

## ON THE NEW UNDERSTANDING OF THE ORDER LITUOLIDA LANKESTER, 1885 (FORAMINIFERA)

VALERIA MIKHALEVICH<sup>1</sup>

**Abstract.** The composition order Lituolida Lankester, 1885 and the diagnosis of the 4 superfamilies, 16 families, 10 subfamilies and 80 genera entering this order sensu strictae are given below. All the diagnoses of the represented taxa (from the order up to the generic level) are emended. Three subfamilies (Comaliamminae, Acruliamminae and Popoviinae) are new.

**Keywords:** Agglutinated foraminifera, Systematica, New taxa.

### INTRODUCTION

Order Lituolida was first described by Lankester in 1885 and later in 1903 years. Lankester separated Lituolids among 10 orders of the class Foraminifera including in its composition families Lituolidae, Trochamminidae, Endothyridae and Loftusiidae. Reophax was included into the family Lituolidae. The diagnosis of the order was as follows: "Test arenaceous, usually regular in contour, chambers of the polythalamous forms frequently labyrinthic. Comprises sandy isomorphs of the simple porcellaneous and hyaline types..." With the exception of Endothyrids, this composition leaves till recent days (of course widened on the account of the new genera and families). Loeblich & Tappan (1992) elaborating further their previous classification (Loeblich & Tappan, 1987) included into this taxon above the Lituolacea (= order Lituolida of Lankester) - 13 superfamilies, and among them Ammodiscacea, Rzehakinacea, Hormosinacea. Thus nearly all known types of the foraminifer shells (pseudotwochambered and multichambered, uniserial and coiled of plano-, strepto- or trochospiral coiling, with different position and character of the aperture and different character of chambers) were united in one taxon. The only common feature for all of them was the agglutinated noncanaliculate wall of the shell (though some forms with canaliculi (*Melatrokerion*, *Coscinophragma*) and pseudopore openings (*Lituolipora*) were also present). This classification based more on the shell wall composition and structure is now generally used and followed by the majority of the authors dealing with foraminiferal classification.

The classification adopted here is based on the new conception of the foraminiferal macrosystem and evolution (Mikhalevich, 1980, 1983, 1992, 2000) which gives the predominant taxonomic significance to the plane of structure of the organism reflected in foraminifera in their skeleton. The shell wall structure and composition is considered to have very important but subordinate meaning. Thus only part of the representatives of the superfamily Lituolacea in the understanding of Loeblich & Tappan, 1992 are entering here the order Lituolida sensu strictae: Mayncinidae, Lituolidae (part): Lituolinae,

Ammomarginulininae (part), Placopsilinidae; from the Haplophragmiacea: Barkerinidae, from the Biokovinacea: Charentiidae, Lituoliporidae, Biokovinidae, from the Loftusiacea: Mesoendothyridae (part): Planiseptinae, Labyrinthininae; Hottingeritidae, Cyclamminidae (part): Buccicrenatinae, Choffatellinae, Pseudochoffatellinae; Spirocyclinidae (some of them also without some genera – see below). Some minor changes within the previous lituolids in the narrow sense are also made. The full revision of the lituolids is not finished yet as the structure of many genera, especially of their initial stages needs to be restudied and specified. The composition and the diagnosis of the 4 superfamilies, 16 families, 10 subfamilies and 80 genera entering the order Lituolida sensu strictae are given below. All the diagnoses of the represented taxa (from the order up to the generic level) are emended.

### SYSTEMATIC DESCRIPTIONS

Phylum **FORAMINIFERA** d'Orbigny, 1826  
Subclass **MILIAMMINANA** Mikhalevich, 1980  
Order **LITUOLIDA** Lankester, 1885

Test multichambered, planispiral, at least initially, later may be uncoiled, coiled part involute (more often) or evolute, chambers from isomorphic nearly subtriangular in outline to broad and low (like in *Peneroplis*), with straight or arcuate sutures, wall agglutinated or microgranular-agglutinated, aperture terminal (areal to final), without a tooth, single or multiple.

**Remarks.** Lituolids included here are to a strong degree isomorphic to some higher Miliolata (for instance *Charentia* to *Derventina*; *Stomatostoecha*, *Choffatella*, *Torinosuella* and many others – to different *Peneroplids*). In the composition of the order Lituolida (Loeblich & Tappan, 1994 and in some following classifications) genera having both agglutinated and microgranular walls and with or without canaliculi or some kind of pore openings were included in spite of the diagnosis of the order defining it as agglutinated and lacking pores. It is indeed impossible to draw a sharp boundary in many

<sup>1</sup> Zoological Institute Russian Academy Sci., Universitetskaya nab., 1, 199034, S. Petersburg, Russia

cases. More often it is easier to distinguish the taxa based on shell form and the position and the character of the aperture. Position of the initial aperture is in many genera unclear and needs more detailed investigations. But in some cases the terminal character of the initial aperture is seen in thin sections in spite that in their diagnosis it is marked like interiomarginal. As it is no sharp boundary between agglutinated and microgranular agglutinated wall the special details in the diagnoses of the genera concerning their wall structure are given only in the cases when these details have diagnostic significance. Forms with the basal aperture, at least at the early stages are excluded from litooids and transferred to the class Rotaliata, subclass Textulariana (order Nautiloculina Mikhalevich, 2003) (Nautiloculina, Haplophragmoides and some others). The uniserial forms as well as ammomarginulinids with the terminal aperture displaced to the peripheral angle and some other ones bearing the nodosariata's features - to the orders Hormosinida Mikhalevich, 1980, Ammomarginulinida Mikhalevich, 2002 and some others of the subclass Hormosinana. Haurania-like forms with trochoid initial part transferred to Textularioidea, trochospiral nezzazatids also are not included here. Pseudotwochambered forms with long tubular second chamber are placed in class Spirillinata (subclass Ammodiscana Mikhalevich, 1980, order Ammodiscida Mikhalevich, 1980), Lituotubida was also separated from litooids (Mikhalevich, 1992, 2000, 2003 (in press)). Some forms took their place within the same subclass but in the other orders: tubular multichambered forms (Rzehakina-like) - in the order Schlumbergerinida Mikhalevich, 1980 (Rzehakinida Saidova, 1981 is its junior synonym), forms streptospirally coiled - in the order Haplophragmoidida Mikhalevich, 1992, some forms with stable cyclic and annular chambers in both generations - in the order Cyclolinida Mikhalevich, 1992.

#### Superfamily **Lituoloidea** de Blainville, 1827

Test free or attached, coiled part involute, wall simple.

#### **Lituolidae** de Blainville, 1827

Test free, planispiral and mostly involute, consisting of early planispirally coiled and later uncoiled rectilinear part usually well developed, chambers of the coiled part usually broad and high (subtriangular) and more often rather inflated, as a rule gradually enlarging in size and not multiple in a whorl, with more or less straight sutures, chambers of the later part usually rounded in section with horizontal sutures, aperture single or multiple.

Ammobaculitinae Alekseychik-Mitskevich, in

Subbotina et al., 1981

Test with a single aperture.

**Remarks.** Subfamily reinstated here from the synonymy of Ammomarginulininae in Loeblich & Tappan, 1987. It differs from the latter in having nonflattened test, horizontal sutures and central position of the aperture, but may be it also belongs wholly or partially to the order Ammomarginulinida, the additional study is necessary. Genera with secreted wall and similar character of chambers occur both among higher nodosariats and higher miliolats and it is sometimes difficult to distinguish such forms among their agglutinated ancestors.

**Ammobaculites** Cushman, 1910 (Pl. I, fig. 1)

Type species: *Spirolina agglutinans* d'Orbigny, 1846

Test with closely coiled early portion and rounded in the section terminal part, aperture rounded, at the center of the coarse apertural surface. C (Miss) - Hol.

**Ammobacularia** Kristan-Tollmann, 1964 (Pl. I, fig. 2)

Type species: *Ammobacularia triloba* Kristan-Tollmann, 1964

Test with closely coiled early portion and rounded in the section terminal part, aperture triangular, nearly triradial in appearance, situated on the fine-grained and slightly produced area. U.Tr.

**Sculptobaculites** Loeblich & Tappan, 1984 (Pl. I, fig. 3)

Type species: *Ammobaculites goodlandensis* Cushman & Alexander, 1930

Test with the planispiral part slightly evolute, terminal aperture rounded, wall extremely coarse (of oolites, calcite prisms of *Inoceramus* shells, shell fragments, foraminifers). Jr - Cr.

**Remarks.** Aperture reported as "arch at the base" but is unclear and needs to be restudied, other features of the genus fit to this subfamily.

**Simobaculites** Loeblich & Tappan, 1984 (Pl. I, fig. 4)

Type species: *Ammobaculites cuyleri* Tappan, 1940

Test with nearly flat sides, flattened to slightly lenticular in section, initial part evolute, aperture terminal. slitlike to fusiform, symmetrically located at the midpoint of the apertural surface. U. Pennsylv. to L, Perm., Cr, Paleoc., Eoc., L. Mioc.

**Ostiobaculites** Bronniman, Whittaker, Zaninetti, 1992 (Pl. I, fig. 5)

Type species: *Ostiobaculites salsus* Bronnimann, Whittaker & Zaninetti, 1992

Test with closely coiled early portion and rounded in the section terminal part, terminal aperture large, almost rectangular slot, parallel to axis of early coiling. Hol.

#### Lituolinae de Blainville, 1827

As Ammobaculitinae, but with the multiple aperture.

**Lituola** Lamarck, 1804 (Pl. I, fig. 6 – 8)

Type species: *Lituolites nautiloidea* Lamarck, 1804

Test with the initial part close coiled, with three or more volutions and numerous chambers, increasing gradually in size as added, rectilinear part well developed, aperture multiple in the uncoiled part and obviously even in the coiled part. U.Tr. – Hol.

**Atactolituola** Loeblich & Tappan, 1984 (Pl. I, fig. 9, 10)

Type species: *Reophax subgoodlandensis* Vanderpool, 1933

Test with the initial part weakly coiled, the only whorl consisting of two or three chambers arranged in arcuate to semicoiled planispire, rectilinear part well developed, may be slightly curved, with the chambers enlarging in size rather rapidly, aperture at the later stage cribrate, at the earlier stage – not described. L. Cr.

**Bulbobuccicrenata** Kerdany & Eissa, 1973 (Pl. I, fig. 11)

Type species: *Bulbobuccicrenata aegyptica* Kerdany & Eissa, 1973

Test with the planispiral initial part well developed, with few globular chambers in a whorl, enlarging so rapidly as added that the last chamber comprises more than one half of the test, rectilinear part weakly developed (only the tendency to uncoil), aperture – scattered rounded or oval openings at the face of the final chamber, obviously the same in the earlier chambers. U. Cr.

**Kolchidina** Morozova, 1967 (Pl. I, fig. 12)

Type species: *Ammobaculites manyschensis* N.K. Bykova, 1953 (= *A. paleocenicus* Cushman, 1947, nom. subst. pro *A. midwayensis* Cushman, 1940)

Test with well expressed both the planispiral and uncoiled part, with numerous chambers gradually increasing in size as added, wall may be considerably thickened resulting in reduced chamber lumen, aperture areal and arcuate to semilunate in the early coil, parallel with the axis of coiling, in the uncoiled stage - multiple, in a depression covering most of the upper portion, comprised by irregular, rounded and elongated openings. L. Paleoc.

**Carasuella** Neagu, 2000 (Pl. I, fig. 13)

Type species: *Carasuella cylindrica* Neagu, 2000

Test with well expressed both planispiral and uncoiled part and gradually increasing chambers, aperture cribrate, comprising many circular pores situated at the convex apertural surface in the uncoiled part, in the earlier coiled part not described, obviously the same. Cr.

**Buzasinidae** Mikhalevich, 2003

Test free, planispirally coiled entirely, involute, compressed to different degree, with somewhat flattened chambers, aperture areal, single, looking as a transverse slit or circular, usually boarded by a narrow lip.

**Buzasina** Loeblich & Tappan, 1985 (Pl. I, fig. 14,

15)

Type species: *Trochammina ringens* Brady, 1879

Test somewhat compressed, involute, with 3-4 chambers per whorl, rapidly enlarging as added, the last one occupying nearly half of the test, wall very finely agglutinated, smooth, with considerable cement, brown, aperture areal, slitlike, equatorial, completely bordered by a narrow lip. U. Cr, Hol.

**Ammosiphonia** He, 1977 (Pl. I, fig. 16)

Type species: *Ammosiphonia vulgaris* He, 1977

Test slightly compressed but with depressed umbilicus on both sides, involute, chambers numerous, enlarging gradually in size, wall finally agglutinated, aperture areal, rounded, elevated on a short tubular neck which is composed from the cementing material only. U.Tr.

**Apostrophoides** McNeil, 1997 (Pl. I, fig. 17)

Type species: *Apostrophoides silus* McNeil, 1997

Test laterally compressed, involute to slightly evolute, biumbilicate, with numerous chambers enlarging gradually in size, wall finally agglutinated, aperture areal, rounded, apertural face projects forward above the aperture, but curved back below it thus forming a sub-apertural notch between the aperture and the preceding whorl. Maastr.

**Remarks.** The notch gives the false impression of the initial uncoiling stage whereas the final chamber is always in contact with the previous whorl and the test is entirely coiled. Placed by the author of the genus into Haplophragmoididae and is transferred here into Buzasinidae on the base of its apertural character.

**Mayncinidae** Loeblich & Tappan, 1985

Test free, entirely planispirally coiled or with weak tendency to uncoil, lenticular to flattened, mostly involute, usually with numerous more or less broad and low flattened chambers per whorl in a rapidly enlarging coil, with septa gently arced, often curving back to the peripheral angle, chambers of the weakly uncoiled part (if present) oval to flattened in section and with oblique sutures, aperture single or multiple, often in the depression of the apertural face.

**Remarks.** Genus *Deuterospira* is excluded - according to description it has basal aperture at the initial stage.

**Mayncininae** Loeblich & Tappan, 1985

Test with the multiple aperture.

**Mayncina** Neumann, 1965 (Pl. I, fig. 18, 19)

Type species: *Daxia orbigny* Cuvillier & Szakall, 1949

Test oval in outline, discoidal to lenticular, in operculinoid spire, chambers arced toward the apertural face, apertural face vertical, subtriangular, truncated to slightly excavated, aperture cribrate, areal, representing pores scattered up the apertural face and seen in thin section as a multiple passages through the septa. U. Cr.

***Flabellocyclolina*** Gendrot, 1964 (Pl. I, fig. 20, 21)

Type species: *Flabellocyclolina laevigata* Gendrot, 1964

Test large, flattened and very thin, fanshape in outline, early stage evolute, with numerous chambers extremely broad and low, later stage peneropliform with flaring and strongly arced chambers, wall calcareous, microgranular, smooth, apertural face horizontal, very thin, aperture multiple, represented by a single row of rounded openings along the apertural face in the median plan of the test. U. Jr., U. Cr.

***Gendrotella*** Maync, 1972 (Pl. I, fig. 22, 23)

Type species: *Choffatella rugoretis* Gendrot, 1968

Test flat, oval in outline, chambers broad and low, arced in the middle, apertural face high and very thin, apertural face vertical, thin, aperture multiple, areal, a series of pores aligned vertically up the apertural face, seen as passages through the septa in thin sections. U. Cr.

***Stomatostoecha*** Applin, Loeblich & Tappan, 1950 (Pl. I, fig. 24, 25)

Type species: *Stomatostoecha plummerae* Applin, Loeblich & Tappan, 1950

Test discoidal to lenticular, oval in outline, with slight tendency to uncoil, incompletely involute, with depressed umbilicus, chambers somewhat more broad and arced than in *Phenacophragma*, apertural face vertical, very high, truncate or depressed centrally, aperture – a vertical row of rounded openings along the apertural face.

**Remarks.** Loeblich & Tappan, 1987 described in the diagnosis the aperture of the late stage as a single slit, but in their figure of the holotype of the type species *S. plummerae* it is distinctly multiple – a vertical row of the rounded openings.

***Comaliamma*** subfam. nov.

Test with the single aperture representing a slit along the apertural face.

***Daxia*** Cuvillier & Szakall, 1949 (Pl. I, fig. 26, 27)

Type species: *Daxia cenomana* Cuvillier & Szakall, 1949

Test nearly circular in outline, lenticular to flattened, depressed at the umbilical region on the both sides, with numerous broad chambers, nearly crescentiform, arced centrally and curving back to the peripheral angle, apertural face vertical, short-triangular, truncated to slightly excavated, aperture areal, small, hardly seen externally, better in thin section. Cr.

**Remarks.** Loeblich & Tappan (1987) marked that the multiple aperture of *Daxia* is probably due to a missidentification.

***Biconcava*** Hamaoui, 1965 (Pl. I, fig. 28, 29)

Type species: *Biconcava bentori* Hamaoui, 1965

Test broadly oval in outline, with slightly flattened sides, partially evolute, biumbilicate, chambers broad but not very low, with the elevated sutures

which are straight to slightly arced, wall microgranular, apertural face vertical, broadly-triangular, depressed in the center, aperture in the earlier chambers – transverse arc above the base, later – long vertical areal slit in a vertical groove, going parallel to the lateral sides.

***Comaliamma*** Loeblich & Tappan, 1985 (Pl. I, fig. 30, 31)

Type species: *Comaliamma charentiformis* Loeblich & Tappan, 1985

Test somewhat elongated, early part lenticular, one or two last chambers may be uncoiled, flat or oval in section and becoming arced, chambers of the early part less broad (only little broader than high), apertural face vertical, oval, slightly excavated, aperture areal in the early coiled stage (piercing the septa in thin section), in the last chambers tending to uncoil - a short terminal slit in a slight depression. L. Cr.

***Freixialina*** Ramalho, 1969 (Pl. I, fig. 32, 33)

Type species: *Freixialina planispiralis* Ramalho, 1969

Test discoidal, oval in outline, partly evolute, with slightly depressed umbilicus on both sides, chambers moderately broad and low, with sutures straight to slightly arced and oblique, apertural face vertical, slightly elongated and slightly convex, aperture - single areal slit. U. Jr.

***Hinogamma*** Neagu, 2000 (Pl. I, fig. 34)

Type species: *Hinogamma danubiana* Neagu, 2000

Test rather thick with flattened sides, broadly oval in outline, involute to evolute, chambers broad but not very low, slightly inflated in the center, laterally flattened, sutures straight to slightly arcuate in the adult, apertural face vertical, slightly elongated and convex, aperture – a long median vertical slit parallel to the lateral sides of the test along the whole height of the apertural face. Cr.

***Phenacophragma*** Applin, Loeblich & Tappan, 1950 (Pl. I, fig. 35, 36)

Type species: *Phenacophragma assurgens* Applin, Loeblich & Tappan, 1950

Test discoidal to auriculate, oval in outline, compressed, partially to significantly evolute, tending to uncoil in the later stage, early chambers moderately broad with straight sutures, later ones broader, with slightly arced sutures, apertural face high, convex, suboval, aperture areal in the coiled stage, as seen in thin sections, terminal slit parallel to the periphery at the apex of the apertural face in later chambers, inner ends of these slits looks at sections as short peripheral curved hemisepta as a matter of fact representing the inner sides of the apertural slit. L. Cr.

***Placopsilinae*** Rhumbler, 1913

Test attached completely or partially, with initial attached planispiral more or less regular and distinct to irregular part and in majority of the genera with the

uncoiled part, which may be attached or free, wall usually thin and translucent on the attached side, more thick on the free side, aperture single or multiple, rounded or slitlike.

**Remarks.** Two of the genera of the family (*Ahaerentia* and *Flatschkofelia*) are described as having initial biserial part. As the biseriality of these forms may be due to the irregularity of the attached forms, they are kept here within Placopsilinids (one of them - *Flatschkofelia* transferred here to Adherentiinae).

Two genera (*Ammocibicides* and *Ammocibicoides*) are not included here as having trochoid test.

Placopsilininae Rhumbler, 1913

Test with initial planispiral coil and single aperture.

**Placopsilina** d'Orbigny, 1850 (Pl. I, fig. 37, 38)

Type species: *Placopsilina cenomana* D'Orbigny, 1850

Test attached throughout, with earlier planispiral part well developed and usually wider than later uncoiling part, peripheral margin rounded, rather regular, lobulated, aperture – terminal, rounded, may have a slight lip. M. Jr. – Hol.

**Subbdeloidina** Frenzen, 1944 (Pl. I, fig. 39, 40)

Type species: *Subbdeloidina haeusleri* Frenzen, 1944

Test completely attached, initial planispiral coil irregular and weakly developed, may be absent, chambers of uncoiled part wider than coiled part, gradually increasing in size, peripheral margin widely rounded, lobulated, aperture terminal, single. L. to U. Jr.

Acruliammininae subfam. Nov

Test with initial planispiral coil and multiple aperture at the adult stage.

**Acruliammina** Loeblich & Tappan, 1946 (Pl. I, fig. 41)

Type species: *Placopsilina longa* Tappan, 1940

Test with the early planispiral part well expressed, later part uncoiling and may become free from the attachment, peripheral margin rounded, lobulate, aperture in the earlier stage – a low slit against the attachment, later terminal and as two slits, finally may become cribrate. L. CR. – U. Cr.

**Lapillincola** Wilson, 1986 (Pl. I, fig. 42)

Type species: *Lapillincola faringdonensis* Wilson, 1986

Test attached completely, with a small planispiral coil, flattened and with unclear sutures and significantly wider uncoiled part which is also flattened with chambers rectangular to arcuate and parallel septa, peripheral margin narrow, aperture – a row of small openings along the apertural face. Aptian.

Adhaerentiinae Loeblich & Tappan, 1986

Test biserial part, planispiral coil not observed, aperture single or multiple.

**Remarks.** Belonging to the lituolids is doubtful because of the biserial (or pseudobiserial) character of the later part.

**Adhaerentia** Plummer, 1938 (Pl. I, fig. 43, 44)

Type species: *Adhaerentia midwayensis* Plummer, 1938

Test biserially arranged initially, then loosely biserial, becoming uniserial finally, proloculus attached, later part may be free and nearly cylindrical, with chambers gradually increasing in size, aperture terminal, single and rounded at the early stage, later irregular in outline and finally multiple consisting of two or more openings. L. Paleoc.

**Remarks.** Test usually attached to Lenticulina or other foraminifera, wall from foraminiferal tests and fish bone fragments, thick, especially near aperture and at the floor of chambers against the previous septum, with restricted chamber lumen.

**Flatschkofelia** Rettori, Senowbari-Daryan & Zuhlke, 1996 (Pl. I, fig. 45)

Type species: *Flatschkofelia anisica* Rettori, Senowbari-Daryan & Zuhlke, 1996

Test with initial attached biserial part, later free, may be biserial to uniserial, aperture of the biserial early part terminal, single, moving to the margin in the uniserial stage. M. Tr.

Superfamily **Barkerinoidea** Smout, 1956

Test with chambers, internally subdivided, wall microgranular or microgranular-agglutinated. L. Cr.

**Biplanatidae** Mikhalevich, 1992

Test planispirally coiled, evolute to semievolute, chambers subdivided by a "plate" associated with the aperture or other type of partitions; aperture in the adult terminal, single or multiple.

**Remarks.** Family separated from the Nezzazatidae, differs from the latter in planispiral rather than trochoid test and in character and position of the aperture, though aperture of the earliest part is not known, but in adult stage it is terminal (areal) – represented by multiple openings or one opening (in Nezzazata aperture is basal). The "plate" of the representatives of this family also differs from that one in Nezzazata – its digitations in the lower part transfer into pillars which may attach the preceding chamber.

**Biplanata** Hamaoui & Saint-Marc, 1970 (Pl. II, fig. 3 - 5)

Type species: *Biplanata peneropliformis* Hamaoui & Saint-Marc, 1970

Test planispiral throughout, evolute to semiinvolute, flattened, may be somewhat flaring at the end, with numerous (up to thirty in the final whorl) broad, very low and slightly curved chambers, subdivided internally by median basally digitate

“plate”, its separate portions attaching as pillars between the multiple openings of the preceding chamber, aperture – a row of openings at the apertural face. U. Cr.

***Merlingina*** Hamaoui, 1965 (Pl. II, fig. 6 – 8)

Type species: *Merlingina cretacea* Hamaoui, 1965

Test almost planispiral but asymmetrical, semievolute and planoconvex at the early stage, later more nearly bilaterally symmetrical, flattened, with angled periphery and deepened umbilical area, tending to become uncoil and flaring finally, chambers broad and low, rapidly increasing in thickness, as a result the apertural surface becomes broad, nearly subcircular, sutures somewhat sinuous, chambers subdivided by slightly undulated toothplate going inward (= that curves inward) from the lateral borders of the apertural face, having two or three basal digitations attaching the septum of the preceding chamber, aperture reported as round at early stage, U- or V-shaped at later stage, associated with a toothplate.

**Remarks.** Aperture is difficult to observe externally.

***Demirina*** Ozcan, 1994 (Pl. II, fig. 9, 10)

Type species: *Demirina meridionalis* Ozcan, 1994

Test planispiral, biumbilicate, semiinvolute, with angled periphery, chambers broad and low, in the early stage arced rectangular, rapidly increasing in size as a result the apertural surface becomes broad, subcircular, adult chambers (the early ones possibly not subdivided) subdivided by transverse partitions which project inward from the chamber wall almost vertically or are slightly inclined, attaching the consecutive septa along the margins of the chamber lumen, usually leaving an empty space in the median part of the chamber cavity, aperture interiomarginal (?) in early stage, later areal, finally cribrate. Cenomanian.

**Remarks.** In the original description the comparison with *Merlingina* is not given.

The disposition of the inner partitions differ from that one of *Merlingina*. The interiomarginal character of the initial aperture is doubtful.

**Barkerinidae** Smout, 1956

Test planispirally coiled, involute, chambers internally subdivided by transverse interseptal partitions, aperture multiple.

***Barkerina*** Frizzell & Schwartz, 1950 (Pl. II, fig. 1, 2)

Type species: *Barkerina barkerensis* Frizzell & Schwartz, 1950

Test subglobular, chambers numerous, transverse partitions are visible in sections, wall agglutinated, microgranular, aperture multiple – a row of small openings along the base of the apertural face. U. Cr.

**Remarks.** Character of the aperture is similar to that one in *Crenatella* Luczkowska, 1972

(Quinqueloculinidae, subfamily Scutulorinae Mikhalevich, 1987) – a low slit subdivided by a distinctly crenulate upper margin.

Superfamily **Biokovinoidea** Guscic, 1977

Test free, entirely planispirally coiled or with later uncoiled part which may be straight or peneropliform and reniform, the planispiral part involute (sometimes semiinvolute) or evolute, the proportions of the development of planispiral and uncoiled parts vary in different families, with agglutinated, microgranular thickened complicated wall, imperforate or perforated, may be with canaliculi and keriotheca- and phrenotheca-like layers and additional endoskeletal elements (pillars, partitions, chomata-like structures), may be alveolar (Buccicrenatidae, Choffatellidae, Spirocyclinidae); aperture terminal, single or multiple.

**Charentiidae** Loeblich & Tappan, 1985

Test with early planispiral coil, involute to semiinvolute, later may uncoil, planispiral part developed more than uncoiled or planispiral throughout, wall agglutinated, with imperforate outer epidermis and inner pseudoalveolar keriotheca-like layer (with cylindrical pseudoalveoles) not reaching either the inner or outer surface (with the exception of *Melathrokerion* having very thin canaliculi), septa homogenous and solid, no additional endoskeletal structures except chomatalike, aperture single or multiple.

**Remarks.** In many genera the early part may be with slight streptospiral oscillations, especially in microsphaeric generation.

***Charentia*** Neumann, 1965 (Pl. II, fig. 11, 12)

Type species: *Charentia cuvillieri* Neumann, 1965

Test early planispiral coil, involute, biumbonate, lenticular to subglobular, later uncoiled part with one, two, rarely up to four chambers, rectilinear, compressed, with subacute to rounded periphery, wall imperforate, pierced by cylindrical canaliculi not reaching either inner or outer wall surface but looking as keriotheca or pseudoalveolar structure, wall of the early chambers and apertural surface solid, noncanaliculate, the portion of the apertural surface beneath the aperture distinctly thickened to form chomatalike triangular projection, aperture areal, an arc near the base of the apertural chamber in the early stage, later becoming triangular, the upper angle of the triangle gradually lengthening to become a narrow slit of the uncoiled chambers. Cr.

**Remarks.** Triangular projections on the spiral septum “superficially resembling fusulinacean chomata” (Loeblich & Tappan, 1987). They also resemble miliolidean tooth. I don’t consider this similarity as occasional or convergent but as showing the close relations of these groups (Mikhalevich, 2003).

***Ismailia*** El-Dakkak, 1974 (Pl. II, fig. 13, 14)

Type species: *Ismailia neumannae* El-Dakkak, 1974

Test planispirally coiled throughout, semiinvolute, leaving open umbilicus, periphery subacute, wall microstructure not described, aperture – a vertical slit in the apertural face, may bifurcate basally. U. Cr.

**Remarks.** Loeblich & Tappan, 1987 supposed it to be congeneric with *Charentia*, but hesitated to unite them as the detailed thin sections of it absent.

**Karaisella** Kurbatov, 1971 (Pl. II, fig. 15, 16)

Type species: *Karaisella usbekistanica* Kurbatov, 1971

Test planispiral, involute, biumbilicate, periphery subacute to subcarinate, wall with imperforate epidermal layer, chomatalike structures on the spiral septum as in *Charentia*, aperture small, rounded, near the midpoint of the apertural face. U. Cr.

**Remarks.** Planispiral coils in the very early stage may oscillate, may be slightly streptospiral. The ultrastructure of the wall similar to that one of *Charentia* was not observed in *Karaisella*, but as the thin section of the type species represents only the early stage and missed the adult one – it's possible to wait the the similar wall ultrastructure like in adult *Charentia*. The rest significant features are found in the both genera. (Loeblich & Tappan, 1987).

**Melathrokerion** Bronnimann & Conrad, 1967 (Pl. II, fig. 18, 19)

Type species: *Melathrokerion valserinensis* Bronnimann & Conrad, 1967

Test planispiral throughout, thick, with broad and rounded peripheral margin, wall of the early chambers and apertural face simple, of the later chambers becoming thick, pseudoalveolar (keriothecalike?), with very narrow cylindrical canaliculi piercing the wall “but not becoming true alveoles” (Loeblich & Tappan, 1987), giving in section radially striate appearance to the wall, chomatalike structures on the spiral suture present (as in *Charentia*), aperture areal, a wide transverse crescentic slit looking as terminal opening. L. Cr.

**Remarks.** It is not clear from the diagnosis whether canaliculi rich the outer surface and open on it, in thin section given by Loeblich & Tappan, 1987, pl. 79, fig. 11 part of the terminal part of the last whorl looks surrounded by the thin imperforate (may be organic) layer, the earlier part of this whorl lacks such layer and canaliculi looks opening outside. The whole character of the test and its wall is close to that one of *Charentia*, so the position of the genus is preserved within this family.

**Moncharmontia** De Castro, 1967 (Pl. II, fig. 20, 21)

Type species: *Neoendothyra apenninica* De Castro, 1966

Test planispiral throughout, involute, biumbilicate, periphery broadly rounded, wall with imperforate outer layer over a canaliculate inner layer, septa and apertural face thin and simple, aperture areal and

multiple: a single arced row boarded by short necks in the early stage, later more numerous openings irregularly distributed near the base of a narrow arced apertural face. U. Cr.

**Remarks.** The character of the wall is not clearly seen from the sections reported in Loeblich & Tappan, 1987.

**Paleomayncina** Sepfontaine in Kaminski, 2000 (Pl. II, fig. 17)

Type species: *Mayncina termieri* Hottinger, 1967

Diagnosis not given, the figure represents only thin section of the shell, but the aperture probably multiple as in *Mayncina*. Sepfontaine (1988) marked the keriothecal character of its wall. Carixian.

**Praekaraisella** Kurbatov, 1972 (Pl. II, fig. 22)

Type species: *Praekaraisella vandobensis* Kurbatov, 1972

Test compressed, planispiral and semiinvolute initially (with slight tendency to be streptospiral), biumbilicate, later chambers with tendency to uncoil into one-two rectilinear chambers, periphery subacute, wall of the earlier chambers simple, in the later chambers “fibrous”, small chomatalike septal bases present against the earlier whorl, aperture areal in coiled part, in the uncoiled chambers - terminal rounded opening. U. Cr.

**Praepeneroplis** Hofker, 1952 (Pl. II, fig. 23)

Type species: *Peneroplis senoniensis* Hofker, 1949

Test planispiral throughout, closely-coiled and involute in the early stage, later slightly evolute and biumbilicate, chambers numerous, cuneate, ultrastructure of the wall not described, chomatalike structures present, aperture areal, ovate to triangular. U. Cr.

**Bosniella** Gusic, 1977 (Pl. II, fig. 24)

Type species: *Bosniella oenensis* Gusic, 1977

Test with early planispiral part and later uncoiled, in microsphaeric form earlier part coiled somewhat irregularly, megalosphaeric one has bilocular embryonal stage, wall thick, homogenous, “perforations separated by narrow microgranular lamellae resulting in a keriothecal structure, septa thick, no endoskeletal structures but chomatalike present, aperture single in the early stage, later becoming cribrate. L. Cr. – as reported in Loeblich & Tappan, 1987.

**Remarks.** The genus moved from Biokovinidae as lacking endoskeletal structures (pillars).

**Lituoliporidae** Gusic & Velic, 1978

Test planispirally coiled, at least initially, later can change the direction of coiling or become uncoiled, uncoiled part not more developed than the planispiral one, wall agglutinated, homogenous, microgranular, with large pores opening both on outer and inner surfaces, no additional endoskeletal structures present, aperture multiple.

**Remarks.** Test possibly involute (figures given

only in sections).

**Lituolipora** Gusic & Velic, 1978 (Pl. II, fig. 25, 26)

Type species: *Lituolipora polymorpha* Gusic & Velic, 1978

Test planispirally coiled initially, later irregularly coiled with changing angle of coiling or uncoiled, from rectilinear to peneropline, wall agglutinated, mostly from calcareous particles, microgranular, thick, with large simple pores, without differentiated endo- or exoskeleton, aperture of the early stage areal, single, later – multiple. L. Jr.

**Buccicrenatidae** Loeblich & Tappan, 1985

Test planispiral initially, involute, with a few chambers per whorl, uncoiled part nearly rectilinear, developed not more than the spiral one, wall of adult chambers distinctly alveolar under imperforate epidermal layer, no additional endoskeletal elements except chomatalike structures, aperture single.

**Remarks.** The family Buccicrenatidae is here transferred from the Loftusiacea; it differs from Charentiidae in its alveolar wall. The presence of chomatalike structures at the bottom of the chambers is similar in both families. I regard this line as the continuation of the phyletic line of the planispiral Tournayellids and Endothyrids (see Loeblich & Tappan, 1987, pl. 79 (8) and pl. 233 (11); pl. 79 (11) and pl. 243 (16)). The families Choffatellidae and Spirocyclinidae are also transferred from the former Loftusiacea. It differs from Lituoliporidae and Biokovinidae also by the absence of pore openings in the outer wall and from Labyrinthinidae also by the absence of complex endoskeleton.

**Buccicrenata** Loeblich & Tappan, 1949 (Pl. II, fig. 27, 28)

Type species: *Ammobaculites subgoodlandensis* Vanderpool, 1933

Test with initial planispiral coil of rather few chambers, involute, later with uncoiled nearly rectilinear part, periphery lobulated, wall with imperforate epidermal layer covering a shallow alveolar layer, in which alveoli are of nearly circular section and may bifurcate, septa simple, solid, chomatalike structures at their base present, aperture terminal, elongate straight or zigzag slit. L/ Cr. to U. Cr.

**Remarks.** Alveolar character of the wall does not extend across the septa.

**Everticyclammina** Redmond, 1964 (Pl. II, fig. 29, 30)

Type species: *Everticyclammina hensoni* Redmond, 1964, (= *Cyclammina greigi* Henson, 1948)

Test planispiral initially, lenticular to slightly compressed, later with slight tendency to uncoil, wall alveolar (except septa), chomatalike structures developed, aperture terminal – short vertical slit. U. Jr. to L. Cr.

**Remarks.** Genus very close to Buccicrenata, differs from the latter in having less compressed test, in form of the chambers, simple slitlike aperture and more massive chomatalike structures.

**Feurtillia** Maync, 1958 (Pl. II, fig. 31)

Type species: *Feurtillia frequens* Maync, 1958

Test planispiral, compressed, involute in early stage, later uncoiling, at least in the microsphaeric form, wall “with distinct subepidermal network of shallow alveoles that appear polygonal in tangential section, septa thick, recurved” (Loeblich & Tappan, 1987), aperture terminal, single, elongated, parallel with the axis of coiling, occupying over the half of the apertural face in adult. U. Jr. to L. Cr.

**Remarks.** Chomatalike structures are hardly seen in thin section. Though Sepfontaine (1988) considered this genus to be a junior synonym of *Everticyclammina*, it is kept here as a separate one as it differs from *Everticyclammina* in the form of the test and the chambers which are more low, broad and arcuate.

**Choffatellidae** Maync, 1958

Test planispirally coiled initially, involute to semiinvolute), strongly compressed – often with short axis of coiling, later uncoiled stage reniform or peneropliform, more rarely rectilinear, planispiral part developed more than uncoiled one, wall with solid outer epidermis and continuous inner alveolar hypodermis, no additional endoskeletal elements developed, aperture multiple.

**Remarks.** Family transferred from the former Loftusiacea, where it had subfamily rank. Differs from loftusiids firstly in quite another structure of the test and also in the absence of the endoskeletal structures (the absence of pillars is underlined in the descriptions of all the included genera). Genera *Amijiella*, *Bramkampella* and *Rectocyclammina* transferred to Ammomarginulinida Mikhalevich, 2002, superfamily Flabellamminopsidoidea Mikhalevich, 2002 on the basis of their test morphology.

**Choffatella** Schlumberger, 1905 (Pl. II, fig. 32, 33)

Type species: *Choffatella decipiens* Schlumberger, 1905

Test planispirally coiled, strongly compressed, partially evolute, with only slight tendency to uncoil, wall with well developed subepidermal network, septa thick, massive, pierced by the large apertures in the median plane of the test, aperture – a single areal row extending up the apertural face in the plane of coiling, those of successive chambers form the radial series as could be seen in axial section, the series of such apertures of the new volutions are intercalated between previous ones. U. Jr. to U. Cr.

**Remarks.** Test similar in form to *Stomatostoecha*, differing from it in the wall character.

**Alveosepta** Hottinger, 1967 (Pl. II, fig. 34)

Type species: *Cyclammina jaccardi* Schrod, 1905



1894

Test planispirally coiled, involute, moderately compressed (megalosphaeric forms more so), with only slight tendency to uncoil, wall with well developed subepidermal layer both on the septa, apertural face and outer chamber wall, aperture in the early stage probably areal, in adult is represented by the large openings (cribrate), "supplementary areal foramina may be produced by resorption of the epidermal layer of the septum" (Loeblich & Tappan, 1987). U. Jr.

**Remarks.** The genus was previously described as having streptospiral coiling of the initial part in microsphaeric test but Banner & Whittaker, 1991 showed that "some (but far from all) specimens of each (generation – V.M.) may add successive chambers which are not centered in a perfect plane, but which are sometimes added obliquely". They also underline that *Alveosepta* is morphologically close to *Choffatella*. All this gives the reason to put it here (with some hesitation) among the other choffatelids. The alveolar subepidermal layer of *Alveosepta* has a distinct gap in the distal part of the septal hypodermis (between the epidermis and hypodermis of the septa) (Banner, Whittaker, 1991). Such feature was not mentioned for the other choffatelid genera. Alveolae of the hypodermal layer may bifurcate or trifurcate distally (Banner & Whittaker, 1991). Though the initial aperture is marked as "interiomarginal" it probably has the same areal position as in the similar litoulid forms but is difficult to observe.

***Torinosuella*** Maync, 1959 (Pl. II, fig. 35, 36)

Type species: *Choffatella peneropliformis* Yabe & Hanzawa, 1926

Test flattened, very thin, with early planispiral coil and more developed flaring to peneropliform uncoiled part, chambers broad and low, increasing rapidly in breadth as added, wall finely agglutinated, with imperforate epidermis and inner alveolar subepidermal meshwork, septa with numerous perforations of the multiple apertural openings, aperture terminal, cribrate. U. Jr.

***Ijdranella*** Bassoullet, Boutakiout & Echarfaoui, 1999 (Pl. II, fig. 37, 38)

Type species: *Ijdranella atlasica* Bassoullet, Boutakiout & Echarfaoui, 1999

Test flattened, with early planispiral involute to evolute coil and peneropliform uncoiled stage, chambers broad and low, increasing rapidly in size, wall with long radial blades united superficially by a coarse network, aperture terminal, possibly multiple. Pliensbachian.

**Remarks.** Aperture of the genus not described. Judging from the thin sections, it is areal, single in the early stage, in one later septa seen as double, possibly multiple in adult. Also judging from the figures of sections it differs from *Torinosuella* in less compressed shell and less low and broad chambers.

Character of septa undescribed but looks massive. Considered by the authors of the genus as belonging to Hauraniids (Amijiellinae) but the character of the shell is closer to choffatelids.

***Palaeocyclammina*** Bassoullet, Boutakiout & Echarfaoui, 1999 (Pl. II, fig. 39, 40)

Type species: *Palaeocyclammina complanata* Bassoullet, Boutakiout & Echarfaoui, 1999

Test planispiral, compressed, involute, with only the slight tendency to uncoil in the last whorl later falciform chambers, wall with imperforate epidermis "covering a reticulate subepidermal skeleton comprised of an irregular superficial network prolonged toward the interior by very short radial blades that are perpendicular to the septa (this structure comprises fine alcoves that divide towards the surface" (Bassoullet et al., 1999), aperture multiple. Pliensbachian.

**Remarks.** Judging from the figures of sections it differs from *Ijdranella* in less compressed shell and less low and broad chambers, the more so from *Torinosuella*. Character of septa not described but looks massive. Considered by the authors of the genus as belonging to Hauraniids (Amijiellinae) but the character of the shell is closer to choffatelids. The long blades comprising "fine alcoves that divide towards the surface" makes this genus transitional from the forms without additional endoskeleton to that ones having it.

***Paracyclammina*** Yabe, 1946 (Pl. II, fig. 41)

Type species: *Loftusia bemmeleni* A. Silvestri, 1932

Test entirely planispiral, nautiloid, with broadly rounded periphery, whorls increasing slowly in height, sutures obviously oblique, wall "with thick alveolar subepidermal layer, cylindrical alveoli coalescing toward the chamber interior and leaving a very shallow chamber lumen" (Loeblich & Tappan, 1987), aperture probably cribrate (as septa are perforated). U. Jr.

**Remarks.** The genus described from sections only. Banner, 1970 considered it to represent "proto-loftusoid" line. Position in this genus is doubtful.

***Pseudocyclammina*** Yabe & Hanzawa, 1926 (Pl. II, fig. 42, 43)

Type species: *Cyclammina lituus* Yokoyama, 1890

Test with early planispiral part subspherical to flattened, involute, later uncoiling into rectilinear narrow part, sutures of the early part oblique, of the uncoiled one – nearly horizontal, wall coarsely agglutinated, with coarse subepidermal network, in a narrow zone in the median plane of the test may be a few irregular pillars, septa thick, massive, perforated by large openings, aperture terminal, cribrate, covering the apertural face. L. Jr. to U. Cr.

**Remarks.** Genus is very close to *Martiguesia* Maync, 1959 differing only in less developed pillars. The latter could possibly be the junior synonym of

*Pseudocyclamina*. Pillars are not the constant feature of this genus and appear occasionally in adult specimens. The genus becomes in this feature transitional between choffatellids and spirocyclinids. The additional study is necessary.

#### **Hottingeritidae** Loeblich & Tappan, 1985

Test planispiral at least initially, evolute, with isomorphic chambers only little higher than broad and straight radial sutures, periphery broadly rounded, wall agglutinated, alveolar, aperture single, areal or representing wide open end of the last chamber as in tubular forms.

#### Hottingeritinae Loeblich & Tappan, 1985

Test planispiral and evolute throughout, aperture representing wide open end of the last chamber as in tubular forms.

**Remarks.** Though previously considered streptospiral, the genus *Hottingerita* is shown to be truly planispiral throughout (Banner & Whittaker, 1991). The authors of this work also marked (following Hottinger, 1967, the work I couldn't get) a special character of its wall similar with that one of *Alveosepta*: the subepidermal canal-like gap in the septal hypodermis. This similarity was the base to unite both genera in one family. But shell morphology of the both genera is strongly different. As the classification adopted here is for the first time based on the shell morphology - the *Alveosepta* which is close to *Choffatella* - is here excluded from the hottingeritids. Some similar features in the wall structure of the agglutinated forms are probably developing in parallel.

**Hottingerita** Loeblich & Tappan, 1985 (Pl. II, fig. 44)

Type species: *Mesoendothyra complanata* Hottinger, 1967

Test flattened, with several volutions all visible from the exterior, numerous chambers per whorl very slowly increasing in size as added, wall with alveolar subepidermal layer both of the outer chamber wall and septa, aperture representing wide open end of the last chamber as in tubular forms. L. Cr.

**Remarks.** Primitive aperture representing wide opening equal to the whole breadth of the chamber was erroneously designated as interiomarginal.

#### Popoviinae subfam. nov.

Test planispiral initially and with well developed uncoiled part, rather thick, uncoiled portion rectilinear, broadly oval in section, wall agglutinated, may be with larger grains, alveolar in structure, septa thin, solid, aperture single areal in the early stage, terminal in uncoiled chambers.

**Remarks.** Subfamily differs from the subfamily Hottingeritinae in having rectilinear uncoiled part, less number of chambers per whorl and areal aperture of the coiled planispiral part. *Popovia* is

transferred from the Alveolophragmiinae on the basis of its terminal (even at the early stage) rather than basal aperture.

**Popovia** Suleymanov, 1965 (Pl. II, fig. 45, 46)

Type species: *Alveolophragmium planum* N.K. Bykova, 1939

Test with early planispiral evolute coil with one-two volutions, radial sutures, later part uncoiled, rectilinear, broadly oval in section, chambers five to seven in a whorl, gradually increasing in size as added, sutures radial in the early part, horizontal in rectilinear one, wall agglutinated, with alveolar subepidermal layer, septa thin, simple, aperture terminal, single, nearly at the middle of the apertural face in the coiled part (judging from the sections), at the adult possibly with a short neck.

**Remarks.** Though the aperture of this form at the earlier part was described as interiomarginal it is nevertheless areal even in the earliest stage - see Loeblich & Tappan, 1987, pl. 97, fig. 9. The genus is transferred from Alveolophragmiinae, genus *Sabellivoluta* Loeblich & Tappan, 1985 from the same subfamily is more possibly belonging to Ammomarginulinoidea group.

#### **Pseudochoffatellidae** Loeblich & Tappan, 1946

Test large, with later uncoiled part developed more than the initial planispiral evolute part, especially in megalosphaeric form, where this initial part can be reduced to protoconch and deuterconch, wall with imperforate epidermis and subepidermal network, no additional endoskeletal elements, aperture terminal, multiple.

**Remarks.** Family transferred from the former Loftusiacea where it was placed as subfamily. It differs from loftusiids firstly in quite another structure of the test and also in the absence of the endoskeletal structures. Genera *Balkhania* and *Montsechiana*, are transferred to order Cyclolinida Mikhalevich, 1992 (superfamily Vaniinoidea Mikhalevich, 2003) on the basis of the character of their tests with cyclic and annular chambers.

**Pseudochoffatella** Deloffre, 1961 Pl. III, fig. 1)

Type species: *Pseudochoffatella cuvillieri* Deloffre, 1961

Test large, discoidal, tests of different generations differ in form and dimensions micro-sphaeric one with nearly parallel sides, planispiral part about two volutions, then going pen-eropliform and afterwards cyclic or annular parts with numerous extremely broad and low chambers, those of peneropliform part significantly arcuate, later ones less so, the whole diameter achieving 12 mm, maximum thickness 1.2 mm; megalosphaeric test with reduced initial coil which is represented by large initial chamber constricted in two unequal parts followed by peneropliform and then flabelliform stage never attaining reniform or cyclic stage and not more than approximately 6 mm in diameter; wall with thin

imperforate epidermal layer and subepidermal polygonal meshwork (of beams, rafters and joists or second order beams, aperture multiple: a series of irregularly arranged openings over apertural face. L. Cr.

**Alzonella** Bernier & Neumann, 1970 (Pl. III, fig. 2)

Type species: *Alzonella cuvillieri* Bernier & Neumann, 1970

Tests of different generations though both having initial planispiral coil differ in form: the microsphaeric one with initial evolute planispiral coil, later usually flabelliform or may be reniform or irregular discoidal, megalosphaeric one after the planispiral coil becomes narrow and rectilinear or subtriangular; wall with imperforate epidermal layer covering reticular subepidermal network comprising short partitions going parallel to and perpendicular to the septa, not deep into the chamber lumen, aperture terminal, multiple – a row of pores on the apertural face. M. Jr.

**Broeckinella** Henson, 1948 (Pl. III, fig. 3)

Type species: *Broeckinella arabica* Henson, 1948

Test large (up to 3.1 mm in diameter), flabelliform, chambers following planispiral evolute stage become arcuate but not completely cyclical, which results in complanate and finally reniform appearance, wall with imperforate outer layer and subepidermal layer which consists of vertical and two sets of transverse partitions aligned from chamber to chamber, outermost part of marginal zone represents polygonal meshwork (subdivided by very short secondary partitions), aperture in the median plane, multiple, opening into the empty part of the chamber situated between the vertical partitions. U. Cr. to M. Paleocene.

**Remarks.** Loeblich & Tappan (1987) doubt if the Cretaceous exemplars belong to this genus.

The difference between microspheric and megalosphaeric tests are not studied.

**Dhrumella** Redmond, 1965 (Pl. III, fig. 4)

Type species: *Dhrumella evoluta* Redmond, 1965

Test large, flattened, planispiral evolute part is followed by uncoiled rectilinear one with broad low chambers, which are slightly arced centrally, subepidermal layer is of short vertical beams not aligned from chamber to chamber and of a few horizontal rafters, probably only one horizontal level per chamber, thus the lower part of the chamber is open, large globular particles are incorporated in septa, aperture obviously multiple, possibly a row of small pores. M. Jr.

**Remarks.** The difference between microsphaeric and megalosphaeric tests not studied, but the figures given (Loeblich & Tappan, 1987) show, that the rectilinear part can be more straight and narrowing to the end (holotype) or finally widening. The subepidermal network is similar to that one of *Alzonella*, but is simpler and beams of successive chambers not align. Nothing is said concerning the

presence or absence of the imperforate epidermis.

**Torremiroella** Brun & Canerot, 1979 (Pl. III, fig. 5 – 7)

Type species: *Torremiroella hispanica* Brun & Canerot, 1979

Test elongated, with early planispiral part followed by uncoiled rectilinear one, wall with imperforate epidermis and very coarse, large irregular projections from the septa can partially fill the chamber and questionably could be considered as endoskeletal structures, aperture terminal, irregularly cribrate in the uncoiled part, unclear in the earlier planispiral one. L. Cr.

**Remarks.** The presence of strange endoskeleton (nither pillar nor other structural elements) possibly makes this genus the intermediate between Pseudochoffatellidae and Spirocyclinidae. The coarse wall obviously obscure the position of initially areal aperture of the planispiral stage if it is disposed close to the base.

**Biokoviniidae** Gusic, 1977

Test with earlier planispirally coiled and later uncoiled part, developed less than the planispiral one, wall honeycomblike in transverse section, with keriothecalike and phrenothecalike structures and additional endoskeleton elements (pillars), aperture multiple.

**Remarks.** Test possibly involute (figures given only in sections).

*Chablasia* is transferred to penderinids. *Bosniella* which was previously included in this family, is similar to *Biokovina* in test arrangement and in the presence of keriothecalike layer and thin perforations, but differ in the absence of endoskeletal structures thus representing an intermediate form between Charentiidae and Biokoviniidae.

**Biokovina** Gusic, 1977 (Pl. II, fig. 47)

Type species: *Biokovina gradacensis* Gusic, 1977

Test with planispiral early stage, later uncoiled and rectilinear, wall with tubules perpendicular to the surface separated by thin microgranular lamellae, resulting in a keriothecalike structure, septa homogenous and massive, endoskeletal interseptal pillars in the middle region of the chambers may fuse together to form partitions and are surrounded by a pillar-free marginal zone, very thin dark lines crossing the chambers approximately perpendicular to the septa appear to be phrenothecalike structures, commonly microgranular, aperture of the early stage – a single areal opening, later – cribrate. L. Jr.

**Remarks.** The genus was described previously as having pores but the pore outer surface was a result of corrosion of the upper epidermal layer (Banner, Whittaker, 1991).

**Labyrinthinidae** Sepfontaine, 1988

Test planispirally coiled, involute, then uncoiled, with uncoiled part not more developed than the

planispiral one, wall agglutinated, microgranular, imperforate, with complex additional endoskeleton of exoskeletal beams and endoskeletal pillars, both these elements may be continuous from chamber to chamber (in *Labyrinthina*) or other kinds of complex endoskeleton in other genera, aperture multiple.

Labyrinthininae Sepfontane, 1988

Test thick, with initial involute planispiral coil and rectilinear uncoiled part which is usually more narrow than the coiled part and rounded or oval in section, with though rather broad chambers, but not very low and with straight sutures, tendency to peneropliform very weak, chamber lumen with complex endoskeleton.

***Labyrinthina*** Weynschenk, 1951 (Pl. II, fig. 48, 49)

Type species: *Labyrinthina mirabilis* Weynschenk, 1951

Test with early stage planispirally coiled, involute, later uncoiling and rectilinear to slightly compressed to peneropliform, wall agglutinated, microgranular, simple, imperforate, chamber interior with a row of exoskeletal beams extending from septum to septum and of endoskeletal pillars extending from chamber floor to roof and also may be continuous from chamber to chamber, aperture single areal opening in the early enrolled stage, areal and multiple over the central part of the apertural face in the adult. L. to U. Jr.

**Remarks.** Though in the diagnosis of this genus the aperture at the initial stage is reported as "interiomarginal" as a matter of fact it is areal even in the chambers of the coiled part as it could be clearly thin from the thin sections.

Planiseptinae Sepfontaine, 1988, nom. nudum

Test thin, compressed, peneropliform, with initial planispiral coil and later flaring uncoiled part with very low and broad chambers and arcuate sutures, endoskeleton structures present, character of the wall (perforate or imperforate) unknown.

***Planisepta*** Sepfontaine in Kaminski, 2000 (Pl. II, fig. 50)

Type species: *Lituola compressa* Hottinger, 1967

Test like in *Paleomayncina* in form but with a complex inner endoskeleton.

**Remarks.** Complete description in Hottinger, 1967 and Sepfontaine, 1984.

? Levantinellinae Fourcade, Mouty & Teherani, 1997

Test compressed, with internal structure of "zigzag pillars" not reaching the lateral wall which is imperforate.

**Remarks.** It is difficult to give the clear diagnosis of the subfamily as the structure of the test of the type genus is somewhat unclear.

***Levantinella*** Fourcade, Mouty et Teherani, 1997 (Pl. II, fig. 51)

Type species: *Mangashtia? egyptiensis*

Fourcade, Arafa & Sigal, 1984

Test compressed, planispirally enrolled in the early stage, later uniserial, chambers has internal structures in the form of "pillars" in the shape of zigzag blade situated in the median plane of the chamber, in the marginal zone of the chamber this pilaroid structure forms intercalating digitations between two apertures of the same row, but it never reaches the lateral wall, subepidermal partitions absent, wall imperforate, aperture multiple, openings aligned in rows alternating from one side of the equatorial plane to the other Oxfordian to Kimmeredgian.

**Remarks.** The genus described only from sections, full picture and many essential characters are unclear. It is compared with *Mangashtia*, whose structure is also unclear.

**Spirocyclinidae** Munier-Chalmas, 1887

Test strongly compressed, initial planispiral part usually not strongly developed, may be irregularly planispiral, the uncoiled part well developed, usually more than initial coiled part, peneropliform to cyclic, chamber interior with complex additional endoskeleton (horizontal and vertical septulae ("beams and rafters" in Loeblich & Tappan, 1987, "partitions" in Banner & Whittaker) and pillars), wall with imperforate epidermal layer and subepidermal network, aperture cribrate.

**Remarks.** Form of the uncoiled part strongly varies within each genus and even within one species Family transferred from the former Loftusiacea (without *Quataria*, *Saudia*, *Thomasella* Sirel, 1998, *Timidonella*, *Vania* having cyclical or annular chambers, and without conical and initially trochospirally coiled forms (*Haurania*, *Spiraloconulus*)), it differs from the families Choffatellidae and Pseudochoffatellidae mainly in its developed endoskeleton.

***Spirocyclina*** Munier-Chalmas, 1887 (Pl. III, fig. 8, 9)

Type species: *Spirocyclina choffati* Munier-Chalmas, 1887

Test large (up to 10 mm in diameter), flattened, planispirally enrolled, slightly asymmetrical, largely involute and peneropline (rarely uncoiled rectilinear tests are met, possibly another generation), chambers numerous (up to 25 in the final whorl), extremely broad and low, arcuate, rapidly increasing giving the test peneropliform appearance, periphery subacute, wall with imperforate epidermal layer and coarse subepidermal network, interseptal beams and rafters or septula subdivide chamber lumen into rectangular chamberlets, near the center of the test the beams may be reduced to pillars or to mere protuberances from the septa intercalated between the apertural pores, but a single elongated one going in the plane of coiling between the apertural pores of successive chambers may subdivide the test, septa compact, of slightly less thickness than the chamber

lumen, aperture terminal, multiple, two rows of pores parallel to plane of coiling in the central elongated depression of the apertural face. U. Cr.

***Anchispirocyclus*** Jordan & Applin, 1952 (Pl. III, fig. 12)

Type species: *Anchispirocyclus henbesti* Jordan & Applin, 1952

Test planispiral to slightly asymmetrical with periphery rounded to subacute, often containing occasional large sand grains or foraminiferal tests, tests of the two generations differ: microsphaeric one large, discoid, flattened and with the undulating edges, later part spreading through peneropline and reniform to nearly circular, with broad and very low arched chambers which may become cyclic finally, megalosphaeric form (judging from the section) less flaring, with less broad and low chambers, wall with imperforate outer layer underlined by a reticulate choffatelloid network of beams and rafters, the narrow chambers are not subdivided inward from reticulate zone leaving empty chamber spaces (called "canal" but not true canal) into which the septal apertures are opened, near the median plane chambers are filled by "irregular labyrinthic structure produced by radial pillars or battresses arising between adjacent apertural passages and extending from septum to septum, battresses of successive chambers radially aligned" (Loeblich & Tappan, 1987), aperture cribrate, openings scattered over apertural face. U. Jr. to L. Cr.

***Martiguesia*** Maync, 1959 (Pl. III, fig. 14, 15)

Type species: *Martiguesia cyclamminiformis* Maync, 1959

Test relatively thick, early planispiral coil well developed, with relatively not broad chambers rather slowly increasing in size as added, with oblique or only gently curved towards the periphery sutures, the uncoiled part nearly rectilinear, more narrow than the initial one, with rather high and not broad chambers divided by nearly straight and horizontal sutures, periphery rounded, wall with imperforate epidermis and coarse subepidermal alveolar network, endoskeletal of irregular radial pillars that subdivide and nearly completely fill the chamber lumen, aperture areal, cribrate. U. Cr.

**Remarks.** The genus strongly resembles the genus *Pseudocyclamina* from Choffatellinae differing from the latter practically only in the strongly developed pillars which in *Pseudocyclamina* are only slightly represented in the median plane of the shell, possibly the *Martiguesia* Maync, 1959 is only the junior synonym of *Pseudocyclamina* Yabe & Hanzawa, 1926. *Martiguesia* differs from other spirillinids in its narrow uncoiled part.

***Pseudospirocyclus*** Hottinger, 1967 (Pl. III, fig. 16 – 18)

Type species: *Pseudospirocyclus maynci* Hottinger, 1967

Test large, compressed, with broad and low

chambers, tests of the two generations differ: the microsphaeric form is larger, involute planispiral coil containing more volutions, chambers low, strongly arched, rapidly increasing in width giving the test widely flaring, peneropliform appearance, in megalosphaeric form chambers of the both parts less broad, those of the uncoiled part slowly increasing with growth, more slightly arched, the adult test with nearly parallel sides, periphery rounded, wall with imperforate outer layer and underlying finely reticular subepidermal network, endoskeletal septa perforated by irregularly arranged apertures aligned from chamber to chamber, postjuvenile chambers with pillars flanking the openings of the septa and aligned with the apertural axes, the empty undivided chamber space between the endoskeletal together with exoskeletal elements and the lateral wall forms passage called "canal", areal, cribrate – numerous small openings scattered over apertural face. U. Jr.

***Redmondellina*** Banner & Whittaker, 1991 (Pl. III, fig. 10, 11)

Type species: *Pseudocyclamina powersi* Redmond, 1964 (= *Alveosepta* (*Redmondellina*) Banner & Whittaker, 1991)

Test compressed (to different degree in different generations), with earlier coiled and later uncoiled part, chambers broad and low, arcuate, more so in the microsphaeric form, uncoiled part slightly peneropliform, wall with thin outer epidermal and subepidermal (alveolar) layers, endoskeleton formed by the hypodermal septa in the median (equatorial) part of the hypodermis of the septa projecting posteriorly to form pillars, pillars connect the septal hypodermis with the preceding septal epidermis, . Mesozoic.

**Remarks.** The genus differs from *Alveosepta* in the presence of endoskeleton (pillars). It is very close to *Alveosepta* and nearly isomorphic with it, and having the same character of the gap between epidermis and hypodermis in distal part of the septa and bifurcating and trifurcating alveolae, described originally as its subgenus. The authors of the genus having restudying Redmond's material described the forms of the three generations: megalosphaeric A1 being more strongly compressed than megalosphaeric A2 and microsphaeric B-generation.

***Reissella*** Hamaoui, 1963 (Pl. III, fig. 19)

Type species: *Reissella ramonensis* Hamaoui, 1963

Test in the early stage planispirally enrolled, involute, later tending to uncoil and flare, chambers broad and low, rapidly increasing in size, sutures radial in early part, later weakly arched, wall imperforate, with "subepidermal mesh formed by elongate primary and short secondary exoskeletal beams vertical to the septa and aligned from chamber to chamber, adjacent beams connected by numerous short horizontal rafters that do not extend

inward beyond the ends of the secondary beams”, “primary aperture elliptical to slitlike, areal, slightly produced on a necklike elevation, near the base of apertural face in the early stage, becoming central in later chambers, numerous scattered apertural pores scattered over the apertural face except for a marginal zone near the chamber periphery.” (Loeblich & Tappan, 1987) U. Cr.

**Remarks.** Pillars absent.

**Sornayina** Marie, 1960 (Pl. III, fig. 20, 21)

Type species: *Sornayina foissacensis* Marie, 1960

Test compressed, oval in outline, planispiral at the early stage, slightly asymmetrical, only rarely uncoiled, chambers broad and low but less broad than in *Spirocyclina* and more slowly enlarging, periphery subangular and slightly lobulate, forms of the two generations differ: microsphaeric one up to 3 mm, more flaring, megalosphaeric – smaller and more nautiloid, “wall with imperforate subepidermal layer and subepidermal reticular meshwork as in Choffatellinae, chamber lumen subdivided into chamberlets by somewhat irregular or even bifurcating transverse septula perpendicular to the septa (less evenly spaced than in *Spirocyclina*), septula progressively reduced inward to form discontinuous pillars and finally only small projections, leaving the chambers open in the subcentral zone, but with a more or less continuous median partition resulting from a single elongate median septulum present in successive chambers that divides the test axially into two equal parts” (Loeblich & Tappan, 1987), aperture terminal, cribrate, openings irregularly scattered over the elongated central part of the apertural face which is depressed between thickened margins. U. Cr.

**Streptocyclamina** Hottinger, 1967 (Pl. III, fig. 13)

Type species: *Pseudocyclamina parvula* Hottinger, 1967

Test compressed, broadly oval to circular in outline, with broadly rounded periphery, planispirally coiled, (though oscillating or slightly streptospiral in the very beginning), chambers broad and low, slightly peneropliform, wall with imperforate epidermal layer and very fine subepidermal network, septa massive, leaving rather big volum of chamber cavity empty, with numerous perforations, pillars few, weakly developed only in adult chambers, aperture terminal, multiple, openings scattered in adult chambers all over the apertural face L. to U. Jr. I

**Remarks.** The genus differs from *Spirocyclina* in the less thickness and less peneropliform appearance as well as in the weaker development of endoskeleton and more delicate subepidermal network, from *Pseudocyclamina* in its test form and more developed pillars. The streptospiral coiling reported for *Spirocyclina* is not well expressed and more probably is a result of somewhat irregular

planispiral oscilating like in *Hottingerita* and *Alveosepta*.

Superfamily **Coscinophragmatoidea** Thalmann, 1951

Test attached, initial part may be coiled, later uncoiled, in curving irregular rows of chambers, or branching, chambers irregular in size and shape, wall complicated - canaliculate, may be alveolar, aperture terminal, single or multiple.

**Haddoniidae** Saidova, 1981

Test with early stage coiled, later uncoiled, irregular, wall canaliculate, aperture terminal – irregular slit with irregular inner projections.

**Haddonia** Chapman, 1898 (Pl. III, fig. 22)

Type species: *Haddonia torresiensis* Chapman, 1898

Test with coiled early stage, later uncoiled, uniserial, may be rectilinear or irregular, branching, chambers broad and low, rather irregular in form, gradually increasing in size, wall coarsely agglutinated externally, internally smoothly finished, canaliculate, aperture of the final part terminal, an irregular slit with one or two inner projections resembling teeth. Hol.

**Stylolina** Karrer, 1877 (Pl. III, fig. 23)

Type species: *Stylolina lapugyensis* Karrer, 1877

Test like in *Lituola*, but inner structure complicated with pillars.

**Remarks.** Reinstated by Popescu et al., 1998 from the synonymy of *Lituola*.

**Coscinophragmatidae** Thalmann, 1951

Test with early stage coiled which may be reduced in some cases, later stage uncoiled, irregular, wall alveolar, perforated, aperture terminal, single or multiple.

**Remarks.** Genus *Ammotrochoides* is not included here as having trochoid test.

**Coscinophragma** Thalmann, 1951 (Pl. III, fig. 26)

Type species: *Lichenopora cribrosa* Reuss, 1846

Test large (up to 34 mm in length), tests of the two generations differ: microsphaeric form with initial coiled part and later uncoiled, rectilinear and may be branching, in megalosphaeric one only the uncoiled part developed, chambers of the both parts very slowly increasing in size; wall three layered: outer coarsely agglutinated layer cemented by the small quantity of matter insoluble in acid, median canaliculate layer with canaliculi going perpendicular to the surface and smaller second order canaliculi going from the first ones outward, inner smooth homogenous calcareous layer covering the inner surface like lamella, aperture at the uncoiled stage terminal, cribrate. L. Cretaceous.

**Remarks.** The trochospiral character of the coiled part and its interiomarginal aperture is doubtful.

***Alpinophragmium*** Flugel, 1967 (Pl. III, fig. 24)

Type species: *Alpinophragmium perforatum* Flugel, 1967

Test irregular, cylindrical, subconical or spreading, coiled part not observed, chambers rapidly increasing in size becoming broad and low, wall microgranular, calcareous, probably agglutinated, with large pores (alveolar?), aperture terminal, cribrate. U. Tr.

***Bdelloidina*** Carter, 1877 (Pl. III, fig. 25)

Type species: *Bdelloidina aggregata* Carter, 1877

Test spreading over the substrate, consists of numerous very broad and low uniserial chambers gradually increasing in size, wall with perforate alveolar structure as in *Coscinophragma*, aperture terminal, multiple – single or double row of openings. Paleocene, Holocene.

**Remarks.** Genus very similar to *Coscinophragma*, the difference in flat attached chambers rather than cylindrical chambers growing erect in *Coscinophragma* could be the result of the variability in the mode of growth.

**REFERENCES**

Banner, F.T., Whittaker, J.E. 1991. Redmond's "new lituolid foraminifera" from the Mesozoic of Saudi Arabia. *Micropaleontology*, 37, p. 41 – 59.

Bassoulet, J.P., Boutakiout, M., Echarfaoui, H. 1999. Deux nouveaux genres, Paleocyclammina et Ijdranella, foraminifères (Textulariina) d'un niveau Liasique a Orbitopsella praecursor (Gumbel) du Moyen Atlas (Maroc). *Revue de Micropaleontologie*, 42/ 3. p. 213 – 230.

Henson, F.R.S. 1948. Larger Imperforate Foraminifera of South-western Asia. Families Lituolidae, Orbitolinidae and Meandropsinidae, London: *British Museum (Natural History)*.

Hottinger, L. 1967. Foraminifères imperfores du Mesozoique marocain. *Notes et Memoires du Service Geologique du Maroc*, 209, p. 1 – 168.

Lankester, E. R., 1885. Protozoa, in *Encyclopaedia Britannica*, 19, 19-th ed., p. 830 – 866.

Lankester, E. R., 1903. *Treatise on Zoology*; Pt. 1, fasc. 2. Introduction and Protozoa. London: A&C Black. p. 47 – 149.

Loeblich, A.R., Jr., & Tappan, H. 1987. *Foraminiferal Genera and their Classification*. Van Nostrand Reinhold. 970 pp, 847 pl.

Loeblich, A.R., Tappan, H., 1992. Present status of Foraminiferal Classification. In: Takayanagi, Y. & Saito, T (eds), *Studies in Benthic Foraminifera*. Tokai University Press, p. 93-102.

Mikhalevich, V.I. 1980. Sistematika i evolyuciya foraminifer v svete novykh dannykh po ih citologii i ul'trastrukture [Systematics and evolution of the Foraminifera in view of the new data on their cytology and ultrastructure]. In: Principy postroeniya makrosistemy odnokletochnykh zhivotnykh. *Trudy Zoologicheskogo Instituta, AN SSSR*, 94, p. 42–61 (In Russian).

Mikhalevich, V.I. 1983. Donnyie Foraminiferyi shelfov tropicheskoy Atlantiki [The bottom foraminifera of the shelves of the Tropical Atlantic]. Skarlato, O. A.

***Goellipora*** Senowbari-Daryan & Zankl, 2000 (Pl. III, fig. 27)

Type species: *Goellipora triassica* Senowbari-Daryan & Zankl, 2000

Test (according to the original description) probably comprised of two chambers, with a convoluted and irregularly coiled Deuteroloculus (in section circular, elliptical or tubular), wall calcareous, microgranular, and very finally agglutinated, perforate. Norian.

**Remarks.** Proloculus and aperture were not observed. Doubtful genus.

**Acknowledgements**

I am deeply thankful to the organizational committee of the Fourth Romanian Symposium on Paleontology for the invitation to participate in this significant scientific meeting and to Professor Theodor Neagu permitting me to work with his perfect collections on Cretaceous lituolids.

(ed) *Zoological Institute of USSR Academy of Sciences*, Leningrad, 247 p., 26 tables. (In Russian)

Mikhalevich, V.I. 1992. Makrosistema foraminifer [The macrosystem of the Foraminifera] *Doct. Thes. St.-Pb.*, 1 - 43 (In Russian).

Mikhalevich, V.I. 2000. Tip Foraminifera d'Orbigny, 1826 – Foraminifery [The phylum Foraminifera d'Orbigny, 1826 – Foraminifers]. In: Alimov, A.F. (ed.), *Protisty: Rukovodstvo po Zoologii*, pt. 1. Nauka Publishers, St. Petersburg, p. 533-623. (In Russian, with English summary p. 611 - 616)

Mikhalevich, V.I. 2003. On the heterogeneity of the former Textulariina (Foraminifera). In: Kaminski M.A., Bubik M., (eds), *Proceedings of the Sixth International Workshop on Agglutinated Foraminifera*, Prague, Czech Republic, Sept. 1 – 7, 2001. *Grzybowski Foundation Special Publication*, 8, p. 00 – 00 (In press).

Neagu, T. 2000. Lower Cretaceous calcareous agglutinated Foraminifera from Southern Dobrogea - Romania. Part IV. *Miscellanea (Lituolacea, Biokovincea and Loftusiacea – some new taxa)*. *Acta Paleontologica Romaniae*, II, p. 287 – 304.

Popescu, G., Cicha, I., & Rögl, F. 1998. Systematic Notes. In: Cicha, I., Rögl, F., Rupp, C., & Cytroka, J. (eds), *Oligocene – Miocene foraminifera of the Central Paratethys. Abhandlungen der senckenbergischen naturforschenden Gesellschaft*, 549, p. 69-325.

Saidova, Kh.M. 1981. O sovremennom sostojanii nadvidovykh taksonov kajnozojskych bentosnykh Foraminifer [On the present state of the supraspecific taxa of the Cenozoic benthonic Foraminifera]. Rauser-Chernousova, D.M., Isakova, T.N., Reitlinger, E.A. (eds) *Moscow: Inst. Okeanologii P.P. Shirshova, Akademiya Nauk SSSR*, p. 1 -73. (In Russian).

Septfontaine, M. 1984. Le Dogger des Prealpes medianes suisses et francaises. Stratigraphie, evolution paleogeographique et paleotectonique. *Memoirs Society Helvetiae des Sciences naturales*, 97, p. 1 –

121.  
Septfontaine, M. 1988. Towards an evolutionary classification of Jurassic lituolids (Foraminifera) in

carbonate platform environment. *Revue de Paléobiologie Special Volume, 2*, p. 229-256.

## PLATES

### PLATE I.

- Fig.1 – *Ammobaculites agglutinans* d'Orbigny, lectotype (x 38) (from Loeblich & Tappan, 1964)  
 Fig. 2 – *Ammobaculites triloba* Kristan-Tollmann, holotype (x 18) (from Kristan-Tollmann, 1964)  
 Fig. 3 – *Sculptobaculites loshkarvicus* (O.A. Korchagin, 1985), (x 120) (from O.A. Korchagin, 1985)  
 Fig. 4 – *Simobaculites cuyleri* (Tappan, 1940), side view of holotype (x 20) (from Tappan, 1940)  
 Fig. 5 - *Ostiobaculites sahsus* Bronnimann, Whittaker & Zaninetti, 1992, (from Kaminski, 2000)  
 Fig. 6 – 8 - *Lituola nauiloidea* Lamarck, 1802 (6 – apertural view of neotype (x 16), 7 – side and apertural views of topotype (x 16), 8 – median section (x 17) (6, 7 – from Loeblich & Tappan, 1964, 8 – from Maync, 1952)  
 Fig. 9, 10 - *Atactolituola subgoodlandensis* (Vanderpool, 1933), 9 – paratype of *Lituola edwardsensis* Ikins & Clabaugh, 1940 (x 12), 10 – *L. edwardsensis*, top and side views (x 12) (from Ikins & Clabaugh, 1940)  
 Fig. 11 – *Bulbobuccicrenata aegyptica* Kerdany & Eissa, 1973, holotype (x 30) (from Kerdany et al., 1973)  
 Fig. 12 – *Kolchidina paleocenica* (Cushman, 1947) (x 15) (from Loeblich & Tappan, 1987)  
 Fig. 13 – *Carasuella cylindrica* Neagu, 2000, side and apertural views (x 50) (from Neagu, 2000)  
 Fig. 14, 15 – *Buzasina ringens* (Brady, 1879), 14 – (x 28), 15 – section (x 28) (14 – from Loeblich & Tappan, 1987, 15 - section made by Mikhalevich in 1962, published by Lukina, 1980)  
 Fig. 16 – *Ammosiphonia vulgaris* He, 1977, side and apertural views (x 20) (from He and Hu, 1977)  
 Fig. 17 – *Apostrophoides silus* McNeil, 1997, (from McNeil, 1997 in Kaminski, 2003)  
 Fig. 18, 19 – *Mayncina orbignyi* (Cuvillier & Szakall, 1949, 18 -side and apertural views of topotype (x 24), 19 – median section (x 45) (19 -from Neumann, 1965, 20 – from Loeblich & Tappan, 1987)  
 Fig. 20, 21 - *Flabellocyclolina laevigata* Gendrot, 1964, 20 – side and peripheral views of holotype (x 24), 21 – equatorial section (x 25) (from Gendrot, 1964)  
 Fig. 22, 23 – *Gendrotella rugoretis* (Gendrot, 1968), 22 – side view of holotype (x 30), 23 – median section (x 30) (from Maync, 1972)  
 Fig. 24, 25 - *Stomatostoecha plummerae* Applin, Loeblich & Tappan, 1950, 24 – side and apertural views of holotype (x 60), 25 – equatorial section of Ma topotype (x 50) (from Loeblich & Tappan, 1987)  
 Fig. 26,27 - *Daxia cenomana* Cuvillier & Szakall, 1949, 26 – side and apertural views of topotype (x 25), 27 – horizontal section of the central; area of Mi topotype (x 55) (from Loeblich & Tappan, 1987)  
 Fig. 28, 29 - *Biconcava bentori* Hamaoui, 1965, 28 – side and apertural views of holotype (x 60), 29 – horizontal section (x 35) (from Hamaoui and Saint Marc, 1970)  
 Fig. 30, 31 - *Comaliamma charentiformis* Loeblich & Tappan, 1985, 26 – side and peripheral views of holotype (x 68), 27 – horizontal section of Ma paratype (x 68) (from Loeblich & Tappan, 1985)  
 Fig. 32 - *Freixialina planispira* Ramalho, 1969, 32 – equatorial section (x 44) (from Ramalho, 1969), 33 - side and apertural view (x 32) (from Neagu, 2000,  
 Fig. 34 - *Hinogammmina danubiana* Neagu, 2000, side and apertural views (x120) (from Neagu, 2000)  
 Fig. 35, 36 - *Phenacophragma assurgens* Applin, Loeblich & Tappan, 1950, 35 – equatorial section of Ma topotype (x 70), 36 – holotype (x 66) (from Applin, Loeblich & Tappan, 1950)  
 Fig. 37,38 - *Placopsilina cenomana* D'Orbigny, 1850, 38 – (x 12 ), 39 – longitudinal section (x 20) (from Perner, 1892)  
 Fig. 39, 40 - *Subbdelloidina haeusleri* Frentzen, 1944, 39 – exterior , 40 – part of detached side (magnification not given) (from Haeusler, 1890)  
 Fig. 41 – *Acruliammina longa* (Tappan, 1940), (x15) (from Loeblich & Tappan, 1964)  
 Fig. 42 - *Lapillincola faringdonensis* Wilson, 1986 (from Kaminski, 2000, magnification not given)  
 Fig. 43, 44 - *Adhaerentia midwayensis* Plummer, 1938, 43 – view of hypotype adheared to Lenticulina (x18), 44 – longitudinal section (x 12) (from Loeblich & Tappan, 1987)  
 Fig. 45 - *Flatschofelia anisica* Rettori, Senowbari-Daryan & Zuhlke, 1996 (from Kaminski, 2000, magnification not given)

### PLATE II.

- Fig. 1, 2 – *Barkerina*, 1 - *Barkerina barkerensis* Frizzell & Schwartz, 1950, apertural views of 1. -holotype (x 43) (from Frizzell & Schwartz, 1950), 2 – *Barkerina dobrogiaca* Neagu, 2000 (from Neagu, 2000, magnification not given)  
 Fig. 3, 4, 5 - *Biplanata peneropliformis* Hamaoui & Saint-Marc, 1970, 3 – side view of holotype (x 25), 4 –



- subequatorial section (x 18 ), 5 – subaxial section (x 15 ), (from Hamaoui & Saint-Marc,1970)  
 Fig. 6, 7, 8 - *Merligina cretacea* Hamaoui, 1965, 6 – side view (x 100), 7 – oblique subequatorial section (x 100), 8 – axial section (x 100) (from Hamaoui & Saint-Marc,1970)  
 Fig. 9, 10 - *Demirina meridionalis* Ozcan, 1994 , type specimens (magnification not given) (from Kaminski, 2000)  
 Fig. 11, 12 – *Charentia cuvillieri* Neumann, 1965, 11 – side and apertural views of holotype (x 28), 12 – horizontal section (x 25) (11 - from Gorbachik, 1968, 12 – from Loeblich & Tappan, 1985)  
 Fig. 13, 14, - *Ismailia neumannae* El-Dakkak, 1974, 13 – side and apertural views of holotype (x 45), 14 – equatorial section (x 55 )(from El-Dakkak, 1974)  
 Fig. 15, 16 - *Karaisella usbekistanica* Kurbatov, 1971, 15 – side and apertural views of holotype (x 47 ), 16 – horizontal section (x 47) (from Kurbatov, 1971)  
 Fig. 17 – *Paleomayncina termieri* (Hottinger, 1967), equatorial section (from Kaminski, 2000)  
 Fig. 18, 19 - *Melathrokerion valserinensis* Bronnimann & Conrad, 1967, 18 – apertural view of holotype (x 14), 19 – equatorial section (x 26) (from Bronnimann & Conrad, 1967)  
 Fig. 20, 21 – *Moncharmontia apenninica* (DeCastro, 1966), median and axial sections (x 38) (from De Castro, 1966)  
 Fig. 22 - *Praekaraisella vandobensis* Kurbatov, 1972, holotype (x 85)(from Kurbatov, 1972)  
 Fig. 23 – *Praepeneroplis senoniensis* (Hofker, 1949), (x 58) (from Loeblich & Tappan, 1964)  
 Fig. 24 - *Bosniella oenensis* Gusic, 1977, median section of holotype (x 25)(from Gusic, 1977)  
 Fig. 25, 26 - *Lituolipora polymorpha* Gusic & Velic, 1978, 25 - tangential section (x 25), 26 - median section of microsphaeric specimen (x 45), (from Gusic & Velic, 1978)  
 Fig. 27, 28 - *Buccicrenata subgoodlandensis* (Vanderpool, 1933), 27 – side and apertural views of topotype (x 12), 28 – equatorial section (x 20 ) (from Loeblich & Tappan, 1987)  
 Fig. 29, 30 – *Everticyclammina virguliana* (Koechlin, 1943), 29 – microsphaeric paratype (x 12), 30 – equatorial section of Mi paratype (x 18)(from Koechlin, 1943)  
 Fig. 31 – *Feurtillia frequens* Maync, 1958, holotype (x 32 ) (from Hottinger, 1967)  
 Fig. 32, 33 - *Choffatella decipiens* Schlumberger, 1905, 32 – side and apertural views of paratype (x 12), 33 – equatorial section of Mi specimen (x 10) (from Hottinger, 1967)  
 Fig. 34 – *Alveosepta jaccardi* (Schrodt, 1894), equatorial section (x 20)(from Hottinger, 1967)  
 Fig. 35, 36 – *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926), 35 – side and apertural view (x 20), 36 – equatorial section of Ma specimen (x 14) (from Maync, 1959)  
 Fig. 37, 38 - : *Ijdranella atlasica* Bassoullet, Boutakiout & Echarfaoui, 1999 (from Kaminski, 2003, magnification not given)  
 Fig. 39, 40 - *Palaeocyclammina complanata* Bassoullet, Boutakiout & Echarfaoui, 1999, (from Kaminski, 2003, magnification not given)  
 Fig. 41 – *Paracyclammina bemmeleni* (A. Silvestri, 1932) median section (x 11) (from A. Silvestri,1932)  
 Fig. 42, 43 - *Pseudocyclammina lituus* (Yokoyama, 1890), 42 – median section (x 14),43 – exterior (x 14), (from Maync, 1959)  
 Fig. 44 - *Hottingerita complanata* (Hottinger, 1967), holotype (x 25) (from Hottinger, 1967)  
 Fig. 45, 46 – *Popovia plana* (N.K. Bykova, 1939), 45 – (x 42), 99, 46 – horizontal section (x 44) (from Suleymanov, 1965)  
 Fig. 47 - *Biokovina gradacensis* Gusic, 1977, median section of holotype (x 13) (from Gusic, 1977)  
 Fig. 48, 49 - *Labyrinthina mirabilis* Weynschenk,1951, 48 - longitudinal section of holotype (x 30), 49 – transverse section of paratype (x 20) (from Cati, 1959)  
 Fig. 50 - *Planisepta compressa* (Hottinger, 1967), magnification not given (from Kaminski, 2000)  
 Fig. 51 – *Levantinella egyptiensis* (Fourcade, Arafa & Sigal, 1984), equatorial section (from Kaminski, 2003, magnification not given)

### PLATE III

- Fig. 1 - *Pseudochoffatella cuvillieri* Deloffre, 1961, median section of Mi test (x 15) (from Gusic, 1975)  
 Fig. 2 – *Alzonella cuvillieri* Bernier & Neumann, 1970, median section (x 52) (from Bernier & Neumann, 1970)  
 Fig. 3 - *Broeckinella arabica* Henson, 1948, holotype (x 20)(from Cherchi & Schroeder, 1978)  
 Fig. 4 - *Dhrumella evoluta* Redmond, 1965, median section (x 72) )(from Loeblich & Tappan, 1987)  
 Fig. 5, 6, 7 - *Torremiroella hispanica* Brun & Canerot, 1979, 5 – subequatorial section of Ma holotype (x 50), 6 – side view (x 40), 7 – terminal part (x 48), (from Brun & Canerot, 1979)  
 Fig. 8, 9 - *Spirocyclina choffati* Munier-Chalmas, 1887, 8 – lectotype (x 16), 9 – equatorial section (x 11 ) (from Maync, 1959)  
 Fig. 10, 11 – *Redmondellina powersi* (Redmond, 1964), 10 – (x 21), 11 – equatorial section (x 22) (Banner & Whittaker, 1991)

- Fig. 12 - *Anchispirocyclus henbesti* Jordan & Applin, 1952, (x15) (from Hottinger, 1967)  
Fig. 13 - *Streptocyclamina parvula* (Hottinger, 1967), median section (x 48) (from Hottinger, 1967)  
Fig. 14, 15 - *Martiguesia cyclamminiformis* Maync, 1959, 14 - equatorial section of Mi paratype (x 12), 15 - axial section of Ma paratype (x 10) (from Maync, 1959)  
Fig. 16, 17, 18 - *Pseudospirocyclus maynci* Hottinger, 1967, 16 - equatorial section of Mi test (x 16), 17 - axial section of Ma test (x 25), 18 - equatorial section of Ma holotype (x 25) (from Hottinger, 1967) Fig. 19 - *Reissella ramonensis* Hamaoui, 1963 (x 33) (from Hamaoui, 1963)  
Fig. 20, 21 - *Sornayina foissacensis* Marie, 1960, 20 - side and apertural views of holotype (x 20), 21 - median section of Ma topotype (x 22) (from Maync, 1961)  
Fig. 22 - *Haddonina torresiensis* Chapman, 1898, lectotype (x 4) (from Loeblich & Tappan, 1987) - median section of Ma topotype (x 22) (from Maync, 1961)  
Fig. 23 - *Stylolina lapugyensis* Karrer, 1877, 127 - lectotype (x 12), 128 - apertural view (from Cicha et al., 1998)  
Fig. 24 - *Alpinophragmium perforatum* Flugel, 1967, section of holotype (x 7) (from Flugel, 1967)  
Fig. 25 - *Bdelloidina aggregata* Carter, 1877, 25a - side view (x 5), 25b - apertural view (x 2.5) (from Loeblich & Tappan, 1987)  
Fig. 26 - *Coscinophragma cribrosa* (Reuss, 1846) (x 2,5) (from Kaeffer, 1974)  
Fig. 27 - *Goellipora triassica* Senowbari-Daryan & Zankl, 2000 (x 30) (from Senowbari-Daryan & Zankl, 2000)





