

Growth anomalies in *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé

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RIASSUNTO — Vengono descritti e illustrati alcuni esemplari anomali di *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé caratterizzati soprattutto dalla presenza di tre raggi di camere equatoriali. Dallo studio di diverse sezioni assiali si è potuto constatare che tali esemplari presentano due apparati embrionali. Vengono infine presentate alcune ipotesi sull'origine di tali anomalie.

ABSTRACT — Some anomalous specimens of *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé with three «spokes» of equatorial chambers are described and illustrated. The study of many vertical sections demonstrates that the specimens examined have two embryonic apparatuses. A tentative interpretation of such anomalous structure is given.

INTRODUCTION

An examination of an assemblage of *Lepidocyclina* and *Miogypsina* collected from a new fossiliferous outcrop recently discovered by one of us (E. Serpagli) in the region of Montegibbio, South-West of Modena (Northern Apennines, F. 86, Tav. I SO, 200m NO of Capriola), showed the presence of many anomalous specimens of *Lepidocyclina*, all of which can be classified as *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé.

The research has been undertaken with the financial support of the Consiglio Nazionale delle Ricerche in the Institute of Paleontology, Modena University. Director: Prof. E. Montanaro Gallitelli.

The faunal assemblage is:

Lepidocyclina (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé

Miogypsina (*Miogypsinoides*) *complanata*
Schlumberger

Robulus sp.

Vulvulina sp.

Other authors have also observed anomalous individuals among the orbitoidal Foraminifera but the present material contains a higher proportion than formerly reported.

The anomalous specimens, seventeen in all, are about 3.7‰ of the total amount of specimens. Berry (1931) found a percentage of 0.4‰ and Kecskemeti (1959) a percentage of about 1‰ in *Discocyclina pratti* (Michelin).

PREVIOUS STUDIES

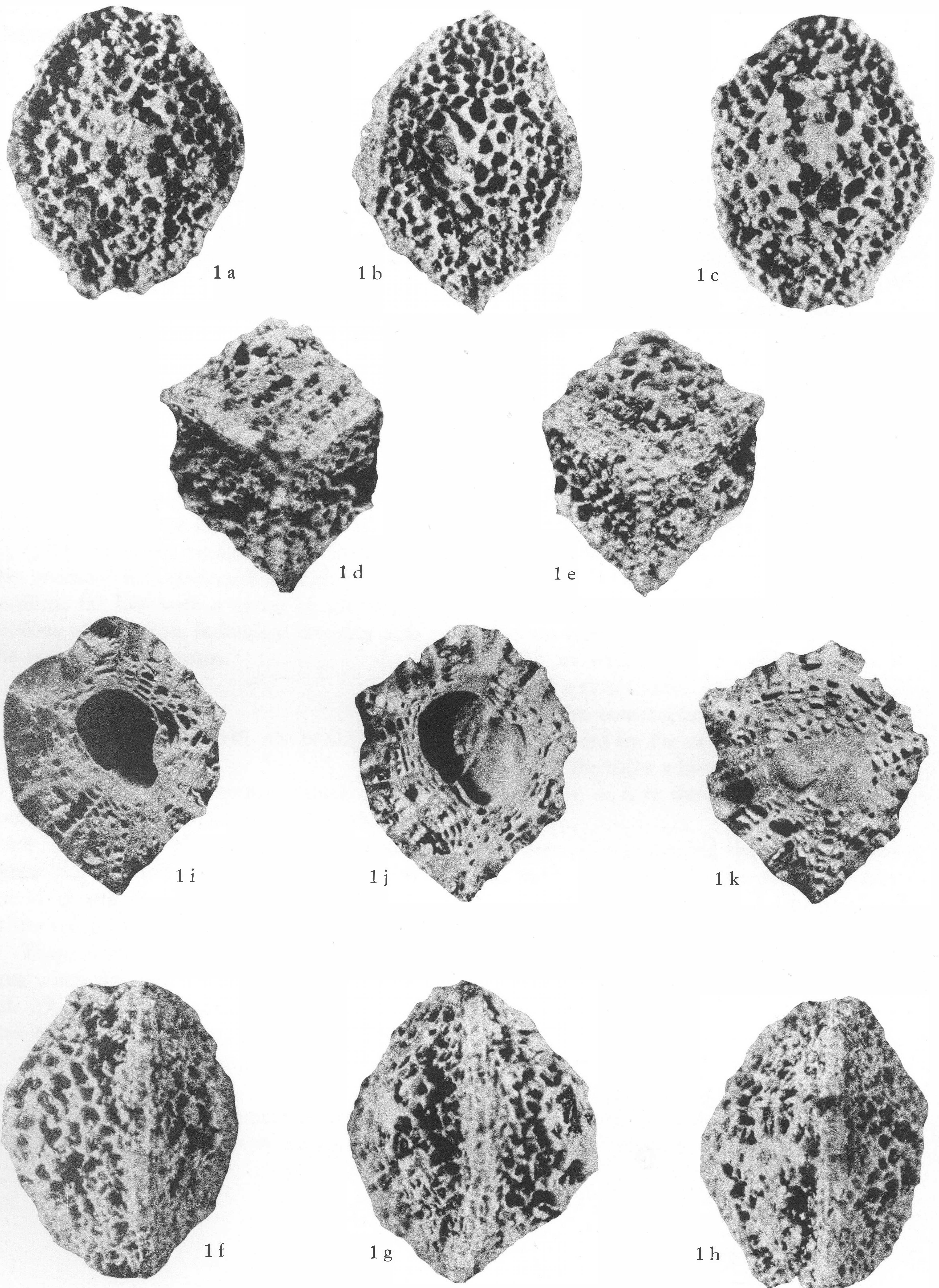
Authors who have studied growth anomalies in orbitoidal Foraminifera have demonstrated two principal types of anomaly.

EXPLANATION OF PLATE 25

Figs. 1a-k - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5137. 1a-c, aspects of three external surfaces; 1d-e, vertical views showing three «spokes» of equatorial chambers; 1f-h, sides views showing three different layers of equatorial chambers; 1i-k, series of vertical sections in the same specimen showing the embryonic apparatuses.

All figures x 19.

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The first type concerns the embryonic apparatus, i. e. multiple or multilocular embryonic chambers but in formation a single, regular layer of equatorial chambers (Hodson, 1926, pl. 7, figs. 4-6; Zuffardi-Comerci, 1929, pl. 9, fig. 22; Cole & Gravell, 1952, pl. 95, fig. 6; Cole, 1960, pl. 4, figs. 4-5 and 1962, pl. 7, figs. 4-6).

The second type, on the other hand, is brought about by the fusion of two individuals (Checchia-Rispoli, 1909, pl. 6, figs. 27a-b, pl. 7, fig. 1; Cushman, 1920, pl. 26, figs. 6-7; Zuffardi-Comerci, 1926, pl. 2, fig. 2 and 1929, pl. 9, fig. 21; Berry, 1931, pl. 5, figs. 6-8; Kecskemeti, 1959, pl. 2, figs. 2, 4, 5; Bieda, 1963, pl. 24, fig. 2).

While the anomalies of the first type have been fully discussed and illustrated, those of the second type have been illustrated mainly only in so far as their external features are concerned.

Only Checchia-Rispoli (1909) and Bieda (1963) have shown two individuals of *Discocyclina* in vertical section but where the embryonic apparatus is not visible. Thus, as far as we are aware, no author has illustrated this anomaly in *Lepidocyclina* with internal sections, far less with a series of successive sections of the same individual crossing also the embryonic apparatus.

DESCRIPTION OF THE ANOMALIES

The fundamental external feature of the anomalous specimens examined is that of three « spokes » of equatorial chambers; hence the specimen has three faces with lateral chambers instead of the two found in normal forms.

These three « spokes », which are clearly seen when the specimen is viewed vertically (pl. 25, figs. 1d-e), meet reciprocally at angles of more or less 120°. This is the type of anomaly most frequently found in our material.

Another type of anomaly is shown in plate 26, fig. 4 viz. two specimens fused

perpendicularly in such a way that the equatorial planes are arranged like the links of a chain.

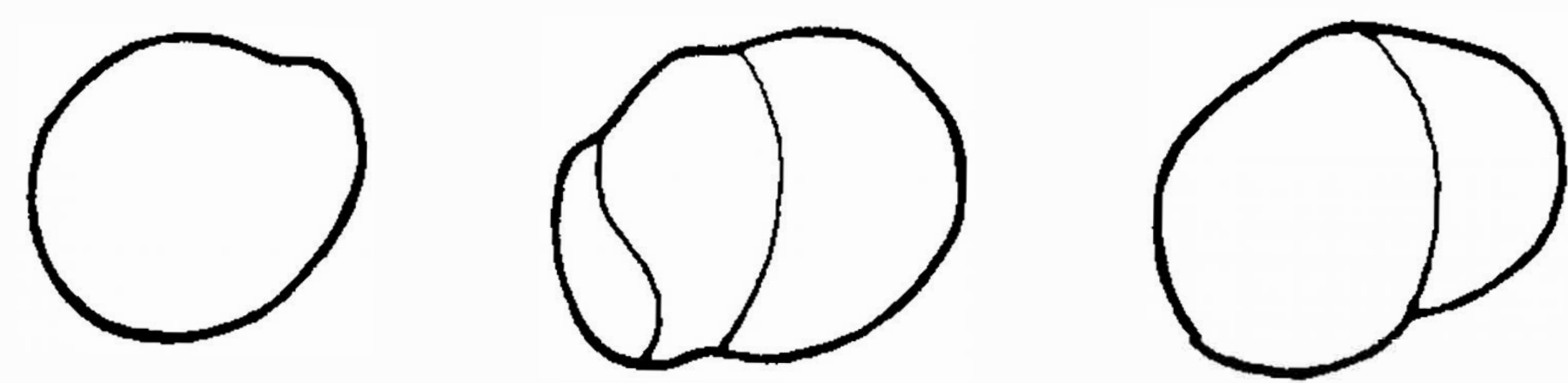
In writings on the subject few authors have pointed out the occurrence of orbitoidal Foraminifera with three « spokes » of equatorial chambers. They have dealt mainly with the development of an individual fused to the side of another partly or already fully developed individual (Zuffardi-Comerci, 1926; Berry, 1931; Kecskemeti, 1959). Only the specimen of *Orthophragmina trigonalis* Checchia-Rispoli illustrated by Checchia-Rispoli (1909) in plate 6, figs. 27a-b and in plate 7, fig. 1, and the specimen of *Discocyclina ephippium* (Schlotheim) illustrated by Bieda (1963) in plate 24, fig. 2, seem comparable, as will be seen, to what has been found in our material.

The study of the external features already seems to suggest two individuals. In fact two of the three « spokes » are continuous while the third joins them more or less in the middle and combines with them. However, it does not correspond to the type noted by Berry (1931) and by Kecskemeti (1959), in which the two individuals are quite distinct; but instead to the much more complex type illustrated by Checchia-Rispoli (1909), in which the two individuals have achieved a closer union and a fuller collaboration in the construction of the shell. This is also proved by the continuity of ornamentation on the sides which is common to both individuals, as it is shown in figures 1a-h in plate 25.

After photographing the external features, vertical sections were taken of some specimens so that the internal aspects of the anomalies could also be observed. It is interesting to note that while the external features are more or less constant in all specimens, the internal features, and in particular those of the embryonic apparatus, are of different types.

In type 1, illustrated by the vertical section of specimen 5138 (pl. 26, fig. 3) and by the series of vertical sections of specimen

5142 (pl. 26, figs. 2a-e), there are two complete embryonic apparatuses both consisting of a protoconch and of a deuterconch. Furthermore, in the last two photographs of the series of sections of specimen 5142 (pl. 26, figs. 2d-e) it can be seen how one individual completely developed its own layer of equatorial chambers, while in the other development is restricted to only half the layer.



Text-fig. 1

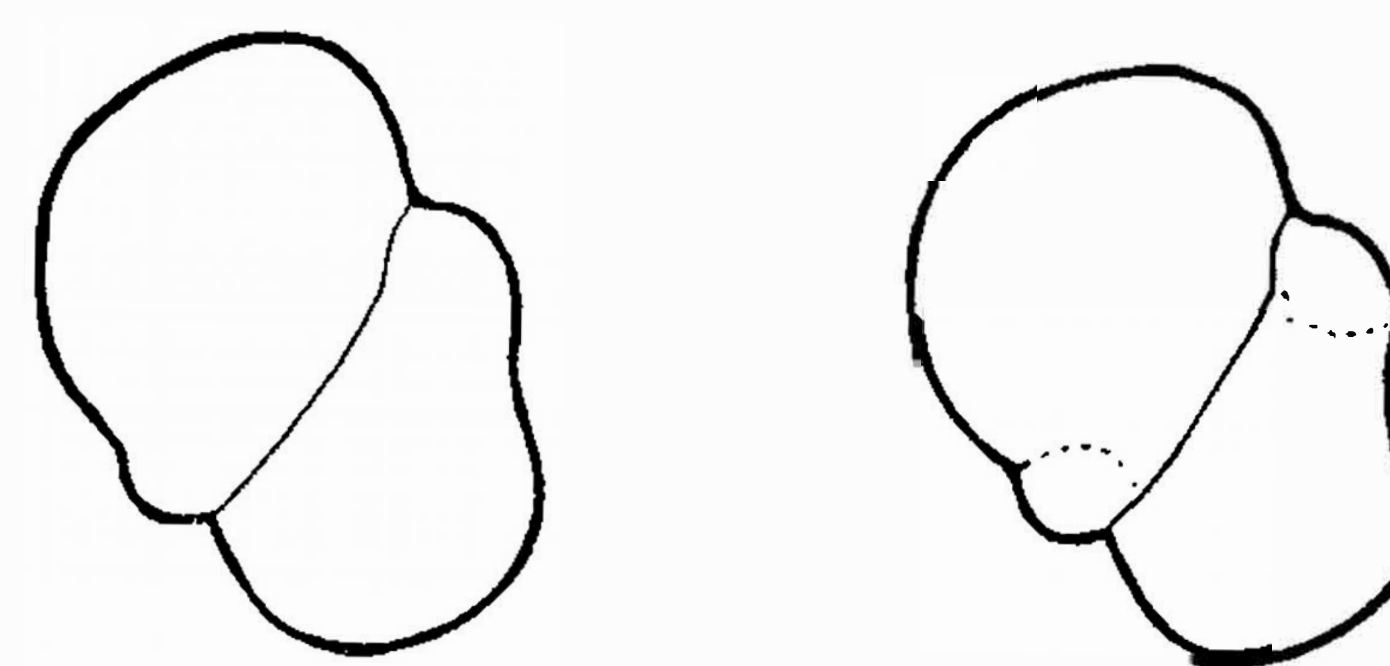
Diagrammatic sketch of the relations between protoconches and deuterconch from the series of vertical sections in specimen 5139 (viz. pl. 26, figs. 1a-c).

In type 2, illustrated by the series of vertical sections of specimen 5139 (pl. 26, figs. 1a-d), the embryonic apparatus turns out to consist of two protoconches with a common deuterconch (viz. text-figure 1). Here again, it can be seen from the last photograph of the series how a single layer of equatorial chambers is fully developed and continuous.

In type 3, illustrated by the series of vertical sections of specimen 5137 (pl. 25, figs. 1i-k) and also shown externally in plate 25, figs. 1a-h, the embryonic apparatus seems, at first sight, to consist of two large cavities of approximately the same dimensions. If the two cavities are interpreted as protoconch and deuterconch respectively, thus belonging to a single individual, one is faced with three difficulties: first of all, one cannot explain how a single embryonic apparatus was able to create two individuals, even if one of them is only partly developed; secondly, in a series of successive, parallel vertical sections across the embryonic apparatus of *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé there should be considerable variation in the reciprocal dimensions of protoconch and deuterconch, which is not true of the series of sections

carried out by us; finally, the wall of the protoconch which remains within the deuterconch and is generally arched, is clearly, in this case, straight (pl. 25, fig. 1j). One should add that such an interpretation would be out of line with previously illustrated cases in which the embryonic apparatus was clearly double.

If, however, the profile of the external edge of the two embryonic cavities is carefully studied, particularly in the section illustrated in plate 25, fig. 1j, one will see two small inflections of the wall corresponding to each cavity. These inflections could mean that there are two protoconches no longer separate from the respective deuterconches. The dividing wall could have disappeared either as a result of reabsorption or during the fossilization process. Each of the two cavities would therefore correspond to the protoconch and the deuterconch of a distinct individual (viz. text-figure 2). The two



Text-fig. 2

Interpretation of embryonic apparatus of specimen 5137 (viz. pl. 25, fig. 1j).

deuterconches would have a part of their wall in common. Thus interpreted this last case would take its place among the anomalies of the first type with two distinct complete embryonic apparatuses.

CONCLUSION

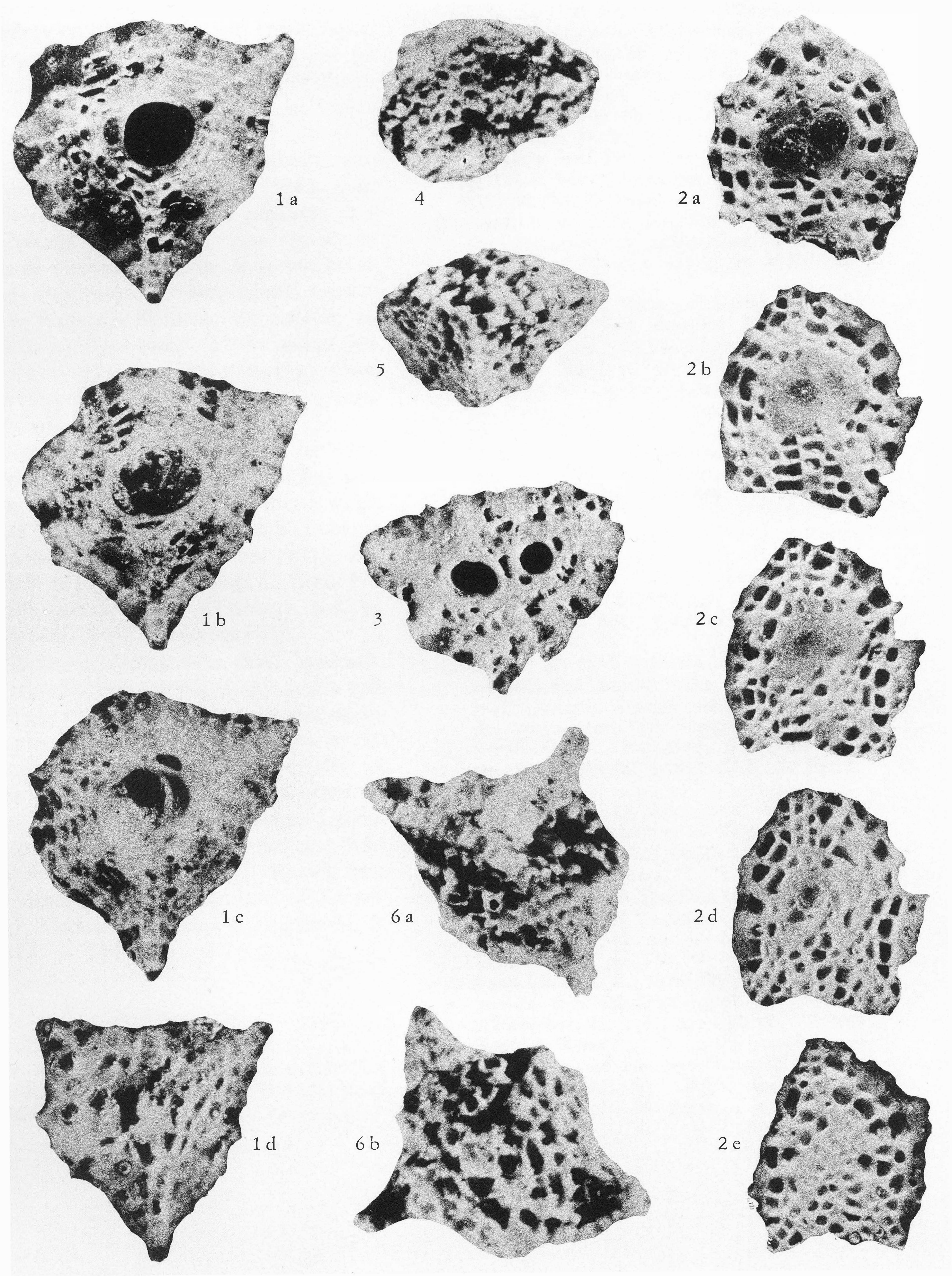
Thus, whether one bases one's conclusions on the external or on the internal features as evidenced by the series of sections, it would seem clear beyond doubt that the specimens of *Lepidocyclina* we examined consist of two individuals. It does not seem appropriate, therefore, to consider these

EXPLANATION OF PLATE 26

- Figs. 1a-d - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5139.
Series of vertical sections in the same specimen showing the embryonic apparatuses.
- 2a-e - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5142.
Series of vertical sections in the same specimen showing the embryonic apparatuses.
- 3 - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5138. Vertical section showing the embryonic apparatuses.
- 4 - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5140.
External view of two individuals arranged like the links of a chain.
- 5 - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5141.
Vertical view showing three « spokes » of equatorial chambers.
- 6a-b - *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé, anomalous specimen. MP 5143.
Vertical views showing the external features.

All figures x 34.

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double specimens as new species, as Checchia-Rispoli (1909) and Berry (1931) did.

Nevertheless, if these cases of double specimens are not infrequent, then the cause which led to their formation remains obscure and one can only suppose some explanations on this point. Any pathological factor can be excluded straight away as we have seen that it is a question not of abnormally developed individual but of two individuals bonded together.

According to an early hypothesis, also reported by Tasnadi-Kubacska (1962, page 36), it is arguable that two gamonts, at a very young stage, come into contact by means of their pseudopodia, thus developing a single shell in which, however, the features of two distinct individuals are present. As observed by Kecskemeti (1959) recent zoological writings report similar cases (e.g. those of the *Mastigophora*) in which two or more individuals have fused together.

Another possibility, always to be borne conjecturally in mind, is that during schizogony two nuclei remained within a single cell. It would then be a case of polivalence, also pointed out by Le Calvez (1959, *fide* Loeblich & Tappan, 1964, page C. 70) in *Planulina mediterranensis* d'Orbigny and by Kecskemeti (1962) in *Nummulites*.

Finally, according to a third hypothesis, it is arguable that the two nuclei which produced the two embryonic apparatuses derive from the division of a single nucleus within the same cell. For this last hypothesis we are indebted to Prof. G. Cognetti, Director of the Institute of Zoology, Modena University, to whom we here express our gratitude.

Specimens examined and figured have been deposited in the Institute of Paleontology, Modena University, Collection M. P. n. 5137 - 5146.

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