

258. SOME FORAMINIFERA FROM THE UPPER
CRETACEOUS OF CALIFORNIA

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Micropaleontological study of the California Upper Cretaceous, embracing the Chico Series as defined by F. M. Anderson (Calif. Div. Mines, Bull. 118, pt. 2, 1941, pp. 183, 185), has shown that this part of the Mesozoic column is divisible into thirteen foraminiferal zones. The foraminifera described in this paper seem to belong to the species most important for recognition of the above-mentioned zones.

The localities are defined with respect to sections, townships, ranges, and counties. In addition, in order to facilitate finding of localities from which a number of the described species have been obtained, there is indicated a stratigraphical position of the sample carrying every given species in reference to the top of the Moreno shale as mapped by Robert Anderson and R. W. Pack (Bull. 603, U. S. Geol. Survey, 1915), and (in one case) in reference to the Funks formation as defined by J. M. Kirby (Bull. Amer. Assoc. Petr. Geol., vol. 27, 1943, pp. 279-305).

Family RHIZAMMINIDAE

Genus BATHYSIPHON M. Sars, 1872

BATHYSIPHON PERAMPLA Cushman and Goudkoff, n. sp. (Pl. 9, fig. 1)

Test large, elongate, tubular, sides parallel; wall fairly thick, of fine sand grains and amorphous material with occasional sponge spicules; chamber opening large and undivided. Breadth of compressed holotype, 3.5 mm.

Holotype (Cushman Coll. No. 42219) from Cretaceous, 1465-1468 ft. depth in Empire Oil and Gas Porterfield No. 1 Well, sec. 7, T. 10 N., R. 2 E., Yolo Co., California. There are smaller specimens with a similar wall structure from Weldon Canyon, 1800 ft. S. and 2700 ft. E. of NE. corner of sec. 34, T. 7 N., R. 2 W., Solano Co., California.

Only incomplete specimens were found, but they show this to be much larger than any of the described Cretaceous species. The specimens are all compressed, but the diameter must have been about 2 mm. at least, in the normal state. It differs from *Bathysiphon alexanderi* Cushman from the Cretaceous of Texas in its much larger size and much coarser test.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES EGGERI Cushman, var. **MINUTA** Cushman and Goudkoff, n. var. (Pl. 9, fig. 2)

Variety differing from the typical in the smaller size and tendency to become more depressed in the umbilical region.

Holotype of variety (Cushman Coll. No. 42222) from Cretaceous, Moreno Gulch, 120 ft. N. and 200 ft. E. of SW. corner of NW. $\frac{1}{4}$ of NE. $\frac{1}{4}$ of sec. 15, T. 14 S., R. 11 E., Fresno Co., California, 7025 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

There is a considerable variation in the excavation of the umbilical region, but the form is evidently allied to *H. eggeri* Cushman which is known from the uppermost Cretaceous of Mexico and Trinidad, and the Corsicana marl of Texas.

HAPLOPHRAGMOIDES COLUSAENSIS Cushman and Goudkoff, n. sp. (Pl. 9, fig. 3)

Test small, planispiral, completely involute, periphery subacute; chambers 8 to 10 in the adult coil, of uniform shape, increasing very gradually in size as added, little if at all inflated; sutures indistinct, not depressed, except very slightly at the periphery; wall arenaceous, with occasional mica flakes, with a fairly smooth surface; aperture a low opening in the median line at the base of the apertural face of the last-formed chamber. Length 0.42-0.63 mm.; breadth 0.40-0.50 mm.; thickness 0.25-0.30 mm.

Holotype (Cushman Coll. No. 42224) from Cretaceous, 3234 ft. depth in Ohio Oil Willard No. 1 A Well in sec. 18, T. 20 N., R. 2 W., Glenn Co., California.

This species differs from *H. eggeri* Cushman in the larger number of chambers and more involute test with a more angular periphery.

Genus CRIBROSTOMOIDES Cushman, 1910

CRIBROSTOMOIDES CRETACEA Cushman and Goudkoff, n. sp. (Pl. 9, fig. 4)

Test subglobular, planispiral, close-coiled, involute, with a distinctly depressed umbilical region, periphery broadly rounded; chambers 8 to 10 in the adult coil, very slightly if at all inflated, increasing very gradually in size as added; sutures fairly distinct, little if at all depressed; wall very finely arenaceous, smoothly finished; aperture in the adult with several pores along the base of the apertural face. Length 0.40-0.50 mm.; breadth 0.35-0.45 mm.; thickness 0.32-0.45 mm.

Holotype (Cushman Coll. No. 42226) from Cretaceous, Martinez Creek, 1470 ft. N. of SW. corner of sec. 23, T. 18 S., R. 14 E., Fresno Co., California, 2820 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

This species somewhat resembles *C. trinitatensis* Cushman and Jarvis from the Cretaceous of Trinidad, but differs in the larger number of chambers, which are higher, the less depressed sutures, and the finer wall. The pores of the apertural face are rather small and often difficult to see.

Besides the type locality, the species also occurs in Moreno Gulch, 400 ft. S. and 200 ft. W. of NE. corner of sec. 15, T. 14 S., R. 11 E., Fresno Co., California, 4780 ft. below top of Moreno, as mapped by R. Anderson and R. W. Pack.

CRIBROSTOMOIDES (?) sp. (Pl. 9, fig. 5)

Several specimens, one of which is figured, are peculiarly contorted. The forms at first glance might be taken as a species of *Trochammina*, as the chambers are carried over strongly to one side leaving the other side smooth. The tests are, however, apparently planispiral. The contortion of the test is too great and too uneven in different specimens to make certain just what the original shape may have been. The specimens are from Cretaceous of Ingram Creek, near SE. corner of NE. $\frac{1}{4}$ of sec. 16, T. 5 S., R. 6 E., Stanislaus Co., California, 9420 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA RUDITA Sandidge, var. **DIVERSA** Cushman and Goudkoff, n. var.
(Pl. 9, fig. 6)

Variety differing from the typical in the somewhat larger size, slightly smoother test, and less tapering form.

Holotype of variety (Cushman Coll. No. 42231) from Cretaceous, 4451 ft. depth in Ohio Oil Willard No. 1 A Well in sec. 18, T. 20 N., R. 2 W., Glenn Co., California.

This form is close to *G. rudita* Sandidge which has a rather wide range in the American Upper Cretaceous from the Austin, Taylor, and Navarro groups. It is variable in its characters, but the California variety seems to be distinct.

GAUDRYINA (PSEUDOGAUDRYINA) PYRAMIDATA Cushman (Pl. 9, figs. 7, 8)

Gaudryina laevigata FRANKE, var. *pyramidata* CUSHMAN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 587, pl. 16, fig. 8.—WHITE, Journ. Pal., vol. 2, 1928, p. 313, pl. 42, fig. 7.—CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 92, pl. 13, fig. 6.—CUSHMAN, Journ. Pal., vol. 6, 1932, p. 333.—CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 18, pl. 5, fig. 3.

Gaudryina (Pseudogaudryina) pyramidata CUSHMAN, Special Publ. 7, Cushman Lab. Foram. Res., 1937, p. 87, pl. 12, fig. 13.

Numerous specimens from the Cretaceous of Rumsey Hills, 1530 ft. N. and 750 ft. E. of SW. corner of sec. 23, T. 12 N., R. 3 E., Sutter Co., California, seem to be identical with this species known from the Upper Cretaceous of Mexico and Trinidad.

Family LAGENIDAE

Genus **PLANULARIA** DeFrance, 1824**PLANULARIA TRICARINELLA** (Reuss) (Pl. 9, fig. 9)

Cristellaria tricarinella REUSS, Sitz. Akad. Wiss. Wien, vol. 46, 1862 (1863), p. 68, pl. 7, fig. 9.

Planularia tricarinella CUSHMAN, Journ. Pal., vol. 6, 1932, p. 334, pl. 50, figs. 5, 6; Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 69, pl. 16, fig. 21; vol. 20, 1944, p. 5, pl. 1, fig. 17.

A few specimens from the Cretaceous of Rumsey Hills, 1000 ft. N. of SE. corner of sec. 22, T. 12 N., R. 3 E., Sutter Co., California, are very close to this species described from Europe but also recorded from the Cretaceous, Pecan Gap chalk, of Texas.

PLANULARIA sp. (Pl. 9, fig. 10)

The single specimen, here figured, is from the Cretaceous, Rumsey Hills, 1000 ft. N. of SE. corner of sec. 22, T. 12 N., R. 3 E., Sutter Co., California. Without more specimens it is difficult to place it specifically.

Genus **DENTALINA** d'Orbigny, 1826**DENTALINA MEGALOPOLITANA** Reuss (Pl. 9, fig. 11)

Dentalina megalopolitana REUSS, Zeitschr. deutsche. geol. Ges., vol. 7, 1855, p. 267, pl. 8, fig. 10.—CUSHMAN, Journ. Pal., vol. 5, 1931, p. 304, pl. 34, fig. 17; Tenn. Div. Geol., Bull. 41, 1931, p. 29, pl. 3, fig. 8; Journ. Pal., vol. 6, 1932, p. 335.—CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 29, pl. 9, fig. 5.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 80, pl. 13, figs. 26-28; vol. 20, 1944, p. 7, pl. 1, fig. 27.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 332, pl. 51, fig. 8.

Specimens which may be included in this species are from the Cretaceous, from 2929 ft. depth in Amerada Petroleum C. L. C. Well No. 1, in sec. 34, T. 16 N., R. 1 W., Colusa Co., California. Originally

described from the Cretaceous of Europe, the species is recorded from the Cretaceous of Trinidad and from the upper part of the Taylor marl and its equivalents in the Gulf Coastal Plain region of the United States.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA CURVISEPTA Cushman and Goudkoff, n. sp. (Pl. 9, figs. 12, 13)

Test elongate, early portion planispirally coiled and somewhat compressed, distinctly keeled, later portion uncoiled and rectilinear, becoming circular in transverse section; chambers of the early coiled portion indistinct, in the uncoiled portion distinct, somewhat inflated; sutures of the early portion indistinct, in the later portion distinct and depressed; wall ornamented with distinct, raised, longitudinal costae, curved over the early portion, later nearly parallel to the elongate axis of the test; aperture in the adult, terminal, radiate, slightly projecting. Length 1.15-1.45 mm.; breadth 0.45-0.50 mm.; diameter 0.37-0.40 mm.

Holotype (Cushman Coll. No. 42240) from Cretaceous, 5020 ft. depth in Ohio Oil Willard No. 1 A Well, in sec. 18, T. 20 N., R. 2 W., Glenn Co., California.

Like most species of the genus, this one is variable in the amount of uncoiling and the relative size of the coiled portion in the megalospheric and microspheric forms. It is closely related to *Marginulina trinitatensis* Cushman from the Cretaceous of Trinidad, but differs in the more elongate form, more raised and heavier costae, and the more compressed early portion.

Family POLYMORPHINIDAE

Genus GLOBULINA d'Orbigny, 1839

GLOBULINA LACRIMA Reuss, var. SUBSPHAERICA (Berthelin) (Pl. 9, fig. 14)

Polymorphina subsphaerica BERTHELIN, Mém. Soc. géol. France, ser. 3, vol. 1, 1880, p. 58, pl. 4, fig. 18.

Globulina lacrima REUSS, var. *subsphaerica* CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 78, pl. 19, figs. 5-7.—CUSHMAN, Tenn. Div. Geol., Bull. 41, 1931, p. 41, pl. 6, fig. 10.—JENNINGS, Bull. Amer. Pal., vol. 23, No. 78, 1936, p. 25, pl. 3, fig. 6.—LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 31, pl. 4, fig. 5.—TAPPAN, Journ. Pal., vol. 14, 1940, p. 113, pl. 17, fig. 24.

This variety is more compressed than the typical form. It is widely distributed in the Cretaceous of Europe. It occurs in America, especially in the Navarro and upper part of the Taylor in Mississippi,

Alabama, and Texas, as well as in the upper part of the Cretaceous of Mexico. There are a few records from lower sections of the Cretaceous. Our figured specimen is from the Cretaceous, 5706 ft. depth, in Jergins Oil Cheney Ranch No. 1 Well in sec. 29, T. 14 S., R. 13 E., Fresno Co., California.

Family HETEROHELICIDAE

Genus AMPHIMORPHINA Neugeboren, 1850

AMPHIMORPHINA (?) sp. (Pl. 9, figs. 15, 16)

The fragmentary specimens figured seem to belong to this genus, but the early stages must be found to make this certain and also for specific identification. They are from the Cretaceous, Rumsey Hills, 1600 ft. N. and 900 ft. E. of SW. corner of sec. 23, T. 12 N., R. 3 E., Sutter Co., California.

Genus SIPHOGENERINOIDES Cushman, 1927

SIPHOGENERINOIDES WHITEI Church (Pl. 9, figs. 17, 18)

Siphogenerinoides whitei CHURCH, Calif. Div. Mines, Bull. 118, pt. 2, 1941, p. 182, pl. 67, fig. 37.—SCHENCK, Journ. Pal., vol. 17, 1943, p. 62.

Our figured specimens are from the Cretaceous, at a depth of 6274 ft., Jergins Oil Cheney Ranch No. 1 Well, sec. 29, T. 14 S., R. 13 E., Fresno Co., California.

The types are from the Moreno shale of Fresno Co., California, and it has been recorded from the Tierra Loma shale member of the Moreno in Merced Co.

SIPHOGENERINOIDES CLARKI Cushman and Campbell, var. **COSTIFERA** Cushman and Goudkoff, n. var. (Pl. 9, fig. 19)

Variety differing from the typical in the surface of the test which, instead of being smooth, has definite, longitudinal costae.

Holotype of variety (Cushman Coll. No. 42245) from Cretaceous, 6988 ft. depth in Jergins Oil Cheney Ranch No. 1 Well, sec. 29, T. 14 S., R. 13 E., Fresno Co., California.

In some respects this form resembles *S. cretacea* Cushman from the Cretaceous of Venezuela, but the general shape of the test and of the chambers more closely resembles *S. clarki*.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA PROLIXA Cushman and Parker (Pl. 10, fig. 1)

Bulimina puschi CUSHMAN (not REUSS), Tenn. Div. Geol., Bull. 41, 1931, p. 47, pl. 7, fig. 19.

Bulimina proluxa CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 98, pl. 15, fig. 5.—SCHENCK, Journ. Pal., vol. 17, 1943, p. 62.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 66, pl. 11, fig. 23.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 337, pl. 53, fig. 8.

This species is known from the Upper Cretaceous, in beds of Navarro age and upper beds of Taylor age in Tennessee, Mississippi, Arkansas, and Texas. Schenck records it from the upper part of the Tierra Loma shale member of the Moreno formation of Merced Co., California. Our present specimens are from 3283 ft. depth in Union Oil Tracy Land No. 1 Well in sec. 14, T. 3 S., R. 6 E., San Joaquin Co., and from Ingram Creek, NW. $\frac{1}{4}$ of sec. 14, T. 5 S., R. 6 E., Stanislaus Co., California. The latter is from horizon 400 ft. stratigraphically below top of Moreno shale, as mapped by R. Anderson and R. W. Pack.

BULIMINA PETROLEANA Cushman and Hedberg (Pl. 10, fig. 2)

Bulimina petroleana CUSHMAN and HEDBERG, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 95, pl. 22, fig. 31.

This species was described from the Upper Cretaceous, Colon formation, of Santander del Norte, Colombia. Our California specimens seem identical when compared with the types. They are from Ingram Creek, NW. $\frac{1}{4}$ of sec. 14, T. 5 S., R. 6 E., Stanislaus Co., California, 400 ft. stratigraphically below top of Moreno shale, as mapped by R. Anderson and R. W. Pack; and Los Banos Creek, near center of sec. 12, T. 11 S., R. 9 E., Merced Co., California, 1080 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

Genus REUSSELLA Galloway, 1933

REUSSELLA CALIFORNICA Cushman and Goudkoff, n. sp. (Pl. 10, figs. 3-5)

Test about $1\frac{1}{2}$ times as long as broad, early stages regularly triserial, in the adult irregular, in some specimens tending to become biserial; chambers distinct, tending to become deeply excavated at the base and with a distinct, sharp ridge along the middle of the chamber, more distinct in the later stages; sutures distinct, depressed; wall distinctly and rather coarsely perforate, unornamented; aperture comma-shaped, at the inner margin of the chamber, with a very slightly raised lip. Length 0.65-0.70 mm.; breadth 0.45-0.50 mm.

Holotype (Cushman Coll. No. 42252) from Cretaceous, North-South road to Vendon, E. $\frac{1}{2}$ of sec. 4, T. 5 N., R. 1 W., Solano Co., California.

In some respects this species remotely resembles *Bulimina limbata* White from the Cretaceous of Mexico. The early stages are very similar to *Reussella spinulosa* (Reuss), but the later chambers become deeply excavated, and there is a tendency to become biserial.

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA OROLOMAENSIS Cushman and Goudkoff, n. sp. (Pl. 10, fig. 7)

Test nearly circular in side view, periphery entire, slightly keeled, biconvex in peripheral view, more strongly convex on the ventral side, umbilical region strongly depressed; chambers distinct, 8 to 9 in the last-formed whorl, not inflated, increasing rather uniformly in size as added; sutures distinct, strongly curved, thickened and appearing darker than the chamber walls; wall smooth, distinctly perforate; aperture an elongate, low opening running from near the periphery to the umbilicus on the ventral side beneath a somewhat flattened lip. Length 0.45-0.65 mm.; breadth 0.40-0.55 mm.; thickness 0.20-0.25 mm.

Holotype (Cushman Coll. No. 42255) from Cretaceous, Russ Syndicate Hewett No. 1 Well, 3511 ft. depth, sec. 28, T. 12 S., R. 11 E., Merced Co., California.

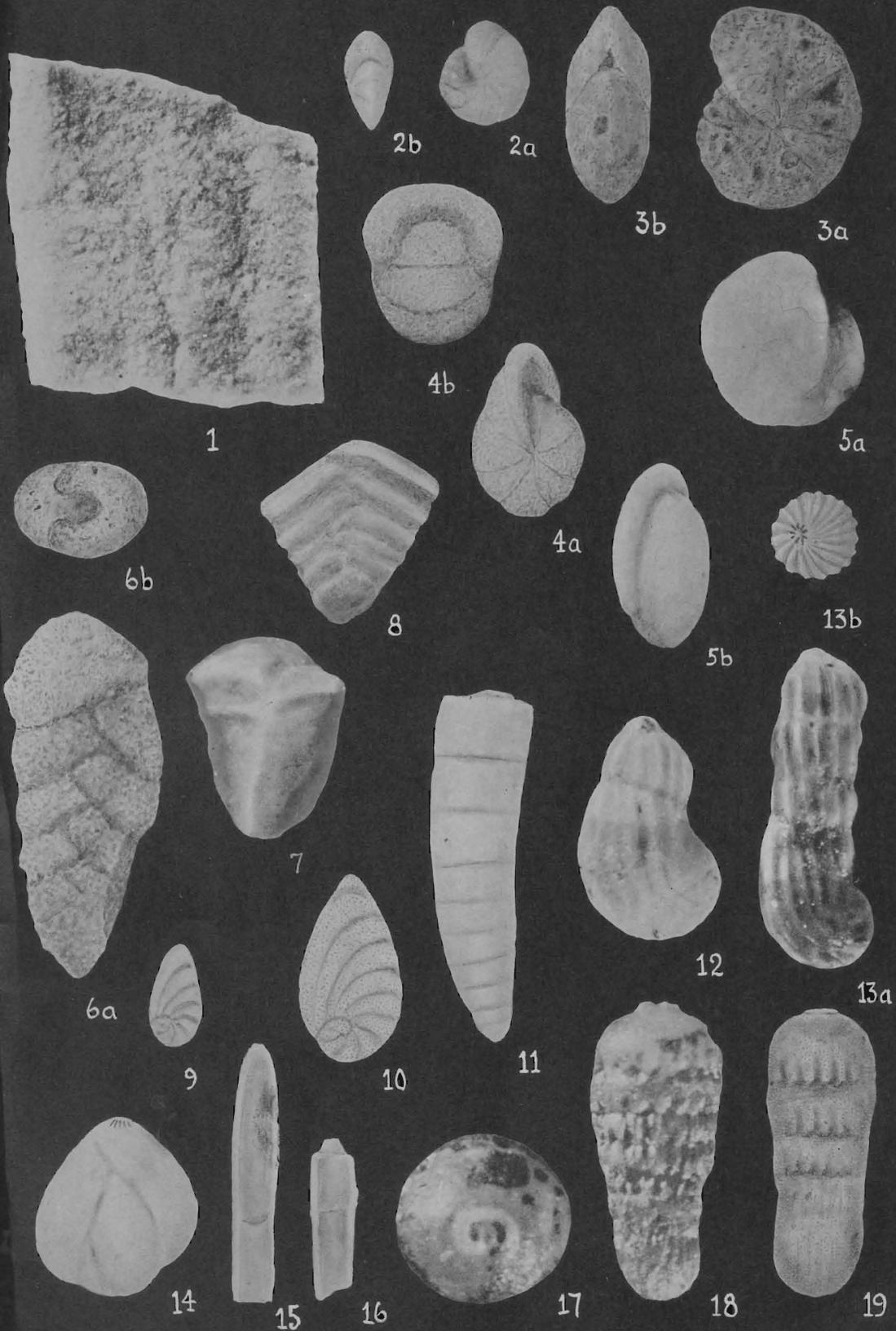
This species differs from *Valvulineria cretacea* Carsey in the fewer chambers to the coil, more strongly curved sutures, more angled periphery, and distinctly depressed umbilicus. Besides the type locality the species also occurs in Milham Exploration Oro Loma No. 1 Well, at a depth of 5625 ft., in sec. 12, T. 12 S., R. 11 E., Merced Co., California.

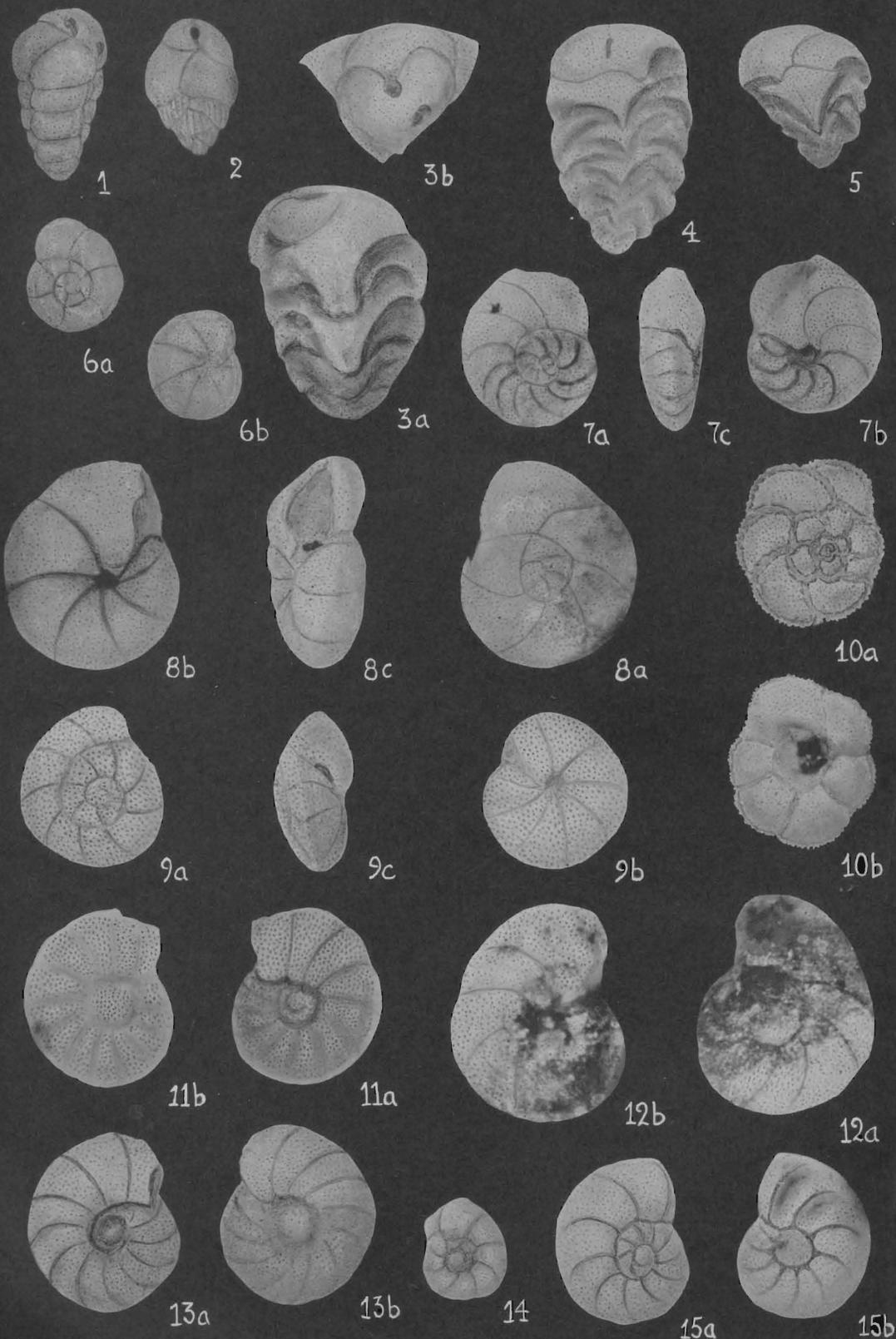
EXPLANATION OF PLATE 9

All figures $\times 50$ unless otherwise noted.

FIG. 1. *Bathysiphon perampla* Cushman and Goudkoff, n. sp. $\times 16$. Holotype. 2. *Haplophragmoides eggeri* Cushman, var. *minuta* Cushman and Goudkoff, n. var. Holotype. 3. *H. colusaensis* Cushman and Goudkoff, n. sp. Holotype. 4. *Cribrostomoides cretacea* Cushman and Goudkoff, n. sp. Holotype. 5. *Cribrostomoides* (?) sp. 6. *Gaudryina rudita* Sandidge, var. *diversa* Cushman and Goudkoff, n. var. $\times 35$. a, front view; b, apertural view. Holotype. 7, 8. *Gaudryina* (*Pseudogaudryina*) *pyramidata* Cushman. $\times 35$. 9. *Planularia tricarinelata* (Reuss). 10. *Planularia* sp. 11. *Dentalina megalopolitana* Reuss. $\times 35$. 12, 13. *Marginulina curvisepta* Cushman and Goudkoff, n. sp. $\times 35$. 12, Paratype, microspheric. 13, Holotype, megalospheric. a, front view; b, apertural view. 14. *Globulina lacrima* Reuss, var. *subsphaerica* (Berthelin). 15, 16. *Amphimorphina* (?) sp. 17, 18. *Siphogenerinoides whitei* Church. 17, apertural view, $\times 43$. 18, front view, $\times 35$. 19. *S. clarki* Cushman and Campbell, var. *costifera* Cushman and Goudkoff, n. var. Holotype.

Unless otherwise noted: a, side view; b, apertural view.





VALVULINERIA LILLISI Cushman and Goudkoff, n. sp. (Pl. 10, fig. 8)

Test nearly circular in side view, periphery in the last whorl very slightly lobulate, rounded, unequally biconvex, the dorsal side slightly convex, the ventral side strongly so, umbilical region strongly depressed; chambers distinct, 7 or 8 in the last-formed whorl, very slightly inflated on the dorsal side, more strongly so on the ventral side, increasing rather rapidly in size as added; sutures distinct, strongly curved, thickened and appearing darker than the chamber walls, slightly depressed on the dorsal side, somewhat more so on the ventral side; wall smooth, rather coarsely perforate; aperture an elongate, low opening running from near the periphery to the umbilicus on the ventral side beneath a very slightly developed lip. Length 0.50-0.65 mm.; breadth 0.45-0.55 mm.; thickness 0.25-0.28 mm.

Holotype (Cushman Coll. No. 42256) from Cretaceous, at 5568 ft. depth in Jergins Oil Cheney Ranch No. 1 Well, sec. 29, T. 14 S., R. 13 E., Fresno Co., California. It also occurs in Western Gulf Lillis-Welch No. 1 Well, at 3864 ft. depth, sec. 26, T. 15 S., R. 12 E., Fresno Co., California.

Genus **GYROIDINA** d'Orbigny, 1826**GYROIDINA GLOBOSA** (Hagenow) (Pl. 10, fig. 6)

Nonionina globosa HAGENOW, Neues Jahrb. für Min., 1842, p. 574.

Rotalia globosa REUSS, Sitz. Akad. Wiss. Wien, vol. 44, 1861 (1862), p. 330, pl. 7, fig. 2.

Gyroidina globosa CUSHMAN, Journ. Pal., vol. 5, 1931, p. 310, pl. 35, fig. 19.—CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 47, pl. 14, figs. 3, 4.—CUSHMAN and HEDBERG, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 97, pl. 23, fig. 14.—CUSHMAN, l. c., vol. 20, 1944, p. 13, pl. 3, fig. 3.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 339, pl. 53, figs. 21, 22.

Gyroidina naranjoensis WHITE, Journ. Pal., vol. 2, 1928, p. 296, pl. 40, fig. 5.

EXPLANATION OF PLATE 10

All figures $\times 50$ unless otherwise noted.

FIG. 1. *Bulimina prolixa* Cushman and Parker. 2. *B. petroleana* Cushman and Hedberg. 3-5. *Reussella californica* Cushman and Goudkoff, n. sp. 3, Holotype, a, front view; b, apertural view. 4, 5, Paratypes. 6. *Gyroidina globosa* (Hagenow). $\times 70$. 7. *Valvulineria orolomaensis* Cushman and Goudkoff, n. sp. Holotype. 8. *V. lillisi* Cushman and Goudkoff, n. sp. Holotype. 9. *Eponides ingramensis* Cushman and Goudkoff, n. sp. $\times 105$. Holotype. 10. *Globotruncana canaliculata* (Reuss). 11. *Anomalina henbesti* Plummer. 12. *Anomalina* cf. *clementiana* (d'Orbigny). 13. *Planulina nacatochensis* Cushman. 14. *Cibicides* cf. *coonensis* (W. Berry). 15. *C. stephensoni* Cushman.

Unless otherwise noted: a, dorsal view; b, ventral view; c, peripheral view.

This species, originally described from the Cretaceous of Europe, is widely distributed in the Cretaceous of America. It occurs particularly in beds of Taylor age, but also extends downward to the upper Austin and upward to the lower Navarro. It also occurs in the Colon shale of Colombia, and probably in Mexico and Trinidad. Our specimens are from 5706 ft. depth in Jergins Oil Cheney Ranch No. 1 Well, sec. 29, T. 14 S., R. 13 E., Fresno Co., California.

Genus EPONIDES Montfort, 1808

EPONIDES INGRAMENSIS Cushman and Goudkoff, n. sp. (Pl. 10, fig. 9)

Test very small, trochoid, strongly biconvex, ventral side more convex than the dorsal, periphery subacute; chambers distinct, 9 or 10 in the final whorl, slightly inflated on the ventral side, increasing very gradually in size as added; sutures distinct, slightly depressed on the ventral side, slightly curved on the dorsal side, nearly radial on the ventral side; wall smooth, rather coarsely perforate; aperture a small, low opening on the ventral side of the last-formed chamber midway between the periphery and the umbilicus. Diameter 0.17-0.23 mm.; thickness 0.12-0.13 mm.

Holotype (Cushman Coll. No. 42258) from Cretaceous, Ingram Creek, NW. $\frac{1}{4}$ of sec. 14, T. 5 S., R. 6 E., Stanislaus Co., California, 400 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

This species in some respects remotely resembles the small form described as *Cibicides cognatus* Galloway and Morrey, but our species has more oblique sutures on the dorsal side, fewer chambers, more acute periphery, and the aperture is on the ventral side as in *Eponides*. It was also found at a depth of 3623 ft. in Union Oil Tracy Land No. 1 Well, sec. 14, T. 3 S., R. 6 E., San Joaquin Co., California.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

GLOBOTRUNCANA CANALICULATA (Reuss) (Pl. 10, fig. 10)

(For references, see these Contributions, vol. 20, 1944, p. 14.)

This species has a wide range, both in the European and American Cretaceous. The figured specimen is one of a series from Moreno Gulch, 150 ft. S. and 420 ft. E. of the center of NW. $\frac{1}{4}$ of sec. 15, T. 14 S., R. 11 E., Fresno Co., California.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA HENBESTI Plummer (Pl. 10, fig. 11)

- Anomalina henbesti* PLUMMER, Univ. Texas Bull. 3501, 1936, p. 290, pl. 5, figs. 7-10.—
 COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 34, pl. 2, figs. 9, 10.
Anomalina complanata CUSHMAN (not REUSS), Tenn. Div. Geol., Bull. 41, 1931, p.
 60, pl. 11, fig. 7.—SANDIDGE, Amer. Midland Nat., vol. 13, 1932, p. 368, pl. 31,
 figs. 30, 31.
Anomalina semicomplanata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14,
 1938, p. 68, pl. 12, fig. 1; vol. 16, 1940, p. 29, pl. 5, fig. 9.—CUSHMAN and HED-
 BERG, l. c., vol. 17, 1941, p. 99, pl. 23, fig. 23.

This species occurs in the upper part of the Taylor and lower part of the Navarro in Tennessee and Texas, as well as in the Colon formation of Colombia and samples from Florida wells. Our specimens are from the Cretaceous of Ingram Cr ek, SE. $\frac{1}{4}$ of NE. $\frac{1}{4}$ of sec. 3, T. 5 S., R. 6 E., Stanislaus Co., California, 270 ft. stratigraphically above top of Panoche, as mapped by R. Anderson and R. W. Pack.

ANOMALINA cf. CLEMENTIANA (d'Orbigny) (Pl. 10, fig. 12)

Specimens close to this species occur at a depth of 6287 ft. in Jergins Oil Cheney Ranch No. 1 Well, sec. 29, T. 14 S., R. 13 E., Fresno Co., California. The raised ornamentation is not so prominent in the California specimens as in the typical form, but otherwise the characters are very similar.

Genus PLANULINA d'Orbigny, 1826

PLANULINA NACATOCHENSIS Cushman (Pl. 10, fig. 13)

- Planulina nacatochensis* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938,
 p. 50, pl. 8, fig. 9; vol. 16, 1940, p. 36, pl. 6, fig. 12.

Specimens, which were compared with the types of this species and seem to be the same, are from the Cretaceous, Moreno Gulch, 300 ft. S. and 1700 ft. W. of NE. corner of sec. 11, T. 14 S., R. 11 E., Fresno Co., California, 1000 ft. stratigraphically below the top of Moreno, as mapped by R. Anderson and R. W. Pack; and from Ingram Creek, NW. $\frac{1}{4}$ of sec. 14, T. 5 S., R. 6 E., Stanislaus Co., California, 230 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack.

Genus CIBICIDES Montfort, 1808

CIBICIDES STEPHENSONI Cushman (Pl. 10, fig. 15)

- Cibicides stephensoni* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938,

p. 70, pl. 12, fig. 5; vol. 16, 1940, p. 37, pl. 7, fig. 2; vol. 20, 1944, p. 16, pl. 3, fig. 16.

This species is known from the Upper Cretaceous beds of upper Taylor and Navarro age in the Gulf Coastal Plain area of the United States. Specimens assigned to this species occur in the Cretaceous of Funks Creek, SW. $\frac{1}{4}$ of sec. 10, T. 17 N., R. 4 W., Colusa Co., California, 255 ft. stratigraphically below top of Funks formation, as mapped by J. M. Kirby; and in well samples in Shell Oil Nissen No. 1 Well, in sec. 7, T. 2 S., R. 3 E., Alameda Co., California, at depths of 796 and 991 ft.

CIBICIDES cf. *COONENSIS* (W. Berry) (Pl. 10, fig. 14)

Specimens from the Cretaceous of Los Banos Creek, NE. $\frac{1}{4}$ of sec. 12, T. 11 S., R. 9 E., Merced Co., California, 150 ft. stratigraphically below top of Moreno, as mapped by R. Anderson and R. W. Pack, are close to this somewhat variable species.

259. SPECIES OF THE GENERA *NODOPHTHALMIDIUM*, *NODOBACULARIELLA*, AND *VERTEBRALINA*

By JOSEPH A. CUSHMAN and RUTH TODD

A number of species, originally assigned to *Vertebralina*, have been found to belong in the genus *Nodobaculariella*, erected by Cushman and Hanzawa in 1937 to include forms which differ from *Vertebralina* in having a planispiral early part and in being bilaterally symmetrical throughout, instead of having a trochoid early part with a dorsal and ventral side in the adult. All of the species of *Vertebralina* and *Nodobaculariella* are reviewed, together with those of *Nodophtalmidium*, a genus related to *Nodobaculariella* in its initial part, but differing in its later development. Type figures and descriptions are copied, two new species and one new variety are described, and one new name is proposed.

Genus *NODOPHTHALMIDIUM* Macfadyen, 1939

Genotype: *Nodobacularia compressa* Rumbler

Nodophtalmidium MACFADYEN, Journ. Roy. Micr. Soc., vol. 59, 1939, p. 167.—CUSHMAN, Foraminifera, 3rd. Ed., 1940, p. 179.

Nubecularia (part) MILLETT (not DEFRANCE).

Nodobacularia (part) of authors.

Test free, consisting of a globular proloculum followed by a planispiral, tubular, second chamber and in the adult a few chambers in a rectilinear series; wall calcareous, imperforate; aperture simple, terminal, with a lip.—Recent; Tertiary (?).

NODOPHTHALMIDIUM COMPRESSUM (Rhumbler) (Pl. 11, fig. 1)

Nodobacularia compressa RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, 1906, p. 38, pl. 2, fig. 14.

Nodophthalmidium compressum MACFADYEN, Journ. Roy. Micr. Soc., ser. 3, vol. 59, 1939, p. 168, text fig. 3.—CUSHMAN, Foraminifera, 3rd. Ed., 1940, pl. 15, fig. 30.

Nodobacularia tibia CUSHMAN (not JONES and PARKER), Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 15, fig. 30.

Rhumbler named and figured this species from Recent material off Lissa Id. in the Adriatic Sea, but gave no description. The type figure, reproduced on our plate, is of a specimen viewed by transmitted light. It shows a proloculum followed by a short chamber, planispiral like *Cornuspira*, it in turn being followed by a chamber in the same plane extending around and out beyond the previous portion. This is followed by two elongate, compressed, rectilinear chambers. The aperture is elongate, oval, with a slightly flaring lip but no sign of a tooth. The length is given as 0.408 mm.

NODOPHTHALMIDIUM (?) IRREGULARIS (Rhumbler) (Pl. 11, fig. 2)

Nodobacularia irregularis RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, 1906, p. 38, pl. 2, fig. 15.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 40, pl. 8, fig. 3.

This species, described and figured from off Laysan in the Pacific, is a very peculiar one. The proloculum is followed by a *Cornuspira*-like chamber, a half coil in length. The remainder of the test is made up of three irregularly shaped chambers in a generally rectilinear series. There is evidently an opening at the outer pointed end, but, in the last two chambers, supplementary openings near the base. The length of the specimens as given is 0.7-0.8 mm. The type figure is reproduced on our plate. It is certainly a very peculiar form, and its generic position subject to some question.

NODOPHTHALMIDIUM ANTILLARUM (Cushman) (Pl. 11, fig. 3)

Articulina antillarum CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 71, pl. 12, fig. 5; Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 52, pl. 12, fig. 4.—BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 165.

Test very elongate, slender, early portion with a planispirally coiled, *Cornuspira*-like chamber following the proloculum, the main portion of the test composed of several cylindrical chambers in a recti-

linear series, gradually increasing in diameter as added but only slightly in length, the outer end with a broad, flaring lip; sutures distinct, marked by the encased lip of the preceding chamber in the adult portion; wall of the early coiled portion smooth, the uniserial chambers with rounded, longitudinal costae; aperture circular at the distal end of the chamber. Length up to 2.50 mm.; diameter 0.25-0.30 mm.

This species, described from the Dry Tortugas, off Florida, is, so far as known, confined to the tropical Atlantic. The original description of *A. antillarum* included two genera under the one name, for it was stated "the early portion in the microspheric form milioline, in the megalospheric form *Cornuspira*-like." The figured holotype, however, shows clearly the *Cornuspira*-like early part, and belongs in *Nodophthalmidium*. The forms with the milioline early part belong in *Articulina paucicostata* Cushman.

Cole (Bull. 6, Florida Geol. Survey, 1931, p. 22, pl. 2, fig. 11) figured an end chamber from the Pliocene of Florida that resembles this species, but may be the end chamber of *Articulina paucicostata* Cushman. The Pacific form from Samoa referred to this species (Cushman, Publ. 342, Carnegie Instit. Washington, 1924, p. 66, pl. 25, fig. 1) is *Articulina elongata* Cushman.

NODOPHTHALMIDIUM MILLETTI (Cushman) (Pl. 11, figs. 4-7)

Nodobacularia milletti CUSHMAN, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 69, pl. 16, figs. 3, 4; Special Publ. 5, Cushman Lab. For. Res., 1933, pl. 16, figs. 25, 26.

Nodophthalmidium milletti CUSHMAN, Foraminifera, 3rd. Ed., 1940, Key, pl. 16, figs. 25, 26.

Articulina conico-articulata MILLETT (not BATSCH), Journ. Roy. Micr. Soc., 1898, p. 511, pl. 12, figs. 9, 10.

Test elongate, tapering, early portion with a planispirally coiled, *Cornuspira*-like chamber following the proloculum, remainder of the test uniserial, rectilinear; chambers distinct, those of the uniserial portion broadest near the base, narrowing toward the apertural end, increasing rapidly in size as added; sutures distinct; wall ornamented by a few, 12 to 18, usually high, thin, plate-like costae, terminating in spines at the basal end, those of the later chambers often bifurcating; aperture elliptical, with a very broad lip. Length of holotype, 1.5 mm.; breadth 0.27-0.33 mm.; thickness 0.27 mm.

The types of this species are from Mokaujar Anchorage, Fiji, and it occurred also in 12 fms., off Levuka, Fiji. The form figured by Mil-

lett from the Malay Archipelago is probably the same as our species.

In some of the specimens the *Cornuspira*-like second chamber consists of nearly two coils, while in others it is shorter and followed by an ornamented chamber $\frac{1}{2}$ to $\frac{1}{3}$ coil in length, but in the same plane.

The later chambers resemble those of *Articulina alticostata* Cushman, but are spreading at the base instead of contracted as in that species, and the costae project into spines. The early stages of *A. alticostata* are definitely quinqueloculine.

NODOPHTHALMIDIUM SIMPLEX Cushman and Todd, new name (Pl. 11, fig. 8)

Nubecularia tibia MILLETT (not JONES and PARKER), Journ. Roy. Micr. Soc., 1898, p. 261, pl. 5, fig. 3.—RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, 1906, p. 38, pl. 2, fig. 13.

Nodobacularia tibia CUSHMAN (not JONES and PARKER), Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 39, pl. 8, figs. 1, 2?

Test elongate, consisting of a globular proloculum followed by a *Cornuspira*-like chamber $\frac{1}{2}$ to a whole coil in length, the remainder of the test uniserial and rectilinear; chambers distinct, those of the adult portion elongate, the basal portion fusiform, then tapering to the apertural end, circular in transverse section; sutures distinct; wall smooth; aperture rounded, terminal. Length of Millett's figured specimen 0.50 mm.; diameter 0.07 mm.

The type specimen is from the Malay Archipelago figured by Millett. The figure given by Rhumbler of a specimen from Korea Strait is very similar. Numerous specimens without the early stages have been referred to Jones and Parker's species, but their position must be left in doubt.

Genus NODOBACULARIELLA Cushman and Hanzawa, 1937

Genotype: *Nodobaculariella japonica* Cushman and Hanzawa

Nodobaculariella CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 41.—CUSHMAN, Foraminifera, 3rd Ed., 1940, p. 180.

Vertebralina (part) of authors.

Spiroloculina (part) of authors.

Articulina (part) of authors.

"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 $\frac{1}{2}$ coil in length, and then by several, rapidly widening chambers, each normally $\frac{1}{2}$ coil in length, some-

times 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.—Tertiary and Recent.”

This genus may be separated from *Vertebralina* d'Orbigny by the early portion which is planispiral and usually shows the proloculum and subsequent *Cornuspira*-like chamber, and by the aperture which is median with the lip equal on both sides instead of having one side more extended than the other as in *Vertebralina*.

NODOBACULARIELLA CASSIS (d'Orbigny) (Pl. 11, figs. 9-12)

Vertebralina cassis d'ORBIGNY, in De la Sagra, Hist. Fís. Pol. Nat. Cuba, 1839, "Foraminifères," p. 51, pl. 7, figs. 14, 15.—CUSHMAN (part), Proc. U. S. Nat. Mus., vol. 59, 1921, p. 64, pl. 15, figs. 1, 4 (not figs. 2, 3, 5-8); (part), Publ. 311, Carnegie Instit. Washington, 1922, p. 62; Bull. 676, U. S. Geol. Survey, 1918, p. 25.—COLE, Bull. 6, Florida Geol. Survey, 1931, p. 23, pl. 5, fig. 8.—BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 74.—CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 44.

Test much compressed, periphery acute, with a distinct, thin, narrow keel; chambers planispiral, typically not involute but occasionally slightly so, irregularly triangular in the adult, slightly inflated, usually two, occasionally three in the adult coil, the adult typically with a single uncoiled chamber; sutures distinct, slightly depressed, nearly straight or gently curved; wall ornamented by numerous fine costae, obliquely curved in the earlier chambers but parallel to the margins in the adult, uncoiled chamber; aperture elongate, terminal with a distinctly everted lip. Length of adults, 0.95-1.12 mm.; breadth 0.50-0.75 mm.; thickness 0.15-0.30 mm.

The types were from shore sands of Cuba. The species is common in warm, shallow water of the tropical Atlantic, and occurs also in the Pliocene of Florida. The species differs from *N. atlantica* Cushman and Hanzawa in the thicker test, usually less clear early stages, more strongly developed keel, and the adult with a final chamber tending to become rectilinear.

NODOBACULARIELLA CONTRACTA (Terquem) (Pl. 11, figs. 13-14)

Vertebralina contracta TERQUEM (part), Mém. Soc. géol. France, ser. 3, vol. 2, 1882, p. 45, pl. 2 (10), figs. 21?, 22 (not figs. 19, 20).—CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 44.

Test small, planispiral, consisting of a proloculum followed by a *Cornuspira*-like second chamber about a coil in length, and in the adult three chambers making up the final whorl, periphery acute but not keeled; chambers slightly inflated, distinct, all visible from both sides, increasing rapidly in size as added; sutures distinct, slightly depressed, nearly straight, tangential; wall with faint costae, nearly parallel to the periphery; aperture very narrow, elongate, with a slightly flaring lip. Length 0.45 mm.; breadth 0.35 mm.; thickness 0.12 mm.

The types were from the Eocene of the Paris Basin. Terquem's figure 22, which is here designated as the type, was from Vaudancourt. Terquem's figure is copied on our plate and an illustration given of a specimen in our collection from the Paris Basin. Terquem's figures 19 and 20 may be the early stages of an *Articulina*, and figure 21 may be the same as his "*V. contracta*", but poorly drawn.

NODOBACULARIELLA CONVEXIUSCULA (H. B. Brady) (Pl. 11, figs. 15, 16)

Spiroloculina (?) *convexiuscula* H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 155, pl. 10, figs. 18-20.—MILLET, Journ. Roy. Micr. Soc., 1898, p. 266.—SIDEBOTTOM, l. c., 1918, p. 6.—CUSHMAN, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 409, pl. 82, fig. 4.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 74.

Test planispiral, compressed, biconvex, somewhat involute in the later development, periphery carinate, usually two chambers in the adult coil; chambers in the adult slightly inflated; sutures slightly depressed; wall ornamented with longitudinal costae slightly curved or in some specimens nearly parallel to the periphery, often somewhat irregular; aperture elongate, oval, with a distinct lip. Diameter 0.75-2.00 mm.; thickness 0.20-0.40 mm.

The types of this species were from Torres Strait in 155 fms. and from off the Admiralty Ids. in 16-25 fms. It is recorded from the Malay Archipelago, off the east coast of Australia in 465 fms., and from off the Philippines in 10-393 fms. We have material from 17-20 fms., Masthead Id., Australia.

The early stages of this species show that it should be placed in *Nodobaculariella* even though the last-formed chambers become slightly embracing, and obscure the earlier ones.

NODOBACULARIELLA INSIGNIS (H. B. Brady) (Pl. 11, figs. 17, 18)

Vertebralina insignis H. B. BRADY, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 187, pl. 12, figs. 9-11.—BAGG, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 123.—CUSH-

MAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 39, pl. 22, figs. 1, 2.—CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 44.

"Test compressed, planospiral, subquadrangular, nearly symmetrical bilaterally; margin angular or partially carinate. Segments few, more or less triangular in outline, embracing - the three segments of the final convolution (with or without a single additional or non-spiral segment) forming almost the entire visible shell. Surface decked with exogenous costae, either distinct or in some parts combined so as to form an irregular reticulated ornament. Aperture a long bordered slit, on the median line of the outer face of the terminal chamber. Length, 1/25th inch (1 mm.)."

The types are from the coral reefs of Tongatabu, Friendly Ids., in 18 fms. We have topotypes from this *Challenger* sta., 172. Brady also records it from off Raine Id., Torres Strait, in 155 fms. Bagg records it from off the Hawaiian Ids., at a depth of 865 fms., possibly carried out into deeper water by currents. The few Atlantic records are not the same species. Howchin records a variety of this species from the older Tertiary of Australia (Trans. Proc. Roy. Soc. So. Australia, vol. 12, 1889, p. 5), but gives no figure.

NODOBACULARIELLA MULTILOCULARIS (H. B. Brady, Parker and Jones)

(Pl. 11, fig. 19)

Articulina multilocularis H. B. BRADY, PARKER, and JONES, Trans. Zool. Soc. London, vol. 12, 1888, p. 215, pl. 40, fig. 10.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 53, pl. 12, fig. 7.

"Test (earlier portion?) free, oval, compressed or complanate; composed of numerous segments arranged as in *Spiroloculina*; lateral faces of the segments flat or slightly hollowed, peripheral edge square or obtuse-angular; apertural end broad, margin everted, orifice simple. Length about 1/50 inch (0.5 millim.)."

The types were from 31 fms., Abrohlos Bank, off Brazil.

The authors mention especially the smooth surface in their notes. The following variety is very close except for the surface ornamentation.

NODOBACULARIELLA MULTILOCULARIS (H. B. Brady, Parker, and Jones).

var. **ORNATA** Cushman and Todd, n. var. (Pl. 11, figs. 20, 21)

Vertebralina multilocularis CUSHMAN and PONTON (not H. B. BRADY, PARKER, and JONES), Bull. 9, Florida State Geol. Survey, 1932, p. 57, pl. 8, figs. 2, 3.

Variety differing from the typical in the surface ornamentation con-

sisting of a few, longitudinal costae, rounded in transverse section, parallel to the periphery.

Holotype of variety (Cushman Coll. No. 41785) from the Miocene, Chipola marl, from Ten-mile Creek, ½ mi. below bridge on Marianna-Clarksville rd. 22 mi. S. of Marianna, Calhoun Co., Fla.

A single Recent specimen from *Albatross* D 2758, lat. 6° 59' 30" S., long. 34° 47' W., in 20 fms., is indetical with the fossil ones in its general characters and in the surface ornamentation. This locality is not far from the type locality of the typical form of the species. It also occurs in the Pliocene, 141-1160 ft., Pointe d'Or, Trinidad, B. W. I.

NODOBACULARIELLA JAMAICENSIS (Cushman and Jarvis) (Pl. 11, figs. 22, 23)

Vertebralina jamaicensis Cushman and Jarvis, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 77, pl. 10, figs. 5, 6.—CUSHMAN and HANZAWA, l. c., vol. 13, 1937, p. 44.

"Test large, much compressed, greatest thickness in the central region represented by the earlier chambers, the adult with as many as four chambers showing in the last-formed coil, becoming increasingly compressed as added, periphery with a distinct, rounded keel, usually without ornamentation; chambers rapidly increasing in size as added in the adult, slightly inflated, very distinct; sutures distinct, depressed, curved; wall ornamented by pits of irregular size, but more or less arranged in a linear series, slightly oblique to the axis of the chamber. Length 2.00 mm.; breadth 1.40 mm.; thickness 0.40 mm."

The types were from the middle Eocene, Lapland Estate, ½ mi. E. of Catadupa Sta., Jamaica, B. W. I. This seems to be the earliest appearance of the genus in America, as *N. contracta* (Terquem), described from the Paris Basin, is the earliest recorded appearance in Europe.

NODOBACULARIELLA ATLANTICA Cushman and Hanzawa (Pl. 12, fig. 1)

Nodobaculariella atlantica CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 42, pl. 5, figs. 7, 8.—CUSHMAN, Foraminifera, 3rd Ed., 1940, Key, pl. 45, fig. 5.

Vertebralina insignis FLINT (not H. B. BRADY), Ann. Rep't U. S. Nat. Mus., 1897 (1899), p. 302, pl. 47, fig. 4.

"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.; thickness 0.12 mm.

The types of this species were from *Albatross* D 2420, lat. 37° 03' 20" N., long. 74° 31' 40" W., off Chesapeake Bay, eastern coast United States, in 104 fms. Flint's specimens, noted above, were from this same station and also stations D 2400 and D 2641 in the Gulf of Mexico and off Florida, 169 and 60 fms.

NODOBACULARIELLA JAPONICA Cushman and Hanzawa (Pl. 12, fig. 2)

Nodobaculariella japonica CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 42, 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 $\frac{1}{2}$ coil in length, and later by 5 or 6 loosely coiled and rapidly widening chambers, usually $\frac{1}{2}$ 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." Thickness 0.20 mm.

The types of this species were from the Pliocene or Pleistocene, Ryukyu limestone, 500 meters N. of Kamikatetsu, Kikaijima, Ryukyu Ids.

NODOBACULARIELLA CULTRATA Howchin and Parr (Pl. 12, fig. 3)

Nodobaculariella cultrata HOWCHIN and PARR, Trans. Roy. Soc. So. Australia, vol. 62, 1938, p. 296, pl. 15, fig. 14.

"Test strongly compressed, periphery subacute with a thin keel; chambers in the early portion consisting of an ovoid proloculum, directly followed by a planospiral chamber extending half way round the

proloculus, remaining chambers roughly triangular in outline with the aboral end recurved, inflated in the middle, not generally involute, the centre of each face of the shell being depressed and showing portions of the earlier whorls, three chambers to the adult whorl; wall ornamented by numerous, fine costae which are parallel to the outside margin; aperture elongate, narrow, terminal, with a slight everted lip. Maximum diameter, 0.65 mm."

The type was from the upper Pliocene of the Metropolitan Abattoirs Bore, Adelaide, Australia. The authors also note its occurrence in beds of lower Miocene age at Muddy Creek, Victoria, Australia.

The species is close to *N. atlantica* Cushman and Hanzawa, but the chambers are more sharply triangular, have a broader keel, and the aperture is more elongate.

NODOBACULARIELLA RUSTICA Cushman and Todd, n. sp. (Pl. 12, figs. 4, 5)

Test planispiral, compressed, biconvex, evolute, periphery broadly carinate; chambers distinct, inflated, in the early stages coiled, later $\frac{1}{2}$ coil in length in the adult; sutures distinct, depressed, strongly curved; wall ornamented with a few, distinct, longitudinal costae, slightly obliquely curved or parallel to the periphery; aperture oval, with a distinctly everted lip. Length 0.85-1.05 mm.; breadth 0.60-0.80 mm.; thickness 0.20-0.25 mm.

Holotype (U. S. N. M. No. 27618) from *Albatross* D 5179, in 37 fms., off Romblon, Philippines. Specimens were also found in other Philippine material and from off the Paumotu Ids.

This species differs from *N. convexiuscula* (H. B. Brady) in the narrower and more inflated chambers, finer costae, and shorter and broader aperture.

NODOBACULARIELLA RUDITA Cushman and Todd, n. sp. (Pl. 12, fig. 6)

Test planispiral and concave in the early part, becoming uniserial, compressed; chambers few, rapidly increasing in size and thickness as added, the last uniserial one elongate; sutures indistinct in the coiled portion, the last one sharply marked by the overhanging base of the uniserial chamber; wall ornamented by high, thin, plate-like costae, 3 on the outer part of the coiled portion, and 9 or 10 on the uniserial chamber; aperture elongate, narrow, surrounded by a broad, strongly everted lip. Length of holotype, 0.85 mm.; diameter of coiled portion 0.40 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 6999) from the coast of Palawan, Philippines.

This species differs from *N. japonica* Cushman and Hanzawa, in its proportionately slenderer form, lacking a peripheral keel, and in its fewer costae, high and plate-like in section.

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 $\frac{1}{2}$ -1 coil in length, succeeded by rapidly widening chambers in a trochoid spire, each $\frac{1}{2}$ 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. Late Tertiary and Recent.

D'Orbigny's Model shows well the characters of this genus, except that the aperture is not well made. Even in the early stages one side of the apertural border extends out much farther than the other, and this character is held throughout growth. The genus is apparently limited to a single species which developed in the late Tertiary and is known only from the Mediterranean and the Indo-Pacific in warm, shallow waters. There is a single record from off the Shetland Ids., but this has not been confirmed by later work, and may have been due to some error. Records from other areas are evidently misidentifications.

VERTEBRALINA STRIATA d'Orbigny (Pl. 12, figs. 7-11)

Lituus SOLDANI, Testaceographica, vol. 1, pt. 1, 1789, p. 76, pl. 67, figs. *uu*, *xx*, *yy*, *zz*.

Vertebralina striata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 283; Modèles No. 81, 1826.—WILLIAMSON, Recent Foram. Gt. Britain, 1858, p. 90, pl. 7, figs. 197, 198.—PARKER, JONES and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 239, pl. 8, fig. 27.—H. B. BRADY, Quart. Journ. Micr. Sci., vol. 16, 1876, p. 405 (list); Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 187, pl. 12, figs. 14-16.—SILVESTRI, Atti Accad. Sci. Acireale, vol. 7, 1896, p. 22.—MILLET, Journ. Roy. Micr. Soc., 1898, p. 607, pl. 13, fig. 1.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 48, No. 5, 1904, p. 18.—DAKIN, Rep. Ceylon Pearl Oyster Fish.,

vol. 5, 1906, p. 231.—CHAPMAN, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1907, p. 125.—SIDEBOTTOM, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, No. 16, 1910, p. 6.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 587.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 38, pl. 22, figs. 3, 4.—MARTINOTTI, Atti Soc. Ital. Sci. Nat., vol. 59, 1920, p. 327, text fig. 170.—CUSHMAN, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 414.—HERON-ALLEN and EARLAND, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 123.—CUSHMAN, Publ. 342, Carnegie Instit. Washington, 1924, p. 58; Bull. 27, Bernice P. Bishop Mus., 1925 (1926), p. 137; Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 96, pl. 22, fig. 6.—HADA, Trans. Sapporo Nat. Hist. Soc., vol. 11, pt. 1, 1929, p. 14.—CUSHMAN (part), Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 73, pl. 16, figs. 8, 10 (not fig. 9); Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 15, fig. 29; Special Publ. 5, 1933, pl. 16, figs. 23, 24.—CUSHMAN and HANZAWA, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 43, pl. 5, figs. 4-6.—YABE and ASANO, Sci. Rep't Tohoku Imp. Univ., ser. 2, Geol., vol. 19, No. 1, 1937, p. 117 (31).—CUSHMAN, Foraminifera, 3rd Ed., 1940, pl. 15, fig. 29; Key, pl. 16, figs. 23, 24.—COLOM, Instit. Español Oceanografía, Notas y Resúmenes, ser. 2, No. 108, 1942, p. 30, pl. 7, figs. 133-135.

“Test much compressed, early portion trochoid, later uncoiled; chambers consisting of a globular proloculum followed by a spiral, tubular chamber $\frac{1}{2}$ -1 coil in length, and 7 or 8, rapidly widening, sub-triangular chambers in a trochoid spire, earliest ones $\frac{1}{2}$ coil in length, then progressively shortening, all visible from the 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.” Thickness 0.12-0.20 mm.

This species was recorded by d'Orbigny from the Mediterranean, the Red Sea, and from the South Pacific at Rawack. Other records have shown it to be widely distributed in the Mediterranean and the Indo-Pacific area in shallow, warm waters. Fossil records that are probably this species are from the Pliocene of Java, and Pliocene or Pleistocene of the Ryukyu Ids.

VERTEBRALINA STRIATA d'Orbigny, var. **RETICULOSA** Cushman (Pl. 12, fig. 12)
Vertebralina striata d'ORBIGNY, var. *reticulosa* CUSHMAN, Bull. 100, U. S. Nat. Mus.,
 vol. 4, 1921, p. 414, pl. 97, fig. 4.

Vertebralina striata CUSHMAN (part), Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 73, pl. 16, fig. 9 (not figs. 8, 10).

Variety differing from the typical form in the ornamentation of the later chambers which have certain of the costae stronger than others in usually alternating areas giving a peculiar, reticulose appearance.

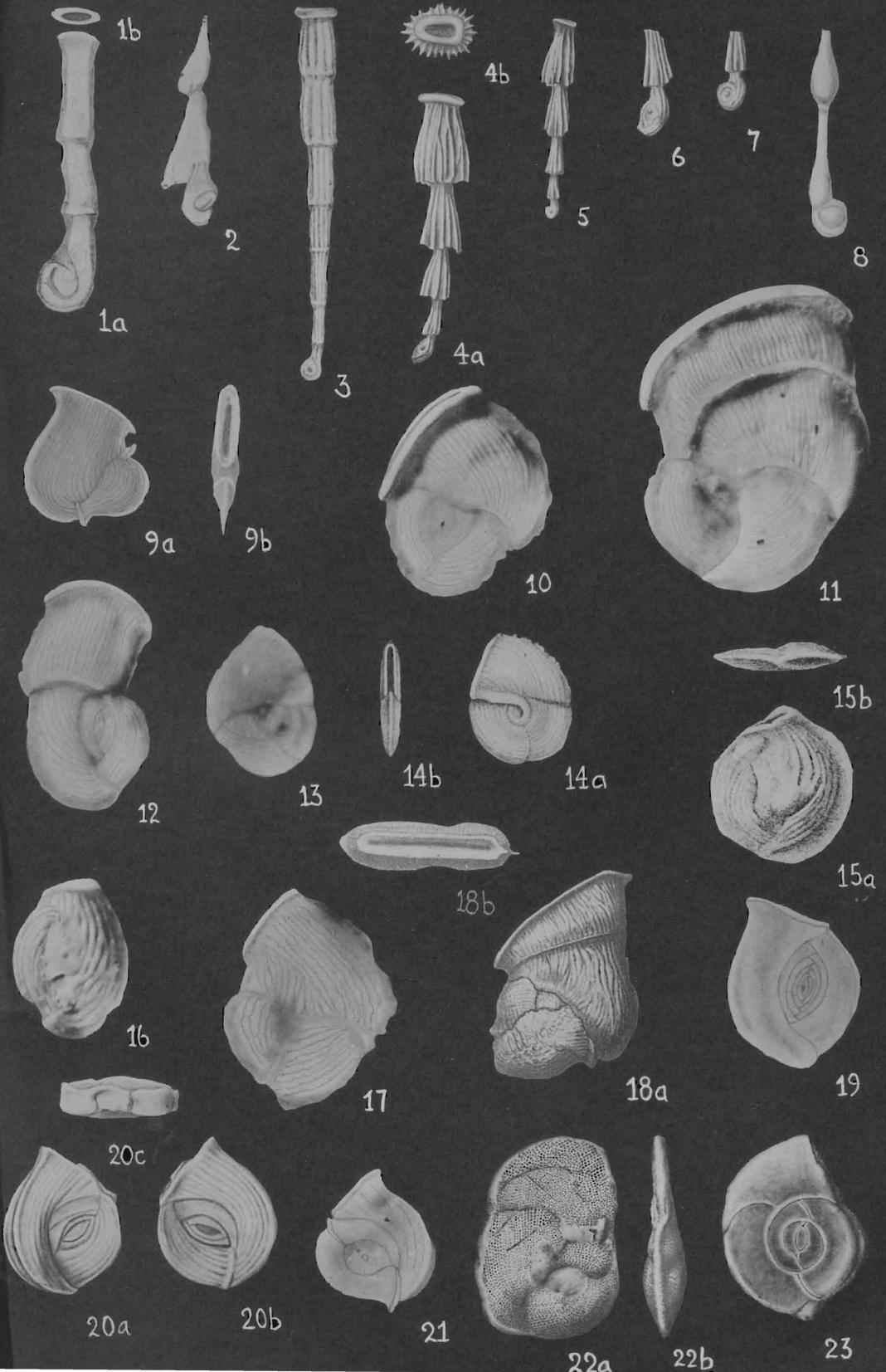
The type of the variety is from *Albatross* D 5160, Sulu Archipelago, Tawi Tawi Group, in 12 fms. The specimen figured by Cushman from 12 fms., Levuka, Fiji, appears to belong in var. *reticulosa*.

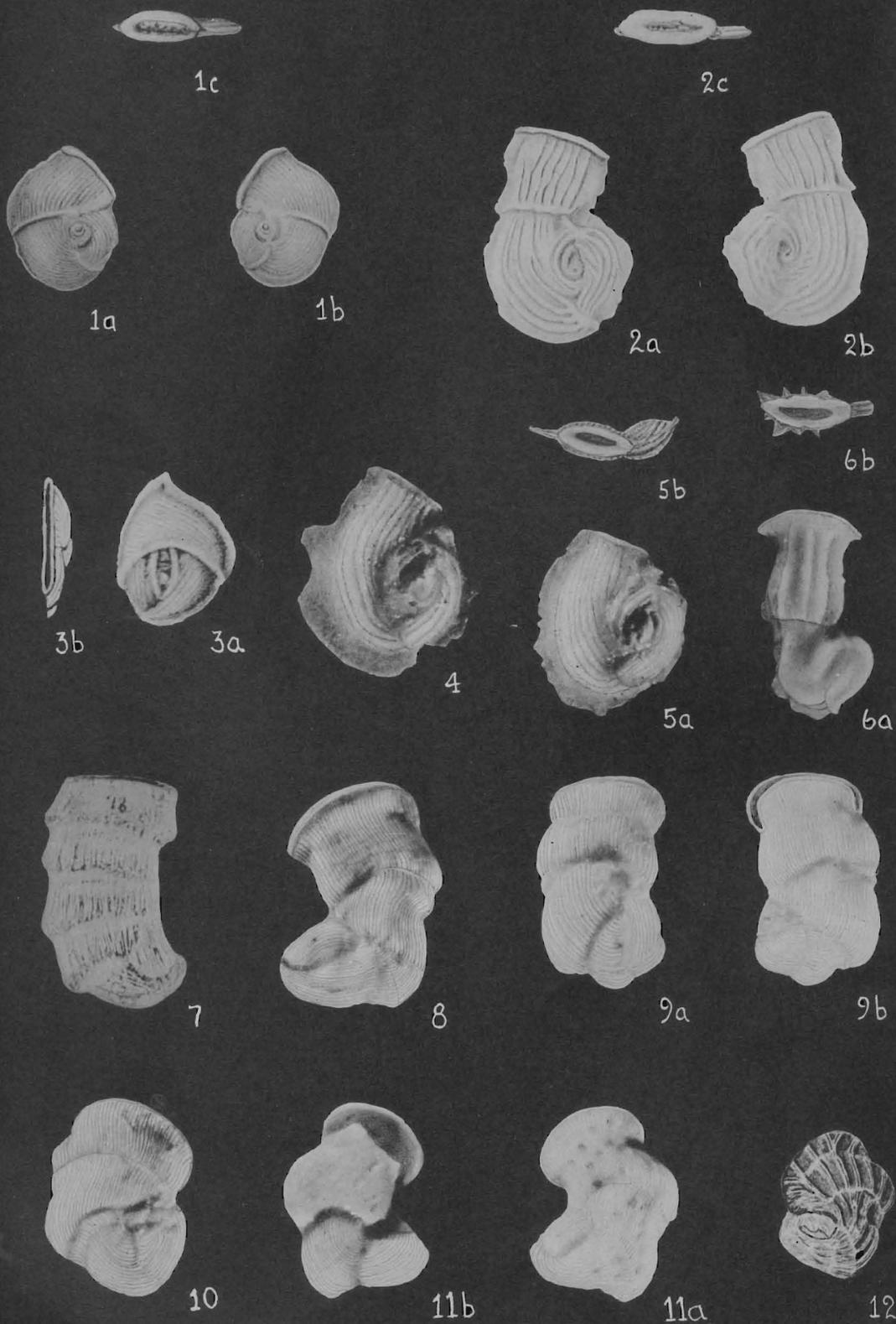
In the original description of this variety it was stated that certain pitted forms occurring with the typical in the Mediterranean belonged in the variety. Upon further examination, these appear to belong with the typical form of the species because their characteristic ornamentation of fine, parallel lines persists to the last chambers and the pitting is only superimposed upon it, while in var. *reticulosa* the finer costae of the earlier chambers are replaced by coarser on the later chambers. Furthermore, these pitted forms occur in the late Tertiary, Ryukyu limestone, Ryukyu Ids. (Cushman and Hanzawa, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 43, pl. 5, fig. 6) with the typical form of the species. A specimen showing the pitted surface is illustrated on our plate (Pl. 12, fig. 11).

EXPLANATION OF PLATE 11

FIG. 1. *Nodophthalmidium compressum* (Rhumbler). Recent, Adriatic. Holotype. $\times 105$. (After Rhumbler). 2. *N.* (?) *irregularis* (Rhumbler). Recent, Pacific. Holotype. $\times 43$. (After Rhumbler). 3. *N. antillarum* (Cushman). Recent, Atlantic. Holotype. $\times 21$. (After Cushman). 4-7. *N. milletti* (Cushman). Recent, Pacific. 4, Holotype. 5, Paratype. $\times 30$. 6, Enlarged view of initial end of holotype. 7, Enlarged view of initial end of paratype. $\times 55$. (After Cushman). 8. *N. simplex* Cushman and Todd, new name. Recent, Pacific. Holotype. $\times 77$. (After Millett). 9-12. *Nodobaculiella cassis* (d'Orbigny). 9, Holotype. Recent, Cuba. $\times 43$. (After d'Orbigny). 10-12, Dry Tortugas, Fla. $\times 38$. 13, 14. *N. contracta* (Terquem). Eocene, Paris Basin. 14, Holotype. $\times 45$. (After Terquem). 13, Topotype. $\times 38$. 15, 16. *N. convexiuscula* (H. B. Brady). Recent. 15, Holotype. Torres Strait. $\times 43$. (After H. B. Brady). 16, *Albatross* D 5179. $\times 38$. 17, 18. *N. insignis* (H. B. Brady). Recent, Tongatabu, Friendly Ids. 18, Holotype. $\times 30$. (After H. B. Brady). 17, Topotype. $\times 38$. 19. *N. multilocularis* (H. B. Brady, Parker, and Jones). Abrohlos Bank, off Brazil. Holotype. $\times 63$. (After H. B. Brady, Parker, and Jones). 20, 21. *N. multilocularis* (H. B. Brady, Parker, and Jones), var. *ornata* Cushman and Todd, n. var. 20, Holotype. Miocene, Florida. *a*, *b*, opposite sides; *c*, apertural view. $\times 50$. (After Cushman and Ponton). 21, *Albatross* D 2758. $\times 38$. 22, 23. *N. jamaicensis* (Cushman and Jarvis). Eocene, Jamaica. $\times 17$. (After Cushman and Jarvis). 22, Holotype. 23, Section.

Unless otherwise noted: *a*, side view; *b*, apertural view.





INCERTAE SEDIS

Vertebralina niebuhrii Ehrenberg (Abhandl. k. Akad. Wiss. Berlin, 1838, p. 135). The original reference is not available to us.

Vertebralina elongata Karrer (Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 155, pl. 3, fig. 10). The types are from the Miocene of Kostej, Banat region of Hungary. The figure does not show the early stages, and it must remain uncertain whether this belongs to *Articulina* or *Nodophthalmidium*. No specimens were found in our material from Kostej.

Vertebralina sarmatica Karrer (Abhandl. k. k. geol. Reichs., vol. 9, 1877, p. 376, pl. 16b, fig. 12). Karrer figures a series of very peculiar specimens under this name from the Miocene of the Vienna Basin. They do not seem to belong to any of the genera included in the present paper.

Vertebralina foveolata Franzenau (Földt. Közlöny, vol. 11, 1881, pp. 49, 101, pl. 3, figs. 19-21). The original reference is not available to us.

Vertebralina laevigata Terquem (Mém. Soc. géol. France ser. 3, vol. 2, 1882, p. 44, pl. 2 (10), figs. 15-18). More than one species is represented in the series given by Terquem from the Eocene of the Paris Basin. We have specimens from Vaudancourt similar to his figures 17 and 18, but they appear to be the early stages of some larger form, probably not belonging in any of the genera dealt with in the present paper.

Vertebralina advena Cushman (U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 102, pl. 25, figs. 5, 6) = *Articulina* (See Special Publ. No. 10, Cushman Lab. Foram. Res., 1944, p. 8, pl. 1, figs. 20, 21).

EXPLANATION OF PLATE 12

FIG. 1. *Nodobaculiariella atlantica* Cushman and Hanzawa. Recent, Atlantic. Holotype. *a*, *b*, opposite sides; *c*, apertural view. $\times 30$. (After Cushman and Hanzawa). 2. *N. japonica* Cushman and Hanzawa. Pliocene or Pleistocene, Japan. Holotype. *a*, *b*, opposite sides; *c*, apertural view. $\times 26$. (After Cushman and Hanzawa). 3. *N. cultrata* Howchin and Parr. Pliocene, Australia. Holotype. *a*, side view; *b*, apertural view. $\times 30$. (After Howchin and Parr). 4, 5. *N. rustica* Cushman and Todd, n. sp. Recent, Philippines. 4, Paratype. 5, Holotype. *a*, side view; *b*, apertural view. $\times 38$. 6. *N. rudita* Cushman and Todd, n. sp. Recent, Philippines. Holotype. *a*, side view; *b*, apertural view. $\times 38$. 7-11. *Vertebralina striata* d'Orbigny. Recent. 7, Photograph of d'Orbigny's Model. 8, 11, Recent, Delos, Mediterranean. 9, 10, Recent, Fiji. 11, Pitted form. 9*a*, *b*, 11*a*, *b*, opposite sides. $\times 38$. 12. *V. striata* d'Orbigny, var. *reticulosa* Cushman. Recent, Pacific. Holotype. $\times 38$. (After Cushman).

260. TWO NEW NAMES FOR VENEZUELAN
FORAMINIFERA.

By JOSEPH A. CUSHMAN and H. H. RENZ

New names are here proposed for two varietal forms described from Venezuela in these Contributions, the names of which were pre-occupied.

GAUDRYINA (PSEUDOGAUDRYINA) JACKSONENSIS Cushman
var. **ABNORMIS** Cushman and Renz, new name

This varietal name is proposed for the variety previously named *Gaudryina (Pseudogaudryina) jacksonensis* Cushman, var. *irregularis* Cushman and Renz, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 6, pl. 1, figs. 11, 12.

BOLIVINA FLORIDANA Cushman, var. **IMPORCATA** Cushman and Renz, new name.

This varietal name is proposed for the variety previously named *Bolivina floridana* Cushman, var. *regularis* Cushman and Renz, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 17, pl. 3, fig. 7.

261. *VIRGULINA NAHEOLENSIS*, NEW NAME.

By J. A. CUSHMAN

In the previous number of these Contributions a species from the Coal Bluff marl member of the Naheola formation of Alabama was named *Virgulina alabamensis* (Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 43, pl. 7, fig. 13). As the name *V. alabamensis* had already been used, the name *Virgulina naheolensis* is here proposed for this species.

RECENT LITERATURE ON THE FORAMINIFERA

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

Colom, G. Una Contribución al Conocimiento de los Foraminíferos de la Bahía de Palma de Mallorca.—Instituto Español de Oceanografía, Notas y Resúmenes, Ser. 2, No. 108, Aug. 12, 1942, pp. 1-49, pls. I-XI.—Notes 103 species and varieties, mostly figured, the following new: *Nubecularia Massutiana* n. sp., *Elphidium maioricense* n. sp., *Discorbis posidonicola* n. sp.

Jepps, Margaret W. Studies on *Polystomella* Lamarck.—Journ. Marine Biol. Assoc. United Kingdom, vol. XXV, Oct. 1942, pp. 607-666, pls. 4, 5, 10 text figs.

—Results of studies of the life history are given, and details of the methods used.

- Myers, Earl H.** Life Activities of Foraminifera in Relation to Marine Ecology.—Proc. Amer. Philos. Soc., vol. 86, No. 3, July 1943, pp. 439-458, pl. 1, 7 text figs.—*Elphidium crispum* (Linnaeus) was used, and its reactions to many different conditions recorded.
- Biology, Ecology, and Morphogenesis of a Pelagic Foraminifer.—Stanford Univ. Publ., Univ. Ser., Biol. Sci., vol. IX, No. 1, 1943, pp. 1-30, pls. 1-4.—The life cycle of *Tretomphalus* was studied in detail, and its relationships to environment, etc. discussed.
- Driver, Herschel L.** Economic Paleontology and Mineralogy—An Appraisal.—Bull. Amer. Assoc. Petr. Geol., vol. 27, No. 7, July 1943, pp. 938-947.—The application of foraminifera and other fossils to the discovery of oil resources.
- Crespin, Irene.** The Stratigraphy of the Tertiary Marine Rocks in Gippsland, Victoria (mimeographed).—Commonwealth of Australia, Dept. Supply & Shipping, Mineral Resources Survey, Bull. No. 9 (Pal. Ser. No. 4), Aug. 1943, pp. 1-101, figs. 1-8.—Foraminifera are used in zoning, and a distribution chart of the many species is given.
- The Genus *Lepidocyclus* in Victoria.—Proc. Roy. Soc. Victoria, vol. LV, pt. II (New Series), Oct. I, 1943, pp. 157-180, pls. III-IX.—Three species occur: *Lepidocyclus* (*Trybliolepidina*) *batesfordensis* sp. nov., *L. (T.) howchini* Chapman and Crespin, and *L. (T.) gippslandica* sp. nov.
- Schenck, Hubert G. and Bradford C. Adams.** Operations of commercial micropaleontologic laboratories.—Journ. Pal., vol. 17, No. 6, Nov. 1943, pp. 554-583, pl. 97, text figs. 1-13.—Details of operations in the use of the foraminifera in commercial laboratories are given, and a long list of indexed references.
- Beck, R. Stanley.** Eocene Foraminifera from Cowlitz River, Lewis County, Washington.—L. c., pp. 584-614, pls. 98-109, text figs. 1-4.—107 species and subspecies are described and figured, of which 25 species and 8 subspecies are new.
- Tromp, S. W.** Micro-fauna of the Upper Cretaceous and Tertiary Sections (Arabian facies) in the Urfa and Gaziantep regions (Southern Turkey).—Bull. Mining Research Institute of Turkey, No. 1/29, 1943, pp. 126-141, 2 charts.—The charts give the vertical distribution of the foraminifera by genera.
- The Micro-fauna of the Lower and Middle Eocene of Raman Dağ Well No. 2. (S. E. Turkey).—L. c., 2/30, 1943, pp. 249-253, 4 charts.—Shows vertical distribution by genera.
- Hedberg, Hollis D. and Augustin Pyre.** Stratigraphy of Northeastern Anzoátegui, Venezuela.—Bull. Amer. Assoc. Petr. Geol., vol. 28, No. 1, Jan. 1944, pp. 1-28, figs. 1-4.—A few foraminifera are mentioned.
- Cushman, Joseph A.** A Foraminiferal Fauna of the Wilcox Eocene, Bashi Formation, from near Yellow Bluff, Alabama.—Amer. Journ. Sci., vol. 242, Jan. 1944, pp. 7-18, pls. 1, 2.—32 species and varieties are recorded, of which 2 are new: *Dentalina wilcoxensis* n. sp., and *Guttulina problema* d'Orbigny, var. *arcuata* n. var.

- The Genus *Articulina* and Its Species.—Special Publ. No. 10, Cushman Lab. Foramin. Res., April 15, 1944, pp. 1-21, pls. 1-4.—All fossil and recent species are described and figured, the following new: *A. canui* n. sp.; *A. jacksonensis* n. sp.; *A. parri* n. sp.; *A. crespinae* n. sp.; *A. victoriana* n. sp.; *A. paucicostata* n. sp.; *A. carinata* n. sp.; *A. fijiensis* n. sp.; *A. alticostata* n. sp.; *A. elongata* n. sp.; and *A. pacifica* n. sp.
- Additional Notes on Foraminifera in the Collection of Ehrenberg.—Journ. Washington Acad. Sci., vol. 34, No. 5, May 15, 1944, pp. 157, 158.—Notes are given on a number of the genera erected by Ehrenberg and their probable relationships.
- Foraminifera from the Shallow Water of the New England Coast.—Special Publ. No. 12, Cushman Lab. Foramin. Res., Aug. 22, 1944, pp. 1-37, pls. 1-4.—There are 115 species and varieties recorded, mostly figured, with one new genus, *Poroepionides* (genotype *Rosalina lateralis* Terquem), and 12 new species and varieties described.
- Bauernschmidt, A. J. West Ranch Oil Field, Jackson County, Texas.—Bull. Amer. Assoc. Petr. Geol., vol. 28, No. 2, Feb. 1944, pp. 197-216, figs. 1-13, tables 1, 2.—Numerous foraminifera noted.
- Cole, W. Storrs. Stratigraphic and Paleontologic Studies of Wells in Florida—No. 3.—Florida Geol. Survey, Geol. Bull. No. 26, 1944, pp. 1-168, pls. 1-29, text figs. 1-5.—Many foraminifera described and figured, the following new: *Nonion browni* n. sp.; *Operculinoides gravelli* n. sp.; *O. nassauensis* n. sp.; *Gyroidina nassauensis* n. sp.; *Siphonina nassauensis* n. sp.; *Discocyclina (Asteroicyclina) nassauensis* n. sp.; *Pseudophragmina (Proporocyclus) cedarkeysensis* n. sp.; *P. hannai* n. sp.
- Cushman, Joseph A. and Russell R. Simonson. Foraminifera from the Tume Formation, Fresno County, California.—Journ. Pal., vol. 18, No. 2, March, 1944, pp. 186-203, pls. 30-34, 5 text figs.—51 species and varieties are recorded and figured, the following new: *Plectofrondicularia packardi* Cushman and Schenck, var. *multilineata* n. var.; *Buliminella barbati* n. sp.; *Bolivina jacksonensis* Cushman and Applin, var. *tumeyensis* n. var.; *Uvigerina atwilli* n. sp.; *Valvulineria tumeyensis* n. sp.; *V. thomasi* n. sp.; *Gyroidina condoni* (Cushman and Schenck), var. *rotundiformis* n. var.; *Eponides dupréi* Cushman and Schenck, var. *ciervoensis* n. var.
- Cole, W. Storrs and Pedro J. Bermudez. New Foraminiferal Genera from the Cuban Middle Eocene.—Bull. Amer. Pal., vol. 28, No. 113, May 4, 1944, pp. 1-20 (331-350), pls. 1-3 (27-29).—Five species are discussed, 3 new, and 4 new genera: *Camagueyia* (genotype *C. perplexa* n. sp.); *Eodictyoconus* (genotype *Pseudorbitolina cubensis* Cushman and Bermudez); *Eoconuloides* (genotype *E. wellsii* n. sp.); and *Eoannularia* (genotype *E. eocenica* n. sp.).
- Schenck, Hubert G. Proloculus in Foraminifera.—Journ. Pal., vol. 18, No. 3, May, 1944, pp. 275-282, text figs. 1, 2.—A discussion of the early chambers of the foraminifera.

- Todd, Ruth.** A Comparative Study of Two Cretaceous Vaginulinas.—*Amer. Journ. Sci.*, vol. 242, June, 1944, pp. 331-339, pl. 1.—*Vaginulina wadei* Kelley and *V. webbervillensis* Carsey are studied as to distinguishing characteristics, stratigraphic position, and evolutionary relationships, and are found to be suitable index fossils for a part of the Upper Cretaceous.
- LeRoy, L. W.** Miocene Foraminifera from Sumatra and Java, Netherlands East Indies. Part 1. Miocene Foraminifera of Central Sumatra, Netherlands East Indies. Part 2. Small Foraminifera from the Miocene of West Java, Netherlands East Indies.—*Colorado School of Mines Quarterly*, vol. 39, No. 3, July, 1944, pp. 1-113, 15 pls., 2 text figs. (maps).—There are 183 species illustrated, 27 species and 2 varieties described as new.
- Franklin, E. S.** Microfauna from the Carapita formation of Venezuela.—*Journ. Pal.*, vol. 18, No. 4, July, 1944, pp. 301-319, pls. 44-48.—There are 98 species recorded with 2 new species and 2 new varieties.
- Cushman, J. A. and W. H. Deaderick.** Cretaceous Foraminifera from the Marlbrook marl of Arkansas.—*L. c.*, pp. 328-342, pls. 50-53.—There are 78 species and varieties recorded, and one new name is proposed.
- Cooper, Chalmer L.** Smaller Foraminifera from the Porters Creek formation (Paleocene) of Illinois.—*L. c.*, pp. 343-354, pls. 54, 55, 2 text figs.—Thirty species are recorded, 2 new.
- Bandy, O. L.** Eocene Foraminifera from Cape Blanco, Oregon.—*L. c.*, pp. 366-377, pls. 60-62.—There are 33 species recorded; one new genus, *Rotorbinella* (genotype *R. colliculus* n. sp.), and 11 new species are described.
- Thalmann, Hans E.** Bibliography and index to new genera, species and varieties of Foraminifera for the year 1941.—*L. c.*, pp. 387-404.
- Cushman, Joseph A. and Ruth Todd.** The Genus *Spiroloculina* and Its Species.—*Special Publ. No. 11, Cushman Lab. Foram. Res.*, Aug. 22, 1944, pp. 1-82, pls. 1-9.—All known and recorded species are reviewed, mostly figured, and the generic positions indicated for those species assigned to *Spiroloculina* but belonging elsewhere. The species are arranged by ages. There are 96 species and varieties of true *Spiroloculina* treated, 28 new, and 64 species and varieties belonging elsewhere. In addition 26 named species are uncertain due to lack of descriptions or figures.