

CONTRIBUTIONS
FROM THE
CUSHMAN LABORATORY
FOR
FORAMINIFERAL RESEARCH

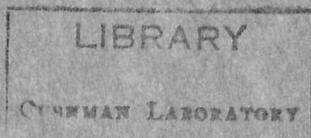
VOLUME 22, PART 1

March, 1946

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SHARON, MASSACHUSETTS, U. S. A.
1946



CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

90 Brook Road, Sharon, Mass., U. S. A.

JOSEPH A. CUSHMAN, Sc.D., *Director*

ALICE E. CUSHMAN, *Secretary, in charge of Publications*

RUTH TODD, M. S., *Research Associate*

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

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Copies of Volume 22, Part 1, were first mailed March 18, 1946

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273. *POLYSEGMENTINA*, A NEW GENUS
OF THE OPTHALMIDIIDAE

BY JOSEPH A. CUSHMAN

In the *Challenger* Report Brady described a species as "*Hauerina circinata*" from the Pacific. A study of the structure and development of this form shows that it is not a *Hauerina*, as the early stages are not quinqueloculine but apparently planispiral and related to *Cornuspira*. The following genus is erected to include this species.

Genus *POLYSEGMENTINA* Cushman, new genus

Genoholotype: *Hauerina circinata* H. B. Brady.

Test in the early stages similar to *Cornuspira* with proloculum and planispirally coiled second chamber several coils in length, in the adult the final coil divided into as many as six or seven short chambers and the test becoming more or less involute; wall calcareous, imperforate; aperture in the adult an elongate area nearly the whole height of the chamber, cribrate.

POLYSEGMENTINA CIRCINATA (H. B. Brady) (Pl. 1, figs. 1-4)

Hauerina circinata H. B. BRADY, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 17; Voy. *Challenger*, Zoology, vol. 9, 1884, p. 191, pl. 11, figs. 14-16.—RHUMBLER, Zool. Jahrb., Abt. Syst., vol. 24, 1906, p. 52, pl. 3, fig. 40.—HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, 1915, p. 589.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 63, pl. 23, figs. 3, 4.

The types of this species are from 6-8 fathoms, off Booby Island. The other records given by Brady are off Wednesday Island, 8 fathoms; Flinders Passage, 7 fathoms; and Torres Strait, 3-11 fathoms. All these are from the region between Australia and New Guinea. Rhumbler's specimens were from off Laysan and Heron-Allen and Earland recorded it from the Kerimba Archipelago. I have typical material from 4-14 fathoms in Albany Passage, Australia.

Rhumbler's figure which is reproduced on our plate shows the early stages. Specimens in our collection also show this in a lesser degree as they are probably microspheric while Rhumbler's specimen was evidently megalospheric. The genus is allied to *Trisegmentina* Wiesner and belongs in the Ophthalmidiidae.

CONTRIBUTIONS FROM THE CUSHMAN LABORATORY
274. THE GENUS *HAUERINA* AND ITS SPECIES.

BY JOSEPH A. CUSHMAN

There have been numerous species assigned to d'Orbigny's genus *Hauerina*. A study has been made of the figures and descriptions and, when possible, of type or topotype material. Some of the species are difficult to place generically until actual specimens may be available for study. It is evident that several species have been placed together under a single name and these have been separated and given new names.

The range of the genus is probably from Eocene to Recent. Most of the species are characteristic of warm, shallow waters. The genus is directly developed from *Quinqueloculina* by the addition in the adult of one or more planispiral coils made up of two or more chambers, and the adult aperture is distinctly cribrate.

Genus *HAUERINA* d'Orbigny, 1839

Genotype: *Hauerina compressa* d'Orbigny.

Hauerina d'ORBIGNY, in De la Sagra, Hist. Physiq. Pol. Nat. Cuba, 1839, "Foraminiferes," pp. xxxviii, xxxix.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 190.—CHAPMAN, The Foraminifera, 1902, p. 97.—CUSHMAN, Special Publ. 1, Cushman Lab. Foram. Res., 1928, p. 150; Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 42; Special Publ. 4, Cushman Lab. Foram. Res., 1933, p. 153; Foraminifera, 3rd Ed., 1940, p. 169.

Test with the early chambers quinqueloculine, later ones more or less in one plane, making a half coil, later gradually shortening so that more than two make up a coil; aperture cribrate.—Eocene to Recent.

The various species are given below; first those that appear to belong definitely in this genus, arranged in geologic sequence, and then those that are doubtful or belong in other genera.

HAUERINA DESERTORUM (Schwager) (Pl. 1, figs. 5, 6)

Spiroloculina desertorum SCHWAGER, Palaeontographica, vol. 30, 1883, Pal. Theil, p. 84, pl. 24 (1), fig. 2.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 75.

Test strongly compressed, rounded, very early portion quinqueloculine, later portion planispiral, with usually two chambers to the coil, periphery acute but not keeled; chambers distinct, somewhat inflated, usually a half coil in length but the last-formed one in the adult often shorter; sutures distinct, depressed; wall with an ornamentation of small pits rather evenly scattered over the surface; aperture cribrate.

The types of this species are from the Eocene, between Siut and Farafrah, Libya. A series of Schwager's specimens were examined in the

Museum at Munich and one of them drawn. A number of the specimens show a short, final chamber. The aperture is distinctly cribrate, placing the species in *Hauerina*.

HAUERINA SIMPLEX Silvestri (Pl. 2, fig. 9)

Hauerina simplex SILVESTRI, Pal. Ital., vol. 32, suppl. 4, 1939, p. 15, pl. 11(1), fig. 1; pl. 12(2), fig. 6.

A copy of the type figure is given on our plate. The details are not well preserved but the figure shows a form with three chambers in the adult coil. It has a rounded periphery but the apertural characters are not given. The diameter is 2 mm.

The types are from the Eocene of Somaliland. More details are needed to make sure of its generic position.

HAUERINA IMPRIMATA (Cushman) (Pl. 1, figs. 7, 8)

Spiroloculina imprimata CUSHMAN, U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 101, pl. 25, fig. 3; Prof. Paper 129-F, 1922, p. 140; Prof. Paper 133, 1923, p. 51.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 75.

"Test broad and flat, complanate, nearly circular in outline, composed of numerous chambers, those of the last-formed coil failing to extend to the base of the preceding chamber, leaving a gap; periphery square, lateral faces nearly flat; the surface ornamented by a series of pits in a more or less linear arrangement. Length about 1 millimeter."

The types of this species are from the Oligocene Byram marl of Byram, Miss. It is also recorded from the Mint Spring marl, Mint Spring Bayou, Vicksburg, Miss. This is a rare species in the American Oligocene and seems to belong in *Hauerina*.

HAUERINA BYRAMENSIS (Cushman) (Pl. 2, fig. 15)

Spiroloculina byramensis CUSHMAN, U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 101, pl. 25, fig. 4; Prof. Paper 133, 1923, p. 51.—CUSHMAN and McGLAMERY, Prof. Paper 197-B, 1942, p. 66.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 74.

"Test compressed, broadly rounded in side view; peripheral margin squarely truncate, sides of the chambers sloping in somewhat toward the center, surface with a beautiful ornamentation consisting of fine hexagonal depressed areas with very narrow thin ridges between covering the entire surface. Length 0.85 mm."

The types of this species are from the Oligocene Byram marl at Byram, Miss. It is also recorded from the Oligocene Chickasawhay marl near Millry, Ala.

This is a highly ornate but delicate species and specimens are rare. They are usually broken and do not give the full apertural details but it is placed in *Hauerina* although with some question.

HAUERINA SANSEBASTIANENSIS Galloway and Heminway (Pl. 1, fig. 12)
Hauerina sansebastianensis GALLOWAY and HEMINWAY, New York Acad. Sci., Sci.
 Survey Porto Rico and Virgin Ids., vol. 3, pt. 4, 1941, p. 315, pl. 5, figs. 3, 4.

"Test discoidal, nearly equally biconvex and biumbilicate, immature specimens relatively more convex; periphery subacute; 4 chambers in last whorl of the adult, 3 in immature forms; chambers subtriangular in shape, increasing rapidly in size, occasionally involute, more commonly with a few milioline chambers showing in the umbilical region; sutures sharply depressed; surface smooth; aperture in the young an elongate slit with bluntly serrate margin extending the full length of the last septal face, in the adult a tuberculate trematophore. Adult specimen diameter, 0.84 by 1.05 millimeters; maximum thickness, 0.37 millimeter."

"This species resembles *H. compressa* d'Orbigny from the Miocene of the Vienna Basin, but is thicker and differs in character of the aperture and in shape of the chambers. It differs from *H. bradyi* Cushman in its greater thickness and different shape of the chambers."

The types are from the middle Oligocene San Sebastian formation of Porto Rico. The aperture as figured is not as completely cribrate as the typical species of *Hauerina*.

HAUERINA TATEANA (Howchin) (Pl. 1, figs. 9, 10)
Spiroloculina tateana HOWCHIN, Trans. Proc. Roy. Soc. So. Australia, vol. 12, 1889,
 p. 3, pl. 1, figs. 4, 5.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram.
 Res., 1944, p. 77.

Test strongly compressed except in the center which is biconvex, circular, early portion quinqueloculine, later adult portion planispiral, periphery rounded; chambers distinct, slightly inflated, a half coil in length in the adult, increasing regularly in width as added; sutures distinct, slightly depressed; wall smooth; aperture apparently cribrate. Diameter about 0.60 mm.

The types of this species are from the Oligocene, Balcombian, Lower Beds at Muddy Creek, Victoria, Australia.

The single topotype in our collection is slightly broken and does not show the aperture well but it seems probable that it is cribrate and therefore to be placed in *Hauerina*.

HAUERINA COMPRESSA d'Orbigny (Pl. 1, fig. 15)
Hauerina compressa d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 119, pl. 5,
 figs. 25-27.

Test small, compressed, rounded, early portion quinqueloculine, later planispiral, peripheral margin slightly lobulate, subacute, with a definite, narrow keel; chambers in the adult 2 to 4 in number, somewhat

inflated; sutures distinct, depressed; wall smooth; aperture cribrate. Diameter 0.55-0.70 mm.

d'Orbigny's types are from the Miocene of the Vienna Basin where it is recorded as rare. Specimens in our collection from Baden are very similar to the type figure except that there are but two entire chambers and a portion of a third that make the last whorl. Although the species has frequently been referred to in the literature it is evident that Recent material is not the same. The few fossil records under this name without figures must be left doubtful until the original specimens are studied. So far as can be definitely determined, the species is known only from the Miocene of the Vienna Basin.

HAUERINA SPECIOSA (Karrer) (Pl. 1, figs. 13, 14)

Spiroloculina speciosa KARRER, Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 135, pl. 1, fig. 8.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 77.

Spiroloculina crenata KARRER, Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 135, pl. 1, fig. 9.—H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 156, pl. 10, figs. 24-26.—?EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 225, pl. 1, figs. 42, 43.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 75.

Test very strongly compressed, rounded, earliest portion quinqueloculine, later and larger portion planispiral, peripheral margin rounded, crenulate; chambers distinct, inflated, two to a coil in the adult; sutures distinct, depressed; wall ornamented with slightly oblique, raised, rounded ridges and depressions in a regular pattern; aperture cribrate.

The types of these two species are from the Miocene of Kostej, Banat region of Hungary. I examined both types in the Museum at Vienna. Although drawn as having an open aperture with a single tooth, the types have in reality a cribrate aperture and both forms belong in *Hauerina*. From a study of the types and a series of topotypes it is apparent that these represent probably megalospheric and microspheric forms of a single species. There are also very typical specimens in our collection from the Miocene of Lapugy, Austria.

There are a few Recent records, especially those of Brady in the *Challenger* Report, that seem very close to this species. They are mostly from shallow waters of the Pacific.

HAUERINA ORNATISSIMA (Karrer) (Pl. 1, fig. 16)

Quinqueloculina ornatisima KARRER, Sitz. Akad. Wiss. Wien, vol. 58, pt. 1, 1868, p. 151, pl. 3, fig. 2.

Test compressed, irregularly rounded, earliest portion quinqueloculine, later portion planispiral, peripheral margin acute, crenulate; cham-

bers distinct, inflated, two or three in the adult coil; sutures distinct, depressed; wall ornamented with radial ridges which are transversely striate; aperture coarsely cribrate. Diameter 0.90-1.25 mm.

The types of this species are from the Miocene of Kostej in the Banat region of Hungary. There are specimens in our collections from the Miocene of Lapugy.

There are many references to this species from the late Tertiary and Recent but a study of a large series seems to show that they are distinct from the European Miocene ones, although all related. A separation of these is attempted here.

HAUERINA MIOCENICA Cushman, n. sp. (Pl. 1, fig. 17; pl. 2, fig. 11)

Hauerina bradyi CUSHMAN and PONTON (not CUSHMAN, 1917), Bull. 9, Florida State Geol. Survey, 1932, p. 50, pl. 6, fig. 1.

Test strongly compressed, rounded, periphery acute, early stages quinqueloculine, later stages planispiral; chambers fairly distinct, slightly inflated, later ones with three or occasionally four making up the adult coil; sutures distinct, slightly depressed in the adult, curved; wall smooth; aperture cribrate. Diameter up to 0.70 mm.

Holotype (Cushman Coll. No. 17798) from the Miocene Chipola marl, McLelland's farm on right (west) bank of Chipola River, about 3 miles E. of village of Carr, Calhoun Co., Florida. It also occurs in the Chipola marl, right (west) bank of Chipola River, at mouth of Senterfeit Branch, Calhoun County, and on Ten-mile Creek, ¼ mile below bridge on Marianna-Clarksville road, 22 miles S. of Marianna, Calhoun Co., Florida.

This species differs from *H. bradyi* Cushman in the larger number of chambers in the adult, more inflated chambers, and coarser and fewer openings of the aperture. In the material examined it appears to be confined to the Chipola marl.

HAUERINA PARRI Cushman, n. sp. (Pl. 1, fig. 18)

Test strongly compressed, periphery subacute, early portion quinqueloculine, later planispiral; chambers of the adult portion two to a coil, slightly if at all inflated; sutures distinct, not depressed; wall ornamented with numerous, very low ridges, radial, but distinctly curved, with very slight transverse costae; aperture cribrate. Diameter 0.50 mm.

Holotype (Cushman Coll. No. 6609) from the Oligocene, Balcombian, Lower Beds of Muddy Creek, Victoria, Australia.

While somewhat resembling other species of the *H. ornatisima* group, this species differs in the very much compressed test including

the quinqueloculine stage and the distinctly curved and very low radial ridges, which are only slightly costate transversely.

HAUERINA INFLATA (d'Orbigny) (Pl. 1, fig. 20)

Frumentaria nautiliforme SOLDANI, Testaceographia, vol. 1, pt. 3, 1795, p. 233, pl. 159, fig. aa.

Triloculina inflata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 300, No. 10.—PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 249, pl. 8, fig. 16.

Hauerina inflata CUSHMAN, Special Publ. 13, Cushman Lab. Foram. Res., 1945, p. 26, pl. 3, fig. 12; pl. 6, fig. 10.

Test compressed, rounded, early portion quinqueloculine, later portion planispiral, peripheral margin slightly lobulate, rounded to subacute; chambers in the adult 3 or 4 in number, increasing slightly in size as added, very slightly inflated; sutures of the earlier portion rather indistinct, in the final whorl somewhat depressed, nearly radial, slightly curved; wall smooth except in the last-formed one or two chambers which have slight costae at right angles to the periphery and near the outer border; aperture cribrate. Diameter about $\frac{1}{2}$ millimeter.

Soldani's figured specimen on which the species is based was a Recent one from the Mediterranean. d'Orbigny recorded it in 1826 as fossil in the environs of Dax, of Bordeaux, of Soissons, and at Castel Arquato. A copy of the type figure of Soldani is given and a specimen from Castel Arquato figured.

The species is definitely a *Hauerina* and the original name is used here, although d'Orbigny later applied the name *Triloculina inflata* to a true *Triloculina* from the Miocene of the Vienna Basin.

HAUERINA GLABRATA (Cushman) (Pl. 1, fig. 19)

Spiroloculina glabrata CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 22, pl. 6, fig. 3.—?COLE, Bull. 6, Florida State Geol. Survey, 1931, p. 23, pl. 1, fig. 2.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 75.

"Test small, broadly elliptical, subcircular, very much compressed, planispiral; chambers rather broad; wall entirely smooth; sutures slightly depressed, indistinct except in the later portion."

The types are from the Pliocene Caloosahatchee marl on Caloosahatchee River, Florida.

Unfortunately available specimens do not show the complete apertural features and the generic position must be left in doubt. Cole records a specimen from the Pliocene of Florida as this species but the figure seems to be different.

HAUERINA HOWELLI Bermudez (Pl. 1, fig. 21; pl. 2, fig. 10)

Hauerina howelli BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 166, pl. 12, figs. 6, 7.

Test strongly compressed, irregularly rounded, periphery subacute, early chambers quinqueloculine, later ones planispiral, two or more in the final coil; chambers distinct, slightly inflated; sutures distinct, slightly depressed; wall with numerous short, raised ridges, nearly at right angles to the periphery, curved; aperture cribrate. Length of holotype 0.5 mm.

The types are from off the coast of Cuba and the species is rare. I have a single specimen from $4\frac{3}{4}$ fathoms, Bird Key Harbor, Dry Tortugas, Florida, that is apparently the same.

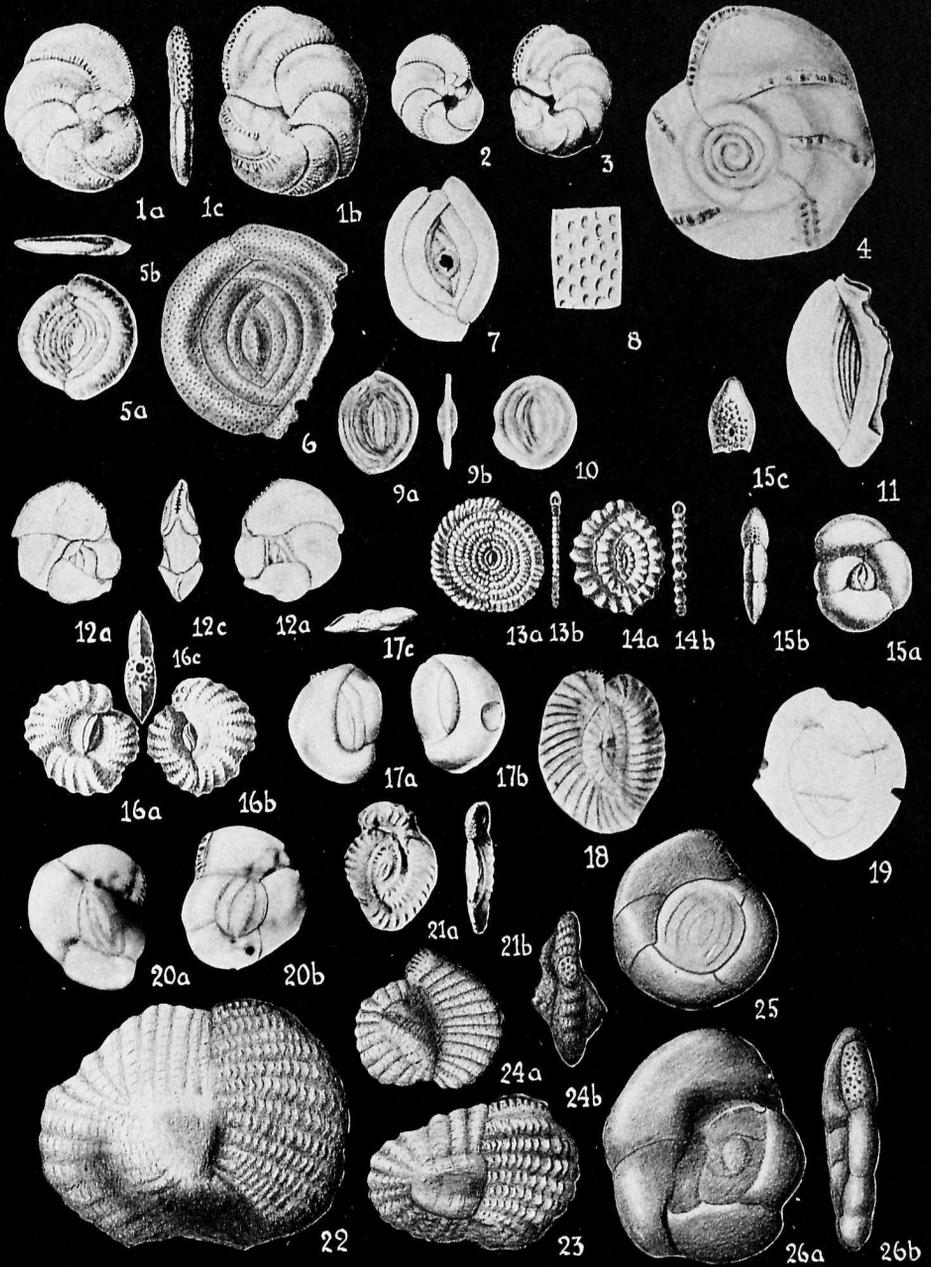
HAUERINA ATLANTICA Cushman, n. sp. (Pl. 1, figs. 25, 26)

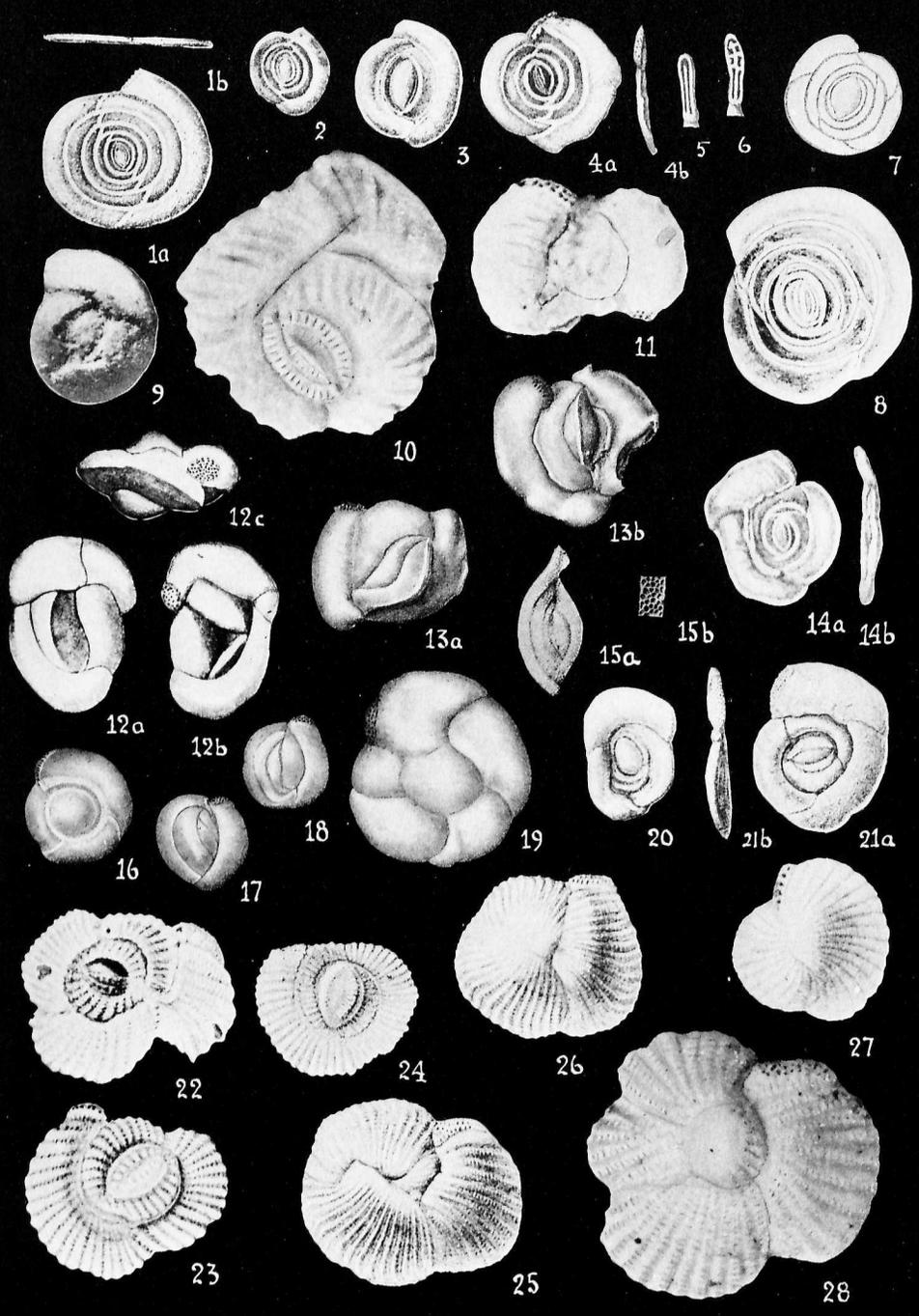
Hauerina bradyi CUSHMAN (not CUSHMAN, 1917), Proc. U. S. Nat. Mus., vol. 59, 1921, p. 72; Publ. 311, Carnegie Inst. Washington, 1922, p. 71; Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 47, pl. 10, figs. 4-9; Smithsonian Misc. Coll., vol. 99, No. 9, 1941, p. 5, pl. 1, figs. 25-27.

Test strongly compressed, periphery rounded, earliest portion irregularly quinqueloculine, later planispiral; chambers of the earlier portion indistinct, those of the final coil distinct, somewhat inflated, three or usually four making up the complete adult coil; sutures of the later portion distinct, depressed, somewhat curved; wall nearly smooth but very finely striate-reticulate; aperture slightly projecting, cribrate. Diameter up to 1 mm.

EXPLANATION OF PLATE I

Figs. 1-4. *Polysegmentina circinata* (H. B. Brady). 1-3, (After H. B. Brady). 1, $\times 25$. 2, 3, $\times 16$. 4, (After Rhumbler). $\times 60$. 5, 6. *Hauerina desertorum* (Schwager). 5, (After Schwager). *a*, front view; *b*, apertural view. 6, One of Schwager's specimens redrawn. 7, 8. *H. imprimata* (Cushman). (After Cushman). 7, Front view. $\times 16$. 8, Surface details. $\times 80$. 9, 10. *H. lateana* (Howchin). (After Howchin). $\times 20$. *a*, front view; *b*, edge view. 11. *H.* sp. (After Cushman). $\times 45$. 12. *H. sansebastianensis* Galloway and Heminway. (After Galloway and Heminway). $\times 20$. *a*, *b*, opposite sides; *c*, apertural view. 13, 14. *H. speciosa* (Karrer). (After Karrer). *a*, *a*, front view; *b*, *b*, edge views. 13, "Spiroloculina speciosa Karrer." 14, "Spiroloculina crenata Karrer." 15. *H. compressa* d'Orbigny. (After d'Orbigny). *a*, front view; *b*, apertural view. $\times 20$. *c*, apertural face more enlarged. 16. *H. ornatisima* (Karrer). (After Karrer). *a*, *b*, opposite sides; *c*, apertural view. 17. *H. miocenica* Cushman, n. sp. Immature Specimen. (After Cushman and Ponton). $\times 50$. *a*, *b*, opposite sides; *c*, apertural view. 18. *H. parri* Cushman, n. sp. Holotype. $\times 50$. 19. *H. glabrata* (Cushman). (After Cushman). $\times 60$. 20. *H. inflata* (d'Orbigny). $\times 35$. *a*, *b*, opposite sides. 21. *H. howelli* Bermudez. (After Bermudez). $\times 40$. *a*, front view; *b*, apertural view. 22-24. *H. occidentalis* Cushman, n. sp. (After Cushman). $\times 60$. 22, Holotype. 23, 24, Paratypes. *a*, front view; *b*, apertural view. 25, 26. *H. atlantica* Cushman, n. sp. (After Cushman). $\times 60$. 25, Paratype. 26, Holotype. *a*, front view; *b*, apertural view.





Holotype (Cushman Coll. No. 4376) from San Juan Harbor, Porto Rico. The species also occurs in 10 fathoms, Montego Bay, Jamaica; at numerous stations in the Dry Tortugas, Florida, in 2-18 fathoms; and in 7-8 fathoms inside reef, Old Providence Island.

This species differs from *H. bradyi* Cushman of the Pacific in the more compressed early portion, rounded periphery, shorter adult chambers, and deeper, more nearly radial sutures.

HAUERINA OCCIDENTALIS Cushman, n. sp. (Pl. 1, figs. 22-24)

Hauerina ornatissima CUSHMAN (not KARRER), Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 47, pl. 10, figs. 10-12; Smithsonian Misc. Coll., vol. 99, No. 9, 1941, p. 5.

Test almost completely involute, periphery rounded to subacute, early stages quinqueloculine, adult planispiral; chambers fairly distinct, slightly inflated, two or three in the adult coil; sutures rather indistinct, little if at all depressed; wall ornamented with numerous, generally radiate ridges, each broken transversely into a series of raised knobs; aperture cribrate. Diameter up to 0.70 mm.

Holotype (Cushman Coll. No. 4392) from the Dry Tortugas, Florida, in 7 fathoms. The species also occurs at several other stations in the Tortugas region; in 3 fathoms, Montego Bay, Jamaica; San Juan Harbor, Porto Rico; and 7-8 fathoms, inside the reef, Old Providence Island.

This species differs from *H. involuta* Cushman in the less inflated chambers, more irregular chambers, and the surface ornamentation which is much coarser, the ridges not curved at the outer ends and more distinctly knobbed.

HAUERINA FRAGILISSIMA (H. B. Brady) (Pl. 2, figs. 1-6, 8)

Spiroloculina fragilissima H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884,

EXPLANATION OF PLATE 2

Figs. 1-6, 8. *Hauerina fragilissima* (H. B. Brady). 1-3, (After H. B. Brady). × 25. 4-6, (After Millett). 4, × 28. 5, 6, Enlarged apertural faces. 8, (After Cushman). × 50. 7. "*H. complanata* Dakin." (After Dakin). × 25. 9. *H. simplex* Silvestri. (After Silvestri). × 10. 10. *H. howelli* Bermudez. Recent, Dry Tortugas. × 50. 11. *H. miocenica* Cushman, n. sp. Holotype. × 50. 12, 13. *H. pacifica* Cushman. (After Cushman). *a, a, b, b*, opposite sides; *c*, apertural view. 12, × 35. 13, × 50. 14, 20, 21. *H. bradyi* Cushman. × 25. *a, a*, front views; *b, b*, apertural views. 14, (After Millett). 20, 21, (After H. B. Brady). 15. *H. byramensis* (Cushman). (After Cushman). *a*, front view, × 8; *b*, surface details, × 40. 16-19. *H. diversa* Cushman, n. sp. (After Cushman). × 45. 16-18, Paratypes. 19, Holotype. 22-24. *H. orientalis* Cushman, n. sp. 22, 23, (After Cushman). × 30. 24, (After H. B. Brady). × 25. 23, Holotype. 25-28. *H. involuta* Cushman, n. sp. 25-27, (After H. B. Brady). × 28. 28, Holotype. × 50.

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p. 149, pl. 9, figs. 12-14.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 75.

Hauerina fragilissima MILLETT?, Journ. Roy. Micr. Soc., 1898, p. 610, pl. 13, figs. 8-10.—HERON-ALLEN and EARLAND?, Trans. Zool. Soc. London, vol. 20, 1915, p. 587, pl. 46, figs. 1, 2.—CUSHMAN?, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 64, pl. 24, fig. 4; Journ. Washington Acad. Sci., vol. 10, 1920, p. 200; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 451; U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 103, pl. 27, fig. 3; Prof. Paper 133, 1923, p. 56; Publ. 342, Carnegie Instit. Washington, 1924, p. 68, pl. 25, figs. 2, 3.—HOWE, Journ. Pal., vol. 2, 1928, p. 175 (list).—CUSHMAN, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 42, pl. 10, fig. 9.—THALMANN, *Eclogae geol. Helvetiae*, vol. 25, 1932, p. 297.

Test very strongly compressed, nearly circular, very early portion quinqueloculine, later portion planispiral, with the chambers a half coil in length, periphery rounded; chambers distinct, very slightly if at all inflated; sutures distinct, slightly depressed; wall smooth, thin, translucent; aperture in the adult cribrate. Diameter 0.50-0.75 mm.

Brady recorded this species from 420 and 620 fathoms off Tahiti; 255 fathoms off Kandavu, Fiji; and 3-28 fathoms off the coast of New Guinea. Typical specimens occur in our material from off Samoa. There are numerous other records from the Indo-Pacific region. Millett's figures seem to show the transition stages from a simple tooth to a cribrate aperture.

Specimens from the Oligocene of the southeastern United States are slightly smaller than the Recent ones from the Indo-Pacific but otherwise seem identical.

“HAUERINA COMPLANATA DAKIN” (Pl. 2, fig. 7)

Hauerina complanata DAKIN, Rep. Ceylon Pearl Oyster Fish., vol. 5, 1906, p. 231, pl. 1, fig. 7.

“This species has the characteristic planispiral porcellaneous test, milioline only in the very early convolutions. It is very thin, with practically circular convolutions. Four of these, with indications of a fifth, are present; the outer, or last, consisting of four chambers. Diameter of specimen, 0.62 mm. This species differs from *H. compressa* in being more regular and even more compressed; the number of convolutions also appears to be greater and a larger number of chambers is present. Several specimens occur in deposits from Stat. LVIII, Gulf of Manaar.”

The above notes are all the description that is given and the figure is copied on our plate. It is difficult to know whether or not this is a true *Hauerina* until the type is studied.

HAUERINA PACIFICA Cushman (Pl. 2, figs. 12, 13)

Hauerina pacifica CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 64, pl. 21, fig. 2; Bull. 27, Bernice P. Bishop Mus., 1925 (1926), p. 141; Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 44, pl. 10, figs. 10, 11.

"Test in the early stages quinqueloculine, with strongly angled chambers, in the adult with the chambers somewhat more inflated but carinate and irregularly coiled, more than two making up a coil; sutures fairly distinct in the early portion but not depressed, in the adult much more depressed; wall smooth, matte; aperture somewhat projecting with a slightly convex sieve plate, with numerous irregularly arranged pores. Length, 0.7 mm."

The types of this species are from 21-33 fathoms, off the Hawaiian Islands, where it is common. Specimens are also recorded from 21 fathoms, Guam Anchorage, Ladrone Islands; and from Mokuaujar Anchorage, Fiji Islands.

HAUERINA BRADYI Cushman (Pl. 2, figs. 14, 20, 21)

Hauerina compressa H. B. BRADY (not d'ORBIGNY), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 190, pl. 11, figs. 12, 13.—MILLET, Journ. Roy. Micr. Soc., 1898, p. 610, pl. 13, fig. 11.

Hauerina bradyi CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 62 (not pl. 23, fig. 2).—CUSHMAN and VALENTINE, Contr. Dept. Geol., Stanford Univ., vol. 1, No. 1, 1930, p. 14, pl. 3, fig. 7.—THALMANN, *Eclogae geol. Helvetiae*, vol. 25, 1932, p. 297.—CUSHMAN, Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 14, fig. 5; Special Publ. 5, 1933, pl. 14, fig. 26; *Foraminifera*, 3rd Ed., 1940, pl. 14, fig. 5; Key, pl. 14, fig. 26.

"Test much compressed, the very earliest chambers milioline, later ones becoming spiroloculine and finally in the last-formed coil more than two chambers appear, usually three making up a complete coil; wall very finely striate-reticulate, periphery rounded or subcarinate, aperture a sieve-plate the entire height of the chamber, curved, with numerous pores. Diameter about 1 mm."

This is a fairly common species in the Indo-Pacific. Millett had the species from the Malay Archipelago. Specimens from off the coast of California seem to belong to this species.

Several species have been included under this name and *H. compressa* so it is difficult to be certain of the name to be applied to those references where figures are not given. By error the figure given (Bull. 71, U. S. Nat. Mus., pt. 6, 1917, pl. 23, fig. 2) was of "*H. circinata* H. B. Brady" and was not the type specimen.

HAUERINA DIVERSA Cushman, n. sp. (Pl. 2, figs. 16-19)

Hauerina bradyi CUSHMAN (not CUSHMAN, 1917), Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 44, pl. 10, figs. 12-15.

Test compressed, nearly circular, periphery rounded, earliest portion quinqueloculine, later planispiral; chambers of the earlier portion somewhat covered and indistinct, in the adult distinct, slightly inflated, three to five making up the adult coil; sutures of the adult portion distinct, slightly depressed, distinctly curved; wall nearly smooth but very finely striate-reticulate; aperture slightly projecting, cribrate, with very fine openings. Diameter up to 1 mm.

Holotype (Cushman Coll. No. 14886) from shallow water off beach at Hereheretue, Paumotu Islands. The species also occurs in 12 fathoms, Levuka, Fiji, and in 18 fathoms, Vavau Anchorage, Tonga Islands.

The species differs from *H. bradyi* Cushman in the rounded periphery, larger number of chambers in the adult coil, less prominent quinqueloculine chambers, and the finely ornamented surface.

HAUERINA ORIENTALIS Cushman, n. sp. (Pl. 2, figs. 22-24)

Hauerina ornatisissima H. B. BRADY (part) (not KARRER), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 192, pl. 7, figs. 18-20 (not 15-17, 21, 22).—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 63, pl. 23, figs. 1, 5; Publ. 342, Carnegie Inst. Washington, 1924, p. 67, pl. 24, figs. 7-9; Bull. 27, Bernice P. Bishop Mus., 1925 (1926), p. 141; Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 43, pl. 10, figs. 16, 17.

Test strongly compressed, irregularly rounded, earliest portion quinqueloculine and strongly angled, later portion very strongly compressed and forming nearly the whole surface of the test, peripheral margin lobulate, subacute, delicately crenulate; chambers distinct, very slightly if at all inflated in the adult coil which consists of usually two or three chambers; sutures distinct, very slightly depressed in the adult; wall ornamented with numerous very fine radial ridges which are transversely striate; aperture rather finely cribrate. Diameter usually less than 1.00 mm., occasionally greater.

Holotype (Cushman Coll. No. 4385) from 17 fathoms, off N. end of Aua Reef, Pago Pago Harbor, Samoa.

This species differs from *H. ornatisissima* (Karrer) in the more compressed test, much finer radial ridges, and more finely cribrate aperture. The ornamentation is more strongly developed on the outer portion of each adult chamber. The species is common in warm, shallow waters of the Tropical Pacific. There are typical specimens in our collections from the following localities: Mokuajar Anchorage, Fiji; Levuka, Fiji, 12 fathoms; off Nairai Island, Fiji; off Fiji, 40-50 fathoms; off Rotonga, 7 fathoms; off Samoa in 17, 18, and 50 fathoms.

Although this species has the general characters of the *H. ornatisissima* group it seems quite distinct when compared with a series from the

Miocene of Europe. Numerous Pacific records for *H. ornatissima* undoubtedly belong in this or the following species, but without seeing the specimens it is impossible to place them definitely and the references are left out here.

HAUERINA INVOLUTA Cushman, n. sp. (Pl. 2, figs. 25-28)

Hauerina ornatissima H. B. BRADY (part) (not KARRER), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 192, pl. 7, figs. 15-17 (not 18-22).—CUSHMAN (part), Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 43 (not pl. 10, figs. 16, 17).

Test almost completely involute, periphery acute, early stages quinqueloculine, adult planispiral; chambers distinct, somewhat inflated, thickest near the inner margin, usually three in the adult coil; sutures distinct, depressed; wall ornamented with numerous radial ridges, often slightly curved toward the periphery, the depressed areas between transversely striate; aperture slightly protruding, distinctly cribrate. Diameter 0.85-0.90 mm.

Holotype (Cushman Coll. No. 43299) from Rongelab Atoll, Marshall Islands. Brady's *Challenger* specimens were from the Admiralty Islands and his figures are copied on our plate. There are specimens in our collections from Port Lotten, Kersail, Caroline Ids.; from Makemo Lagoon, and off Rangiroa, Paumotu Ids.; 21 fathoms, Guam Anchorage, Ladrone Ids.; and off Midway Island.

The species differs from *H. orientalis* Cushman in the involute character, thicker test, and the curved ridges of the ornamentation. This species has probably been referred to as *H. ornatissima* in various Pacific records but specimens would have to be reexamined to determine this.

The specimens figured by Howchin and Parr (Trans. Roy. Soc. So. Australia, vol. 62, 1938, p. 294, pl. 15, figs. 8, 9) from the upper Pliocene of Australia as "*H. ornatissima* (Karrer)," have some characters which suggest *H. involuta*, especially in the peculiar curvature of the ridges.

HAUERINA sp. (Pl. 1, fig. 11)

Hauerina sp. CUSHMAN, U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 103, pl. 27, fig. 4; Prof. Paper 133, 1923, p. 56.

"A single somewhat broken specimen in the marl from Byram belongs to the genus *Hauerina*. It differs from *H. fragilissima* in the sharp edge to the peripheral borders of the chambers, even carinate, and the character of the wall, which though thin and transparent seems to have deep pits or possibly perforations at wide but regular intervals, in a single irregular line down the curved part of the chamber."

The single specimen is from the Oligocene Byram marl of Byram, Miss.

HAUERINA *sp.*

Hauerina *cf.* *compressa* D'ORBIGNY SILVESTRI, Pal. Ital., vol. 32, suppl. 4, 1939, p. 15, pl. 3, fig. 8.

This form is figured in a rock section from the Eocene of Somaliland. It does not seem to be identical with d'Orbigny's species from the Miocene of the Vienna Basin and may represent a new species but the characters cannot be distinguished from the thin section.

INCERTAE SEDIS

Hauerina antiqua Reuss (Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862 (1863), p. 35, pl. 2, fig. 1). This species from the Cretaceous of Germany is definitely not a *Hauerina* but may possibly be a *Planispirina*.

Spiroloculina alata Reuss = *Hauerina*? (Neues Jahrb. für Min., 1853, p. 671, pl. 9, fig. 1.—Cushman and Todd, Special Publ. 11, Cushman Lab. For. Res., 1944, p. 74). No specimens of this species are available for study and it is difficult to place it definitely until material can be found from which to obtain the full characters. Reuss' specimens were from the Tertiary of the Mainz Basin of Germany.

Hauerina alternans Costa (Atti Accad. Pont., vol. 7, pt. 2, 1856, p. 211, pl. 20, fig. 5). Under this name Costa figured a very peculiar specimen from the Pliocene of Italy. It is impossible to place this form generically, especially when it is known that many of Costa's figures are not accurately drawn.

Hauerina nautiliformis (Soldani) (Silvestri, Mem. Pont. Accad. Nuovi Lincei, vol. 12, 1896, p. 57). The form referred to *Frumentaria nautiliformia* Soldani (Testaceographia, vol. 2, 1798, p. 48, pl. 20, fig. x) from the Pliocene of Italy does not seem to belong in *Hauerina*.

Spiroloculina hyalina F. E. Schulze = *Hauerina* (Arch. Mikrosk. Anat., vol. 11, 1875, p. 132, pl. 6, figs. 14-16.—Cushman and Todd, Special Publ. 11, Cushman Lab. For. Res., 1944, p. 75). From the figures of this species it is very difficult to place it generically. Some of its characters suggest *Hauerina* but the apertural features are not clear. It was described from the North Sea.

SPECIES DESCRIBED AS *HAUERINA*
BUT BELONGING IN OTHER GENERA

Hauerina exigua H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 267. Recent, Pacific. (= *Planispirina*)

- Hauerina inconstans* H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 268. Recent, Atlantic and Pacific. (= *Ophthalmidium*)
- Hauerina borealis* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 46. Recent, North Atlantic. (= *Planispirina contraria*)
- Hauerina circinata* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 17; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 191, pl. 11, figs. 14-16. Recent, Pacific. (= *Polysegmentina* Cushman, n. gen.)
- Hauerina intermedia* Howchin, Trans. Proc. Roy. Soc. So. Australia, vol. 12, 1889, p. 4, pl. 1, fig. 6. I have a fine series of specimens of this species from the Tertiary of Australia and there is no trace of a cribrate aperture. The species should be placed in *Nummuloculina*.

275. THE SPECIES OF *GLOBIGERINA* DESCRIBED BETWEEN 1839 AND 1850.

BY JOSEPH A. CUSHMAN

As the species of Foraminifera described under the genus *Globigerina* are in such a chaotic state, and as they are so abundant in both Recent and fossil deposits, an attempt is being made to clarify the group. The species should make good index fossils in many cases.

The surface structures in the Globigerinidae have not been studied in detail but are worthy of careful study as they have characters that are constant and help greatly to distinguish the different species.

The species described in 1826 have already been noted (see these Contributions, vol. 17, 1941, pp. 38-42, pls. 10, 11) and those from the shore sands of Cuba described in 1839 (see these Contributions, vol. 21, 1945, pp. 74, 75, pl. 12).

In order to make clear the characters of the species described between 1839 and 1850 the original descriptions and figures have been restudied together with topotype specimens where available, and the results are given here together with copies of the original figures.

GLOBIGERINA CANARIENSIS d'Orbigny (Pl. 3, fig. 1)

Globigerina canariensis d'ORBIGNY, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, 1839, vol. 2, pt. 2, "Foraminifères," p. 133, pl. 2, figs. 10-12.

"Test strongly convex, slightly oval, higher than broad, marked throughout by large rugose depressions, not perforated. Spire projecting, elevated, slightly obtuse at its apex, composed of three whorls, less distinct at the apex, from nine to eleven chambers in the adult. Chambers oblong in the line of the axis, slightly separated and angular, determining the relative convexity of each chamber; three in each

whorl with a very slight umbilicus. Aperture single, in a recession of the umbilical border, only slightly visible.

"Color white or slightly yellowish.

"Some of the specimens have the general form of *Globigerina elongata*, from the Adriatic; but they cannot be united in a single species, as *G. canariensis* is more definitely depressed, the spire more pronounced and chambers more numerous, the aperture elongate, hardly visible, while in *G. elongata* it is larger, more rounded, and more toward the exterior. Diameter $\frac{1}{3}$ mm."

The types are from sands of Teneriffe and it is recorded as very common.

A copy of the type figure is given. It has not been referred to since its original publication. No specimens in our collections can be referred to it.

GLOBIGERINELLA HIRSUTA (d'Orbigny) (Pl. 3, fig. 2)

Globigerina hirsuta d'ORBIGNY, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, 1839, vol. 2, pt. 2, "Foraminifères," p. 133, pl. 2, figs. 4-6.—OWEN, Journ. Linn. Soc., Zool., vol. 9, 1867, p. 149, pl. 5, fig. 5.—MACKIE, Science Gossip, 1867, p. 131, text fig. 128.—HOGG, Microscope, 1886, p. 18, pl. 3, fig. 77.

"Test orbicular, depressed, broader than high, covered throughout with elongated, tubular, hollow spines, giving a hirsute appearance. Spire concave at the tip, partly involute on the same plane, composed of two whorls, the first indistinct and composed of eight or nine chambers in all. Chambers spherical, distinct, five in the last whorl, increasing rapidly in size and forming a large umbilicus. Aperture single, crescent-shaped, with a slight lip, in the umbilicus. Diameter $\frac{1}{3}$ mm.

"Color white.

"Of all the species of the genus this is perhaps the most beautiful, most remarkable in the length of the tiny tubes making the hispid surface, by its regularity of form and its coiling without a spire. The five chambers of the last whorl resemble *G. dutertrei*, from which it differs in its lack of a projecting spire, by its spines, and its coiling."

The types are from the sands of Tenneriffe.

The species has hardly been referred to since its original publication. From the figures and description, a free translation of which is given above, it would appear to belong in *Globigerinella*. A copy of d'Orbigny's figure is given.

GLOBIGERINA INFLATA d'Orbigny (Pl. 3, fig. 3; pl. 4, figs. 1-4)

Globigerina inflata d'ORBIGNY, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, 1839, vol. 2, pt. 2, "Foraminifères," p. 134, pl. 2, figs. 7-9.

"Test orbicular, very convex, nearly spherical, nearly as high as

broad, slightly marked with small points or depressions, making a dull surface. Spire slightly convex, very obtuse, partly covered by the later chambers, composed of two whorls, indistinct at the apex, with seven or eight chambers in all. Chambers globular, slightly separated from one another with four in the final whorl, sutures slightly depressed, radiate and forming a very slight umbilical depression. Aperture single, crescent-shaped, very elongate, occupying nearly the entire length of the final chamber. Diameter $\frac{1}{3}$ mm.

“Color white.

“We know no other species that can be confused with this with its spire partially covered by half the size of the chambers; it is also more spherical in its general shape, and one of the least umbilicated.”

The types are from the sand of Santa Cruz, in Teneriffe, where it is rare.

This species has been very widely recorded. Some of the earlier fossil records are probably not of this species and many of them are without figures. The species is widely distributed in the present oceans and it apparently appeared at least as early as the Oligocene. The fossil specimens should be carefully compared with typical Recent material.

GLOBIGERINA CRETACEA d'Orbigny (Pl. 3, fig. 5; pl. 4, figs. 5, 6)

Globigerina cretacea d'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 34, pl. 3, figs. 12-14.

“Test suborbicular, compressed, rugose, surface covered with small, uneven points. Spire slightly convex, very obtuse, composed of three distinct whorls, four or five chambers in the adult whorl. Chambers spherical, a little depressed, five in the last-formed whorl, distinctly separated, with a large, deep, central umbilicus. Aperture very large, crescentic, in the umbilicus. There is a second aperture, perhaps accidental, in the third chamber. Diameter $\frac{1}{4}$ mm.

“No other species of the genus is as depressed as this, nor having such a large umbilicus.

“A single specimen from Saint-Germain, France, but abundant in England.”

This is a very common species in the Upper Cretaceous of Europe and America and probably elsewhere. There are a great many published records for this species ranging from Jurassic to Recent, mostly without figures. In those records accompanied by figures it is evident that several species have been included under this name. Typical specimens are figured and will give the general appearance of this species.

GLOBIGERINA ELEVATA d'Orbigny (Pl. 3, fig. 4)

Globigerina elevata d'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 34, pl. 3, figs. 15, 16.

"Test very convex, oval, oblong, rugose; spire convex, elevated, obtuse at its apex, composed of four whorls of which only the final one is distinct. Chambers oblong, compressed, three and a half in a whorl, all well separated, the sutures fairly deep, umbilical end pointed.

"The species nearest this with a distinct spire are *Globigerina helicina* from the Adriatic and *Globigerina canariensis*; but this is distinguished from the first by having the chambers compressed but not depressed; and from the second by having chambers not angled; and from both, by the lack of an umbilicus.

"Common in the environs of Sens, but rare in England."

There are very few records for this species and I have failed to find specimens that could be called at all typical in abundant material from the European Cretaceous that I have examined.

GLOBIGERINA CONFLUENS Hagenow

Globigerina confluens HAGENOW, Neues Jahrb. für Min., 1842, p. 571.

GLOBIGERINA GLOBOSA Hagenow

Globigerina globosa HAGENOW, Neues Jahrb. für Min., 1842, p. 571.

These two species from the Cretaceous of Germany were not figured and remain as *nominae nudae*.

GLOBIGERINA FOVEOLATA Ehrenberg

Globigerina foveolata EHRENBURG, Bericht k. preuss. Akad. Wiss. Berlin, 1844, p. 67; Mikrogeologie, 1854, pl. 21, fig. 96; pl. 22, fig. 74; pl. 24, fig. 49.

The specimens named by Ehrenberg are from the Cretaceous of North Africa. The figures are very poor but some of them are probably *Globigerina cretacea* d'Orbigny and the name is a synonym of d'Orbigny's species. The types are mounted in balsam and difficult to study.

GLOBIGERINA TROCHOIDES Reuss (= Eggerella?)

Globigerina trochoides REUSS, Verstein. böhm. Kreide., pt. 1, 1845-6, p. 36, pl. 12, fig. 22; Haidinger's Nat. Abhandl., vol. 4, pt. 1, 1851, p. 37, pl. 3, fig. 5.

The types of this species were not found in our study of the Reuss collections in Prague and Dresden. Other specimens, however, seem definitely to show that this is not a *Globigerina* but an arenaceous form probably belonging in the genus *Eggerella*. It occurs commonly in the Upper Cretaceous of North America in beds of Navarro and Taylor age.

The general shape of this species might suggest that this is similar to d'Orbigny's *Globigerina elevata* but the wall is fairly smooth while d'Orbigny's species is figured as rugose.

GLOBIGERINA REGULARIS d'Orbigny (Pl. 3, fig. 6)

Globigerina regularis d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 162, pl. 9, figs. 1-3.

From the type figure of this species it does not appear to be a *Globigerina*. There are very few references to the species and the few that give figures show that the material was not the same as d'Orbigny's. He recorded it from Nussdorf as rare. I have examined much material from Nussdorf without finding any *Globigerinas* that could be identified with this species and it must remain doubtful until types can be studied. Specimens seen in the Museum at Vienna named *G. regularis* d'Orbigny were definitely not this species.

GLOBIGERINA QUADRILOBATA d'Orbigny (Pl. 3, fig. 7)

Globigerina quadrilobata d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 164, pl. 9, figs. 7-10.

Like the preceding, this species has apparently been recorded only from the Pliocene and Pleistocene of Italy and the Isle of Rhodes and only figured by Costa. His figure is not convincing that it is identical with d'Orbigny's. It is recorded as rare from Nussdorf. It would appear that it may be an irregular specimen and the name allowed to lapse.

GLOBIGERINA BILOBATA d'Orbigny (Pl. 3, fig. 9; pl. 4, figs. 7-10)

Globigerina bilobata d'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 164, pl. 9, figs. 11-14.

This is a peculiar species in having the last two chambers in the adult making up almost the entire surface of the test. Specimens must be very rare in the Vienna Basin material as samples from many localities were searched for specimens of this species without results. d'Orbigny recorded it only from Nussdorf and as rare.

In material from the Miocene of Roumania this species occurs in large numbers showing the stages in development.

In the early stages there are three and part of a fourth chamber to the whorl. This decreases to three and then to practically two in the adult. The umbilical area is open slightly in the earlier stages but is almost entirely even with the rest of the surface in the adult. The aperture in the early stages is relatively large and opens into the umbilicus, but in the adult becomes relatively smaller and is near the border of the test. The surface of the test is very finely and evenly pitted as shown in the type figure.

This is evidently a specialized species of the Miocene of Southern Europe but like other species of that region may be looked for in the Indo-Pacific and perhaps in Tropical America.

GLOBIGERINA CONCINNA Reuss (Pl. 3, figs. 10-12; pl. 4, figs. 11-15)

Globigerina concinna REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 373, pl. 47, fig. 8.

Globigerina diplostoma REUSS, l. c., p. 373, pl. 47, figs. 9, 10; pl. 48, fig. 1.

From the study of a large series of these two forms they seem to belong to one species. In the younger stages there are but four chambers in the last-formed whorl, while in adult specimens there are often five. The spire is very low and the umbilicus broad and deep with a large aperture as shown in Reuss' type figures. There is no sign of any supplementary apertures on the dorsal side and the species is evidently a true *Globigerina*.

Reuss gives a number of localities for these in the Miocene of Southern Europe. There are numerous references to these two species, both fossil and Recent, but those accompanied by figures seem to show that they are mostly not the same as Reuss' species. Like other species of this area, the species should be looked for in the late Tertiary of the Indo-Pacific, Mediterranean, and Tropical American regions.

This species is very close to *Globigerina bulloides* d'Orbigny as shown by a comparison of topotypes from Rimini. The latter species has four chambers in the adult whorl while *G. concinna* has five, but otherwise the two are very similar and *G. concinna* may perhaps have only varietal standing. d'Orbigny's Model No. 76 of *G. bulloides* has definitely four chambers in the adult whorl. The description of both four- and five-chambered stages with different specific names makes for much confusion, and it is necessary to have a large series from any locality to make certain of this character and the final specific name to be used.

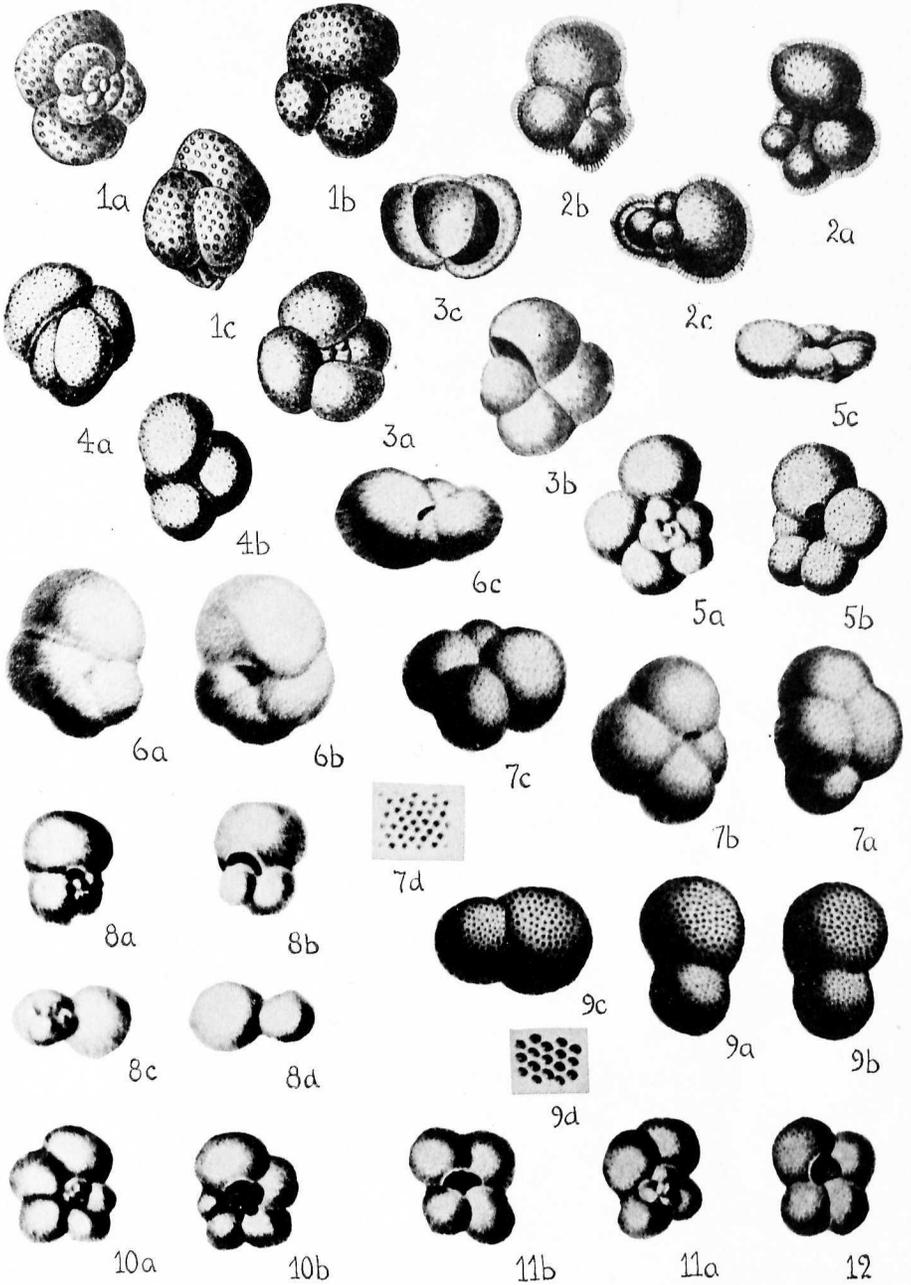
GLOBIGERINOIDES TRILOBA (Reuss) (Pl. 3, fig. 8; pl. 4, figs. 16-18)

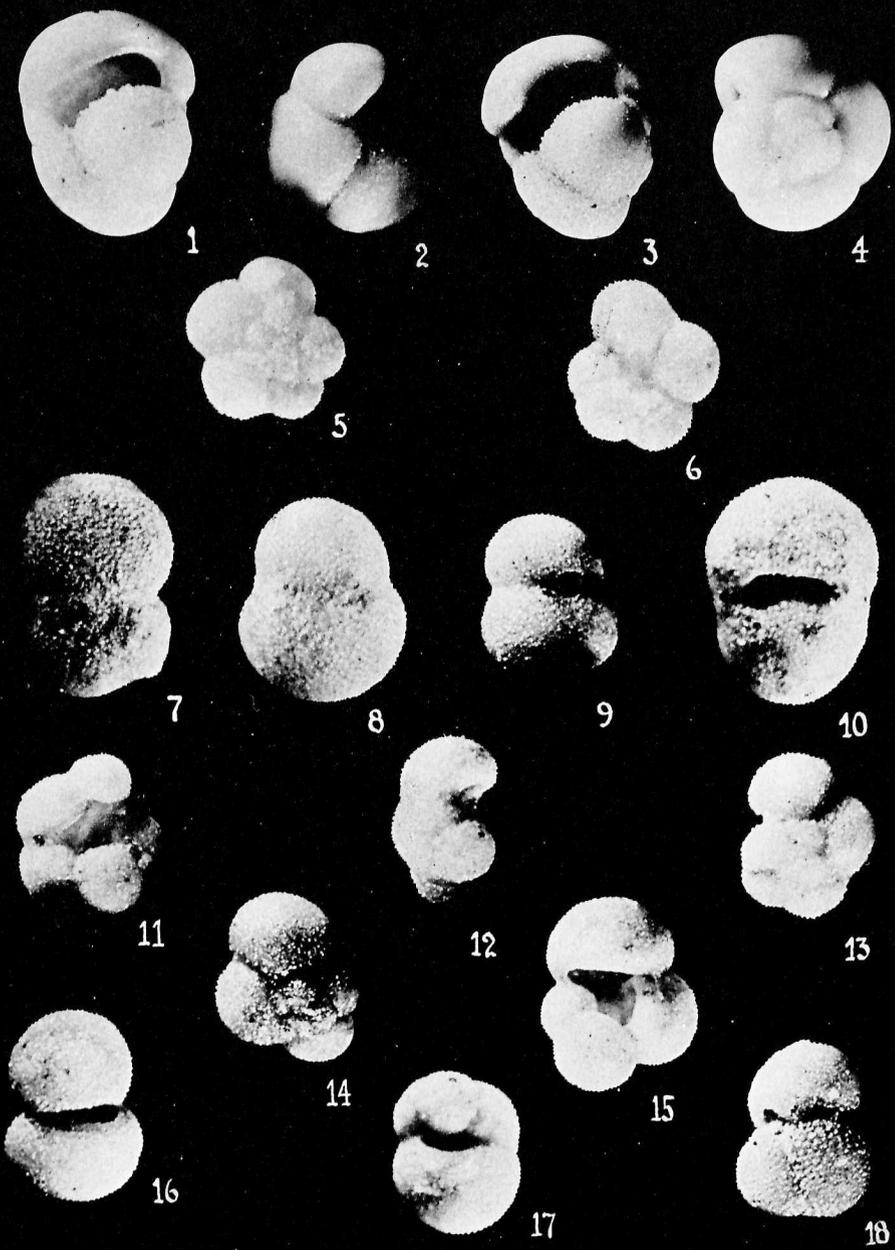
Globigerina triloba REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 374, pl. 47, fig. 11.

We have specimens available from several of the many localities noted by Reuss for this species, among them a good series from the Miocene of Baden. Reuss' figure and description show this to belong

EXPLANATION OF PLATE 3

Fig. 1. *Globigerina canariensis* d'Orbigny. 2. *Globigerinella hirsuta* (d'Orbigny). 3. *Globigerina inflata* d'Orbigny. 4. *G. elevata* d'Orbigny. a, side view. 5. *G. cretacea* d'Orbigny. 6. *G. regularis* d'Orbigny. 7. *G. quadrilobata* d'Orbigny. 8. *Globigerinoides triloba* (Reuss). d, peripheral view from opposite side. 9. *Globigerina bilobata* d'Orbigny. 10-12. *G. concinna* Reuss. 11, 12, "*G. diplostoma* Reuss." 12, Ventral view. (Figs. 1-7, 9, After d'Orbigny; figs. 8, 10-12, After Reuss. In all figures unless otherwise noted: a, dorsal view; b, ventral view; c, peripheral view; d, surface detail enlarged).





to *Globigerinoides* as there are definite supplementary apertures on the dorsal side. The surface characters are very different from those of *Globigerina concinna* Reuss and are similar to other known species of *Globigerinoides*, consisting of a network of rather coarse but uniform depressions, without any spinose projections.

The species has been recorded frequently, both as a species and as a variety of *Globigerina bulloides* d'Orbigny. From a comparison with specimens of *Globigerinoides trilocularis* (d'Orbigny) (see these Contributions, vol. 17, 1941, p. 39, pl. 10, figs. 14-17; pl. 11, fig. 1) from the Miocene of France, the two seem to be identical. d'Orbigny did not figure or describe his species and the only reference to *G. trilocularis* prior to 1850 is that of Roemer (Neues Jahrb. für Min., 1838, p. 390, pl. 3, fig. 41a). Roemer's specimens were from the Oligocene of Osnabrück and an examination of material from this locality shows that specimens identical with Roemer's figure are true *Globigerinas* and not *Globigerinoides* and thus not the same as d'Orbigny's species to which they were referred. It would seem, therefore, that d'Orbigny's name is a *nomen nudum* and Reuss' later name, *Globigerinoides triloba*, should be used for this species. Specimens from the Pliocene of Italy and Recent material from the Mediterranean also seem to be identical with this species.

RECENT LITERATURE ON THE FORAMINIFERA

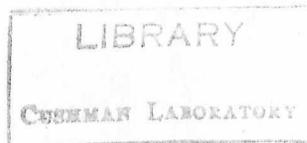
Below are given some of the more recent works on the foraminifera that have come to hand:

- Hedberg, H. D. and F. Hedberg. Bibliografía e Índice de la Geología de Venezuela.— Tomado de la Revista de Fomento, Nos. 58-59, Año VII, 1945, pp. 1-81, map.— Records the literature on the geology of Venezuela and in the last part tabulates the papers by 14 districts, and under Paleontology mentions those papers that bear on the Foraminifera.

EXPLANATION OF PLATE 4

All figures $\times 50$

Figs. 1-4. *Globigerina inflata* d'Orbigny. Recent, Western Atlantic. 1, 3, Apertural views; 2, ventral view; 4, dorsal view. 5, 6. *G. cretacea* d'Orbigny. Cretaceous, Dortmund, Germany. 5, Dorsal view; 6, ventral view. 7-10. *G. bilobata* d'Orbigny. Miocene, Balina, District of Niebedinti, Roumania. 7, Dorsal view; 8, side view; 9, 10, ventral views. 11-15. *G. concinna* Reuss. 11-13, Miocene, Halbersdorf, Austria. 11, Ventral view; 12, side view; 13, dorsal view. 14, 15, "*G. diplostoma* Reuss." Voss-lau, bei Wien, Austria. 14, Dorsal view; 15, ventral view. 16-18. *Globigerinoides triloba* (Reuss). Miocene, Baden, Austria. 16, Side view; 17, ventral view; 18, dorsal view.



- Wickenden, R. T. D.** Mesozoic Stratigraphy of the Eastern Plains, Manitoba, and Saskatchewan—Canada Geological Survey, Memoir 239, 1945, pp. 1-87, pls. 1-5, maps.—Gives a few lists of Foraminifera.
- Cushman, Joseph A. and Alva C. Ellisor.** The foraminiferal fauna of the Anahuac formation.—Journ. Pal., vol. 19, No. 6, Nov. 1945, pp. 545-572, pls. 71-78.—The foraminiferal fauna is given and most of the species figured. Fifteen new species and seven new varieties are described.
- Mathews, Richard D.** *Rectuwigerina*, a new genus of Foraminifera from a restudy of *Siphogenerina*.—L. c., pp. 588-606, pls. 81-83, 3 text figs.—A new genus, *Rectuwigerina*, is proposed with a new subgenus, *Transversigerina*. Numerous original figures are reproduced; thirty-five species, one new, being assigned to this new genus.
- Thalman, Hans E.** Bibliography and index to new genera, species, and varieties of Foraminifera for the year 1943.—L. c., pp. 648-656.
- Stone, Benton.** *Stichocassidulina*, a new genus of Foraminifera from northwestern Peru.—L. c., vol. 20, No. 1, January, 1946, pp. 59-61, 3 text figs.—A new genus with the genoholotype *Stichocassidulina thalmani* Stone, n. sp.

J. A. C.

The following lists were kindly sent in by Dr. A. ten Dam, and many of the papers have been received.

PUBLICATIONS ON FORAMINIFERA ISSUED DURING THE YEARS 1940-1945 IN THE NETHERLANDS

I. Issued from the Micropaleontological Laboratory of the State Geological Survey of the Netherlands:

- A. ten Dam and Th. Reinhold.** The Genus *Darbyella* and its species.—Geol. & Mijnbouw, T. 3, No. 4, pp. 108-111, 2 pl., 1941.—Describes 3 species, 1 new: *Darbyella nitida* ten Dam et Reinhold.
- A. ten Dam and Th. Reinhold.** Ein Vorkommen von *Pernerina depressa* (Perner) im Hervien der Peel-Gegend.—Geol. & Mijnbouw, T. 3, No. 5, pp. 157-159, 1 pl., 1941.—Describes 1 species.
- A. ten Dam and Th. Reinhold.** Nonioninidae as Tertiary Index-Foraminifera.—Geol. & Mijnbouw, T. 3, No. 6, pp. 209-212, 2 pl., 1941.—Describes 1 new species: *Nonion granulosum* ten Dam et Reinhold.
- A. ten Dam and Th. Reinhold.** Asterigerinen als Index-Foraminiferen fuer das nord-west-Europaeische Tertiaer.—Geol. & Mijnbouw, T. 3, No. 7, pp. 220-223, 1 pl., 1941.—Describes 3 species, 2 new: *Asterigerina frankei* ten Dam et Reinhold and *Asterigerina staeschei* ten Dam et Reinhold.
- A. ten Dam and Th. Reinhold.** Trimorphie bei einer *Uvigerina*.—Geol. & Mijnbouw, T. 3, No. 8, pp. 237-240, 2 pl., 1941.—Describes 1 new species: *Uvigerina hosiusi* ten Dam et Reinhold.
- A. ten Dam and Th. Reinhold.** Some foraminifera from the Lower Liassic and the Lower Oolitic of the Eastern Netherlands.—Geol. & Mijnbouw, T. 4, No. 1, pp. 8-11, 2 pl., 1942.—Describes 1 species.
- A. ten Dam and Th. Reinhold.** Die stratigraphische Gliederung des niederländischen

- Plio-Plistozäns nach Foraminiferen.—Med. Geol. Stichting, Serie C. V. No. 1, pp. 1-65, 6 pl., 5 tab., 1941.—Describes 95 species, 8 new.
- A. ten Dam and Th. Reinhold.** Die stratigraphische Gliederung des niederländischen Oligo-Miozäns nach Foraminiferen.—Med. Geol. Stichting, Serie C. V. No. 2, pp. 1-106, 10 pl., 8 tab., 1942.—Describes 168 species, 10 new.
- A. ten Dam.** Overzicht over de foraminiferenfauna van het tertiair in Nederland.—Hand. Ned. Nat. Gen. Congres, pp. 317-318, 1943.
- A. ten Dam.** Facies in het nederlandse Mesozoicum en Kaenozoicum op grond van de microfauna.—Versl. Bijeenk. Micropal., No. 1, Sept. 1943, pp. 1-2.
- A. ten Dam.** Methoden voor faciesanalyse met foraminiferen.—Versl. Bijeenk. Micropal., No. 2, Oct. 1943, pp. 1-2.
- A. ten Dam.** Stratigraphie, sedimentatie en micropaleontologie.—Versl. Bijeenk. Micropal., No. 5, June, 1944, pp. 1-3.
- A. ten Dam.** Onder-Lias in de proefboring T. der R. O. V. D. op grond van foraminiferen.—Geol. & Mijnbouw, T. 6, No. 1-2, p. 14, 1944.
- A. ten Dam.** Oude en nieuwe boringen in het Plio-Plistoceen van Nederland, No. 1.—Geol. & Mijnbouw, T. 6, No. 5-6, p. 45, 1944.
- A. ten Dam.** Een nieuwe soort van het geslacht *Polymorphina* d'Orbigny.—Geol. & Mijnbouw, T. 6, No. 5-6, p. 44, 1944.—Describes 1 new species: *Polymorphina striatula* ten Dam.
- A. ten Dam.** La stratigraphie et la microfaune du Tertiaire des Pays-Bas.—Compte Rendus de la Soc. Géol. de France, 1944, pp. 81-83.
- A. ten Dam.** Les microfaunes de l'Albien des Pays-Bas comparées avec les faunes contemporaines du Nord-Ouest de l'Europe.—Comptes Rendus de la Soc. Géol. de France, 1944, pp. 105-107.
- A. ten Dam.** Un coup d'oeil sur la structure de Bassin éocène des Pays-Bas.—Comptes Rendus de la Soc. Géol. de France, 1944, pp. 128-130.
- A. ten Dam and E. Schijfsma.** Note sur les genres foraminifères *Gyroidina* d'Orbigny et *Valvulineria* Cushman.—Comptes Rendus de la Soc. Géol. de France, 1944, pp. 143-144.
- A. ten Dam.** Bijdrage tot de Kennis van het Tertiair in Oost-Nederland.—Verh. Geol. Mijnbouwk. Gen., T. 14, pp. 135-146, 1944.
- A. ten Dam.** Die stratigraphische Gliederung des niederländischen Paläozäns und Eozäns nach Foraminiferen.—Med. Geol. Stichting, Serie C. V. No. 3, pp. 1-142, 6 pl., 1944.—Describes 170 species, 32 new.

II. Published by students of the State University of Utrecht:

- D. G. Montagne.** Geologie und Paleontologie der Umgebung von Sestanovac, Dalmatien.—Diss. Utrecht, 1941, pp. 1-93, 8 pl.—Describes 58 species, 5 new.
- J. F. C. de Witt Puyt.** Geologische und paleontologische Beschreibung der Umgebung von Ljubuski, Hercegovina.—Diss. Utrecht, 1941, pp. 1-99, 5 pl.—Describes 72 species, 8 new, and 1 new genus.
- J. van Soest.** Geologie und Paleontologie des zentralen Biokovo, Dalmatien.—Diss. Utrecht, 1942, pp. 1-42, 5 pl.—Describes 18 species, 6 new, and 1 new genus.
- A. Th. C. Rutgers.** Geologie und Paleontologie des SO Teiles des Biokovo und seines Hinterlandes, Dalmatien.—Diss. Utrecht, 1942, pp. 1-43, pl. 1-4.—Describes 34 species, 4 new.

- A. van Wessem.** Geology and Paleontology of central Camaguey, Cuba.—Diss. Utrecht, 1943, pp. 1-88, 3 pl.—Describes 60 species, 11 new.
- F. G. Keijzer.** Outline of the Geology of the Eastern part of the Province of Oriente, Cuba.—Diss. Utrecht, 1945, pp. 1-216, 11 pl.—Describes 95 species, 36 new, and 4 new genera and 2 new subgenera.
- M. G. Rutten.** A synopsis of the Orbitoididae.—*Geol. & Mijnb.*, T. 3, No. 2, pp. 34-62, 1941.—Describes 14 genera and 10 subgenera; none new.
- J. P. van der Sluis and D. R. de Vletter.** Youngtertiary smaller foraminifera from the neighbourhood of Ngimbang, East Java.—*Proc. Ned. Ak. Wetensch.*, T. XLV, No. 10, 1942, pp. 1010-1015.—Describes 14 species, 6 new.
- F. G. Keijzer.** An addition to Smaller foraminifera from the Lower Oligocene of Cuba.—*Proc. Ned. Ak. Wetensch.*, T. XLV, No. 6, 1942, pp. 607-608.—Describes 1 new variety.
- F. G. Keijzer.** Eine neue eozäne Foraminiferengattung aus Dalmatien.—*Proc. Ned. Ak. Wetensch.*, T. XLIV, No. 8, 1941, pp. 1006-1007.—Describes 1 new species and 1 new genus.
- R. C. van Bellen.** Some eocene Foraminifera from the neighbourhood of Ricice near Imotski, E. Dalmatia, Yugoslavia.—*Proc. Ned. Ak. Wetensch.*, T. XLIV, No. 8, 1941, pp. 996-1003, 1 pl.—Describes 35 species, 7 new, and 1 new genus.
- R. C. van Bellen, J. F. C. de Witt Puyt, A. C. Rutgers, and J. van Soest.** Smaller Foraminifera from the Lower Oligocene of Cuba.—*Proc. Ned. Ak. Wetensch.*, T. XLIV, No. 9, 1941, pp. 1140-1146, 1 pl.—Describes 32 species, 11 new.

III. Published by members of the University of Leyden:

- L. U. de Sitter.** Faciesanalyse.—*Geol. & Mijnbouw*, T. 3, No. 8, pp. 225-237, 1941.
- G. A. de Neve.** Quelques remarques sur les Camerinidae et sur la structure interne de *Camerina orbignii* et de *Camerina memmelensis*.—*Verh. Geol. Mijnbouwk. Gen.*, T. XIV, pp. 347-360, 1944.

IV. Published by other institutions:

- J. Dufour.** Eenige opmerkingen uit de practijk van een micropalaeontoloog.—*Geol. & Mijnbouw*, T. 5, No. 9-10, pp. 68-74, 1943.

Generally new species means new varieties as well as new species.

LITERATURE ON FORAMINIFERA ISSUED IN FRANCE DURING THE WAR

- P. Marie.** Zones à Foraminifères du Gault dans le département de l'Aube.—*C. R. Soc. Géol. de France*, 1941, pp. 38-39.
- P. Marie.** Zones à foraminifères des marnes du Gault de Wissant (Pas de Calais).—*Ibidem*, 1941, pp. 53-54.
- P. Marie.** Zones à foraminifères du Gault atteintes par forage dans la région parisienne.—*Ibidem*, 1941, pp. 135-136.
- P. Marie.** Sur la microfaune des argiles albiennes du Pays de Bray.—*Ibidem*, 1941, p. 82.
- P. Marie.** Sur la microfaune du Vraconnien d'Eze (Alpes Mar.).—*Ibidem*, 1942, pp. 205-206.—These five short papers deal with the index-foraminifera of the french

Albian or Gault and the author lists several important zones with their guide-fossils.

- P. Marie.** Sur le valeur des zones à petits foraminifères des Petites Pyrénées.—C. R. Soc. Géol. de France, 1943, pp. 110-11.
- P. Marie.** Rectification et remarque relatives au Tertiaire d'Aquitaine.—Ibidem, 1943, pp. 95-96.
- P. Marie.** Sur l'Aturien et ses limites dans les Petites Pyrénées.—Ibidem, 1942, pp. 172-173.
- P. Marie.** Sur la faune de Foraminifères de la Craie à *Belemnitella mucronata* du Nord de l'Allemagne.—Ibidem, 1942, pp. 131-132.
- P. Marie.** A propos des Foraminifères pléistocènes de la Côte des Somalis.—Ibidem, 1941, pp. 70-71.
- P. Marie.** A propos des foraminifères de Calcaire à Rudistes des Martigues (Var).—Ibidem, 1941, pp. 29-30.—In these six short notes Marie lists several index-foraminifera for different strata.
- P. Marie.** Sur la valeur stratigraphique du genre *Coleites* Plummer.—C. R. Soc. Géol. France, 1943, pp. 20-21.—Marie mentions three species of *Coleites* and discusses their stratigraphical value.
- P. Marie.** A propos de la présence du genre *Hantkenina* dans le Nummulithique du bassin de l'Adour.—Ibidem, 1943, pp. 10-11.—Marie discusses in this note the stratigraphical occurrence of five species of *Hantkenina*.
- P. Marie.** A propos de *Technitella thompsoni* Heron-Allen et Earland (Foraminifère).—Bull. du Muséum, Vol. 13, pp. 469-471, 1941.—The author describes specimens like those described by Heron-Allen and Earland from the North Sea, found by him in the Mediterranean. It seems certain that this species is no foraminifer but an *Holothuria* from a genus or species closely related to *Pseudocumis marioni* (v. Marenzeller).
- P. Marie.** A propos des Foraminifères d'un sable de plage provenant de Tahiti.—1940, Bull. du Muséum, 2e Série, Vol. 12, pp. 348-350.
- P. Marie.** A propos des foraminifères d'un sable de plage provenant de l'île de Maurice.—Ibidem, 1941, Vol. 13, pp. 309-313.—In these two papers Marie lists numerous recent foraminifera.
- P. Marie.** Sur le répartition actuelle de *Cyclammina cancellata* Brady.—C. R. des Séances de la Soc. de Biogéographie, Vol. 18, pp. 46-49, 1941.—Some new data about the distribution of *Cyclammina cancellata* in recent seas.
- P. Marie.** Sur la faune de foraminifères des dépôts littoraux actuels de la mer Rouge et de Djiboute.—Mém. de la Soc. Linn. de Normandie, N. S., Vol. 1, pp. 53-71, 1941.—The author gives a brief review of the microfauna of littoral deposits of the Red Sea and describes a microfauna very much like that of the Kerimba archipelago.
- P. Marie.** Les Foraminifères de la craie à *Belemnitella mucronata* du Bassin de Paris.—Mém. de Muséum Nat. d'Hist. Nat., N. S., Vol. 12, pt. 1, pp. 1-296, 37 pl., 1941.
- A. Bonte et P. Marie.** Nouvelles observations sur la structure du gisement de lignite du Grand Denis (Doubs).—C. R. Soc. Géol. de France, 1943, pp. 144-145.—Lists several foraminifera.
- Y. Gubler.** Les caractères bathymétriques du Flysch créacé supérieur au sud de

- Pau.—Ibidem, 1944, pp. 101-103.—The author mentions the stratigraphical distribution of some species of *Praevalveolina*.
- J. Burger et J. Schoeller. Sur une coupe de l'Eocène au flanc sud de l'anticlinal d'Audignon.—Ibidem, 1944, pp. 132-133.—Mentions several index-foraminifera.
- P. Schneegans. Evolution des facies du Flysch néocrétacé sous les Petites Pyrénées de la Haute-Garonne.—Ibidem, 1944, pp. 41-43.—Gives several lists with index-foraminifera.
- J. Burger et J. Schoeller. Sur l'existence du Lutétien au contact de l'accident triassique de Thétien (Landes).—Ibidem, 1944, pp. 44-45.—Mentions several species of *Camerina*.
- J. Cuvillier. Sur quelques foraminifères du Crétacé Supérieur des Landes.—Ibidem, 1943, pp. 208-210.—Lists several index-foraminifera, especially larger foraminifera.
- R. Barbier. L'âge du Flysch des Aiguilles d'Arves et du Grès d'Annot.—Ibidem, 1943, pp. 214-216.—Lists several species of *Camerina*.
- M. Leriche. Sur l'extension verticale d'*Orbitolites complanatus* Lmk. dans le Lutétien du Bassin de Paris.—Ibidem, 1943, pp. 169-170.—Describes the stratigraphical distribution of *O. complanatus*.
- R. Abrard. Sur la répartition stratigraphique d'*Orbitolites complanatus* Lmk.—Ibidem, 1943, pp. 178-179.—This note is a supplement to the note of Leriche.
- Y. Gubler. Remaniement d'une microfaune du Crétacé supérieur dans le Lutétien de Trésieurs (Aude).—Ibidem, 1943, pp. 96-98.—Lists several index-foraminifera.
- L. Morellet. Présence d'*Orbitolites complanatus* Lmk. dans le Lutétien inférieur de Grignon (Seine et Oise).—Ibidem, 1943, p. 157.—A short note on the distribution of *O. complanatus*.
- R. Abrard. Observation relative à une note de MM. L. et J. Morellet sur le Bartonien et à une note de M. G. Denizot sur l'Oligocène.—Ibidem, 1942, pp. 8-10.—Lists several species of *Camerina*.
- J. Bourcart, P. H. Fischer, et P. Marie. Sur un grès quaternaire à faune chaude recueilli sur la plage de La Baule.—Ibidem, 1942, pp. 10-12.—Marie lists several foraminifera, characteristic of warm water.
- R. Barbier, Y. Gubler, M. Lys, et V. Perebaskine. A propos des faunes de foraminifères du Crétacé supérieur en Aquitaine.—Ibidem, 1943, pp. 85-87.—Lists several index-foraminifera.
- R. Ciry et H. Tintant. Sur la présence d'une microfaune dans le pliocène marin de Millas (Pyr.-orientales).—Ibidem, 1945, pp. 165-167.—The authors give a brief review of a microfauna of 70 species from the Pliocene of southern France.
- J. Bourcart. Le Sénonien à Roscoff (Finistère).—Ibidem, 1945, pp. 195-197.—In this note the author mentions some index-foraminifera identified by P. Marie.

FORAMINIFERAL LITERATURE ISSUED IN GERMANY DURING THE WAR

- F. Bettenstaedt. Grundlagen und Erfahrungen bei mikrofaunistischen Untersuchungen an ausgeschlammten Spülproben aus Rotary-bohrungen im Tertiär und Kreide Nord-West-Deutschlands.—Oel und Kohle, Vol. 38, pp. 949-964, 1942.—In a relatively long paper the author gives a review of the methods of investigating samples from rotary-drillings in the Tertiary and Cretaceous of NW-Germany.

The results of his experiences are important for every micropaleontologist interested in economic work. At the end he compares his results with data obtained by core-drilling. He lists several index-foraminifera for Tertiary and Cretaceous deposits.

- F. Bettenstaedt and C. A. Wicher.** Der mikropaläontologischen Nachweis von marinen Valendis auf der Pompeckjschen Schwelle.—Oel und Kohle, Vol. 39, pp. 109-113, 1 text fig., 1943.—In this note the authors describe the microfaunal contents of the marine Valenginian (Lower Cretaceous). Several lists with Foraminifera are given.
- H. Hiltermann.** Stand und Aussichten der angewandten Mikropaläontologie in den Erdölfeldern West-Galiziens.—Oel und Kohle, Vol. 36, pp. 289-292, 6 text figs., 1940.—This short paper is more or less a preliminary report on the possibilities and achievements of the study of the foraminifera in Western-Galicia, after this region was occupied by the Germans in 1939. After giving a review of previous work here, which begins with Uhlig and ends with Grzybowski, the author figures 6 different faunulae in the form of photographs with descriptive text of these faunal associations. He lists several index-foraminifera for these deposits.
- H. Hiltermann.** Ein litorales Paläozän in Nord-Deutschland.—Zeitschr. Deutsche Geol. Ges., Vol. 93, pp. 259-269, 2 pl., 1941.—In two drilling-wells, about 12 km. from each other, in the neighbourhood of Hannover, the author found an alternation of continental sediments with spores etc. and of littoral sediments with a typically Paleocene microfauna. He lists numerous foraminifera and gives two photographs of the typical microfaunal association.
- H. Hiltermann.** Zur Stratigraphie und Mikrofossilführung der Mittelkarpathen.—Oel und Kohle, Vol. 39, pp. 745-755, 10 text figs., 1943.—In this stratigraphical paper, more or less a detailed report after the preliminary report of 1940, the author proves on the evidence of some 8000 samples that with the aid of the microfauna it is possible to make a reliable stratigraphy in the carpathian "flysch." The author lists numerous foraminifera and gives 6 photographs of the typical microfaunal associations. He proves that it is possible to compare these microfaunae with those of the caucasian and dalmatian "flysch". Hiltermann deals here with important microfaunae of agglutinated foraminifera.
- L. Riedel and C. A. Wicher.** Zur Grenze Jura-Kreide in NordWest-Deutschland.—Oel und Kohle, Vol. 38, pp. 1019-1021, 1 text fig., 1942.—Both authors give their point of view on the Jurassic-Cretaceous contact in NW-Germany; Wicher on the microfauna (Foraminifera for brackish Valenginian and Ostracoda for the Wealden); and Riedel on the lithology and macrofauna.
- K. A. Schuette.** Die Kosten von Erdöl-Tiefbohrungen in den Vereinigten Staaten von Amerika.—Oel und Kohle, Vol. 36, pp. 159-162, 1940.—Mentions micropaleontological problems. (Non vidi).
- K. Staesche and H. Hiltermann.** Microfaunen aus dem Tertiär Nord-West-Deutschlands.—Abh. der Reichsst. für Bodenforschung, N. F., No. 201, 1940, pp. 1-26, 53 pl.—This work contains a series of excellent photographs of microfaunal associations from the German Tertiary with some plates with the most important index-foraminifera. For superficial comparison these plates are very valuable, though the determinations are not exact and the accompanying text

much too short. Especially for fast stratigraphical work in the NW-European Tertiary these association-photographs are useful.

- W. Taubert.** Foraminiferen-Statistik zur Gliederung des turonen Plänermergels von Dresden.—*Neues Jahrb. f. Min. Geol. und Pal.*, Beil Band, Abt. B., Vol. 86, p. 99, text fig., 1941.—In this article Taubert lists several characteristic species of the Turonian marls near Dresden and gives statistic diagrams of the investigated sections in several quarries near Dresden. At the end the author gives a stratigraphic interpretation of these diagrams.
- C. A. Wicher.** Eine bewährte Auslesevorrichtung für Mikrofossilien.—*Oel und Kohle*, Vol. 36, p. 211, 3 text figs., 1940.—Wicher gives here some photographs of a very useful apparatus for sorting microfossils.
- C. A. Wicher.** Zur Stratigraphie der Grenzschichten Jura-Kreide Nord-West-Deutschlands.—*Oel und Kohle*, Vol. 36, pp. 263-269, 3 pl., 3 text figs., 1940.—It has always been difficult to make a good stratigraphic division of the NW-European Wealden. Wicher gives here a stratigraphic division of these sediments. With the exception of the brackish sediments at the top, which show a typical *Ammobaculites*, all lower parts of the Wealden are characterized by fresh-water Ostracoda and show no Foraminifera.
- C. A. Wicher.** Praktikum der angewandten Mikropaläontologie.—Verlag Gebr. Bornträger, Berlin-Zehlendorff, pp. 1-143, 15 text figs., 28 pls., 1942.—In this book the author gives a detailed review of the most practicable methods of micropaleontological investigation. In the first chapters Wicher discusses the general methods and principles of sampling, washing, and sorting. He gives much attention to a simple, practicable and fast method for disintegrating hard samples by crystallization of sodium-sulfate. He gives many a recommendable hint for exact stratigraphical work with microfauna and microflora. To illustrate some of the results of applied micropaleontology he gives 28 plates with 50 photographs of microfaunal associations of the different horizons of the German Mesozoic with a short accompanying text. As a symposium of the best known and most practicable methods of investigation in applied micropaleontology, this work has doubtless much value, as it is an excellent supplement on the methods described in short in the well known "Foraminifera, their Classification and Economic Use" by J. A. Cushman.
- C. A. Wicher.** Neues aus der angewandten Mikropaläontologie.—*Oel und Kohle*, Vol. 39, pp. 441-442, 1943.—In this short paper Wicher lists some foraminifera from the Valenginian, Maestrichtien, and Danien from a stratigraphical point of view.
- C. A. Wicher and K. Hoffmann.** Der grobe Aufbereitungsrückstand ein wertvolles Bindeglied auf dem Wege zur Biostratigraphie.—*Oel und Kohle*, Vol. 38, pp. 821-824, 4 pls., 1942.—In this paper Wicher and Hoffmann point to the necessity of investigating, together with the typical microfossils such as Foraminifera, Ostracoda, and Diatoms, the very small Ammonites, Gastropoda, or Pelecypoda. On some plates they figure some of the most important microscopic macrofaunal elements like Ammonites and Gastropoda.

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