and further to the West, the leeward patchreefs.

II. THE SORITIDAE OF LIZARD ISLAND — SYSTEMATICS AND NOTES

I shall hereafter follow the systematics of Loeblich and Tappan (1964). Synonymy is restricted to holotype reference (*) and some important works.

Order *Foraminifera* (Eichwald, 1830)
Suborder *Miliolina* (Delage and Hérouard, 1896)
Superfamily *Miliolacea* (Ehrenberg, 1939)
Family *Soritidae* (Ehrenberg, 1839)
Subfamily *Peneroplinae* (Schultze, 1854)
Genus *Peneroplis* (de Montfort, 1808)

1) *Peneroplis planatus* (Fichtel and Moll)
(Pl. I, figs. 1-3).

1798 *Nautilus planatus*, var., Fichtel and Moll; Testacea microscopica aliaque minuta ex generibus *Argonauta* et *Nautilus* ad naturam delineata et descripta.; Vienna, p. 91, pl. XVI, figs. 1d, e, f.

1960 *Peneroplis planatus* (Fichtel and Moll); Barker; Taxonomic notes on the species figured by Brady in Rep. For. Challenger...

a) Distribution : See table I. Maximum frequency, in surface sediment, occurs in the L2-L3 area that is in the immediate neighbourhood of the small mangrove; also occurs in the patchreef shoals (L16). The species is present in small numbers throughout the major part of the reef with the exception of the entrance and the northern part of the lagoon, which could perhaps be a current- and wave-sorting effect. All of the high-concentration areas are shoals (maximum depth 2 m).

On the surrounding shelf the concentration is low, except for L22 (— 24,4 m at low tide) where the concentration is moderate. These shelf sediments however, particulerly in front of the windward barrier (L22) appear very much as relict sediments because of the generalised worn, eroded aspect of the larger foraminifera and shell fragments. Anyhow, unlike Murray's (1973) suggestion about reefal foraminifers undergoing little postmortem displacement because of their supposed protected life-habitat, it seems more probable that our *P. planatus* concentrations are the result of mechanical postmortem test-accumulations.

In their studies of the southern Persian Gulf, Clarke and Keij (1973) state that, among many other foraminiferal species, *Peneroplis* specimens live loosely attached to seaweeds and that their tests are therefore easily subjected to transportation after the death of the weeds. This constatation agrees with my observations; the

(*) Holotype references have not been repeated under the item « references » at the end of this work.

TABLE I. — *Frequency and distribution of the Lizard Id.* Soritidae

main reefs units	species / sample nº	Peneroplis planatus	Peneroplis pertusus	Spirolina acicularis	Spirolina arietina	Sorites marginalis	Amphisorus hemprichii	Marginopora vertebralis (regular form)	Marginopora vertebralis (irregular form)
leeward patch-reef and internal platform	L 16	× ×	× × ×	×		× ×	× ×		× × ×
	L 20	×	×			×	× × ×		× ×
	L 19	×	×			×	× ×		× ×
	L 15	×	× ×	×			×		
lagoon	L 14	×	×			×	×		× × ×
	L 18						×		
	L 6		×						
	L 7	×	×			× × ×	×		
	L 8		×			× ×	×		×
	L 9	×	×			×	×		× × ×
	L 10	×			×	× ×	×		×
	L 11	×				×	×		× ×
lagoon inlet	L 12		×						
	L 13								×
sandy shoal and beach	L 2	× ×	× ×	×					× ×
	L 3	× × ×	× ×	× ×		×			×
	L 4	×	× ×	× ×		×			×
	L 43		×	×					× ×
	L 5						× ×		× ×
windward barrier	L 30	×	×						× ×
	L 25						×		× × ×
shelf	L 22	× ×	× × ×			× ×	× × ×	× × ×	
	L 23	×	× × ×			× ×	× × ×	× × ×	
	L 24	×	× × ×			× × ×	× × ×	× × ×	
	L 21	×	× ×			× ×	×	× × ×	
	L 42								
	L 37	×	× ×		×	× ×	× × ×	× × ×	

× = rare, × × = common, × × × = abundant.

only three formaline-preserved samples in our collection, two from Lizard Id. and one from Nymph Id, containing some branches of *Halimeda* and some other algae (exact location unknown) show that *P. planatus* and *P. pertusus* are attached to the branches of these algae, in moderate numbers, associated with lots of other foraminiferal species.

b) Taxonomic notes : See further.

2) *Peneroplis pertusus* (Forskål)
(Pl. I, figs. 4-5; Pl. II, fig. 4).

1775 *Nautilus pertusus*. Descriptiones animalium. (Post mortem auctoris editit Carsten Niebuhr). Copenhagen : Möller, p. 125.

1960 *Peneroplis pertusus* (Forskal); Barker; Taxonomic notes... : pl. XIII, fig. 16, 17, 23.

a) Distribution : See table I. In general this species is more frequent than *P. planatus*. The areas of maximum frequency are approximately the same as these of *P. planatus*. Here again we note the absence of the species in the lagoon inlet. Frequencies are quite high in the southern shelf sediments (L22, L23, L24) and slightly lower elsewhere upon the shelf. For the rest, the remarks reported for *P. planatus* are applicable to *P. pertusus*.

b) Taxonomic notes : See further.

Genus *Spirolina* (Lamarck, 1804)

3) *Spirolina acicularis* (Batsch).
(Pl. II, figs. 2-3).

1791 *Nautilus* (*Lituus*) *acicularis*; Batsch; A.I.G.C., Testaceorum arenulae marinae tabulae sex. (Sechs Kupfertafeln mit Conchilien des Seesandes); Jena : University Press, pp. 3, 6.

1960 *Spirolina acicularis* (Batsch); Barker : Taxonomic notes..., pl. XIII, figs. 20, 21.

a) Distribution : See table I. The species is very rare in the Lizard samples, except for the L2-L3-L4 area near the mangrove where it has been found in moderate numbers. Isolated specimens occur west of this area (L43, L15, L16), thus covering grosso modo the area of maximum frequency of the Peneroplids described above. The species is absent elsewhere.

b) Taxonomic notes : See further.

4) *Spirolina arietina* (Batsch).
(Pl. I, figs. 6-8; Pl. II, fig. 1).

1791 *Nautilus* (*Lituus*) *arietinus*; Batsch, A.I.G.C.; Testaceorum arenulae marinae tabulae sex.; Jena : University Press, pp. 3-6).

1960 *Spirolina arietina* (Batsch); Barker; Taxonomic notes...; (Pl. XIII, figs. 18, 19, 22).

a) Distribution : See table I. Extremely rare in the Lizard samples. One complete specimen has been found in sample 10, and some fragments and broken specimens in sample L37.

b) Taxonomic notes : See below.

5) Taxonomic notes and remarks concerning the Peneroplis and Spirolina species of Lizard Island.

Whether or not the four reported forms, *P. planatus*, *P. pertusus*, *S. acicularis*, *S. arietina*, are four well-separated species or not, is a question which apparently has not yet been solved in a satisfactory way up to now. L. Blanc-Vernet (1969) discusses this problem in her Ph. D. thesis on Mediterranean foraminifera; she quotes a thesis by G. Glacon on the foraminifers of the Gulf of Gabès in which the author suggests that these four forms could have differentiated from a common enrolled ancestor. (See also the discussion in the Catalogue of Foraminifera, Ellis and Messina, under the title *Nautilus* (*Lituus*) *arietinus* (Batsch, 1971).

As far as our Lizard samples are concerned, the fact that *P. planatus*, *P. pertusus* and *S. acicularis* are found together and present their maximal frequency at the same place suggests that they live in similar settings and accumulate in identical taphonomical conditions. Moreover the four described peneroplid forms share many fundamental characters whereas the variable morphology presents frequent intermediate stages : for instance in *Peneroplis*, the apertural face developes gradually from a larger and shorter *pertusus*-type into a narrow and elongate *planatus*-type; SEM photographs clearly show that the single openings composing the cribrate aperture of *P. pertusus* are formed in exactly the same way as those of *P. planatus* (see fig. 3, Pl. I; figs. 1, 4, Pl. II). Wall sculpture is the same in both forms (very finely perforated depressions between non-perforate ribs) and is the same again in both *Spirolina*-forms. Furthermore, J. M. 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, club-shaped (as in *S. acicularis*), flattened (as in *S. arietina*, or yet completely arcuate (as in *P. planatus* and *P. proteus*), could be found in a single specimen. Similar observations have been reported by Clarke and Keij (1973) who observed growth aberrations in a *Peneroplis* form which they did not identify specifically but which, judging from the plates, seems to be *Peneroplis proteus* (d'Orbigny). These authors state that a relation exists between the increase of these growth aberrations and abnormal salinities (50-70 ‰) in the sampled area and that « this growth aberration is probably a response to the great variability of the climate in these environments ». One might then wonder whether our reported *Peneroplis* and *Spirolina* species — identified according to the classical systematics — are real species or sort of end members belonging to one or several series of growth forms which developed in different microenvironmental conditions (due for instance to seasonal climatic, substrate etc. changes).

Subfamily *Soritinae* (Ehrenberg, 1839)
Genus *Sorites* (Ehrenberg, 1839)

6) *Sorites marginalis* (Carpenter)
(Pl. III, figs. 1, 2, 5; Pl. VII, figs. 1, 2).

1856 *Orbitolites marginalis*; Carpenter; Researches on the Foraminifera. Monograph of the genus *Orbitolites*; Philos. Trans. Roy. Soc. London, 146.

1940 *Sorites marginalis* (Lamarck); Lacroix; Orbitolites de la Baie de Cauda (figures).

1961 *Sorites marginalis* (Carpenter); Lehmann, R.; Strukturanalyse einiger Gattungen der Subfamilie *Orbitolitinae.* (several figures and plates).

a) DISTRIBUTION : See table I. The tests of *S. marginalis* show two areas of high concentrations : (1) the southern part of the lagoon where particularly thin and fresh tests can be found, and (2) the whole shelf surrounding Lizard Id. In our shelf samples, over 90 % of the encountered tests were altered and worn.

b) TAXONOMIC NOTES : thanks to the excellent work of R. Lehmann (1961) we were able to control the identification of our *Soritinae* by means of thin-sections. The aequatorial section of the A-form (figs. 1, 2, pl. VII) shows indeed the protoconch surrounded by the flexostyl channel, the first chambers of the *Peneroplis*-stage with rapidly increasing number of chamberlets (the first cyclical chamber being the twelfth), the particularly shaped septula and the thick septa. The external features are illustrated on pl. III, figs. 1 and 2, where can be seen the rounded margin with the oblong apertures. Some specimens show aberrant growth patterns such as the development of continuous chamber growth around a fragment of a broken specimen (see pl. III, fig. 5). All examined specimens are A-forms.

Genus *Amphisorus* (Ehrenberg, 1839)

7) *Amphisorus hemprichii* (Ehrenberg).
(Pl. III, figs. 3, 4; Pl. IV, fig. 6; Pl. VII, figs. 3, 4).

1839 *Amphisorus hemprichii*; Ehrenberg, C. G. : Über die Bildung der Kreidefelsen und des Kreidemergels durch unsichtbare Organismen; Abh. Koningl. Akad. Wiss. Berlin, p. 130.

1961 *Amphisorus hemprichii* (Ehrenberg); Lehmann, R. : Struktur-analyse einiger Gattungen ... *Orbitolitinae.* (Several figures).

a) DISTRIBUTION : See table I. Within the limits of the reef complex of Lizard Id. The species presents its maximum frequency on the internal protected reef flat (L16, L20, L19) and on the sandy shoal (L5). Elsewhere the species is rare or absent, even near the mangrove (L3, L4, L43) which is rather remarkable as this zone appears to be an area of mechanical accumulation of tests. In the shelf sediments surrounding Lizard Id., the species is abundantly represented. One striking difference distinguishes the specimens from the two units (reef complex — shelf) : within the reef complex, specimens are rather small and tend to develope thicker and rather irregular tests whereas the shelf specimens are invariably thin, extremely regular, ... and worn.

In general, the observed intraspecific variability runs parallel to the one observed in *Marginopora vertebralis* (see further) though less obvious.

b) TAXONOMIC NOTES : Details of an aequatorial section of an A-form are shown in figs. 3, 4, pl. VII; fig. 4, pl. VII shows part of the outer cyclical chambers; the annular channels and septa appear on the left whereas on the right, the typical « mushroom » structure (Lehmann, 1961), formed by chamberlet septula and corresponding stolon, can be distinguished. The embryonic apparatus (fig. 3, pl. VII) shows the protoconch (the left part of the protoconch wall was injured during thin-sectioning), the flexostyl channel and the deuteroconch with its wall pierced by stolons leading to the chamberlets of the first chamber.

Our Lizard material differs slightly from Lehmann's Kei-Island specimens by the following particularities : the greatest number of chambers reported by Lehmann for *A. hemprichii* in 35, whereas several of our specimens present up to 40 or even more of them; this difference could be environmentally controlled (slow reproduction rate, due to some unknown physical inhibiting factor, may for instance cause gigantism).

The second difference lies in the number of stolons in the wall of the deuteroconch; Lehmann states that the maximum number is twelve, whereas our specimen from fig. 3, pl. VII presents 13-14 openings. Sectioning of a larger number of australian specimens will show whether this is a constant feature of Barrier reef *Amphisorus* or not. Microspheric specimens have not yet been found in our material up to now.

Specific external features are illustrated by SEM photographs figs. 3, 4, pl. III. The margin is rounded, the two chamber layers, caracterised by the displacement of opposite chamberlets by the length of half a chamberlet, are clearly visible as well as the corresponding apertures of the marginal face, appearing in a double row. In general, folded and undulating specimens are much less frequent than irregular *Marginopora* specimens. (See below). Very often, the tests show signs of discontinuous growth (growth stages) as has been observed on *Amphisorus* from the Gulf of Elat (Hottinger, 1972).

Genus *Marginopora* (Blainville, 1830)

8) *Marginopora vertebralis* (Blainville).
(Pl. II, fig. 5; Pl. IV, figs. 1-5; Pl. V; Pl. VI; Pl. VII, figs.5-6).

1830 *Marginopora vertebralis*; de Blainville, H. M. D.; Mollusques, Vers et Zoophytes; Dictionn. Sci. Nat. 60, p. 377.

1850 *Orbitolites complanata*; Carpenter, W. B. : Quart. Journ. Geol. Soc. London, vol. 6, p. 30.

1960 *Marginopora vertebralis* (Blainville); Barker, Taxonomic notes ... pl. XVI, figs. 1-6, 8-11.

1961 *Marginopora vertebralis* (Quoy and Gaimard) : Lehmann : Strukturanalyse einiger Gattungen ... (several figs.).

a) Distribuiton : as will be discussed further, two distinct types are represented in the material from Lizard Id. : flat and irregular forms.

a.1) The irregular form (fig. 5, pl. II; fig. 4, pl. IV;p l. V; pl. VI; fig. 5, pl. VII). (See also Barker, 1960, pl. XVI, figs. 8-11) occurs exclusively within the limits of the reef complex s.s. (see fig. 2). It is abundant or moderately frequent on the shoals and reef flats where many broken tests occur together with rather fresh ones. One formaline-preserved sample from the sandy shoal shows thickets of *Halimeda* densely covered with fresh, large irregular *Marginopora* (up to 1 cm and more), some of them solidly attached to the thalli. This form is extremely rare or absent in the central lagoon area which suggests that it is confined to very shallow environments.

a.2) The flat form (figs. 1-3, pl. IV; fig. 6, pl. VII) occurs exclusively in the shelf sediments surrounding Lizard Id. (see fig. 2). Juvenile specimens of this form can be easily distinguished from juvenile specimens of the irregular form by their much less concave surfaces and narrower straight margin. It is abundant in these sediments, but most specimens are strongly worn and lack the embryonic apparatus. This form seems to live on the organic film coating the sea floor and on algae.

As will be shown below, both forms represented in the Lizard Id. material belong apparently to the megalospheric generation of one single species; they should therefore be considered as ecophenotypic variants, the factors controlling their particular overall morphology being unknown so far.

b) Taxonomic notes and discussion :

b.1) The internal features of both forms are identical, as can be seen in aequatorial thin-sections or SEM photographs. Arrangement of chambers, chamberlets, stolons, septa and septula as well as the *Orbitolites* structure of the principal chamber layer, are illustrated on pl. VII, fig. 6, representing an aequatorial thin-section of a flat form, and on pl. IV, fig. 5 showing a ground down specimen of the irregular form. Fig. 5, pl. VII (oblique section through an irregular specimen) shows the layer of secondary chambers above and the principal chamber layers with the typical *Orbitolites* structure below.

The embryos of the irregular and the flat form are identical; they show that both types are A-forms and they correspond completely with the descriptions by Lehmann (restriction made for the presence in the Lizard specimens of a rather well-developed flexostyl, clearly visible on fig. 5, pl. IV). Photo 6, pl. VII shows an aequatorial thin-section through the embryo of a flat specimen whereas photo 5, pl. IV shows the embryo of a sectioned specimen of the irregular type. Both photographs illustrate the protoconch, flexostyl channel and large enveloping deuteroconch with stolons giving access to the chamberlets of the first cyclical chamber; the number of stolons is variable but always falls in the range defined by Lehmann.

b.2) The external features of the irregular form are shown in fig. 4, pl. IV; fig. 5, pl. II; pl. V; pl. VI; where can be seen the secondary chamber layers (visible on the surface), as well as the rounded margin with the pores lying in regular depressions and surrounded by pronounced, smooth collars. This form corresponds with the illustrations given by Brady (1884) of his *Marginopora* « *laciniata* » (see also Barker, 1960); it is characterised by its very irregular outline and folded and twisted margin. All intermediate forms occur, ranging from specimens with a simple undulating margin to the extremely complicated aberrations or even monstruosities consisting of two fused and « twinned » specimens (see pl. V, pl. VI — this might be a phenomenon related to what Loeblich and Tappan (1964) mentioned as « polyvalence »).

b.3) Figs. 1, 3, pl. IV show external features of the flat form. Marginal face, pores and layers of secondary chambers are identical to those of the irregular form. A constant feature of the flat form is its relatively narrow margin without undulation even in aberrations like the one illustrated on pl. IV, fig. 3. Specimens consisting of a fragment surrounded by annular chambers, as was illustrated for *Sorites marginalis*, can also be found.

b.4) Discussion : Two types of *Marginopora* are present in the Lizard samples, an irregular and a flat one; they have well-separated occurence areas (reef flats, shoals — shelf). Both types are represented by megalospheric forms, no microspheric specimens were observed.

Accordingly, the irregular forms cannot be called *M. laciniata* for Hofker (1930) restricted this term to what he supposed to be the microspheric form of *M. vertebralis*.

It follows that the term *laciniata* should be dropped as Hofker's arguments (1930; see also Barker 1960) are not valid on the one hand, and as we have shown evidence for considering the irregular *Marginopora* as ecovariants of *M. vertebralis* on the other.

III. CONCLUSIONS

1) Foraminiferal thanatocoenoses are clearly distributed into two main assemblages : the reef complex assemblage and the surrounding shelf one. This is reflected not only by the distribution of the *Soritidae*, as shown in this note, but also by that of other groups as will be explicited in forthcoming papers. Furthermore the two environments are not only, or necessarily, characterised by different specific taxa, but also by the development of different specific ecophenes. This is very obvious in the case of *Marginopora*, but we met a similar (though less obvious) variability in *Amphisorus*, and even in *Peneroplis* (tests of *P. pertusus* are indeed more frequent than those of *P. planatus* in shelf sediments, and vice versa in the shallower reef sediments). *Amphistegina* (that will be discussed in a separate note), appears also to be a genus whose overall test morphology is strongly depth-controlled.

In general, *Soritid* tests are thinner, flatter and more regular in these deeper water shelf sediments. As this also applies to other foraminiferal forms such as *Amphistegina* and some other Rotaliids, we can but stress the influence of even small-scale depth differences on the morphology of tests of a single foraminiferal species or, anyhow, closely related forms. Future field work will provide a more complete sampling of this highly interesting area.

2) The observations made on samples from the reef complex itself (reef flats, lagoon, patch-reefs) show much more post-mortem transportation than could be expected after Murray's (1973) conclusions on reef foraminiferal thanatocoenoses; a coral reef is not always such a closed system : in the case of Lizard Id. for instance, the main inlet and the proximal lagoon area are strongly swept by currents; furthermore, empty reef-flat foraminiferal tests can be easily transported in a mainly NW direction, during hurricanes or storms. Several forms of our *Soritidae* are for instance transported over a distance of some kilometers and accumulate in the shallower northwestern part of the lagoon (sandy shoal and further on the leeward patch-reefs); this leads us to the preliminary conclusion that the main test transport trend is in a NW direction in the Lizard Id. reef complex. Results of work in progress show that the heavier tests of species living on the windward reef flat suffer a smaller transportation as they are trapped in depressions bordering the immediate backreef area. Accordingly it might be very misleading for palaeocoelogists to overgeneralize data reported about the distributional patters of recent foraminiferal thanatocoenoses.

As far as the displacement of tests on the shelf itself is concerned, no definite comments can be given at this stage of investigation because of the width of the initial sampling mesh and the apparent uniformity of foraminiferal thanatocoenoses.

3) From a pure systematical point of view, the observed ecophenotypic variability in our *Soritidae* (and other foraminiferal groups) appears to be quite significant and invalidates the strict application of the current taxonomic rules in actuopalaeontological work; it also demonstrates once more the complexity of the problems raised when dealing with the dynamics of recent foraminiferal communities.

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PLATE I

Fig. 1. — *Peneroplis planatus*. Sandy shoal; × 32

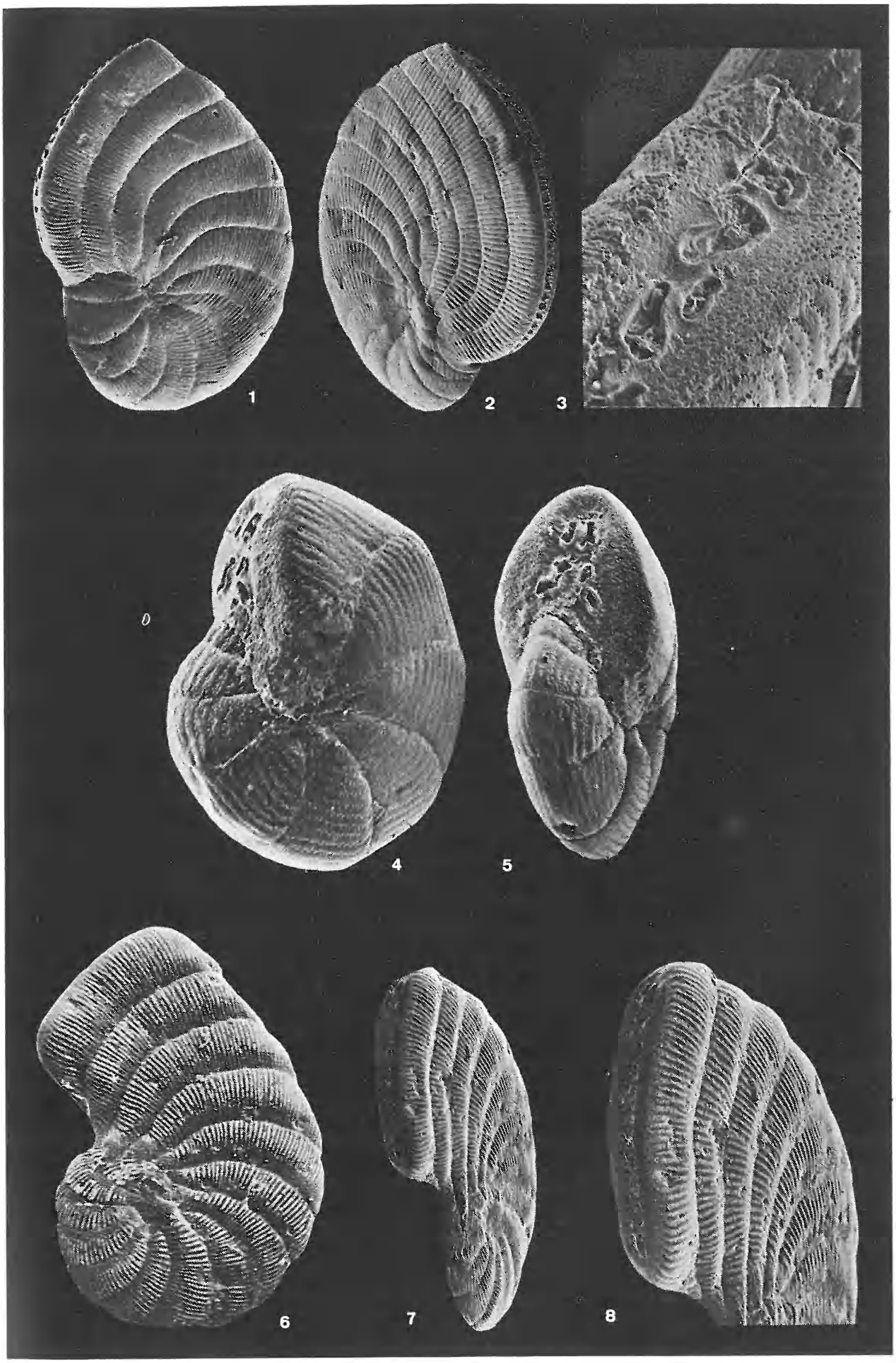
Fig. 2. — *Peneroplis planatus*. Shallow shelf sediments; × 37

Fig. 3. — Detail of apertural face of specimen shown in Fig. 1, Pl. I (compare with figs. 1, 4; Pl. II) × 208

Figs. 4, 5. — *Peneroplis pertusus*. Sandy shoal; × 118.

Figs. 6, 7, 8. — *Spirolina arietina*. Sample L 10; Figs. 6, 7 : × 42, Fig. 8 : × 72

PLATE I



2

PLATE II

Fig. 1. — Detail of apertural face of the specimen shown in Figs. 6, 7, 8, Pl. I (compare with fig. 3, Pl. I; Figs. 4, Pl. II); × 514

Figs. 2, 3. — *Spirolina acicularis*. Sandy shoal; × 36

Fig. 4. — Apertural face of the *Peneroplis pertusus* — specimen shown on Figs. 4, 5; Pl. I (compare with fig. 3, Pl. I; fig. 1, Pl. II); × 292

Fig. 5. — *Marginopora vertebralis*; young specimen of the irregular form. Lagoon; × 18.

PLATE II

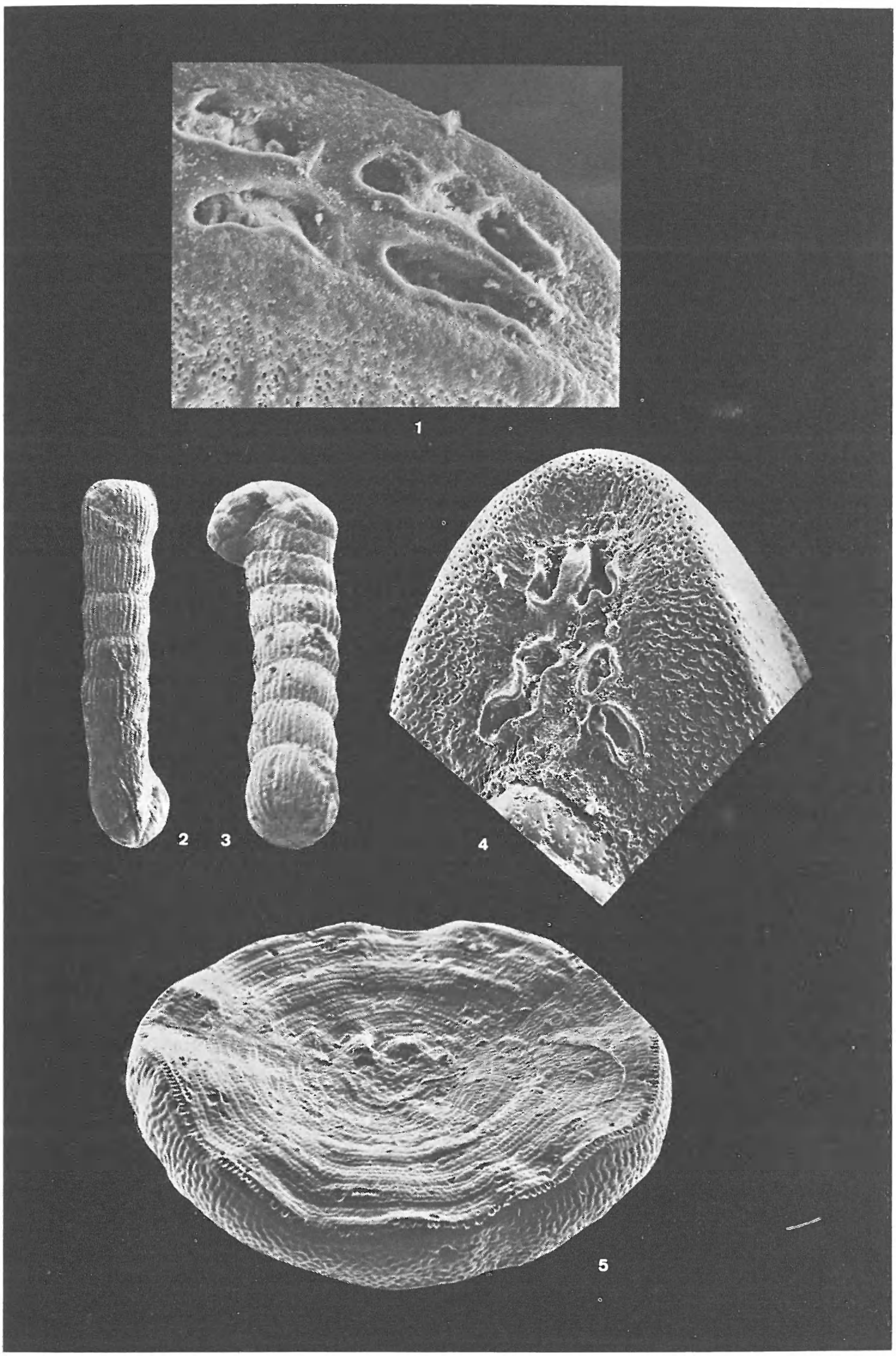


PLATE III

Fig. 1. — *Sorites marginalis*. Shallow shelf sediments. × 18

Fig. 2. — id., detail of margin showing single row of apertures. × 60

Fig. 3. — *Amphisorus hemprichii*. Worn specimen found in shallow shelf sediments. × 17

Fig. 4. — id., detail of margin showing the double row of apertures. × 63

Fig. 5. — *Sorites marginalis*, aberrant specimen (continuous annular chamber growth around a fragment of a broken specimen). Shallow shelf sediment. × 21

PLATE III

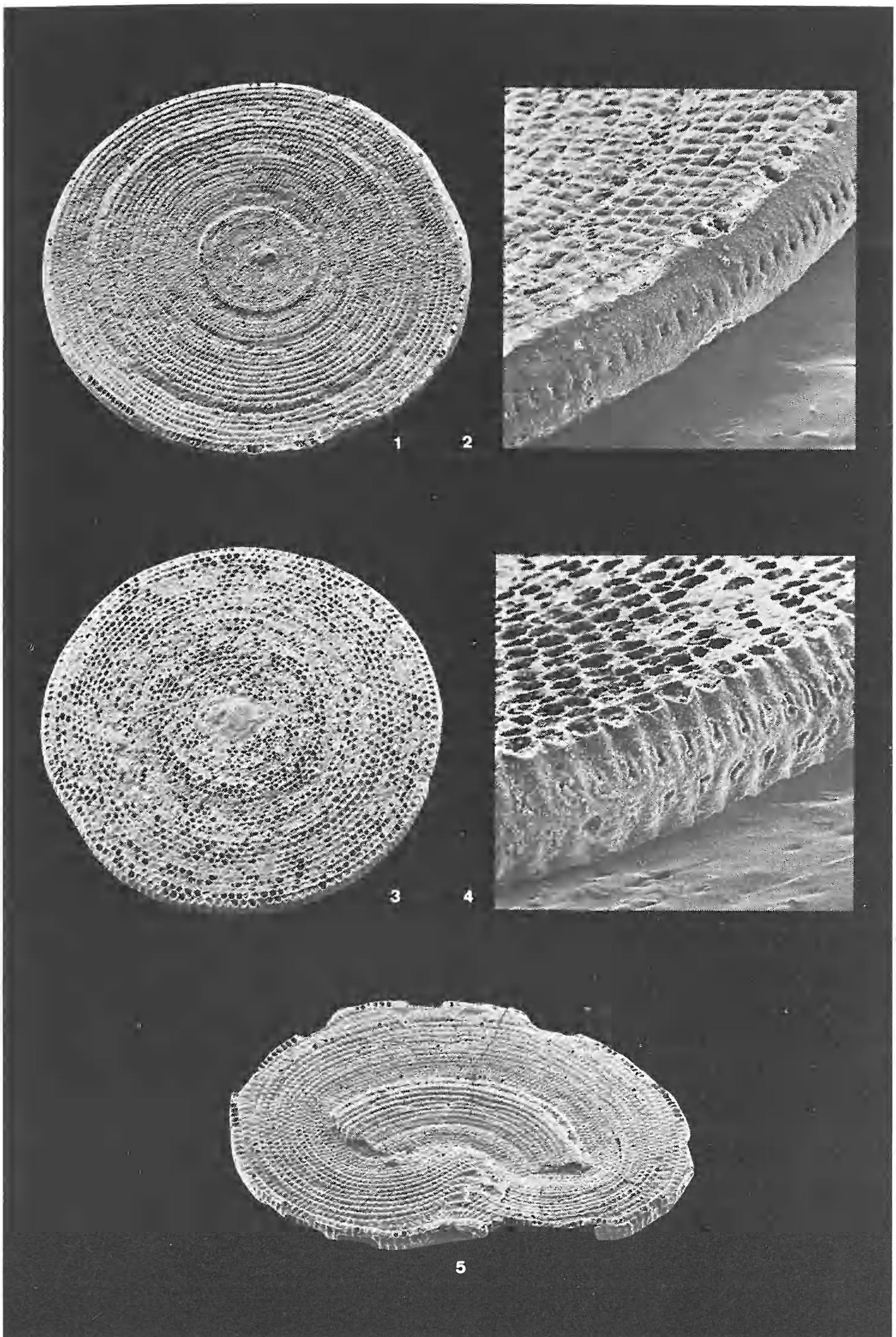


PLATE IV

Fig. 1. — *Marginopora vertebralis*, flat form. Shallow shelf sediments. × 11

Fig. 2. — Margin of the specimen shown in fig. 5, Pl. II, showing pores lying in depressions and surrounded by smouth collars, as well as the secondary chamber layer. × 32

Fig. 3. — *Marginopora vertebralis*, flat form. Aberrant specimen. Shallow shelf sediment. × 11

Fig. 4. — *Marginopora vertebralis*, irregular form. Detail of typically doubled and folded margin showing the same structural details as fig. 2, Pl. IV. Reef flat, windward barrier. × 20

Fig. 5. — *Marginopora vertebralis*, irregular form. Aequatorial section showing embryo with protoconch, flexostyl channel, deuteroconch and stolons giving access to the first cyclical chamber. Reef flat, windward barrier. × 125 (courtesy L. Marchand)

Fig. 6. — *Amphisorus hemprichii*, another view upon the margin of a specimen from the shallow shelf sediments. × 63

PLATE IV

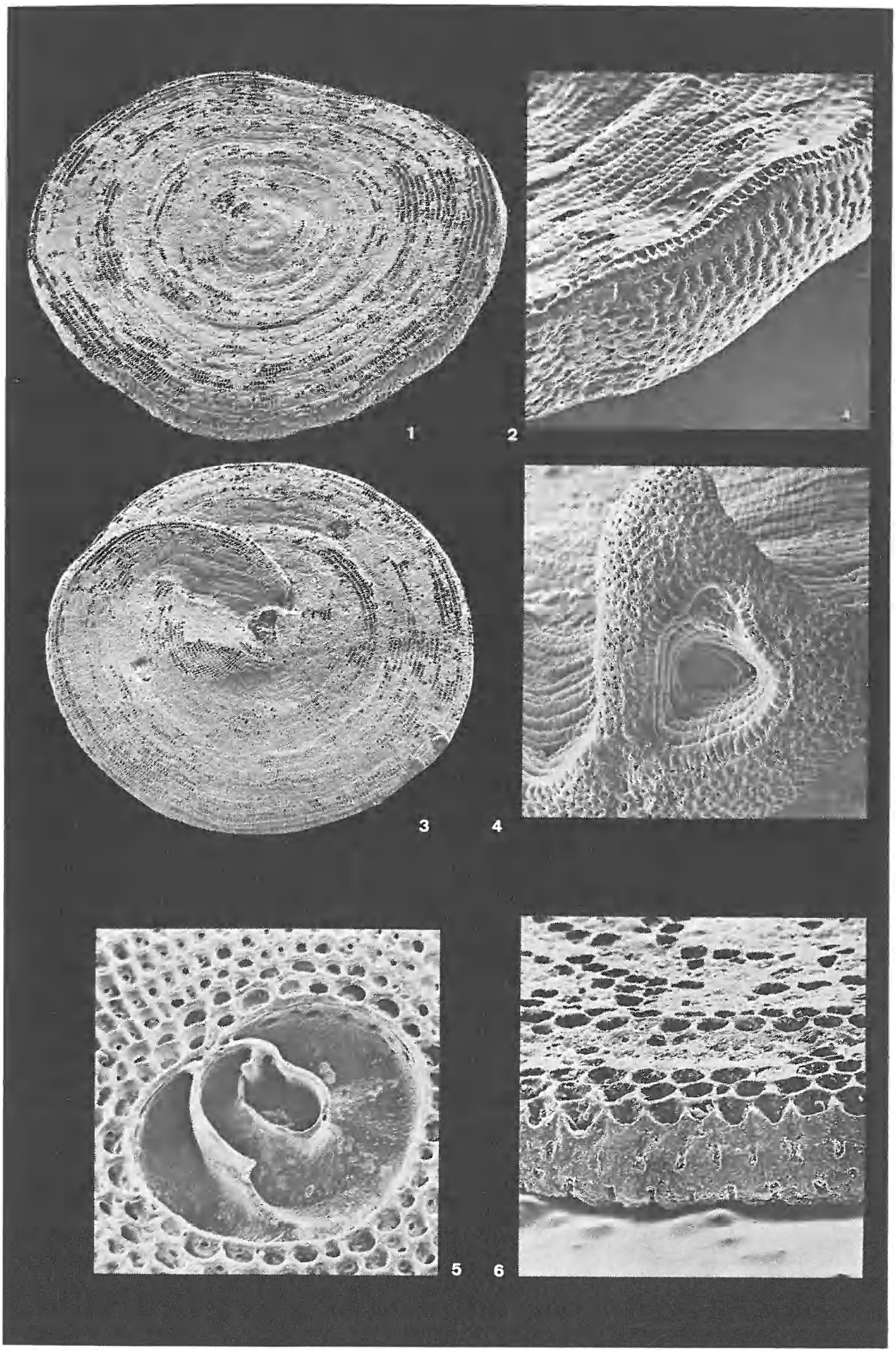


PLATE V

Marginopora vertebralis, irregular form. « Twinned » Specimen. Reef flat, windward barrier. × 12

PLATE V

PLATE VI

Marginopora vertebralis, irregular form. Another example of the variability of this form. Reef flat, windward barrier. × 11

PLATE VI

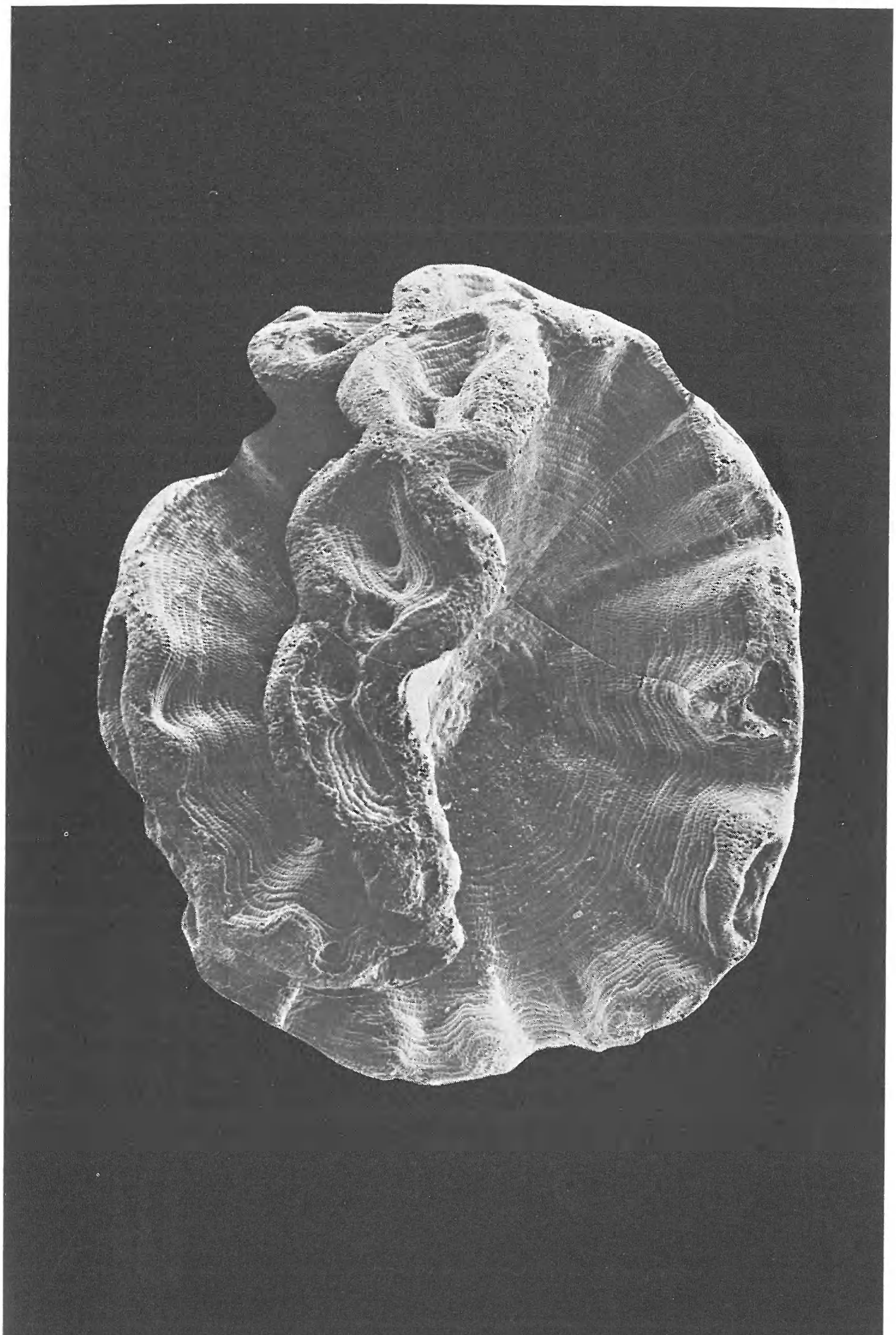


PLATE VII

All photographs taken from thin-sections of specimens embedded in canadabalsam.

Fig. 1. — *Sorites marginalis*, aequatorial section of an A-form. Lagoon. × 65.

Fig. 2. — id., showing protoconch, flexostyl, *Peneroplis*-stage and cyclical chambers, septula and septa. × 157

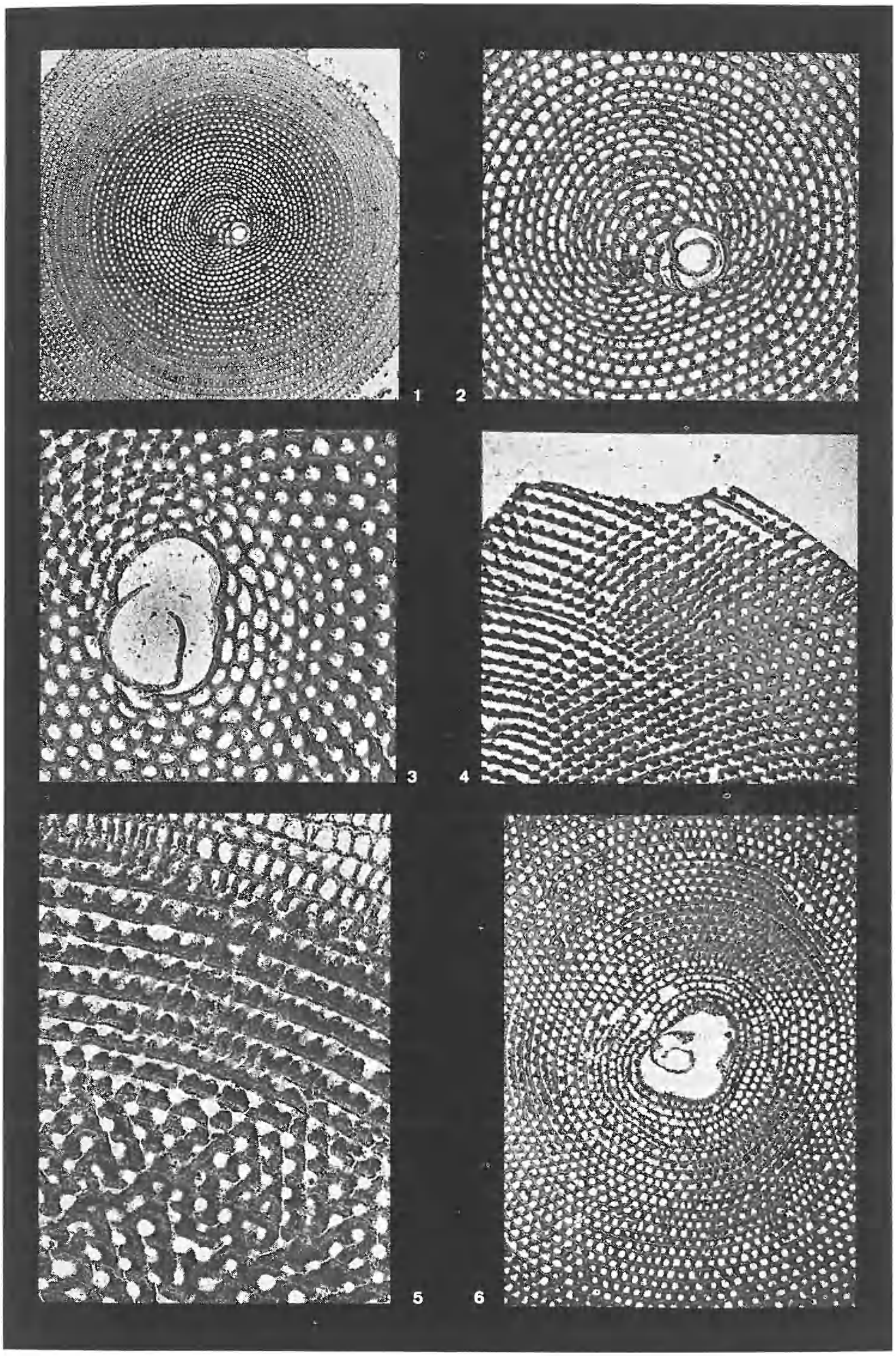
Fig. 3. — *Amphisorus hemprichii*. Aequatorial section, showing embryonic apparatus with protoconch, flexostyl channel (the left part of the protoconch wall has partly disappeared) and deuteroconch with its wall pierced by stolons leading to the first chambers. × 149

Fig. 4. — id., showing part of the outer cyclical chambers. On the left, the annular channels and septa can be seen, whereas on the right the typical « mushroom » structure appears. × 56.

Fig. 5. — *Marginopora vertebralis*, flat form. Shallow shelf sediment. Part of an oblique section showing secondary surface chamber layer above and principal chamber layer with the typical *Orbitolites*-structure below. × 132

Fig. 6. — id., aequatorial section showing embryonic apparatus with protoconch, flexostyl, deuteroconch, stolons and cyclical chambers (compare with fig. 5, Pl. IV). × 53

PLATE VII



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