CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

183. NOTES ON SOME OF THE SPECIES REFERRED TO VERTEBRALINA AND ARTICULINA, AND A NEW GENUS NODOBACULARIELLA

By JOSEPH A. CUSHMAN and SHOSHIRO HANZAWA

Study of late Tertiary material from the Ryukyu Islands and comparison with Recent material from the Pacific and elsewhere have led us to an examination of the species referred by various authors to the genera *Vertebralina* and *Articulina*. Notes on some of these species may be of use to other workers, and are here given, though often necessarily in an indefinite way. It would help in the solution of some of these problems if living material could be studied, and the actual development of related tests of the microspheric and megalospheric forms could be studied in larger series. The description of the new genus and its type species will be given first, so that it may be included in the later discussions.

Genus NODOBACULARIELLA Cushman and Hanzawa, n. gen.

Genotype, *Nodobacullariella japonica* Cushman and Hanzawa, n. sp.

Test free, compressed, early portion planispiral, later becoming uncoiled, nearly or sometimes completely bilaterally symmetrical; chambers consisting of a globular proloculum, immediately followed by a planispiral, tubular chamber ½ coil in length, and then by several, rapidly widening chambers, each normally ½ coil in length, sometimes shorter so that three chambers may make up a coil, the adult stage with somewhat involute chambers, partially concealing the earlier ones, and in the final development a single, uncoiled chamber; wall calcareous, imperforate; aperture long, narrow, in the median portion of the terminal face of the chamber, with an everted lip, but without teeth.

This is a genus of shallow, warm waters so far as known as a Tertiary and Recent one.

Nodobacullariella resembles *Nodobacularia*, Rhumbler, but our genus has the ophthalmidium stage much more developed and the uncoiled portion much reduced. It should be placed in the family Ophthalmidiidae.

NODOBACULARIELLA JAPONICA Cushman and Hanzawa, n. sp. (Pl. 5, figs. 9-11)

Test strongly compressed, early portion planispiral, later uncoiled, nearly or completely bilaterally symmetrical, periphery acute, with a thin keel; chambers in the early portion consisting of a globular proloculum, directly followed by a planispiral, tubular chamber ½ coil in length, and later by 5 or 6 loosely coiled and rapidly widening chambers, usually ½ coil in length and 180° apart, sometimes reduced in length so that 3 chambers make a coil, the coils separated somewhat and filled by the thin keel of the earlier coil, chambers usually involute or sometimes evolute, in the former with umbilici at the center on both sides, the last chamber uncoiled, usually rectangular in side view; sutures depressed, often obscure; wall calcareous, imperforate, ornamented by distinct, longitudinal costae, sometimes anastomosing to form a reticulate pattern; aperture a long, narrow opening in the median portion of the terminal face of the chamber, with an everted lip, but without teeth. Length up to 1.20 mm.; breadth 0.95 mm.

Holotype (Institute of Geology and Paleontology, Tohoku Imperial University, Sendai, Japan) from the Ryukyu limestone, (Pliocene or Pleistocene, 500 meters N. of Kamikatetsu, Kikaijima, Ryukyu Islands; paratypes (Cushman Coll. No. 23729).

NODOBACULARIELLA ATLANTICA Cushman and Hanzawa, n. sp. (Pl. 5, figs. 7, 8)

Test very strongly compressed, periphery acute with a distinct, thin, narrow keel; chambers planispiral, not involute, all typically visible from either side, in the adult triangular, very slightly inflated in the middle, usually 3 in the adult coil, occasionally 2; wall ornamented by numerous, fine costae obliquely curved, sometimes much reduced or almost wanting; aperture elongate, narrow, terminal, with a slightly everted lip. Length 0.60-0.75 mm.; breadth 0.50-0.65 mm.

Holotype (Cushman Coll. No. 23726) from *Albatross* D2420, eastern coast U. S., 37° 03′ 20″ N.; 74° 31′ 40″ W. in 104 fms.

This is the form referred by Flint to "*Vertebralina insignis* Brady" (Ann. Rep't U. S. Nat. Mus., 1897 (1899), p. 302, pl. 47, fig. 4), but differs from Brady's species in the less involute chambers, which are less inflated, usual absence of uniserial chambers, and more simple, costate surface ornamentation.

Genus VERTEBRALINA d'Orbigny, 1826

Genotype, *Vertebralina striata* d'Orbigny

Vertebralina D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 283.

Test free, compressed, early portion a trochoid spiral, later uncoiled and rectilinear; chambers consisting of a globular proloculum, immediately followed by a planispiral, tubular chamber ½-1 coil in length, succeeded by rapidly widening chambers in a trochoid spire, each ½ coil or less in length, all visible from the dorsal side, only 3 or 4 of the last-formed visible from the ventral side, leaving a deep, ventral umbilicus; wall calcareous, imperforate; aperture elongate, narrow, terminal, but somewhat lateral, the lip on the dorsal side more extended than on the ventral side in both young and adult stages.

The type species was first described by d'Orbigny from the Mediterranean, Red Sea and South Seas (Rawack).

VERTEBRALINA STRIATA d'Orbigny (Pl. 5, figs. 4-6)

Test much compressed, early portion trochoid, later uncoiled; chambers consisting of a globular proloculum followed by a spiral, tubular chamber ½-1 coil in length, and 7 or 8, rapidly widening, subtriangular chambers in a trochoid spire, earliest ones ½ coil in length, then progressively shortening, all visible from dorsal side, those of the last coil visible from the ventral side which is deeply umbilicate, followed by usually 3, uncoiled, nearly quadrate chambers; sutures distinct, in the later portion depressed; wall ornamented by fine, longitudinal or oblique costae, often fused with a reticulate pattern, and often with deep pits near the apertural margin; aperture simple, elongate, somewhat lateral, the lip on the dorsal side more protruded than on the ventral. Coiled portion up to 1.00 mm. in length and 0.94 mm. in breadth; uncoiled adults up to 1.40 mm. in length and 1.00 mm. in breadth.

A figure is given of the original model of d'Orbigny, of a Recent specimen from the Mediterranean and of two specimens from the Ryukyu limestone, (Pliocene or Pleistocene), 500 meters N. of

Kamikatetsu, Kikai-jima, Ryukyu Islands. The species is somewhat variable, but the main characters are fairly constant.

In dealing with these various forms, we have studied all the available material. In order to definitely determine the status of a number of species, it will be necessary to study the actual types, and as this cannot be done by us at present, some species must be left as indefinite.

Vertebralina cassis d'Orbigny (in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 51, pl. 7, figs. 14, 15) and *V. mucronata* d'Orbigny (l. c., p. 52, pl. 7, figs. 16-19) are quinqueloculine or triloculine in their early stages and should be assigned to *Articulina*.

Vertebralina contracta Terquem (Mém. Soc. géol. France, ser. 3, vol. 2, 1882, p. 45, pl. 2 [10], figs. 19-22) from the Eocene of the Paris Basin evidently includes two different species. Figs 19, 20 seem to represent early stages of an *Articulina*, while figs. 21, 22 probably belong to *Nodobaculariella*.

Vertebralina laevigata Terquem (l. c., p. 44, pl. 2 [10], figs. 15-18) is evidently not well figured, and is probably not a true *Vertebralina* but is difficult to place without seeing the type.

Vertebralina elongata Karrer (Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 155, pl. 3, fig. 10) from the Miocene of Kostej does not show the early stages in the type figure. It is evidently not a *Vertebralina*, but belongs either to *Nodobacularia* or *Articulina*.

Vertebralina sarmatica Karrer (Abhandl. k. k. geol. Reichs., vol. 9, 1877, p. 376, pl. 16-*b*, fig. 12) from the Miocene of the Vienna Basin is evidently not a *Vertebralina*, and its definite position is difficult to make out.

Vertebralina insignis H. B. Brady (Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 187, pl. 12, figs. 9-11) from Recent Pacific material is probably a *Nodobacullariella*, but as a single topotype is at present available to us it is impossible to state this with certainty.

Vertebralina advena Cushman (U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 102, pl. 25, figs. 5, 6) from the lower Oligocene of Byram, Miss. has the early chamber quinqueloculine, and should be assigned to *Articulina*.

Vertebralina jamaicensis Cushman and Jarvis (Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 77, pl. 10, figs. 5, 6) from the Eocene of Jamaica is bilaterally symmetrical, the aperture terminal and median, and so evidently should be referred to our new genus *Nodobacullariella*.

Of the various species described as *Articulina* that are available to us, the following are apparently generically and specifically valid.

Articulina nitida d'Orbigny (Ann. Sci. Nat., vol. 7, 1826, p. 300; Modèles, 1826, No. 22).

A. sagra d'Orbigny (in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, Foraminifères, p. 183, pl. 9, figs. 23-26).

A. gibbulosa d'Orbigny (Foram. Foss. Bass. Tert. Vienne, 1846, p. 282, pl. 20, figs. 16-18).

A. sulcata Reuss (Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 383, pl. 49, figs. 13-17).

A. lineata H. B. Brady (Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 185, pl. 13, figs. 6-11).

A. foveolata Heron-Allen and Earland (Journ. Roy. Micr. Soc., 1909, p. 317, pl. 15, fig. 8).

A. mexicana Cushman (Publ. 311, Carnegie Instit. Washington, 1922, p. 70, pl. 11, figs. 7, 8).

A. mayori Cushman (l. c., p. 71, pl. 13, fig. 5).

A. byramensis Cushman (U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 103, pl. 27, figs. 5, 6).

A. terquemi Cushman (Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 3, pl. 1, figs. 7 *a-c*).

The following species should probably be assigned elsewhere:

Articulina conico-articulata (Batsch). This specific name has been assigned by various authors to *Vertebralina* and *Articulina*. The original figure and description are inadequate to prove whether it belongs to *Articulina*, *Nodobacularia* or *Vertebralina*, particularly as the early stages are unknown. It seems wise, therefore, to discard this name, as it represents an invalid species. The form described by Millett under the above name has already been assigned to *Nodobacularia milletti* Cushman.

Articulina compressa Reuss (Neues Jahrb. für. Min., 1853, p. 673, pl. 9, figs. 3 *a*, *b*). This is perhaps a *Nodobaculariella*, but at least is not an *Articulina*.

Articulina funalis H. B. Brady (Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 185, pl. 13, figs. 6-11) and its var. *inornata* H. B. Brady (l. c., p. 186, pl. 13, figs. 3-5) are already placed in the genus *Tubinella*.

*Articulina multiloculari*s H. B. Brady, Parker and Jones (Trans. Zool. Soc., London, vol. 12, 1888, p. 215, pl. 40, fig. 10) according to the original description has a spiroloculine plan of

growth. It probably therefore belongs to *Nodobaculariella*, but not to *Vertebralina* or *Articulina*.

The few other species as already stated cannot be determined without a study of the actual type specimens.

184. NOTES ON SOME EUROPEAN EOCENE SPECIES OF BULIMINA

By JOSEPH A. CUSHMAN and FRANCES L. PARKER

In our study of the genus *Bulimina* and its related genera, it has been necessary to establish definitely the characters of the earlier species described by d'Orbigny and others. As the original works of d'Orbigny have been inaccessible to workers, they have apparently followed the figures given in the *Challenger* Report which are usually not identical. A review of the literature has shown what an array of varied figures are identified by later authors with the earlier species. It is with the hope that it may help others to an understanding of these older species, which must be considered before later names may be applied, that the following notes are made. Illustrations are given of carefully drawn specimens, from the type locality when possible, so that the characters of the various forms may be available for other workers.

BULIMINA PYRULA d'Orbigny (Pl. 6, fig. 1)

Bulimina pyrula D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 184, pl. 11, figs. 9, 10.

Test of medium size, about 1½ times as long as broad, acuminate at both ends; chambers few, slightly inflated, 2-3 whorls, the last-formed whorl composing about ⅞ of the test; sutures slightly depressed; wall smooth, polished, often translucent, frequently ornamented with one or more small spines at the base, coarsely perforate; aperture loop-shaped, with a well defined lip and tooth. Length of specimens from Baden 0.36-0.64 mm.; diameter 0.26-0.40 mm.

This species occurs at several localities in the Vienna Basin. The figured specimens are from Baden, and are topotypes.

D'Orbigny in his description and figure does not show the pres-

ence of occasional spines at the base of the test, but as they are very small and often absent it seems probable that he overlooked them entirely. In all other respects our specimens coincide closely with his.

Although this species has been recorded many times from Tertiary and Recent material by numerous authors, very few figures have been given. Those that do appear are evidently based on the figures given by Brady in the *Challenger* Report which should be referred to *Globobulimina*, and are not the same as the species of d'Orbigny.

BULIMINA PUPOIDES d'Orbigny (Pl. 6, figs. 2, 3)

Bulimina pupoides D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 185, pl. 11, figs. 11, 12.

Test of medium size, twice as long as broad or less, very slightly tapering; chambers numerous, somewhat inflated, about 5 whorls; sutures distinct, depressed; wall smooth, often somewhat translucent, perforate; aperture loop-shaped, with a well defined lip, and often with a tooth. Length of specimens from Baden 0.30-0.80 mm.; diameter 0.20-0.40 mm.

The species occurs at many localities in the Vienna Basin. The figured specimens are from Baden, near Vienna.

Our specimens coincide closely with d'Orbigny's figures and description. There is some variation in the relative length of the test and the height of the chambers, and two extremes are figured.

Brady's *Challenger* figures referred to this species are of Recent specimens from the South Atlantic, and are not identical. An examination of the published figures referred to this species shows a bewildering array of forms, few of them being at all like that of the Vienna Basin Miocene species.

BULIMINA OVATA d'Orbigny (Pl. 6, figs. 4, 5)

Bulimina ovata D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 185, pl. 11, figs. 13, 14.

Test of medium size, twice as long as broad or less, oval in shape, the broadest portion about ⅓ of the way down from the apertural end; chambers few, somewhat inflated, 2-3 whorls, the last-formed whorl forming ½ or more of the test; sutures distinct, depressed; wall smooth, somewhat translucent, perforate; aperture loop-shaped, with a well defined lip and tooth. Length

of specimens from Baden 0.38-0.64 mm.; diameter 0.26-0.34 mm.

The species occurs at several localities in the Vienna Basin. The figured specimens are from Baden, near Vienna.

This form is closely related to *B. pupoides* d'Orbigny, but differs from it in the oval form of the test and in the shape of the chambers. D'Orbigny's figures of this species apparently represent the microspheric form, which occurs far less commonly than the megalospheric.

BULIMINA BUCHIANA d'Orbigny (Pl. 6, figs. 6, 7)

Bulimina buchiana D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 186, pl. 11, figs. 15-18.

Test of medium size, about twice as long as broad, gradually tapering, broadest portion somewhat above the middle, sometimes with a well developed, basal spine; chambers numerous, 5-6 whorls in the adult form, distinct in the later portion; sutures in the smooth part of the test distinct, depressed; wall of most of the last-formed whorl smooth, perforate, rest of test with longitudinal costae usually extending unbroken across at least 2 chambers, sometimes more; aperture loop-shaped with a distinct lip. Length of specimens from Baden 0.34-0.90 mm.; diameter 0.22-0.44 mm.

EXPLANATION OF PLATE 5

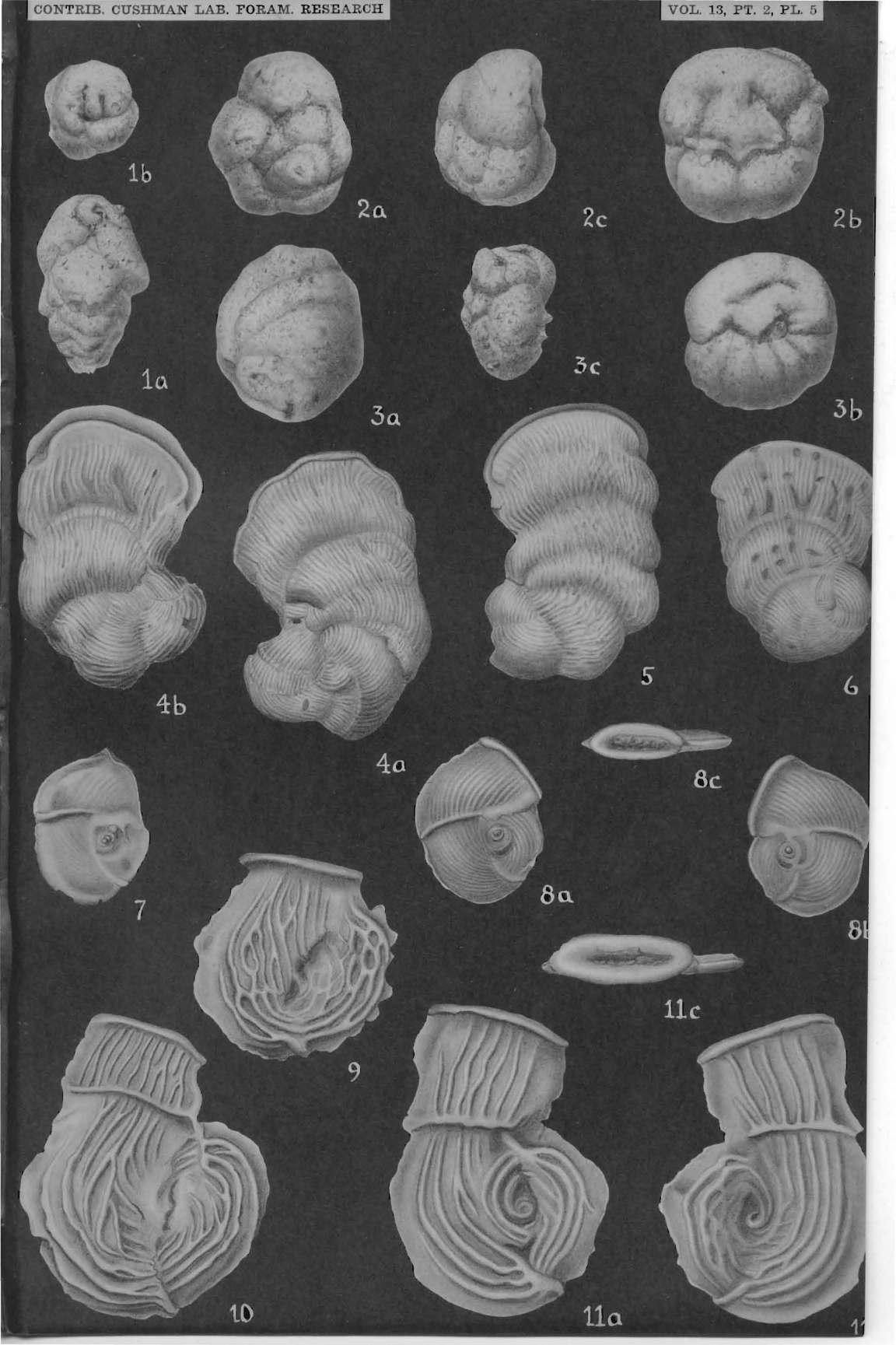
FIGS.

1. *Valvulina martii* Cushman and Bermudez. Eocene, 850 meters NW. of Peñon, 7 kms. S. of Hato Nuevo, Matanzas Province, Cuba. × 35. *a*, front view; *b*, apertural view.
2. *Valvulammina cubensis* Cushman and Bermudez. Eocene, 850 meters NW. of Peñon, 7 kms. S. of Hato Nuevo, Matanzas Province, Cuba. × 20. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
3. *V. affinis* Cushman and Bermudez. Eocene, 850 meters NW. of Peñon, 7 kms. S. of Hato Nuevo, Matanzas Province, Cuba. × 20. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

4–6. *Vertebralina striata* d'Orbigny. × 35. 4, Recent, Id. of Delos, Mediterranean. *a*, dorsal view; *b*, ventral view. 5, 6, Pleistocene(?), Ryukyu limestone, Ryukyu Ids.

7, 8. *Nodobaculariella atlantica* Cushman and Hanzawa, n. gen. and n. sp. × 35. Recent, *Albatross* D2420, Lat. 37° 03′ 20″ N.; Long. 74° 31′ 40″ W., 104 fms. 7, Paratype. 8, Holotype. *a*, *b*, opposite sides; *c*, apertural view.

9–11. *N. japonica* Cushman and Hanzawa, n. gen. and n. sp. × 35. Pleistocene(?), Ryukyu limestone, Ryukyu Ids. 9, 10, Paratypes. 11, Holotype. *a*, *b*, opposite sides; *c*, apertural view.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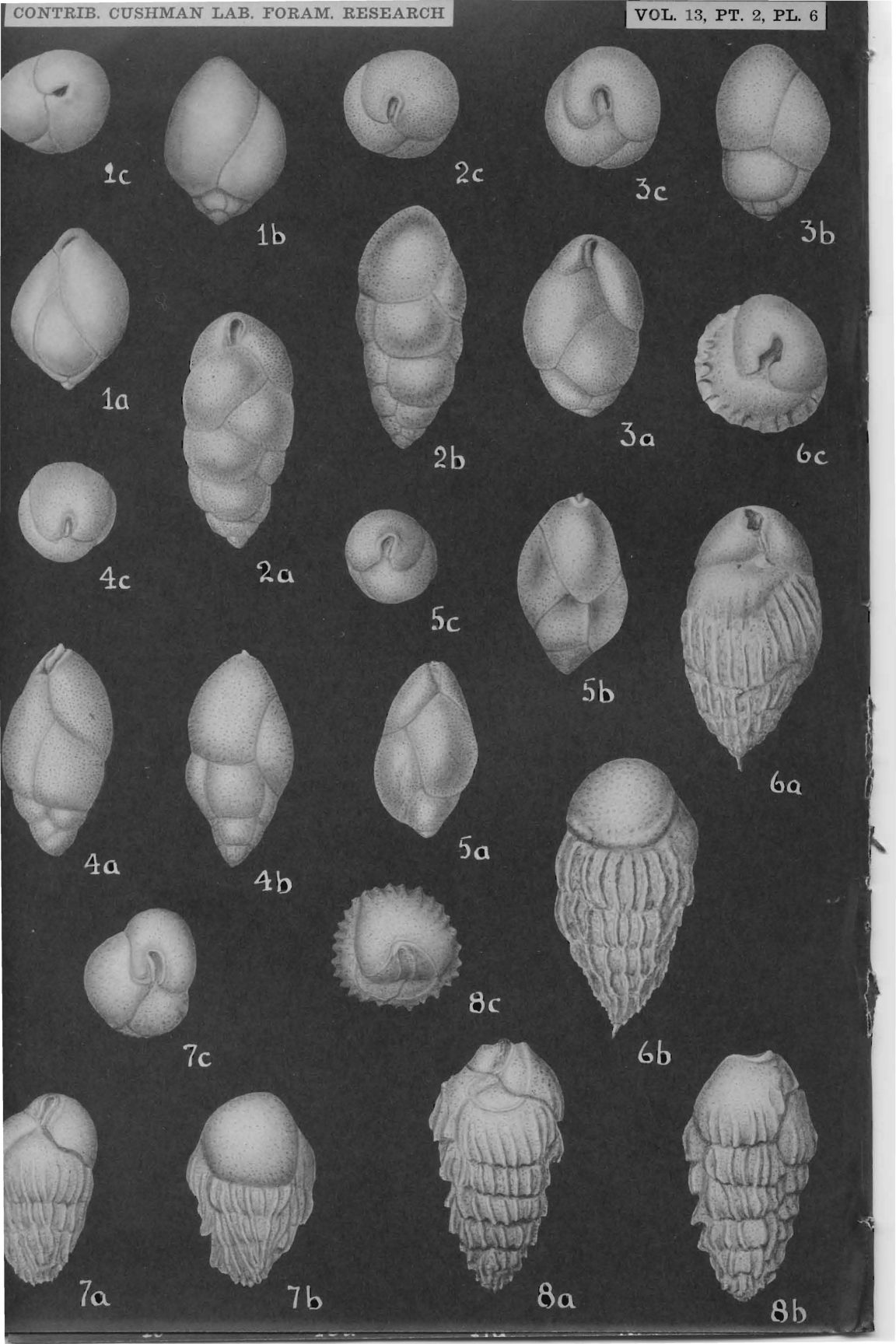
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This species occurs at many localities in the Vienna Basin. The figured specimens are from Baden, near Vienna.

Our specimens coincide closely with d'Orbigny's figures and description. He shows two forms, one elongate and somewhat fusiform, the other shorter and broader. The costae are lower and more numerous than in the form referred to this species by Brady in the *Challenger* Report, a form which has evidently been followed by many later authors. The literature shows very coarsely costate forms as well as smooth ones referred to under this name.

BULIMINA ELONGATA d'Orbigny (Pl. 7, figs. 1-3)

Bulimina elongata D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 187, pl. 11, figs. 19, 20.

Bulimina inconstans EGGER, Neues Jahrb. für Min., 1857, p. 283, pl. 12, figs. 1-3, 8-9.

Bulimina scabriuscula REUSS, Sitz. Akad. Wiss. Wien, vol. 42, 1860 (1861), p. 360, pl. 2, figs. 13 *a*, *b*.

Test long and slender, 3 or more times as long as broad, width practically uniform throughout most of the test, except in the microspheric form where the last-formed chambers are inflated; chambers numerous, 5-6 whorls, slightly inflated; sutures distinct, depressed; wall smooth, polished, often translucent, very finely perforate; aperture a long, loop-shaped opening with a well defined lip. Length of specimens from Baden and Nussdorf 0.28-0.67 mm.; diameter 0.14-0.22 mm.

This species occurs at many localities in the Vienna Basin. Figure 1 is from the type locality at Nussdorf, and figures 2 and 3 are from Baden near Vienna.

Specimens from Dingden, Germany, were found to be identical with the Vienna forms, and were also found to coincide with Reuss' description and figures of *B. scabriuscula*, which is therefore placed in the synonymy. Other specimens were found at

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EXPLANATION OF PLATE 6

FIGS.

1. *Bulimina pyrula* d'Orbigny. × 50. Topotype.
2, 3. *B. pupoides* d'Orbigny. × 50.
4, 5. *B. ovata* d'Orbigny. 4, × 70. 5, × 50.
6, 7. *B. buchiana* d'Orbigny. × 50.
8. *B. buchiana* d'Orbigny, var. *calabra* Seguenza. × 70.

In all figures: *a*, front view; *b*, rear view; *c*, apertural view.

Ortenburg, Germany, which is similar to Egger's type locality for *B. inconstans*, and which indicates that the species should be placed in the synonymy here also.

Our specimens, even in a single locality, show a wide range of variation. Representative forms, however, coincide closely with d'Orbigny's figures and description.

BULIMINA TUBERCULATA Egger (Pl. 7, fig. 4)

Bulimina tuberculata EGGER, Neues Jahrb. für Min., 1857, p. 284, pl. 12, figs. 4-7.

Test small, about twice as long as broad, triangular in cross section with rounded angles, slightly tapering; chambers numerous, about 5 whorls, arranged in series with adjacent chambers joined in a zigzag line, inflated; sutures distinct, depressed; wall coarsely punctate; aperture a broad, loop-shaped opening. Length of specimens from Ortenburg 0.24-0.42 mm.; diameter 0.12-0.20 mm.

This species is very common in the Miocene near Ortenburg, Germany, which is Egger's type locality for this species. A topotype is here figured.

Our specimens seem to be identical with the form shown in Egger's first three figures (figs. 4-6); the fourth figure (fig. 7) apparently represents a young form of another species which occurs with *B. tuberculata*, but is quite distinct from it both generically and specifically.

BULIMINA ELONGATA d'Orbigny, var. TENERA Reuss (Pl. 7, fig. 5)

Bulimina tenera REUSS, Sitz. Akad. Wiss. Wien, vol. 55, pt. 1, 1876, p. 94, pl. 4, figs. 11, 12.

Variety differing from the typical in having the last-formed whorl forming much the larger portion of the test, usually about ⅔, in the more pointed, apertural end and broader aperture. Length of specimens from Baden 0.40-0.50 mm.; diameter 0.14-0.20 mm.

The variety occurs at Baden, in the Vienna Basin, and in the Miocene of Egypt.

Although we have no topotype material of this variety (Miocene, Wieliczka, Galicia), our specimens are so similar to Reuss' first two figures (figs. 11 *a*, *b*) that there seems little doubt of the identification. The third figure (fig. 12) obviously represents another form entirely, and may be disregarded. The form has

been made a variety of *B. elongata* d'Orbigny, owing to its very close resemblance to that species. The initial portions of both are identical.

BULIMINA BUCHIANA d'Orbigny, var. CALABRA Seguenza (Pl. 6, fig. 8)

Bulimina buchiana D'ORBIGNY, var. *calabra* SEGUENZA, Atti. Accad. Pont. Nuovi Lincei, ser. 3, vol. 6, 1880, p. 146, pl. 13, fig. 34.

Variety differing from the typical in having more whorls and somewhat more overhanging chambers. Length of figured specimen 0.60 mm.; diameter 0.30 mm.

Our specimens are from the Tortonian, shelly sand, Varpolata, Hungary, one of which is figured.

Our specimens seem to coincide closely with that described by Seguenza.

BULIMINA ELONGATA d'Orbigny, var. SUBULATA Cushman and Parker, n. var. (Pl. 7, fig. 6, 7)

Variety differing from the typical in having well developed spines at the base of the test, varying in length and number. Length of specimens from Baden 0.32-0.57 mm.; diameter 0.20-0.24 mm.

Holotype of variety (Cushman Coll. No. 23723) from the Miocene of Baden, near Vienna, Austria.

This form has been referred to *B. aculeata* d'Orbigny by authors, but is quite distinct from that species. It occurs frequently with the typical form, but can be easily separated from it by spinose characters. Specimens were found from several localities of the Vienna Basin Miocene and in other Miocene localities of Europe and Egypt.

BULIMINA ELONGATA d'Orbigny, var. LAPPA Cushman and Parker, n. var. (Pl. 7, fig. 8)

Variety differing from the typical in having a much shorter, broader test with thicker walls, the initial portion of the test covered with very short, blunt spines. Length of specimens from Nussdorf 0.30-0.54 mm.; diameter 0.20-0.28 mm.

Holotype of variety (Cushman Coll. No. 23725) from the Miocene of Nussdorf, near Vienna, Austria.

This variety is much less common than *B. elongata*, var. *lappa*, but sometimes occurs with it. Reuss has referred to it as *B. aculeata* Czjzek (Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 374, pl. 47, fig. 13). It is distinguished from the typical form and from the variety *subulata* by its shorter, heavier test and the

short spines, which often appear only as a roughening of the lower portion of the test. We have specimens from several localities in the Miocene of the Vienna Basin.

Questionable species:

Bulimina buccinoides Egger (Neues Jahrb. für. Min., 1857, p. 282, pl. 10, figs. 9-11) from the Miocene of Hausbach, Bavaria. No material referable to this species was found. The ambiguous character of the figure makes a positive identification difficult.

Bulimina pygmaea Egger (l. c., p. 284, pl. 12, figs. 10, 11) from the Miocene of Habühl, Bavaria. The figure obviously does not represent a *Bulimina*. Sherborn suggests that the form belongs to the genus *Verneuilina*.

Bulimina incrassata Karrer (Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 177, pl. 4, fig. 12) from the Miocene of Kostej, near Banat, Hungary. The figures resemble the megalospheric form of *B. pupoides* d'Orbigny which occurs at this locality, but are too poor to permit a positive identification.

Bulimina bulbiformis Seguenza (Atti. Accad. Pont. Nuovi Lincei, ser. 3, vol. 6, 1880, p. 146, pl. 13, fig. 35) from the Miocene of Calabria. No topotype material referable to this form was available.

Bulimina calcarata Seguenza (l. c., p. 146, pl. 13, fig. 36) from the Miocene of Calabria. Specimens of *B. pyrula* d'Orbigny from Baden show spines at the base similar to Seguenza's figured specimen. The figure is too poor, however, to permit of a positive identification.

Bulimina triquetra Franzenau (Termesz, Füzetek, vol. 15, 1892, p. 139) from the Miocene of Romhany, Hungary. No figures were given of this species.

Bulimina parvula Franzenau (l. c., p. 139) from the Miocene of Romhany, Hungary. No figures were given of this species.

Bulimina porrecta Franzenau (Glasn. Hrvat. Nar. Druztva, vol. 7, pt. 6, 1894, pl. 5, figs. 1 *a*, *b*) from the Miocene of Markusevec. Identification is impossible owing to the lack of topotype material.

Bulimina cuspidata Franzenau (l. c., pl. 5, figs. 2, 3) from the Miocene of Markusevec. The figures resemble *B. pyrula* d'Orbigny, but lack of topotype material makes a positive identification impossible.

Bulimina andreaei Schubert (Sitz. deutsch. nat.-med. Ver. Bohmen, "Lotos" XX, 1900, p. 59, pl. 2, fig. 3) from the Miocene

of Moravia (Wolfsdorf) = *Virgulina* (*Virgulinella*) *pertusa* (Reuss) (Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 22, pl. 3, figs. 16 *a*, *b*).

Bulimina rotula Schubert (Jahrb. k. k. Geol. Reichs., Wien, vol. 53, 1904, p. 416, pl. 19, fig. 7) from the Tertiary of Austria. Nothing referable to this species was found.

Bulimina affinis d'Orbigny, var. *tenuissimestriata* Schubert (l. c., p. 416, pl. 19, fig. 5) from the Tertiary of Austria. Nothing referable to this species was found.

Bulimina elegans d'Orbigny, var. *gibba* Schubert (l. c., p. 416, pl. 19, fig. 6) from the Tertiary of Austria. A single specimen similar to Schubert's figure was found in Miocene material from Bulgaria.

Bulimina arcuata d'Orbigny (Ann. Sci. Nat., vol. 7, 1826, p. 270, No. 12; Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6 *a*, vol. 5, 1908, p. 46, pl. 1, fig. 12) from the Miocene near Dax, France. The figure suggests that the form belongs to the genus *Robertina*, but lack of topotype material referable to it makes a positive identification impossible.

Bulimina convoluta Williamson, var. *dehiscens* Heron-Allen and Earland (Journ. Roy. Micr. Soc., 1924, p. 143, pl. 8, figs. 26-28) from the Miocene of "Filter Quarry," Victoria, Australia = *Ceratobulimina dehiscens* (Heron-Allen and Earland) (Cushman and Harris, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 176, pl. 29, figs. 7 *a-c*).

Bulimina sculptilis Cushman, var. *laciniata* Cushman and Parker and *Buliminella bassendorfensis* Cushman and Parker (Contr. Cushman Lab. Foram. Res., vol. 13, 1937, pp. 38, 40). The data for our type locality for these forms was incomplete as sent us with the material. Our attention has been called to this by Dr. Hubert G. Schenck, and he has given us the complete data for these which should read as follows: railroad cut, south side of Alsea Bay, Sec. 19, T. 13 S., R. 11 W., Waldport Quadrangle, Lincoln Co., Oregon, collected by H. E. Wheeler and H. G. Schenck, Sept. 14, 1926. This locality is shown in Dr. Schenck's report "Stratigraphic relations of western Oregon Oligocene formations," (Univ. Calif. Publ. Bull. Dept. Geol. Sci., vol. 18, No. 1 [Nov. 30, 1928], p. 33).

Siphogenerinoides clarki Cushman and Campbell (Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 91). The types of

this species were incorrectly labeled when sent to this laboratory, and Mr. C. C. Church has given the corrected locality as follows: "Marsh Creek, Contra Costa County, California, at the bend just below mouth of Briones Creek, ½ mile southwest of John Marsh house, S/2, SW/4, NW/4, Section 35, Township 1 North, Range 2 East, M. D. B. & M., Byron Quadrangle."

185. NOTES ON THE EARLY DESCRIBED EOCENE SPECIES OF UVIGERINA AND SOME NEW SPECIES

By JOSEPH A. CUSHMAN and PATRICIA G. EDWARDS

Studies which we are making on the genus *Uvigerina* and its allied forms have necessitated the determination in so far as possible of the earlier described species. Herewith are some notes on those species which were described by the earlier authors from the Eocene of Europe, as it is necessary to know those species definitely before our American forms can be compared with them, as in many cases the species of the two areas are very similar if not identical. As in numerous other genera of the foraminifera, a few species such as *"U. pygmaea, U. tenuistriata, U. angularis"* and so forth have been used constantly to include a great variety of forms both fossil and Recent, which, from the figures given, are not at all related to those species as defined and figured by the original authors.

We have endeavored to study topotype material of these earlier species which are not always adequately figured or described.

UVIGERINA EOCAENA Gümbel (Pl. 8, figs. 1, 2)

Uvigerina eocaena GÜMBEL, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 10, 1870, p. 645, pl. 2, fig. 78.

Test elongate, about twice as long as broad, later portion very slightly compressed, earlier portion definitely triserial, in the adult tending slightly to become biserial, greatest breadth at about the middle; chambers fairly distinct, somewhat inflated; sutures slightly depressed; wall ornamented with numerous, rather high, longitudinal costae, those of each chamber independent of adjacent ones; aperture rounded, with a short neck and slight lip. Length up to 0.65 mm.; diameter 0.35 mm.

The types of this species are from Eocene Nummulitenmergel of Hammer. We have not been able to find this species in our material from the type locality, but the figured specimens which seem to be identical are from the Eocene of Haering.

The type figure given by Gümbel is evidently not an adult specimen, and is very similar to our plate 8, figure 2. Most of the specimens seem not to have developed beyond this stage, but occasional ones such as plate 8, figure 1, develop the adult characteristics shown, giving the distinct fusiform shape, and tending slightly to become biserial. So far as our material shows, this seems to be a species limited to this phase of the Eocene as developed in southern Central Europe. As the small ones seem to be more pointed at the initial end, it is possible that these may be microspheric forms, and do not develop the adult characteristics as do the megalospheric forms with the broader, more rounded, initial end.

ANGULOGERINA MURALIS (Terquem) (Pl. 8, figs. 3-5)

Uvigerina muralis TERQUEM, Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 119, pl. 12 (20), figs. 26-29.

Uvigerina selseyensis HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1907, p. 437, pl. 18, figs. 1-3.

Tritaxia dehiscens HALKYARD, Mem. Proc. Manchester Lit. Philos. Soc., 1917-1918 (1919), p. 44, pl. 3, fig. 8.

Angulogerina macgillavryi PIJPERS, Geol. Pal. Bonaire (D. W. I.), 1933, p. 67, text figs. 82-86.

Test elongate, 2-2½ times as long as broad, generally triangular in transverse section, angles somewhat rounded; chambers of the earliest portion regularly triserial, somewhat inflated, rounded, later ones becoming irregular, deeply excavated at the base; sutures of the early portion slightly excavated, in the adult very deeply so; wall distinctly perforate; aperture with a very short neck and a slight lip. Length 0.30-0.40 mm.; diameter 0.20-0.22 mm.

Like most of Terquem's Paris Basin Eocene species, this is represented in his original paper by very irregular figures, and it is necessary to study the types or topotype material to determine the exact characters of this species. His description is particularly good when he says that the chambers in the adult are very deeply excavated below and concave above. Such forms are found abundantly in all the Paris Basin Eocene, and we have several hundreds of specimens from many localities. The mate-

rial described by Heron-Allen and Earland is evidently based on Eocene material washed out of the deposits of similar age, which they mention in their work as being one of the sources of the material found along the shore at Selsey. Their figures agree very well with the large series of specimens of *Angulogerina muralis* (Terquem) which we have. The form figured by Halkyard in the reference above is also probably the same form, and was referred by Heron-Allen and Earland to their species. The form described and figured by Pijpers in the reference given is very close to this form as mentioned by the author in his notes. We have not seen topotype material of this species, but it is at least closely related to the Paris Basin species.

UVIGERINA ABBREVIATA Terquem (Pl. 8, figs. 6-7)

Uvigerina abbreviata TERQUEM, Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 120, pl. 12 (20), fig. 33.

Test elongate, slender, 2½-3½ times as long as broad, the sides nearly parallel for most of the length, generally rounded in transverse section, triserial; chambers distinct, slightly inflated; sutures distinct, slightly depressed; wall smooth but distinctly perforated; aperture very short, without a definite neck but with a slight lip. Length 0.40-0.50 mm.; diameter 0.15 mm.

The types of this species are from the Eocene of the Paris Basin. We have it from numerous localities in rather typical form, and it seems to be better figured than most of Terquem's other species. Our figured specimen is from the Eocene, Calcaire grossier, Couche à *Cerithium giganteum*, Beauves, France.

EXPLANATION OF PLATE 7

FIGS.

1–3. *Bulimina elongata* d'Orbigny. × 70. 1, Topotype. 2*a*, 3*a*, front views; 2*b*, 3*b*, apertural views.

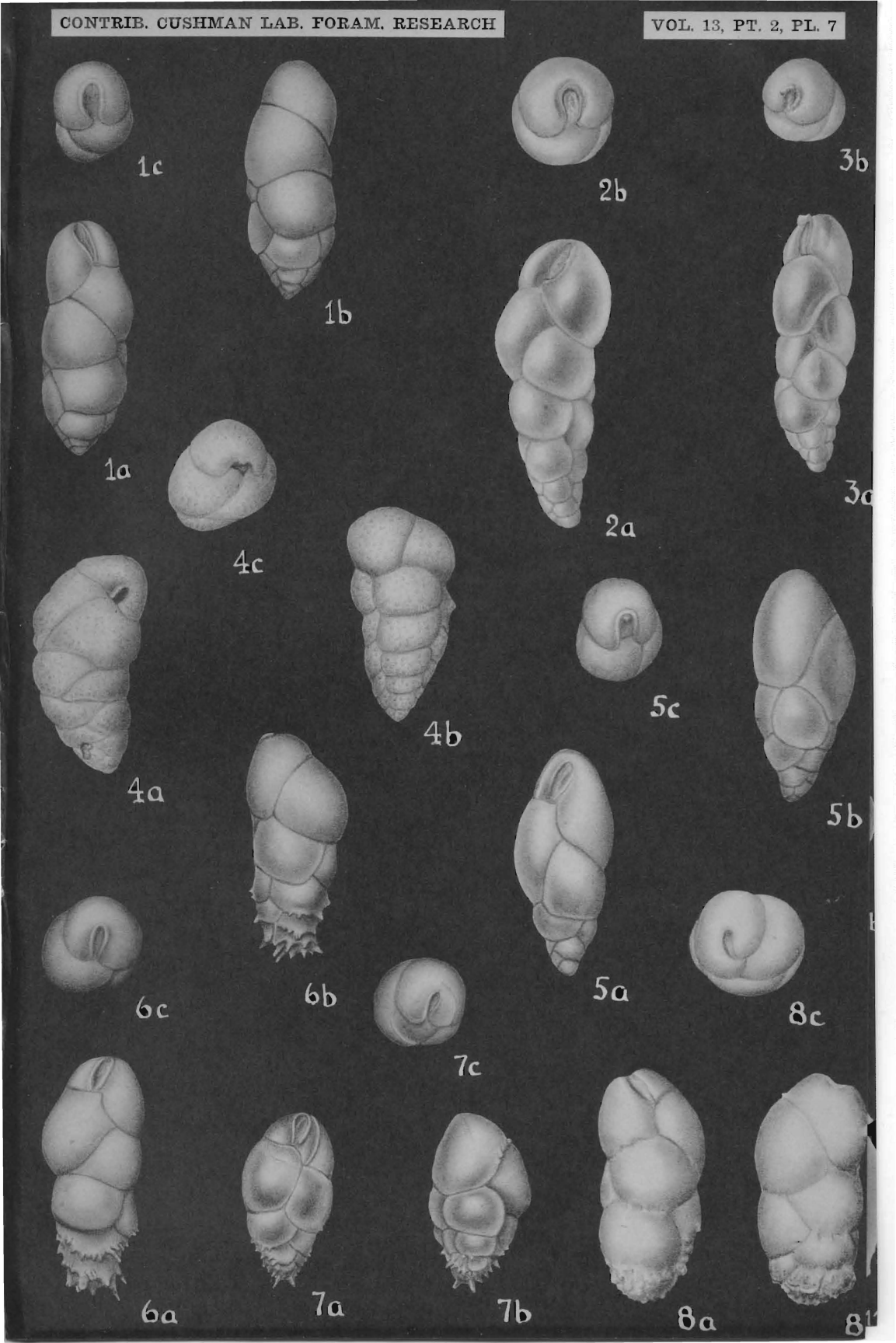
4. *B. tuberculata* Egger. × 90. Topotype.

5. *B. elongata* d'Orbigny, var. *tenera* Reuss. × 90.

6, 7. *B. elongata* d'Orbigny, var. *subulata* Cushman and Parker, n. var. × 70. 6, Holotype. 7, Paratype.

8. *B. elongata* d'Orbigny, var. *lappa* Cushman and Parker, n. var. × 70. Holotype.

Unless otherwise designated: *a*, front view; *b*, rear view; *c*, apertural view.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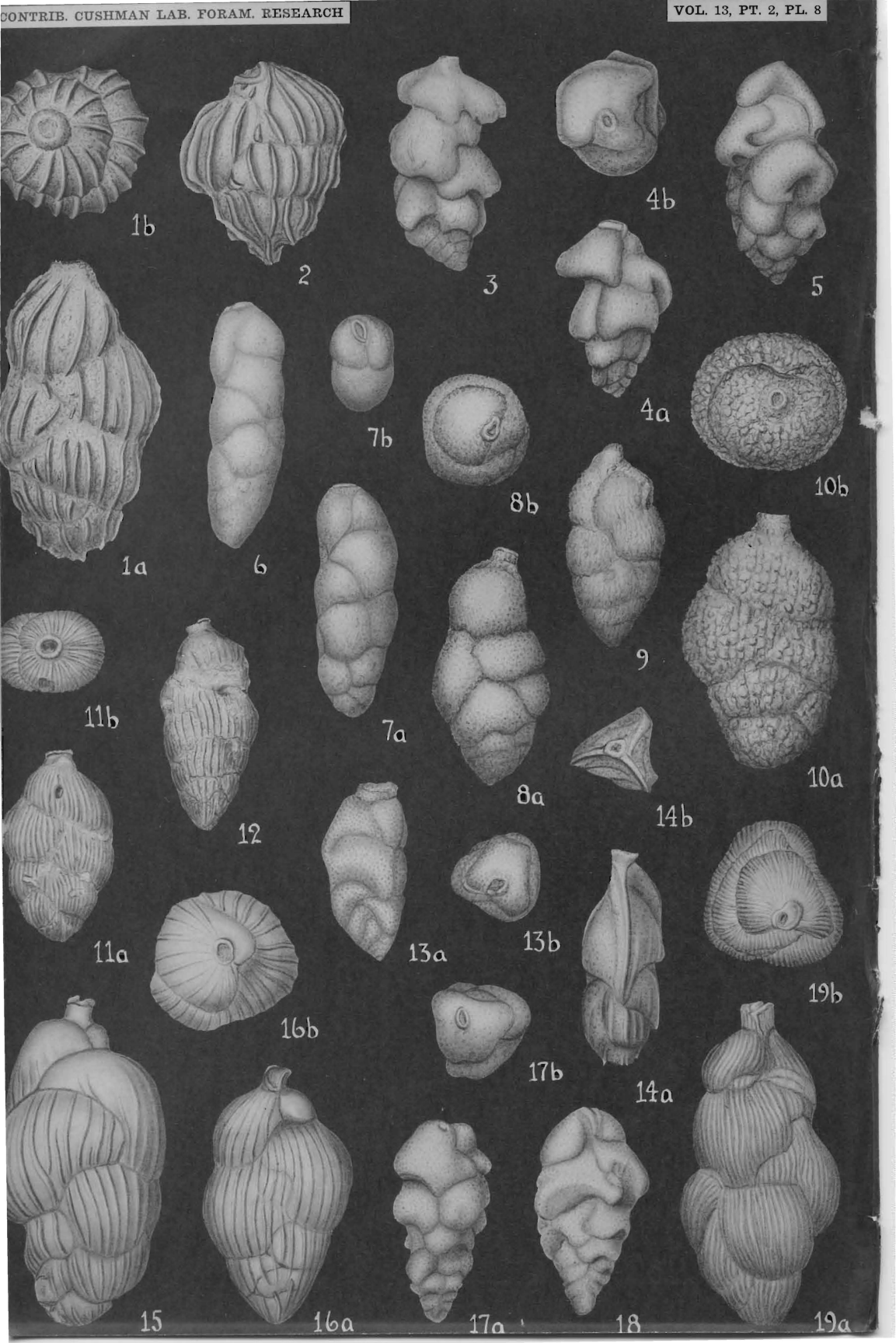
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UVIGERINA FRAGILIS Terquem

Uvigerina fragilis TERQUEM, Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 120, pl. 12 (20), fig. 30.

Under this name Terquem figures a very peculiarly shaped specimen, the early portion of which seems to be biserial and the later chambers extremely irregular. It is difficult even to know the genus to which this should be assigned from the figure. It is recorded as very rare at Vaudancourt, Paris Basin. Without seeing the types it is impossible to definitely place it.

UVIGERINA NUDA Terquem

Uvigerina nuda TERQUEM, Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 120, pl. 12 (20), fig. 31.

The figure of this species also is evidently incorrectly drawn, as no specimens from the type locality were found which could be identified with this. It is described from Vaudancourt.

EXPLANATION OF PLATE 8

FIGS.

1, 2. *Uvigerina eocaena* Gümbel. × 70. Eocene, Haering, Tyrol. 1, Adult, megalospheric(?) form. 2, Immature, microspheric(?) form.

3–5. *Angulogerina muralis* (Terquem). × 80. Eocene, Lutetien. 3, 4, Parnes (Oise), France 5, Grignon, France.

6, 7. *Uvigerina abbreviata* Terquem. × 80. Eocene, Calcaire grossier, Couche à *Cerithium giganteum*, Beauves, France.

8, 9. *U. farinosa* Hantken. × 80. Eocene, Neustift b. Ofen, near Budapest, Hungary. Topotypes.

10. *U. lappa* Cushman and Edwards, n. sp. Eocene, Haering, Tyrol. × 80. Holotype.

11, 12. *U. biserialis* Cushman and Edwards, n. sp. × 70. Eocene, Blue marl, Biarritz, France. 11, Holotype. 12, Paratype.

13. *Angulogerina elongata* (Halkyard). Eocene, Blue marl, Biarritz, France. × 80. Holotype.

14. *A. halkyardi* Cushman and Edwards, n. sp. Eocene, Blue marl, Biarritz, France. × 100. Holotype.

15, 16. *Uvigerina hantkeni* Cushman and Edwards, n. sp. × 70. Eocene, Kiscell, near Budapest, Hungary. 15, Paratype. 16, Holotype.

17, 18. *Angulogerina europaea* Cushman and Edwards, n. sp. × 80. Eocene, Montien, Les Moulinaus, France. 17, Paratype. 18, Holotype.

19. *A. pulchella* Cushman and Edwards, n. sp. Eocene, Blue marl, Biarritz, France. × 100. Holotype.

In all figures: *a*, front view; *b*, apertural view.

UVIGERINA RUGOSA Terquem

Uvigerina rugosa TERQUEM, Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 120, pl. 12 (20), fig. 32.

No specimens were found in our material from Vaudancourt which seemed to be identical with the species. The name was already used by d'Orbigny in 1826, but without figures.

UVIGERINA FARINOSA Hantken (Pl. 8, figs. 8-9)

Uvigerina farinosa HANTKEN, Magy. kir. földt. int. évkonyve, vol. 4, 1875 (1876), p. 53, pl. 7, fig. 6; Mitth. Jahrb. kön. ungar. geol. Anstalt., vol. 4, 1875 (1881), p. 62, p. 7, fig. 6.

Test elongate, about twice as long as broad, circular in transverse section, greatest breadth at about the middle; chambers in the later portion inflated, distinct, becoming much more elongate than in the early portion; sutures distinct, depressed; wall roughened with slight spinose projections arranged more or less in longitudinal lines; aperture rounded or irregularly compressed, with a short but distinct neck and distinct lip. Length 0.40-0.45 mm.; diameter 0.20 mm.

The types of this species are from the upper Eocene of Neustift b. Ofen near Budapest, Hungary. Our figured specimens are topotypes. Hantken's figure of this species, like others that he gives, is evidently somewhat conventionalized, and our series of specimens shows a considerable amount of irregularity in shape, particularly in the last-formed chamber which is frequently somewhat flattened on the inner face. The species is fairly common in the upper Eocene of Hungary.

UVIGERINA LAPPA Cushman and Edwards, n. sp. (Pl. 8, fig. 10)

Test somewhat longer than broad, very slightly compressed in the later portion, greatest breadth at about the middle; chambers fairly distinct, slightly inflated; sutures somewhat depressed; wall ornamented by a series of bluntly rounded, spinose projections, arranged generally in longitudinal lines; aperture rounded with a short but distinct neck and slightly thickened lip. Length 0.40-0.50 mm.; breadth 0.28-0.30 mm.; thickness 0.20-0.22 mm.

Holotype (Cushman Coll. No. 23731) from Eocene of Haering, Tyrol, Austria.

This species differs from *U. farinosa* Hantken in the larger, stouter test which is slightly compressed in the later portion, and in the very coarsely spinose ornamentation.

UVIGERINA BISERIALIS Cushman and Edwards, n. sp. (Pl. 8, figs. 11, 12)

Test small, 1½-2 times as long as broad, somewhat compressed in the adult and tending to become biserial, early portion triserial; chambers fairly distinct, very slightly inflated; sutures slightly depressed; wall ornamented by very numerous, fine, longitudinal costae only slightly broken at the sutures; aperture rounded with a short but distinct neck and thickened lip. Length 0.40--0.45 mm.; breadth 0.20-0.25 mm.; thickness 0.18 mm.

Holotype (Cushman Coll. No. 23732) from Eocene, Blue marl of Biarritz, France.

This species differs from *U. eocaena* Gümbel in the much smaller size, more compressed and definitely biserial chambers in the adult, and the very much finer costae which are often continuous from one chamber to adjacent ones.

This is perhaps the form referred by Halkyard to *U. tenuistriata* Reuss from this same locality.

ANGULOGERINA ELONGATA (Halkyard) (Pl. 8, fig. 13)

Tritaxia elongata HALKYARD, Mem. Proc. Manchester Lit. Philos. Soc., 1917-1918 (1919), p. 44, pl. 3, figs. 9 *a-c.*

"Test vitreous, elongate, parallel-sided, aboral end pointed, section triangular, angles rounded. Arrangement of chambers at first tri-serial, afterwards bi- and finally uniserial. Aperture, a short neck with phialine lip. Length 0.32 to 0.45 mm.

"One of its distinguishing features is the presence of hollows or excavations on the sutural lines, these are partly formed by the folding of the chamber-walls and partly by a tendency to backward prolongation of the sutural margin of the chamber, such as is seen in *Tritaxia dehiscens*. In weak specimens the test is much elongated and is more circular in transverse section than in typical examples."

The above description is that given by Halkyard. On our plate is a figure of a rather poor specimen of this species from the type locality. Others show perhaps even better the characters of slight indentation or folds on the basal margin of the sutures, as noted and figured by Halkyard. Heron-Allen and Earland suggest that this is simply an elongate form of their *"Uvigerina selseyensis,"* but there are numerous topotypes of Halkyard's species in our collection, and the two do not seem at all alike.

ANGULOGERINA HALKYARDI Cushman and Edwards, n. sp. (Pl. 8, fig. 14)

Test elongate, 2-3 times as long as broad, sharply triangular in transverse section, the angles sharply keeled; chambers fairly distinct, especially in the later portion where they are sharply excavated at the base; sutures distinct, depressed; wall ornamented with slight longitudinal costae, particularly on the basal half of the chambers, and the initial end with a few very short spines; aperture rounded with a distinct neck and slightly expanded lip. Length 0.25-0.35 mm.; diameter 0.12-0.15 mm.

Holotype (Cushman Coll. No. 23734) from Eocene, Blue marl of Biarritz, France.

This species may be distinguished from *Angulogerina elongata* (Halkyard) by the very sharply triangular form, distinct keels and costate surface.

This is possibly the form referred to "*Uvigerina angulosa* Williamson" by Halkyard from this locality.

UVIGERINA HANTKENI Cushman and Edwards, n. sp. (Pl. 8, figs. 15, 16)

Uvigerina pygmea HANTKEN (not D'ORBIGNY), **Magy. kir. földt. int.** évkonyve, vol. 14, 1875 (1876), p. 52, pl. 7, fig. 4; **Mitth. Jahrb. kön.** ungar. geol. Anstalt., vol. 4, 1875 (1881), p. 62, pl. 7, fig. 4.

Test about twice as long as broad, rounded in transverse section, greatest breadth usually above the middle; chambers distinct, inflated, increasing rather rapidly in height in adult; sutures distinct, slightly depressed; wall ornamented by numerous longitudinal costae, often continuing over the sutures from one chamber to adjacent ones, the last-formed chambers often with the upper portion smooth; aperture rounded with a distinct neck and slight lip. Length 0.65-0.80 mm.; diameter 0.35-0.40 mm.

Holotype (Cushman Coll. No. 23736) from Eocene, clay wall E. end of clay pit, brickyard of Zgyesült Tegla es Cementgyar R. R., Budapest, Hungary.

This species differs from *U. eocaena* Gümbel in the more inflated chambers, more numerous and lower costae continuous over the sutures, and the much more definite and elongate neck.

This is evidently the form referred to d'Orbigny's species by Hantken from this same region, but is not identical with d'Orbigny's species from the Pliocene of Italy.

ANGULOGERINA EUROPAEA Cushman and Edwards, n. sp. (Pl. 8, figs. 17, 18)

Test elongate, tapering, 2-2½ times as long as broad, greatest breadth toward the apertural end, generally triangular in transverse section; chambers distinct, in the adult progressively more excavated at the base toward the apertural end; sutures distinct depressed; wall smooth but conspicuously perforate; aperture oval, without a distinct neck, but with a slightly thickened lip. Length 0.35-0.40 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 23738) from the Eocene, Montien of Les Moulinaus, France.

This species differs from *A. muralis* (Terquem) in the much more regular form, more distinct angles, and much less separation of chambers in the adult. The aperture is elongate, and somewhat suggests that of *Bulimina*, perhaps showing in this early Eocene species the development of *Uvigerina* from *Bulimina*.

ANGULOGERINA PULCHELLA Cushman and Edwards, n. sp. (Pl. 8, fig. 19)

Test about twice as long as broad, greatest breadth usually below the middle, generally triangular in transverse section, the angles broadly rounded; chambers distinct, inflated, the later ones tending to become elongate and less compact; sutures distinct, compressed; wall ornamented with numerous, very fine, longitudinal costae which continue even to the apertural neck; aperture irregular in shape, oval or triangular, with a distinct neck and slightly expanded lip. Length 0.40-0.45 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 23740) from Eocene, Blue marl of Biarritz, France.

This species differs from *A. elongata* (Halkyard) from the same locality in the much stouter form, more inflated chambers, and the very fine, longitudinal costae.

RECENT LITERATURE ON THE FORAMINIFERA

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

Thompson, M. L. *Nagatoella*, a New Genus of Permian Fusulinids.—Journ. Geol. Soc. Japan, vol. 43, No. 510, 1936, pp. 195-202, pl. 12(2).

The Genotype of *Fusulina*, S. S.—Amer. Journ. Sci., vol. 32, Oct., 1936, pp. 287-291.

Fusulinids from the Black Hills and Adjacent Areas in Wyoming.—Journ. Pal., vol. 10, No. 2, March, 1936, pp. 95-113, pls. 13-16.—14 species and a variety described and figured, 10 new.

Pennsylvanian Fusulinids from Ohio.—L. c., vol. 10, No. 8, Dec., 1936, pp. 673-683, pls. 90, 91.—7 species and varieties, 5 new.

Garrett, J. B., Jr. Occurrence of *Nonionella cockfieldensis* at Claiborne, Alabama.—L. c., vol. 10, No. 8, Dec., 1936, pp. 785, 786.—Lists many species of foraminifera and ostracodes.

Palmer, Dorothy K. and Pedro J. Bermudez. An Oligocene Foraminiferal Fauna from Cuba.—Mem. Soc. Cubana Hist. Nat., vol. 10, No. 4, Nov., 1936, pp. 227-271, pls. 13-20.—Fauna has 182 species and varieties, 24 new.

Asano, Kiyosi. Fossil Foraminifera from the Kakegawa District, Totomi, Japan. (In Japanese with a resumé in English, see below.)

New Foraminifera from the Kakegawa District, Totomi, Japan.—Jap. Journ. Geol. Geog., vol. 13, Nos. 3, 4, 1936, pp. 327-331, pls. 36, 37.—16 new species and subspecies, and a new genus *Dyofrondicularia*.

Reed, R. D. and J. S. Hollister. Structural Evolution of Southern California.—Bull. Amer. Assoc. Petr. Geol., vol. 20, No. 12, Dec., 1936, pp. 1529-1704, with numerous plates, text figures and maps.—Mentions numerous index foraminifera.

Monsour, Emil. Micro-Paleontologic Analysis of Jackson Eocene of Eastern Mississippi.—L. c., vol. 21, No. 1, Jan., 1937, pp. 80-96.

Wiesner, H. Sur la découverte de Diatomées et autres microfossiles peu connus dans le crétacé superieur de la Bohême.—Annales de Protistologie, vol. 5, 1936, pp. 151-155, pls. VI, VII.

Albritton, Claude C., Jr. Upper Jurassic and Lower Cretaceous Foraminifera from the Malone Mountains, Trans Pecos Texas.—Journ. Pal., vol. 11, No. 1, Jan., 1937, pp. 19-23, pl. 4 (part).—7 species figured, 4 new.

Age of the Malone Fauna.—Field & Laboratory, vol. V, No. 2, April, 1937, pp. 48-50.—Mentions 3 species of foraminifera.

Hoffmeister, William S. and Charles T. Berry. A New Genus of Foraminifera from the Miocene of Venezuela and Trinidad.—L. c., pp. 29, 30, pl. 5 (part).—*Suggrunda porosa* n. gen. and n. sp. related to *Bolivina*.

Rhumbler, L. Foraminiferen der Kieler Bucht, gesammelt durch A. Remane,. II Teil. (Ammodisculinidae bis einschl. Textulinidae.)—Kieler Meeresforschungen, Vol. 1, 1936, pp. 179-242, text figs. 127-246.—Numerous new forms described from Kiel Bay.

Chapman, F. and W. J. Parr. A Classification of the Foraminifera.—Proc. Roy. Soc. Victoria, vol. XLIX, Pt. 1 (New Ser.), 1936, pp. 139-151.

Foraminifera and Ostracoda from Soundings Made by the Trawler "Bonthorpe" in the Great Australian Bight.—Journ. Roy. Soc. Western Australia, vol. XXI, 1934-35, (March 25, 1935), pp. 1-7, pl. I.—One new name, *Pyrgo fornasinii*, and a new species, *Clavulina serventyi*.

On the Discovery of Fusulinid Foraminifera in the Upper Palaeozoic of North-west Australia: With a Note on a New Bivalve.—Victorian Naturalist, vol. LIII, March, 1937, pp. 175-179, pl. XVI.—A new species, *Carbonicola minutissima*.

Crespin, Irene. The Larger Foraminifera of the Lower Miocene of Victoria. —Pal. Bull., Bull. 2, 1936, pp. 1-15, pls. 1, 2; map.—Numerous species described and figured, none new.

Le Calvez, Jean. *Processus schizogoniques chez le Foraminifere* Planorbulina mediterranensis *d'Orb.*—Comptes rendus Seances Acad. Sci., vol. 204, Jan. 11, 1937, pp. 147-149, text figs. 1-4.

Umbgrove, J. H. F. A New Name for the Foraminiferal Genus Heterospira. —Leidsche Geologische Mededeelingen, vol. 8, 1937 (Jan. 15, 1937), p. 155.—A new name, *Biplanispira*, proposed.

Wright Barker, R. and Thomas F. Grimsdale. Studies of Mexican Fossil Foraminifera.—Ann. Mag. Nat. Hist., ser. 10, vol. xix, Feb., 1937, pp. 161-178, pls. V-IX.—Several new species described and figured, and a new genus, *Pseudolepidina*.

[illegible]n, F. Die Foraminiferen in Sven Nilssons Petrificata Suecana 1827. —Geol. Fören. Förhandl., vol. 59, 1937, pp. 59-76, pl. II, text figs. 1-6. —A new genus, *Svenia*.

Thiadens, A. A. Cretaceous and Tertiary Foraminifera from Southern Santa Clara Province, Cuba.—Journ. Pal., vol. 11, No. 2, March, 1937, pp. 91-109, pls. 15-19, text figs. 1-3.—Several new species and varieties.

Hanzawa, Shoshiro. Notes on Some Interesting Cretaceous and Tertiary Foraminifera from the West Indies.—L. c., pp. 110-117, pls. 20, 21.

Thompson, M. L. Fusulinids of the Subfamily Schubertellinae.—L. c., pp. 118-125, pl. 22.—A new subgenus, *Eoschubertella*.

Thompson, M. L. and C. L. Foster. Middle Permian Fusulinids from Szechuan, China.—L. C., pp. 126-144, pls. 23-25.—Several new species, and a new subfamily, Ozawainellinae.

Henbest, Lloyd G. Keriothecal Wall-Structure in *Fusulina*, and Its Influence on Fusuline Classification.—L. c., vol. 11, No. 3, April, 1937, pp. 212-230, pls. 34, 35.

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