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Lituolipora polymorpha n. gen., n. sp. (Foraminiferida, Lituolacea?) from the Middle Liassic of the Outer Dinarids in Croatia and the establishment of a new family, Lituoliporidae

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Lituolipora polymorpha n. gen., n. sp. has a coarsely perforate microgranular wall, which distinguishes it from similarly shaped genera and necessitates the establishing of a new family. It is assigned to the Textulariina but its position within the Foraminiferida is thoroughly discussed. It is suggested that another genus with a similar wall structure, *Moncharmontia* (De Castro), be assigned to the same family. The new species occurs at several localities accompanied by typical Middle Liassic microfossils and thus seems to be a reliable marker for the Middle Lias, or the *Orbitopsella praecursor* subzone, respectively.

INTRODUCTION

Several years ago a new foraminifer was identified in shallow marine Middle Liassic limestones of the Outer Dinaric »carbonate platform« in Croatia. At various localities it has been found to occur in a narrow stratigraphic horizon, usually only a few meters thick, but always accompanied by a typical Middle Liassic microfossil association: *Orbitopsella* spp., *Labyrinthina* (= »Lituosepta«) *recoarensis* (Cati), *L. compressa* (Hottinger), *Pseudocyclammina liasica* Hottinger, *Palaeodasycladus* sp., some specifically undetermined forms but which are known to characterize the Lower and Middle Lias, such as small valvulinids »with columellar siphon« (cf. Hottinger, 1967: Pl. 4, fig. 22), etc. Recently this form has been found at two sites in sufficient abundance to enable its full understanding and description which led to the establishment of a new family and a new genus and species.

PALEONTOLOGIC DESCRIPTION

Order Foraminiferida

Suborder Textulariina

Superfamily Lituolacea?

Family Lituoliporidae n. fam.

Diagnosis: Free, multi-chambered (plurilocular) benthic Foraminiferida; test spirally coiled, at least in early stage; later stages may be uncoiled or may change the direction of coiling; wall characteristic of the family: simple, homogeneous, microgranular but coarsely perforate; pores open at both ends.

Type genus: *Lituolipora* n. gen.

Note: Concerning the family name, see Nomenclatorial remark in Gušić (1977).

Genus *Lituolipora* n. gen.

Diagnosis: Early stage spirally coiled; the plane of coiling may vary from being almost planispiral to deviating in each whorl at about 30–40° from the median plane. Later stages may be variously developed; changing the plane of coiling up to 90° (in microspheric tests) or being uncoiled, rectilinear or peneropline. Inner structure simple: no endoskeleton or exoskeleton present. Wall typical of the family: thick, one-layered, microgranular, coarsely perforate; pores simple. Aperture in early stage simple, basal and/or central, afterward cribrate. Dimorphism observed. Megalospheric embryo consists of 2 (3?) chambers.

Name: Similar to *Lituola* but with perforate wall.

Type species: *Lituolipora polymorpha* n. gen., n. sp.

Lituolipora polymorpha n. gen., n. sp.

Plates I–X

1972. *Mayncina termieri* Hottinger. — Castellarin, pl. 19, fig. 8.

Name: owing to the polymorphous appearance, particularly pronounced in microspheric tests.

Material: 16 slides (7 of which from the type locality) with numerous randomly oriented sections.

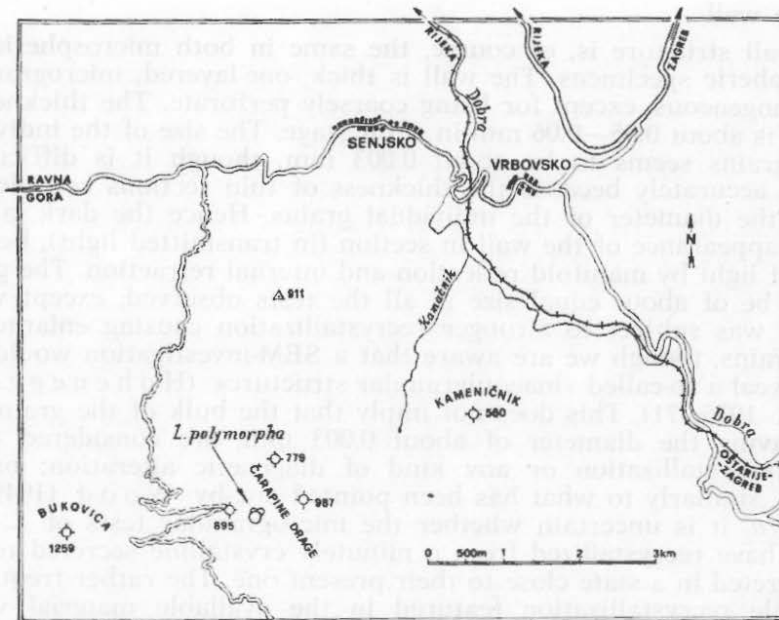
Holotype: Pl. I, fig. 1.

Type locality: Gorski Kotar, central Croatia. The exact position of the type locality is shown in Text-fig. 1.

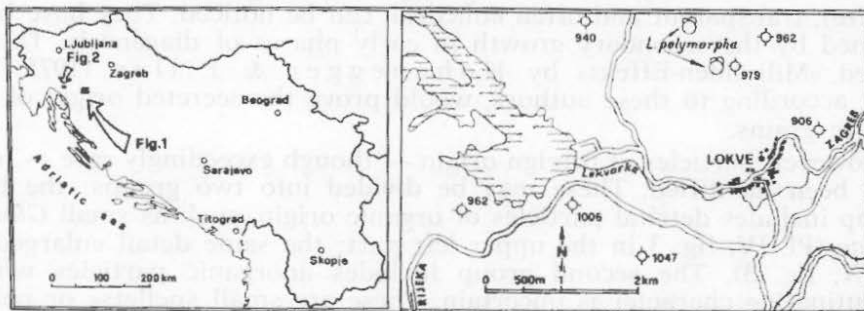
Other finding sites: Two localities, situated about 55 km westward from the type locality. Their exact position is shown in Text-fig. 2.

Age: Middle Lias (= *Orbitopsella praecursor* subzone). For detailed stratigraphic position see under the heading Stratigraphic position.

Diagnosis: as for the genus; because, for the time being, no other species of the same genus are known.



Text-fig. 1. Situation map of the type locality
Sl. 1. Smještaj tipičnog lokaliteta



Text-fig. 2. Left: general situation map. Right: situation map of the finding places near Lokve

Sl. 2. Lijevo: opća smještajna karta, Desno: smještaj dvaju nalazišta u blizini Lokava

Description

1. The wall

The wall structure is, of course, the same in both microspheric and megalospheric specimens. The wall is thick, one-layered, microgranular, and homogeneous, except for being coarsely perforate. The thickness of the wall is about 0.05—0.06 mm in adult stage. The size of the individual calcite grains seems to be about 0.003 mm, though it is difficult to measure accurately because the thickness of thin sections considerably exceeds the diameter of the individual grains. Hence the dark, almost opaque, appearance of the wall in section (in transmitted light), because of loss of light by manifold reflection and internal refraction. The grains seem to be of about equal size in all the tests observed, except where the wall was subject to stronger recrystallization causing enlargement of the grains, though we are aware that a SEM-investigation would probably reveal a so-called »inaequigranular structure« (Hohenegger & Piller, 1975: 71). This does not imply that the bulk of the grains, i.e. those having the diameter of about 0.003 mm, are considered to be spared recrystallization or any kind of diagenetic alteration; on the contrary, similarly to what has been pointed out by Wood (1949) for *Endothyra*, it is uncertain whether the microgranular tests of *L. polymorpha* have recrystallized from a minutely crystalline secreted test or were secreted in a state close to their present one. The rather frequently observable recrystallization featured in the available material would perhaps suggest the first supposition as the more probable. However, even Hohenegger & Piller (1975: 71), in spite of SEM-investigation, were unable to decide whether such larger calcite grains (i.e. those with the diameter over 0.002 mm) in what they called an »inaequigranular« wall structure were original or formed in the course of diagenesis. Occasionally considerably larger calcite grains (up to 0.05 mm in size), transparent and often euhedral, can be noticed. They have been formed by the secondary growth in early phases of diagenesis. This is called »Milioliden-Effekt« by Hohenegger & Piller (1975: 70), and, according to these authors, would prove the secreted origin of the calcite grains.

However, particles of foreign origin — though exceedingly rare — have also been identified. These may be divided into two groups: the first group includes detrital particles of organic origin, such as small *Glomospirae* (Pl. IV, fig. 3 in the upper left part; the same detail enlarged in Pl. X, fig. 3). The second group includes anorganic particles whose agglutinating character is uncertain. These are small »pellets« or pellet-like granules, which appear as small black spots within the wall of *L. polymorpha* when viewed under low or medium magnification. However, when a higher magnification is used, these spots disappear and become unrecognizable. Thus there is no certainty as to their agglutinating nature, though such pellet-like particles may be observed in the surrounding sediment. Such particles, whatever their true nature and origin, are also only seldom observable. However, we do not exclude the possibility that in a different environment, with more abundant influx of detrital particles, distinctly agglutinated *Lituoliporas* could possibly be found.

The simultaneous presence of both agglutinating particles and the »Milioliden-Effekt« is in apparent contradiction with H o h e n e g g e r's & P i l l e r's (1975: 70) statement that agglutinated foraminifers do not show the »Milioliden-Effekt«, due to the fact that agglutinated grains, even if consisting only of calcite, are coated with the surrounding cement which should protect them from early diagenetic alterations. This may well be true, but nevertheless the presence of both foreign particles and the »Milioliden-Effekt« in *L. polymorpha* can easily be explained by the fact that agglutinating particles are present only as single, isolated grains.

The pores are circular to subcircular in cross section, simple (i.e. not branching or »anastomosing«), directed perpendicularly to the outer surface except where the wall bends inward to form the septa (similarly as shown in D e C a s t r o's, 1966: Text-fig. 5D, diagrammatic sketch for his new genus and species *Moncharmontia apenninica*). The diameter of the pores in adult specimens amounts to 0.01 mm or slightly more and it is, generally speaking, about the same all along their length for the majority of pores. Slightly funnel-shaped pores have also been observed (Pl. II, fig. 5), though rarely. Smaller tests have smaller pores (compare e.g. figs. 1—3 to figs. 4—5 in Pl. VIII). The pores are visibly open at both ends, i.e. to the outer surface and to the chamber interior. There are no traces of an inner chitinous membrane lining the chamber interior or of what is usually called an imperforate epidermis either. Both these features have been shown to exist in Recent agglutinated foraminifers (M u r r a y, 1973), though H e d l e y (1963: 436) is of the opinion that an inner »chitinous« lining is not common. As to the lack of an imperforate outer »epidermis«, we are convinced that it is not due to abrasion of the tests, but represents, indeed, an important primary characteristic. The lack of an inner chitinous membrane, if indeed being primarily present, is easily explained in fossil specimens.

The pores do not touch mutually, but do leave a rather ample microgranular portion of wall among them. The distance between the pores varies from about 0.02 to 0.04 mm, i.e. it is twice or more the diameter of the pores. Such a coarsely perforate wall is obviously different from both keriothecal (honeycomb-like) and from those walls which have been described as being »fibrous in appearance«. Hence it should be emphasized that the distinction has to be made between perforate and keriothecal and/or fibrous walls, and while all these types can be spoken of as »porous«, they must not be confused and/or considered synonymous.

The wall forms the septa by bending inward. The perforations gradually disappear in the septa, similarly as it has been diagrammatically sketched by D e C a s t r o (1966: Text-fig. 5D) for *Moncharmontia apenninica*. The loss of porous appearance in the septa has also been shown to exist in Recent agglutinated foraminifers (M u r r a y, 1973: 782). Thus the septa are massive and perforated only by apertural openings. The diameter of apertural openings in the adult stage (= cribrate aperture) is about 0.02—0.05 mm. Understandably, the thickness of the septa equals that of the wall, except at the places of new chamber addition, where the widened basal portion of the next chamber adds to the thickness of

the previous septum. This has also been schematically represented by De Castro (1966: Text-fig. 5D) for *M. apenninica*.

Due to the absence of any exo- and endoskeletal structures the chamber lumina are free, filled with sparry calcite. Occasionally two phases of the filling can be recognized: an early even rim cement lining the chamber interior, and later mosaic cement in the middle (Pl. I, fig. 1; the same detail enlarged in Pl. X, fig. 6; Pl. III, fig. 3). The same feature can sometimes, but more rarely, be observed also on the outside of the test, indicating the deposition in a clear water environment.

2. Microspheric tests

The general shape of the microspheric tests is the one of a spirally coiled, with prominent umbilical depressions on both sides (Pl. IV, figs. 1—2; Pl. VI, fig. 2), and variously developed later stages. Sometimes the umbilical depressions are not so prominent due to irregular coiling and overlapping of individual whorls (Pl. V, figs. 1—2). The proloculus has not been clearly observed (Pl. V, fig. 1?). In the initial stage the manner of coiling is not completely clear, probably being irregular or sort of a plectogyroid type (Pl. I, fig. 1; Pl. IV, fig. 2; Pl. V, figs. 1—2). It is followed by the spirally coiled stage, consisting of about 3—4 whorls, and during which the plane of coiling of each individual whorl may deviate up to 40° from the median plane. In some specimens, however, the deviations of the plane of coiling are so slight that they may be considered almost planispiral. In still other tests the coiling is of a slightly sigmoidal type (Pl. V, fig. 2). The polymorphous appearance becomes even more prominent in the next, final stage, which may be developed in different ways. It may be uncoiled, varying in shape from rectilinear to peneropline, or the last whorl(s) may abruptly change the plane of coiling at various degrees, up to 90° (Pl. I, fig. 1). Analogously, the uncoiled stage may be in continuation with the plane of coiling of the last whorl or may have quite a different direction (Pl. VI, fig. 1). It consists of 3—4 chambers.

The chambers are broad and low, the height of the chambers being approximately equal or slightly larger than the thickness of the septa (about 0.05 mm), while the width of the chambers is 3—4 times greater than the height.

The aperture is at first simple, probably basal, then central and finally (in about the second or third whorl) cribrate. The diameter of the apertural openings varies from 0.02 to 0.05 mm, or even more, in the cribrate stage.

Microspheric tests with an uncoiled final stage appear to be more common than the ones with differently coiled last whorl(s).

When a population of *L. polymorpha* is viewed as a whole, then the above mentioned irregularities in the growth pattern give the microspheric tests of *L. polymorpha* the characteristic and easily recognizable polymorphous appearance.

The size of the microspheric tests is about 1 mm.

3. Megalospheric tests

Megalospheric tests are, as a rule, smaller than the microspheric ones, usually half the size of the microspheric tests (about 0.5 mm), and more uniform. The megalospheric embryo seems to be of a complex type: the globular proloculus is immediately followed and partly overlapped by the second chamber, and separated from it by a very thin (chitinoid?) wall, which is seldom preserved. What remains visible in most cases is the characteristic contour of the embryo, not spherical but with a sausage-shaped additional chamber on one side (Pl. IX, figs. 2—3, 5?, 6?, 7?, 8—9). This is, however, not clearly visible owing to the unsatisfactory state of preservation. The diameter of the proloculus is about 0.05—0.06 mm. A spirally coiled stage follows, in which, similarly to microspheric tests, the mode of coiling may vary from the almost planispiral one to the one in which the plane of coiling of individual whorls deviates up to about 40° from the median plane. After about 1.5—2 spirally coiled whorls the test may develop an uncoiled, more or less peneropline, portion consisting of 2—3 chambers. The uncoiled stage is not present in all megalospheric tests observed. The shape of individual chambers is analogous to that of microspheric tests, the chambers being low and broad. Their height (0.04—0.05 mm) equals or surpasses slightly the thickness of the septa. The aperture is in coiled stage simple, at first basal then central, becoming cribrate in the uncoiled stage (if the latter is present).

Comparison

L. polymorpha n. gen., n. sp. is easily and unambiguously distinguished from all other Mesozoic foraminiferal genera of similar shape by its coarse and easily visible perforations. However, in cases when the perforate wall structure is obscured due to recrystallization (i.e. when the secreted, or slightly recrystallized, calcite grains of the wall and those of the cement entering the perforations merged together into a homogeneous opaque mass), it may be mistaken for *Mayncina termieri* Hottinger. Two points may be particularly misleading in suggesting the conspecificity of *M. termieri* and *L. polymorpha*: (1) similar shape and size, and (2) occurrence in the same stratigraphic horizons, accompanied by the same accompanying forms (*Orbitopsella*, »*Lituosepta*«, etc.). Therefore we were at first reluctant to establish a new species for our forms, counting on the possibility that Hottinger's (1967: Pl. 3, figs. 1—11) material of »*Mayncina termieri* and related forms« may, in fact, represent a *Lituolipora* (meaning a new genus) in which the perforate wall structure has not been preserved. Should this be the case, the nomenclatorial change concerning the specific name would, obviously, be necessary. However, after having carefully considered all factors involved we came to the conclusion that we were dealing with a new genus and species, distinguishable from *M. termieri* and from all other described and/or figured forms which were made available to us, except for the form mentioned in the synonymy in which the perforate wall

structure is clearly recognizable, in spite of small magnification. The following items favoring the generic and specific separation of our forms have to be pointed at:

1. In all of Hottinger's pictures (1967: Pl. 3, figs. 1—11) an imperforate microgranular wall structure, not differing from the one in accompanying imperforate forms (*Orbitopsella*, Textulariidae, Valvuliniidae; figs. 1—2), is recognizable. The imperforate wall structure of *M. termieri* is particularly well visible in Hottinger's figs. 1, 2—7 and 11, though no detailed picture of wall structure in larger magnification is given.

2. In contrast to the above mentioned situation in Hottinger's material, i.e. when the wall of *M. termieri* (and related forms) appears identical to the one of accompanying imperforate forms, in our material the difference between the wall structure of *L. polymorpha* and of the accompanying imperforate forms is clearly visible (Pl. VI, fig. 7; Pl. X, figs. 1—2 compared to figs. 3—4, 6). This point seems insofar more important since the sediment in Hottinger's material is similar to our own: in both cases, the cement is for the most part made of sparry calcite. Were it not so, i.e. were the cement represented by micritic mud, the filling of the perforations in the wall of *L. polymorpha* with such muddy matrix could conceivably obscure the perforate wall structure, resulting in a seemingly imperforate microgranular structure. However, since in Hottinger's material not micritic mud but sparry calcite (for the most part) would enter the pores in the wall of *M. termieri* (if they were existent), the pores should be visible in about the same way as they are in our material of *L. polymorpha*. Therefore we became convinced that *M. termieri* differed from *L. polymorpha* in its original wall structure, which justified the generic separation.

The question of whether *M. termieri* — reported to have a microgranular wall (Hottinger, 1967: 31) — should be assigned to the genus *Mayncina*, characterized by an arenaceous wall (Neumann, 1965) is irrelevant here, but we wish to express our agreement with Hottinger that the existence or nonexistence of agglutination can depend solely on the environmental conditions (about that see also, e.g. Septfontaine, 1971: 295; Gušić, 1975: 17; etc.). We are taking advantage of this opportunity to make our views clear, for diametrically opposing views on this subject still seem to persist among the foraminiferologists.

3. Morphologically, all figured sections of *M. termieri* and related forms in Hottinger (1967: Pl. 3, figs. 1—11) reveal a much more regular growth pattern: a stable planispiral coiling passing into a peneropline growth of chambers; this is also expressly mentioned by Hottinger (1967: 31). Though an axial section figured by Hottinger (1967: Pl. 3, fig. 8) shows a slightly oscillating coiling, comparable to what has been observed in *L. polymorpha* (it is interpreted by Hottinger as a »slightly oblique axial section«), it is still far from being identical with the widely varying polymorphism (including the varying mode of coiling) of *L. polymorpha*. In addition, the rectilinear uncoiled stage does not seem to be as frequently developed in *M. termieri* as it is

in *L. polymorpha*. The specimen (section) chosen by Hottinger as the holotype of *M. termieri* shows the above mentioned differences best, so that it can in no way be identified with much more irregular and thicker-walled specimens of *L. polymorpha*.

As for other forms, similar in section to *Mayncina* (e.g., *Lituola*, *Charentia*, *Gendrotella*), the same criteria for distinguishing them of *L. polymorpha* may be applied as have been outlined above in relation to *Mayncina*.

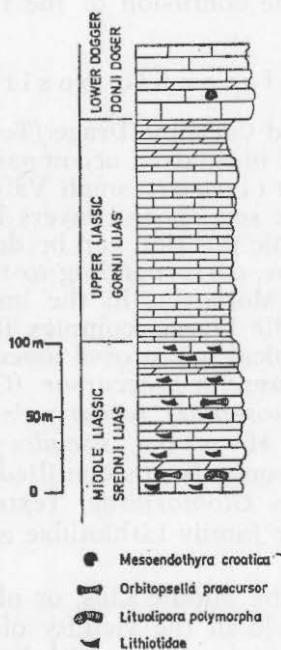
The only Mesozoic foraminiferal genus which has an identical type of wall structure is Upper Cretaceous *Moncharmontia apenninica* (De Castro, 1966, 1967). It is, however, quite different morphologically which makes impossible the confusion of the two forms.

Stratigraphic position

At the type locality, called Čarapine Drage (Text-fig. 1), *L. polymorpha* has been found in a bed of biosparite, accompanied by *Orbitopsella* sp., *Mayncina* cf. *termieri* Hottinger, small Valvulinidae with »columellar siphon«, etc., within the sequence of layers known as *Lithiotis* limestone. Hence its stratigraphic position can be defined as Middle Liassic, or, in biostratigraphic terms, corresponding to the *Orbitopsella praecursor* subzone, respectively. Moreover, in the immediate vicinity of the topotype locality, the Middle Liassic complex (below and above the *L. polymorpha*) contains a typical microfossil assemblage, characterized by the following forms: *Orbitopsella praecursor* (G ü m b e l), *Orbitopsella* spp., *Labyrinthina* (=»*Lituosepta*«) *recoarensis* (C a t i), *Haurania deserta* H e n s o n, *H. amiji* H e n s o n, *Pseudocyclamina liasica* H o t t i n g e r, *Earlandia* sp. (frequently misidentified as *Aeolisaccus dunningtoni* E l l i o t t), numerous *Glomospirae*, Textulariidae, etc. Debris of pelecypods belonging to the family Lithiotidae are encountered throughout this complex of beds.

The lower boundary of the Middle Lias, or of the *Lithiotis* limestone respectively, is not definable in the vicinity of the type locality of *L. polymorpha*, for there is a fault contact with Lower Malmian limestone. Therefore the position of the bed with *L. polymorpha* can be defined only with the regard to the upper boundary of the Middle Lias, which coincides with the disappearing of the Lithiotidae and the above mentioned microfossil assemblage. Stratimetric measurements in the field have shown the position of the bed with *L. polymorpha* to be about 100 m below the boundary Middle Lias (= *Lithiotis* and *Orbitopsella* limestone) — Upper Lias (the so-called »spotted limestone«, or »Fleckenkalk«), or else about 250 m below the boundary Upper Lias—Lower Dogger, which is defined lithologically. About 30 m above that boundary, in a thick-bedded micrite, *Mesoendothyra croatica* Gušić has been found, thus proving the Lower Doggerian age (= *Mesoendothyra croatica* cenozone). The stratigraphic situation in the region of the type locality is schematically shown in Text-fig. 3.

In the vicinity of Lokve (Text-fig. 2), the stratigraphic situation is similar to the one at the type locality. *L. polymorpha* occurs, here again, in a bed of biosparite, only about 10 cm thick, under- and overlain by micrite. It is accompanied by *Orbitopsella praecursor*, probably *Orbitopsella* sp., *Labyrinthina* (= »*Lituosepta*«) cf. *compressa* (H o t t i n g e r), *Glomospirae*, Textulariidae, etc. Though the pelecypods of the family Lithiotidae are lacking in this region, the age of the bed with *L. polymorpha* may be reliably defined as Middle Lias, i.e. *Orbitopsella praecursor* subzone. Both finding sites in this region are situated near the fault



Text-fig. 3. Schematized geological column of the type locality region
 Sl. 3. Shematizirani geološki stup područja tipičnog lokaliteta

boundary with the Upper Triassic dolomite, so that the lower limit of the Middle Lias (= *Orbitopsella praecursor* subzone) cannot be observed in this region either. The two finding sites in Middle Liassic limestone, though situated very close to each other, are tectonically separated by a zone of Upper Triassic dolomite, about 250 m wide.

Later (when this paper was already submitted to the editor), *L. polymorpha* was identified in the Middle Liassic deposits of Mazinska šuma, north of Mazin, Lika (Croatia), and in Middle Liassic deposits on Mt. Bio-kovo, about 1.5 km NE of Brist.

ON THE SUPRAGENERIC ATTRIBUTION OF THE GENUS
LITUOLIPORA

To our knowledge, the simple, coarsely perforate test wall of *L. polymorpha* represents a unique case among the homogeneous microgranular walls in Mesozoic foraminiferids, with the exception of the above mentioned *Moncharmontia apenninica*. Therefore it seems useful to compare the wall structure of *L. polymorpha* more closely with different types of wall structures present in the foraminiferids.

Simple, distinctly open (or even funnel-shaped) perforations in *L. polymorpha* are rather coarse and, in general, circular in cross section. They differ markedly from the keriothecal wall structure in the fusulinaceans in that the alveoli in the keriothecal structure are not distinctly open on the surface, are honey-combed rather than circular in cross section due to their closely spaced arrangement, and in that true keriothecal wall structures are, in general, far more complex. The only point which is common to both *L. polymorpha* and the Fusulinina (as regarded by Loeblich & Tappan, 1964, 1974) is that the wall is built up of secreted microgranular calcium carbonate. As to the presence or absence of detritic inclusions, they are deemed to be of no crucial importance, for small amounts of foreign particles are known to be present also in test of some Endothyraea (cf. Loeblich & Tappan, 1964: C 338—339 — Tournayellidae; C 343 — Endothyrinae, etc.). Soviet authors, who have studied Paleozoic foraminifers in minute detail and developed their taxonomy and classification accordingly, also include into the family Tournayellidae, for instance, both purely microgranular and agglutinated forms (e.g. Brazhnikova & Vdovenko, 1973: 241). They even consider that heavily agglutinated forms (e.g. family Forschiidae) may have developed from the tournayellids. In the quoted paper, however, both these families are included into the order Ammodiscida — just because of the existence of the agglutination, but what we intended to show was that, frequently enough, it was not possible to separate taxonomically the agglutinate and nonagglutinate forms.

The same main differences as quoted above prevent us from approaching *L. polymorpha* to those Mesozoic foraminiferids which do possess a keriothecal wall structure (family Biokovinidae — Gušić, 1977). On the other hand, the perforations in *L. polymorpha* can neither be regarded as a specifically evolved exoskeleton, in spite of a possible superficial similarity with the abraded tests having an alveolar exoskeleton (*sensu* Hottinger, 1967: 19) or a »labyrinthic wall structure«, respectively (*sensu* Neumann, 1967: Fig. 19A on p. 44). The perforations in *L. polymorpha* are distinctly open on the surface and hence no kind of imperforate »epidermis«, however thin, can be spoken of. Still another possible comparison does not fit. The relatively coarse perforations in *L. polymorpha* are not comparable to the fine tubules in the wall of some agglutinated foraminiferids. These tubules are minute (most frequently 1—4 μm in diameter), slightly irregular, commonly branching and/or »anastomosing«. Moreover, in contrast to the long-held opinion of their being open on the surface (summarizingly in Loeblich &

Tappan, 1964: C 91, fig. 52; Neumann, 1967: 43, 212, 218; and Murray, 1973: 780), it has recently been shown that they end blindly just beneath the outer wall, i.e. they are closed with either organic cement or agglutinated material (Murray, 1973). But even when dealing with etched or abraded tests which give the appearance of being perforate, they cannot be mistaken for coarse, distinctly open perforations in *L. polymorpha*. Equally so, the difference between regular, tube-like pores in *L. polymorpha* and the highly irregular porous wall in *Trochoporina* (Soliman, 1972) is obvious. As to the existence of an organic membrane, which is frequently spoken of as closing the pores both in the inside of the chambers and possibly also at their outer ends in Recent agglutinate foraminiferids, it may reasonably be supposed to have been existing also in *L. polymorpha*, though Hedley (1963: 436), as already mentioned, is of the opinion that an inner »chitinous« lining in arenaceous shells is not common. Whichever the case, it would in no way affect the validity of the above quoted differences between the simple, coarsely perforate wall of *L. polymorpha* and a finely porous inner layer of the wall in agglutinated foraminiferids. For it has to be emphasized once again that the presence of perforations in *L. polymorpha* being open on the surface is certainly not due to the abrasion of the tests prior to final deposition, for it is impossible to conceive that all tests have suffered just the same degree of abrasion. At least those tests which had been embedded in a muddy micritic matrix would have preserved traces of an outer imperforate »epidermis«. Because the same situation is present also with *M. apenninica*, which has since been found at a number of localities in the peri-Mediterranean realm, this certainly rules out the possibility that the aspect of perforations being open on the surface is due to abrasion of tests.

Finally, the pores in *L. polymorpha* are much too large to be caused by radial crystallization, i.e. by the linear alignment of calcite granules resulting in a fibrous or »pseudofibrous« appearance (cf. Cummings, 1956). This is also valid for *M. apenninica*, and hence all the above mentioned statements apply also to that species.

From all that has been exposed so far it follows that *L. polymorpha* cannot be fittingly placed into any of the formally recognized foraminiferal taxa of the family rank. Therefore the new family, Lituoliporidae, has been proposed above. The establishment of the new taxon of the family rank is felt to be justified because of the wall structure, which, as it has been outlined above, differs from all types of wall structures (including also some exoskeletal structures) present in Mesozoic foraminiferids. It is further suggested that the new family be tentatively placed in the Textulariina, superfamily Lituolacea(?), though the wall structure has been described as microgranular with rare detritic inclusions. De Castro (1966) considered his new genus and species *Moncharmontia apenninica* to represent the youngest offspring of the Endothyridae. However, in this respect we fully agree with Hohenegger & Piller (1975: 73) that the wall structure alone should not be the decisive factor in the classification of post-Triassic microgranular (= »inaequigranular« in Hohenegger & Piller, 1975) foraminife-

rids, but that, in addition, phylogenetic relationships must also be considered. Moreover, Hohenegger & Piller (1975: 83) made an important point in suggesting that post-Triassic foraminiferids with an »inaequigranular« wall structure must not necessarily derive from the Fusulinina (sensu Loeblich & Tappan, 1964, 1974, i.e. including the Endothyridae), but may have derived from the Textulariida (=Textulariina in Loeblich & Tappan, 1964, 1974) with carbonate cement which ceased to agglutinate foreign particles. This view is in accordance with what has been stated above, i.e. that no »demarcation line« of taxonomic significance can be drawn between the more or less agglutinated and the purely microgranular forms, provided that the forms in question show a phylogenetic relationship. If this view is accepted, it may have far-reaching implications in the classification of the foraminiferids, which, of course, lies beyond the scope of this paper.

As it has been briefly mentioned in the concluding paragraph on the comparison of *L. polymorpha* with other forms, Upper Cretaceous *Moncharmontia apenninica* shows an identical wall structure. Though it was said to be »reminiscent of the keriothecal wall structure of the fusulines and identical to the wall structure of many Paleozoic genera, e.g. *Cribrospira*« (De Castro, 1966: 10), and later considered to be similar to the »striated« wall structure of *Charentia cuvillieri* Neumann by Hottinger (1967: 33), it was described (De Castro, 1966: 10) as being built of a single layer of microgranular calcite with apparent perforations. It is obviously the same as in *L. polymorpha*, the perforations being proportionally smaller but of the same type (tubular, simple, relatively coarse). Therefore, in the present authors' opinion, it cannot be identified with, or spoken of as, the keriothecal wall structure for the reasons which have been dealt with at sufficient length above. Hence it follows that the grouping of the two genera into one family appears logical. Thus the family Lituoliporidae, n. fam., would, for the time being, include two morphologically distinct and stratigraphically separated genera, Upper Cretaceous *Moncharmontia* (De Castro) and Liassic *Lituolipora* n. gen.

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Lituolipora polymorpha n. gen., n. sp. (Foraminiferida, Lituolacea?)
iz srednjeg lijasa Vanjskih Dinarida Hrvatske
i uspostavljanje nove porodice, Lituoliporidae

I. Gušić i I. Velić

UVOD

Već nekoliko godina zapaža se jedna nova foraminiferska vrsta u plitkomorskim srednjolijaskim vapnencima iz područja »karbonatnog praga« Vanjskih Dinarida u Hrvatskoj. Na više lokaliteta ustanovljena je njena prisutnost u jednom razmjerno uskom stratigrafskom horizontu, često svega nekoliko metara debljine, ali uvijek u pratnji tipične srednjolijaske mikrofosilne zajednice: *Orbitopsella* spp., *Labyrinthina* (=»Lituosepta«) *recoarensis* (Cati), *L. compressa* (Hottinger), *Pseudocyclammia liasica* Hottinger, *Palaeodasycladus* sp., te malih, specifički neodredivih oblika koje je Hottinger (1967: tab. 4, sl. 22) označio kao »sitne valulinide s kolumelarnim sifonom«, a za koje je poznato da su vezane za donji i srednji dio lijasa. Osim toga, redovito su prisutni i oblici bez uže stratigrafske vrijednosti: brojne i dosta karakteristične, relativno krupne glomospire, s velikim brojem klupčastih zavoja i s karakterističnim kuglastim prolokulusom okruženim drugačije

građenom (hitinoidnom?, odnosno samo djelomice mineraliziranom) stijenkom (v. tab. X, sl. 5), tekstulariide, *Thaumatoporella parvovesiculifera* (Raineri) i dr. Nedavno je ta foraminifera nađena na dva lokaliteta u dovoljno velikom broju primjeraka, odnosno presjeka, da se opiše i ilustrativno prikaže, što je dovelo do uspostavljanja nove familije, te novog roda i vrste.

PALEONTOLOŠKI OPIS

Red Foraminiferida
 Podred Textulariina
 Superfamilija Lituolacea?
 Familija Lituoliporidae n. fam.

Dijagnoza: Slobodne, multilokularne, bentičke foraminifere; kućica spiralno savijena, barem u početnom stadiju; kasnije može biti odvijena ili može promijeniti način rasta; stijenka jednostavna, homogena, mikrogranulirana, grubo perforirana; perforacije (pore) otvorene su na oba kraja.

Tipični rod: *Lituolipora* n. gen.

Rod *Lituolipora* n. gen.

Dijagnoza: Kućica spiralno savijena u početnom stadiju; način savijanja može varirati od gotovo posve planispiralnog pa do takvog gdje ravnina namatanja pojedinih zavoja odstupa za 30–40° od medijalne ravnine. Zadnji zavoj (u mikrosteričnih primjeraka) može naglo promijeniti smjer savijanja (do 90°), ili može biti odvijena na različite načine (pravocrtno, peneroplidno). Stijenka tipična i karakteristična za familiju, debela, jednoslojna, perforirana razmjerno grubim, jednostavnim porama. Unutrašnja građa jednostavna, bez egzoskeleta i endoskeleta. Ušće u početnom stadiju jednostavno, središnje ili/i bazalno, u kasnijem stadiju sitasto. Postoji dimorfizam. Megalosferični nukleokonh sastoji se od 2 (3?) klijetke.

Porijeklo imena: Sličan rodu *Lituola*, ali perforirane stijenke.

Tipična vrsta: *Lituolipora polymorpha* n. gen., n. sp.

Lituolipora polymorpha n. gen., n. sp.

Table I—X

1972. *Mayncina termieri* Hottinger. — Castellarin, tab. 19, sl. 8.

Ime: prema izraženom polimorfizmu, osobito u mikrosferičnih primjeraka.

Materijal: 16 izbrusaka, od toga 7 sa tipičnog lokaliteta, s velikim brojem slučajnih presjeka.

Holotip: tab. I, sl. 1.

Locus typicus: Gorski Kotar, lokalitet Čarapine Drage, oko 5,5 km jugo-zapadno od mjesta Vrbovsko. Točan položaj nalazišta vidi se na sl. 1.

Ostala nalazišta: Dva lokaliteta, oko 55 km zapadno od tipičnog lokaliteta, odnosno oko 2 km sjeverozapadno od mjesta Lokve. Točan položaj ovih nalazišta prikazan je na sl. 2.

Stratum typicum: srednji lijas, odnosno podzona *Orbitopsella praecursor*. Detaljnije vidi u poglavlju Stratigrafski položaj.

Dijagnoza: kao za rod, budući da za sada nisu poznate druge vrste istog roda s kojima bi se mogla izvršiti usporedba.

Opis

1. Stijenka

Građa stijenke jednaka je, razumljivo, i u mikrosferičnih i u makrosferičnih primjeraka. Stijenka je debela, jednoslojna i homogena, mikrogranulirana, perforirana razmjerno krupnim porama. Debljina stijenke je oko 0,05–0,06 mm u odraslom stadiju. Veličina pojedinih kalcitnih zrna je oko 0,003 mm, premda je to teško sa sigurnošću utvrditi jer je debljina preparata znatno veća od veličine pojedinih

zrna. Zato i jest stijenka u prolaznom svjetlu neprozirna, tamna, gotovo crna, jer dolazi do gubitka svjetla u stijenci mnogostrukom refleksijom i unutrašnjom refrakcijom. Veličina pojedinih zrna čini se da je približno jednolika u svim primjercima, osim na mjestima gdje je stijenka bila podvrgnuta jačoj rekristalizaciji pa su zrna veća. Vjerojatno je, naime, da je mikrogranularna stijenka, onakva kakvu je danas vidimo, također nastala rekristalizacijom iz još sitnije kristalinične stijenke, a ne da je izlučena u svom današnjem stanju. Općenito prisutne pojave rekristalizacije u istraženim preparatima govore tome u prilog, premda se niti istraživanjima pomoću stereoskopa ne može uvijek sa sigurnošću utvrditi da li su pojedina veća zrna u takvoj »inekvigranularnoj« stijenci primarna ili produkt rekristalizacije u (vjerojatno ranoj) dijagenezi (Hohenegger & Piller, 1975: 71). Sličnu sumnju u prvotni karakter mikrogranularne stijenke izrazio je, za rod *Endothyra*, Wood (1949). Mjestimično se mogu naći i znatno veća kalcitna zrna (do 0,05 mm veličine), prozirna i često pravilnih kristalnih formi, nastala sekundarnim rastom u ranim fazama dijageneze (= tzv. »miliolidni efekt«, Hohenegger & Piller, 1975: 70). Prema navedenim autorima, takva pojava svjedoči da se radi o izlučenim (a ne aglutiniranim) zrnima kalcita.

Međutim, utvrđene su i čestice stranog porijekla, koje možemo smatrati aglutiniranim. To su izuzetno rijetke sitne glomospire (Tab. IV, sl. 3 gore lijevo; isti detalj povećano na Tab. X, sl. 3). Druga grupa čestica su one čiji aglutinirajući karakter nije mogao biti sigurno utvrđen. To su sitni »peleti« ili čestice nalik peletima koje se pojavljuju kao crne kružne mrlje u stijenci, kad se promatra pod malim ili srednjim povećanjem. No kad se promatra pod većim povećanjem, te čestice se ne mogu razabrati. Prema tome nije sigurno da se radi o česticama stranog porijekla, iako su takve čestice vidljive u okolnom sedimentu. No i takve čestice, nesigurnog porijekla, zapažaju se vrlo rijetko. Nije, međutim, isključeno, da bismo u drugačijem okolišu (s bogatijim donosom detritičnog materijala) imali i jače, ili čak izrazito, aglutinirane lituolipore.

Istovremeno postojanje »miliolidnog efekta« i aglutinirajućih čestica kosi se sa zapažanjima Hoheneggera & Piller (1975: 70), naime da aglutinirane foraminifere nikada ne pokazuju »miliolidni efekt« (= sekundarni rast kalcitnih kristala), jer da su aglutinirana zrna, pa makar i isključivo kalcitna, obavijena okolnim cementom stijenke koji ih štiti od ranodijagenetskih promjena. S tim objašnjenjem možemo se složiti, iako je ono vjerojatno nepotpuno; no u našem slučaju istovremeno postojanje »miliolidnog efekta« i aglutiniranih čestica lako je objasniti činjenicom da su aglutinirane čestice prisutne u stijenci lituolipore samo izuzetno rijetko, kao izolirane, pojedinačne čestice, tako da bismo za primjerke lituolipora kakve nalazimo u našem materijalu teško mogli reći da se radi o aglutiniranim foraminiferama u pravom smislu riječi.

Pore (perforacije) su manje-više kružne u poprečnom presjeku, jednostavne (tj. ne račvaju se niti »anastomoziraju«), i usmjerene su okomito na vanjsku površinu stijenke, osim na mjestima gdje stijenka povija prema unutra tvoreći septe. Takav raspored pora odgovara onom kako ga je shematski prikazao De Castro (1966: sl. 5D) za svoj novi rod i vrstu *Moncharmontia apenninica*, a i logičan je, ako se sjetimo da je svaki septum neko vrijeme predstavljao završni stadij rasta. Promjer pora u odraslih primjeraka iznosi oko 0,01 mm, pa i više, i, općenito uzevši, većina pora ima jednaki promjer cijelom dužinom. Zapažene su također, iako rijetko, i pore ljevkastog oblika (Tab. II, sl. 5). Manji primjerci imaju i sitnije pore (usp. npr. sl. 1—3 i 4—5 na tab. VIII). Očito je da su pore otvorene na oba kraja, tj. i prema vani i u unutrašnjost klijetaka. Ništa nam ne ukazuje na postojanje nekog, kolikogod tankog, vanjskog imperforatnog sloja (»epiderme«), kao niti na postojanje hitinoidne membrane u unutrašnjosti klijetaka. Ohje ove pojave postoje kod recentnih aglutiniranih foraminifera (Murray, 1973). Što se tiče nedostatka vanjskog »epidermalnog« imperforatnog sloja, uvjereni smo da razlog tome nije u mogućem trošenju (abradiranju) vanjske površine kućica, nego da se radi o značajnoj primarnoj osobini. Što se pak tiče toga da ne nalazimo tragove unutrašnje hitinoidne membrane, logično je da se takvo svojstvo teško može sačuvati prilikom fosilizacije.

Pore se međusobno ne dodiruju. Razmak između pora varira od oko 0,2 do 0,4 mm; on je dvostruk ili veći nego što je promjer pora. Ovako grubo perforirana stijenka očito se razlikuje od keriotekalne (sačaste) stijenke, kao i od onih stijenki

koje su opisane kao »fibrozne«. Svi navedeni tipovi stijenke mogu se označiti kao »porozni«, ali taj naziv nije dovoljno precizan, pa se navedeni izrazi ne smiju miješati ili smatrati sinonimima.

Povijajući prema unutra, stijenka tvori septe. Perforacije se u septima gube, slično kao što je to shematski prikazao De Castro (1966: sl. 5D) za vrstu *Moncharmorntia apenninica*. Murray (1973) je ustanovio da se i kod recentnih aglutiniranih foraminifera porozna građa stijenke (pore tu doduše ne probijaju na površinu) u septima gubi. Septi su perforirani ušćanim otvorima. Promjer ušćanih otvora u odrasлом stadiju, tj. kad ušće postaje sitasto, iznosi oko 0,05 mm. Debljina sepata približno je jednaka debljini stijenke (oko 0,05 mm) (što je kod ovakvog načina građe sepata i logično), osim na mjestima prirasta slijedeće klijetke, gdje prošireni bazalni dio stijenke slijedeće klijetke čini da debljina sepata prividno izgleda veća.

Budući da nema nikakvih ni egzoskeletnih ni endoskeletnih strukturnih elemenata, unutrašnjost klijetaka je slobodna, ispunjena sparitom. Katkada se mogu razaznati dvije faze sparitnog ispunjenja: rubni cement koji oblaže unutrašnje zidove klijetke i kasniji mozaični cement koji ispunjava središnje dijelove (Tab. I, sl. 1 i dr.). Ista pojava, tj. postojanje obrubnog cementa, može se zapaziti i s vanjske strane nekih primjeraka (iako rjeđe), što oboje svjedoči da su kućice nakon uginuća organizma taložene u bistroj vodi.

2. Mikrosferični primjerci

Opći izgled mikrosferičnih primjeraka jest spiralno savijena kućica s izrazitim umbilikalnim uleknućima s obje strane (tab. IV, sl. 1—2; tab. VI, sl. 2) i s različito razvijenim završnim stadijem. Prolokulus nije bilo moguće sigurno zapaziti (tab. V, sl. 1). Početni stadij, koji uključuje oko 3—4 klijetke, također nije jasno vidljiv tako da ni način savijanja nije posve jasan; vjerojatno je nepravilan ili sličan plektogiroidnom tipu (tab. I, sl. 1; tab. IV, sl. 2; tab. V, sl. 1—2). Slijedi jasno spiralno savijeni stadij, koji se sastoji od oko 3—4 zavoja, koji mogu varirati od gotovo planispiralnog načina namatanja pa do takvog gdje ravnina namatanja svakog pojedinog zavoja odstupa i za 40° od medijalne ravnine. Postoje i sigmoidalno savijeni primjerci (tab. V, sl. 2). Osobito uočljivo svojstvo mikrosferičnih primjeraka jest da slijedeći, odnosno završni stadij, može biti razvijen na različite načine. Završni zavoji mogu naglo promijeniti smjer rasta odnosno namatanja, čak i do 90° u odnosu na prethodne zavoje — obično je tako pod pravim kutom savijeni zavoj ujedno i zadnji zavoj — ili može slijediti odmotani stadij, koji može biti pravocrtan ili peneropliforman. U tom slučaju, odmotani završni stadij može nastaviti rast u ravnini zadnjeg zavoja, ili može rasti u nekom drugom smjeru. Odvijeni stadij može sadržavati 3—4 klijetke.

Ovaj izraženi i lako uočljivi polimorfizam mikrosferičnih primjeraka jest ujedno i najkarakterističnija osobina vrste, prisutna u svim istraženim populacijama (i na tipičnom lokalitetu i na svim drugim nalazištima).

Primjerci s odvijenim i/ili peneropliformnim završnim stadijem čini se da su ipak nešto češći nego oni kojima su zadnji zavoji (ili zadnji zavoj) savijeni na različite načine.

Klijetke su široke i niske; visina klijetaka je jednaka do otprilike dva puta veća od debljine sepata (oko 0,05 mm), dok je širina (ili promjer) klijetke oko 3—4 puta veća od visine.

Ušće je ispočetka jednostavno bazalno, zatim središnje, i konačno postaje (u drugom ili trećem zavoju) sitasto. Takav oblik zadržava do kraja rasta. U odrasлом stadiju, tj. kada je ušće sitasto, promjer ušćanih otvora iznosi oko 0,05 mm.

Veličina mikrosferičnih primjeraka iznosi oko 1 mm.

3. Megalosferični primjerci

Kućice megalosferičnih primjeraka su, u pravilu, sitnije nego one mikrosferičnih primjeraka, obično oko 1/2 do 2/3 veličine mikrosferičnih primjeraka u prosjeku (oko 0,5 mm), iako se mogu naći i krupni megalosferični primjerci koji se veličinom približavaju sitnijim mikrosferičnim primjercima. Megalosferični primjerci su i uniformniji, tj. ne pokazuju toliko izražen polimorfizam. Koliko je moguće suditi prema raspoloživim presjecima, čini se da je megalosferični nukleokonh kompleksnog tipa: neposredno uz kuglasti prolokulus nalazi se deuteronh koji

djelomično obuhvaća prolukulus s jedne strane, a odvojen je od njega vrlo tankom stijenkom, koja nije uvijek sačuvana (vidljiva). Karakter komunikacije kroz tu stijenku (broj ušćanih otvora, ili sl.) nije bilo moguće utvrditi. Na nekim presjecima (Tab. IX, sl. 2—3, 5?, 6?, 7?, 8—9) zapaža se kao da je i sam prolukulus podijeljen veoma tankom stijenkom u dva dijela. Promjer prolukulusa iznosi 0,05—0,06 mm. Nakon opisanog embrionalnog kompleksa slijedi spiralno savijeni stadij, koji, analogno kao kod mikrosferičnih primjeraka, može varirati od gotovo planispiralnog savijanja pa do takvog gdje ravnine namatanja pojedinih zavoja odstupaju za 20—30° od medijalne ravnine. Nakon otprilike 1,5—2 zavoja može slijediti odvijeni stadij, obično manje ili više peneropliformnog oblika. Taj stadij sastoji se od 2—3 klijetke, a nije zapažen u svih megalosferičnih primjeraka. Oblik pojedinih klijetaka analogan je kao i kod mikrosferičnih primjeraka: klijetke su široke i niske. Visina klijetaka jednaka je ili tek nešto veća od debljine sepata (= oko 0,04—0,05 mm). Ušće je u savijenom stadiju jednostavno, prvo bazalno zatim središnje, a ako je odvijeni stadij razvijen, sitasto.

Usporedba

L. polymorpha n. gen., n. sp. jasno se razlikuje od svih drugih mezozojskih rodova i vrsta sličnog oblika (a takvih je ne mali broj) po svojim razmjerno grubim i jasno vidljivim perforacijama (porama) u stijenci. Ova dijagnostička osobina može postati teže uočljiva u slučajevima jače rekristalizacije stijenke; u tom slučaju, naime, izlučena kalcitna zrna koja izgrađuju stijenku i ona koja naknadno ispune perforacije mogu se stopiti zajedno u naizgled homogenu, neprozirnu masu. U takvim slučajevima moguće je da se *L. polymorpha* zamijeni s vrstom *Mayncina termieri* Hottinger (1967). Dvije činjenice osobito mogu utjecati na takvu zamjenu: 1) sličan oblik i veličina, i 2) pojavljivanje u istom stratigrafskom nivou, u društvu istih popratnih oblika (orbitopsele, »lituosepte« i dr.). Zato smo se ispočetka dvoumili da li da naše oblike smatramo novom vrstom; sumnjali smo, naime, da možda Hottingerova »*Mayncina termieri* i srodni oblici« (1967: Tab. 3, sl. 1—11) ne predstavlja, u stvari, lituoliporu (dakle novi rod) kod koje perforirana građa stijenke nije sačuvana. Ukoliko bi to bio slučaj, moralo bi se, naravno, zadržati Hottingerovo ime vrste. No, nakon pažljivog proučavanja, i razmotrivši različite mogućnosti, zaključili smo da u našem materijalu imamo novi rod i vrstu, koja se razlikuje od svih do sada opisanih oblika, osim oblika navedenog u sinonimiji, kod kojeg se, usprkos malom povećanju, može razabrati perforirana građa stijenke. Evo koje su činjenice bile odlučne za postavljanje novog roda i vrste:

1. Na svim Hottingerovim slikama (1967: Tab. 3, sl. 1—11) može se razabrati mikrogranulirana stijenka, jednaka kao što ju pokazuju i popratni imperforatni oblici (*Orbitopsella*, *Textulariidae*, *Valvulinidae*; sl. 1—2). Mikrogranulirana građa stijenke vrste *M. termieri* naročito je jasno vidljiva na Hottingerovim slikama 1, 2—7 i 11, iako nedostaje detaljna slika pod većim povećanjem.

2. Suprotno od opisane situacije u Hottingerovom materijalu, tj. gdje stijenka vrste *M. termieri* ne pokazuje nikakve razlike prema stijenci popratnih imperforatnih oblika, u našem materijalu razlika u građi stijenke između vrste *L. polymorpha* i popratnih imperforatnih oblika (*Orbitopsella*, *Textulariidae*) je jasno vidljiva (usp. npr. tab. VI, sl. 7; tab. X, sl. 1—2 naprama 3—4, 6). Ova činjenica još više dobiva na značenju ako uzmemo u obzir da se i u Hottingerovom i u našem materijalu radi o sličnom sedimentu: cement se najvećim dijelom (iako ne u potpunosti) sastoji od bistrog sparita (kalcita). Kada tome ne bi bilo tako, tj. kad bi se cement sastojao od mikritnog mulja, taj mikritni mulj ispunio bi perforacije u stijenci i može se pretpostaviti da se perforacije u tom slučaju ne bi mogle razabrati, tj. stijenka bi mogla poprimiti prividno imperforatni mikrogranulirani izgled. Budući da i u Hottingerovom materijalu cement koji bi ispunio perforacije u stijenci (kada bi one postojale) predstavlja bistri kalcit, perforacije u stijenci bile bi vidljive kao što su u našem materijalu. Zaključak koji nam se nametnuo jest da se *M. termieri* i *L. polymorpha* razlikuju po prvotnoj građi stijenke, što je u svakom slučaju dovoljno za generičku distinkciju.

Ovdje nije od značenja pitanje da li *M. termieri* — za koju se kaže da ima granuliranu stijenku (Hottinger, 1967: 31) — pripada rodu *Mayncina*, koji je prvot-

no karakteriziran aglutiniranom stijenkom (Neumann, 1965), ali želimo naglasiti da se u tom pogledu posve slažemo s mišljenjem Hottingera da postoja-nje i stupanj aglutinacije može biti uvjetovano isključivo ekološkim uvjetima (o tome vidi također npr. Septfontaine, 1971: 295; Gušić, 1975: 17, i dr.). Koristimo dakle ovu priliku da iskažemo svoje mišljenje, jer čini se da među foraminiferolozima još uvijek postoje posve oprečna mišljenja o tom pitanju.

3. Morfološki, svi prikazani presjeci vrste *M. termieri* i srodnih oblika u Hottingerovom materijalu (1967: Tab. 3, sl. 1—11) pokazuju znatno pravilniji oblik i način rasta: stabilno planispiralno namatanje na koje slijedi peneropliforman stadij; to Hottinger i izrijekom naglašava (1967: 31). Premda jedan osni presjek od prikazanih Hottingerovih primjeraka (1967: Tab. 3, sl. 8) pokazuje oscilirajuće namatanje, slično kao kod vrste *L. polymorpha* (Hottinger taj presjek interpretira kao »malo kosi osni presjek«), to je još uvijek daleko od toga da bismo to mogli poistovjetiti sa široko varirajućim polimorfizmom (uključujući i različite načine savijanja) u vrste *L. polymorpha*. Osim toga, odvijeni stadij čini se da nije tako redovito prisutan u vrste *M. termieri* kao u vrste *L. polymorpha*. Primjerak (presjek) koji je izabran za holotip vrste *M. termieri* pokazuje navedene osobine najbolje izražene (Hottinger, 1967: Tab. 3, sl. 7), tako da se nikako ne može poistovjetiti s mnogo nepravilnijim i varijabilnijim primjercima vrste *L. polymorpha*.

Što se tiče drugih rodova, sličnih u presjecima rodu *Mayncina* (*Lituola*, *Charentia*, *Gendrotella*), za njihovo razlikovanje od vrste *L. polymorpha* vrijede isti kriteriji koji su navedeni u odnosu na rod *Mayncina*.

Jedina mezozojska foraminifera koja ima sličnu građu stijenke kao *L. polymorpha* jest gornjokredna *Moncharmontia apenninica* (De Castro, 1966, 1967). Ona se, međutim, jasno razlikuje oblikom i veličinom, tako da zamjena nije moguća.

Stratigrafski položaj

Na tipičnom lokalitetu (sl. 1), u području zvanom Čarapine Drage, *L. polymorpha* nađena je u sloju biosparita, praćena specifički neodređenim orbitopselama, unutar *Lithotis*-vapnenaca. Prema tome, njen stratigrafski položaj može se sigurno označiti kao srednji lijas, odnosno kao podzona *Orbitopsella praecursor*. Osim toga, u neposrednoj blizini, srednjolijaski kompleks naslaga (ispod i iznad sloja s *L. polymorpha*) sadrži tipičnu mikrofossilnu zajednicu: *Orbitopsella praecursor* (Gumbel), *Orbitopsella* sp., *Labyrinthina* (=»*Lituosepta*«) *recoarensis* (Cati), *Haurania deserta* Henson, *H. amiji* Henson, *Pseudocyclammina liasica* Hottinger, *Earlandia* sp. (što se često krivo određuje kao *Aeolisaccus dunningtoni* Elliott), brojne glomospire (vidi Uvod), oftalmidiide (=»*Vidalina martana*« Farinacci), tekstulariide i dr. Ljuštore litiotida prisutne su u čitavom tom kompleksu naslaga.

Donja granica srednjeg lijasa nije otkrivena na užem području nalazišta, jer je srednji lijas u rasjednom kontaktu s vapnencima donjeg malma. Zato se položaj sloja s *L. polymorpha* može odrediti samo u odnosu prema gornjoj granici srednjeg lijasa, koja je određena nestankom litiotida i navedene mikrofossilne zajednice i istovremenim nastupom tzv. mrljastih vapnenaca. Stratimetrijskim mjerenjima na terenu utvrđen je položaj sloja s *L. polymorpha* oko 100 m ispod granice srednji—gornji lijas, odnosno oko 250 m ispod litološki određene granice gornji lijas—donji doger. Oko 30 m iznad te granice, u debelo uslojenom mikritu, nađena je *Mesoendothyra croatica* Gušić, čime je dokazana donjodogerska starost tih naslaga (= cenozona *Mesoendothyra croatica*). Stratigrafski stup šireg područja tipičnog nalazišta prikazan je na sl. 3.

U okolici Lokava (sl. 2), stratigrafski odnosi slični su onima na tipičnom lokalitetu. Ovdje je *L. polymorpha* nađena također u samo jednom sloju biosparita, debljine svega oko 10 cm, a u neposrednoj krovini i podini su mikriti i fosiliferni mikriti. U sloju s *L. polymorpha* dolaze još *Orbitopsella praecursor*, vjerojatno *Orbitopsella* sp., *Labyrinthina* (=»*Lituosepta*«) cf. *compressa* (Hottinger), vjerojatno *Mayncina termieri*, tekstulariide, glomospire i dr. Premda ovdje nisu nađeni litiotidi, starost naslaga s *L. polymorpha* može se jasno odrediti kao srednji lijas, odnosno podzona *Orbitopsella praecursor*. Oba nalazišta u tom području smještena su blizu rasjedne granice s gornjotrijaskim dolomitom, tako da se ni ovdje ne

može odrediti donja granica srednjeg ljasca, odnosno podzone *Orbitopsella praecursor*. Ta dva nalazišta u srednjolijaskim vapnencima, premda vrlo blizu jedno drugome, odvojena su tektonski pojasom gornjotrijaskog dolomita širine oko 250 m.

Nakon što je ovaj rad već bio predan u štampu, *L. polymorpha* nađena je i u srednjolijaskim vapnencima područja Mazinske šume u Lici (sjeverno i sjeverozapadno od Mazina), i u srednjolijaskim vapnencima na Biokovu, oko 1,5 km sjeveroistočno od Brista.

O SUPRAGENERIČKOM POLOŽAJU RODA *LITUOLIPORA*

Koliko nam je poznato, jednostavna i grubo perforirana stijenka vrste *L. polymorpha* predstavlja jedinstvenu iznimku među mezozojskim foraminiferama s homogenom mikrogranuliranom stijenkom, uz već spomenutu vrstu *Moncharmontia apenninica*. Zato je potrebno izvršiti detaljniju usporedbu s ostalim tipovima stijenke koje susrećemo kod mezozojskih foraminifera.

Jednostavne, jasno otvorene (ili čak ljevokaste) perforacije u stijenci vrste *L. polymorpha* su, srazmjerno svojoj veličini, dosta razmaknute i manje-više kružne u poprečnom presjeku. One se bitno razlikuju od keriotekalne stijenke u fuzulinida, gdje alveole nisu jasno otvorene na površini već je to jedva primjetno (tektum je bio smatran imperforatnim slojem), u poprečnom presjeku su sačaste zbog gustog rasporeda i međusobnog pritiska, i konačno, keriotekalne stijenke su općenito daleko složenije i kompleksnije građe. Jedino je mikrostruktura stijenke u užem smislu zajednička: i keriotekalne stijenke i stijenka u vrste *L. polymorpha* izgrađene su od prvotno izlučenog, mikrogranuliranog kalcita. Što se tiče postojanja detritičnih čestica, to svojstvo ne smatramo osobito značajnim. Poznato je naime da varijabilne količine stranog materijala mogu biti prisutne i kod nekih Endothyraeae, npr. Tournayellidae, Endothyraeae; — cf. Loeblich & Tappan (1964: C 338—339, C 343). Pa i sovjetski autori, koji su osobito detaljno proučili paleozojske foraminifere i razradili njihovu taksonomiju i klasifikaciju, također npr. u porodicu Tournayellidae ubrajaju i »čiste« mikrogranulirane i aglutinirane oblike (Bražnikova & Vdovenko, 1973: 241), pa čak smatraju da su se izrazito aglutinirani oblici (familija Forchidiidae) mogli razviti iz turnajelida. U navedenom djelu, doduše, obje te familije pribrajaju se redu Ammodiscida upravo zbog postojanja aglutinacije, ali ono što smo željeli naglasiti to je da često puta nije moguće taksonomski odvojiti aglutinirane od neaglutiniranih oblika.

Uglavnom jednake razlike vrijede i u odnosu prema onim mezozojskim foraminiferama za koje možemo reći da doista imaju građu stijeuke keriotekalnog tipa (familija Biokoviniidae; Gušić, 1977). S druge strane, perforacije u stijenci vrste *L. polymorpha* ne mogu se smatrati niti kao specifično razvijeni tip egzoskeleta, usprkos moguće površne sličnosti s abradiranim primjercima tzv. alveolarnog tipa egzoskeleta (prema Hottingeru, 1967: 19) odnosno tzv. labirintične građe stijenke (prema Neumann, 1967: sl. 19A na str. 44). Naime, perforacije u vrste *L. polymorpha* su jasno otvorene na površini i prema tome ne može biti govora o postojanju bilo kakvog »imperforatnog epidermalnog sloja«, kolikogod bio tanak. Nadalje, razmjerno grube perforacije u vrste *L. polymorpha* ne mogu se usporediti niti s finim porama-cjevčicama u stijenci nekih aglutiniranih foraminifera. Te cjevčice su sitne, promjera obično od 1 do 4 μm , nepravilne, često se račvaju i/ili »anastomoziraju«. Suprotno od dugo uvriježenog mišljenja da su one otvorene na površini (v. sumarno u Loeblich & Tappan, 1964: C91, sl. 52; u Neumann, 1967: 43, 212, 218 i u Murray, 1973: 780), Murray (1973) je pokazao da one završavaju slijepo u stijenci, tj. da su zatvorene bilo organski izlučenim kalcij-karbonatom bilo aglutiniranim materijalom. No i kada imamo abradirane ili najetkane (nagrižene) kućice koje onda izgledaju kao da su perforirane, jasna je razlika prema grubim, otvorenim perforacijama u vrste *L. polymorpha*. Jednako tako jasna je razlika između pravilnih, jednostavnih, cjevastih pora u lituolipore i vrlo nepravilno i neravnomjerno porozne stijenke u roda *Trochoporina* (Soliman, 1972). Što se pak tiče postojanja organske membrane koja se često spominje s unutrašnje, a katkada i s vanjske strane pora kod recentnih aglutiniranih foraminifera, njeno postojanje može se pretpostaviti i za života vrste *L. polymorpha*,

premda, za razliku od navedenog, Hedley (1963: 436) smatra da u većini slučajeva takva »hitinska« membrana ne postoji. No bez obzira što je od toga točno, to nimalo ne umanjuje značenje navedenih razlika između jednostavne, grubo perforirane stijenke u vrste *L. polymorpha* i fino poroznog unutrašnjeg sloja stijenke u aglutiniranih foraminifera. Naime, treba opetovano naglasiti da to što su perforacije u vrste *L. polymorpha* jasno otvorene na površini sigurno nije rezultat trošenja (abrazije) kućice. Posve je nevjerovatno, naime, da bi baš svi primjerci pokazivali jednak stupanj natrošenosti; oni koje nalazimo istaložene u mikritnom mulju morali bi imati sačuvane tragove vanjskog imperforatnog epidermalnog sloja. Budući da je isti slučaj i s vrstom *Moncharmontia apenninica*, koja je do sada nađena na velikom broju lokaliteta diljem perimediteranskog područja, to isključuje mogućnost da se u svim tim slučajevima radi o jednako abradiranim primjercima.

Konačno, treba odbaciti i mogućnost da je perforirana građa stijenke u vrste *L. polymorpha* rezultat radijalne kristalizacije, tj. linearnog poređaja kalcitnih zrnaca, što daje tzv. fibrozni ili »pseudofibrozni« izgled stijenke (cf. Cummings, 1956). Takve stijenke obično više nalikuju (površno gledano) »pravim« keriotekalnim stijenkama, iako »keriotekalna« građa često nije tako jasna. Perforacije u vrste *L. polymorpha* suviše su krupne da bi se mogle objasniti na takav način. Ovo također, kao uostalom i sve prethodne napomene u ovom poglavlju, vrijedi i za vrstu *M. apenninica*.

Iz svega što je do sada bilo rečeno slijedi da vrstu *L. polymorpha* ne možemo smjestiti ni u jednu postojeću, tj. formalno važeću, foraminifersku familiju. Zato je na početku ovog članka postavljena nova familija, Lituoliporidae. Postavljanje novog taksona na nivou familije čini nam se opravdanim zbog različitosti u osebujne građe stijenke. Dalje je nagoviješteno da se ta familija, za sada, uvrsti u podred Textulariina, superfamiliju Lituolacea, premda je stijenka opisana kao mikrogranulirana s izuzetno rijetkim stranim česticama. De Castro (1966) je svoj novi rod i vrstu *Moncharmontia apenninica*, za koju je već bilo spomenuto da pokazuje jednaku građu stijenke kao *L. polymorpha*, smatrao najmlađim odvjetkom endotirida i pribrojio ju je toj paleozojsko-trijaskoj skupini. No u tom pogledu čini nam se da se treba složiti s mišljenjem što su ga iznijeli Hohenegger & Piller (1975: 73), a to je da u klasifikaciji posttrijaskih mikrogranuliranih (»inekvigranuliranih« u Hohenegger & Piller, 1975) foraminifera treba voditi računa i o filogenetskim odnosima i mogućim vezama, a ne bazirati njihovu klasifikaciju isključivo na osnovi građe stijenke. Osim toga, Hohenegger & Piller (1975: 83) napomenuli su da posttrijaske foraminifere s »inekvigranularnom« građom stijenke mogu potjecati i od Textulariida (=Textulariina u Loeblich & Tappan, 1964) s karbonatnim cementom koje su prestale aglutinirati strane čestice, a ne samo od Fusulinina. To mišljenje u skladu je s onim što je gore rečeno, tj. da se između nekih manje ili više aglutiniranih i »čistih« mikrogranuliranih oblika ne može povući »demarkaciona linija« taksonomskog značenja, pogotovo kad se radi o oblicima koji pokazuju moguću filogenetsku povezanost. Treba napomenuti da takav stav, ako se prihvati, može imati dalekosežne posljedice u klasifikaciji foraminifera, no to, dakako, izlazi izvan okvira ovog rada.

Kao što je već nekoliko puta ukratko spomenuto u prethodnom tekstu, gornjokredna vrsta *Moncharmontia apenninica* (De Castro, 1966, 1967) ima isti tip građe stijenke kao *L. polymorpha*. Premda njen autor kaže za nju da podsjeća na keriotekalnu građu stijenke u fuzulina i da je identična građi stijenke kod mnogih paleozojskih rodova, npr. *Criboospira* (De Castro, 1966: 10), u opisu se kaže da je stijenka izgrađena od jednog jedinog sloja mikrogranuliranog kalcita s jasnim perforacijama (»con apparente perforazioni«). Očito je dakle da se radi o jednakoj stijenci kao što ju ima i *L. polymorpha*, s tom razlikom da su perforacije srazmjerno veličini foraminifere nešto sitnije ali jednakog tipa (jednostavne, cjevaste, razmjerno grube). Zbog toga smo mišljenja da se takva građa stijenke ne može smatrati srodnom keriotekalnoj stijenci kod fuzulinida, zbog razloga koji su opširno navedeni na početku ovog poglavlja. Zato se čini logičnim rodove *Moncharmontia* i *Lituolipora* grupirati zajedno, tj. u istu familiju. Time familija Lituoliporidae n. fam. za sada uključuje dva morfološki jasno odjeljiva i stratigrafski jako »razmaknuta« roda: gornjokredni *Moncharmontia* De Castro i lijski *Lituolipora* n. gen.

PLATE — TABLA I

Lituolipora polymorpha n. gen., n. sp., x ca. 80

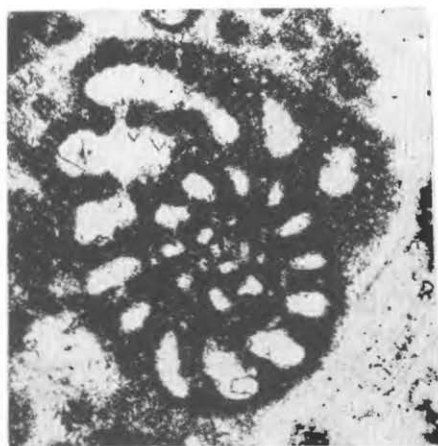
Microspheric tests (mikrosferični primjerci); median or nearly median sections (medijalni ili približno medijalni presjeci)

- 1 Holotype. Specimen with the last whorl having changed the direction of coiling to almost 90°. Note the irregular initial coiling. (Holotip. Primjerak kod kojeg zadnji zavoj mijenja smjer namatanja za gotovo 90° prema prethodnim zavojima. Zapaža se i nepravilno početno namatanje). Slide (izbrusak) CR-1302B, locality (nalazište) Čarapine Drage.
- 2 Specimen with uncoiled later stage. Note a small *Glomospira* in the first septum of the uncoiled stage. (Primjerak s odvijenim kasnijim stadijem. Zapaža se sitna aglutinirana *Glomospira* u prvom septu odvijenog stadija). Slide (izbrusak) CR-1302B/3, locality (nalazište) Čarapine Drage.
- 3 Specimen with uncoiled last stage having changed the direction of growth. (Primjerak s odvijenim završnim stadijem koji je promijenio smjer rasta). Slide (izbrusak) CR-1302B/6, locality (nalazište) Čarapine Drage.
- 4 Specimen with marked irregularities in both early and final coiling. (Primjerak s nepravilno savijenim ranim i završnim zavojima). Slide (izbrusak) CR-1302B/3, locality (nalazište) Čarapine Drage.

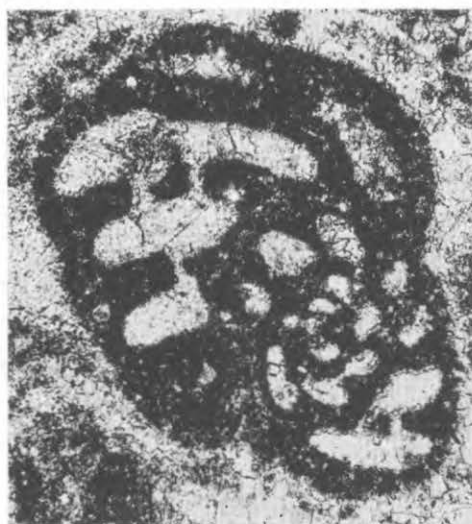


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PLATE — TABLA II

Lituolipora polymorpha n. gen., n. sp., x ca. 80

- 1—3 Median or nearly median sections of microspheric tests with peneropline final stage. Note the irregular initial coiling. (Medijalni ili gotovo medijalni presjeci mikrosferičnih primjeraka s peneroplidnim završnim stadijem. Zapaža se nepravilno početno namatanje).
- 4 Large megalospheric(?) test with peneropline last chamber(s). (Krupan megalosferični? primjerak s peneroplidnim završnim stadijem).
- 5 Tangential section, probably of the uncoiled stage. Note slightly funnel-shaped pores in the uppermost part. (Tangencijalni presjek, vjerojatno kroz odvijeni stadij. Zapažaju se blago ljevkaste pore u vršnom dijelu).

Slides (izbrusci): 1=ČR-1302B/5; 2, 5=ČR-1302B/1; 3=ČR-1302B/4; 4=ČR-1302B/6.
Locality (nalazište): Čarapine Drage.



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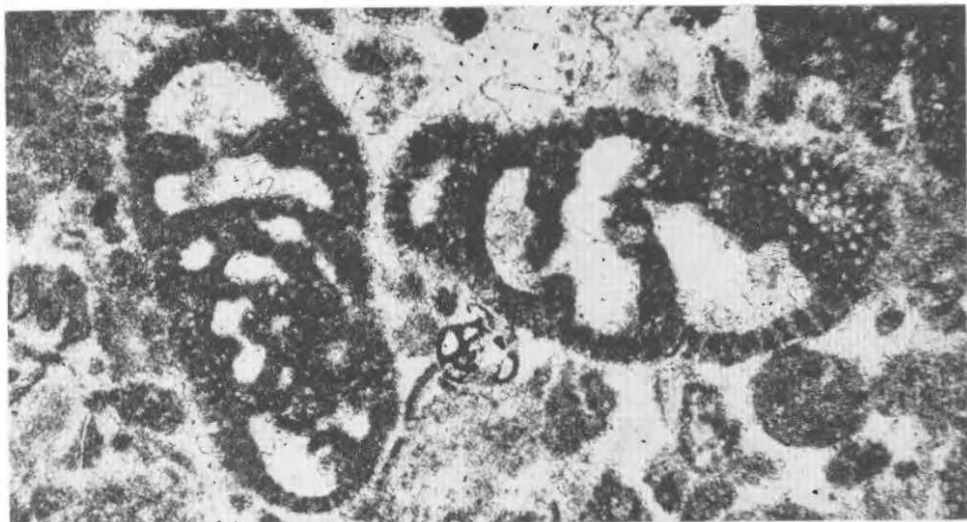
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PLATE — TABLA III

Lituolipora polymorpha n. gen., n. sp., x ca. 80

Variously oriented sections (Različito orijentirani presjeci)

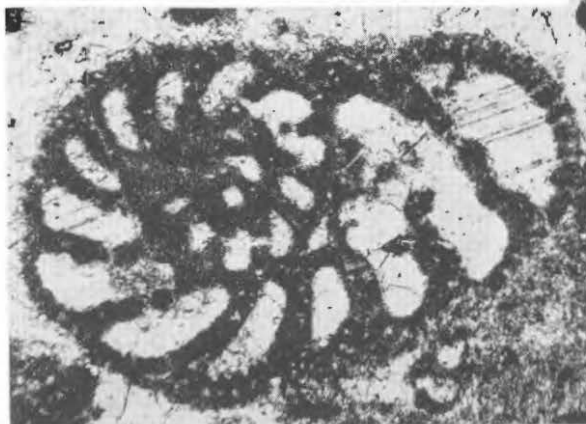
- 1 On the left: microspheric specimen; note the changing direction of chamber addition during ontogeny. (Lijevo: mikrosferični primjerak; zapaža se mijenjanje smjera prirasta klijetaka tijekom ontogenije). Slide (izbrusak) ČR-1302B/6, locality (nalazište) Čarapine Drage.
- 2 Tangential section. (Tangencijalni presjek). Slide (izbrusak) Ob-141/5, locality (nalazište) Lokve.
- 3 Microspheric tests with more or less rectilinearly uncoiled later stages. Left: median section, right: tangential section. (Mikrosferični primjerci s više-manje pravocrtno odvijenim kasnijim stadijem. Lijevo: medijalni presjek, desno: tangencijalni presjek). Slide (izbrusak) ČR-1302B/1, locality (nalazište) Čarapine Drage.



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PLATE — TABLA IV

Lituolipora polymorpha n. gen., n. sp., x ca. 80

- 1 Vertical section (parallel to axial) of a probably microspheric test. (Vertikalni presjek, približno paralelan osnom, vjerojatno mikrosferičnog primjerka). Slide (izbrusak) Ob-153/5, locality (nalazište) Lokve.
- 2 Approximately vertical axial section of a microspheric test. Note the irregular initial coiling. (Približno vertikalni osni presjek mikrosferičnog primjerka. Zapaža se nepravilno početno namatanje). Slide (izbrusak) ČR-1302B/2, locality (nalazište) Čarapine Drage.
- 3 Tangential sections of two tests. Note a *Glomospira* on the left side of the septum of the upper test, and a possibly agglutinating particle in the upper right part. (Tangencijalni presjeci dvaju primjeraka. U lijevom dijelu septuma gornjeg primjerka zapaža se aglutinirana *Glomospira*, a u desnom gornjem dijelu jedna možda aglutinirana čestica). Slide (izbrusak) Ob-153/2, locality (nalazište) Lokve.
- 4 Tangential vertical section, approximately parallel to axial, cutting the uncoiled stage. Note the almost doubled thickness of the septa due to the deposition of the next chamber wall. (Tangencijalni vertikalni presjek, približno paralelan osnom, kroz odvijeni stadij. Zapaža se da su septi gotovo dvostruko deblji od stijenke, zbog prirasta slijedeće klijetke). Slide (izbrusak) ČR-1302B/4, locality (nalazište) Čarapine Drage.
- 5 Approximately vertical axial section of a probably microspheric test. (Približno vertikalni osni presjek vjerojatno mikrosferičnog primjerka). Slide (izbrusak) ČR-1302B/6, locality (nalazište) Čarapine Drage.
- 6 Tangential section through the coiled stage. (Tangencijalni presjek kroz savijeni stadij). Slide (izbrusak) ČR-1302B/2, locality (nalazište) Čarapine Drage.



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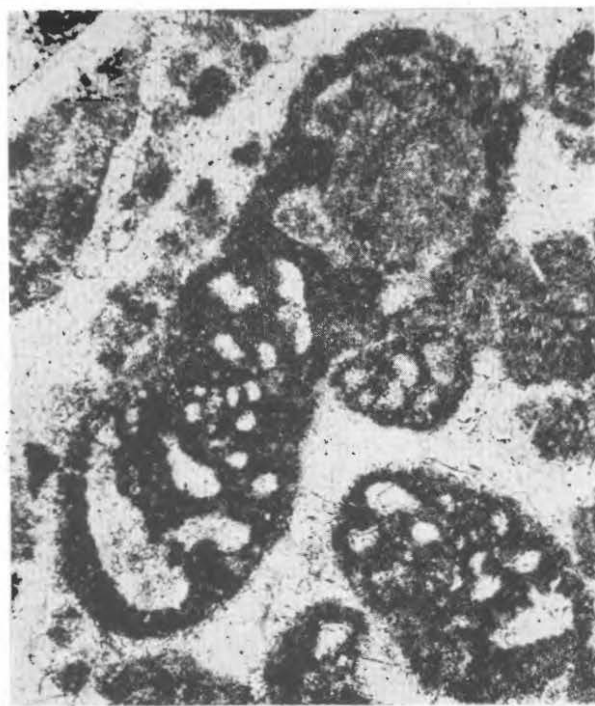


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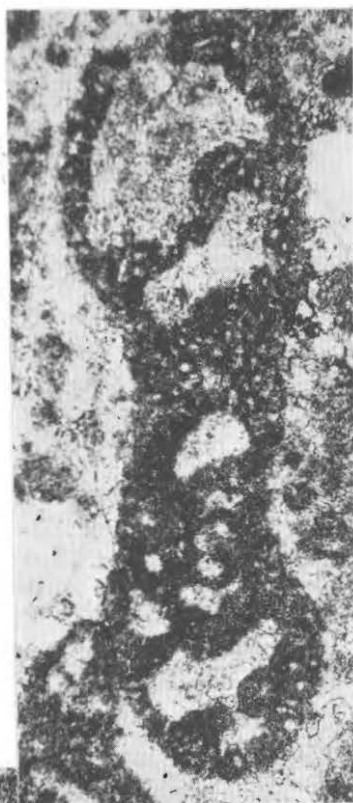
PLATE — TABLE V

Lituolipora polymorpha n. gen., n. sp., x ca. 80

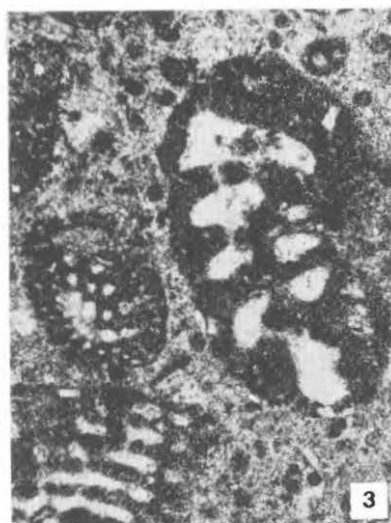
- 1 Approximately axial section of a microspheric test (left) and oblique section near to median) of a probably megalospheric test (lower right corner). Note the irregular mode of coiling in the left specimen. (Približno osni presjek mikrosferičnog primjerka, lijevo, i kosi, približno medijalni presjek vjerojatno megalosferičnog primjerka, u donjem desnom dijelu. Kod mikrosferičnog primjerka zapaža se nepravilno namatanje). Slide (izbrusak) CR-1302B/3, locality (nalazište) Čarapine Drage.
- 2 Approximately axial section of a microspheric test. Note the irregular and slightly sygmoidal mode of coiling. (Približno osni presjek mikrosferičnog primjerka. Zapaža se nepravilno i blago sigmoidalno namatanje). Slide (izbrusak) CR-1302B/3, locality (nalazište) Čarapine Drage.
- 3 Right side: oblique section of a megalospheric test; left side: transversal section through the uncoiled part, cutting a septum; note the cribrate aperture; lower left corner: fragment of *Orbitopsella* sp.; note the difference in the wall structure. (Desno: kosi presjek megalosferičnog primjerka; lijevo: poprečni presjek kroz odvijeni dio, zahvaćen septum; vidi se sitasto ušće; lijevi donji kut: fragment *Orbitopsella* sp.; vidi se razlika u građi stijenke. Slide (izbrusak) Ob-153/5, locality (nalazište) Lokve.
- 4—5 Tangential and oblique-tangential section. (Tangencijalni i koso-tangencijalni presjek). Slides (izbrusci): Ob-153/2 (Lokve) and (i) CR-1302B/1 (Čarapine Drage).



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PLATE — TABLA VI

Lituolipora polymorpha n. gen., n. sp. x ca. 80

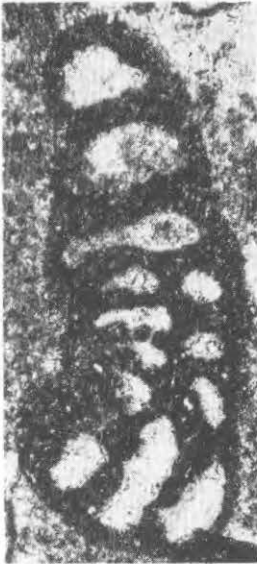
- 1 Vertical axial section of a microspheric test. Note the irregular initial coiling and the changed direction of growth of the uncoiled stage (= upper part of the picture). (Vertikalni osni presjek mikrosferičnog primjerka. Zapaža se nepravilno početno namatanje i promjena smjera rasta odvijenog stadija; gornji dio slike). Slide (izbrusak) ČR-1302B/2, locality (nalazište) Čarapine Drage.
- 2 Axial section of a microspheric test. (Osni presjek mikrosferičnog primjerka). Slide (izbrusak) ČR-1302B/3, locality (nalazište) Čarapine Drage.
- 3 Oblique section, near to the median, of a probably microspheric test. (Kosi presjek, blizak medijskom, vjerojatno mikrosferičnog primjerka). Slide and locality as 2. (Izbrusak i nalazište kao 2).
- 4, 6, 7 Shallow tangential sections, showing perforations in cross section. Note the difference in the wall structure between an imperforate Textulariid (upper part in fig. 7) and *L. polymorpha*. (Plitki tangencijalni presjeci, koji pokazuju pore u poprečnom presjeku. Zapaža se razlika u građi stijenke između imperforatne tekstulariide (sl. 7 gore) i vrste *L. polymorpha*). Slides (izbrusci) ČR-1302B/5, ČR-1302B/3 and ČR-1302B/6, locality (nalazište) Čarapine Drage.
- 5 Tangential section of a probably megalospheric test. (Tangencijalni presjek vjerojatno megalosferičnog primjerka). Slide (izbrusak) ČR-1302B/4, locality (nalazište) Čarapine Drage.



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PLATE — TABLA VII

Lituolipora polymorpha n. gen., n. sp. x ca. 80

- 1—3 Tangential sections of microspheric tests. (Tangencijalni presjeci mikrosferičnih primjeraka). Slides (izbrusci) Ob-153/8, Ob-153/5, Ob-153/2; locality (nalazište) Lokve.
- 4 Very irregularly grown test, probably microspheric. (Vrlo nepravilan primjerak, vjerojatno mikrosferičan). Slide (izbrusak) ČR-1302B/6, locality (nalazište) Čarapine Drage.



PLATE — TABLA VIII

Lituolipora polymorpha n. gen., n. sp. x ca. 80

Variouly oriented sections (Različito orijentirani presjeci).

Note the size of the pores being in proportion with the size of the test (figs. 4—5 vs. figs. 1—3, 6). (Zapaža se razlika u veličini pora ovisno o veličini primjerkaka; sl. 4—5 prema sl. 1—3, 6). Slides (izbrusci): 1 = CR-1302B/5, 2, 4 = CR-1302B/6, 5 = CR-1302B/1, locality (nalazište) Čarapine Drage; 3 = Ob-153/6, 6 = Ob-153/2, locality (nalazište) Lokve.

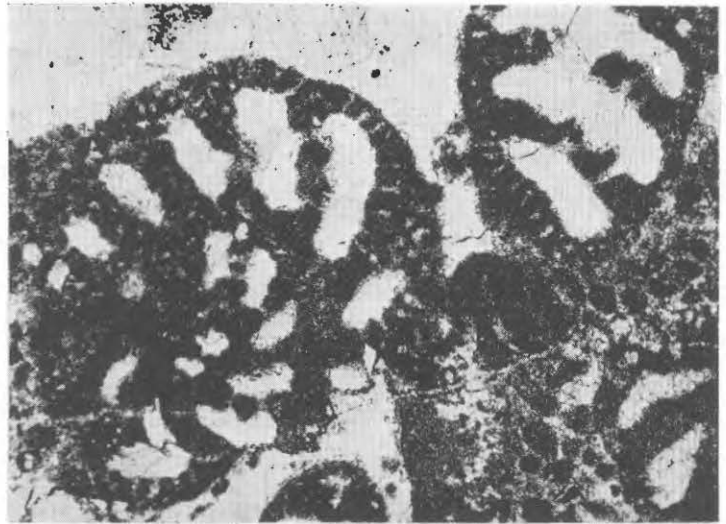
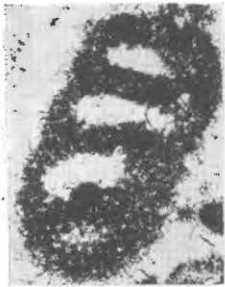
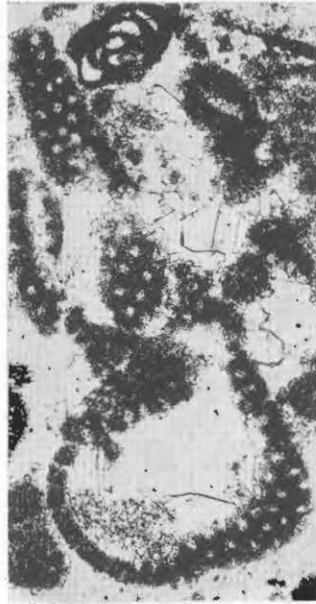
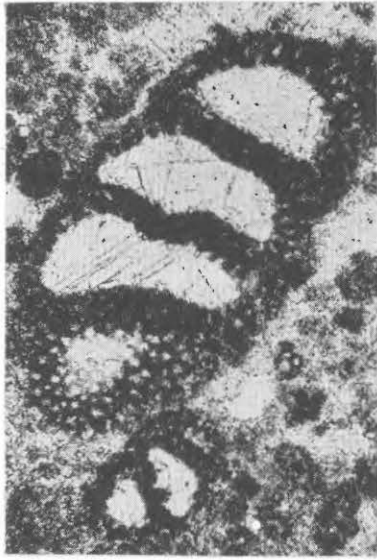


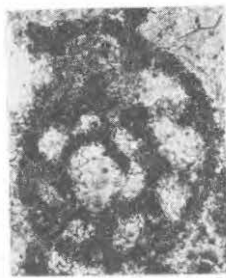
PLATE — TABLA IX

Lituolipora polymorpha n. gen., n. sp., x ca. 80
Megalospheric tests (Megalosferični primjerci).

In the majority of sections the bilocular nucleoconh with particular shape is recognizable. This is particularly well visible in figs. 3, 5, 8 and 9, while in figs. 2 and 6 even a trilocular unit may be envisaged. In approximately axial sections the irregular mode of coiling is visible (figs. 4, 7, 8—11). (Na većini presjeka razaznaje se bilokularni nukleokonh specifičnog oblika. To se osobito dobro zapaža na sl. 3, 5, 8 i 9, dok se na sl. 2 i 6 čak može pretpostaviti i postojanje 3 klijetke. U približno osnim presjecima — sl. 4, 7, 8—11 vidi se nepravilno namatanje). Slides (izbrusci): 1, 2, 3, 5 = ČR-1302B; 4 = 1302B/4; 6 = ČR-1302B/3; 7, 8, 11 = ČR-1302B/6; 10 = ČR-1302B/5, locality (nalazište) Čarapine Drage; 9 = Ob-153/6, locality (nalazište) Lokve.



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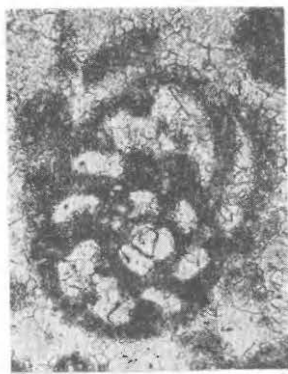
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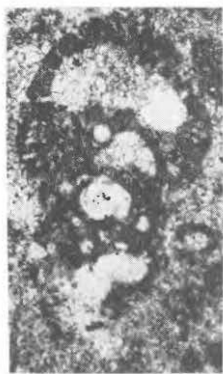
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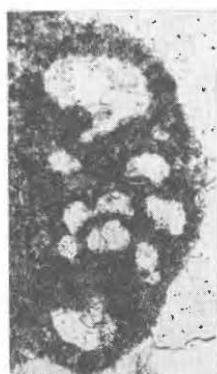
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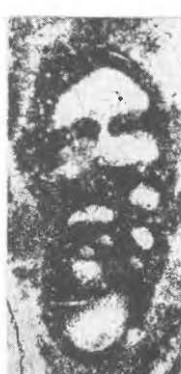
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PLATE — TABLA X

Details of wall structure. (Detalji građe stijenke).

- 1, 2 Imperforate microgranular wall of textulariids. (Imperforatna mikrogranulirana stijenka tekstulariida). 1 = ca. 200x; 2 = ca. 140x.
- 3, 4, 6 Coarsely perforate microgranular wall of *L. polymorpha*, with very rare foreign inclusions — a *Glomospira* in fig. 3. (Grubo perforirana mikrogranularna stijenka u vrste *L. polymorpha*, s vrlo rijetkim inkluzijama stranih čestica: *Glomospira* u sl. 3). 3 = ca. 140x; 4, 6 = ca. 200x.
- 5 Imperforate microgranular wall in *Glomospira* sp. No foreign detritic inclusions are recognizable. (Imperforatna mikrogranulirana stijenka u *Glomospira* sp. Strane detritične čestice ne mogu se razabrati). x ca. 200.

All the forms figured show essentially the same (simple, homogeneous) microstructure of the wall (= microgranular, or »inaequigranular« according to Hohenegger & Piller, 1975), with the only difference that the microgranular wall in *L. polymorpha* is distinctly perforated by relatively coarse, simple pores.

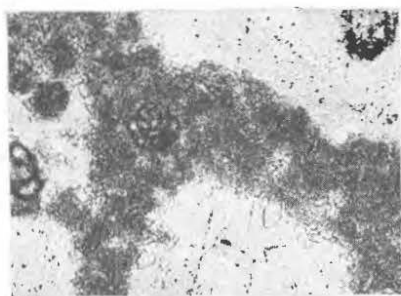
Svi prikazani oblici posjeduju u biti jednaku, jednostavnu i homogenu, mikrostrukturu stijenke, tzv. mikrogranuliranu odnosno »inekvigranularnu« prema Hoheneggeru & Pilleru, (1975), s jedinom razlikom što je mikrogranulirana stijenka u vrste *L. polymorpha* jasno perforirana razmjerno grubim, jednostavnim porama.



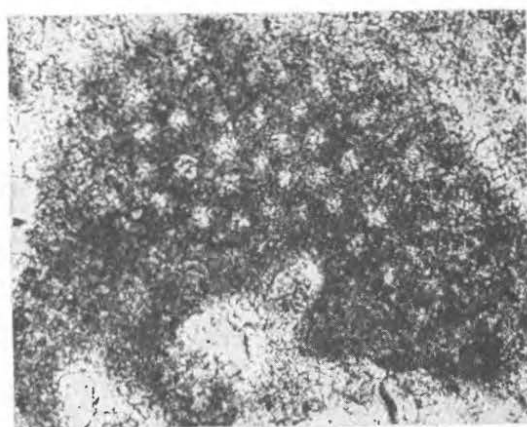
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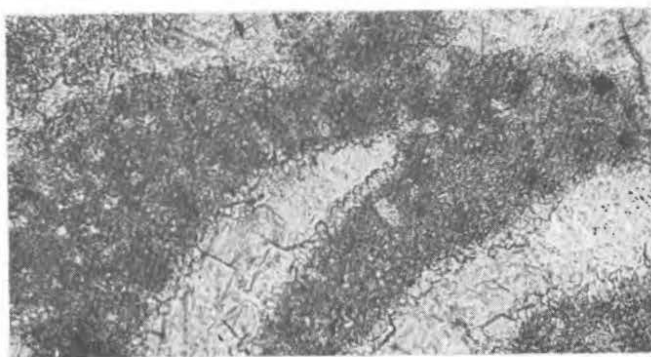
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