CONTRIBUTIONS

from the

CUSHMAN LABORATORY

for

FORAMINIFERAL RESEARCH

Volume 3, Part 4

December 1927

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DECEMBER 1927

SHARON, MASSACHUSETTS, U. S. A.

CONTENTS

These contributions will be issued quarterly. They will contain short papers with plates, describing new forms and other interesting notes on the general research work on the foraminifera being done on the group by the workers in this laboratory. New literature as it comes to hand will be briefly reviewed.

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CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

49. TRIMORPHISM IN THE FORAMINIFERA

By JOSEPH A. CUSHMAN

The question of specific limits in the foraminifera is a difficult one at best but the generic position of species is also at times a very perplexing one. In 1925, Hofker published a paper entitled: "On Heterogamy in Foraminifera" (Tijdschr. Ned. Dierk. Vereen, ser. 2, vol. 19, 1925, pp. 68-70) in which he reviews much of the work that has been done on the life history of the foraminifera, and comes to the conclusion that there are three forms in each "species". One results in the microspheric form from the union of flagellispores, with a microspheric proloculum. The ultimate size of the adult test is large, and its developmental stages the most complete of the three forms. This microspheric form may give rise to several generations of megalospheric forms some with a very large proloculum, others much smaller and gradations between the two extremes.

In his most recent work on the Foraminifera of the Siboga Expedition, Hofker has applied his theory of the existence of three forms in each species to the material collected by that expedition with results that will be startling to some who have not studied large series, especially of tropical foraminifera. To think that "species" usually placed in different genera should be forms of one and the same species is perhaps difficult for some, but there are many such actual cases in the literature as well as shown in recent material. The effect upon the already complicated nomenclature will be very confusing and the Rules of Nomenclature will be sure to have peculiar applications. A classic example of this trimorphism is found in d'Orbigny's

work on the Foraminifera of the Vienna Basin. On Plate 1, fig. 26 is "*Nodosaria aculeata* d'Orbigny" with a very large proloculum and with four chambers in a rectilinear arrangement, the surface coarsely spinose. On Plate 2, fig. 16 is "*Dentalina floscula* d'Orbigny" with a smaller proloculum, and with six chambers, the axis of the earlier ones slightly curved, the surface coarsely spinose. On Plate 3, fig. 17 is "*Marginulina hirsuta* d'Orbigny" with a still smaller probably microspheric proloculum, the number of chambers indefinite but at least nine, the earlier ones in a strong curve. I have abundant material from Baden and these forms with some intermediates are present, the "*Marginulina*" in some specimens compressed laterally in the young, and with a very small proloculum. There can be no doubt in a study of this series but that a single species is present.

If according to the Rules of Nomenclature, the first of these is chosen as the type, it will be called "*Nodosaria aculeata* d'Orbigny" but with it must be put the Dentaline and Marginuline forms which would very greatly stretch the definition of *Nodosaria* to say the least. If on the other hand the name be "*Marginulina hirsuta* d'Orbigny" as that form shows the greatest number of chambers and the most nearly complete life history, these other megalospheric forms may be grouped with it as forms with incomplete stages with perhaps less difficulty.

In our California Pleistocene and Pliocene as well as in the living forms of the Eastern border of the Pacific along North and South America, we have a broad form described as *Truncatulina ornata* d'Orbigny. In this species which becomes in large specimens very broad and a true *Planulina* (Cushman, Bull. Scripps Inst. Oceanography, Tech. Ser., vol. 1, No. 10, p. 176, pl. 6, fig. 12) there is another form which at first would seem unrelated but occurs with it both fossil and at many stations off the coast which is biconvex. This has recently been named "*Cibicides mckannai*" by Galloway and Wissler (Journ. Pal., vol. 1, 1927, p. 65, pl. 10, fig. 5 *a*, *b*). There is a third form which fills in the intermediate stages between the two and all three forms belong to d'Orbigny's species. Two forms with such different shapes and stages are even more distinct at first sight than those of d'Orbigny cited above, but when hundreds of specimens are studied from numerous stations and the various intermediates studied, the real limits of the species in its different forms are to be seen. Some of the examples given by

Hofker are perhaps even more striking than these.

There are however some species which although they occur in both microspheric and megalospheric forms and perhaps the second megalospheric form or forms keep closely to a single generic character. Many species have fixed characters that enable them to become index fossils of close horizons and to have very limited geographical ranges in the present ocean.

One of the beneficial things that comes from this varied form is its effect upon our classification of the group. It can hardly be that various generic characters assumed by the different forms of a species can be other than closely related, and the young of the microspheric form will give very strong clues to the relationship of the different genera involved. It is very clear that *Planulina* and *Cibicides* (*Truncatulina*) are closely related genera and that *Marginulina, Dentalina* and *Nodosaria* developed in that order from a close coiled ancestry. So one studying the rare microspheric forms of *Globigerina* with the early stages flattened, non-spinose and like *Discorbis* such as figured by Rhumbler (Plankton Exped. Foraminifera, 1911, pl. 32, and others) must come to the idea that the Globigerinas are a specialized group derived from a smooth *Discorbis*-like ancestry through high specialization. Such characters will help to clear our classification at the same time that it may confuse our ideas as to what to call a species and in what genus it should be placed.

It may be argued that *Nodosaria, Dentalina* and *Marginulina* are not good genera if one species may assume forms so diverse that it might be placed in all three genera. On the other hand, there are apparently many species which so far as we know do not jump across generic lines as do these. The Lagenidae are primitive and plastic, and close distinctions are not so possible as in some other groups.

Hofker's studies show that one should be slow to describe new species from single or even few specimens and that it is very necessary to know whether a specimen is a microspheric or megalospheric one. Sectioned specimens are of great value, and the publication of really good sections is sure to help greatly in the study of many foraminifera.

The extent of the application of Hofker's ideas is not yet apparent but enough is known of the various forms which the foraminifera assume to show that it should be given very wide testing and its possibilities on the matter of nomenclature be carefully considered.

50. THE WORK OF FICHTEL AND MOLL AND OF MONTFORT

By JOSEPH A. CUSHMAN

The work of Fichtel and Moll, Testacea Microscopica, published in Vienna in 1798 with twenty-four colored plates, all but the first one of foraminifera, is the most important of the earlier works on the foraminifera. The still earlier works on which Linné based his few species of foraminifera are not well illustrated. The work of Fichtel and Moll is for the most part excellently illustrated and in my own copy, the colors of the plates are beautifully preserved in spite of their age. The work of Fichtel and Moll is important for the specific names used, all of which are referred to *Nautilus*, but also as the basis on which genera were erected by numerous later authors. The first of these is Denys de Montfort. In the first volume of his Conchyliologie Systématique, he erected a great many genera most of them based on the figures in Fichtel and Moll. His drawings are very crude wood cuts which try to unite in one figure two or more views, and occasionally he makes a composite figure based on figures of specimens which belong to different genera. Were it not that Montfort refers definitely to the figures of Fichtel and Moll, more of his generic names could be discarded. Unfortunately, Montfort does not refer to the work of Lamarck published in 1801 and 1804. Lamarck's names precede those of Montfort in a number of genera.

The material which Fichtel and Moll had came from several sources. Four of these give most of the species. These are Rimini, the locality on the Italian coast of the Adriatic from which many of the species came which were recorded by Gaultieri, Bianchi, Linné, Soldani and afterward by d'Orbigny. It is one of the most famous of the localities for foraminifera. Coroncina, near Siena, a quarry in the Pliocene was the original type locality of another considerable lot of species and a locality made famous by both earlier and later writers. Material from the concretions from the Mediterranean gave many species as well as sands from the Red Sea. In order to have for study topotype material in considerable amounts, I made special col-

lecting trips last July to both Rimini and Coroncina, in both places foraminiferal material being abundant. I have also Mediterranean material which is probably more or less similar to that which Fichtel and Moll had. For the Red Sea material, I am indebted to Mr. W. A. Macfadyen who has supplied me with an excellent series of samples of his own collecting. With the study of Lamarck's types of species before 1808, it is possible to interpret much of the earlier work.

Montfort gave a generic name to nearly all of the separate figures of Fichtel and Moll's work so that his genera are monotypic ones. They may for convenience be grouped. There are sixteen generic names given by Montfort to forms which have usually been known as *"Cristellaria"*. I found at Caen the types of Lamarck's *Lenticulina rotulata* which is a typical *"Cristellaria"* and if the name *"Cristellaria"* is to be disturbed, *Lenticulina* Lamarck must be used for it. There may be a difference of opinion among workers as to the extent to which *"Cristellaria"* may be usefully subdivided. The group is one of the most plastic of any of the foraminifera. The genus *Robulus* of Montfort may be retained for those species which have the radiate aperture and in addition a rounded opening below the apex in the apertural face but the gradations between the purely radiate forms of aperture and those with the additional opening are closely bridged.

Under *Lenticulina* Lamarck the following genera of Montfort may be placed as more or less synonymous.

Phonemus Montfort Genus III, pp. 10-12; *Pharamus,* Genus IX, pp. 34-36; *Antenor,* Genus XVIII, pp. 70-72; *Oreas,* Genus XXIV, pp. 94-96; *Patrocles,* Genus LV, pp. 218-220; *Spincterules,* Genus LVI, pp. 222-224; *Clisiphontes,* Genus LVII, pp. 226-228; *Herion,* Genus LVIII, pp. 230-232; *Rhinocurus,* Genus LIX, pp. 234-236; *Macrodites* (?), Genus LX, pp. 238-240; *Lampas,* Genus LXI, pp. 242-244; *Scortimus,* Genus LXIII, pp. 250-252; *Linthurus,* Genus LXIV, pp. 254-256; *Astacolus,* Genus LXVI, pp. 262-264; and *Periples,* Genus LXVIII, pp. 270-272. A number of these "genera" have the apertural face with the supplementary aperture and as such may be perhaps placed under *Robulus,* Genus LIV, pp. 214-216. Among these are *Phonemus, Pharamus, Patrocles, Spincterules, Herion, Rhinocurus, Scortimus, Linthurus,* and *Astacolus.*

The first of the generic names for what was later called *Polystomella* Lamarck is *Elphidium* Montfort, Genus IV, pp. 14-

16. Under this as synonyms may be grouped several names of Montfort, *Geophonus,* Genus V, pp. 18-20; *Pelorus,* Genus VI, pp. 22-24; *Chrysolus,* Genus VII, refers to Plate 19, figs. *g, h, i,* as does *Astacolus* later but neither is close to the figures of Fichtel and Moll; *Andromedes,* Genus X, pp. 38-40; *Sporilus,* Genus XI, pp. 42-44; *Themeon,* Genus LI, pp. 202-204, and *Cellanthus,* Genus LII, pp. 206-208.

Nonion Montfort, Genus LIII, pp. 210-212 with the type *N. incrassatus* Fichtel and Moll, could hardly be distinguished, but for the original figures of Fichtel and Moll. Under *Nonion* as synonyms may be grouped *Melonis,* Genus XVII, pp. 66-68; and *Florilus,* Genus XXXIV, pp. 134-136.

Cibicides Montfort, Genus XXXI, pp. 122-124, must take the place of *Truncatulina* of d'Orbigny, 1826. *Polyxenes,* Genus XXXV, pp. 138-140, is probably a synonym.

Eponides Montfort, Genus XXXII, pp. 126-128, now takes the place of *Pulvinulus* Lamarck and *Pulvinulina* of later authors as the same species *Nautilus repandus* Fichtel and Moll is the type species of each.

Camerina Bruguiere has as synonyms from Montfort's names *Lycophris* (?), Genus XL, pp. 158-160; *Rotalites,* Genus XLI, pp. 162-164; and *Egeon,* Genus XLII, pp. 166-168.

Of the names given to the forms later called *Alveolina,* the first is *Borelis* Montfort, Genus XLIII, pp. 170-172. A synonym of this is *Clausulus,* Genus XLV, pp. 178-180.

Orbitolites Lamarck may have *Discolites,* Genus XLVII, pp. 186-188 as a synonym but the figure and description are both poor.

Archaias Montfort, Genus XLVIII, pp. 190-192, is the first name used for what was later given the name *Orbiculina, Helenis,* Genus XLIX, pp. 194-196 and *Ilotes,* Genus L, pp. 198-200, are synonyms of *Archaias.*

Peneroplis Montfort may be used for the flattened forms while *Spirolina* Lamarck, 1804, is used for the uncoiled more or less cylindrical forms.

Cancris Montfort, Genus LXVII, pp. 266-268 based on Fichtel and Moll's pl. 20, figs. *d, e, f,* has the type *Cancris auriculus* (Fichtel and Moll), common in the Mediterranean and elsewhere.

Reophax Montfort has long been used although there are but the two figures of Soldani and Montfort to depend upon. Soldani's types are in Siena, but I was unable to see the specimens

on which Soldani's figure was based and which was used by Montfort who drew a very extraordinary figure from it to illustrate his genus.

Of the other genera given by Montfort, nearly all are unidentifiable as they are not based on good figures of other authors or like *Tinoporus* Genus XXXVII, pp. 146-148 which is evidently made up of a combination of more than one genus and is a figure of a "hybrid" form which does not exist in nature.

It will be seen from the foregoing that fortunately very few of the names given by Montfort have generic standing. Of these there are the following: *Elphidium* for forms commonly known as *Polystomella; Nonion* for *Nonionina; Cibicides* for *Truncatulina* in general; *Eponides* for some of the species which have been called *Pulvinulina; Borelis* for *Alveolina* (in part); *Archaias* for *Orbiculina, Peneroplis, Cancris* for some of the species that have been called *Pulvinulina,* and *Reophax.*

51. SOME NOTES ON THE GENUS CERATOBULIMINA

By JOSEPH A. CUSHMAN and REGINALD W. HARRIS

In 1851, Reuss described the species *Rotalina contraria* (Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 76, pl. 5, fig. 37) from the Oligocene of Hermsdorf near Berlin. Many authors have referred fossil and recent specimens to this species, usually under the generic name *Bulimina.* That these various forms do not belong to *Bulimina* has long been evident. Toula in 1920 (Jahrb. Geol. Reichsanst., vol. 64, 1920, p. 665) erected the genus *Ceratobulimina* with the genotype *Rotalina contraria* Reuss. To this genus should be referred many other species. We are indebted to Mrs. Helen J. Plummer and Mr. W. J. Parr for some excellent specimens.

GENUS CERATOBULIMINA Toula, 1920

Genotype, monotypic, *Rotalina contraria* Reuss.

Ceratobulimina TOULA, Jahrb. Geol. Reichanst., vol. 64, 1920, p. 665.
Rotalina REUSS (in part) (not of D'ORBIGNY) Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 76.

Cassidulina H. B. BRADY (in part) (not of D'ORBIGNY) Quart. Journ. Micr. Sci., vol. 21, 1881, p. 59.

Bulimina H. B. BRADY (in part) Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 409.

Buliminella CUSHMAN, (in part), Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 89.

Pulvinulina RZEHAK (in part) (not of PARKER AND JONES), Ann. K. K. Nat. Hofmuseums, vol. 3, pt. 3, 1888, p. 263.

Rotalia PLUMMER (in part) (not of LAMARCK), Univ. Texas Bull. 2644, 1927, p. 156.

Test rotaliform, all chambers visible from the dorsal side, those of the last-formed whorl only visible on the ventral side, close coiled, chambers numerous, distinct; wall thick, added to as growth progresses, the entire exterior polished; ventral side of the test with the umbilicus open, the aperture extending into the ventral side of the last-formed chamber and in perfect adult specimens the aperture covered by a thin convex plate merged with the chamber wall above the aperture in a semicircular line, the lower end thin, lip-like.

The peculiar aperture which characterizes the genus is evidently too open for the best success of the animal and as a consequence the protecting plate was developed. This is present in well preserved specimens at least in the adult condition. It may be broken away as in Pl. 30, fig. 16 showing the aperture below and often one or more of the plates of the previous chambers. The wall is continuously being added to with the new chambers giving a stratified appearance in section (Pl. 30, fig. 14). This is also seen in *Cassidulina* and other genera derived from *Ceratobulimina*. As chambers are broken back it is seen (Pl. 30, fig. 15) that there is a partition built in across the lower portion of the apertural opening shutting the upper portion off into a semicircular portion. This is evidently a secondary structure and appears only in those chambers which have been covered by later ones. One end of this partition seems to be attached below the original apertural face. The very smooth character of the surface appears like that of *Cypraea* in the Mollusca where the mantle covers the entire test and is in *Ceratobulimina* probably due to the fact that the protoplasm covers the entire test, a fact borne out by the laminated character of the wall due to continual thickening.

A study of available material seems to show that *Ceratobulimina* like many other genera probably originated in the Upper Cretaceous from a *Discorbis*-like ancestry. It is closely related

to *Pulvinulinella* and *Cassidulina* which were probably derived from it in the Eocene. All three genera are still living, most abundantly in the Pacific.

A description of some of the species follows:

CRETACEOUS SPECIES

CERATOBULIMINA CRETACEA Cushman and Harris, new species

Plate 29, figures 1 *a-c;* Plate 30, figure 11

Test small, slightly longer than broad, usually 7 chambers in the last-formed whorl; sutures distinct, limbate but not raised; wall smooth, polished; aperture extending slightly into the last-formed chamber in a rounded triangular opening, covered in well preserved specimens with a slightly developed thin plate attached above the inner end of the aperture. Length 0.43 mm.; breadth 0.30 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 7030) from Upper Cretaceous, Navarro formation of Mexia Oil Field, Mexia, Texas.

This is the most primitive of the species of the genus so far seen. The aperture does not extend so far into the apertural face and the protecting plate is only partially developed.

EOCENE SPECIES

CERATOBULIMINA PERPLEXA (Plummer)

Plate 29, figures 2 *a-c*

Rotalia perplexa PLUMMER, Univ. Texas Bull. 2644, 1927, p. 156, pl. 12, figs. 2 *a-c.*

"Test oval, about equally biconvex, considerably compressed; peripheral margin broadly rounded, somewhat lobate; chambers smooth, glistening, finely punctate, gently curving, 6 to the final whorl; dorsal sutures marked by thick, smooth or very slightly elevated, tapering bands that become distinctly angular at their broadest points; ventral sutures depressed, radiate from a sunken umbilicus; aperture a conspicuous round opening at the base of the septal face and protected by an arched flap that is directed into the umbilicus."

"Length up to .5 mm.; average .35 mm."

The types are from the Midway Eocene of Texas and it is recorded by Mrs. Plummer from the topmost Navarro and from the Wilcox at Nanafalia, Alabama.

CERATOBULIMINA EXIMIA (Rzehak)

Plate 29, figures 3, 4; Plate 30, figures 12-16

Pulvinulina eximia RZEHAK, Ann. K. K. Nat. Hofmuseums, vol. 3, pt. 3, 1888, p. 263, pl. 11, figs. 7 *a-c*.

Test slightly longer than broad, broadly oval in peripheral view, 7-9 chambers in the last-formed whorl, distinct; sutures distinct, either depressed or becoming thickened, limbate and sometimes even raised on the dorsal side, the later sutures with a conspicuous angle near the inner margin; wall thick, smooth and highly polished; aperture, a broad somewhat oblique opening in the ventral side of the last-formed chamber, in fully preserved specimens with a protecting plate covering the aperture. Length up to 1.20 mm.; breadth 1.00 mm.; thickness 0.75 mm.

This species described by Rzehak from Europe seems to be identical with the very common species of the American Claiborne. The aperture is broader and more rounded than the later species in which the opening becomes increasingly elongate.

CERATOBULIMINA ALAZANENSIS Cushman and Harris, new species

Plate 29, figures 5 *a-c;* Plate 30, figures 3-5

Test very slightly longer than broad, periphery broadly rounded, usually 6 chambers in the last-formed whorl; sutures distinct, slightly depressed, not limbate; wall smooth and polished; aperture more elongate than in the older species and nearer the axis of coiling. Length 0.75 mm.; breadth 0.60 mm.; thickness 0.40 mm.

Holotype from Alazan Clays, Arroyo Camalla, Tepitzintla-El Humo road, about 4 kms. E. of El Humo, Mexico, collected by Dr. T. Wayland Vaughan.

It also occurs at other stations in the Alazan Clays of Mexico.

The chambers of the last-formed coil gradually become wider and more involute on the dorsal side than in any other older species and in this character resemble the later Tertiary species.

OLIGOCENE SPECIES

CERATOBULIMINA CONTRARIA (Reuss)

Plate 29, figures 6 *a-c*

Rotalina contraria REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 76, pl. 5, fig. 37.

Ceratobulimina contraria TOULA, Jahrb. Geol. Reichsanst., vol. 64, 1920, p. 665.

The original figure of this species is copied here. It seems that the fore-shortening in the figure is not correct and the specimen appears flatter than it probably should. We have specimens that may be referred to this species but none from the Hermsdorf locality. The aperture as figured is more elongate than the older species and more nearly approaches some of the Australian Miocene and Recent forms. There are 7 chambers in the last-formed whorl.

The types were from the Oligocene of Hermsdorf, near Berlin.

Numerous fossil and recent forms have been referred to this species.

MIOCENE SPECIES

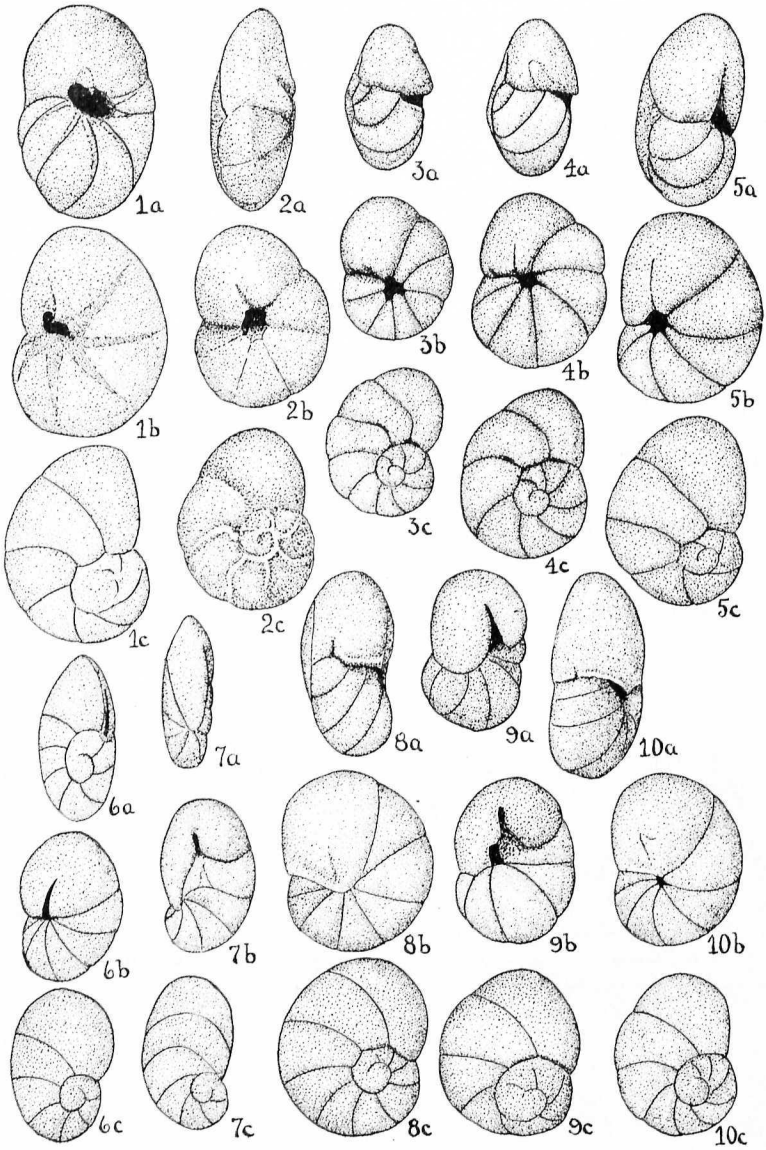
CERATOBULIMINA HAUERII (d'Orbigny)

Plate 29, figures 8 *a-c;* Plate 30, figures 1, 2

Rotalina hauerii D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 151, pl. 7, figs. 22-24.

Test nearly as broad as long, periphery rounded, test compressed, usually 7 or 8 chambers in the last-formed whorl, distinct, those of the last-formed coil somewhat more involute toward the growing end; wall smooth and polished; sutures distinct, slightly depressed; aperture rather large, the axis pointing slightly to the dorsal side of the axis of coiling, covered in well preserved specimens with a thin protecting plate with a slightly upturned border covering the umbilical region. Length 1 mm.; breadth 0.85 mm.; thickness 0.50 mm.

We have numerous specimens of this species from the type locality of Baden near Vienna. The characters are rather constant, the protecting plate being very well developed. In many respects it seems to be closely related to the Mexican form and more closely still to the Australian form.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EXPLANATION OF PLATE 29

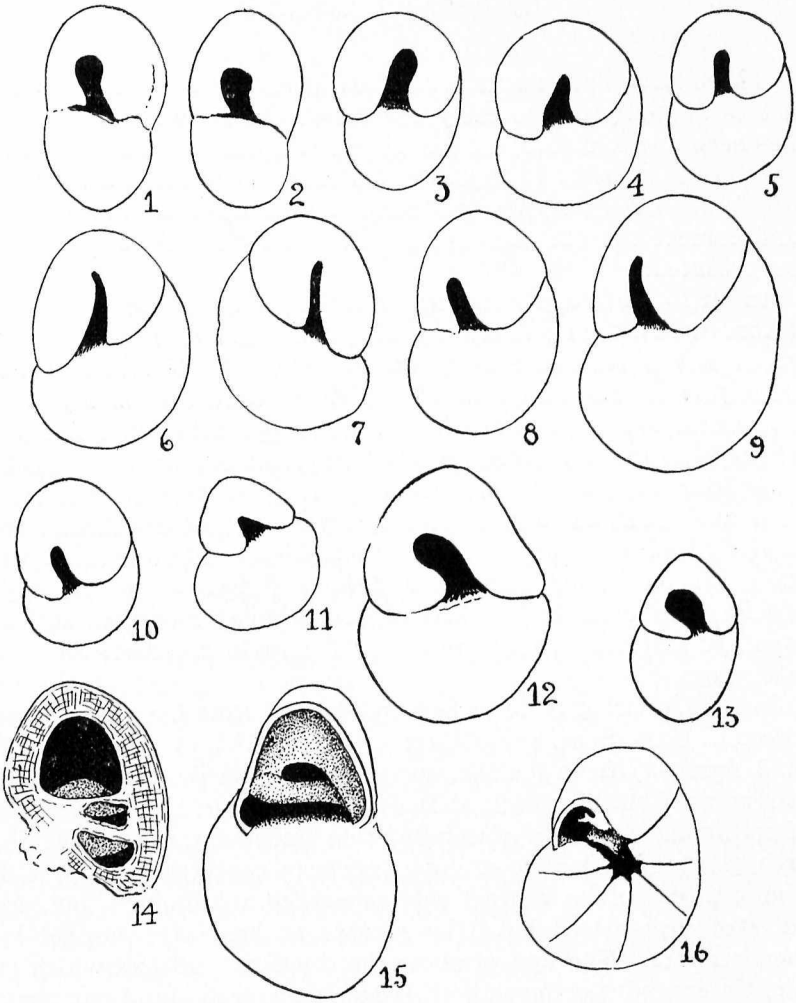
In all figures *a* is peripheral view; *b*, ventral view; *c*, dorsal view.

FIGS. 1 *a-c*. *Ceratobulimina cretacea* Cushman and Harris, n. sp. × 65.
FIGS. 2 *a-c*. *Ceratobulimina perplexa* (Plummer). × 65. After Plummer.
FIGS. 3 *a-c*. *Ceratobulimina eximia* (Rzehak). After Rzehak.
FIGS. 4 *a-c*. *Ceratobulimina eximia* (Rzehak). × 35. Claiborne specimen.
FIGS. 5 *a-c*. *Ceratobulimina alazanensis* Cushman and Harris, n. sp. × 65.
FIGS. 6 *a-c*. *Ceratobulimina contraria* (Reuss). After Reuss.
FIGS. 7 *a-c*. *Ceratobulimina dehiscens* (Heron-Allen and Earland). × 65. From the Miocene of Australia.
FIGS. 8 *a-c*. *Ceratobulimina hauerii* (d'Orbigny). × 40. Specimen from Baden.
FIGS. 9 *a-c*. *Ceratobulimina pacifica* Cushman and Harris, n. sp. × 55.
FIGS. 10 *a-c*. *Ceratobulimina hauerii* (d'Orbigny), var. *australis* Cushman and Harris, n. var. × 40.

EXPLANATION OF PLATE 30

All figures × 40.

FIGS. 1, 2. *Ceratobulimina hauerii* (d'Orbigny).
FIGS. 3-5. *Ceratobulimina alazanensis* Cushman and Harris, n. sp.
FIGS. 6-10. *Ceratobulimina hauerii* (d'Orbigny), var. *australis* Cushman and Harris, n. var.
FIG. 11. *Ceratobulimina cretacea* Cushman and Harris, n. sp.
FIGS. 12-16. *Ceratobulimina eximia* (Rzehak).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52. EPISTOMINA ELEGANS (D'ORBIGNY) AND E. PARTSCHIANA (D'ORBIGNY)

By JOSEPH A. CUSHMAN

There have been many erroneous ideas as to the actual characters of many of the early species of the foraminifera. This has been due to a study of the figures without reference to either the actual types or to topotype material. Very often a study of the types or topotypes will give a true idea of the species, and correct the previous errors which may otherwise be easily perpetuated.

In 1826, d'Orbigny named *Rotalia* (*Turbinulina*) *elegans* (Ann. Sci. Nat., vol. 7, 1826, p. 276, No. 54). There is no figure given but a reference is given to Soldani ("*Hammoniformis trochiformis*" Sold. app., tab. 2, fig. R.="Nautili *Ammoniformes* sive *trochiformis*", Soldani, Test vol. 2, App., 1798, pl. 2, fig. R.). There is no locality given by d'Orbigny, but Soldani's specimens were from the Pliocene of Coroncina, Italy. The species is common at Coroncina, and I have a large suite of specimens for study. No description is given by d'Orbigny of this species, and its characters must rest upon Soldani's figure and the type specimen which is in the Soldani Collection at Siena, as well as topotype material from Coroncina. This will be described on a later page.

In 1846, d'Orbigny described and figured *Rotalina partschiana* (Foram. Foss. Bass. Tert. Vienne, 1846, p. 153, pl. 7, figs. 28-30, pl. 8, figs. 1-3) from the Miocene of the Vienna Basin. It is rare at Nussdorf but abundant at Baden. A study of the large suites of specimens available especially from Baden shows that the figures given of this species have not been correctly interpreted. The sutures on the ventral side especially are limbate, but are not strongly raised above the surface as has been thought by some writers. The figures show the thickened sutures which in slightly eroded specimens both recent and fossil stand out when the wall is worn away. d'Orbigny's description gives 9-11 chambers in the last whorl but the megalospheric form usually has 7-8 while the microspheric form may have as many as 14. The test is much more convex in the megalospheric than in the microspheric form. It may be noted that the two figures of the ven-

tral side given by d'Orbigny have respectively 8 or 9 chambers while the dorsal views seem to show more.

I have examined many specimens from various formations from the Miocene onward and have been unable to find distinctions that are constant and are not due to microspheric or megalospheric forms or to differences in thickness of the chamber wall.

GENUS EPISTOMINA Terquem, 1883

Epistomina TERQUEM, Bull. Soc. géol. France, ser. 3, vol. 11, 1883, p. 37, (Genotype *E. regularis* TERQUEM).

Rotalia (*Turbinulina*) (in part), D'ORBIGNY, 1826, Ann. Sci. Nat., vol. 7, p. 276.

Rotalia (in part) D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 153.

Pulvinulina (in part) PARKER AND JONES, Phil. Trans., vol. 155, 1865, p. 397, and later authors.

Placentula BERTHELIN, Bull. Soc. géol. France, ser. 3, vol. 11, 1882, p. 16 (not *Placentula* LAMARCK, 1822).

Test free, biconvex, trochoid, all whorls visible from the dorsal side, only the last-formed one from the ventral side; chambers numerous, usually distinct, not inflated; sutures distinct, of very solid material, limbate, on the dorsal side oblique, on the ventral side obliquely radiate, strongly limbate in nearly all species, sometimes strongly raised into a highly ornate surface, umbilicus usually filled and umbonate; wall finely perforate, usually thin between the sutures, especially on the dorsal side, often with irregular thickened areas appearing light colored against the darker translucent portion; apertures of two sorts, one in the normal position for the Rotaliidae, at the inner margin of the ventral side of the chamber or in the face itself, the other elongate, just below the periphery and in the axis of coiling, in later chambers usually filled with clear shell material.

There are a number of species from the Jurassic on. One species that I have in abundance from the Russian Jurassic is very similar to the later species but those of the Cretaceous in particular are often highly ornate. The genus is widely distributed at the present time.

It may be noted here that *Truncatulina favosoides* Egger, (Abhandl. Kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 150, pl. 20, figs. 22-25) is an *Epistomina*. The type is in the collection at Munich, and I have in my collection numerous specimens from the type locality of Gerhardsreuth and others

of Egger's localities. There are numerous interesting species in the European Jurassic and Cretaceous which cannot be adequately dealt with in this short paper.

EPISTOMINA ELEGANS (d'Orbigny)

"Nautili *Ammoniformes* sive *trochiformes*," SOLDANI, Test., vol. 2, App., 1798, pl. 2, fig. R.

Rotalia (*Turbinulina*) *elegans* D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 276, No. 54, (not *Rotalia elegans*, l. c. p. 272, No. 6=nomen nudum).

Rotalina partschiana D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 153, pl. 7, figs. 28-30; pl. 8, figs. 1-3.

Pulvinulina repanda, var. *elegans* PARKER AND JONES, Phil. Trans., vol. 155, 1865, p. 397, pl. 16, figs. 44-46.

Pulvinulina partschiana REUSS, Sitz. Akad. Wiss. Wien, vol. 55, 1867, p. 104.—KARRER, l. c., vol. 58, 1868, p. 186.—H. B. BRADY, Rep. Voy. *Challenger*, Zool., vol. 9, 1884, p. 699, pl. 105, figs. 3 *a-c*, text fig. 21.—EGGER, Abhandl. Kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 410, pl. 17, fig. 43; pl. 18, figs. 25-27.—CHAPMAN, Proc. Zool. Soc. London, 1895, p. 42.—FLINT, Ann. Rep't. U. S. Nat. Mus., 1897 (1899), p. 331, pl. 75, fig. 3.—BAGG, Proc. U. S. Nat Mus., vol. 34, 1908, p. 162.—CHAPMAN, Proc. Roy. Soc. Victoria, vol. 22, 1910, p. 287.—TOULA, Jahrb. Kais.-Kön. Geol. Reichs., vol. 64, 1914 (1915), p. 666.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 64.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 260.—CUSHMAN, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 344.—HERON-ALLEN AND EARLAND, British Antarctic Exped., Zool., vol. 6, 1922, p. 218.—MARTINOTTI, Atti Soc. Ital. Sci. Nat., vol. 62, 1923, p. 352.

Pulvinulina elegans PARKER, JONES AND H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 174, pl. 12, fig. 142.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 699, pl. 105, figs. 4-6.—H. B. BRADY, PARKER AND JONES, Trans. Zool. Soc., vol. 12, 1888, p. 228, pl. 46, fig. 2.—J. WRIGHT, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 492.—SILVESTRI, Mem. Accad. Pont. Nuovi Lincei, vol. 9, 1893, p. 214.—AMICIS, Boll. Soc. Geol. Ital., vol. 12, 1893, p. 163.—EGGER, Abhandl. Kön. bay. Akad. München, Cl. II, vol. 18, 1893, p. 410, pl. 18, figs. 37-39.—GOES, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 97, pl. 16, fig. 808.—AMICIS, Nat. Sicil., Ann. XIV, 1895, p. 119.—CHAPMAN, Proc. Zool. Soc. London, 1895, p. 42.—SILVESTRI, Atti Accad. Sci. Acireale, vol. 7, 1896, p. 88.—GOES, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 76.—FLINT, Rep't. U. S. Nat. Mus., 1897 (1899), p. 331, pl. 75, fig. 1.—JONES, Foram. Crag, pt. 4, 1897, p. 324, pl. 7, figs. 32 *a*, *b*.—KIAER, Rep't. Norwegian Fish. & Mar. Invest., vol. 1, No. 7, 1900, p. 47.—FORNASINI, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 10, 1902, p. 58.—MILLETT, Journ. Roy. Micr. Soc., 1904, p. 501.—CHAPMAN, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1907, p. 139.—BAGG, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 161.—CHAPMAN, Subantarctic Islands of New Zealand, 1909, p. 362; Proc. Roy. Soc. Victoria, vol. 22, 1910, p. 288; Journ. Linn. Soc. Zool., vol.

30, 1910, p. 421.—SCHUBERT, Abhandl. geol. Reichs., vol. 20, pt. 4, 1911, p. 112, pl. 3, fig. 3.—BAGG, U. S. Geol. Surv. Bull. 513, 1912, p. 86, pl. 26, figs. 11-15.—HERON-ALLEN AND EARLAND, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 138.—TOULA, Jahrb. Kais.-kön. Geol. Reichs., vol. 64, 1914 (1915), p. 645.—PEARCEY, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1029.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 63, pl. 26, fig. 3.—CHAPMAN, Biol. Res. *Endeavour*, vol. 3, pt. 1, 1915, p. 32.—HERON-ALLEN AND EARLAND, Trans. Zool. Soc., vol. 20, 1915, p. 717; Trans. Linn. Soc. London, vol. 11, 1916, p. 277; Journ. Roy. Micr. Soc. 1916, p. 52.—SIDEBOTTOM, Journ. Roy. Micr. Soc., 1918, p. 260.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 631; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 342.—HERON-ALLEN AND EARLAND, British Antarctic Exped., Zoology, vol. 6, 1922, p. 218; Journ. Roy. Micr. Soc., 1924, p. 180; Journ. Linn. Soc. Zool., vol. 35, 1924, p. 637.—CUSHMAN, Bernice P. Bishop Museum, Bull. 27, 1925, p. 134.

Epistomina partschiana CUSHMAN, Bull. Scripps Inst. Ocean., Tech. Ser., vol. 1, No. 10, 1927, p. 163, pl. 5, figs. 4, 5.

Epistomina bradyi GALLOWAY AND WISSLER, Journ. Pal., vol. 1, 1927, p. 60, pl. 10, fig. 1.

Epistomina flinti GALLOWAY AND WISSLER, l. c., p. 61, pl. 9, fig. 16.

Test biconvex, either with the sides nearly equally convex or the ventral side more strongly so especially in the microspheric form, periphery rounded or in small specimens more acute; chambers usually distinct, typically 7-9 in the megalospheric form, increasing to as many as 14 in the largest microspheric specimens; sutures distinct, limbate, but not raised, on the dorsal side strongly oblique, on the ventral side obliquely radial ending at the center in an umbonate mass; wall finely perforate, in the thin walled specimens often showing a complex pattern of thickenings, in thick walled specimens opaque; aperture usually narrow on the ventral side at the base of the last-formed chamber toward the periphery with a supplementary aperture in the axis of coiling, parallel to the peripheral margin and just ventral to it, elongate. Diameter up to 2 mm. in microspheric specimens.

Plate 31, figs. 1-3, all from the Pliocene of Coroncina, Italy, the type locality of *Epistomina elegans* (d'Orbigny) give the characters of the type. Plate 32, figs. 7, 8 are from the type figure of Soldani. Plate 31, figs. 4-6 are from Baden in the Miocene of the Vienna basin and represent typical *E. partschiana* (d'Orbigny).

These specimens were selected at random from a large series from each locality and show very little if any real differences. Both series have specimens in which the pattern of the wall is

apparent, due to unequal thickening and the same character is widely spread in the recent material in the present oceans.

The species is very thickly distributed and often very abundant as though it might perhaps be pelagic at some early stage. I have it from the type localities of Coroncina and Baden as well as other localities in the Miocene and Pliocene of Europe, from the Pliocene and Pleistocene of California, from the Miocene of Australia and from very many localities in the present oceans. There seems to be very little variation in the species in all this series except such as may be accounted for in the difference in characters usually present in megalospheric and microspheric forms.

Many of the smooth forms from Eocene material and some from the Cretaceous and even Jurassic are close to this species but enough differences are present to distinguish them.

In the more highly ornamented species of the Cretaceous there are a number of well characterized species.

Only those references are given which from a study of my own material seem to belong here.

Rotalina pleurostomata Schlumberger, (Feuille des Jeunes Naturalistes, ann. XIII, 1883, p. 25, pl. 3, figs. 5 *a, b,*) probably is the same as *Epistomina elegans* (d'Orbigny). The figures are not at all of a normal form, but Schlumberger in a note says that some of the shadows and characters of his original drawings have been exaggerated by the lithographer and leave much to be desired. Such figures might easily be misinterpreted.

Brady places *Rotalia flosculiformis* Schwager (*Novara*-Exped., Geol. Theil, vol. 2, 1866, p. 262, pl. 7, fig. 109) as a synonym of *"Pulvinulina partschiana"*. I have some of Schwager's original material from the Pliocene of Kar Nicobar and a search of this seems to show that the form called by Schwager *R. flosculiformis* which is close to the figure given by him is in reality a *Pulvinulinella* and not *Epistomina*. It is broadly keeled and has the aperture of *Pulvinulinella* and no sign of the aperture of *Epistomina*. No specimens of *Epistomina* were found in the material I have nor in my Pliocene material from Sumatra and Borneo.

EXPLANATION OF PLATE 31

In all figures *a* is peripheral view; *b*, dorsal view; *c*, ventral view. All × 65.

FIGS. 1-3. *Epistomina elegans* (d'Orbigny). Specimens from the Pliocene of Coroncina, Italy.

FIGS. 4-6. *Epistomina elegans* (d'Orbigny). (*E. Partschiana* (d'Orbigny)) from the Miocene of Baden near Vienna.

EXPLANATION OF PLATE 32

All figures *Epistomina elegans* (d'Orbigny).

FIG. 1. Microspheric specimen from the Miocene of Baden in peripheral outline. × 45.

FIG. 2. Microspheric specimen from off the Pacific Coast of America. × 45.

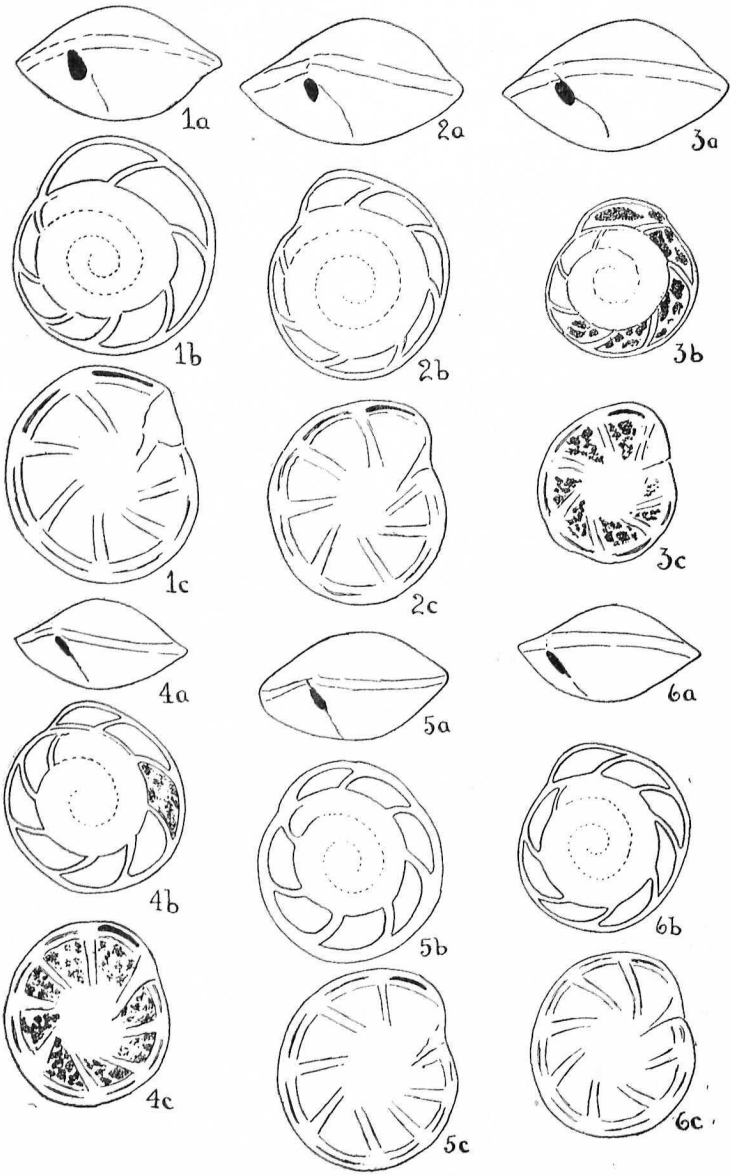
FIG. 3. Microspheric specimen from the Gulf of Mexico. × 45.

FIGS. 4 *a*, *b*. Megalospheric specimen from the same station as fig 2. × 45. *a*, peripheral view; *b*, dorsal view.

FIGS. 5 *a*, *b*. Megalospheric specimen from off Fowey Rocks, Fla. × 65. *a*, peripheral view; *b*, dorsal view.

FIGS. 6 *a*, *b*. Megalospheric specimen from Pico formation (Pliocene) of Los Angeles Basin. × 65. *a*, peripheral view; *b*, dorsal view.

FIGS. 7, 8. From Soldani's original figures. 7, ventral view; 8, dorsal view.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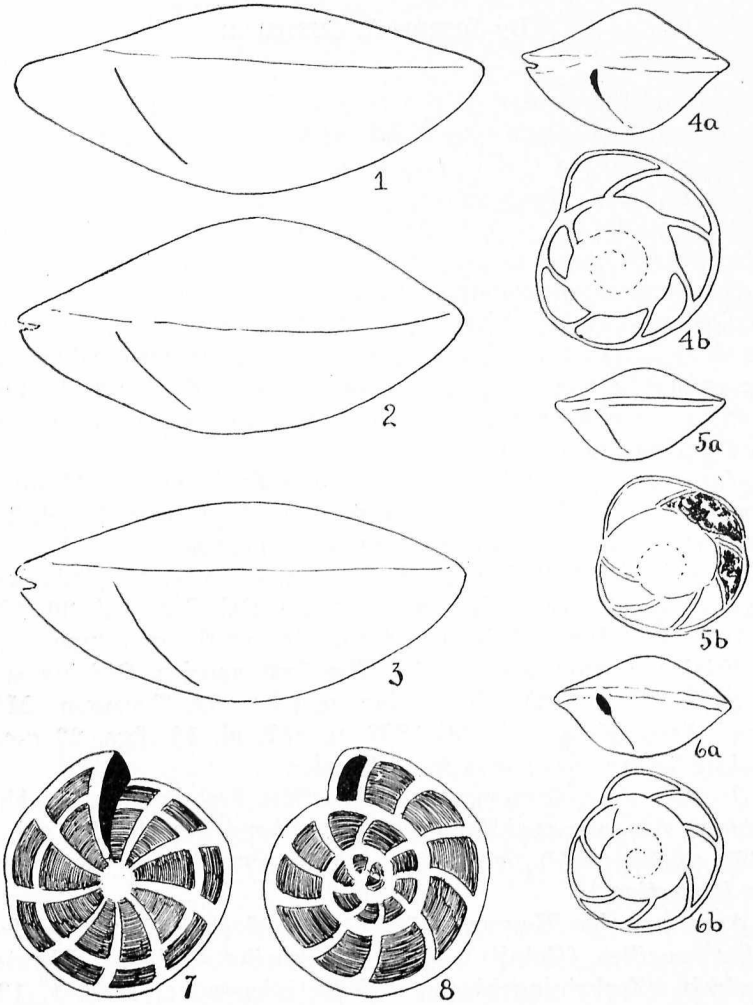
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53. THE DESIGNATION OF SOME GENOTYPES IN THE FORAMINIFERA

By JOSEPH A. CUSHMAN

Many of the genera of the foraminifera as in all groups of the animal kingdom are represented by single species. In these monotypic genera, the genotypes are of course established. In others although the genus may now have a number of known species, at the time of the erection of the genus but a single species was known and as far as the genotype is concerned, it is also a monotypic genus. In many other genera where several species were included by the original author subsequent workers have designated genotypes. A few genera which are recognized have not had genotypes designated. To make more definite the characters of a number of genera, genotypes are here designated for them.

Masonella H. B. Brady, 1889. The first species, *Masonella planulata* H. B. Brady, Ann. Mag. Nat. Hist., ser. 6, vol. 3, p. 295, fig. 1, is here designated as the genotype.

Nodosinella H. B. Brady, 1876. The first species, *Nodosinella digitata* H. B. Brady, Carbonif. Foram. Pal. Soc., vol. 30, 1876, p. 103, pl. 7, figs. 1-3, is here designated as the genotype.

Silicina Bornemann, 1874. The first species, *Silicina polymorpha* (Terquem)=*Involutina polymorpha* Terquem, Mém. Acad. Imp. Metz., vol. 44, 1863, p. 432, pl. 10, figs. 23 *a-c*, is designated as the genotype of *Silicina*.

Problematina Bornemann, 1874. The first species, *Problematina deslongchampsi* Terquem, Mém. Acad. Imp. Metz., vol. 44, 1863, p. 432, pl. 10, fig. 22 *a*, *b*, is designated as the genotype of *Problematina*.

Agathammina Neumayr, 1887. The first species, *Agathammina pusilla* (Geinitz)=*Serpula pusilla* Geinitz, Verstein. deutsch. Zechsteingebirges und Rothliegenden, Heft 1, 1846, p. 6, pl. 3, figs. 3-6, is designated as the genotype of *Agathammina*.

Cornuspira Schultze, 1854. In 1916, I designated *Cornuspira foliacea* (Philippi) as the genotype of *Cornuspira*. This was not one of the names used by Schultze at the time he erected the genus. *Cornuspira planorbis* Schultze as the first species should

be designated as the genotype (Organismus Polythalamien, 1854, p. 40, pl. 2, fig. 21). However, this species is apparently a synonym of *Cornuspira foliacea* (Philippi) and no change except in the matter of terminology is made.

Nouria Heron-Allen and Earland, 1914. The first species *Nouria polymorphinoides* Heron-Allen and Earland, Trans. Zool. Soc., vol. 20, 1914, p. 376, pl. 37, figs. 1-15, is here designated as the genotype.

Stacheia H. B. Brady, 1876. The first species *Stacheia marginulinoides* H. B. Brady, Carbonif. Foram., Pal. Soc., vol. 30, 1876, p. 112, pl. 7, figs. 16-21, is here designated as the genotype.

Glandulina d'Orbigny, 1826. The first species *Glandulina laevigata* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 252, pl. 10, figs. 1-3, is here designated as the genotype.

Flabellina d'Orbigny, 1839. The first species placed by d'Orbigny under this genus, *Flabellina rugosa* d'Orbigny, Mém. Soc. Géol. France, ser. 1, vol. 4, 1840, p. 23, pl. 2, figs. 4, 5 and 7, is here designated as the genotype.

Globulina d'Orbigny, 1826. The first species, *Globulina gibba* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 266, Modèle No. 63, is here designated as the genotype.

Vitriwebbina Chapman, 1892. The first species figured by Chapman, *Vitriwebbina sollasi* Chapman, Geol. Mag. dec. 3, vol. 9, 1892, p. 53, pl. 2, figs. 1-3, is here designated as the genotype.

Bradyina Möller, 1878. The second species given by Möller, *Bradyina nautiliformis* Möller, Mem. Acad. Imp. Sci. St. Petersburg, ser. 7, vol. 25, No. 9, 1878, p. 83, pl. 3, figs. 4 *a-d*, pl. 10, figs. 3 *a*, *b*, is here designated as the genotype. The other earlier species is somewhat questionable.

Assilina d'Orbigny, 1826. The first species, *Assilina discoidalis* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 296, Modèle No. 88, is here designated as the genotype.

Spiroclypeus H. Douvillé, 1905. The first species, *Spiroclypeus orbitoideus* H. Douvillé, Bull. Soc. Géol. France, ser. 4, vol. 5, 1905, p. 460, is here designated as the genotype.

Dendritina d'Orbigny, 1826. The first species, *Dendritina arbuscula* d'Orbigny, Ann. Sci. Nat., vol. 7, 1926, p. 285, pl. 15, figs. 6, 7, is here designated as the genotype.

Monalysidium Chapman, 1900. The first species given under this genus by Chapman, *Peneroplis* (*Monalysidium*) *sollasi*

Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, p. 3, pl. 1, fig. 6, is here designated as the genotype of *Monalysidium*.

Sorites Ehrenberg, 1838. *Sorites dominicensis* Ehrenberg, Abhandl. K. Akad. Wiss. Berlin, 1838, p. 134, is here designated as the genotype.

Heterohelix Ehrenberg, 1843. Two forms are given by Ehrenberg under his *Spiroplecta americana*. The form figured, Mikrogeologie, pl. 32, fig. 25, is here designated as the genotype of *Heterohelix*.

Guembelina Egger, 1899. The first species given by Egger, *Guembelina globulosa* (Ehrenberg)=*Textularia globulosa* Ehrenberg, Abhandl. K. Akad. Wiss. Berlin, 1838, p. 135, pl. 4, fig. 8, is here designated as the genotype of *Guembelina*.

Mimosina Millett, 1900. *Mimosina hystrix* Millett, Journ. Roy. Micr. Soc., 1900, p. 549, pl. 4, fig. 14, is here designated as the genotype after a study of the originals of the species given by Millett, now in the Collection of Heron-Allen and Earland in London.

Entosolenia Ehrenberg, 1848. Of the several species noted by Williamson, the first actually described in full, *Entosolenia lineata* Williamson, Ann. Mag. Nat. Hist., ser. 2, vol. 1, 1848, p. 18, pl. 2, fig. 18, is here designated as the genotype.

Siphogenerina Schlumberger, 1883. I selected as the genotype, *Siphogenerina raphanus* (Parker and Jones) although this species was not included by Schlumberger at the time of his erection of the genus. The genotype should be designated as *Siphogenerina costata* Schlumberger which is however apparently a synonym of the earlier *S. raphanus* (Parker and Jones).

Ellipsoidina Seguenza, 1859. The first species *Ellipsoidina ellipsoides* Seguenza, Eco Peloritans, ser. 2, vol. 5, 1859, fasc. 9, p. 12, pl., figs. 1-3, is here designated as the genotype.

Gyroidina d'Orbigny, 1826. The first species, *Gyroidina orbiculus* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 278. Modèle No. 13, is here designated as the genotype.

Asterigerina d'Orbigny, 1839. *Asterigerina carinata* d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminiférès", p. 118, pl. 5, fig. 25, pl. 6, figs. 1, 2, is here designated as the genotype.

Cycloloculina Heron-Allen and Earland, 1908. The first species, *Cycloloculina annulata* Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1908, p. 536, pl. 12, figs. 1-7, is here designated as the genotype.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand.

Hofker, J.
Die Foraminiferen aus dem Senon Limburgens. VI.
(Nat. Maan., Nat. Gen. Limburg, Jaarg. 16, No. 9, Sept. 30, 1927, pp. 125-128, 1 plate.) *Limburg.*
A paper devoted to structural details of *Polytrema minutum* and *Pulvinulina binkhorsti.*

Van der Vlerk, I. M., and J. H. F. Umbgrove.
Tertiaire Gidsforaminiferen van Nederlandsch Oost-Indië.
(Dienst van den Mijnbouw in Nederlandsch-Indië. Weten-Schappelijke Mededeelingen No. 6, 1927, pp. 1-31, 24 text figs., table.) *Bandoeng.*
A paper dealing with the index foraminifera of the East Indian region giving the distribution of the genera and a table of detailed stratigraphy of the region. The illustrations are for the most part beautifully executed diagrammatic figures showing the exterior, vertical and the equatorial sections. This is of pocket size and cloth covered for field use.

Vaughan, T. Wayland.
Larger Foraminifera of the Genus Lepidocyclina related to Lepidocyclina mantelli.
(Proc. U. S. Nat. Mus., vol. 71, Art. 8, 1927, pp. 1-5, pls. 1-4.) *Washington.*
One new species is described, and three other species and one variety figured.

Umbgrove, J. H. F.
Neogene Foraminiferen van de Soengei Beboeloe, Pasir (Zuidoost-Borneo). (Summary in English.)
(Wetensch. Med. Dienst Mijnb. Nederl.-Indië, No. 5, 1927, pp. 1-14, 2 pls.) *Weltevreden.*
A paper mostly on *Lepidocyclina* and *Miogypsina.*

Silvestri, A.

Sul Genere "Lepidorbitoides" A. Silvestri e di un Suo Nuovo giacimento.

(Mem. Pont. Accad. Sci. Nuovi Lincei, vol. 10, 1927, pp. 109-140, pl. 1.) *Rome.*

A treatment of eleven species referred to this genus. Two of the species are figured.

Tobler, Aug.

Neue Funde von obereocänen Grossforaminiferen in der nordperuanischen Küstenregion.

(Eclogae geol. Helv., vol. 20, No. 3, 1927, pp. 415-422, 1 text fig.) *Basel.*

The distribution, particularly of the orbitoids of this region, is given with a bibliography of papers relating to these forms in Peru.

Werenfels, A.

Geology of the Illescas Region, Northern Peru, (South Ameria).

(Ecologae geol. Helv., vol. 20, No. 4, 1927, pp. 473-486, 1 plate, 4 text figs.) *Basel.*

A few species are noted, taken from the previous paper of Dr. Tobler's. The figures are maps and the plate one of photographs of surface topography.

Hofker, J.

The Foraminifera of the Siboga Expedition. Part I. Families Tinoporidae, Rotaliidae, Nummulitidae, Amphisteginidae.

(Monograph IV, Siboga Exped., pt. 1, Nov. 1927, pp. 1-78, pls. I-XXXVIII, text figs. 1-11.) *Leiden.*

An exhaustive treatment with many detailed figures and sections of these groups. The plates show the finer structure, and some excellent technical methods for studying the internal structure are given.

Hodson, Floyd and Helen.

Short Cuts in Picking out and Sectioning Foraminifera.

(Bull. Amer. Assoc. Petr. Geol., vol. 10, No. 11, Nov. 1926, pp. 1173, 1174.) *Chicago.*

The use of heavy liquids, oxy-acetylene torch and acid are all noted.

Liebus, Adalbert.

Neue Beiträge zur Kenntnis der Eozänfauna des Krappfeldes in Kärnten.

(Jahrb. Geol. Bund., vol. 77, 1927, pp. 333-392, pls. 12-14.) *Wien.*

There are 49 species and varieties of foraminifera with 8 described as new. A few other groups are briefly noted and a six page bibliography given.

Woodring, W. P.

Marine Eocene Deposits on the East Slope of the Venezuelan Andes.

(Bull. Amer. Assoc. Petr. Geol., vol. 11, No. 9, Sept. 1927, pp. 992-996.) *Chicago.*

A discussion of the orbitoid foraminifera found and their relationships to the species of Panama, the West Indies and elsewhere.

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Some results of the study of Ehrenberg's original collection are given.

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Twelve species mostly arenaceous are described, five of them new.

J. A. C.