CONTRIBUTIONS
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CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

282. THE GENUS *CERATOBULIMINA* AND ITS SPECIES

By Joseph A. Cushman

A review of the species of this genus was made a number of years ago by Cushman and Harris, "Some Notes on the Genus *Ceratobulimina*" (Contr. Cushman Lab. Foram. Res., vol. 3, 1927, pp. 171-179, pls. 29, 30). Since that time a number of other species have been described as well as a new subgenus, and many records have been given, and these are included in the present paper.

This genus was evidently derived from the *Discorbis* or *Eponides* group of the Rotaliidae with the aperture extending into the central part of the apertural face. There is a tendency in some specimens toward an alternating character in the later chambers, strongly suggesting the structure characteristic of the genus *Cassidulina;* and its relationships seem definitely to be with the Cassidulinidae. Like other genera of this family, the living species seem to be most abundant in the Pacific region.

Genus CERATOBULIMINA Toula, 1920

Genoholotype, *Rotalina contraria* Reuss

Ceratobulimina Toula, Jahrb. k. k. geol. Reichsanst., vol. 64, 1920, p. 665.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 84.—Cushman and Harris, l. c., p. 171.—Cushman, Special Publ. 1, Cushman Lab. Foram. Res., 1928, p. 290; Special Publ. 4, 1933, p. 254.—Plummer, Amer. Midland Nat., vol. 17, 1936, p. 460.—Glaessner, Studies in Micropaleontology, vol. 1, fasc. 3, 1937, p. 19.—Finlay, Trans. Roy. Soc. New Zealand, vol. 69, 1939, p. 115.—Cushman, Foraminifera, 3rd Ed., 1940, p. 281.

Rotalina (part) Reuss (not d'Orbigny), Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 76.

Cassidulina (part) H. B. Brady (not d'Orbigny), Quart. Journ. Micr. Sci., vol. 21, 1881, p. 59.

Pulvinulina (part) Rzehak (not Parker and Jones), Ann. k. k. Nat. Hofmuseums, vol. 3, pt. 3, 1888, p. 263.

Buliminella (part) Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 88.

Bulimina (part) of authors. *Rotalia* (part) of authors.

Test rotaliform; all chambers visible dorsally, ventrally only those of the last-formed whorl, close coiled, ventrally umbilicate; wall calcareous, finely perforate, added to as growth progresses, laminate, entire exterior polished; aperture elongate, extending into the ventral side of the cham-

ber, and in perfect adult specimens aperture covered by a thin convex plate, merged with the chamber wall above the aperture in a semicircular line, lower end thin, lip-like.—Upper Cretaceous to Recent.

CRETACEOUS SPECIES

CERATOBULIMINA CRETACEA Cushman and Harris (Pl. 17, figs. 1, 2)

Ceratobulimina cretacea CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 173, pl. 29, fig. 1; pl. 30, fig. 11.—CUSHMAN, Tenn. Div. Geol., Bull. 41, 1931, p. 56, pl. 10, fig. 2; Special Publ. 5, Cushman Lab. Foram. Res., 1933, pl. 33, fig. 1.—PLUMMER, Amer. Midland Nat., vol. 17, 1936, p. 460, text fig. 5.—CUSHMAN, Foraminifera, 3rd Ed., 1940, Key, pl. 33, fig. 1.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 70, pl. 12, fig. 7.—CUSHMAN, U. S. Geol. Survey Prof. Paper 206, 1946, p. 143, pl. 59, figs. 6, 7.

Test small, slightly longer than broad, usually seven chambers in the last-formed whorl; sutures distinct, somewhat 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 0.40-0.45 mm.; breadth 0.30-0.35 mm.; thickness 0.20-0.25 mm.

The types of this species are from the Upper Cretaceous, Navarro formation, of Mexia, Texas. It is a characteristic species of beds of Navarro age above the Nacatoch sand, and has been recorded from Texas, Arkansas, Tennessee, and Mississippi. It is the earliest known species of the genus and also the most primitive.

TERTIARY SPECIES

CERATOBULIMINA PERPLEXA (Plummer) (Pl. 17, figs. 3-5)

Rotalia perplexa PLUMMER, Univ. Texas Bull. 2644, 1926 (1927), p. 156, pl. 12, fig. 2.

Ceratobulimina perplexa CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 173, pl. 29, fig. 2.—PLUMMER, Amer. Midland Nat., vol. 17, 1936, p. 460, text figs. 1-4.—GLAESSNER, Studies in Micropaleontology, vol. 1, fasc. 3, 1937, pp. 20, 23, pl. 1, figs. 2, 3; pl. 2, fig. 25.—ISRAELSKY, Proc. 6th Pac. Sci. Congress, 1939, p. 579, pl. 6, figs. 3, 4.—VAN BELLEN, Proc. Ned. Akad. Wetenschappen, vol. 44, 1941, p. 1000, pl., fig. 20.—DE WITT PUYT, Geol. Pal. Beschr. Umgebung von Ljubuski, Hercegovina, Utrecht, 1941, p. 69, pl. 1, figs. 58, 62.—BROTZEN, Sver. Geol. Under., ser. C, No. 451, 1942, p. 37, text figs. 12, 14.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 41, pl. 7, figs. 23, 24.

"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 of this species are from the Paleocene of Texas. It is recorded also from the Paleocene, Naheola formation, of Alabama, the Wilcox Eocene of Nanafalia, Alabama, and from the Eocene of California and from southern Europe.

CERATOBULIMINA EXIMIA (Rzehak) (Pl. 17, figs. 6-8)

Pulvinulina eximia RZEHAK, Ann. k. k. Nat. Hofmuseums, vol. 3, pt. 3, 1888, p. 263, pl. 11, fig. 7.

Ceratobulimina eximia CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 174, pl. 29, figs. 3, 4; pl. 30, figs. 12-16.—COLE, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 220 (20).—STADNICHENKO, Journ. Pal., vol. 1, 1928, p. 233, pl. 38, figs. 9-11.—CUSHMAN and THOMAS, l. c., vol. 3, 1929, p. 182, pl. 24, fig. 3.—NUTTALL, l. c., vol. 4, 1930, p. 277.—PLUMMER, Amer. Midland Nat., vol. 17, 1936, p. 460, text figs. 6-10.—GRAVELL and HANNA, Bull. Amer. Assoc. Petr. Geol., vol. 22, 1938, p. 1007, pl. 5, figs. 12, 14.—HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 80, pl. 11, figs. 12, 13.—CUSHMAN and APPLIN, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 43, pl. 8, figs. 8, 9.

Ceratobulimina eximia RZEHAK, var. WEINZIERL and APPLIN, Journ. Pal., vol. 3, 1929, p. 407, pl. 42, fig. 3.

Ceratobulimina declivis (REUSS), var. *mexicana* COLE, Bull. Amer. Pal., vol. 14, No. 51, 1927, p. 31, pl. 5, fig. 16.

Rotalia dorri COLE, l. c., p. 29, pl. 4, figs. 5, 6.

Test slightly longer than broad, biconvex, broadly oval in peripheral view, periphery rounded, ventral side umbilicate; chambers eight to ten in the adult whorl, increasing gradually in size as added, slightly inflated on the ventral side; sutures distinct, on the dorsal side with a distinct angle, ventrally nearly radial, occasionally limbate and raised on the dorsal side; wall smooth, polished; aperture comma-shaped, in the peripheral face of the last-formed chamber. Length 0.50-0.60 mm.; breadth 0.40-0.55 mm.; thickness 0.30-0.35 mm.

The types of this species are from the Eocene of Nieder-Hollabrun in Austria. A copy of the type figure is given. It is a characteristic species of the American Eocene of Claiborne age, occurring in Texas, Louisiana, and Mexico.

CERATOBULIMINA BUNDENSIS van Bellen

Ceratobulimina bundensis VAN BELLEN, Med. Geol. Stichting, ser. C-V, No. 4, 1946, p. 68, pl. 9, figs. 13-18.

"Test biconvex. Ventral side showing only the last whorl, which consists of about six to eight chambers separated by depressed, slightly curved sutures, deeply umbilicate. Dorsal side showing more than one

whorl. Dorsal sutures curved, depressed. Aperture a triangular opening at the base of the last chamber about midway between umbilicus and periphery, sometimes covered with a plate. Periphery in the young subacute, later on more bluntly rounded. The convexity at the dorsal side in the young is somewhat less than ventrally. Dim.: 0.54 x 0.46 x 0.30 mm."

The types are from the middle Eocene from borings in the southern part of the province of Limburg, Netherlands.

CERATOBULIMINA WESTRALIENSIS Parr (Pl. 17, fig. 9)

Ceratobulimina westraliensis PARR, Journ. Roy. Soc. W. Australia, vol. 24, 1937-38, p. 83, pl. 2, fig. 12.

"Test slightly longer than broad, compressed, umbilicate on the ventral side; periphery rounded; chambers numbering seven to eight in the last-formed whorl; sutures thickened and sometimes limbate and raised in the early portion of the test, depressed in the later portion of the shell; wall thick and polished; aperture a slit at the base of the inner margin of the last-formed chamber, septal face of chamber with a median umbilical notch and dent of varying width. Length up to 0.5 mm.; width to 0.4 mm.; thickness to 0.25 mm."

The types are from the upper Eocene of West Australia.

"*C. perplexa* (Plummer), from the Eocene (Midway) of Texas, U. S. A., is fairly closely related, but has only six chambers to the adult whorl and a smaller and more rounded umbilical depression than the present species. *C. westraliensis* also has generally a much larger umbilical notch than *C. perplexa,* although it is variable in this respect."

CERATOBULIMINA CONTRARIA (Reuss) (Pl. 17, figs. 10, 11)

Rotalina contraria REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 76, pl. 5, fig. 37. —BORNEMANN, l. c., vol. 7, 1855, p. 341.

Ceratobulimina contraria TOULA, Jahrb. k. k. geol. Reichsanst., vol. 64, 1920, p. 665.—CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 175, pl. 29, fig. 6.—TEN DAM and REINHOLD, Med. Geol. Stichting, ser. C-V, No. 2, 1942, p. 92, pl. 6, fig. 9.—CRESPIN, Bull. 9 (Pal. Ser. No. 4), Commonwealth of Australia, Min. Res. Survey, (mimeographed), 1943, p. 78 (list).

Test small, slightly longer than broad, strongly biconvex, broadly oval in peripheral view, periphery rounded, ventral side slightly umbilicate; chambers usually seven in the adult whorl, increasing rather rapidly in size as added, inflated on the ventral side, only slightly so on the dorsal side; sutures distinct, very slightly depressed, only slightly curved, not limbate; wall smooth, polished; aperture elongate, nearly straight, reaching beyond the center of the flattened, apertural face of the last-formed chamber. Length 0.45-0.52 mm.; breadth 0.35-0.40 mm.

The types of this species are from the Oligocene of Hermsdorf, Ger-

many. We have numerous topotypes of this species in our collections. The figures given by ten Dam and Reinhold seem to be very typical. It has also been recorded from the Miocene of Australia.

CERATOBULIMINA ALAZANENSIS Cushman and Harris (Pl. 18, figs. 17, 18)

Ceratobulimina alazanensis CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 174, pl. 29, fig. 5; pl. 30, figs. 3-5.—NUTTALL, Journ. Pal., vol. 6, 1932, p. 27.—CORYELL and EMBICH, l. c., vol. 11, 1937, p. 302, pl. 43, fig. 8.—FRANKLIN, l. c., vol. 18, 1944, p. 317, pl. 47, fig. 8.—CUSHMAN, Special Publ. 16, Cushman Lab. Foram. Res., 1946, p. 35, pl. 7, fig. 6.

Test very slightly longer than broad, periphery broadly rounded, usually six 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.

The types are from the Oligocene, Alazan clay, of Mexico.

The species occurs at a number of localities in the Alazan clay in Mexico and is recorded from the Oligocene of Venezuela, and the Jackson Eocene, Cocoa sand, of Alabama, but these are not entirely typical. It is also recorded from the Yazoo clay of Mississippi (Bergquist, Bull. 49, Mississippi State Geol. Survey, 1942, p. 91, pl. 9, figs. 17, 18) but this is evidently not the same as the typical specimens from the Alazan, as it has more chambers and a somewhat different shape. It probably represents a different species. The form figured from the Miocene of Haiti (Coryell and Rivero, Journ. Pal., vol. 14, 1940, p. 342, pl. 44, fig. 14) also is not typical.

CERATOBULIMINA WASHBURNEI Cushman and Schenck (Pl. 18, figs. 1-3)

Ceratobulimina washburnei CUSHMAN and SCHENCK, Univ. Calif. Publ., Bull. Dept. Geol. Sci., vol. 17, 1928, p. 314, pl. 45, fig. 1.—BECK, Journ. Pal., vol. 17, 1943, p. 609, pl. 108, figs. 20, 24.—CUSHMAN and FRIZZELL, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 87.

Test somewhat longer than broad, periphery very broadly rounded; six or seven chambers in the last-formed whorl, slightly inflated on the ventral side; sutures indistinct except between the last three or four chambers; wall smooth; aperture covered by a thin, arched plate with a trace of a lip. Length 0.50 mm.; breadth 0.40 mm.; thickness 0.35 mm.

The types of this species are from the Oligocene, Keasey shale, of Oregon. It has also been recorded from the Oligocene, Lincoln formation, of Washington, and from the Eocene of Cowlitz River, Lewis Co., Washington.

The species somewhat resembles *Ceratobulimina pacifica* Cushman and Harris but is smaller and the chambers narrower.

CERATOBULIMINA EVOLUTA Cushman and Jarvis (Pl. 18, fig. 4)

Ceratobulimina evoluta CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 16, pl. 3, fig. 17.—GLAESSNER, Studies in Micropaleontology, vol. 1, fasc. 3, 1937, p. 20, pl. 1, figs. 8, 9.—RENZ, Proc. 8th Amer. Sci. Congress, 1942, p. 548 (list).

Test trochoid, close coiled except the last chamber which, in the adult, forms the beginning of a loose coil, periphery broadly rounded; chambers distinct, not inflated, seven or eight in the final whorl; sutures distinct, somewhat limbate in some specimens; wall smooth and polished; aperture large, the narrow inner end extending to the middle of the apertural face, widening toward the base. Length 0.60 mm.; breadth 0.45 mm.; thickness 0.38 mm.

The types are from the "Bamboo clay" of Oligocene age from the Cipero section of Trinidad. It has not been recorded elsewhere.

In some specimens there is a definite tendency toward uncoiling.

CERATOBULIMINA LORNENSIS Finlay (Pl. 18, fig. 5)

Ceratobulimina lornensis FINLAY, Trans. Roy. Soc. New Zealand, vol. 69, 1939, p. 116, pl. 13, fig. 61.

"Shell sub-circular, almost as broad as long; last chamber somewhat projecting, considerably inflated, not compressed. Six chambers in last whorl, progressively more separated as growth proceeds so that sutures become deeper and periphery more lobulate anteriorly; last chamber irregularly bulbous, with a rounded or slightly flattened terminal face into which projects for one third to half its length a narrow, not very deep, apertural furrow. Umbilicus widely open, about a quarter of width of shell, overlapped for half its width by free margin of last chamber before it joins previous whorl. Dorsal side with the radial sutures of last three chambers distinct, all others obscure. No ornament, surface smooth. Length, 0.75 mm.; width, 0.65 mm."

The types are from the lower Oligocene of New Zealand and there are no other records.

It differs from *Ceratobulimina kellumi* Finlay in its flattish subcircular test.

CERATOBULIMINA DEHISCENS (Heron-Allen and Earland) (Pl. 18, figs. 8-10)

Bulimina convoluta WILLIAMSON, var. *dehiscens* HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1924, p. 143, pl. 8, figs. 26-28.—CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 53.

Ceratobulimina dehiscens CUSHMAN and HARRIS, l. c., vol. 3, 1927, p. 176, pl. 29, fig. 7.

Test about twice as long as broad, somewhat compressed, biconvex, periphery subacute, ventral side somewhat umbilicate; chambers fairly distinct, very slightly inflated on the ventral side with a slight elongate depression in the middle; sutures not depressed except slightly in the

later portion on the ventral side, slightly curved; wall smooth, polished; aperture a narrow opening running into the ventral face of the last-formed chamber. Average length 0.40 mm.; breadth 0.22 mm.; thickness 0.13 mm.

The types of this species are from the Miocene of Muddy Creek, Victoria, Australia. Topotypes seem to show that this species should be placed in *Ceratobulimina*. It is distinct in its elongate form, distinct compression and subacute periphery.

CERATOBULIMINA KELLUMI Finlay (Pl. 18, fig. 6)

Ceratobulimina kellumi FINLAY, Trans. Roy. Soc. New Zealand, vol. 69, 1939, p. 115, pl. 13, fig. 60.

"Shell at least one and a half times as long as broad, compact, very inflated, elongate-globular, with no pronounced angles; six chambers in last whorl. Sutures distinct, practically flush with surface, usually markedly limbate, depressed into short furrows near umbilicus, which is practically closed. Aperture a very deep, narrow, entirely open furrow, extending from umbilical area two-thirds of distance into terminal face, slightly sigmoid, about one-fifth width of face. Dorsal surface tightly coiled, smoothly and evenly rounded; earlier chambers forming an almost flat top, spiral suture distinct but not sunken. Length, 0.65 mm.; width, 0.45 mm."

The types are from the Miocene of New Zealand.

CERATOBULIMINA CARPATICA Bieda (Pl. 18, fig. 7)

Ceratobulimina carpatica BIEDA, Ann. Soc. Geol. Pologne, vol. 12, 1936, p. 267, pl. 8, fig. 5.

The type figures of this species are reproduced on our plate. The type specimens are from the Miocene of Galicia. The original description is in Polish, but in addition there is a French description as follows: Size of specimens: 0.25-0.5 mm. Our specimens are distinguished from the other species of this genus by a different shape of the last chamber, which is large and ends in a flat plate, upon which is situated the aperture which has the form of a recurved slit. In the middle of the whorl is a carina. The first whorls are small and hardly visible. They constitute with the last an almost flat surface. This last character is also found in the species *C. contraria,* originating from the Septaria clays described by Reuss. *C. carpatica* is found rarely in the sandy shales of Brzozowa and of Gromnik.—Translation.

RECENT SPECIES

CERATOBULIMINA PACIFICA Cushman and Harris (Pl. 18, figs. 11-16)

Ceratobulimina pacifica CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res.,

vol. 3, 1927, p. 176, pl. 29, fig. 9.—CUSHMAN, Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 26, fig. 1.—CHAPMAN and PARR, Australasian Antarctic Exped., ser. C, vol. 1, pt. 2, 1937, p. 80.—CUSHMAN, Foraminifera, 3rd Ed., 1940, pl. 26, fig. 1.—LEROY, Colorado School Mines Quart., vol. 36, No. 1, pt. 1, 1941, p. 42, pl. 1, figs. 30-32; pt. 2, 1941, p. 85, pl. 4, figs. 34, 35; vol. 39, No. 3, pt. 2, 1944, p. 89, pl. 7, figs. 7, 8.

Buliminella contraria CUSHMAN (not REUSS), Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 89, text fig. 143.

Test nearly as broad as long, periphery very broadly rounded, the last chambers becoming somewhat involute on the dorsal side; usually six chambers in the last-formed whorl; sutures distinct, very slightly depressed; aperture narrow, elongate, narrowing toward the middle of the face. Length 0.90 mm.; breadth 0.65 mm.; thickness 0.40 mm.

The types of this species are from off the Philippines in 494 fathoms. The species has been recorded from the Miocene from the East Indies by LeRoy in the references given above and some of his figures are reproduced on our plate. It is possible that the form figured by H. B. Brady in the *Challenger* Report, 1884, pl. 54, fig. 18, as "*Bulimina contraria* Reuss" may belong here.

CERATOBULIMINA TENUIS Chapman and Parr (Pl. 19, fig. 1)

Ceratobulimina tenuis CHAPMAN and PARR, Australasian Antarctic Exped., ser. C, vol. 1, pt. 2, 1937, p. 80, pl. 7, fig. 11.

"Test thin, hyaline; consisting of a series of seven more or less elongated chambers arranged on a marginuline plan on the superior face, the earlier forming a partial coil around the proloculum, and gradually lengthening, and posed obliquely to the end of the test. Inferior face with the inrolled edges of the successive chambers forming a median groove at the summit of which at the base of the last-formed chamber is situated the elongated bulimine aperture. The widest part of the test equals about one-third of the length. Length, 0.3 mm.; width, 0.136 mm."

The types of this species are from the Antarctic.

"This delicate little species is probably the most elongate form of the genus *Ceratobulimina.* A related but shorter and stouter species has been described from the Batesford limestone (L. Miocene) of Victoria by Heron-Allen and Earland under the name of *Bulimina convoluta,* var. *dehiscens.*" [See *Ceratobulimina dehiscens* (Heron-Allen and Earland)].

CERATOBULIMINA ? CHAPMANI (Heron-Allen and Earland) (Pl. 19, figs. 2-4)

Bulimina chapmani HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, 1922, p. 130, pl. 4, figs. 18-20.—CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 21.

Ceratobulimina chapmani CUSHMAN and PARKER, l. c., p. 21.

Bulimina seminuda CHAPMAN (not TERQUEM), British Antarctic Exped., Geology, vol. 2, 1907-9, p. 29, pl. 2, fig. 9.

"Test free, perforate, helicoid. Consisting of a double series of chambers, arranged in a rapidly increasing spiral, the outer series being largely predominant and increasing in size much more rapidly than the inner series. Sutural lines flush, but often thick, and showing as bands of clear shell-substance. The oral face of the final chamber flat, containing the aperture, which is a well-marked cleft running half-way across the septal face. Size (across oral face): Length up to 0.80 mm.; breadth up to .60 mm.; thickness up to .50 mm."

The types of this species are from the Antarctic area.

From the description it is difficult to place this species generically but the figures, which are reproduced on our plate, would seem to indicate its close relationship to *Ceratobulimina.* No specimens were available for study.

Subgenus CERATOCANCRIS Finlay, 1939

Subgenoholotype, *Ceratobulimina (Ceratocancris) clifdenensis* Finlay

Ceratocancris FINLAY, Trans. Roy. Soc. New Zealand, vol. 69, 1939, p. 117.

Differing from typical *Ceratobulimina* in having a completely covering plate above the aperture.

This plate is present in species from the Tertiary of the European area and the late Tertiary and Recent of the Australian region.

CERATOBULIMINA (CERATOCANCRIS) HAUERII (d'Orbigny) (Pl. 19, figs. 5, 6)

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

Ceratobulimina hauerii CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 175, pl. 29, fig. 8; pl. 30, figs. 1, 2.—GLAESSNER, Studies in Micropaleontology, vol. 1, fasc. 3, 1937, p. 20, pl. 1, figs. 4-7.

Test nearly as broad as long, periphery rounded, test somewhat compressed; chambers distinct, usually seven or eight in the last-formed whorl, those of the later part of the last-formed whorl more involute; sutures distinct, slightly depressed; wall smooth and polished; aperture fairly large, the axis slightly dorsal to the axis of coiling, in well preserved specimens covered with a thin, projecting plate, with a slightly upturned border covering the umbilical region. Length up to 1 mm.; breadth 0.85 mm.; thickness 0.50 mm.

The types of this species are from the Miocene at Baden, near Vienna, Austria. There are numerous specimens in our collections from the type locality and from Nussdorf that show that this species should be included in this subgenus.

CERATOBULIMINA (CERATOCANCRIS) CLIFDENENSIS Finlay (Pl. 19, fig. 7)

Ceratobulimina (Ceratocancris) clifdenensis FINLAY, Trans. Roy. Soc. New Zealand, vol. 69, 1939, p. 117, pl. 13, fig. 62.

"This is so closely related to the Australian *C. australis* that it is best described by comparison. I have only broken specimens of the latter from Muddy Creek, but they agree with the good figures given by the original authors and later by Chapman, Parr and Collins (1934, p. 559, pl. 10, figs. 26a-c). These show that the Balcombian species has a notably longer furrow (and probably corresponding tongue), a more rounded and inflated terminal face, and a less involute coiling on the dorsal side. In New Zealand shells the furrow is extremely faint, and it and the tongue reach only one-third of the way into the face; this is very markedly and sharply flattened off at an acute angle with the basal periphery, which is thus more sharply bevelled than in *australis;* dorsally the chambers expand rapidly, the initial coils being very small. There are seven chambers visible ventrally as in *australis*. Length, 0.7 mm.; width, 0.5 mm."

The types are from the lower Miocene of New Zealand.

CERATOBULIMINA (CERATOCANCRIS) AUSTRALIS Cushman and Harris

(Pl. 19, figs. 8, 9)

Ceratobulimina hauerii (D'ORBIGNY), var. *australis* CUSHMAN and HARRIS, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 176, pl. 29, fig. 10; pl. 30, figs. 6-10. —CHAPMAN, PARR and COLLINS, Journ. Linn. Soc., Zool., vol. 38, (No. 262), 1934, p. 559, pl. 10, fig. 26.—VALK, in RUTTEN and HOTZ, Geol., Petrogr. and Paleont. Results Explor. Island of Ceram, 3rd ser., Geol., No. 1, 1945, p. 26.

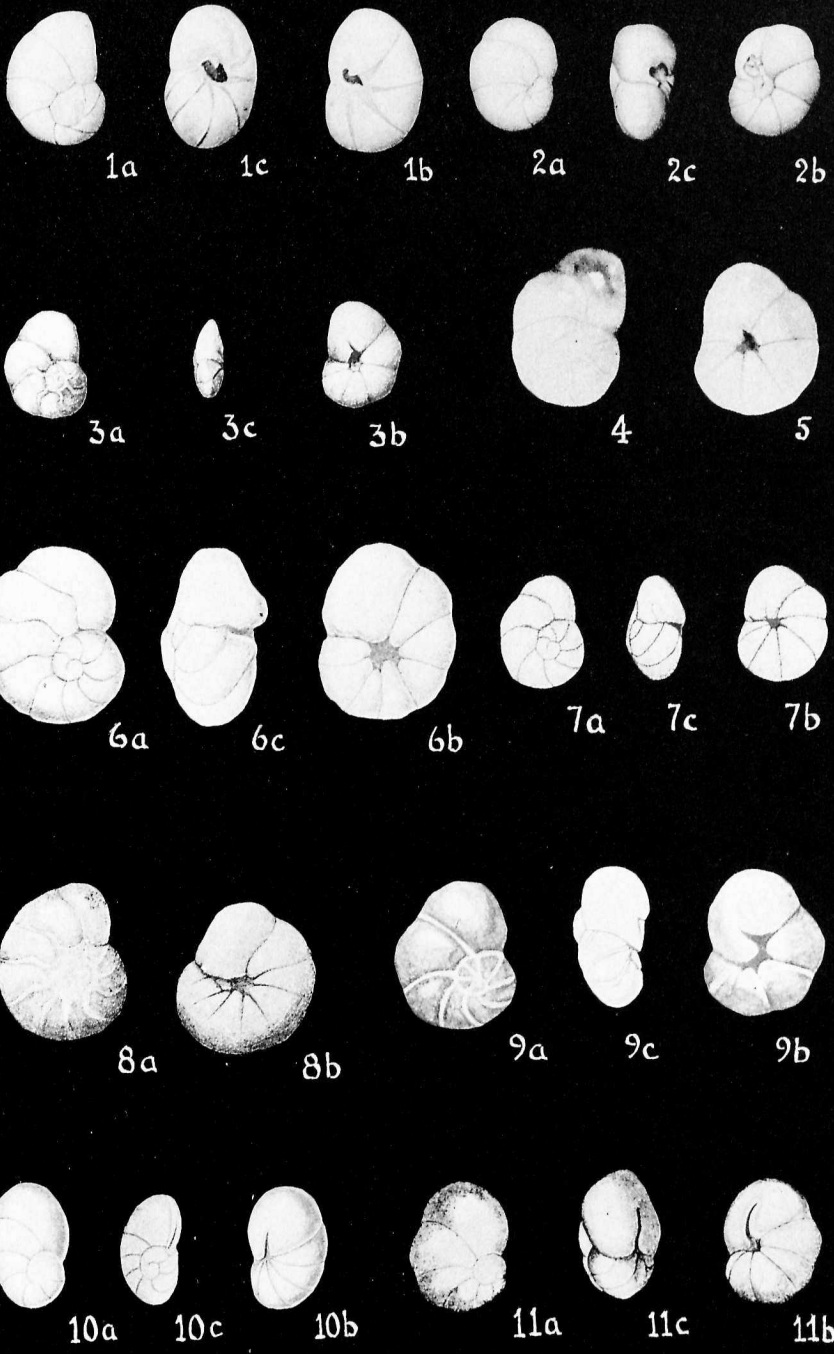
Ceratobulimina australis PARR, Mining and Geol. Journ., vol. 2, 1942, p. 363 (list).

Test somewhat longer than broad, somewhat compressed, periphery rounded, ventral side somewhat umbilicate; chambers distinct, typically seven in the last-formed whorl, increasing rather rapidly in size as added; sutures distinct, slightly curved, only slightly depressed; wall smooth and polished; aperture large, extending nearly to the center of the apertural face, covered in the last-formed chamber by a thin, projecting plate extending to the umbilicus. Length 0.50-0.65 mm.; breadth 0.37-0.45 mm.; thickness 0.28-0.30 mm.

EXPLANATION OF PLATE 17

FIGS. 1, 2. *Ceratobulimina cretacea* Cushman and Harris. 1, Upper Cretaceous, Navarro formation, Mexia, Texas. × 55. (After Cushman and Harris). 2, Upper Cretaceous, Coon Creek, Tennessee. × 52. 3-5. *C. perplexa* (Plummer). 3, Paleocene, Midway, of Texas. × 40. Three separate specimens. (After Plummer). 4, 5, Paleocene, Naheola formation of Alabama. × 75. 4, Dorsal view. 5, Ventral view. (After Cushman and Todd). 6-8. *C. eximia* (Rzehak). 6, Eocene, Austria. (After Rzehak). 7, Eocene, Claiborne, Louisiana. × 32. (After Cushman and Harris). 8, Eocene, Claiborne, Texas. × 30. (After Weinzierl and Applin). 8*a*, dorsal view; 8*b*, ventral view of another specimen. 9. *C. westraliensis* Parr. Upper Eocene, West Australia. × 40. (After Parr). 10, 11. *C. contraria* (Reuss). 10, Oligocene, Hermsdorf, Germany. (After Reuss). 11, Tertiary, Netherlands. × 40. (After ten Dam and Reinhold).

(*a*, dorsal view; *b*, ventral view; *c*, apertural view)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11b

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17c

17b

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The types are from the Tertiary, Balcombian, of Grices Creek, Victoria, Australia. It is also recorded from the Miocene of a bore at Parwan, Victoria, and from the Plio-Pleistocene of West Seran, D. E. I. There are also specimens in our collections from the Miocene of a bore at Hopevale Station, near Geelong, Victoria, sent by W. J. Parr.

CERATOBULIMINA ? INFLATA ten Dam (Pl. 19, fig. 10)

Ceratobulimina inflata TEN DAM, Med. Geol. Stichting, ser. C-V, No. 3, 1944, p. 124, pl. 4, fig. 5.

This species described from the Eocene (Lutetian) of the Netherlands, from the figures, does not have the typical apertural or umbilical characters of this genus and would appear to belong in *Valvulineria*. It may possibly belong in the subgenus *Ceratocancris*. No specimens were available for study.

CERATOBULIMINA ? LENTICULA (Reuss)

Marie has referred Reuss' *Rotalia lenticula* to *Ceratobulimina* (Mém. Mus. Nation. Hist. Nat., n. ser., vol. 12, pt. 1, 1941, p. 226, pl. 35, figs. 326-328), but this species does not appear to belong in this genus.

283. A NEW SPECIES OF *AMPHISTEGINA* FROM THE EOCENE OF ECUADOR*

BY J. A. CUSHMAN and R. M. STAINFORTH

The species here described is unique in its general shape and the form of the supplementary chambers. Sections are given to show the internal structure.

* Published with the permission of International Ecuadorean Petroleum Company of Toronto.

EXPLANATION OF PLATE 18

FIGS. **1-3.** *Ceratobulimina washburnei* Cushman and Schenck. 1, Oligocene, Keasey shale, of Oregon. × 27. (After Cushman and Schenck). 2, 3, Eocene, Washington. × 35. 2, Dorsal view. 3, Peripheral view. (After Beck). **4.** *C. evoluta* Cushman and Jarvis. Oligocene, Trinidad, B. W. I. × 35. *a*, ventral view; *b*, apertural view. **5.** *C. lornensis* Finlay. Lower Oligocene, New Zealand. × 25. Ventral view. (After Finlay). **6.** *C. kellumi* Finlay. Miocene, New Zealand. × 25. Ventral view. (After Finlay). **7.** *C. carpatica* Bieda. Miocene, Galicia. × 38. (After Bieda). **8-10.** *C. dehiscens* (Heron-Allen and Earland). Miocene, Muddy Creek, Victoria, Australia. × 55. 8, Dorsal view. 9, Ventral view. 10, Peripheral view. (After Heron-Allen and Earland). **11-16.** *C. pacifica* Cushman and Harris. 11, Recent, 494 fathoms, Philippines. × 25. (After Cushman and Harris). 12-16, Miocene, East Indies. 12, 13, × 33. 14-16, × 27. 12, 14, Dorsal views. 13, 16, Ventral views. 15, Peripheral view. (After LeRoy). **17, 18.** *C. alazanensis* Cushman and Harris. 17, Oligocene, Alazan clay, Mexico. × 50. (After Cushman and Harris). 18, Eocene, Cocoa sand, Alabama. × 70. Ventral view of specimen with last chamber broken away.
(*a*, dorsal view; *b*, ventral view; *c*, apertural view)

AMPHISTEGINA ELLIOTTI Cushman and Stainforth, n. sp. (Pl. 20, figs. 1-6)

Test strongly conical in shape, the dorsal side nearly flat or only slightly convex, the ventral side nearly as deep as wide, periphery subacute; chambers of the dorsal side involute, strongly curved, the ventral side with supplementary chambers distinctly curved and in some specimens apparently tending to become slightly labyrinthic; sutures rather indistinct except in abraded specimens, but very strongly curved; wall especially on the ventral side marked by prominent, raised papillae, the dorsal side also with distinct papillae in well preserved specimens; aperture on the ventral side, elongate, at the inner margin of the last-formed chamber. Height 0.75-1.00 mm.; diameter 0.75-1.50 mm.

Holotype (Cushman Coll. No. 47222) from the middle Eocene, Estero Pollo, a small tributary on the left bank of Rio Verde, about 22½ km. in a straight line from the river mouth, northwest Ecuador. The samples were collected by D. H. Elliott and are numbers 13144, 13451-B in the sample lists of International Petroleum Co. in Guayaquil. The species is known only from this one locality.

The species differs from *Amphistegina lopeztrigoi* Palmer from the Eocene of Cuba in the more conical form and the smaller papillae.

Loose specimens of *A. elliotti* are abundant in the washed residue of shaley pockets within a limestone exposed in strike-section in the stream. The species can also be recognized in thin-sections of the limestone. The accompanying fauna is a *Discocyclina-Archaeolithamnion* assemblage such as typifies the "Guayaquil limestone" of Sheppard[1]. Although there are outcrops of typical "Guayaquil limestone" in the Rio Verde area, the Estero Pollo exposure is atypical in containing megascopic clastic material. On faunal grounds it must be regarded as a slight facies-variant of the "Guayaquil limestone."

In thin-sections of the Estero Pollo limestone and of a few free specimens of larger foraminifera picked from the shaley material, the following species were noted:

Discocyclina (Discocyclina) anconensis Barker ?
Discocyclina (Discocyclina) meroensis (Berry)
Discocyclina (Discocyclina) sheppardi Barker ?
Discocyclina (Asterocyclina) sp.
Pseudophragmina (Proporocyclina) peruviana (Cushman) ?

The specific determinations are partly tentative because of the nature of the material, but the subgeneric determination of *Asterocyclina* sp. is positive, based on free specimens from the shaley material. It is a quad-

[1] Sheppard, G. "The geology of southwestern Ecuador." London, 1937.

rate species closely related to *A. rutteni* Vaughan and undoubtedly related to '*Asterodiscocyclina*' *stewarti* Berry from the middle Eocene of Peru. The assemblage as a whole shows a distinct affinity to that recently described from the Upper Scotland formation of Barbados, of which Vaughan[2] states: "The foraminiferal fauna of the Upper Scotland formation is obviously Middle Eocene, and it may be considered the type Middle Eocene of America."

The limestone on Estero Pollo is overlain by beds containing a suite of small foraminifera and radiolaria which indicate high middle to upper Eocene age.

On the foregoing evidence, *Amphistegina elliotti* must be considered a middle Eocene species, probably from the lower part of that interval.

284. A NEW GENUS, *CRIBROPYRGO*, AND A NEW SPECIES OF *ROTALIA*

By Joseph A. Cushman and Pedro J. Bermudez

The following very unusual form seems to belong to a new genus here described:

Genus CRIBROPYRGO Cushman and Bermudez, n. gen.
Genoholotype, *Cribropyrgo robusta* Cushman and Bermudez

Test calcareous, imperforate, similar in general structure to *Pyrgo* but differing from that genus in its cribrate aperture and from *Fabularia* in its simple, undivided chambers.—Recent.

CRIBROPYRGO ROBUSTA Cushman and Bermudez, n. sp. (Pl. 20, figs. 7-9)

Test large, subglobular, about as broad as long, biserial in the adult; chambers inflated, the last-formed one making up a very large part of the surface, increasing rapidly in size as added; suture slightly depressed; wall calcareous, imperforate, with very fine longitudinal striae; aperture with a distinct cribrate plate, convex, and raised slightly above the general contour of the test. Length up to 2.40 mm.; breadth up to 2.25 mm.

Holotype (Cushman Coll. No. 47213) from off Cienfuegos, Cuba, in 1075 fathoms, lat. 21° 49′ 30″ N.; long. 80° 43′ W., *Atlantis* sta. 3338.

In some respects this genus resembles *Pyrgoella* but the apertural characters are quite different.

ROTALIA ROLSHAUSENI Cushman and Bermudez, n. sp. (Pl. 19, figs. 11-13)

Test small, trochoid, biconvex, dorsal side slightly convex, ventral

[2] Vaughan, T. W. "American Paleocene and Eocene Larger Foraminifera." Mem. 9, Geol. Soc. Amer., pt. I, 1945.

side more strongly so, periphery bluntly angled; chambers distinct, about 6 in the last-formed whorl, slightly inflated, increasing gradually and rather uniformly in size as added; sutures distinct, somewhat depressed, slightly curved, somewhat limbate; wall very finely perforate, thin, smooth; aperture a low opening on the ventral border of the last-formed chamber. Diameter 0.50-0.60 mm.; height 0.35-0.38 mm.

Holotype (Cushman Coll. No. 47216) from the Gulf of Mexico, off the Rio Grande, Texas, at a depth of 83 feet. Collected by F. W. Rolshausen.

This species most closely resembles *Rotalia beccarii* (Linné), var. *tepida* Cushman but differs in the lower spire, more angled periphery, and the somewhat larger size.

285. TWO NEW NAMES IN THE FORAMINIFERA

By Joseph A. Cushman and Ruth Todd

In Special Publication No. 15, 1945, of this Laboratory a new species was described and named *Bolivina imporcata* Cushman and Todd (p. 47, pl. 7, fig. 14). Dr. Hans E. Thalmann has called our attention to the fact that it is a homonym of *Bolivina floridana* Cushman, var. *imporcata* Cushman and Renz (Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 78) from the Agua Salada formation of Venezuela. The name *Bolivina dissentiata* Cushman and Todd is therefore proposed for the species described from the Miocene of Buff Bay, Jamaica.

In the same publication the new species *Dentalina jarvisi* Cushman and Todd (p. 22, pl. 3, fig. 22) was described and figured. Now that distribution is again possible, papers published during the war years are becoming available. In one of these is the new species *Dentalina jarvesi* [*jarvisi*] Montagne (Geol. Pal. Umgebung von Sestanovac, Dalmatien, Utrecht, 1941, p. 51, pl. 6, fig. 22). It is from the Eocene of Dalmatia and our species is not the same. A new name *Dentalina jamaicensis* Cushman and Todd is therefore proposed for the species from Jamaica.

286. SOME HOMONYMS IN "FORAMINIFERA FROM THE MIDDLE EOCENE IN THE SOUTHERN PART OF THE NETHERLANDS PROVINCE OF LIMBURG."

By Dr. Robert C. Van Bellen,
Iraq Petroleum Company, Kirkuk, Iraq.

My thanks are due to Dr. H. E. Thalmann and Dr. W. van den Bold

for calling my attention to the fact that some homonyms occur in the above mentioned paper.

Nonion ornatum van Bellen is preoccupied by *Nonionina ornata* Costa 1856 (Atti Acc. Pont. Napoli, 7, 2, p. 203, pl. 17, f. 17). It must therefore be renamed and I propose the following new name in honour of Dr. Thalmann to whose aid in many spheres I owe much:
Nonion thalmanni nov. nom.
Nonion ornatum van Bellen (non Costa)
1946, van Bellen, Med. Geol. St. C-V-4, p. 44, no. 49, pl. 4, f. 7*-10.
1946, van Bellen, Acad. thesis Utrecht, same page etc.

The proposed new species-name *Discorbis plana* is twice pre-occupied; by Heron-Allen and Earland in 1932 (Disc. Rep. 4, p. 413, pl. 14, f. 9-12) and by Brotzen in 1936 (Sver. geol. und. Avh. Ser. C, no. 396, Arsbok 30, no. 3, p. 146, pl. 10, f. 6, text fig. 52). Its new name will be in honour of my esteemed tutor, the late Prof. Dr. L. M. R. Rutten.
Discorbis rutteni nov. nom.
Discorbis plana van Bellen (non Heron-Allen & Earland, non Brotzen).
1946, van Bellen, Med. Geol. St. C-V-4, p. 53, no. 63, pl. 6, f. 4-9.
1946, van Bellen, Acad. thesis Utrecht, same page etc.

Eponides budensis (Hantken) in the author's paper is a synonym for *"Truncatulina" budensis* Hantken 1875 (Mitt. k. ung. geol. Landesanst. 4, p. 75, pl. 8, f. 6). In the same paper by Hantken, however, a *"Pulvinulina" budensis* Hantken 1875 (l.c., p. 78, pl. 9, f. 5) is noted. This latter has already been renamed *Eponides budensis* (Hantken) so that either *"Pulvinulina" budensis* must have a new name, or a new species-name is needed for *"Truncatulina" budensis*. Because the first arrangement will cause much confusion, I prefer the second and propose the following new name for this species, in honour of my colleague Dr. J. M. Zinkstok, paleontologist B. P. M., the Hague, Holland:
Eponides zinkstoki nov. nom.
Eponides budensis van Bellen
1946, van Bellen, Med. Geol. St. C-V-4, p. 56, no. 69, pl. 7, f. 1-3.
1946, van Bellen, Acad. thesis, Utrecht, same page etc.

Cibicides choctawensis Cushman & McGlamery, var. *ornata* of the author is preoccupied by *"Truncatulina" lobatula* (Walker & Jacob) var. *ornata* Cushman (1918, Bull. 676, U. S. G. S. p. 61, pl. 18, f. 1, 2). It is here renamed:

* This is a correction of a misprint in the author's paper; which gives f. 1-10.

Cibicides choctawensis Cushman & McGlamery, var. *dorso-involuta* nov. nom.

Cibicides choctawensis Cushman & McGlamery, var. *ornata* van Bellen.
1946, van Bellen, Med. Geol. St. C-V-4, p. 79, no. 101, pl. 12, f. 7-9.
1946, van Bellen, Acad. Thesis Utrecht, same page etc.

Terquemia, the name of the new genus proposed has twice been anticipated: by Tate in 1868 for a Jurassic Lamellibranch genus and by van Veen in 1932 for an Ostracod genus. Moreover *Terquemina* Galloway 1933 exists. In recognition of my colleague Dr. W. van den Bold the following new name is proposed:

Boldia nov. nom.

Terquemia van Bellen (non Tate, non van Veen)
1946, van Bellen, Med. Geol. St. C-V-4, p. 86, no. 111.
1946, van Bellen, Acad. Thesis Utrecht, same page.

Consequently the name of the genotype must be altered to *Boldia lobata* (Terquem).

An interesting fact may be stated here, since most of the literature published in Holland during wartime, and shortly afterwards is not available for colleagues in other parts of the world. Dr. van den Bold has found another species of this interesting genus. He called it *Boldia vandersluisi.* The figures given here are reproduced from his thesis. The specimens were found in the Lower Eocene or Paleocene of Guatemala and perhaps also in British Honduras. The figured specimen measured 1.00 mm in diameter and 0.60 mm in thickness. More details will be found in van den Bold's paper, entitled: 1946, W. A. van den Bold, Contribution to the study of *Ostracoda* with special reference to the

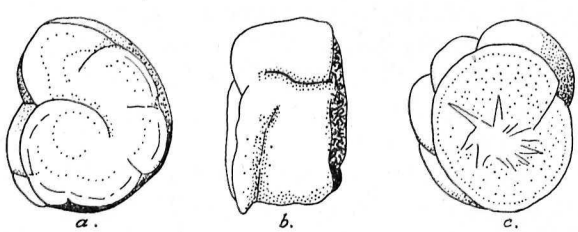


Fig. 1; *Boldia vandersluisi* van den Bold. *a*: dorsal view; *b*: peripheral view; *c*: ventral view. (copied from W. A. van den Bold 1946)

Tertiary and Cretaceous microfauna of the Caribbean region, Acad. Thesis, Utrecht. Moreover my colleague Dr. J. van der Sluis, when studying *Foraminifera* from Eocene strata in Eastern Ceram (Seran) in the

Netherlands East Indies has recently found a third species of this genus. It has not yet been published.

It seems therefore that this genus is rather widespread geographically whereas so far as known at present, its vertical range is quite small.

Rotalia terquemi van Bellen which name resembles closely *"Rotalina" (Rotalia) terquiemi* d'Orbigny 1849 (1850), Prodrôme, p. 242, has therefore to be renamed:

Rotalia pseudomarginata nov. nom.

Rotalia terquemi van Bellen

1946, van Bellen, Med. Geol. St., C-V-4, p. 63.

1946, van Bellen, Acad. Thesis Utrecht, same page.

Discorbis patellinaformis is a name which will cause confusion as there is already a *Discorbis patelliformis* Brady, 1884, Challenger Rep., vol. 9, p. 647, pl. 88, f. 1. Therefore I propose a new name:

Discorbis confusa nov. nom.

Discorbis patellinaformis van Bellen.

1946, van Bellen, Med. Geol. St., C-V-4, p. 52, no. 62, pl. 6, f. 1-3.

1946, van Bellen, Acad. Thesis Utrecht, same page etc.

Kirkuk —
16th September, 1946.

287. ADDITIONAL HOMONYMS IN FORAMINIFERA ERECTED SINCE 1940

By Hans E. Thalmann

A list of foraminiferal homonyms has been published in vol. 9, pt. 4, 1933 of these "Contributions." Further records of homonyms were regularly included in the writer's annual "Bibliography and Index to new genera, species, and varieties of Foraminifera" which were published, starting with the year 1931, in the "Journal of Paleontology" since volume 7, 1933. General remarks on foraminiferal homonyms were made in a paper published in volume 28 of the "American Midland Naturalist," 1942. The following list comprises homonyms mainly found in the European literature on Foraminifera issued during the war-years 1940 to 1945, available to the writer only after the termination of the hostilities. Some homonyms, erected during the current year 1946 are also included insofar as the literature could be studied up to October 1st, 1946.

The Articles 34, 35, and 36 of the "International Rules of Zoological

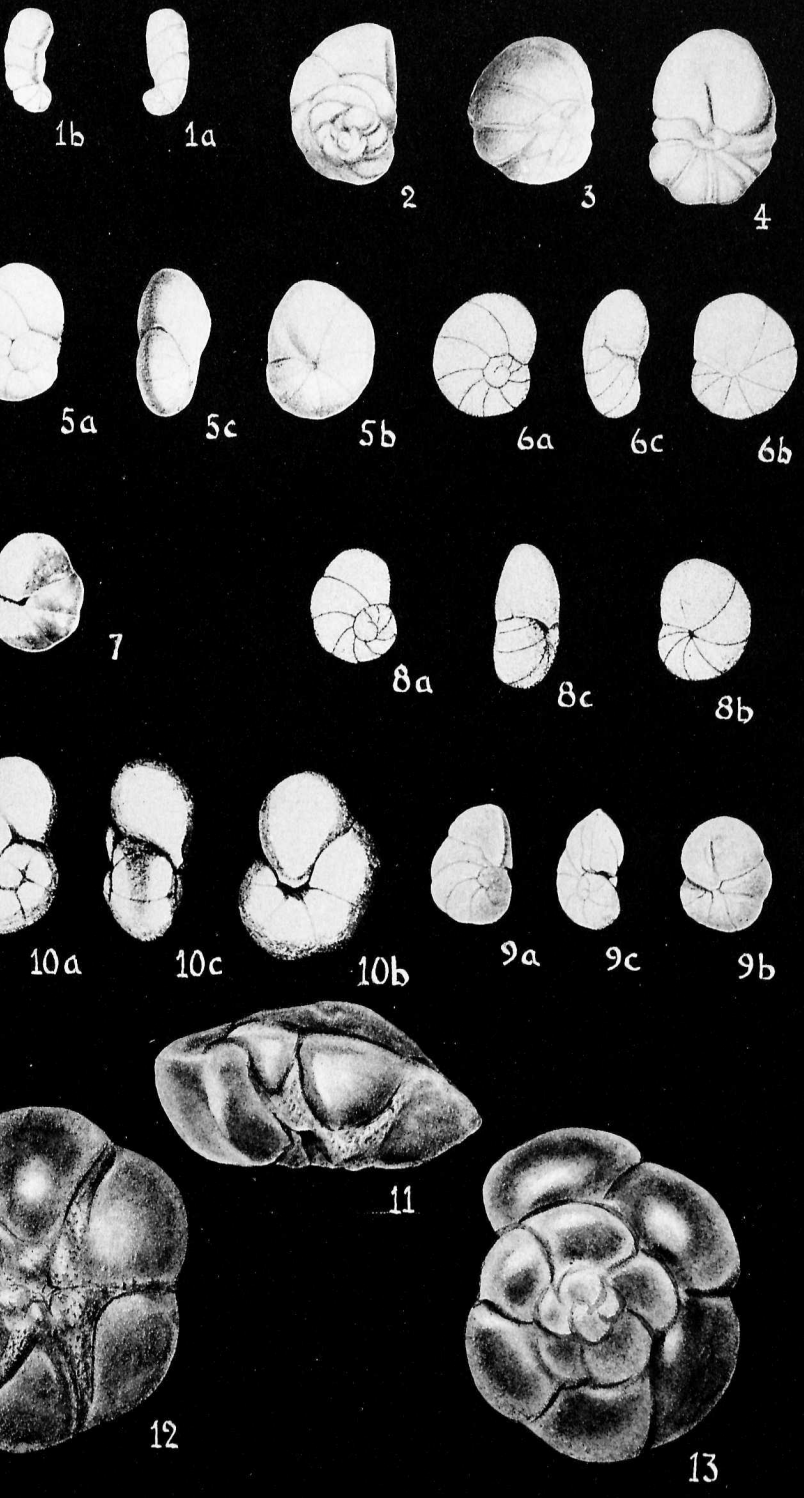
Nomenclature" (IRZN), and Declaration 1, the so-called "Code of Ethics to be observed in the renaming of homonyms" (issued October 26th, 1943 in "Opinions and Declarations rendered by the International Commission on Zoological Nomenclature," London, 1943, vol. I, pt. 1, pp. 1-6) govern the handling of homonyms of genera, subgenera, species, and subspecies (varieties). For the benefit of all concerned in the field of foraminiferology it is strongly suggested that each worker in Foraminifera become thoroughly and intimately familiar not only with the IRZN, but also with the "Declarations and Opinions" of the International Commission on Zoological Nomenclature.

Notwithstanding the fact that the existence of foraminiferal homonyms since 1931 has been made known to the respective authors, it is astounding to find out how few of them have since been corrected, i. e. re-named, even in many cases where the authors had been informed by personal letters in accordance with the "Code of Ethics." It should be emphasized that once an author of a homonym has been informed either by private letter, or by printed lists of homonyms, it is his duty and obligation to take immediate action to remedy his error, because the "Code of Ethics" impedes another worker to perform this necessary operation at least as long as the original author is still alive. Thanks to the laziness of the duly informed "homonymist" the nomenclatorial mess persists ad infinitum and thus hampers the progress of science. All authors who have erected homonyms in Foraminifera in the past and not yet taken the small effort involved in re-naming them, are, therefore, urgently requested to carry out their duty within the next twelve months from the date of publication of this issue of the "Contributions"; if not done so within this liberally alloted period they should forfeit the stipulations of the "Code of Ethics" (Monaco, 1913) so that re-naming of their homonyms can be performed by such workers who regard it as a responsibility and professional duty towards future gener-

EXPLANATION OF PLATE 19

FIG. 1. *Ceratobulimina tenuis* Chapman and Parr. Recent, Antarctic. × 60. (After Chapman and Parr). 2-4. *C. ? chapmani* (Heron-Allen and Earland). Recent, Antarctic. × 27. 2, Dorsal view. 3, Peripheral view. 4, Ventral view. (After Heron-Allen and Earland). 5, 6. *C. (Ceratocancris) hauerii* (d'Orbigny). Miocene, Baden, near Vienna, Austria. 5, (After d'Orbigny). 6, × 25. (After Cushman and Harris). 7. *C. (C.) clifdenensis* Finlay. Miocene, New Zealand. × 25. Ventral view. (After Finlay). 8, 9. *C. (C.) australis* Cushman and Harris. 8, Tertiary, Balcombian, Grices Creek, Victoria, Australia. × 25. (After Cushman and Harris). 9, Miocene, Victoria, Australia. × 32. (After Chapman, Parr and Collins). 10. *C. ? inflata* ten Dam. Eocene, Lutetian, Netherlands. × 60. (After ten Dam). 11-13. *Rotalia rolshauseni* Cushman and Bermudez, n. sp. Recent, Gulf of Mexico, off Rio Grande. × 85. 11, 12, Paratypes. 13, Holotype. 11, Peripheral view. 12, Ventral view. 13, Dorsal view.

(*a*, dorsal view; *b*, ventral view; *c*, apertural view)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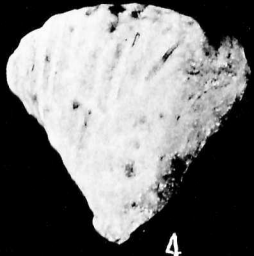

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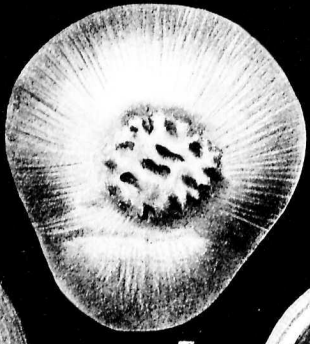

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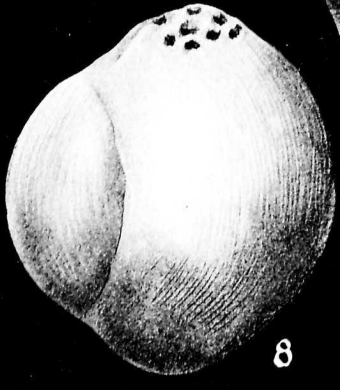
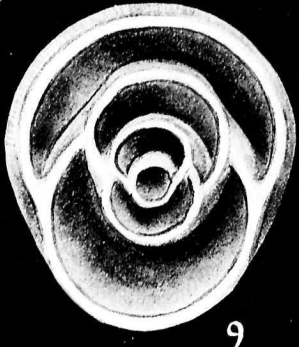


8



9

ations of foraminiferologists to keep the nomenclature in a clean state of order.

The following list of homonyms is arranged according to the year of publication:

1940:

Lagena cincta Buchner, Nova Acta Leopoldina, new ser., vol. 9, No. 62, p. 464, pl. 11, figs. 179 and 180, preoccupied by *Lagena (Fissurina) cincta* (Seguenza, 1862) Foram. Monotal. Messina, p. 62, pl. 2, fig. 31.

Lagena costae Buchner, *ibid.*, p. 510, pl. 21, figs. 424 and 425, preoccupied by *Lagena (Phialina) costae* (Seguenza, 1862), Foram. Monotal. Messina, p. 48, pl. 1, fig. 28.

Lagena heron-alleni Buchner, *ibid.*, p. 531, pl. 26, figs. 559-561, preoccupied by *Lagena heron-alleni* Earland, 1934, Discovery Reports, vol. 10, p. 152, pl. 6, figs. 55-57.

Lagena neglecta Buchner, *ibid.*, p. 503, pl. 19, figs. 405 and 406, preoccupied by *Lagena neglecta* Buchner, *ibid.*, p. 463, pl. 11, figs. 173-178.

Lagena nucelloides Buchner, 1940, var. *corrosa* Buchner, *ibid.*, p. 519, pl. 22, fig. 478, preoccupied by *Lagena corrosa* Buchner, 1940, *ibid.*, p. 488, pl. 16, figs. 313-316.

Lagena sidebottomi Buchner, *ibid.*, p. 484, pl. 16, figs. 297-299, preoccupied by *Lagena sidebottomi* Earland, 1934, Discovery Reports, vol. 10, p. 161, pl. 7, fig. 23.

Lagena simplex Buchner, *ibid.*, p. 465, pl. 11, figs. 193 and 194, preoccupied by *Lagena (Oolina) simplex* (Terquem, 1862), Foram. du Lias, 2nd Mem., p. 112, pl. 5, fig. 2.

1941:

Dentalina recta Marie, Mém. Museum Nation. Hist. Nat. Paris, new ser., vol. 12, fasc. 1, p. 93, pl. 12, fig. 149, preoccupied by:

a) *Nautilus (Dentalina) recta* Montagu, 1803, Testac. Brit., p. 197, and Montagu, 1808, Supplem., p. 82, pl. 19, figs. 4 and 7;

EXPLANATION OF PLATE 20

FIGS. 1-6. *Amphistegina elliotti* Cushman and Stainforth, n. sp. Eocene, Ecuador. × 35. 1, 2, Transverse sections of the dorsal portion. 3, Transverse section of labyrinthic ventral portion. 4, Peripheral view showing conical ventral side. 5, Dorsal view of slightly eroded specimen showing arrangement of chambers on dorsal side. 6, Ventral view showing labyrinthic chambers. 1-3, 4, 6, Paratypes. 5, Holotype. 7-9. *Cribropyrgo robusta* Cushman and Bermudez, n. gen., n. sp. Recent, off Cuba. × 20. 7, Apertural view. 8, Side view. 9, Transverse section. 8, Holotype. 7, 9, Paratypes.

b) *Dentalina recta* Seguenza, 1880, Mem. R. Accad. Lincei, Cl. sci. fis. mat., Roma, (3), vol. 6, p. 221. Not figured.

c) *Dentalina recta* Gosse, 1855, Mar. Zool., p. 12, text fig. 11. Note: there exists also a *Nodosaria recta* Schwager 1866.

Discorbis clementiana (d'Orbigny, 1840) var. *laevigata* Marie, ibid., p. 212, pl. 33, fig. 309, preoccupied by *Discorbis (Aristerospira) laevigata* (Ehrenberg, 1858), Monatsber. k. Preuss. Akad. Wiss. Berlin, p. 16, figured in Abhandl. k. Akad. Wiss. Berlin 1872 (1873), pl. 11, fig. 10.

Discorbis clementiana (d'Orbigny, 1840) var. *rugosa* Marie, *ibid.*, p. 213, pl. 33, figs. 310 and 311, preoccupied by *Discorbis (Rosalina) rugosa* (d'Orbigny, 1839), Voy. Amér. Méridion., vol. 5, pt. 2, "Foraminifères," p. 42, pl. 2, figs. 12-14.

Eggerellina gibbosa Marie, 1941, var. *conica* Marie, *ibid.*, p. 35, pl. 7, fig. 71, preoccupied by *Eggerellina brevis* (d'Orbigny, 1840) var. *conica* Marie, 1941, *ibid.*, p. 34, pl. 7, fig. 70.

Eggerellina gibbosa Marie, 1941, var. *globulosa* Marie, 1941, *ibid.*, p. 35, pl. 7, fig. 73, preoccupied by *Eggerellina intermedia* (Reuss), var. *globulosa* Marie, 1941, *ibid.*, p. 33, pl. 7, fig. 69.

Frondicularia bicornis Reuss, 1845, var. *rhomboidalis* Marie, *ibid.*, p. 129, pl. 15, fig. 184, preoccupied by:

a) *Frondicularia rhomboidalis* d'Orbigny, 1826, Ann. Sci. Nat., (1), vol. 7, p. 256, Modèles Nr. 3;

b) *Frondicularia rhomboidalis* Terquem, 1862, Mém. Acad. Imp. Metz, vol. 42, (2), Nr. 9, p. 439, pl. 5, fig. 19.

Frondicularia sagittula Marie, *ibid.*, p. 117, pl. 14, fig. 164, preoccupied by *Frondicularia alata* d'Orbigny, 1826, var. *sagittula* van den Broeck, 1876, Ann. Soc. Belge Microsc., vol. 2, p. 113, pl. 2, figs. 12 and 14.

Frondicularia sepiolaris Marie, 1941, forma nova *typica* Marie, *ibid.*, p. 131, pl. 15, fig. 187; pl. 16, fig. 188, preoccupied by *Frondicularia typica* Costa, 1855 (1857), Mem. Accad. Sci. Napoli, vol. 2, p. 372, pl. 3, fig. 5.

Frondicularia sepiolaris Marie, 1941, var. *laevigata* Marie, ibid., p. 132, pl. 15, fig. 187, preoccupied by:

a) *Frondicularia laevigata* d'Orbigny 1826, Ann. Sci. Nat. VII, p. 256, Nr. 7;

b) *Frondicularia laevigata* Karrer, 1868, Sitzber. k. Akad. Wiss. Wien, vol. 58, (1), p. 167, pl. 4, fig. 3.

Gaudryina gradata Berthelin, 1880, var. *crassa* Marie, *ibid.*, p. 66, pl. 3, fig. 29, preoccupied by:

a) *Gaudryina crassa* Karrer, 1870, Jahrb. k. k. geol. Reichs-Anst. Wien, vol. 20, p. 166, pl. 1 (10), fig. 4;

b) *Gaudryina crassa* Marsson, 1878, Mitth. Naturwiss. Ver. Neu-Vorpommern u. Rügen, vol. 10, p. 158, pl. 3, fig. 17 (error for fig. 27).

Gaudryina aff. *gradata* Berthelin, 1880, var. *gracilis* Marie, *ibid.*, p. 66, pl. 3, fig. 28, preoccupied by *Gaudryina gracilis* Cushman and Laiming, 1931, Journ. Paleont., vol. 5, p. 95, pl. 10, fig. 1.

Globotruncana linnei (d'Orbigny, 1839) var. *stuarti* Vogler, Palaeontogr., Suppl.—Bd. 4, series 4, Lief. 4, p. 289, pl. 24, figs. 8-13, preoccupied by *Rosalina (Globotruncana) stuarti* de Lapparent, 1918, Terr. Crét. Hendaye, Mém. Explic. Carte géol. detaillée de France, p. 14, pl. I, figs. 5-7, text fig. 5 a-c.

Lagena amphora Reuss, 1863, var. *cylindrica* Marie, *ibid. (ut supra)*, p. 75, pl. 9, fig. 84, preoccupied by *Lagena cylindrica* Smith, 1915, Ann. Mag. Nat. Hist., ser. 8, vol. 15, p. 306, pl. 13, fig. 3/8a.

Lagena apiculata Reuss, 1863, var. *ovoidea* Marie, *ibid.*, p. 81, pl. 9, fig. 98, preoccupied by *Lagena hispida* Reuss, 1858, var. *ovoidea* Marie, 1941, *ibid.*, p. 77, pl. 9, fig. 91.

Lagena ovum (Ehrenberg, 1843) var. *mucronata* Marie, *ibid.*, p. 79, pl. 9, fig. 95, preoccupied by:

a) *Lagena mucronata* Terquem and Berthelin, 1875, Mém. Soc. géol. France, (2), vol. 10, No. 3, p. 14, pl. 1, fig. 8;

b) *Lagena striata* (Walker and Jacob, 1784) var. *mucronata* Alcock, 1866, Proc. Lit. Phil. Soc. Manchester, vol. 5, p. 99.

Lenticulina frankei Marie, ibid., p. 100, pl. 9, fig. 105, preoccupied by *Lenticulina frankei* Eichenberg, 1933, 25 Jahresb. Nied. geol. Ver. Hannover, p. 16, pl. 6, fig. 2.

Lenticulina incrassata Marie, *ibid.*, p. 102, pl. 10, fig. 108, preoccupied by *Lenticulina (Nautilus) incrassata* (Fichtel and Moll, 1798), Test. Micr., p. 38, pl. 4, figs. a-c. (Note: there exists also a *Cristellaria incrassata* Ehrenberg, 1854).

Marginulina burgundiae Terquem, 1864, subspec. *dentaliniformis* Frentzen, Beitr. Naturk. Forsch. Oberrheingebiet, vol. 6, p. 334, pl. 3, figs. 35-37, preoccupied by *Marginulina dentaliniformis* Mariani, 1888, Atti Soc. Ital. Sci., vol. 30, p. 113, pl. 1, fig. 45.

Nodosaria annulifera Frentzen, *ibid.*, p. 316, pl. 2, figs. 20 and 21,

preoccupied by *Nodosaria annulifera* Gümbel, 1868 (1870), Abhandl. Math.-Phys. Cl. Bayer. Akad. Wiss., vol. 10, p. 614, pl. 1, fig. 21.

Nodosaria caudata Frentzen, *ibid.*, p. 317, pl. 2, fig. 22, preoccupied by *Nodosaria (Vaginulina) caudata* (d'Orbigny, 1826), Ann. Sci. Nat. vol. 7, p. 258, Nr. 8, *teste* Parker, Jones and Brady, 1871, Ann. Mag. Nat. Hist., (4), vol. 8, p. 163, pl. 9, fig. 60.

Nodosaria laevigata Frentzen, *ibid.*, p. 319, pl. 2, figs. 26 and 27, preoccupied by:

a) *Nodosaria laevigata* Nilsson, 1825 (1826), K. Vet. Akad. Handl., p. 342, figured in Nilsson, 1827, Petrif. Suecana, p. 8, pl. 9, figs. 20 a, A, B.

b) *Nodosaria (Glandulina) laevigata* d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 252, No. 1, pl. 10, figs. 1-3.

Rosalinella globigerinoides Marie, ibid. *(op. cit. ut supra)*, p. 239, pl. 36, figs. 338 and 339. Since the genus *Rosalinella* Marie, 1941, apparently is a synonym of *Globotruncana* Cushman, 1927, this species becomes a homonym of *Globotruncana globigerinoides* Brotzen, 1936, Sver. geol. Unders., ser. C, No. 396, p. 177, pl. 12, fig. 3; pl. 13, fig. 3. The same is the case with

Rosalinella lapparenti Marie, ibid., p. 241, pl. 36, fig. 341, which, since *Rosalinella* is synonymous with *Globotruncana*, is already preoccupied by *Globotruncana lapparenti* Brotzen, 1936, Sver. geol. Unders., ser. C, No. 396, p. 175. (For *Rosalina linnei* de Lapparent, 1918 (not d'Orbigny, 1839), Mem. Carte geol. France, Hendaye, pl. 1, figs. 1-4, 7; pl. 6, figs. 2, 3; pl. 8; pl. 9, fig. 2; text figs. 1-3, 5*d*.).

1942:

Cristellaria (Robulus) grandis ten Dam and Reinhold, Mededeel. Geol. Stichting Haarlem, ser. C, vol. 5, No. 2, p. 54, pl. 3, fig. 3; pl. 9, fig. 9, preoccupied by *Cristellaria americana* Cushman, 1918, var. *grandis* Cushman, 1920, U. S. Geol. Surv., Prof. Pap. 128-D, p. 68, pl. 11, fig. 2.

Globigerina (Globotruncana) marginata (Reuss, 1845) subsp. *linnaeana* Olbertz, Palaeont. Zeitschr., vol. 23, p. 135, pl. 5, fig. 4, preoccupied by *Globigerina (Rosalina, Globotruncana) linnaeana* (d'Orbigny, 1839) *in* H. B. Brady, 1884, Reports Challenger, Zool., vol. 9, p. 598, pl. 82, fig. 12, pl. 114, fig. 21.

Globotruncana renzi Gandolfi, Riv. Ital. di Pal., anno 48, Mem. 4, p. 124, pl. 3, fig. 1, pl. 4, figs. 28 and 29, pl. 11, fig. 2. This particu-

lar species is a "synonymous homonym," and at the same time a "homonymous synonym" of *Globotruncana renzi* Thalmann, 1942 as it is based, *pro parte,* by both authors, on the same reference (indication). Thalmann's name appeared in April 1942 in a short abstract of the "Programme" for the Denver-Meeting of the American Association of Petroleum Geologists, while Gandolfi's name was published in a well-established scientific publication. It is, therefore, the writer's conviction, that Gandolfi's name should be taken as the valid one, or, alternatively, that the species should be referred to in future under a combination of the two authors' names: *Globotruncana renzi* Thalmann-Gandolfi, 1942. The recently issued Opinion 172, rendered by the International Commission on Zoological Nomenclature (vol. 2, pt. 42, pp. 471-482 of the "Opinions and Declarations," London, 22nd January 1946) only refers to types of genera published on, or before, 31st December 1930. In the writer's opinion this Opinion 172 should be extended also to include species and varieties (subspecies) designated in "abstracts and similar publications" before and after December 31st, 1930. The nomenclatorial status of *Globotruncana renzi* is dealt with in a forthcoming note in the "Eclogae Geologica Helvetiae" (Proceedings of the Swiss Paleontological Society Annual Meeting in Zurich, September 1946.)

Lagena (Fissurina) marginata (Walker and Boys, 1784) subsp. *costata* Olbertz, *op. cit. (ut supra),* p. 103, pl. 4, fig. 4, preoccupied by:

a) *Lagena costata* (Williamson, 1858, *Entosolenia*), Rec. British Foram., p. 9, pl. 1, fig. 18;

b) *Lagena auriculata* Brady, 1881, var. *costata* Brady, 1881 Quart. Jour. Microsc. Sci., vol. 21, p. 61.

Nummulites cretaceus Pérébaskine, Bull. Soc. géol. France, ser. 5, vol. 12, p. 119, text figs. 1-7, preoccupied by *Nummulites cretacea* Fraas, 1867, Württemberg. Naturhist. Jahreshefte, p. 227, pl. 2, fig. 8.

Vaginulina striatula ten Dam and Reinhold, *op. cit. (ut supra),* p. 65, pl. 4, fig. 10; pl. 9, fig. 12, preoccupied by *Vaginulina striatula* Roemer, 1842, N. Jahrb. f. Min. etc., p. 273, pl. 7-B, figs. 2 a-c.

1943:

Bullopora laevis (Sollas, 1877), var. *hispida* Kline, Mississippi State Geol. Surv., Bull. 53, p. 43, pl. 4, fig. 16, preoccupied by *Bullopora*

chapmani (Plummer, 1927), var. *hispida* Kline, *ibid.*, p. 43, pl. 4, fig. 12.

Robulus pseudo-costatus (Plummer, 1927) var. *inornatus* Kline, *ibid.*, p. 18, pl. 1, fig. 6, preoccupied by *Robulina inornata* d'Orbigny, 1846, Foram. Fossiles Vienne, p. 102, pl. 4, figs. 25, 26.

1944:

Globotruncana lapparenti Brotzen, 1936, subsp. *lapparenti* Bolli, 1944, Eclog. geol. Helvet., vol. 37, p. 230, text fig. 1, Nrs. 15 and 16; pl. 9, fig. 11, preoccupied by *Globotruncana lapparenti* Brotzen, 1936, Sver. geol. Unders., ser. C, No. 396, p. 175, and also preoccupied by *Rosalinella (=Globotruncana) lapparenti* Marie, 1941, *ut supra.*

Rotalia granulosa ten Dam, Mededeel. Geol. Stichting Haarlem, ser. C., vol. 5, No. 3, p. 121, pl. 4, fig. 2, preoccupied by *Rosalina (Rotalia) granulosa* Karrer, 1864 (1865), Sitzber. k. Akad. Wiss. Wien, vol. 1, Abth. 1, p. 710, pl. 2, fig. 14.

1945:

Quinqueloculina byramensis Hermes, Proefschrift (Thesis) Univ. Rijks-Univ. Utrecht, p. 35, pl. 5, fig. 3, preoccupied by *Quinqueloculina byramensis* Cushman, 1923, U. S. Geol. Surv., Prof. Pap. 133, p. 54, pl. 8, fig. 5.

Quinqueloculina nitida Norvang, The Zool. of Iceland, vol. 2, pt. 2, p. 7, text fig. 1, preoccupied by *Triloculina (Quinqueloculina) nitida* d'Orbigny, 1839, *in* Barker, Webb and Berthelot, Hist. Nat. Iles Canaries, vol. 2, pt. 2, "Foraminifères," p. 141, pl. 3, figs. 22-24.

Saracenaria cushmani Palmer, Bull. Amer. Paleont., vol. 29, No. 115, p. 38, pl. I, fig. 5, preoccupied by *Saracenaria cushmani* Tappan, 1940, Jour. Paleont., vol. 14, p. 106, pl. 16, fig. 17.

1946: (listed only so far as literature on Foraminifera was available to the writer up to October 1st, 1946):

Bolivina subangularis Brady, 1881, var. *irregularis* Germeraad, in Rutten and Hotz, Geol. Petr. and Pal. Results, Island Ceram, (3), Geol., No. 2, p. 68, pl. 3, figs. 15 and 16, preoccupied by *Bolivina irregularis* Terquem, 1882, Mém. Soc. géol. France, (3), vol. 3, p. 149, pl. 15, fig. 21.

Robulus alto-costatus Germeraad, *ibid.*, p. 65, pl. 1, figs. 20 and 21, preoccupied by *Robulus mexicanus* (Cushman) var. *alticostatus* Cushman and Barksdale, 1930, Contr. Geol. Dept. Stanford Univ., vol. I, p. 63, pl. 11, figs. 4-7.

A few words may be added with reference to the "Recommendations" to Article 36 of the IRZN, regarding the avoiding of the introduction of new names which differ only "in termination or in a variation of spelling which might lead to confusion." Workers in Foraminifera, who are about to publish a paper, would do well in following these "Recommendations," as can be seen from a few examples taken at random from the recent literature of Foraminifera: (slightly differing names are put in parentheses).

Lagena guttata Buchner 1940 (*L. gutta* Smith 1915; *L. guttula* Buchner 1940).

Lagena ollula Buchner 1940 (*L. ollulata* Matthes 1939).

Arenobulimina conica Marie 1941 (*A. conoidea* (Perner 1892)).

Lenticulina polygonalis Marie 1941 (*L. polygonata* Franke 1936).

Marginulina orbignyi Marie 1941 (*M. orbignyana* Neugeboren 1851).

Textularia conoidea Marie 1941 (*T. conuloidea* Costa 1856).

Bulimina trigonalis ten Dam 1944 (*B. trigona* Terquem 1882; *B. trigonula* Chapman 1904).

Cristellaria globulosa ten Dam 1944 (*C. globosa* v. Hantken 1868 or *C. globosa* Zwingli and Kübler 1870).

Cases where the radical of a geographic name is used for a species or variety name, as. f. i. *cubanus, cubensis, mediterraneus, mediterranensis.* etc., could be cited by the scores, as is also the case with patronymic derivatives. A few examples may, however, be given regarding foraminiferal genera:

Bolivinitella Marie 1941 (*Bolivinella* Cushman 1927)

Cercidina Vogler 1941 (*Cercidia* Thorell, 1869, Aves)

Gyromorphina Marie 1941 (*Gyromorphus* Guillebeau 1894, Coleopt.)

Olympia Reichel 1945 (1946) (*Olympina* Risso 1826, Crust., and *Olympina* Vest 1867, Moll.)

Taberina Keijzer 1945 (*Taberia* Paetel 1875, Moll.)

Lasiotrochus Reichel 1945 (1946) (*Lasiotrechus* Ganglbauer 1892, Coleopt.).

Eggerella Cushman 1933 (*Egerella* Stoliczka 1870, Moll.)

All above-cited examples, however, are valid names from the standpoint of the IRZN; but their similarity can easily create confusion — a fact which could have been avoided by selecting non-ambiguous and better-differentiating names.

New York, October 1946
HANS E. THALMANN

RECENT LITERATURE ON THE FORAMINIFERA

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

Earland, Arthur. A Note on the Genus *Rhaphidoscene*.—Journ. Roy. Micr. Soc., ser. III, vol. LXIV, pts. 1 & 2, March & June 1944, pp. 26-30.—This genus is a sponge and not a foraminifer.

Loeblich, Alfred R., and **Helen Tappan.** New Washita Foraminifera.—Journ. Pal., vol. 20, No. 3, May, 1946, pp. 238-258, pls. 35-37, text figs. 1-4.—Thirty-one species are described, 29 new, with four new genera, *Polychasmina* (genotype *P. pawpawensis* n. sp.), *Meandrospira* (genotype *M. washitensis* n. sp.), *Acruliammina* (genotype *Placopsilina longa* Tappan), and *Planomalina* (genotype *P. apsidostroba* n. sp.).

Cushman, Joseph A. Upper Cretaceous Foraminifera of the Gulf Coastal Region of the United States and Adjacent Areas.—U. S. Geol. Survey Prof. Paper 206, August 22, 1946, pp. 1-241, pls. 1-66.—Nearly 600 species and varieties are recorded and nearly all figured. Distribution tables are given for many of the species.

Tertiary Foraminifera from St. Croix, Virgin Islands, with a note on the geology by D. J. Cederstrom.—L. c., Prof. Paper 210-A, 1946, pp. 1-17, 2 text figs., distribution chart.—A total of 103 forms were found in three wells.

Stone, Benton. *Siphogenerinoides* Cushman (order Foraminifera, family Buliminidae).—Journ. Pal., vol. 20, No. 5, Sept. 1946, pp. 463-478, pls. 71, 72, text figs. 1, 2.—The structure is discussed and 4 new species and 1 new variety described.

Crespin, Irene. A Lower Cretaceous fauna in the northwest basin of Western Australia.—L. c., pp. 505-509, text figs. 1, 2.—A list of foraminifera is given.

Henbest, Lloyd G. Deaderick collection of Foraminifera.—L. c., pp. 517, 518.

Sutton, F. A. Geology of Maracaibo Basin, Venezuela.—Bull. Amer. Assoc. Petr. Geol., vol. 30, No. 10, Oct. 1946, pp. 1621-1741, 11 text figs., pl. 1 (map).—Lists of foraminifera are given and a few thin sections figured.

Cushman, Joseph A. and **H. H. Renz.** The Foraminiferal Fauna of the Lizard Springs Formation of Trinidad, British West Indies.—Special Publ. No. 18, Cushman Lab. Foram. Res., Oct. 1946, pp. 1-48, pls. 1-8, 1 map.—The fauna contains 154 species and 21 varieties of which 12 species and 10 varieties are new.

Phleger, Fred B. Jr., and **Walter A. Hamilton.** Foraminifera of two submarine cores from the North Atlantic Basin.—Bull. Geol. Soc. Amer., vol. 57, Oct. 1946, pp. 951-966, pl. 1, tables 1-3, figs. 1-3.

J. A. C.