# CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

## 262. FORAMINIFERA OF THE LOWER PART OF THE MOOREVILLE CHALK OF THE SELMA GROUP OF MISSISSIPPI*

By Joseph A. Cushman

Comparatively little has been published on the foraminifera of Mississippi. At the present time, research in this and adjoining states makes it seem that recording of the species from the Mooreville chalk would be of value. The fauna of the lower part of the Mooreville chalk is, as will be noted, related to that of the Austin chalk of Texas. Two localities are used and referred to as follows: locality 1: Selma group, lower part. Lower part of Mooreville chalk. Bank of branch south of Fulton road, ½ mile east of Mooreville, Lee Co., Miss. Coll. by L. W. Stephenson. U.S.G.S. 9521; and locality 2: Selma group, lower part. Lower part of Mooreville chalk, just above Tombigee sand member of the Eutaw formation. Probably upper Austin age. Exposure in east-facing slope of Mantachie Creek valley, Mantachie road, 5 miles northeast of Mooreville, Itawamba Co., Miss. Coll. by L. W. Stephenson. U.S.G.S. 9518. The faunas of the two localities, while in general the same, differ in the occurrence of some of the rarer species. This may be due partly to ecologic conditions and partly to slight differences in the position in the section.

To save space, references to synonymy are made to previous numbers of these Contributions.

### Family REOPHACIDAE

#### Genus REOPHAX Montfort, 1808

**REOPHAX CLAVULINUS (Reuss)** (Pl. 13, fig. 1)

*Haplostiche clavulina* Reuss, in Geinitz, Palaeontographica, vol. 20, pt. 2, 1872-75 (1874), p. 121, pl. 24, figs. 7, 8.—Perner, Sitz. k. böhm. Ges. Wiss. Prag, 1893, p. 38.—Matouschek, Lotos, vol. 43, 1895, p. 126.—Franke, Abhandl. Preuss. geol. Landes., n. ser., vol. 111, 1928, p. 20, pl. 2, fig. 4.—Schnetzer, Centralbl. Min., Jahrg. 1934, Abt. B, p. 88, text fig. 4.

Test elongate, slightly tapering, increasing in width gradually toward the apertural end; chambers numerous, short, usually broader than high; sutures slightly depressed; wall arenaceous, usually somewhat roughly finished; aperture terminal, rounded, sometimes with a trace of a slight neck. Length up to 2.00 mm.; breadth 0.40 mm.

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This species was originally described from the Upper Cretaceous of Saxony, and was recorded by Perner and Matouschek from the Cretaceous of Bohemia, and by Franke from the Upper Cretaceous of Germany. Specimens similar to those from Europe are found in the Annona chalk of Texas and the basal Selma chalk of Alabama and Mississippi. It is rare at locality 1.

## Family TEXTULARIIDAE

### Genus SPIROPLECTAMMINA Cushman, 1927

**SPIROPLECTAMMINA LAEVIS (Roemer), var. CRETOSA Cushman**

(For references and figures, see these Contributions, vol. 20, 1944, p. 2, pl. 1, fig. 4, and Journ. Pal., vol. 18, 1944, p. 329, pl. 50, fig. 6.)

This is a widely distributed form in beds of Taylor age but rare in the Austin. It is rare at locality 2.

## Family VERNEUILINIDAE

### Genus GAUDRYINA d'Orbigny, 1839

**GAUDRYINA RUDITA Sandidge**

(For references and figures, see Journ. Pal., vol. 18, 1944, p. 329, pl. 50, figs. 9, 10.)

This species is largely one of Navarro age, much less common in beds of Taylor age, and very rare in the Austin. It is rare at locality 1.

**GAUDRYINA (SIPHOGAUDRYINA) AUSTINANA Cushman** (Pl. 13, fig. 2)

(For references, see these Contributions, vol. 18, 1942, p. 53.)

Although there are a few occurrences in the lower part of the Taylor marl, most of them are in beds of Austin age. It occurs rarely at locality 1.

**GAUDRYINA (SIPHOGAUDRYINA) ELLISORAE Cushman** (Pl. 13, fig. 3)

*Gaudryina (Siphogaudryina) ellisorae* CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 13, pl. 2, fig. 12; Special Publ. No. 7, 1937, p. 87, pl. 12, figs. 15, 16.

The range of this species is from the upper beds of Austin age to lower beds of Taylor age. The species is present in considerable numbers at both localities.

### Genus PSEUDOCLAVULINA Cushman, 1936

**PSEUDOCLAVULINA CLAVATA (Cushman)** (Pl. 13, fig. 6)

(For references, see Journ. Pal., vol. 18, 1944, p. 330, pl. 50, figs. 15-17.)

This is a widely distributed species in beds of Austin, Taylor, and Navarro age. Numerous specimens occur at locality 1.

### Genus PSEUDOGAUDRYINELLA Cushman, 1936

**PSEUDOGAUDRYINELLA CAPITOSA (Cushman)** (Pl. 13, fig. 4)

(For references, see these Contributions, vol. 18, 1942, p. 54.)

Most of the occurrences of this species are in beds of Taylor age, but it occurs in some numbers in our material from locality 1, showing that it apparently originated in the upper part of the Austin. The uniserial chambers in Austin specimens are not as highly developed as in specimens of Taylor age.

## Family VALVULINIDAE

### Genus DOROTHIA Plummer, 1931

**DOROTHIA ALEXANDERI Cushman** (Pl. 13, fig. 5)

*Dorothia alexanderi* CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 28, pl. 4, fig. 13; Special Publ. No. 7, 1937, p. 82, pl. 8, fig. 37.

This is a characteristic species of beds of Austin age, especially the upper part, and there is a single occurrence in the basal Taylor. It occurs only at locality 2 but specimens are fairly numerous.

## Family LAGENIDAE

### Genus ROBULUS Montfort, 1808

**ROBULUS MÜNSTERI (Roemer)** (Pl. 13, fig. 7)

(For references, see these Contributions, vol. 18, 1942, p. 56.)

The American range of this species includes the Austin and Taylor. It is, like many species of this genus, subject to considerable variation. Specimens occur at both our localities but are not common. Similar specimens have recently been recorded from the Marlbrook marl of Arkansas. (Journ. Pal., vol. 18, 1944, p. 331, pl. 50, fig. 28).

**ROBULUS PSEUDO-SECANS Cushman**

(For references and figure, see these Contributions, vol. 17, 1941, p. 59, pl. 15, fig. 7.)

The only other known occurrences of this species are in the Neylandville marl of the Navarro group and in the middle part of the Selma chalk of Taylor age at the type locality in Tennessee. Rare and young specimens occur at locality 2.

### Genus LENTICULINA Lamarck, 1804

**LENTICULINA cf. ROTULATA Lamarck**

A single specimen questionably referable to this species was found at locality 2.

### Genus MARGINULINA d'Orbigny, 1826

**MARGINULINA AUSTINANA Cushman, var. ACESCENS Cushman** (Pl. 13, fig. 9)

*Marginulina austinana* CUSHMAN, var. *acescens* CUSHMAN, Contr. Cushman Lab. Foram Res., vol. 13, 1937, p. 93, pl. 13, fig. 9.

This variety was described from the lower part of the Gober tongue of the Austin chalk of Texas. There have been no other records for it. It is interesting, therefore, to find it in the Mooreville chalk of the Selma group at locality 2.

**MARGINULINA TEXASENSIS Cushman** (Pl. 13, fig. 8)

*Marginulina texasensis* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 95.—FRIZZELL, Journ. Pal., vol. 17, 1943, p. 342, pl. 56, fig. 4.—CUSHMAN and DEADERICK, l. c., vol. 18, 1944, p. 332, pl. 51, figs. 6, 7.

*Marginulina texana* CUSHMAN (not GARRETT and ELLIS), Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 95, pl. 14, figs. 1-4.

The types are from the Pecan Gap chalk member of the Taylor marl and the species is found mostly in beds of Taylor age with a few records from lower beds of Navarro age. It occurs in the Marlbrook marl of Arkansas and in the Mal Paso shale (Upper Cretaceous) of Peru. Similar specimens occur in the Cretaceous of Trinidad. It is very rare at locality 2.

## Genus DENTALINA d'Orbigny, 1826

**DENTALINA ALTERNATA (Jones)**

(For references and figure, see Journ. Pal., vol. 18, 1944, p. 332, pl. 51, fig. 11.)

Specimens of this widely ranging species occur at locality 2. It is known from beds of Navarro, Taylor, and Austin age.

**DENTALINA LORNEIANA d'Orbigny** (Pl. 13, fig. 11)

(For references, see these Contributions, vol. 16, 1940, p. 77.)

This species ranges from beds of Austin age upward into lower beds of Navarro age. It occurs in considerable numbers at both localities. It has recently been figured from the Pecan Gap chalk member of the Taylor marl (These Contributions, vol. 20, 1944, p. 6, pl. 1, fig. 24).

**DENTALINA LEGUMEN Reuss** (Pl. 13, fig. 14)

(For references, see these Contributions, vol. 16, 1940, p. 77.)

This species was described from the Cretaceous of Lemberg and has a wide range, both in Europe and America. Its range includes beds of Austin, Taylor, and Navarro age. It occurs commonly at both localities. It has recently been figured from the Corsicana marl (These Contributions, vol. 19, 1943, p. 57, pl. 10, fig. 5).

**DENTALINA GRACILIS d'Orbigny** (Pl. 13, fig. 12)

*Dentalina gracilis* D'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 14, pl. 1, fig. 5.—FRANKE, Abhandl. Preuss. geol. Landes., n. ser., vol. 111, 1928, p. 29, pl. 2, fig. 22.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 77, pl. 13, figs. 9-11.—CUSHMAN and DEADERICK, l. c., vol. 18, 1942, p. 57, pl. 11, fig. 4.—CUSHMAN and TODD, l. c., vol. 19, 1943, p. 57, pl. 10, fig. 6.—CUSHMAN, l. c., vol. 20, 1944, p. 6, pl. 1, fig. 28.

This is a very variable and wide ranging form, occurring in beds of Austin, Taylor, and Navarro age. It occurs at both our localities.

## Genus NODOSARIA Lamarck, 1812

**NODOSARIA AFFINIS Reuss** (Pl. 13, fig. 18)

(For references, see Journ. Pal., vol. 18, 1944, p. 333.)

This is one of the largest and most common species of the Cretaceous, ranging throughout the Upper Cretaceous, except for the portion of Eagle Ford age. It occurs particularly at locality 1. Additional records to the above are to be found in these Contributions, vol. 19, 1943, p. 57, pl. 10, fig. 11 and vol. 20, 1944, p. 7, pl. 2, fig. 1.

**NODOSARIA DISTANS Reuss** (Pl. 13, figs. 19-21)

*Nodosaria distans* REUSS, Zeitschr. deutsch. geol. Ges., vol. 7, 1855, p. 264, pl. 8, fig. 5.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 87, pl. 15, figs. 24, 25.—FRIZZELL, Journ. Pal., vol. 17, 1943, p. 345, pl. 56, fig. 14.

Specimens referable to this species occur at both localities. It was described from the Upper Cretaceous of Germany and apparently occurs in beds of upper Austin and lower Taylor age. A questionable specimen was figured from the Mal Paso shale of Peru.

**NODOSARIA OBSCURA Reuss** (Pl. 13, figs. 16, 17)

(For references, see Journ. Pal., vol. 18, 1944, p. 334 and these Contributions, vol. 20, 1944, p. 7.)

This species has previously not been recorded from beds of Austin age, although it is common in beds of Taylor and lower Navarro age. It occurs abundantly in both our localities. It has also been recorded from the Lower Cretaceous.

**NODOSARIA FUSULA Reuss** (Pl. 13, fig. 15)

(For references, see these Contributions, vol. 16, 1940, p. 88.)

Typical specimens occur at both localities, but less commonly than the preceding species. It occurs in the American Cretaceous in beds of Austin age and of lower Taylor age. It is quite different from *N. obscura* in the apertural characters, in the shape of chambers, and in the ornamentation.

**NODOSARIA ALTERNISTRIATA Morrow**

*Nodosaria alternistriata* MORROW, Journ. Pal., vol. 8, 1934, p. 190, pl. 29, fig. 1.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 88, pl. 15, figs. 26, 27.

This species is very close to the preceding but differs in the less tapering apertural end of the chamber and less depressed sutures. The costae are also more developed but not nearly as plate-like as in *N. obscura*. The types are from the basal Niobrara chalk (Cretaceous) of Kansas. The specimens from locality 1 appear to give the only other record for this species.

## Genus PSEUDOGLANDULINA Cushman, 1929

**PSEUDOGLANDULINA COSTULATA Cushman, n. sp.** (Pl. 13, fig. 10)

Test small, about twice as long as broad, fusiform, initial end pointed, circular in transverse section; chambers uniserial, seven or eight in number, increasing rapidly in size as added, the final one forming nearly two-thirds of the surface of the entire test; sutures distinct, but not depressed; wall smooth in the early portion, but the adult chambers with several low, longitudinal costae; aperture terminal, radiate. Length 0.35-0.38 mm.; diameter 0.15-0.18 mm.

Holotype (Cushman Coll. No. 42458) from the lower part of the Mooreville chalk of the Selma group (Upper Cretaceous), on the east-facing slope of Mantachie Creek valley, Mantachie road, 5 miles NE of Mooreville, Itawamba Co., Miss.

The species is rather rare but those obtained were all of the same character. The species differs from *P. pygmaea* (Reuss) in the few and low costae confined largely to the final chamber and in the more fusiform shape.

## Genus VAGINULINA d'Orbigny, 1826

**VAGINULINA MULTICOSTATA Cushman** (Pl. 13, fig. 13)

*Vaginulina multicostata* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 28, pl. 4, fig. 4.—ALBRITTON and PHLEGER, Journ. Pal., vol. 11, 1937, p. 351.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 58, pl. 10, fig. 19.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 334, pl. 52, fig. 3.

*Vaginulina simondsi* CUSHMAN (part) (not CARSEY), Tenn. Div. Geol., Bull. 41, 1931, p. 33, pl. 4, fig. 7 (not fig. 8); Journ. Pal., vol. 5, 1931, p. 306, pl. 35, fig. 7.

This is a common species in beds of Navarro age and less so in those of Taylor age. Very typical specimens occur at locality 2 but are not common.

**VAGINULINA TEXANA Cushman**

(For references and figures, see these Contributions, vol. 18, 1942, p. 59, pl. 12, figs. 1-6.)

Broken specimens belonging to this species occur at locality 2. The species is an excellent index fossil for beds of Austin age.

## Genus FRONDICULARIA Defrance, 1826

**FRONDICULARIA LINEARIS Franke** (Pl. 13, fig. 22)

*Frondicularia linearis* FRANKE, Abhandl. Preuss. geol. Landes., n. ser., vol. 111, 1928, p. 72, pl. 6, figs. 17, 18.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 21, pl. 4, figs. 19, 20; vol. 20, 1944, p. 8, pl. 2, fig. 7.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 335, pl. 52, figs. 8, 9.

The types of this species are from the Cretaceous of Germany. Specimens occur in the American Cretaceous in beds of Taylor age and upper beds of Austin age. Specimens occur at both of our localities.

**FRONDICULARIA UNDULOSA Cushman**

(For references and figures, see these Contributions, vol. 18, 1942, p. 60, pl. 13, figs. 2, 3.)

Broken specimens occur at locality 2. The species is found mostly in beds of Austin age and less commonly in lower beds of Taylor age.

### Genus KYPHOPYXA Cushman, 1929

**KYPHOPYXA CHRISTNERI (Carsey)** (Pl. 13, figs. 23, 24)

(For references, see these Contributions, vol. 18, 1942, p. 62.)

This common American species of Taylor and Austin age occurs at both localities.

### Genus LAGENA Walker and Jacob, 1798

**LAGENA cf. VULGARIS Williamson** (Pl. 13, fig. 26)

Numerous specimens with a globular or oval body and long slender neck may be referred to this species. They occur at both localities.

**LAGENA cf. ACUTICOSTA Reuss** (Pl. 13, fig. 25)

Numerous specimens of a highly costate form occur at locality 2 and may be referred to Reuss' species. Such forms have a wide range in beds of Austin, Taylor, and Navarro age.

**LAGENA HISPIDA Reuss** (Pl. 13, fig. 27)

Specimens from both localities have the general appearance of this species to which many forms of different characters have been referred.

## Family POLYMORPHINIDAE

### Genus GLOBULINA d'Orbigny, 1839

**GLOBULINA LACRIMA Reuss** (Pl. 13, fig. 28)

(For references, see these Contributions, vol. 19, 1943, p. 61, pl. 11, fig. 3.)—FRIZZELL, Journ. Pal., vol. 17, 1943, p. 348, pl. 56, fig. 27.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 9, pl. 2, fig. 15.

This species is more common in beds of Navarro and Taylor age than in the Austin. Specimens occur at both localities.

**GLOBULINA LACRIMA Reuss, var. HORRIDA Reuss** (Pl. 13, figs. 29, 30)

(For references, see these Contributions, vol. 19, 1943, p. 62.)

A few specimens occur at locality 2. Its range is similar to the typical form of the species.

### Genus RAMULINA Rupert Jones, 1875

**RAMULINA cf. ACULEATA (d'Orbigny)** (Pl. 13, figs. 33, 34)

A few broken specimens similar to those usually assigned to this species occur at both localities.

## Family HETEROHELICIDAE

### Genus BOLIVINOPSIS Yakovlev, 1891

**BOLIVINOPSIS ROSULA (Ehrenberg)**

(For references and figures, see Journ. Pal., vol. 18, 1944, p. 336, pl. 53, fig. 1.)—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 64, pl. 11, fig. 10.—CUSHMAN, l. c., vol. 20, 1944, p. 10, pl. 2, fig. 17.

This is a common species in the American Cretaceous, occurring in beds of Austin, Taylor, and Navarro age. Typical specimens occur at both localities but, as usual, are mostly broken as the test is a very delicate one.

### Genus GUMBELINA Egger, 1899

**GÜMBELINA MOREMANI Cushman** (Pl. 14, fig. 1)

*Gümbelina moremani* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 10, pl. 2, figs. 1-3.

This species is largely confined to that portion of the American Cretaceous of Eagle Ford age, but it does occur rarely in beds of Austin age. Typical specimens are fairly common at locality 1.

**GÜMBELINA REUSSI Cushman** (Pl. 14, fig. 2)

*Gümbelina reussi* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 11, pl. 2, figs. 6-9.—CUSHMAN and DEADERICK, l. c., vol. 18, 1942, p. 63, pl. 15, figs. 5-7.

*Textularia globulosa* REUSS (not EHRENBERG), Verstein. böhm. Kreide., pt. 1, 1845, p. 39, pl. 12, fig. 23 (?).

The range of this species is through beds of Austin age and beds of lower Taylor age. It occurs commonly at locality 2.

**GÜMBELINA PLUMMERAE Loetterle** (Pl. 14, fig. 3)

*Gümbelina plummerae* LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 33, pl. 5, figs. 1, 2.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938,

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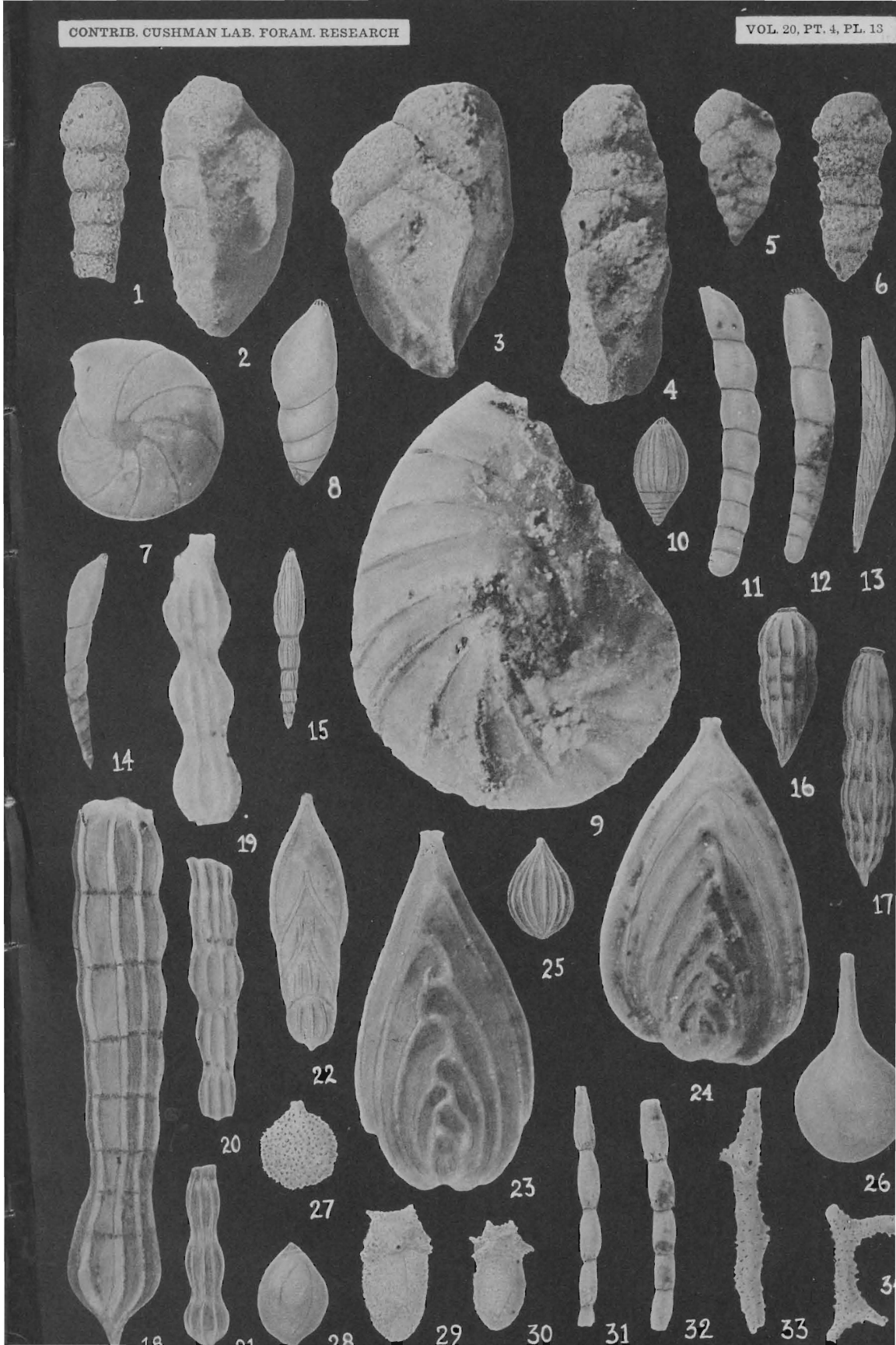
## EXPLANATION OF PLATE 13

FIG. 1. *Reophax clavulinus* (Reuss). Loc. 1. × 30. 2. *Gaudryina (Siphogaudryina) austinana* Cushman. Loc. 1. × 38. 3. *G. (S.) ellisorae* Cushman. Loc. 2. × 38. 4. *Pseudogaudryinella capitosa* (Cushman). Loc. 2. × 38. 5. *Dorothia alexanderi* Cushman. Loc. 2. × 50. 6. *Pseudoclavulina clavata* (Cushman). Loc. 1. × 50. 7. *Robulus münsteri* (Roemer). Loc. 1. × 38. 8. *Marginulina texasensis* Cushman. Loc. 2. × 75. 9. *M. austinana* Cushman, var. *acescens* Cushman. Loc. 2. × 38. 10. *Pseudoglandulina costulata* Cushman, n. sp. Holotype. Loc. 2. × 75. 11. *Dentalina lorneiana* d'Orbigny. Loc. 1. × 50. 12. *D. gracilis* d'Orbigny. Loc. 2. × 50. 13. *Vaginulina multicostata* Cushman. Loc. 2. × 50. 14. *Dentalina legumen* Reuss. Loc. 2. × 50. 15. *Nodosaria fusula* Reuss. Loc. 2. × 50. 16, 17. *N. obscura* Reuss. Loc. 1. × 50. 18. *N. affinis* Reuss. Loc. 1. × 38. 19-21. *N. distans* Reuss. Loc. 2. × 50. 22. *Frondicularia linearis* Franke. Loc. 1. × 50. 23, 24. *Kyphopyxa christneri* (Carsey). Loc. 1. × 50. 25. *Lagena* cf. *acuticosta* Reuss. Loc. 2. × 75. 26. *L.* cf. *vulgaris* Williamson. Loc. 1. × 75. 27. *L. hispida* Reuss. Loc. 2. × 75. 28. *Globulina lacrima* Reuss. Loc. 2. × 50. 29, 30. *G. lacrima* Reuss, var. *horrida* Reuss. Loc. 2. × 50. 31, 32. *Ellipsonodosaria stephensoni* Cushman. Loc. 1. × 50. 33, 34. *Ramulina* cf. *aculeata* (d'Orbigny). Loc. 1. × 50.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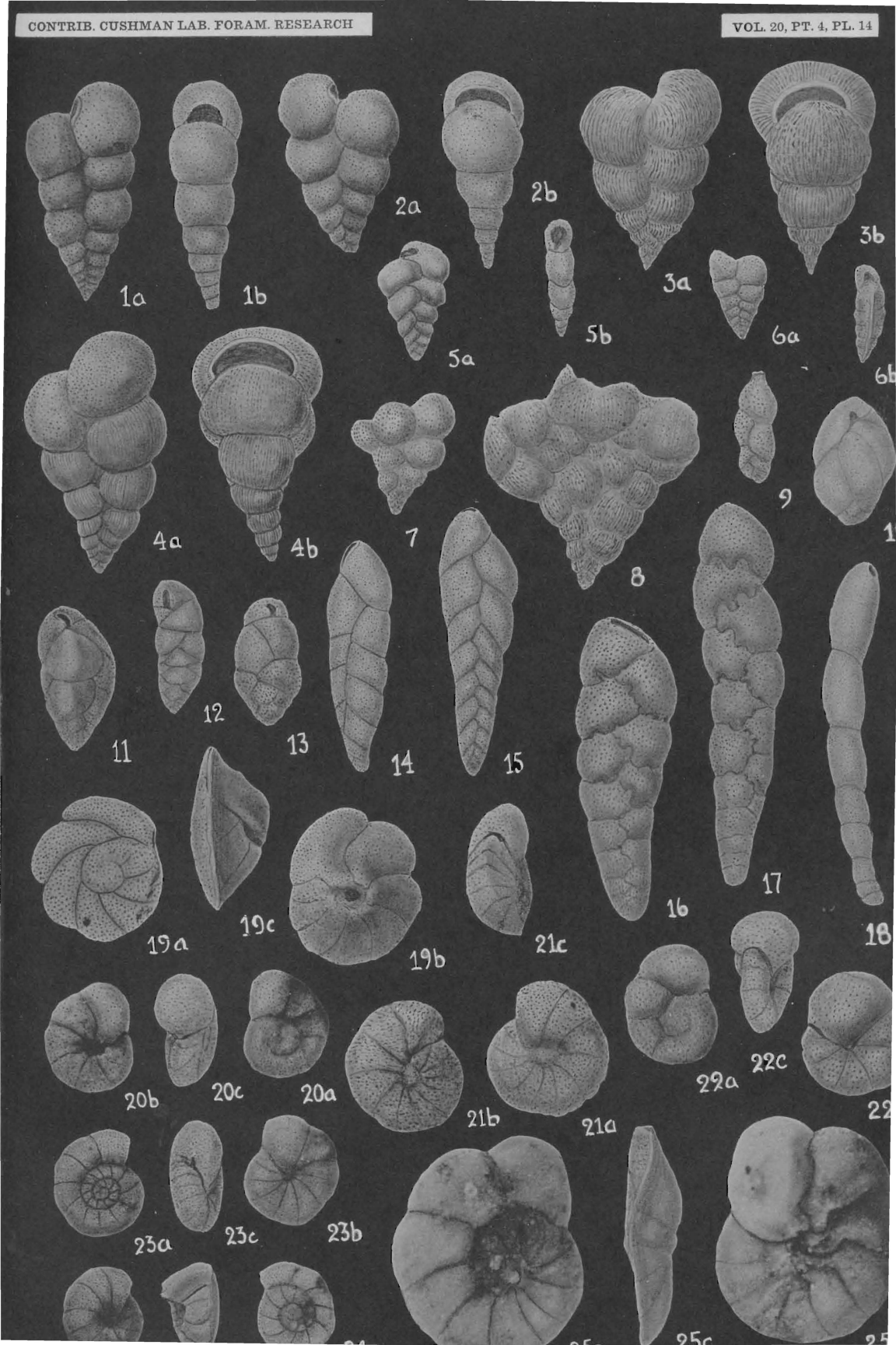
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p. 15, pl. 3, figs. 3-5.—Cole, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 34 (list), pl. 3, fig. 9.—Cushman and Deaderick, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 62, pl. 15, figs. 2-4.—Cushman, l. c., vol. 20, 1944, p. 10, pl. 2, fig. 18.

*Textularia globulosa* Carsey (not Ehrenberg), Univ. Texas Bull. 2612, 1926, p. 25, pl. 5, fig. 2.

This species was described from the Niobrara chalk (Cretaceous) of Kansas and Nebraska. Most of the occurrences are in beds of Austin and Taylor age but a few specimens from beds of lower Navarro age seem identical. It occurs commonly at both localities.

**GÜMBELINA STRIATA (Ehrenberg)** (Pl. 14, fig. 4)

(For references, see these Contributions, vol. 18, 1942, p. 63.)—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 64, pl. 11, fig. 11.—Cushman, l. c., vol. 20, 1944, p. 10, pl. 2, fig. 19.

This species was described from the Upper Cretaceous of Europe. In America it occurs in beds of Austin, Taylor, and lower Navarro age. It is common at both localities.

**GÜMBELINA PSEUDOTESSERA Cushman** (Pl. 14, fig. 5)

*Gümbelina pseudotessera* Cushman, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 14, pl. 2, figs. 19-21; vol. 20, 1944, p. 10.

*Gümbelina tessera* Cushman (not *Grammostomum tessera* Ehrenberg), Journ. Pal., vol. 6, 1932, p. 338, pl. 51, figs. 4, 5.—Loetterle, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 34, pl. 5, fig. 4.—Voorwijk, Proc. Roy. Acad. Amsterdam, vol. 40, No. 2, 1937, p. 7, pl 1, figs. 3, 4.

This species ranges through beds of Austin and Taylor age and has been recorded from the Cretaceous of Nebraska and Cuba. It is much less common than the preceding species, but occurs at both localities.

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## EXPLANATION OF PLATE 14

Fig. 1. *Gümbelina moremani* Cushman. Loc. 1. *a,* front view; *b,* side view. × 75. 2. *G. reussi* Cushman. Loc. 2. *a,* front view; *b,* side view. × 75. 3. *G. plummerae* Loetterle. Loc. 2. *a,* front view; *b,* side view. × 75. 4. *G. striata* (Ehrenberg). Loc. 1. *a,* front view; *b,* side view. × 75. 5. *G. pseudotessera* Cushman. Loc. 1. *a,* front view; *b,* side view. × 75. 6. *G. carinata* Cushman. Loc. 2. *a,* front view; *b,* side view. × 75. 7. *Ventilabrella austinana* Cushman. Loc. 2. × 75. 8. *V. eggeri* Cushman. Loc. 2. × 75. 9. *Eouvigerina austinana* Cushman. Loc. 2. × 90. 10. *Buliminella carseyae* Plummer. Loc. 2. × 90. 11. *Bulimina triangularis* Cushman and Parker. Loc. 1. × 90. 12, 13. *Neobulimina canadensis* Cushman and Wickenden. Loc. 2. × 90. 14. *Virgulina tegulata* Reuss. Loc. 2. × 90. 15. *Loxostomum plaitum* (Carsey). Loc. 1. × 90. 16. *L. clavatum* (Cushman). Loc. 2. × 75. 17. *L. cushmani* Wickenden. Loc. 2. × 75. 18. *Nodosarella texana* Cushman. Loc. 2. × 75. 19. *Globorotalia umbilicata* Loetterle. Loc. 2. × 75. 20. *Valvulineria plummerae* Loetterle. Loc. 2. × 50. 21. *Cibicides subcarinatus* Cushman and Deaderick. Loc. 2. × 50. 22. *Valvulineria infrequens* Morrow. Loc. 2. × 50. 23. *Gyroidina depressa* (Alth). Loc. 1. × 50. 24. *G. girardana* (Reuss). Loc. 2. × 50. 25. *Planulina texana* Cushman. Loc. 1. × 50.

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

**GÜMBELINA CARINATA Cushman** (Pl. 14, fig. 6)

*Gümbelina carinata* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 18, pl. 3, fig. 10.

Previous records indicate that this species is most common in the lower beds of Taylor age. It has not been found previously in beds of Austin age. It is very rare at locality 2.

## Genus VENTILABRELLA Cushman, 1928

**VENTILABRELLA AUSTINANA Cushman** (Pl. 14, fig. 7)

*Ventilabrella austinana* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 26, pl. 4, fig. 19.

*Ventilabrella eggeri* CARMAN (not CUSHMAN), Journ. Pal., vol. 3, 1929, p. 314, pl. 34, fig. 7.—LOETTERLE, Nebraska Geol. Survey, 2d. ser., Bull. 12, 1937, p. 35, pl. 5, fig. 5.

This species is largely restricted to beds of Austin age but occurs rarely in the Eagle Ford shale and in lower beds of Taylor age. It occurs also in the Niobrara chalk of Nebraska and Kansas. A few specimens occur at locality 2.

**VENTILABRELLA EGGERI Cushman** (Pl. 14, fig. 8)

*Ventilabrella eggeri* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 2, pl. 1, figs. 10-12; Special Publ. No. 5, 1933, pl. 26, figs. 14, 15; Contr., vol. 14, 1938, p. 25, pl. 4, figs. 12-14.

*Gümbelina acervulinoides* EGGER (part), Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 36, pl. 14, fig. 20.

This species is most common in lower beds of Taylor age, but is also well distributed in the Austin. It occurs at both localities.

## Genus EOUVIGERINA Cushman, 1926

**EOUVIGERINA cf. AMERICANA Cushman**

Two specimens were found from locality 2 which seem to be nearer to *E. americana* than to *E. aculeata.*

**EOUVIGERINA AUSTINANA Cushman** (Pl. 14, fig. 9)

*Eouvigerina austinana* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 61, pl. 7, fig. 5.

A single specimen from locality 2 evidently belongs to this species. Most of the occurrences are from beds of Austin age, but a few are from the lower part of the Taylor.

## Genus PSEUDOUVIGERINA Cushman, 1927

**PSEUDOUVIGERINA PLUMMERAE Cushman**

(For references, see Journ. Pal., vol. 18, 1944, p. 337.)—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 12.

This species is most abundant in beds of Taylor age but it extends

upward into lower beds of Navarro age and downward into upper beds of Austin age. It is very rare at locality 2.

## Family BULIMINIDAE

### Genus BULIMINELLA Cushman, 1911

**BULIMINELLA CARSEYAE Plummer** (Pl. 14, fig. 10)

(For references, see these Contributions, vol. 20, 1944, p. 12.)

This species is common at both localities. It ranges from beds of Austin age to those of lower Navarro age.

### Genus BULIMINA d'Orbigny, 1826

**BULIMINA TRIANGULARIS Cushman and Parker** (Pl. 14, fig. 11)

*Bulimina triangularis* CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 97, pl. 15, fig. 6.—COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 4, fig. 1.

Previous occurrences are in beds of Taylor and Navarro age. Cole has recorded it from the Selma chalk in well samples from Florida. It occurs at both of the Mooreville chalk localities.

### Genus NEOBULIMINA Cushman and Wickenden, 1928

**NEOBULIMINA CANADENSIS Cushman and Wickenden** (Pl. 14, figs. 12, 13)

(For references, see Journ. Pal., vol. 18, 1944, p. 337.)—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 66.—FRIZZELL, Journ. Pal., vol. 17, 1943, p. 350, pl. 57, fig 3.

Specimens are fairly common at locality 2. The species ranges throughout the Upper Cretaceous.

### Genus VIRGULINA d'Orbigny, 1826

**VIRGULINA TEGULATA Reuss** (Pl. 14, fig. 14)

*Virgulina tegulata* REUSS, Verstein. böhm. Kreide., pt. 1, 1845, p. 40, pl. 13, fig. 81.—CUSHMAN, Special Publ. No. 9, Cushman Lab. Foram. Res., 1937, p. 4, pl. 1, figs. 8-12; Contr., vol. 20, 1944, p. 12, pl. 2, fig. 26.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 338, pl. 53, fig. 11.

This species, described from the Turonian (Cretaceous) of Europe, ranges in the American Upper Cretaceous from the Eagle Ford, through the Austin and Taylor into the lower beds of Navarro age. It occurs only at locality 2.

### Genus LOXOSTOMUM Ehrenberg, 1854

**LOXOSTOMUM PLAITUM (Carsey)** (Pl. 14, fig. 15)

(For references, see these Contributions, vol. 17, 1941, p. 95.)—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 67, pl. 11, fig. 26.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 338, pl. 53, fig. 13.

This species is widely distributed in beds of Navarro and Taylor age. It occurs at locality 1.

**LOXOSTOMUM CUSHMANI Wickenden** (Pl. 14, fig. 17)

(For references, see these Contributions, vol. 18, 1942, p. 63.)—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 12, pl. 2, fig. 28.

This species is found in beds of Taylor age but more commonly in those of Austin age. The types are from the Boyne beds of Manitoba, Canada. Specimens are common at locality 2.

**LOXOSTOMUM CLAVATUM (Cushman)** (Pl. 14, fig. 16)

*Loxostomum clavatum* CUSHMAN, Journ. Pal., vol. 6, 1932, p. 340, pl. 51, fig. 8; Special Publ. No. 9, Cushman Lab. Foram. Res., 1937, p. 171, pl. 20, figs. 6-8.

This species ranges through beds of Austin and Taylor age into those of lower Navarro. It occurs at locality 2.

## Family ELLIPSOIDINIDAE

### Genus NODOSARELLA Rzehak, 1895

**NODOSARELLA TEXANA Cushman** (Pl. 14, fig. 18)

*Nodosarella texana* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 46, pl. 8, fig. 1.

Most of the occurrences of this species are from beds of Austin age with a very few from beds of lower Taylor age. It occurs at locality 2.

### Genus ELLIPSONODOSARIA A. Silvestri, 1900

**ELLIPSONODOSARIA STEPHENSONI Cushman** (Pl. 13, figs. 31, 32)

*Ellipsonodosaria stephensoni* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 52, pl. 9, figs. 10-15.—CUSHMAN and TODD, l. c., vol. 19, 1943, p. 67, pl. 11, fig. 28.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 338, pl. 53, figs. 14-16.

Previous known occurrences of this species have been from beds of Navarro and upper Taylor age. Typical specimens occur at locality 1. The species is a very delicate one, easily broken, and may be easily overlooked.

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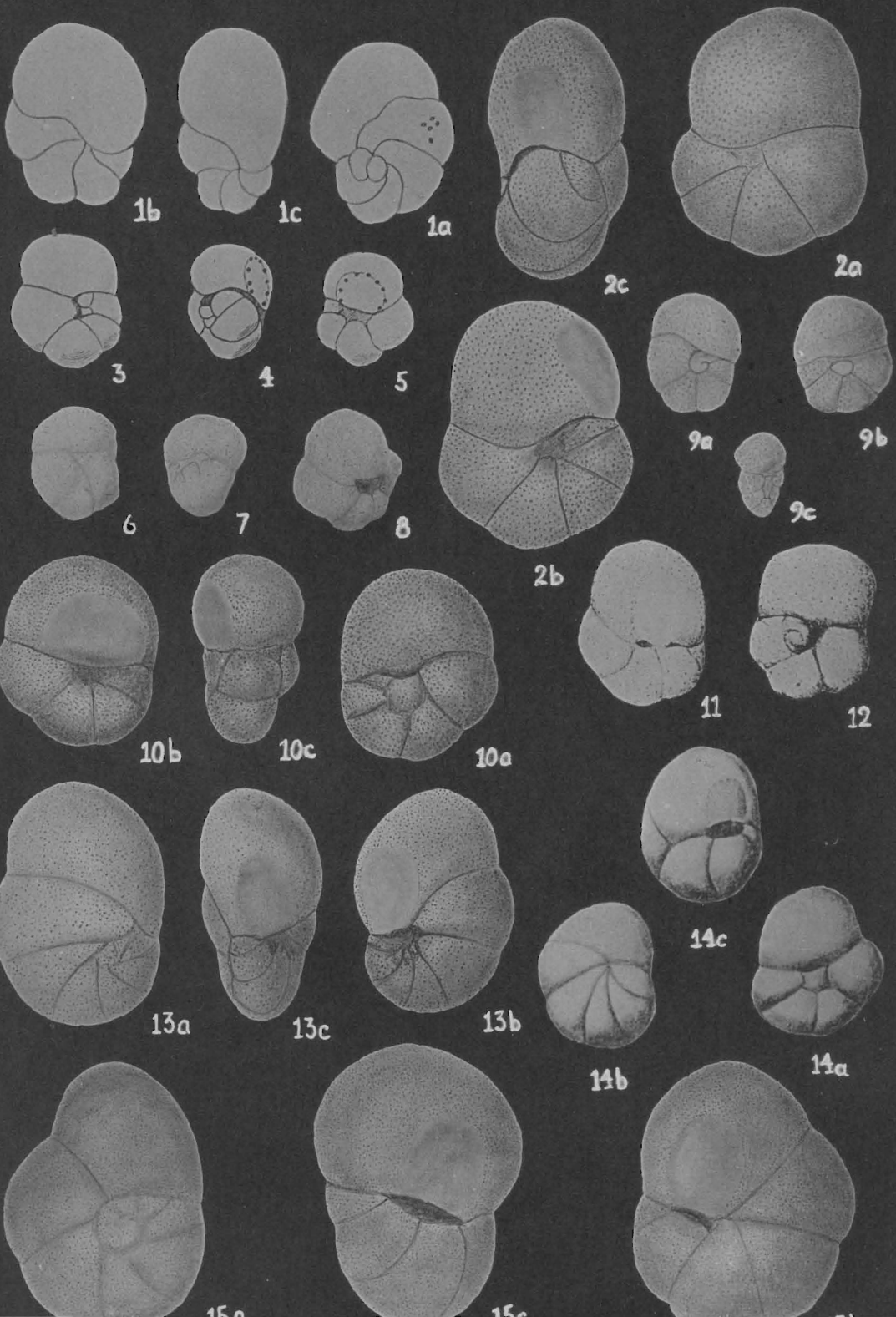
## EXPLANATION OF PLATE 15

FIGS. 1, 2. *Baggina parisiensis* (d'Orbigny). Eocene, France. 1, After Fornasini; copied from d'Orbigny's "Planches inédites." 2, × 90. 3-5. *B.* (?) *thalmanni* Pijpers. Eocene, Bonaire. 3, dorsal view; 4, peripheral view; 5, ventral view. × 30. (After Pijpers). 6-8. *B. marielina* Cushman and Bermudez. Eocene, Cuba. × 25. 6, Paratype, dorsal view. 7, Paratype, peripheral view. 8, Holotype, ventral view. (After Cushman and Bermudez). 9, 10. *B. xenoula* Hadley. 9, Oligocene, Mississippi. *a, b,* × 53. *c,* × 36. (After Hadley). 10, Oligocene, Alabama. × 90. 11, 12. *B. cojimarensis* Palmer. Oligocene, Cuba. 11, ventral view; 12, dorsal view. × 50. (After Palmer). 13. *B. pulchra* Cushman and Todd, n. sp. Holotype. Oligocene, Germany. × 60. 14, 15. *B. californica* Cushman. Miocene, California. 14, × 36. (After Cushman). 15, Monterey shale, type locality, 2 mi. S. of Monterey, Calif. × 60.

*a,* dorsal view; *b,* ventral view; *c,* peripheral view.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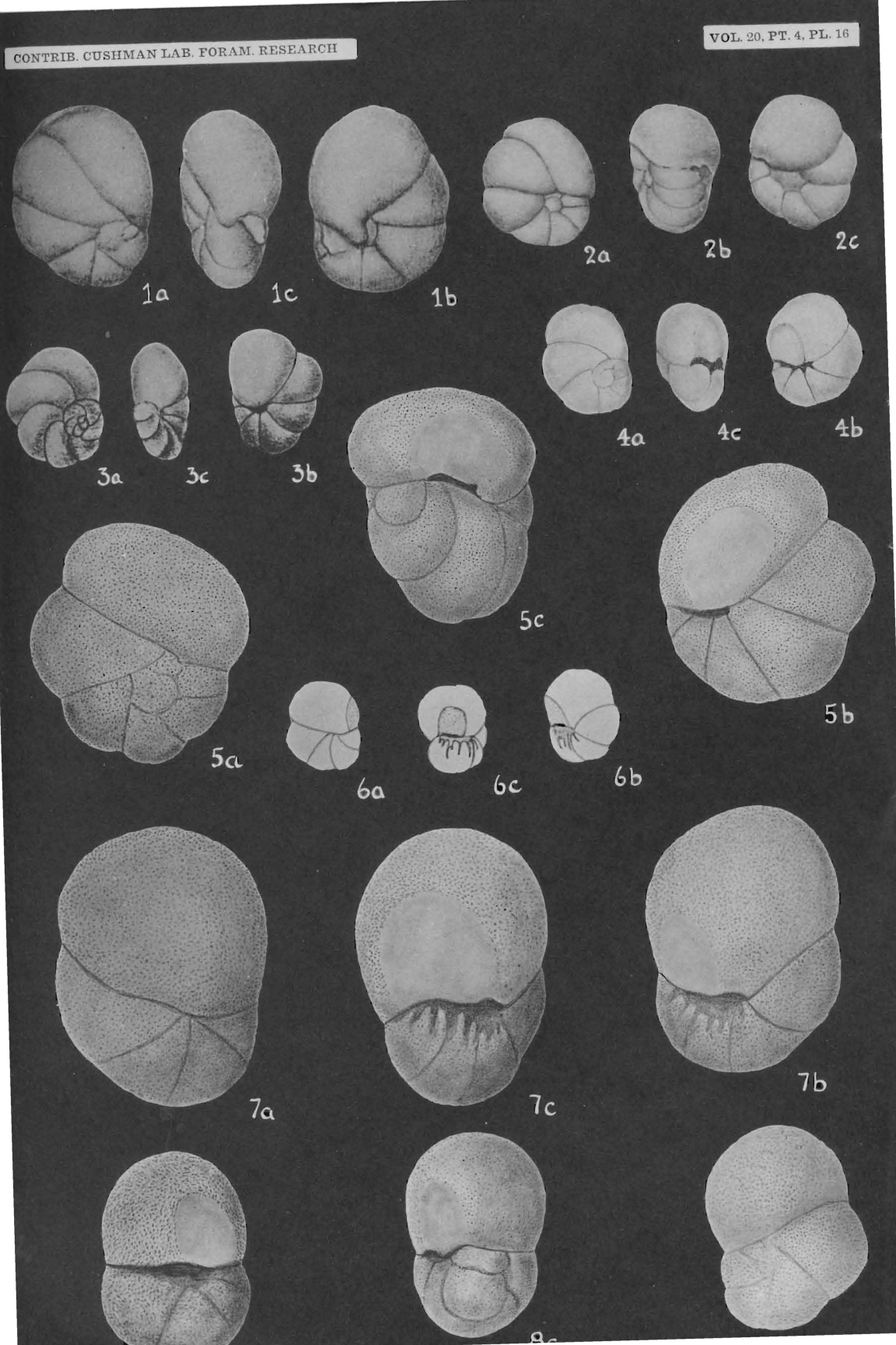
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## Family ROTALIIDAE

### Genus VALVULINERIA Cushman, 1926

**VALVULINERIA PLUMMERAE Loetterle** (Pl. 14, fig. 20)

*Valvulineria plummerae* LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 41, pl. 6, figs. 5, 6.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 13, pl. 3, fig. 1.

The most common occurrences of this species are in beds of Austin and Taylor age, but it also occurs less commonly in those of Navarro age. Rare specimens occur at locality 2.

**VALVULINERIA INFREQUENS Morrow** (Pl. 14, fig. 22)

*Valvulineria infrequens* MORROW, Journ. Pal., vol. 8, 1934, p. 197, pl. 30, fig. 3.—CUSHMAN and DEADERICK, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 64, pl. 15, figs. 17-19.

The types of this species are from the Upper Cretaceous of Kansas. It is most common in beds of Austin age and less so in those of lower Taylor age. It is common at both of the Mooreville chalk localities.

### Genus GYROIDINA d'Orbigny, 1826

**GYROIDINA DEPRESSA (Alth)** (Pl. 14, fig. 23)

(For references, see Journ. Pal., vol. 18, 1944, p. 339.)—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 68, pl. 12, fig. 4.—CUSHMAN, l. c., vol. 20, 1944, p. 13, pl. 3, fig. 2.

This species ranges throughout the American Upper Cretaceous. It occurs at both localities.

**GYROIDINA GIRARDANA (Reuss)** (Pl. 14, fig. 24)

*Rotalina girardana* REUSS, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 73, pl. 5, fig. 34.
*Gyroidina girardana* CUSHMAN, Journ. Pal., vol. 5, 1931, p. 311, pl. 36, fig. 1; Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 30, fig. 3.—COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 2, fig. 13.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 68, pl. 12, fig. 3.—CUSHMAN, l. c., vol 20, 1944, p. 13.

This species also ranges throughout most of the American Upper Cretaceous, with the exception of the Eagle Ford shale. It occurs at both localities.

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## EXPLANATION OF PLATE 16

FIG. 1. *Baggina robusta* Kleinpell. Miocene, California. × 36. (After Kleinpell). 2. *B. robusta* Kleinpell, var. *globosa* Kleinpell. Miocene, California. × 30. (After Kleinpell). 3. *B. compressa* LeRoy. Miocene, Central Sumatra. × 40. (After LeRoy). 4, 5. *B. inflata* LeRoy. Miocene, Central Sumatra. 4, × 36. (After LeRoy, 1944). 5, Paratype. × 75. 6, 7. *B. totomiensis* Makiyama. Pliocene, Japan. 6, × 15. (After Makiyama). 7, Lower Pliocene, Yamaguti, Kakio-mura, Minamitama-gun, Tokio Pref., Japan. × 60. 8. *B. gibba* Cushman and Todd, n. sp. Holotype. Pliocene, Italy. × 75.

*a*, dorsal view; *b*, ventral view; *c*, peripheral view.

## Family GLOBOROTALIIDAE

### Genus GLOBOTRUNCANA Cushman, 1927

**GLOBOTRUNCANA CRETACEA Cushman**

*Globotruncana cretacea* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 67, pl. 11, fig. 6; vol. 15, 1939, p. 92, pl. 16, fig. 8.—COLE, Florida Dept. Conservation, Geol. Bull. 20, 1942, p. 61, pl. 2, fig. 5.

This species ranges through the Austin and Taylor upward into the Nacatoch sand of the Navarro group. It is fairly common at both Mooreville chalk localities.

**GLOBOTRUNCANA cf. VENTRICOSA White**

A few specimens from locality 2 are somewhat like this species described from the Papagallos formation of Mexico and occurring in beds of Austin age.

### Genus GLOBOROTALIA Cushman, 1927

**GLOBOROTALIA UMBILICATA Loetterle** (Pl. 14, fig. 19)

*Globorotalia umbilicata* LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 43, pl. 6, fig. 9.

The types are from the Niobrara chalk of Nebraska. It is fairly common in beds of Austin age and extends upward into those of Taylor age. Typical specimens occur at both Mooreville chalk localities.

## Family ANOMALINIDAE

### Genus PLANULINA d'Orbigny, 1826

**PLANULINA TEXANA Cushman** (Pl. 14, fig. 25)

*Planulina texana* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 69, pl. 12, fig. 3; vol. 16, 1940, p. 33, pl. 6, fig. 7.—CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 341.

This species ranges through beds of Austin age into beds of lower Taylor age. It is fairly common at both Mooreville chalk localities.

**CIBICIDES SUBCARINATUS Cushman and Deaderick** (Pl. 14, fig. 21)

*Cibicides subcarinatus* CUSHMAN and DEADERICK, Journ. Pal., vol. 18, 1944, p. 341.

*Anomalina coonensis* W. BERRY (not *Truncatulina coonensis* W. BERRY), in Berry and Kelley, Proc. U. S. Nat. Mus., vol. 76, Art. 19, 1929, p. 14, pl. 2, figs. 22-24.

*Cibicides coonensis* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 39, pl. 7, figs. 6-8.—CUSHMAN and HEDBERG, l. c., vol. 17, 1941, p. 100, pl. 23, fig. 21.

*Anomalina pseudopapillosa* CUSHMAN (not CARSEY), Tenn. Div. Geol., Bull. 41, 1931, p. 61, pl. 12, fig. 4.

This species occurs mainly in beds of Taylor and Navarro age. Specimens from locality 2 seem to be identical, however, and it is common there.

# 263. THE GENERA *BAGGINA* AND *NEOCRIBRELLA* AND THEIR SPECIES

By Joseph A. Cushman and Ruth Todd

Two genera of the Rotaliidae, *Baggina* and *Neocribrella*, are closely related and represented by comparatively few species. Their distribution is interesting. The earliest appearances of *Baggina* are in the Eocene of France and America. In Europe *Baggina* continued on through the Oligocene, Miocene, and Pliocene, and one species may exist today in the Mediterranean. In America *Baggina* continued into the Oligocene but then, like many other forms of foraminifera and other marine groups, migrated westward, being found in the Miocene of California and in the Pliocene of the Pacific area, and one species at least is living today in the Indo-Pacific region.

The genus *Neocribrella*, with its specialized apertural characters, probably developed from *Baggina* in the Eocene of France and apparently became extinct in the Eocene.

The species of *Baggina* are related to those of *Cancris* and *Valvulineria* and some of the species described as *Baggina* probably belong in those genera.

## Genus BAGGINA Cushman, 1926

Genotype, *Baggina californica* Cushman

*Baggina* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 63; vol. 3, 1927, p. 79; Special Publ. No. 1, 1928, p. 279; Bull. 104, U. S. Nat. Mus., pt. 8, 1931, p. 75; Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, p. 242; Foraminifera, 3rd. Ed., 1940, p. 269.
*Globigerina* (part) d'Orbigny, 1826.
*Pulvinulina* (part) of authors.
*Discorbina* (part) of authors.
*Discorbis* (part) of authors.

Test subglobular, trochoid; chambers large and inflated, few, dorsally more or less involute, ventrally completely so; wall calcareous, perforate, with a clear lunate area above the aperture; aperture elongate oval, on the ventral side of the last formed chamber, with a slight lip or usually without a lip.—Eocene to Recent.

The following species seem to belong to this genus and a list is given of those species described as *Baggina* but probably belonging elsewhere.

**BAGGINA PARISIENSIS (d'Orbigny)** (Pl. 15, figs. 1, 2)

*Globigerina parisiensis* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 277.—Fornasini, Rend. Accad. Sci. Bologna, ser. 5, vol. 7, 1903, p. 141, pl. 1, fig. 5.

*Discorbina globigerinoides* HALKYARD (not PARKER and JONES), Mem. Proc. Manchester Lit. Philos. Soc., vol. 62, 1918 (1919), p. 114.

Test somewhat compressed, slightly longer than broad, almost equally biconvex, the dorsal side slightly less strongly convex, ventral side slightly umbilicate, periphery broadly rounded, the earlier chambers on the dorsal side somewhat covered by the last whorl; chambers strongly inflated, increasing rapidly but rather uniformly in size as added, typically five in the final whorl; sutures on the dorsal side slightly depressed, nearly radial, ventrally more strongly depressed, nearly radial; wall smooth, rather coarsely perforate except the thin clear area above the aperture; aperture an elongate opening in the umbilical area of the ventral side, with a very slight lip. Length 0.38-0.45 mm.; breadth 0.30-0.35 mm.; thickness 0.20-0.24 mm.

D'Orbigny named this species in 1826 giving the locality as fossil in the region of Paris. Our figured specimen is from the Eocene, Lutetien moyen, middle bed at Grignon, France. It is fairly common there and, from the outline figure given by Fornasini, seems to be the same as that named by d'Orbigny. Similar specimens occur in the Eocene, Blue Marl, of Biarritz, France, and in the Eocene of Neustift, near Ofen, Hungary.

**BAGGINA (?) THALMANNI Pijpers** (Pl. 15, figs. 3-5)

*Baggina thalmanni* PIJPERS, Geol. Pal. Bonaire, 1933, p. 69, text figs. 97-99.

"Test biconvex, thick. Chambers few, inflated and rounded, rapidly increasing in size, with huge last formed chamber. Sutures distinct, depressed. On the dorsal side somewhat more than one coil is visible. Ventral side involute. Wall coarsely perphorate. Aperture ventral, not distinct; above the aperture (on the last formed chamber) is a clear white space, consisting of the largest part of a circle, truncated towards the (apertural) inner margin of the chamber. At or quite near the border of this white space there are ca. 9 supplementary apertures."

The species was described from the upper Eocene, well near Porto Spano, Columbia Plantation, Bonaire, D. W. I. We have had no material of this species.

The ring of pores about the clear area is unusual and possibly may eventually place this species in the genus *Neocribrella*.

**BAGGINA MARIELINA Cushman and Bermudez** (Pl. 15, figs. 6-8)

*Baggina marielina* CUSHMAN and BERMUDEZ, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 25, pl. 2, figs. 21-23.—BERMUDEZ, Mem. Soc. Cubana Hist. Nat., vol. 11, 1937, p. 340.

"Test only slightly compressed, dorsal side somewhat flattened, ventral side strongly convex and somewhat umbilicate, periphery broadly rounded, spire depressed and covered by the last whorl; chambers few, about 4 or 5 in the final whorl, much inflated, increasing rapidly in size as added, becoming involute on the dorsal side, ventrally ending in a truncate lobe at the inner end; sutures of the dorsal side slightly depressed, nearly straight; strongly oblique, ventrally strongly depressed, slightly curved, nearly radial; wall smooth; aperture an elongate opening in the umbilical region of the ventral side. Length 0.75 mm.; breadth 0.65 mm.; thickness 0.60 mm."

The types are from the Eocene, 4.5 kms. W. of Guanajay on road to Mariel, Pinar del Rio Province, Cuba. It differs from *B. californica* Cushman in the more inflated chambers on the ventral side, more largely covered spire dorsally, and the lobular character of the ventral ends of the chambers.

**BAGGINA XENOULA Hadley** (Pl. 15, figs. 9, 10)

*Baggina xenoula* HADLEY, Bull. Amer. Pal., vol. 22, No. 74, 1935, p. 6, pl. 1, fig. 5.
*Baggina thalmanni* ? CUSHMAN and MCGLAMERY (not PIJPERS), U. S. Geol. Survey Prof. Paper 189-D, 1938, p. 111, pl. 26, fig. 14.

"Test trochoid, subglobular, dorsal side somewhat evolute, ventral side involute, with an open and depressed umbilicus, periphery broadly rounded; chambers few, usually five in the last whorl, final chamber considerably larger than any of the others; sutures narrow, slightly depressed, almost straight on both sides; wall thin, calcareous, coarsely perforate except around the central region of the ventral side, which is smooth and clear; aperture a moderately high arch, located at the base of the last formed chamber and on the ventral side, extending from the umbilicus to near the periphery." Length 0.32-0.40 mm.; breadth 0.25-0.30 mm.; thickness 0.20-0.23 mm.

The types are from the Oligocene, west bank of Bucatunna Creek, NW. ¼ sect. 17, T. 8, R. 5 W., Wayne Co., Miss. Hadley also records it from numerous other localities in the Oligocene of Mississippi. We have topotype specimens received from Hadley. It occurs also in the Oligocene of Alabama. Cushman and McGlamery referred their specimens to *B. thalmanni* Pijpers on the basis of secondary openings on the ventral side, but a larger series shows these to occur only in occasional individuals somewhat larger than the usual size. Most of the Alabama, Chickasawhay, specimens, one of which is drawn on our plate, are similar to topotypes of Hadley's species.

**BAGGINA COJIMARENSIS Palmer** (Pl. 15, figs. 11, 12)

*Baggina cojimarensis* PALMER, Mem. Soc. Cubana Hist. Nat., vol. 15, 1941, p. 198, pl. 16, figs. 13, 14.

"Test small for the genus, subglobular; dorsally slightly flattened, 4-5 chambers in the final whorl, the chambers increasing rapidly in size so that the final one occupies nearly half the dorsal surface; dorsal sutures gently depressed; periphery very broad and rounded, lobate in side view; ventral sutures radial, gently depressed; aperture a narrow slit opening into the umbilical depression. Surface finely conspicuously perforate with the exception of a large clear area above the aperture on the final chamber. Maximum diameter of holotype 0.5 mm., thickness 0.36 mm., from Palmer Sta. 1808."

*Baggina cojimarensis* was described from the upper Oligocene Cojimar formation of Cuba. "There are few characters by which the Cojimar *Baggina* differs from *B. marielina* Cushman and Bermudez but these few details separate them satisfactorily. The Cojimar species is flat dorsally, not having the depressed spire of the Eocene species, it is less inflated ventrally and the aperture lacks the well marked grooves of *B. marielina*."

**BAGGINA PULCHRA Cushman and Todd, n. sp.** (Pl. 15, fig. 13)

*Baggina parisiensis* CUSHMAN (not *Globigerina parisiensis* D'ORBIGNY), Bull. Soc. Sci. Seine-et-Oise, ser. 2, vol. 9, 1928, p. 55, pl. 3, fig. 3.

Test distinctly compressed, about ¾ as broad as long, dorsal side very slightly convex, ventral side strongly convex and somewhat umbilicate, periphery broadly rounded, earlier chambers on the dorsal side covered by the last whorl; chambers strongly inflated, increasing rapidly, but rather uniformly, in size as added, typically six in the final whorl, becoming relatively more narrow toward the base; sutures on the dorsal side very slightly more depressed, nearly radial; wall smooth, finely perforate, with a clear area above the aperture; aperture a slightly arched opening in the umbilical area of the ventral side, occasionally with a slight lip. Length 0.50-0.60 mm.; breadth 0.38-0.47 mm.; thickness 0.17-0.19 mm.

Holotype (Cushman Coll. No. 42364) from the Oligocene, Doberg near Bünde, Germany. The species is rather common in this material and it is also found in the upper Oligocene, Stampien, of Jeurs, France.

*B. pulchra* differs from *B. parisiensis* (d'Orbigny) in the more compressed and more elongate test, more chambers to the whorl, and the chambers more elongate and narrower toward the base.

**BAGGINA CALIFORNICA Cushman** (Pl. 15, figs. 14, 15)

*Baggina californica* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 64, pl. 9, fig. 8; Special Publ. No. 4, 1933, pl. 24, fig. 15; Special Publ. No. 5, 1933, pl. 31, fig. 7.—WOODRING, BRAMLETTE, and KLEINPELL, Bull. Amer. Assoc. Petr. Geol., vol. 20, 1936, pp. 136, 141, 145 (lists).—KLEINPELL, Miocene Stratig. Calif., 1938, p. 324, pl. 13, fig. 3.—CUSHMAN, Foraminifera, 3rd. Ed., 1940, pl. 24, fig. 15; Key, pl. 31, fig. 7.

Test subglobular, dorsal side somewhat flattened, ventral side strongly convex, umbilicate, periphery broadly rounded, earlier chambers on the dorsal side covered by the last whorl; chambers very strongly inflated, increasing very rapidly in size as added, the last formed one forming nearly one half the area of the surface of the test, typically five in the adult whorl; sutures distinct, somewhat depressed throughout, slightly curved; wall smooth, finely perforate, with a semi-elliptical clear area above the aperture; aperture, an elliptical opening in the umbilical area of the ventral side. Length 0.62-0.75 mm.; breadth 0.50-0.60 mm.; thickness 0.50-0.60 mm.

The types are from the Miocene, Monterey shale, of San Luis Obispo Co., Calif. According to Kleinpell, the species occurs at numerous localities in California in the Relizian, Luisian, and Mohnian stages.

**BAGGINA ROBUSTA Kleinpell** (Pl. 16, fig. 1)

*Baggina robusta* KLEINPELL, Miocene Stratig. Calif., 1938, p. 325, pl. 11, fig. 8.—WEAVER, Univ. Washington Publ. Geol., vol. 6, No. 1, 1944, p. 23 (list).

"Test rotaliform, ventrally convex, dorsally somewhat flattened, thickest across ultimate chamber, which flares strongly, umbilical area depressed, periphery sub-acute; chambers distinct, moderately inflated, increasing markedly in size, five to six in last coil, earlier coils faintly discernible on ventral side; sutures distinct, very slightly depressed, slightly curved; wall smooth, finely perforate, aperture extending outward from umbilicus as a narrow arched slit. Length of type, 0.76 mm.; breadth, 0.56 mm.; thickness, 0.48 mm."

The types of this species are from the Miocene of Reliz Canyon, Calif., and it has been recorded from a number of additional localities in California. "The large test, long, flaring, ultimate chambers, narrow sutural depressions and subacute periphery will distinguish this species from the other more involute species of the genus. It is perhaps intermediate between *Valvulineria nuttalli* Palmer and Bermudez and the later *Baggina californica*; its generic position, in fact, is somewhat doubtful."

**BAGGINA ROBUSTA Kleinpell, var. GLOBOSA Kleinpell** (Pl. 16, fig. 2)

*Baggina robusta* KLEINPELL, var. *globosa* KLEINPELL, Miocene Stratig. Calif., 1938, p. 326, pl. 13, fig. 2.—SCHENCK and CHILDS, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 2, 1942, p. 26 (list).

*Discorbina allomorphinoides* CHAPMAN (not REUSS), Proc. Calif. Acad. Sci., ser. 3, Geol., vol. 1, 1900, p. 253, pl. 30, fig. 8.—BAGG, Bull. 268, U. S. Geol. Survey, 1905, p. 45, pl. 8, fig. 5.

*Baggina californica* CUSHMAN and PARKER (not CUSHMAN), Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 14, pl. 2, fig. 11.

"Variety differs from the typical in the less deeply depressed sutures, the greater relative thickness, and more uniformly inflated test in which the individual chambers are not as well defined as in the species *sensu strictu*."

Specimens from Bagg's material and from Cushman and Parker's have been examined and found to conform well with the type figure of this variety.

**BAGGINA COMPRESSA LeRoy** (Pl. 16, fig. 3)

*Baggina compressa* LEROY, Nat. Tijdschr. Nederl.-Indie, vol. 99, pt. 6, 1939, p. 259, pl. 5, figs. 26-28.

"Test medium, slightly longer than broad, somewhat compressed, periphery rounded, lobulate; chambers distinct, five to six in last whorl, increasing rather rapidly in size as added, inflated, particularly last two or three; sutures distinct, depressed, curved, more obliquely curved on dorsal side; wall smooth, finely perforate; aperture ventral and within depressed umbilical region. Height 0.45 mm.; thickness 0.23 mm."

The types are from the Miocene of Central Sumatra. We have not seen topotypes of this species.

**BAGGINA INFLATA LeRoy** (Pl. 16, figs. 4, 5)

*Baggina inflata* LEROY, Nat. Tijdschr. Nederl.-Indie, vol. 99, pt. 6, 1939, p. 260, pl. 1, figs. 14-16; Colorado School Mines Quart., vol. 39, No. 3, 1944, p. 36, pl. 3, figs. 1-3; pl. 6, figs. 31-33.

"Test medium, somewhat longer than broad, periphery broadly rounded, spiral flat on dorsal side, strongly convex ventrally; chambers

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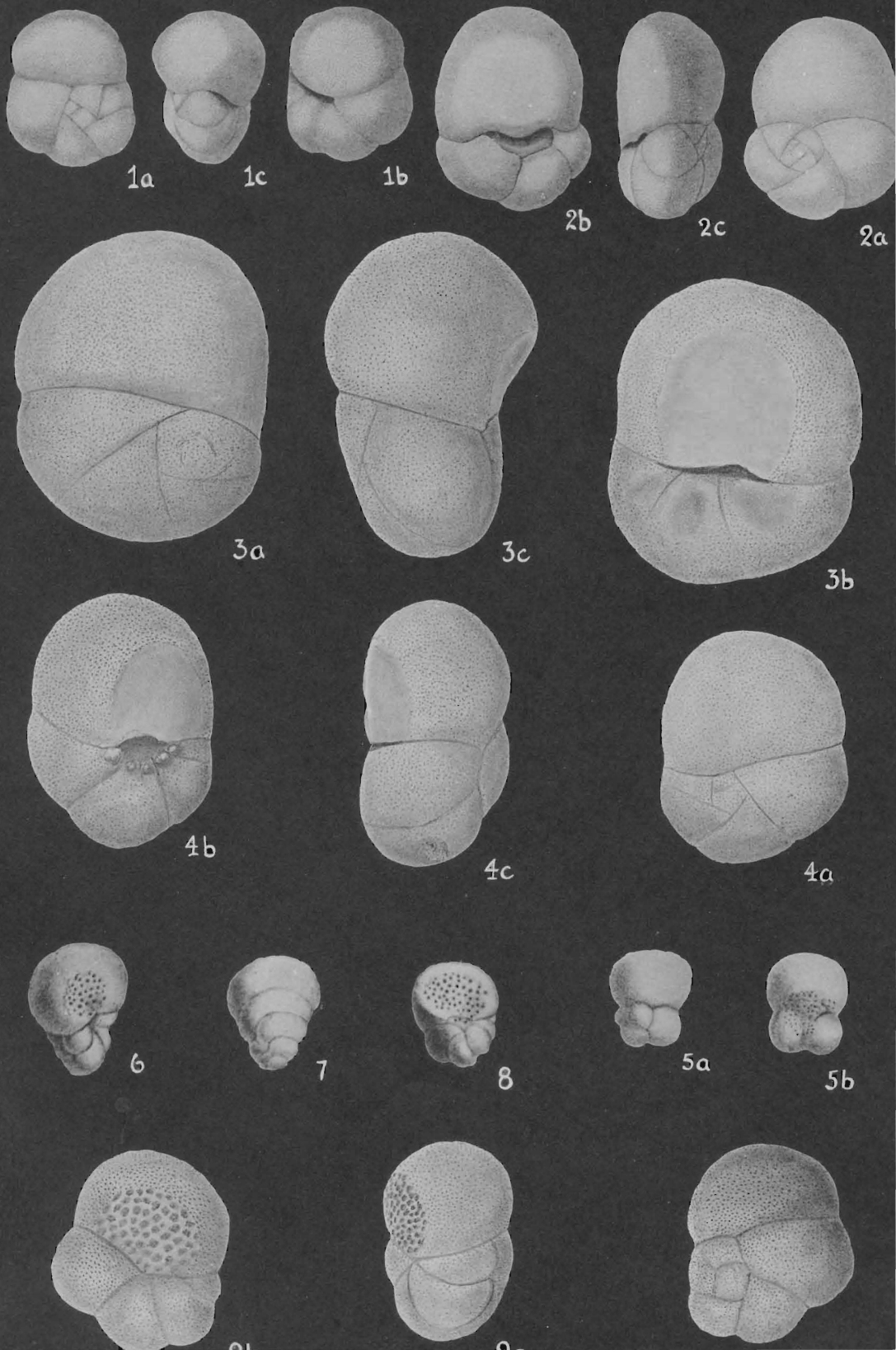
EXPLANATION OF PLATE 17

FIGS. 1-3. *Baggina philippinensis* (Cushman). Recent, Philippines. 1, 2, × 36. (After Cushman). 1, *"Pulvinulina philippinensis* Cushman". 2, *"Discorbis allomorphinoides* Reuss". 3, *Albatross* D 5178. × 60. 4. *B. philippinensis* (Cushman), var. *pilulifera* Cushman and Todd, n. var. Holotype. Recent, 12½ mi. E. of Cape Byron, Australia. × 60. 5. *Neocribrella megasphaerica* (Gümbel). Eocene, Germany. × 6. (After Gümbel). 6-9. *N. globigerinoides* (Parker and Jones). Eocene, France. 6-8, × 16. (After Parker and Jones). 6, peripheral view. 7, dorsal view. 8, ventral view. 9, × 60.

*a*, dorsal view; *b*, ventral view; *c*, peripheral view.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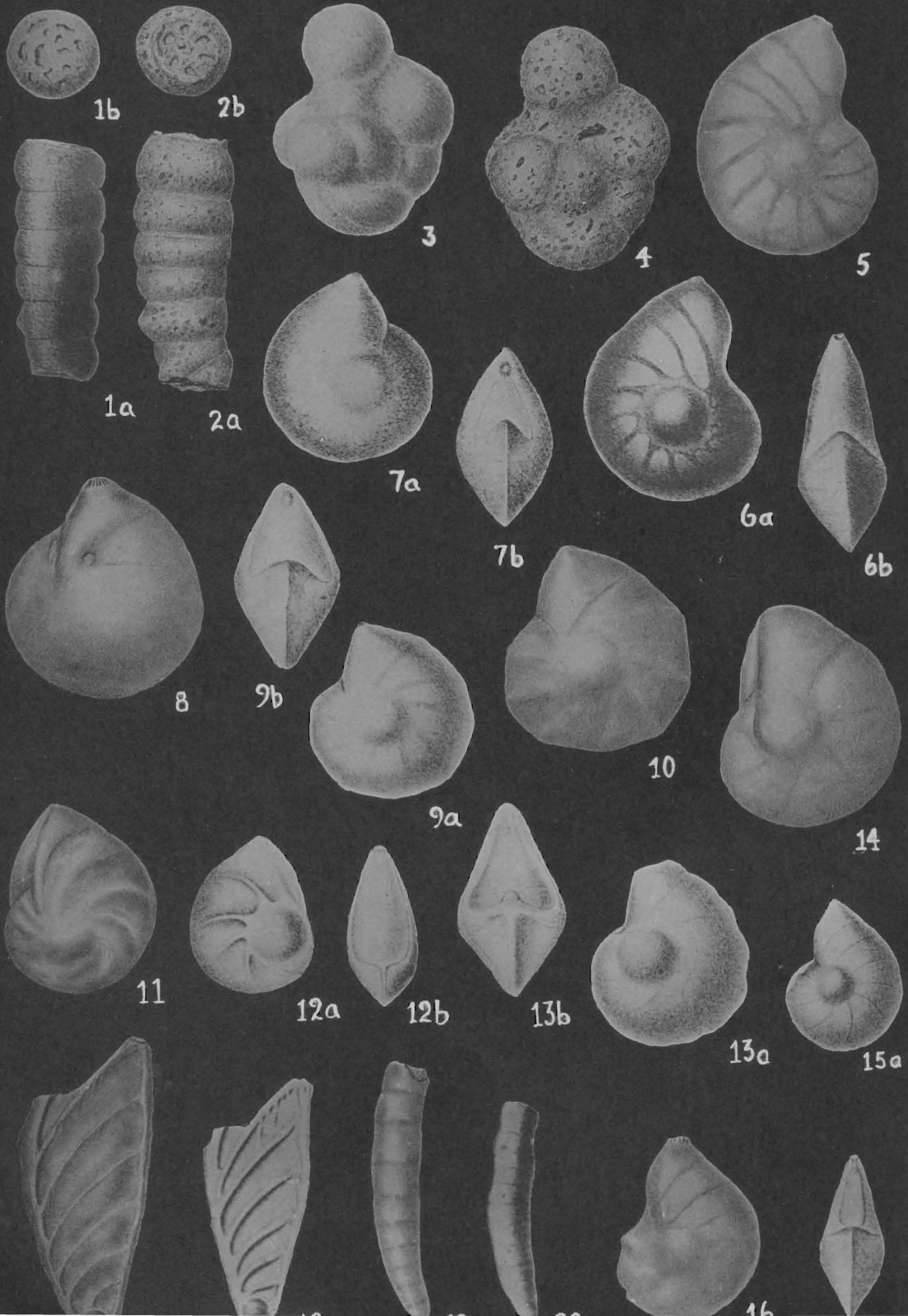
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distinct, inflated, particularly last two or three, four to five in last whorl, enlarging very rapidly as added, the last one constituting about one third of the test, last chamber has a clear lunar space immediately over aperture; sutures, distinct, deeply depressed, slightly curved, non-limbate; wall smooth, finely perforate; aperture ventral, in umbilical region, with small lip. Length 0.38 mm.; thickness 0.25 mm."

The types are from the Miocene of Central Sumatra. We have paratypes, one of which is figured, received from the author. They show a broader test than the type figure and more like those figured in the second reference above.

**BAGGINA TOTOMIENSIS Makiyama** (Pl. 16, figs. 6, 7)

*Baggina totomiensis* MAKIYAMA, Mem. College Sci., Kyoto Imp. Univ., ser. B, vol. 7, 1931, pp. 42 (list), 52, text fig. 4.

Test large, somewhat longer than broad, nearly biconvex, ventral side slightly umbilicate, periphery very broadly rounded, earlier chambers on dorsal side somewhat covered by the last whorl; chambers strongly inflated, the last formed one in the adult making up nearly half the surface of the test, five or six in the last whorl; sutures slightly depressed, very slightly curved; wall smooth, very finely perforate, with a large, clear area above the aperture, on the ventral side with elongate, raised areas below the aperture; aperture an elongate opening in the umbilical area of the ventral side, with a slight lip. Length 0.75-0.92 mm.; breadth 0.60-0.70 mm.; thickness 0.50-0.60 mm.

The types are from the Pliocene of Kamiyasiki, Taruki-mura, Ogasa-gun, Totomi Prefecture, Japan. We have topotypes from the author and numerous typical specimens from the Pliocene of Yamaguti, Kakio-mura, Minamitama-gun, Tokio Prefecture, and from Takasiro, Kisino-mura, Koyu-gun, Miyazaki Prefecture, Japan.

The species is one of the largest of the genus and is particularly

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EXPLANATION OF PLATE 18

FIGS. 1, 2. *"Lituola cylindrica* Perner." 1, Type figures after Perner. 2, Type redrawn. *a, a,* front views; *b, b,* apertural views. 3, 4. *"L. globigerinoides* Perner." 3, Type figure after Perner. 4, Type redrawn. 5, 6. *"Cristellaria erecta* Perner." 5, Type redrawn. 6, Type figures after Perner. 7, 8. *"C. glabra* Perner." 7, Type figures after Perner. 8, Type redrawn. 9, 10. *"C. polygona* Perner." 9, Type figures after Perner. 10, Type redrawn. 11, 12. *"C. umbilicata* Perner." 11, Type redrawn. 12, Type figures after Perner. 13, 14. *"C. obsoleta* Perner." 13, Type figures after Perner. 14, Type redrawn. 15, 16. *"C. similis* Perner." 15, Type figures after Perner. 16, Type redrawn. 17, 18. *"Vaginulina cenomana* Perner." 17, Type redrawn. 18, Type figure after Perner. 19, 20. *"Marginulina arcuata* Perner." 19, Type redrawn. 20, Type figure after Perner.

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

marked by the raised ridges of the ventral side pointing toward the aperture.

The form figured as *Baggina* sp. A by LeRoy (Colorado School Mines Quart., vol. 36, No. 1, 1941, p. 117, pl. 2, figs. 4-6) from the Pliocene of Java probably belongs to this species.

**BAGGINA GIBBA Cushman and Todd, n. sp.** (Pl. 16, fig. 8)

Test very slightly compressed, about ⅓ longer than broad, unequally biconvex, dorsal side much less convex, ventral side strongly convex, umbilicate, periphery broadly rounded, earlier chambers on the dorsal side covered by the last whorl; chambers strongly inflated, increasing very rapidly but rather uniformly in size as added, four or five, usually five in the final whorl; sutures only slightly depressed; nearly radial; wall smooth, finely perforate, with a clear area above the aperture, aperture an elongate opening in the umbilical area of the ventral side, with a slight but distinct lip. Length 0.55-0.70 mm.; breadth 0.40-0.45 mm.; thickness 0.35-0.38 mm.

Holotype (Cushman Coll. No. 42374) from the Pliocene, clay pit near Coroncina, near Siena, Italy. Specimens, apparently identical, occur in the Pliocene of Stazzano, Italy, and in the Miocene of Baden, Niederleis, and Perchtoldsdorf, Austria.

This species resembles *B. parisiensis* (d'Orbigny) but is much more inflated, much broader in edge view, and more finely perforate.

It is possible that the outline figures referred by Fornasini to "*Pulvinulina allomorphinoides* Reuss" (Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 8, 1900, p. 40, text fig. 44) from the Adriatic may represent this species.

**BAGGINA PHILIPPINENSIS (Cushman)** (Pl. 17, figs. 1-3)

*Pulvinulina hauerii* H. B. Brady (part) (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 690, pl. 106, fig. 7 (not fig. 6).

*Pulvinulina philippinensis* Cushman, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 331, pl. 58, fig. 2.

*Baggina philippinensis* LeRoy, Colorado School Mines Quart., vol. 36, No. 1, 1941, p. 84, pl. 6, figs. 36, 37.

*Discorbis allomorphinoides* Cushman (not Reuss), Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 306, pl. 58, fig. 1.

Test nearly as broad as long, ventral face flattened, dorsal side slightly convex, periphery broadly rounded; chambers strongly inflated, increasing very rapidly in size as added, the last formed one in the adult making up one half of the surface of the test, four or five in the last formed whorl, usually four; sutures distinct, slightly depressed;

wall coarsely perforate with a clear, semicircular area above the aperture; aperture elongate, on the ventral side of the last formed chamber, opening into the umbilicus. Length 0.80-0.87 mm.; breadth 0.65-0.68 mm.; thickness 0.45-0.52 mm.

The types are from Recent dredgings, *Albatross* station D 5268, Verde Island Passage, Philippines, in 170 fathoms. It also occurs at other localities in the Philippine region and in 17 fathoms, Pago Pago Harbor, Samoa.

The figure referred to *Discorbis subobtusa* Cushman (Bull. 100, U. S. Nat. Mus., vol. 4, 1921, pl. 70, fig. 2) evidently was an error and the figure is of *Baggina philippinensis*.

**BAGGINA PHILIPPINENSIS (Cushman), var. PILULIFERA Cushman and Todd, n. var.**
(Pl. 17, fig. 4)

Variety differing from the typical in the strong beading of the ventral side where each chamber ends at the umbilicus in a fairly large, rounded, bead-like process.

Holotype (Cushman Coll. No. 42381) from Recent dredgings, 12½ miles E. of Cape Byron, Australia.

In the beading this form somewhat resembles *B. totomiensis*, but in the number and shape of the chambers it seems identical with *B. philippinensis*.

Species described as *Baggina* but probably belonging elsewhere:

*Baggina cancriformis* Kleinpell (Miocene Stratig. Calif., 1938, p. 324, pl. 9, fig. 24). It is difficult to make out the characters of this species from the figures, but, from the description, it would appear to belong to the genus *Cancris*.

*Baggina subinaequalis* Kleinpell (Miocene Stratig. Calif., 1938, p. 326, pl. 19, figs. 6, 9, 12). Topotypes, with the original figures and description, show this to probably belong to the genus *Valvulineria*.

### Genus NEOCRIBRELLA Cushman, 1928

Genoholotype, *Discorbina globigerinoides* PARKER and JONES

*Neocribrella* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 6; Special Publ. No. 1, 1928, p. 280; Bull. 104, U. S. Nat. Mus., pt. 8, 1931, p. 76; Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, p. 242; Foraminifera, 3rd. Ed., 1940, p. 269.—BROTZEN, Sver. Geol. Under., Ser. C, No. 451, 1942, p. 27.

*Discorbina* (part) of authors.

Test trochoid, somewhat involute in later stages; chambers comparatively few, inflated; wall calcareous, perforate; aperture in adult, several small rounded pores, in a depression of the ventral face of the chamber. Eocene.

This genus may have been derived from *Baggina*, which occurs in the same locality, by the addition of numerous secondary apertures. It apparently did not persist beyond the Eocene.

Besides the genoholotype, there are a few other Eocene forms that may possibly belong here, such as *Baggina thalmanni* Pijpers and "*Discorbina megasphaerica* Gümbel", both of which seem to have supplementary apertures, but a further study of these is necessary when material is available.

**NEOCRIBRELLA GLOBIGERINOIDES (Parker and Jones)** (Pl. 17, figs. 6-9)

*Discorbina globigerinoides* PARKER and JONES, Philos. Trans., 1865, pp. 385, 421, pl. 19, fig. 7.

*Neocribrella globigerinoides* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 6, pl. 1, figs. 6, 7; Special Publ. No. 5, 1933, pl. 31, fig. 9; Foraminifera, 3rd. Ed., 1940, Key, pl. 31, fig. 9.—BROTZEN, Sver. Geol. Under., Ser. C, No. 451, 1942, p. 27, fig. [pl.] 9, fig. 9.

Test subglobular, earlier portion more compressed, ventral side umbilicate, periphery broadly rounded, axis of coiling changing in development; chambers inflated, increasing rapidly in size as added, especially in thickness, the last formed chambers in the adult at somewhat of an angle to the earlier plane of coiling, five or six in the final whorl; sutures somewhat depressed; wall coarsely perforate; aperture an elongate opening at the base of the last formed chamber at the umbilicus, with numerous small, circular openings in the ventral side of the last formed chamber. Length 0.50-0.63 mm.; breadth 0.42-0.50 mm.; thickness 0.38-0.40 mm.

The types are from the Eocene of Grignon, near Paris, France. We have a series of topotypes that shows the characters well. The species is probably derived from *Baggina parisiensis* (d'Orbigny) which occurs in the same material. Halkyard recorded the species from the

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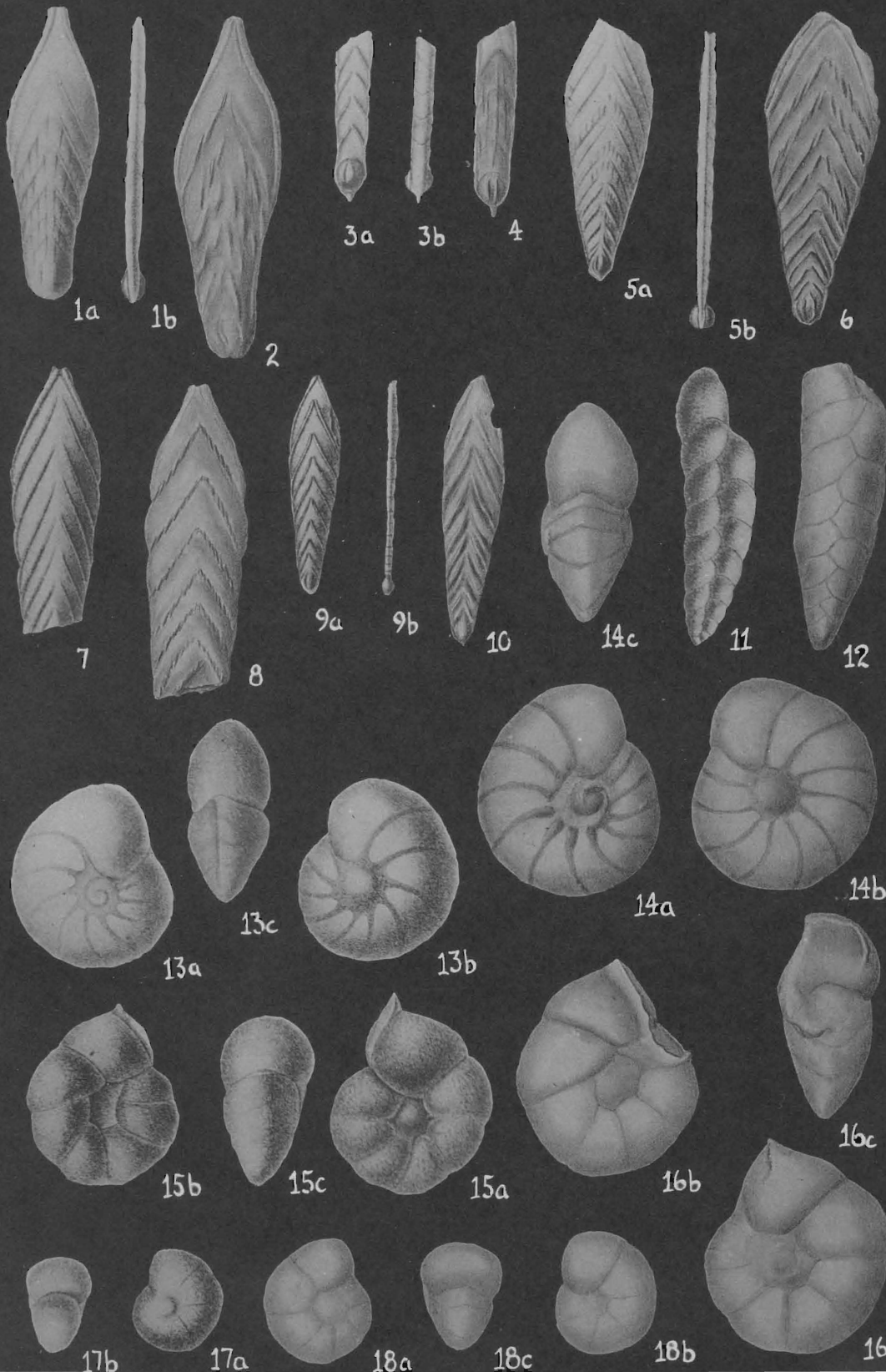
EXPLANATION OF PLATE 19

FIGS. 1, 2. "*Frondicularia coronata* Perner." 1, Type figures after Perner. *a*, front view; *b*, edge view. 2, Type redrawn. 3, 4. "*F. linea* Perner." 3, Type figures after Perner. *a*, front view; *b*, edge view. 4, Type redrawn. 5, 6. "*F. obsoleta* Perner." 5, Type figures after Perner. *a*, front view; *b*, edge view. 6, Type redrawn. 7, 8. "*F. acutangula* Perner." 7, Type figure after Perner. 8, Type redrawn. 9, 10. "*F. lanceolata* Perner." 9, Type figures after Perner. *a*, front view; *b*, edge view. 10, Type redrawn. 11, 12. "*Textularia parallela* Perner." 11, Type figure after Perner. 12, Type redrawn. 13, 14. "*Discorbina crassisepta* Perner." 13, Type figures after Perner. 14, Type redrawn. *a*, *a*, dorsal views; *b*, *b*, ventral views; *c*, peripheral view. 15, 16. "*D. inflata* Perner." 15, Type figures after Perner. 16, Type redrawn. *a*, *a*, dorsal views; *b*, *b*, ventral views; *c*, *c*, peripheral views. 17, 18. "*D. oligostegia* Perner." 17, Type figures after Perner. *a*, ventral view; *b*, peripheral view. 18, Type redrawn. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.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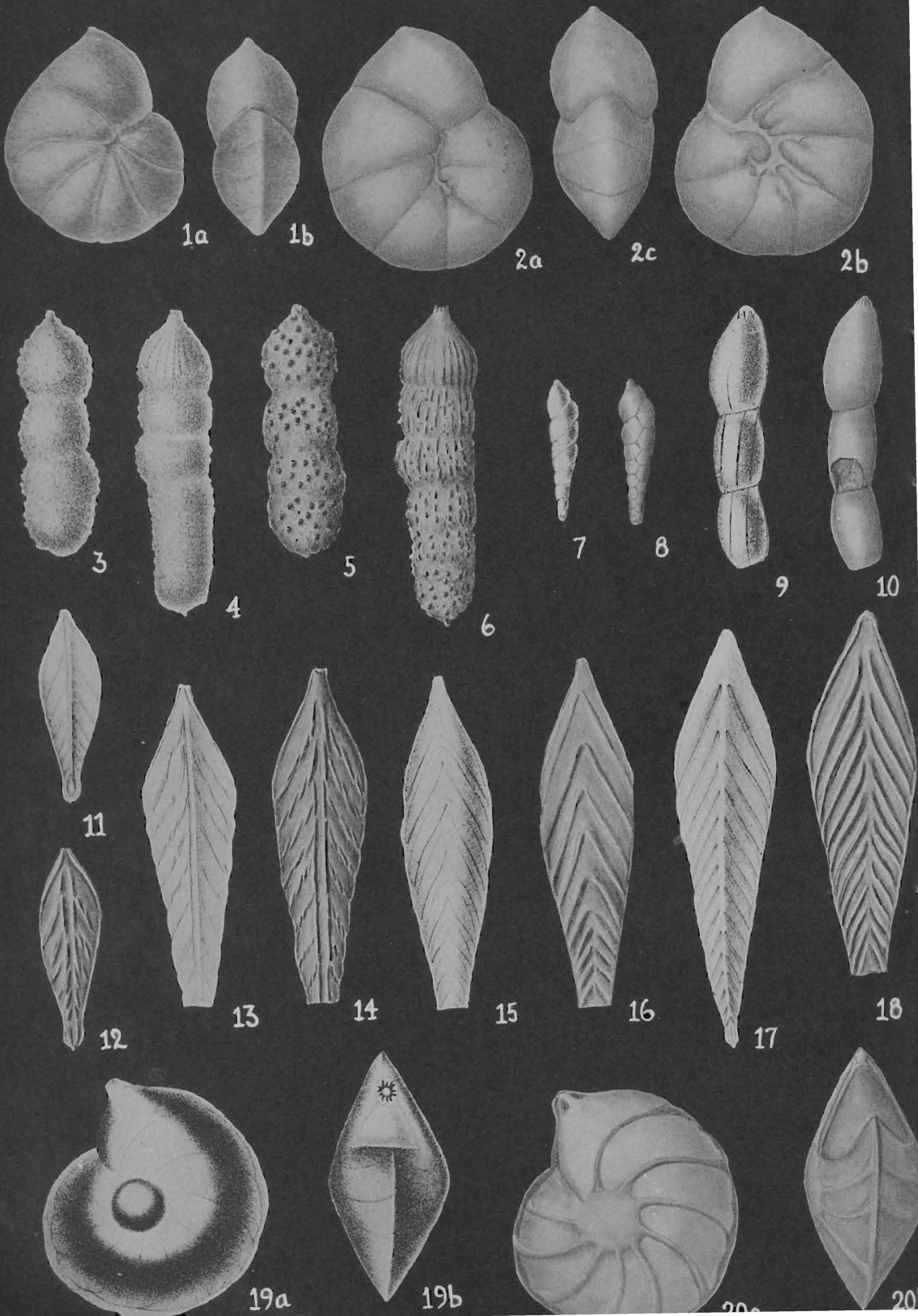
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Eocene, Blue Marl, of Biarritz, France, but our specimens from Biarritz belong in *Baggina parisiensis* (d'Orbigny).

NEOCRIBRELLA MEGASPHAERICA (Gümbel) (Pl. 17, fig. 5)

*Discorbina megasphaerica* GÜMBEL, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 10, 1870, p. 655, pl. 2, fig. 96.

The figure given by Gümbel is copied on our plate. The types are from the Eocene of Hammer, Germany, where it is recorded as very rare. We have a single topotype specimen and, from this and the original figure and description, it may be that this species should be assigned to *Neocribrella*. It is very much larger than any of the other species of either *Neocribrella* or *Baggina*.

## 264. NOTES ON SOME OF THE CRETACEOUS FORAMINIFERA DESCRIBED BY PERNER IN 1892 AND 1897

By Joseph A. Cushman

In the summer of 1932 when in Prague I was able, through the courtesy of Dr. Perner and the Director of the Nahrodi Museum at Prague, to examine the type specimens of many of Perner's species and compare them with the published figures. The figures given in the papers are in some cases very difficult to interpret, and numerous types were redrawn in Prague by Margaret Moore. The drawings are here reproduced together with the original figures for comparison.

The first of these papers by Perner is entitled: Foraminifery Ceskeho Cenomanu (Ceska Akad. Cis. Frantiska Josefa, vol. 16, 1891 (1892), pp. 49-65, pls. 1-10). Many of the original figures are well drawn, but a number of them are reproduced here and notes are given that were made at the time the types were examined and redrawn.

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EXPLANATION OF PLATE 20

Figs. 1, 2. "*Discorbina regularis* Perner." 1, Type figures after Perner. *a*, dorsal view; *b*, peripheral view. 2, Type redrawn. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 3-6. "*Nodosaria hispida* d'Orbigny, var. *agglutinans* Perner." 3, 4, Type figures after Perner. 5, 6, Types redrawn. 7, 8. "*Dentalina Roemeri* Neugeboren, var. *clavuliformis* Perner." 7, Type figure after Perner. 8, Type redrawn. 9, 10. "*D. Folkestoniensis* Chapman, var. *cylindroides* Perner." 9, Type figure after Perner. 10, Type redrawn. 11, 12. "*Frondicularia Fritschi* Perner, var. *pseudocanaliculata* Perner." 11, Type figure after Perner. 12, Type redrawn. 13, 14. "*F. Fritschi* Perner, var. *interrupta* Perner." 13, Type figure after Perner. 14, Type redrawn. 15, 16. "*F. Chapmani* Perner." 15, Type figure after Perner. 16, Type redrawn. 17, 18. "*F. angusta* Nilsson, var. *glabra* Perner." 17, Type figure after Perner. 18, Type redrawn. 19, 20. "*Cristellaria acuta* Reuss, var. *erecta* Perner." 19, Type figures after Perner. 20, Type redrawn. *a, a*, side views; *b, b*, peripheral views.

**"LITUOLA CYLINDRICA Perner"** (Pl. 18, figs. 1, 2)

PERNER, 1892, p. 52, pl. 2, figs. 7-12, text fig. 5.

The chambers are not really labyrinthic but have multiple apertures. The wall is arenaceous with a large proportion of cement, the grains angular and distinct. The exterior in fig. 12 is as shown in Perner's figure, yellowish in color, but the central divisions whitish and apparently not chitinous. As none of the specimens have the early stages, it is difficult to assign it to its generic position with certainty.

**"LITUOLA GLOBIGERINOIDES Perner"** (Pl. 18, figs. 3, 4)

PERNER, 1892, p. 52, pl. 2, figs. 15-17.

The type shows the test is made of a large proportion of cement and is smoothly finished on the exterior. It is not like any of our American Cretaceous species.

**"CRISTELLARIA ERECTA Perner"** (Pl. 18, figs. 5, 6)

PERNER, 1892, p. 63, pl. 4, figs. 12, 13.

The type is fairly well figured. The keel is fairly sharp and the sutures dark as shown. The center is not so definitely umbonate, but is smoothed evenly as shown in edge view. The aperture was originally radiate as shown by the remnants of the original slits. There is no elongate ventral slit and the species is probably to be placed in *Lenticulina.*

**"CRISTELLARIA GLABRA Perner"** (Pl. 18, figs. 7, 8)

PERNER, 1892, p. 62, pl. 5, figs. 1, 2.

The reversed side of the type is drawn. The specimen is much more definite than the original figure.

**"CRISTELLARIA POLYGONA Perner"** (Pl. 18, figs. 9, 10)

PERNER, 1892, p. 63, pl. 5, figs. 3, 4.

The umbo is not as high as the original figure indicates.

**"CRISTELLARIA UMBILICATA Perner"** (Pl. 18, figs. 11, 12)

PERNER, 1892, p. 63, pl. 5, figs. 5, 6.

The original figures are much conventionalized. The opposite side of the type was redrawn. The name was already used by Reuss in 1862 for another form.

**"CRISTELLARIA OBSOLETA Perner"** (Pl. 18, figs. 13, 14)

PERNER, 1892, p. 63, pl. 5, figs. 7, 8.

The type is a poorly preserved specimen. The umbo in the type figure is too prominent. The species is close to and probably identical with "*C. glabra*".

**"CRISTELLARIA SIMILIS Perner"** (Pl. 18, figs. 15, 16)

PERNER, 1892, p. 63, pl. 5, figs. 9, 10.

This is a larger specimen than the preceding ones but less enlarged in the figure. The type specimen seems to indicate that this is an adult of some of the foregoing species. Another specimen on the type slide is more flattened. It is not the same as *C. similis* Terquem, 1870.

**"VAGINULINA CENOMANA Perner"** (Pl. 18, figs. 17, 18)

PERNER, 1892, p. 62, pl. 5, fig. 18.

The type shows little more than the original figure but the redrawn figure shows the real characters more truly.

**"MARGINULINA ARCUATA Perner"** (Pl. 18, figs. 19, 20)

PERNER, 1892, p. 61, pl. 5, figs. 20, 21.

The specimen has the sutures very slightly raised in later growth. This is probably to be included as a synonym under *Dentalina megalopolitana* Reuss.

**"FRONDICULARIA CORONATA Perner"** (Pl. 19, figs. 1, 2)

PERNER, 1892, p. 58, pl. 7, fig. 2.

The type figure is conventionalized as the redrawn figure shows.

**"FRONDICULARIA LINEA Perner"** (Pl. 19, figs. 3, 4)

PERNER, 1892, p. 59, pl. 7, fig. 3.

This type figure is also conventionalized and fails to show the longitudinal costae.

**"FRONDICULARIA OBSOLETA Perner"** (Pl. 19, figs. 5, 6)

PERNER, 1892, p. 59, pl. 7, fig. 6.

This also was not well figured and was redrawn. The sides are more convex than shown in the edge view.

**"FRONDICULARIA ACUTANGULA Perner"** (Pl. 19, figs. 7, 8)

PERNER, 1892, p. 61, pl. 7, fig. 11.

The surface characters were not correctly drawn in the type figure and it was redrawn.

**"FRONDICULARIA LANCEOLATA Perner"** (Pl. 19, figs. 9, 10)

PERNER, 1892, p. 60, pl. 7, fig. 12.

The type figure is fairly well drawn but is somewhat conventionalized. It is not the same as *F. lanceolata* Costa, 1857.

**"TEXTULARIA PARALLELA Perner"** (Pl. 19, figs. 11, 12)

PERNER, 1892, p. 54, pl. 9, fig. 13.

It is difficult to see how the type figure could have been drawn from the type specimen that is redrawn on our plate. It somewhat resembles *Textularia anceps* Reuss.

**"DISCORBINA CRASSISEPTA Perner"** (Pl. 19, figs. 13, 14)

PERNER, 1892, p. 65, pl. 10, fig. 2.

The redrawn figures give a clearer idea of the actual surface characters. It is probably to be placed in *Anomalina.*

**"DISCORBINA INFLATA Perner"** (Pl. 19, figs. 15, 16)

PERNER, 1892, p. 65, pl. 10, fig. 4.

The redrawn figures show the characters of the type specimens more clearly than the originals.

**"DISCORBINA OLIGOSTEGIA Perner"** (Pl. 19, figs. 17, 19)

PERNER, 1892, p. 65, pl. 10, fig. 5.

This is probably a *Gyroidina.*

**"DISCORBINA REGULARIS Perner"** (Pl. 20, figs. 1, 2)

PERNER, 1892, p. 65, pl. 10, fig. 6.

The type figures are not very accurate and show only one side. The type was redrawn in all three views.

The second paper in the same series is entitled: Über die Foraminiferen der Weissenberger Schichten, (as above), 1897.

**"NODOSARIA HISPIDA d'Orbigny, var. AGGLUTINANS Perner"** (Pl. 20, figs. 3-6)

PERNER, 1897, p. 25, pl. 2, figs. 10-12.

This is a peculiar form with the earliest chambers spinose, the later chambers with the ornamentation becoming linear, the last chamber in the type specimen becoming costate. The specimens have some matrix clinging to the early portion probably due to the spinose surface. This probably led to the varietal name *"agglutinans"* and the peculiarly drawn original figures.

**"DENTALINA ROEMERI Neugeboren, var. CLAVULIFORMIS Perner"** (Pl. 20, figs. 7, 8)

PERNER, 1897, p. 37, pl. 3, fig. 16.

The type figure shows the specimen as though it were spiral. The type specimen was redrawn and other topotypes seen and studied. The specimen is really biserial and identical with *Loxostomum tegulatum* (Reuss).

**"DENTALINA FOLKESTONIENSIS Chapman, var. CYLINDROIDES Perner"** (Pl. 20, figs. 9, 10)

PERNER, 1897, p. 30, pl. 3, fig. 17.

The type figure shows a costate surface but these are probably drawn from longitudinal cracks due to injury in fossilization. The middle chamber may have very slight costae but they are difficult to make out. The earliest chamber of the three is entirely smooth. Reuss already had used the name *Dentalina cylindroides* in 1860.

**"FRONDICULARIA FRITSCHI Perner, var. PSEUDOCANALICULATA Perner"**
(Pl. 20, figs. 11, 12)

PERNER, 1897, p. 39, pl. 4, fig. 13.

The type figure is slightly conventionalized. The sutures in the type are slightly raised and there are intermittent costae. It is probably a young stage of the following variety.

**"FRONDICULARIA FRITSCHI Perner, var. INTERRUPTA Perner"**
(Pl. 20, figs. 13, 14)

PERNER, 1897, p. 39, pl. 4, fig. 15.

This is much more accurately drawn than most of the figures. It probably is the adult of the preceding variety. Costa already had used the name *Frondicularia interrupta* in 1857.

**"FRONDICULARIA CHAPMANI Perner"** (Pl. 20, figs. 15, 16)
PERNER, 1897, p. 44, pl. 4, fig. 17.

The type figure is peculiarly drawn and does not show the surface characters. The type is redrawn.

**"FRONDICULARIA ANGUSTA Nilsson, var. GLABRA Perner"** (Pl. 20, figs. 17, 18)
PERNER, 1897, p. 40, pl. 5, fig. 7.

The type figure gives the impression that the sutural lines are depressed and the median line raised, while the exact opposite is true as seen in the redrawn figure.

**"CRISTELLARIA ACUTA Reuss, var. ERECTA Perner"** (Pl. 20, figs. 19, 20)
PERNER, 1897, p. 50, pl. 6, fig. 6.

This is one of the poorest and most conventionalized figures in this paper. Our redrawn figure gives the true characters of the surface.

## RECENT LITERATURE ON THE FORAMINIFERA

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

Hedberg, Hollis D. Mesozoic Stratigraphy of Northern South America. — Proc. Eighth Amer. Sci. Congress, May 1940, vol. 4, 1942, pp. 195-227. — Mentions a few foraminifera.

Nicol, David. New West American Species of the Foraminiferal Genus Elphidium. —Journ. Pal., vol. 18, No. 2, March 1944, pp. 172-185, pl. 29, 7 text figs.— Results are given of a study of Pleistocene and Recent material from the west coast of North America. The following are given as new: *Elphidium fax* n. sp.; *E. fax fax* n. subsp.; *E. fax pingue* n. subsp.; *E. fax barbarense* n. subsp.; *E. excubitor* n. sp.; *E. concinnum* n. sp.

Barker, R. Wright. Some Larger Foraminifera from the Lower Cretaceous of Texas.

—L. c., pp. 204-209, pl. 35.—Three species are discussed and figured, one new, *Coskinolina adkinsi* n. sp.

**Lozo, Frank E., Jr.** Biostratigraphic Relations of Some North Texas Trinity and Fredericksburg (Comanchean) Foraminifera.—Amer. Midland Nat., vol. 31, No. 3, May 1944, pp. 513-582, 5 pls., 22 text figs.—Collections were made at many outcrops that are carefully mapped, and list of species is given. Thirty-nine species are described and figured, 9 new.

**Weaver, Charles E.** Geology of the Cretaceous (Gualala Group) and Tertiary Formations along the Pacific Coast between Point Arena and Fort Ross, California.—Univ. Washington Publ. in Geol., vol. 6, No. 1, July 1944, pp. 1-29, 13 plates (maps and chart).—This paper deals mostly with stratigraphic data, but a table of distribution of many species of foraminifera is given.

**Crespin, Irene.** Some Lower Cretaceous Foraminifera from Bores in the Great Artesian Basin, Northern New South Wales.—Journ. Proc. Roy. Soc. New South Wales, vol. 78, Aug. 30, 1944, pp. 17-24, pl. 1.—Notes are given on previously described species and eight new species are described as follows: *Haplophragmoides chapmani, Trochammina raggatti, T. parvula, Spiroplectammina cushmani, Marginulina subcretacea, Lenticulina warregoensis, L. gunderbookaensis* and *Planulina cretacea.*

The Occurrence of Cycloclypeus in the Tertiary Deposits of South Australia.—Trans. Roy. Soc. So. Australia, vol. 68, pt. 1, 1944, pp. 120, 121.—Besides the records for *Cycloclypeus victoriensis* Crespin, a number of other foraminifera are listed.

**MacNeil, F. Stearns.** Oligocene Stratigraphy of Southeastern United States.—Bull. Amer. Assoc. Petr. Geol., vol. 28, No. 9, Sept. 1944, pp. 1313-1354, 1 fig.—Mentions a few foraminifera.

**Ellisor, Alva C.** Anahuac Formation.—L. c., pp. 1355-1375, 2 figs., 7 pls.—Lists of Foraminifera are given and numerous previously described species refigured.

**Cushman, Joseph A.** Notes on the Cretaceous Species Described by Karrer.—Amer. Journ. Sci., vol. 242, Nov. 1944, pp. 607-613, pls. 1, 2.—The new species described by Karrer in 1870 from the Cretaceous of Austria were studied in Vienna and the resulting notes are given and the redrawn types figured.

J. A. C.