CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

THE FORAMINIFERAL FAUNA OF THE TYPE LOCALITY OF THE PECAN GAP CHALK*

By JOSEPH A. CUSHMAN

The type locality of the Pecan Gap Chalk member of the Taylor marl is in a cut of the Gulf, Colorado, and Santa Fe Railway, ½ mile east of Pecan Gap, Delta Co., Texas. Samples from this chalky material were collected by Cushman and Waters from two levels, called stations 31 and 32, the latter about six feet above the former.

By careful preparation, boiling with soda, and washing the residue gently, a very good fauna was obtained. It is interesting to note that in spite of the fact that the chalky deposits at the type locality are more or less uniform there is a considerable difference in some of the species even in the six-foot gap between the stations. For example, station 32 contains many specimens of *Stensiöina americana*, but this species was not found in the material from station 31. On the other hand, station 31 has many more species than station 32 with an indication that ecologically it might have been deposited under somewhat deeper conditions.

Where the synonymy has been given for the various species in fairly recent papers, reference is made to the page where these may be found. Additional species are present from both localities, but represented by immature or poorly preserved specimens which cannot be identified with accuracy, and these are left out.

The following species were found:

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX CONSTRICTUS (Reuss) (Pl. 1, fig. 1)

Haplostiche constricta REUSS, in Geinitz, Palaeontographica, vol. 20, pt. 2, 1872-75 (1874), p. 122, pl. 24, figs. 9-12.—PERNER, Sitz. k. böhm. Ges. Wiss. Prag, 1893, p. 38.—MATOUSCHEK, Lotos, vol. 43, 1895, p. 125.—FRANKE, Verhandl. naturh. Ver. preuss. Rheinlande u. Westfälens, Jahrg. 69, 1912 (1913), p. 260; Abhandl. geol.-pal. Inst. Univ. Greifswald, vol. 6, 1925, p. 8, pl. 1, fig. 7; Abhandl. Preuss. geol. Landes., n. ser., vol. 111, 1928, p. 20, pl. 2, fig. 5.—BROTZEN, Zeitschr. deutschen Palästina-Vereins, Jahrg. 1934, p. 32.

Test composed of a few, usually 2 or 3, subglobular chambers, in-

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creasing very little if at all in diameter; chambers distinct, the later ones becoming constricted so that the sutures are much depressed; wall coarsely arenaceous, roughly finished; apertural end when perfect terminating in a definite neck. Length 1.25 mm.; diameter 0.45 mm.

The American specimens referred to this species may be distinguished from *Reophax texanus* by the more elongate chambers and by the very definitely constricted necks between the chambers. In America this species occurs mostly in the Taylor marl and its members, but specimens also occur in the Prairie Bluff chalk of Alabama. It is rare at station 31.

Family AMMODISCIDAE

Genus AMMODISCUS Reuss, 1861

AMMODISCUS CRETACEUS (Reuss) (Pl. 1, fig. 2)

(For references see these Contributions, vol. 10, 1934, p. 45)

A single specimen was found at station 31.

Family LITUOLIDAE

Genus AMMOBACULITES Cushman, 1910

AMMOBACULITES STEPHENSONI Cushman (Pl. 1, fig. 3)

Ammobaculites stephensoni CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 49, pl. 5, fig. 2.

The species is largely confined to the members of the Taylor group. Specimens occur at station 31.

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA LAEVIS (Roemer), var. CRETOSA Cushman (Pl. 1, fig. 4)

Spiroplectammina laevis (ROEMER), var. *cretosa* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 87, pl. 11, fig. 3.—JENNINGS, Bull. Amer. Pal., vol. 23, No. 78, 1936, p. 12, pl. 1, fig. 2.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 52, pl. 9, fig. 3.—CUSHMAN and TODD, l. c., vol. 18, 1942, p. 25, pl. 5, fig. 1.

Spiroplectammina semicomplanata PLUMMER (not CARSEY), Univ. Texas Bull. 3101, 1931, p. 129, pl. 8, fig. 8 (not fig. 7).

This is a common variety throughout the Taylor group with rare occurrences in the Austin group. It occurs commonly at both stations.

Genus TEXTULARIA Defrance, 1824

TEXTULARIA RIPLEYENSIS W. Berry (Pl. 1, fig. 5)

Textularia ripleyensis W. BERRY, in Berry and Kelley, Proc. U. S. Nat. Mus., vol. 76, Art. 19, 1929, p. 4, pl. 2, fig. 2.—CUSHMAN, Tenn. Div. Geol., Bull. 41, 1931, p.

19, pl. 1, figs. 6, 7; Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 96, pl. 11, figs. 12, 13; Journ. Pal., vol. 6, 1932, p. 332.—SANDIDGE, l. c., 1932, p. 267, pl. 41, figs. 6-8.

This species is widely distributed throughout the upper and middle parts of the Taylor marl for which it is an excellent index fossil. A few records include the members of the lower part of the Navarro group which have numerous species in common with the Taylor group.

Family VERNEUILINIDAE

Genus TRITAXIA Reuss, 1860

TRITAXIA ELLISORAE Cushman (Pl. 1, fig. 6)

Tritaxia ellisorae CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 5, pl. 1, fig. 9; Special Publ. No. 7, 1937, p. 28, pl. 4, figs. 9, 10.

This species was described from material of Pecan Gap chalk age. It occurs at both stations and seems to be an index fossil for this part of the Cretaceous.

Genus PSEUDOCLAVULINA Cushman, 1936

PSEUDOCLAVULINA CLAVATA (Cushman) (Pl. 1, fig. 8)

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

This widely ranging species occurs at both stations.

Genus CLAVULINOIDES Cushman, 1936

CLAVULINOIDES TRILATERA (Cushman) (Pl. 1, fig. 7)

(For references see Special Publ. No. 7, Cushman Lab. Foram. Res., 1937, p. 121)

Typical specimens occur at both stations.

CLAVULINOIDES TRILATERA (Cushman), var. CONCAVA (Cushman) (Pl. 1, fig. 9)

(For references see Special Publ. No. 7, 1937, p. 121)

Specimens were found only at station 32.

CLAVULINOIDES ASPERA (Cushman) (Pl. 1, fig. 10)

(For references see Special Publ. No. 7, 1937, p. 122)

Specimens were found only at station 31.

Genus HETEROSTOMELLA Reuss, 1865

HETEROSTOMELLA AMERICANA Cushman (Pl. 1, figs. 11, 12)

(For references see Special Publ. No. 7, 1937, p. 142)

This is an index fossil for the Taylor group, although a few specimens from the Navarro resemble it. The microspheric and megalospheric forms are quite different in shape as shown in the figures. It is common at both stations.

Family VALVULINIDAE

Genus ARENOBULIMINA Cushman, 1927

ARENOBULIMINA AMERICANA Cushman (Pl. 1, fig. 13)

(For references see Special Publ. No. 8, 1937, p. 44)

This species ranges from the Austin group upward into the Navarro, but is most abundant in the Taylor group. It occurs at both stations.

Genus EGGERELLA Cushman, 1933

EGGERELLA (?) TROCHOIDES (Reuss) (Pl. 1, fig. 14)

(For references see Special Publ. No. 8, 1937, p. 46)

This seems to be a characteristic fossil of the upper part of the Taylor group with a very few records from the lower part of the Navarro group. It is rare at station 31.

Genus DOROTHIA Plummer, 1931

DOROTHIA STEPHENSONI Cushman (Pl. 1, figs. 15, 16)

Dorothia stephensoni CUSHMAN, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 28, pl. 4, fig. 15; Special Publ. No. 8, 1937, p. 82, pl. 8, figs. 31, 32.

This is a common species with a wide range in the American Upper Cretaceous, but is especially abundant in the Taylor marl. It occurs at both stations.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

There are numerous specimens belonging to this genus, but most of the available specimens represent young stages, and, in the present chaotic condition of the Cretaceous species of *Robulus*, cannot be identified with any reasonable degree of certainty.

EXPLANATION OF PLATE 1

(All figures × 50)

FIG. 1. *Reophax constrictus* (Reuss). 2. *Ammodiscus cretaceus* (Reuss). 3. *Ammobaculites stephensoni* Cushman. 4. *Spiroplectammina laevis* (Roemer), var. *cretosa* Cushman. 5. *Textularia ripleyensis* W. Berry. 6. *Tritaxia ellisorae* Cushman. 7. *Clavulinoides trilatera* (Cushman). 8. *Pseudoclavulina clavata* (Cushman). 9. *Clavulinoides trilatera* (Cushman), var. *concava* (Cushman). 10. *C. aspera* (Cushman). 11, 12. *Heterostomella americana* Cushman. 11, Megalospheric form; 12, microspheric form. 13. *Arenobulimina americana* Cushman. 14. *Eggerella* (?) *trochoides* (Reuss). 15, 16. *Dorothia stephensoni* Cushman. 17. *Planularia tricarinella* (Reuss). 18. *Marginulina cretacea* Cushman. 19. *Nodosaria* cf. *aspera* Reuss. 20. *Marginulina* cf. *tripleura* (Reuss). 21. *M. bullata* Reuss. 22. *M. munda* Cushman. 23. *M.* sp. 24. *Dentalina lorneiana* d'Orbigny. 25. *D. basitorta* Cushman. 26. *Marginulina* cf. *recta* (d'Orbigny). 27. *Dentalina megalopolitana* Reuss. 28. *D. gracilis* d'Orbigny. 29. *D. solvata* Cushman. 30. *D. catenula* Reuss. 31. *D. alternata* (Jones).


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Genus PLANULARIA Defrance, 1824

PLANULARIA TRICARINELLA (Reuss) (Pl. 1, fig. 17)

(For references see these Contributions, vol. 17, 1941, p. 69)

The only American Cretaceous record for this species is from the Pecan Gap chalk. It is rare at station 31.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA STEPHENSONI Cushman

Marginulina stephensoni CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 93, pl. 13, figs. 10, 11.

This species apparently ranges from the Austin group to the lower part of the Navarro group. It is rare at station 31.

MARGINULINA MUNDA Cushman (Pl. 1, fig. 22)

Marginulina munda CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 34, pl. 5, figs. 11, 12.

This species is recorded only from its type locality, the upper part of the Taylor marl, 0.3 miles by road SE. of Gastonia, Kaufman Co., Texas. It is rare at station 31.

MARGINULINA cf. RECTA (d'Orbigny) (Pl. 1, fig. 26)

A few specimens from station 31 are apparently related to this species described by d'Orbigny from the Cretaceous, White Chalk, of the Paris Basin. It occurs rarely in the upper part of the Taylor marl of Texas.

MARGINULINA CRETACEA Cushman (Pl. 1, fig. 18)

Marginulina cretacea CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 94, pl. 13, figs. 12-15.

The range of this species is apparently confined to the Taylor group and the lower part of the Navarro group. It occurs at both stations.

EXPLANATION OF PLATE 2

(Figs. 1 and 33, × 38; others, × 50)

FIG. 1. *Nodosaria affinis* Reuss. 2. *N. obscura* Reuss. 3. *N. proboscidea* Reuss. 4. *Pseudoglandulina lagenoides* (Olszewski). 5. *Saracenaria triangularis* (d'Orbigny). 6. *Palmula rugosa* (d'Orbigny). 7. *Frondicularia linearis* Franke. 8. *F. archiaciana* d'Orbigny. 9. *F. frankei* Cushman. 10. *F. intermittens* Reuss. 11. *Dentalina aculeata* d'Orbigny. 12. *Lagena* cf. *acuticosta* Reuss. 13. *L.* cf. *apiculata* Reuss. 14. *L.* cf. *substriata* Williamson. 15. *Globulina* cf. *lacrima* Reuss. 16. *Pyrulina* cf. *cylindroides* (Roemer). 17. *Bolivinopsis rosula* (Ehrenberg). 18. *Gümbelina plummerae* Loetterle. 19. *G. striata* (Ehrenberg). 20. *G. planata* Cushman. 21. *G. globocarinata* Cushman. 22. *Bolivinoides decorata* (Jones), var. *delicatula* Cushman. 23. *B. decorata* (Jones). 24. *Buliminella carseyae* Plummer. 25. *Bulimina reussi* Morrow. 26. *Virgulina tegulata* Reuss. 27. *Bolivina cretosa* Cushman. 28. *Loxostoma cushmani* Wickenden. 29. *Pleurostomella subnodosa* Reuss. 30. *Eouvigerina gracilis* Cushman. 31. *Pseudouvigerina cretacea* Cushman. 32. *Nodosarella gracillima* Cushman. 33. *Bullopora laevis* (Sollas).

MARGINULINA cf. TRIPLEURA (Reuss) (Pl. 1, fig. 20)

Marginulina cf. *tripleura* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 95, pl. 14, figs. 5, 6.

The few occurrences of this form are from the Taylor group and the Neylandville marl of the lower part of the Navarro group. It occurs rarely at station 31.

MARGINULINA BULLATA Reuss (Pl. 1, fig. 21)

Marginulina bullata REUSS, Verstein. böhm. Kreide., pt. 1, 1845, p. 29, pl. 13, figs. 34-38.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 96, pl. 14, figs. 9-15.

The American Cretaceous occurrences of this species are almost entirely in the Taylor group, with very rare ones in the lower part of the Navarro group. It is rare at station 31.

MARGINULINA sp. (Pl. 1, fig. 23)

A single incomplete specimen from station 32 is figured. The same form was found in a sample of the upper part of the Taylor marl, branch of Kickapoo Creek, 1200 feet S. of public road, 1.8 miles NW. of Annona, Red River Co., Texas. It may prove to be a good index fossil for this part of the Taylor.

Genus DENTALINA d'Orbigny, 1826

DENTALINA ALTERNATA (Jones) (Pl. 1, fig. 31)

(For references see these Contributions, vol. 16, 1940, p. 76)

Specimens of this species are easily broken and only fragmentary ones occur at both stations. It ranges from the upper part of the Austin group into the lower part of the Navarro group.

DENTALINA GRACILIS d'Orbigny (Pl. 1, fig. 28)

(For references see these Contributions, vol. 18, 1942, p. 57)

Specimens referable to this species occur throughout most of the American Upper Cretaceous section. It is rare at station 31.

DENTALINA LORNEIANA d'Orbigny (Pl. 1, fig. 24)

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

This widely ranging species occurs at station 31.

DENTALINA BASITORTA Cushman (Pl. 1, fig. 25)

Dentalina basitorta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 37, pl. 6, figs. 4, 5; vol. 16, 1940, p. 80, pl. 13, figs. 21, 22.—CUSHMAN and HEDBERG, l. c., vol. 17, 1941, p. 88, pl. 21, fig. 24.

This species is almost entirely confined to the Taylor marl or its equivalents. It occurs at station 31.

DENTALINA ACULEATA d'Orbigny (Pl. 2, fig. 11)

Dentalina aculeata D'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 13, pl.

1, figs. 2, 3.—REUSS, in Geinitz, Grundr. Verstein., 1845-46, p. 654, pl. 24, fig. 10. —CUSHMAN, Journ. Pal., vol. 6, 1932, p. 335, pl. 50, fig. 7.

Broken specimens referable to this species occur at both stations. No complete specimens have been obtained. They may possibly belong to *Ramulina*.

DENTALINA MEGALOPOLITANA Reuss (Pl. 1, fig. 27)

(For references see these Contributions, vol. 16, 1940, p. 80)

In the American Cretaceous, specimens referable to this species occur mostly in the Taylor marl or its equivalents, but there are a few records from the Navarro group. It is rare at station 32.

DENTALINA CATENULA Reuss (Pl. 1, fig. 30)

Dentalina catenula REUSS, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 185, pl. 3, fig. 6. —CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 81, pl. 13, figs. 29-34.

This species seems to be largely confined to the upper and middle parts of the Taylor group with a few records from the lower part of the Navarro group. It occurs in some numbers at station 31.

DENTALINA SOLVATA Cushman (Pl. 1, fig. 29)

Dentalina solvata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 39, pl. 6, figs. 9-14; vol. 16, 1940, p. 83, pl. 14, figs. 13-17.

Typical specimens occur at station 31. Most of the occurrences of this species are in the Taylor group with rare ones in the Austin and lower part of the Navarro group.

Genus NODOSARIA Lamarck, 1812

NODOSARIA AFFINIS Reuss (Pl. 2, fig. 1)

(For references see these Contributions, vol. 18, 1942, p. 58)

This widely ranging species occurs at both stations.

NODOSARIA cf. ASPERA Reuss (Pl. 1, fig. 19)

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

The American Cretaceous records for this species are almost entirely from beds of Taylor age. It is very rare at station 31.

NODOSARIA OBSCURA Reuss (Pl. 2, fig. 2)

(For references see these Contributions, vol. 16, 1940, p. 90, and additions below)

Nodosaria obscura TAPPAN, Journ. Pal., vol. 14, 1940, p. 104, pl. 16, figs. 7, 8.— VIEAUX, l. c., vol. 15, 1941, p. 627 (list).—Lozo, Bull. Amer. Assoc. Petr. Geol., vol. 27, 1943, p. 1066 (list).—TAPPAN, Journ. Pal., vol. 17, 1943, p. 496, pl. 80, figs. 1, 2.

The species in the American Upper Cretaceous occurs mainly in the upper beds of Taylor age and lower beds of Navarro age. The above additional records are from the Lower Cretaceous. It occurs rarely at station 31.

NODOSARIA PROBOSCIDEA Reuss (Pl. 2, fig. 3)

Nodosaria proboscidea REUSS, in Haidinger's Nat. Abhandl., vol. 4, 1851, p. 23, pl. 1, fig. 6.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 89, pl. 16, figs. 8, 9.

The few American Cretaceous records for this species are from the upper part of the Taylor marl. It is rare at station 31.

Genus PSEUDOGLANDULINA Cushman, 1929

PSEUDOGLANDULINA LAGENOIDES (Olszewski) (Pl. 2, fig. 4)

(For references see these Contributions, vol. 17, 1941, p. 89)

The American records for this species are from the beds of Navarro age and the upper beds of Taylor age. Specimens occur at station 31.

Genus SARACENARIA Defrance, 1824

SARACENARIA TRIANGULARIS (d'Orbigny) (Pl. 2, fig. 5)

Cristellaria triangularis D'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 27, pl. 2, figs. 21, 22.

Saracenaria triangularis CUSHMAN and CHURCH, Proc. Calif. Acad. Sci., ser. 4, vol. 18, 1929, p. 505, pl. 37, figs. 13, 14.—CUSHMAN and HEDBERG, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 88, pl. 21, fig. 35.

There are numerous Cretaceous records for this species, many of them not typical. In the American Cretaceous it ranges from the Austin group into the lower beds of Navarro age, but is most common in the Taylor group. It occurs at both stations.

Genus PALMULA Lea, 1833

PALMULA RUGOSA (d'Orbigny) (Pl. 2, fig. 6)

(For references see these Contributions, vol. 11, 1935, p. 83)

In the American Cretaceous this species is most frequent in beds of Taylor age, although the records include a few in the Navarro group and one in the upper part of the Austin group. It occurs at both stations.

Genus FRONDICULARIA Defrance, 1826

FRONDICULARIA GOLDFUSSI Reuss

(For references see these Contributions, vol. 17, 1941, p. 91)

The American Cretaceous records are mostly from the beds of Taylor age with a few from the upper part of the Austin group. It is rare at station 31.

FRONDICULARIA LINEARIS Franke (Pl. 2, fig. 7)

(For references see these Contributions, vol. 12, 1936, p. 21)

In the American Cretaceous the range of this species seems to be from the upper beds of Austin age through most of the beds of Taylor age. It is rare at station 31.

FRONDICULARIA INTERMITTENS Reuss (Pl. 2, fig. 10)

(For references see these Contributions, vol. 18, 1942, p. 61)

This species is a characteristic one of beds of Taylor age, especially of the upper part. It is rare at station 31.

FRONDICULARIA FRANKEI Cushman (Pl. 2, fig. 9)

(For references see these Contributions, vol. 12, 1936, p. 18)

This species is characteristic of the upper and middle beds of Taylor age, although there are a few records from the lower beds of Navarro age. Typical specimens occur at station 31.

FRONDICULARIA ARCHIACIANA d'Orbigny (Pl. 2, fig. 8)

(For references see these Contributions, vol. 12, 1936, p. 19)

This species, in the American Cretaceous, is characteristic of beds of Taylor age with a few records from the lower beds of Navarro age. It occurs rarely at both stations.

Genus LAGENA Walker and Jacob, 1798

LAGENA cf. ACUTICOSTA Reuss (Pl. 2, fig. 12)

Specimens referred to this species occur commonly at station 32 but very rarely at station 31.

LAGENA cf. APICULATA Reuss (Pl. 2, fig. 13)

A single specimen from station 31 may be referred to this species.

LAGENA cf. SUBSTRIATA Williamson (Pl. 2, fig. 14)

A single specimen from station 31 resembles this species.

Family POLYMORPHINIDAE

Genus GLOBULINA d'Orbigny, 1826

GLOBULINA cf. LACRIMA Reuss (Pl. 2, fig. 15)

A single specimen from station 32 may be referred questionably to this species.

Genus PYRULINA d'Orbigny, 1839

PYRULINA cf. CYLINDROIDES (Roemer) (Pl. 2, fig. 16)

Rare specimens from station 31 seem related to this species.

Genus BULLOPORA Quenstedt, 1856

BULLOPORA LAEVIS (Sollas) (Pl. 2, fig. 33)

(For references see these Contributions, vol. 19, 1943, p. 63)

This species seems to have a wide vertical range from the upper part of the Austin group to the Navarro. The specimen from station 31 shows several connected chambers attached to a small pebble.

Family HETEROHELICIDAE

Genus BOLIVINOPSIS Yakovlev, 1891

BOLIVINOPSIS ROSULA (Ehrenberg) (Pl. 2, fig. 17)

(For references see these Contributions, vol. 19, 1943, p. 64)

This species has a wide range in the American Upper Cretaceous. It occurs at both stations.

Genus GÜMBELINA Egger, 1899

GÜMBELINA PLUMMERAE Loetterle (Pl. 2, fig. 18)

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

The range of this species is from the upper beds of Austin age through the Taylor group and into the Neylandville marl of the lower part of the Navarro group. It occurs at both stations.

GÜMBELINA STRIATA (Ehrenberg) (Pl. 2, fig. 19)

(For references see these Contributions, vol. 18, 1942, p. 63)

While the range of this species in the American Cretaceous is from beds of Austin age through the Taylor group into the Neylandville marl of the lower part of the Navarro group, it is found most frequently in the upper beds of Taylor age. It occurs at station 31.

GÜMBELINA PLANATA Cushman (Pl. 2, fig. 20)

Gümbelina planata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 12, pl. 2, figs. 13, 14.

This species is known only from the upper portion of the Taylor marl. It occurs rarely at station 31.

GÜMBELINA PSEUDOTESSERA Cushman

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.

Gümbelina pseudotessera CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 14, pl. 2, figs. 19-21.

This species apparently ranges through the Austin and Taylor groups. It occurs at station 32.

GÜMBELINA GLOBOCARINATA Cushman (Pl. 2, fig. 21)

Gümbelina globocarinata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 10, pl. 2, figs. 4, 5.—CUSHMAN and DEADERICK, l. c., vol. 18, 1942, p. 63.

From available records the vertical range of this species seems to be from the Austin group, through the Taylor, and into horizons equivalent to the Neylandville marl of the Navarro group, but not above. It occurs at station 32.

Genus BOLIVINOIDES Cushman, 1927

BOLIVINOIDES DECORATA (Jones) (Pl. 2, fig. 23)

Bolivina decorata JONES (in Wright), Proc. Belfast Nat. Field Club, 1884-85 (1886),

Appendix 9, p. 330, pl. 27, figs. 7, 8.—WRIGHT (in Welch), Irish Naturalist, 1902, p. 179 (list).—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1909, p. 336; 1910, p. 409, pl. 7, figs. 1, 2.—MACFADYEN, Geol. Mag., vol. 69, 1932, p. 487 (list), pl. 35, fig. 20.

Bolivinoides decorata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 4, 1927, p. 89, pl. 12, fig. 9; Special Publ. No. 5, 1933, pl. 26, fig. 18.—SANDIDGE, Amer. Midland Nat., vol. 13, 1932, p. 196, pl. 19, fig. 16.—COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 4, fig. 9.

The typical form of the species occurs most commonly in the upper and middle beds of Taylor age with rare occurrences in the Navarro group. It is common at both stations.

BOLIVINOIDES DECORATA (Jones), var. DELICATULA Cushman (Pl. 2, fig. 22)

Bolivina decorata CUSHMAN (not JONES), Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 586, pl. 15, fig. 11.—WHITE, Journ. Pal., vol. 3, 1929, p. 43, pl. 5, fig. 1.—PLUMMER, Univ. Texas Bull. 3101, 1931, p. 181, pl. 10, fig. 10.

Bolivinoides decorata (JONES), var. *delicatula* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 4, 1927, p. 90, pl. 12, fig. 8; Journ. Pal., vol. 1, 1927, p. 158, pl. 28, fig. 7.—CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 99, pl. 14, fig. 9.—CUSHMAN, Journ. Pal., vol. 5, 1931, p. 308, pl. 35, fig. 13.—CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 42, pl. 13, fig. 2.—CUSHMAN, Journ. Pal., vol. 6, 1932, p. 338, pl. 51, fig. 6; Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 26, fig. 19.

The variety has nearly the same range as the typical form, but is usually less common and frequently does not occur with it. It is present at station 31.

Genus EOUVIGERINA Cushman, 1926

EOUVIGERINA GRACILIS Cushman (Pl. 2, fig. 30)

Eouvigerina gracilis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 1, 1926, p. 5, pl. 1, fig. 2; Special Publ. No. 4, 1933, pl. 21, fig. 16.—ALBRITTON and PHLEGER, Journ. Pal., vol. 11, 1937, p. 351.—CUSHMAN, Foraminifera, their Classification and Economic Use, 3rd. Ed., 1940, pl. 21, fig. 16.

This species seems to be an index fossil for Cretaceous beds of Taylor age. It is rare at station 31.

Genus PSEUDOUVIGERINA Cushman, 1927

PSEUDOUVIGERINA CRETACEA Cushman (Pl. 2, fig. 31)

Pseudouvigerina cretacea CUSHMAN, Tenn. Div. Geol., Bull. 41, 1931, p. 46, pl. 7, fig. 14; Journ. Pal., vol. 6, 1932, p. 339.—COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 4, fig. 3.

Pseudouvigerina plummerae CUSHMAN (not CUSHMAN, 1927), Journ. Pal., vol. 5, 1931, p. 309, pl. 35, fig. 18.

The few records for this species give it a wide range from Austin to Navarro. It occurs at station 31.

PSEUDOUVIGERINA cf. PLUMMERAE Cushman

A single incomplete specimen from station 31 is the only one referable to this species.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA CARSEYAE Plummer (Pl. 2, fig. 24)

Bulimina compressa CARSEY (as n. sp.), Univ. Texas Bull. 2612, 1926, p. 29, pl. 4, fig. 14.

Buliminella carseyae PLUMMER, l. c., Bull. 3101, 1931, p. 179, pl. 8, fig. 9.—CUSHMAN, Journ. Pal., vol. 6, 1932, p. 340.—CUSHMAN and PARKER, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 8, pl. 2, fig. 6.—LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 37, pl. 5, fig. 10.—COLE, Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 4, fig. 2.

The range of this species is from the Austin group to the lower part of the Navarro group. It occurs commonly at both stations.

Genus BULIMINA d'Orbigny, 1826

BULIMINA REUSSI Morrow (Pl. 2, fig. 25)

(For references see these Contributions, vol. 17, 1941, p. 95)

The range of this species is from the Austin group through the Taylor to beds of early Navarro age. It occurs at both stations.

Genus NEOBULIMINA Cushman and Wickenden, 1928

NEOBULIMINA cf. SPINOSA Cushman and Parker

A few specimens from station 31 may be referred to this species. The known range is through beds of Taylor age into the lower beds of Navarro age.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA TEGULATA Reuss (Pl. 2, fig. 26)

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.

This species extends throughout the American Cretaceous except the upper beds of Navarro age. It occurs at both stations.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA CRETOSA Cushman (Pl. 2, fig. 27)

(For references see Special Publ. No. 9, 1937, p. 43)

The range of this species is mostly in beds of Taylor age with a few records from the Navarro group. It occurs at both stations.

Genus LOXOSTOMA Ehrenberg, 1854

LOXOSTOMA CUSHMANI Wickenden (Pl. 2, fig. 28)

(For references see these Contributions, vol. 18, 1942, p. 63)

The range of this species is mostly confined to beds of Austin and

Taylor age. It is fairly common at station 31, but the crenulations are not strongly developed, and are only near the apertural end.

Family ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA Reuss, 1860

PLEUROSTOMELLA SUBNODOSA Reuss (Pl. 2, fig. 29)

(For references see Journ. Pal., vol. 6, 1932, p. 341)

This seems to be an index fossil for beds of Taylor age. It occurs at both stations. Cole records it from Selma chalk well samples from Florida (Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 4, fig. 7).

Genus NODOSARELLA Rzehak, 1895

NODOSARELLA GRACILLIMA Cushman (Pl. 2, fig. 32)

Nodosarella gracillima CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 64, pl. 7, fig. 14.

Nodosarella sp. MORROW, Journ. Pal., vol. 8, 1934, p. 197, pl. 29, figs. 2, 3.

This species is found mostly in beds of Austin age and in the lower beds of the Taylor group. It is rare at station 31.

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA PLUMMERAE Loetterle (Pl. 3, fig. 1)

Gyroidina nitida PLUMMER (not REUSS), Univ. Texas Bull. 3101, 1931, p. 191, pl. 14, fig. 5.

Valvulineria plummerae LOETTERLE, Nebraska Geol. Survey, 2d ser., Bull. 12, 1937, p. 41, pl. 6, figs. 5, 6.

This species occurs in beds of Austin and Taylor age. It occurs at station 31.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA DEPRESSA (Alth) (Pl. 3, fig. 2)

(For references see these Contributions, vol. 17, 1941, p. 97)

This is a wide ranging species in the American and European Cretaceous. It is very rare at station 31.

GYROIDINA GLOBOSA (Hagenow) (Pl. 3, fig. 3)

(For references see these Contributions, vol. 17, 1941, p. 97)

This species is particularly characteristic of beds of Taylor age, but it extends also into the upper beds of Austin age and lower beds of Navarro age. It occurs at both stations.

GYROIDINA cf. GIRARDANA (Reuss)

A few specimens from station 31 have an angled periphery, and may be placed under this species. It is variable in this character, however.

Genus STENSIÖINA Brotzen, 1936

STENSIÖINA AMERICANA Cushman and Dorsey (Pl. 3, fig. 4)

Cibicides excolata CUSHMAN (not *Truncatulina excolata* CUSHMAN, 1926), Journ. Pal., vol. 5, 1931, p. 315, pl. 36, fig. 8; l. c., vol. 6, 1932, p. 345.

Stensiöina excolata COLE (not CUSHMAN), Florida Dept. Conservation, Geol. Bull. 16, 1938, p. 35 (list), pl. 3, figs. 2, 3.

Stensiöina americana CUSHMAN and DORSEY, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 5, pl. 1, fig. 7.

This species ranges throughout beds of Taylor age, and occurs less commonly in the lower beds of Navarro age. It is common at station 32, but was not found at all at station 31.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA TEXANA Cushman (Pl. 3, fig. 5)

Pulvinulinella texana CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 49, pl. 8, fig. 8.

This is a characteristic species of beds of Taylor age with rare occurrences in the Neylandville marl and Saratoga chalk of the lower part of the Navarro group. It is common at both localities.

Family CHILOSTOMELLIDAE

Genus ALLOMORPHINA Reuss, 1850

ALLOMORPHINA MINUTA Cushman (Pl. 3, fig. 7)

Allomorphina minuta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 72, pl. 13, fig. 3.

Previous records are from the upper part of the Austin chalk. This is the first record from beds of Taylor age. It occurs rarely at station 31.

Genus PULLENIA Parker and Jones, 1862

PULLENIA AMERICANA Cushman (Pl. 3, fig. 6)

(For references see these Contributions, vol. 19, 1943, p. 7)

This species is most common in beds of Taylor age, but also occurs in those of Navarro age, especially the lower part. It occurs at both stations.

Family GLOBIGERINIDAE

Specimens belonging to the genera *Globigerina* and *Globigerinella* occur at both stations. Specific names cannot be given until more work is done on the types of the various species.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

GLOBOTRUNCANA CANALICULATA (Reuss) (Pl. 3, fig. 8)

Rosalina canaliculata REUSS, Denkschr. Akad. Wiss. Wien, vol. 7, 1854, p. 70, pl. 26, fig. 4.

Globigerina canaliculata EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 172, pl. 21, figs. 15-17, 24-26.

Globotruncana canaliculata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 116, pl. 23, fig. 11.—WHITE, Journ. Pal., vol. 2, 1928, p. 282, pl. 38, fig. 3. —CUSHMAN, l. c, vol. 6, 1932, p. 343, pl. 51, fig. 14.—CUSHMAN and DEADERICK, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 65, pl. 15, figs. 23-27.

This species has a wide range in the American Cretaceous. It occurs at both stations.

GLOBOTRUNCANA MARGINATA (Reuss) (Pl. 3, fig. 9)

Rosalina marginata REUSS, Verstein. böhm. Kreide., pt. 1, 1845, p. 36, pl. 8, figs. 54, 74; pl. 13, fig. 68.

Globotruncana marginata THALMANN, Eclogae geol. Helvetiae, vol. 27, 1934, p. 414 (list).—JEDLITSCHKA, Mitth. nat. Ver. Troppau, C. S. R., 1935, p. 14.—GLAESSNER, Studies in Micropaleontology, vol. 1, fasc. 1, 1937, p. 38.

Typical specimens of this species are most common in beds of Austin age and lower beds of Taylor age, although it occurs also in beds referred to the Neylandville marl of Navarro age. It occurs only at station 31.

GLOBOTRUNCANA ARCA Cushman (Pl. 3, fig. 10)

(For references see these Contributions, vol. 19, 1943, p. 71)

Nearly all the records for this species are from beds of Taylor age with a very few from the Navarro group. It occurs at both stations, more abundantly at station 31.

GLOBOTRUNCANA FORNICATA Plummer (Pl. 3, fig. 11)

(For references see these Contributions, vol. 17, 1941, p. 99)

The range of this species is through the Taylor group up to the Neylandville marl of the Navarro. It occurs very rarely in the Corsicana marl member of the Navarro group (Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 71). Specimens referred to this species occur at both stations.

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA MICHELINIANA (d'Orbigny) (Pl. 3, fig. 13)

Rotalina micheliniana D'ORBIGNY, Mém. Soc. géol. France, ser. 1, vol. 4, 1840, p. 31, pl. 3, figs. 1-3.

Globorotalia micheliniana CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 45, pl. 6, fig. 8; Special Publ. No. 5, 1933, pl. 35, fig. 13; Foraminifera, their Classification and Economic Use, 3rd. Ed., 1940, Key, pl. 35, fig. 13.

Gyroidina micheliniana CUSHMAN, Journ. Pal., vol. 6, 1932, p. 342, pl. 51, fig. 12.

Eponides micheliniana PLUMMER, Univ. Texas Bull. 3101, 1931, p. 192, pl. 14, fig. 11.

Truncatulina refulgens (MONTFORT), var. *conica* CARSEY, l. c., Bull. 2612, 1926, p. 46, pl. 4, fig. 15.

Gyroidina alabamensis SANDIDGE, Journ. Pal., vol. 6, 1932, p. 283, pl. 43, figs. 13-15.

Although from a few localities in beds of Austin age, the largest number of records is from beds of Taylor age. The species is especially abundant in the more chalky phases of the middle and upper beds. It is common at both stations.

GLOBOROTALIA MEMBRANACEA (Ehrenberg) (Pl. 3, fig. 12)

(For references see these Contributions, vol. 19, 1943, p. 71)

The American Cretaceous records are mostly from the Velasco shale of Mexico. It occurs also in the Corsicana marl member of the upper part of the Navarro. A very few specimens apparently of this species occur at station 32.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA AMMONOIDES (Reuss) (Pl. 3, fig. 14)

Rosalina ammonoides REUSS, Geogn. Skizzen Böhmen, vol. 2, pt. 1, 1844, p. 214; Verstein. böhm. Kreide., pt. 1, 1845, p. 36, pl. 8, fig. 53; pl. 13, fig. 66.

Anomalina ammonoides CHAPMAN, Quart. Journ. Geol. Soc., vol. 50, 1894, p. 722.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 28, pl. 5, figs. 4, 5.

The range of this species in the American Cretaceous is apparently limited to beds of Austin and Taylor age. It is common at both stations.

ANOMALINA PINGUIS Jennings (Pl. 3, fig. 15)

Anomalina pinguis JENNINGS, Bull. Amer. Pal., vol. 23, No. 78, 1936, p. 37, pl. 5, fig. 1.

Anomalina grosserugosa PLUMMER (not GÜMBEL), Univ. Texas Bull. 3101, 1931, p. 201, pl. 14, fig. 9.

Specimens from both stations seem to be identical with this species.

Genus PLANULINA d'Orbigny, 1826

PLANULINA TAYLORENSIS (Carsey) (Pl. 3, fig. 17)

(For references see these Contributions, vol. 18, 1942, p. 15)

This species is particularly characteristic of beds of Taylor age with a few records from the lower beds of Navarro age. It is common at both stations.

Genus CIBICIDES Montfort, 1808

CIBICIDES STEPHENSONI Cushman (Pl. 3, fig. 16)

Cibicides stephensoni CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 70, pl. 12, fig. 5; vol. 16, 1940, p. 37, pl. 7, fig. 2.

This species is most common in the upper beds of Taylor age, but extends upward into the lower beds of Navarro age. It occurs at both stations.

CIBICIDES BEAUMONTIANUS (d'Orbigny) (Pl. 3, fig. 18)

(For references see these Contributions, vol. 16, 1940, p. 39)

In the American Cretaceous the range of this species is from the Annona chalk member of the Taylor to the Saratoga chalk member of the Navarro. It is common at both stations.

CIBICIDES cf. CONSTRICTUS (Hagenow) (Pl. 3, fig. 19)

(For references see these Contributions, vol. 16, 1940, p. 40)

A few specimens from station 32 resemble this species. It has been previously recorded from the Saratoga chalk.

FORAMINIFERA FROM THE AQUIA FORMATION OF VIRGINIA*

By Joseph A. Cushman

Although the mega-fossils of the Eocene of the Atlantic Coastal Plain region of the United States are fairly well known, very little is recorded in regard to micro-fossils, especially the Foraminifera. Recent well drillings in eastern Virginia[1] have produced samples which it is important to have placed correctly as to their geologic age. The samples are often fairly rich in foraminifera, but faunas recorded in the literature with which they may be compared are mostly from rather remote areas. To make available data from the immediate areas, field samples were collected by Mr. D. J. Cederstrom of the U. S. Geological Survey. This work was done as part of the cooperative investigation of Coastal Plain geology and ground water resources by the State and Federal Surveys. The samples have been prepared and the faunas mounted for study. The results are given in the following pages.

There are a few species represented by single specimens or immature or broken ones that are not included here. The relationships of the fauna are very interesting, and definitely place the age of the beds as Wilcox Eocene. The fauna as a whole indicates that it lived in waters of considerable depth.

Undoubtedly some of the species recorded by Bagg in the Eocene volume of the Maryland Geological Survey (1901) are of equivalent age with these from Virginia. No attempt has been made to place these in the synonymy as the figures are somewhat conventionalized, and the actual specimens should be studied.

The collections included here from Marlboro Point are from prac-

1 Cederstrom, D. J., Deep Wells in the coastal plain of Virginia. Virginia Geol. Survey, Reprint Ser. No. 6, 1943.

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tically the type locality of the Aquia formation. This section is probably identical with Gildersleeve's Section 2.[2] The sample from the *Turritella* beds at Fairview Beach may be compared with Gildersleeve's Section 6,[3] and may possibly be classed as belonging to the Nanjemoy formation. The third locality contains Eocene mega-fossils. The three localities have many species in common, as will be shown.

List of Stations

From Marlboro Point, between the mouths of Potomac and Aquia Creeks on the Potomac River, Stafford Co., Va.

1. 0-2 feet.
2. 2-8 feet.
3. 8-14 feet, to bottom of first ledge.
4. In first rock layers at 15 feet.
5. 16-19 feet, above first rock layer.
6. 19-22 feet, below second rock layer.
7. 22-28 feet.
8. 28-34 feet.
9. 40-46 feet.
10. 52-58 feet.

From Fairview Beach, south shore of Potomac River, south of Maryland Point, King George Co., Va.

11. Soft streaks in *Turritella* beds.

From 0.5 mi. SE. Stafford Court House, Stafford Co., Va., elev. 180 ft.

12. Eocene rocky fossil ledge.

Family SACCAMMINIDAE

Genus SACCAMMINA M. Sars, 1869

SACCAMMINA SPHAERICA M. Sars (Pl. 3, fig. 20)

Rare specimens resembling this species occur at station 10. The only previous American Tertiary record for this species is that of Cole from the Eocene, Chapapote formation, of Mexico. (Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 204 (4), pl. 3, fig. 15).

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX CURTUS Cushman (Pl. 3, fig. 21)

Reophax curtus CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 8, pl. 2, figs.

2 Gildersleeve, Benjamin, Eocene of Virginia. Virginia Geol. Survey, Bull. 57, 1942, p. 18.
3 L. c., p. 21.

2, 3; Contr. Canadian Biol., 1921 (1922), p. 139.—HADA, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. 6, 1931, p. 57, text fig. 8.—EARLAND, *Discovery* Rep'ts,

vol. 10, 1934, p. 79; vol. 13, 1936, p. 30.—CUSHMAN and MCCULLOCH, Allan Hancock Pacific Exped., vol. 6, No. 1, 1939, p. 58, pl. 2, fig. 12.

This species has not previously been recorded as a fossil. Specimens are typical, having three chambers in the adult, rapidly increasing in size, and composed of coarse grains. The species is fairly common at station 11, and rare at stations 6, 9, and 12.

A single specimen, apparently the later chambers of a species of *Reophax*, also occurred and is figured for reference (Pl. 3, fig. 22).

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES sp. (Pl. 3, fig. 23)

The figured specimen from station 5 is the only representative of this species. It is a much compressed form with very indistinct sutures.

HAPLOPHRAGMOIDES cf. SPHAERILOCULUM Cushman (Pl. 3, fig. 24)

There are no fossil records for this species, but these specimens from Virginia are very similar to Recent ones. They are rare at stations 11 and 12.

Genus AMMOBACULITES Cushman, 1910

AMMOBACULITES sp. (Pl. 3, fig. 25)

Although represented by but a single specimen from station 12, it seems definite enough in its characters to be placed on record until more specimens may be found.

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA WILCOXENSIS Cushman and Ponton (Pl. 3, figs. 26, 27)

Spiroplectammina wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 51, pl. 7, fig. 1.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 78, pl. 13, figs. 1, 2.—TOULMIN, Journ. Pal., vol. 15, 1941, p. 571, pl. 78, fig. 1. —CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 8, pl. 1, figs. 1, 2.

This is a characteristic and common species of the Wilcox Eocene. It was described from the Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala., and has been recorded from the Bashi formation of Woods Bluff and near Yellow Bluff, Alabama. Toulmin recorded it from the Wilcox, Salt Mountain limestone, of Clark Co., Ala. It is abundant in the Virginia material, occurring at stations 3, 4, 6, 7, 9, 10, 11, and 12.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA sp.

A few very small specimens probably belong to *Gaudryina*, but it

seems best to await more material before trying to specifically identify them. They are rare at stations 5, 11, and 12.

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1859

TROCHAMMINA HOWEI Cushman, n. sp. (Pl. 3, fig. 28)

Test small, dorsal side slightly convex, ventral side less convex, somewhat umbilicate, periphery broadly rounded, composed of about three whorls; chambers four to the whorl, gradually increasing in size, those of the adult whorl increasing only slightly, somewhat inflated, especially on the ventral side; sutures nearly straight, slightly depressed on the dorsal side, nearly radial and strongly depressed on the ventral side; wall distinctly arenaceous but smoothly finished; aperture on the ventral side of the last-formed chamber, elongate, slightly arched, with a slightly developed, overhanging lip. Length 0.30-0.38 mm.; breadth 0.24-0.30 mm.; thickness 0.07-0.09 mm.

Holotype (Cushman Coll. No. 39685) from the Eocene, Aquia formation, *Turritella* beds, Fairview Beach, King George Co., Va.

The species differs from *Trochammina teasi* Cushman and Ellisor of the Eocene of Texas in the less compressed test, rounded periphery, and umbilicate ventral side, and from *T. claibornensis* Howe from the Claiborne Eocene of Louisiana in the much broader chambers, straight sutures, and umbilicate ventral side. The new species is named in honor of Dr. H. V. Howe.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS WILCOXENSIS Cushman and Ponton (Pl. 3, figs. 29, 30)

Robulus wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 52, pl. 7, fig. 3.—TOULMIN, Journ. Pal., vol. 15, 1941, p. 579, pl. 78, figs. 24, 25, text fig. 2H.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 27, pl. 5, fig. 7.

This characteristic species was described from material of Wilcox Eocene age, Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala. Toulmin recorded it from the Wilcox Eocene, Salt Mountain limestone, of Clark Co., Ala., and from the upper Midway limestone of Fort Gaines, Ala. Cushman and Todd recorded it from the Paleocene, Naheola formation, of Alabama. In the Virginia material it is common, and occurs at stations 7, 8, 9, 10, and 11.

ROBULUS cf. KNIGHTI Toulmin (Pl. 4, fig. 1)

A single specimen from station 10 resembles this species described

from the Wilcox Eocene, Salt Mountain limestone, of Alabama, but it is not entirely typical.

ROBULUS sp. (Pl. 4, fig. 2)

The figured specimen is very similar to that figured by Howe from the Cook Mountain Eocene as "*Lenticulina guayabalensis* Cole" (Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 42, pl. 5, fig. 7). A comparison with paratypes of Cole's species shows it not to be the same. His Mexican form has straighter sutures, more strongly developed keel, and higher umbo.

Genus DARBYELLA Howe and Wallace, 1933

DARBYELLA WILCOXENSIS Cushman and Garrett (Pl. 4, fig. 3)

Darbyella wilcoxensis CUSHMAN and GARRETT, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 79, pl. 13, figs. 11, 12.—CURRAN, Bull. Amer. Assoc. Petr. Geol., vol. 27, 1943, p. 1378 (list).

The types of this species are from the Wilcox Eocene, Bashi formation, of Woods Bluff, Ala. It has been recorded from the Eocene "Tejon" of the Chico Martinez Creek area, Kern Co., Calif. The only specimen found in the Virginia material is that figured. It is from station 11 and is typical.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA cf. EXQUISITA (Toulmin) (Pl. 4, fig. 6)

The specimen figured resembles the species described by Toulmin from the Salt Mountain limestone of Alabama (Journ. Pal., vol. 15, 1941, p. 583, pl. 79, fig. 7). It is a megalospheric specimen from station 6.

MARGINULINA sp. (Pl. 4, fig. 4)

A very few specimens of the form figured occur at stations 6 and 7. They are very close to the form figured by Toulmin from the Salt Mountain limestone of Alabama as "*Vaginulinopsis brantleyi* (Garrett)" (Journ. Pal., vol. 15, 1941, p. 583, pl. 79, figs. 8-10). This is not the same as *Hemicristellaria brantleyi* Garrett (Journ. Pal., vol. 15, 1941, p. 154, pl. 26, figs. 1-4) as shown by comparison with specimens kindly furnished by Messrs. Garrett and Toulmin. Our species is smaller, more compressed, and much less highly ornamented.

Genus DENTALINA d'Orbigny, 1826

DENTALINA cf. COMMUNIS d'Orbigny (Pl. 4, fig. 7)

Specimens of the form illustrated here have been figured in the literature under many names. They occur rarely at stations 1, 3, 4, and 8, and are fairly common at stations 6 and 7.

DENTALINA cf. HEXACOSTATA Howe (Pl. 4, fig. 11)

The single two-chambered specimen figured from station 7 seems probably to be the young stage of the species described by Howe from the Eocene, Cook Mountain formation, of Louisiana (Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 44, pl. 5, fig. 13).

DENTALINA VIRGINIANA Cushman, n. sp. (Pl. 4, figs. 8, 9)

Test small, consisting of 4 or 5 chambers, initial end with a short spine, apertural end slightly projecting; chambers nearly uniform in size, somewhat inflated; sutures slightly depressed, usually more so on one side than the other; wall ornamented with longitudinal costae, 7 or 8 in number, continuous over the sutures, typically somewhat spiral in position, the last chamber often smooth; aperture, terminal, radiate, slightly projecting. Length 0.75-0.85 mm.; diameter 0.18 mm.

Holotype (Cushman Coll. No. 39705) from the Eocene, Aquia formation, 22′-28′ sample, section at Marlboro Point, Stafford Co., Va.

This species is close to *Nodosaria milamensis* Howe from the Eocene, Cook Mountain formation, of Louisiana, but differs in the dentaline form, smaller size, fewer costae, and their inclination to be spiral. The species also occurs at station 6. It is very constant in its size and other characters.

DENTALINA WILCOXENSIS Cushman (Pl. 4, fig. 10)

Dentalina wilcoxensis CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 8, pl. 1, figs. 5, 6.

The types of this species are from the Wilcox Eocene, Bashi formation, from near Yellow Bluff, Ala. It occurs very rarely at station 6.

There are a few other forms in the Virginia material that may be assigned to *Dentalina,* but they are represented by single or broken specimens.

Genus VAGINULINA d'Orbigny, 1826

VAGINULINA PLUMOIDES Plummer, var. VIRGINIANA Cushman, n. var. (Pl. 4, fig. 5)

Variety differing from the typical in the more strongly curved sutures, more strongly developed costae, especially on the dorsal side, which is decidedly thickened, and the fewer chambers.

Holotype of variety (Cushman Coll. No. 39718) from the Eocene, Aquia formation, 8′-14′ sample, to bottom of first ledge, Marlboro Point, Stafford Co., Va.

The few specimens found are distinctive, and may represent a new species. It is evidently related to and possibly derived from *V. plumoides* Plummer of the Paleocene of Texas.

Genus LAGENA Walker and Jacob, 1798

LAGENA CLAVATA (d'Orbigny) (Pl. 4, fig. 12)

Rare specimens referable to this species occur at stations 6 and 7.

LAGENA COSTATA (Williamson) (Pl. 4, fig. 13)

Single specimens from stations 1 and 7 may be referred to this species.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

GUTTULINA cf. PROBLEMA d'Orbigny (Pl. 4, fig. 14)

Specimens, mostly representing immature individuals, from stations 1, 2, 4, 6, and 10 may be referred to this species, although few of them have reached their full development.

GUTTULINA cf. WILCOXENSIS Cushman and Ponton

A few immature specimens from stations 5 and 7 probably represent the young stages of this species.

Genus GLOBULINA d'Orbigny, 1839

GLOBULINA GIBBA d'Orbigny (Pl. 4, figs. 17, 18)

Specimens which seem identical with this species were found at stations 1, 2, 3, 6, 7, 9, 10, and 11.

Genus PYRULINA d'Orbigny, 1839

PYRULINA sp. (Pl. 4, fig. 16)

The single specimen figured from station 1 is the only representative of this genus in the collection.

Genus GLANDULINA d'Orbigny, 1826

GLANDULINA LAEVIGATA d'Orbigny, var. (Pl. 4, fig. 20)

Two specimens from station 6 belong to this genus, as the arrangement of the early chambers shows. They resemble var. *ovata* (Cushman and Applin), but are not exactly the same when compared with the types.

Genus PSEUDOPOLYMORPHINA Cushman and Ozawa, 1928

PSEUDOPOLYMORPHINA WILCOXENSIS Cushman and Ponton (Pl. 4, fig. 19)

Pseudopolymorphina wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 61, pl. 8, figs. 5, 6.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 81, pl. 14, fig. 11.

The types of this species are from the Wilcox Eocene, Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala., and it has also been recorded from the Wilcox, Bashi formation, of Woods Bluff, Ala. It is common in the Virginia material at stations 1, 2, 3, 4, 6, 7, 8, 10, and 11.

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

SIGMOMORPHINA SEMITECTA (Reuss), var. TERQUEMIANA (Fornasini) (Pl. 4, fig. 15)

(For references see these Contributions, vol. 19, 1943, p. 37)

There are numerous records for this variety from the American Eocene, including the Claiborne and Jackson, and from the Paleocene Midway. It is fairly common in the Virginia material, occurring at stations 1, 2, 3, 6, 7, 8, 9, and 11.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA OVATA d'Orbigny (Pl. 4, figs. 21, 22)

This species has been recorded from much of the Tertiary of America, including some Wilcox Eocene records. Specimens occur commonly at stations 7, 8, 9, and 11.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA WILCOXENSIS Cushman and Ponton (Pl. 4, fig. 24)

Virgulina wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 67, pl. 8, fig. 22.—CUSHMAN, Special Publ. No. 9, Cushman Lab. Foram. Res., 1937, p. 6, pl. 1, fig. 17.—CUSHMAN and GARRETT, Contr., vol. 15, 1939, p. 82, pl. 14, figs. 19-21.—CUSHMAN, l. c., vol. 16, 1940, p. 67, pl. 11, fig. 19; Amer. Journ. Sci., vol. 242, 1944, p. 11, pl. 1, figs. 19, 20.

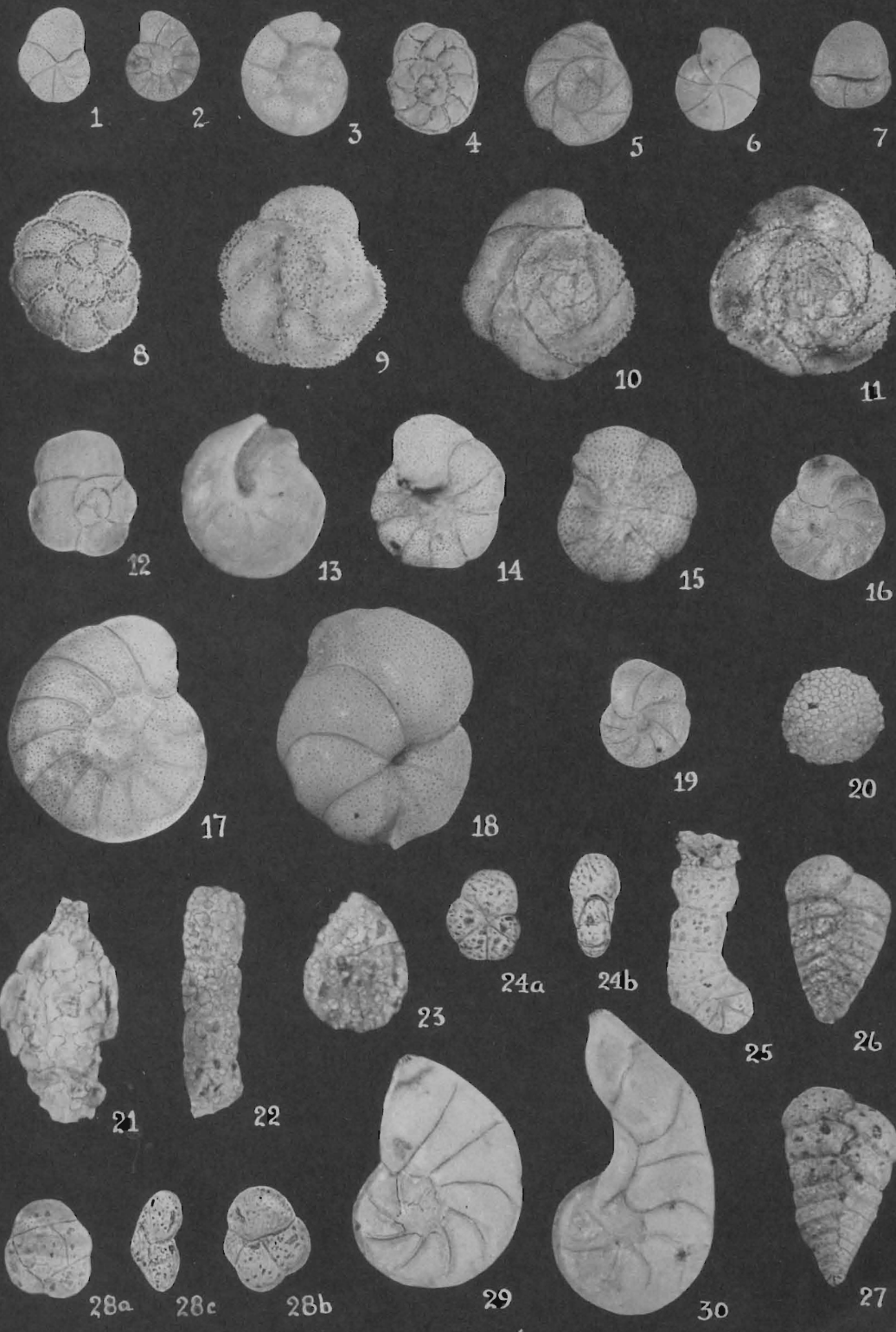
The types of this species are from the Wilcox Eocene, Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala. It is also recorded from the Wilcox, Bashi formation, of Woods Bluff and near Yellow Bluff, Ala., and from the upper beds of the Midway of Alabama. In the Virginia material it is very rare at station 5.

EXPLANATION OF PLATE 3

(All figures × 50)

Figures 1-19 from Pecan Gap chalk; figures 20-30 from Aquia formation.

FIG. 1. *Valvulineria plummerae* Loetterle. 2. *Gyroidina depressa* (Alth). 3. *G. globosa* (Hagenow). 4. *Stensiöina americana* Cushman and Dorsey. 5. *Pulvinulinella texana* Cushman. 6. *Pullenia americana* Cushman. 7. *Allomorphina minuta* Cushman. 8. *Globotruncana canaliculata* (Reuss). 9. *G. marginata* (Reuss). 10. *G. arca* Cushman. 11. *G. fornicata* Plummer. 12. *Globorotalia membranacea* (Ehrenberg). 13. *G. micheliniana* (d'Orbigny). 14. *Anomalina ammonoides* (Reuss). 15. *A. pinguis* Jennings. 16. *Cibicides stephensoni* Cushman. 17. *Planulina taylorensis* (Carsey). 18. *Cibicides beaumontianus* (d'Orbigny). 19. *C.* cf. *constrictus* (Hagenow). 20. *Saccammina sphaerica* M. Sars. 21. *Reophax curtus* Cushman. 22. *R.* (?) sp. 23. *Haplophragmoides* sp. 24. *H.* cf. *sphaeriloculum* Cushman. *a*, side view; *b*, apertural view. 25. *Ammobaculites* sp. 26, 27. *Spiroplectammina wilcoxensis* Cushman and Ponton. 28. *Trochammina howei* Cushman, n. sp. Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 29, 30. *Robulus wilcoxensis* Cushman and Ponton.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Genus ANGULOGERINA Cushman, 1927

ANGULOGERINA VIRGINIANA Cushman, n. sp. (Pl. 4, fig. 23)

Test minute, elongate, tapering, triangular in section, the sides concave and the angles slightly rounded, triserial except for the last 2 or 3 chambers in the adult which are irregularly uniserial; chambers of the early portion indistinct, in the adult somewhat separated and more inflated; sutures indistinct except in the very last portion in the adult where they are somewhat depressed; wall ornamented with fine longitudinal costae continuous over most of the test; aperture in the adult terminal, with a short neck and slight lip. Length 0.30-0.40 mm.; diameter 0.10-0.12 mm.

Holotype (Cushman Coll. No. 39773) from the Eocene, Aquia formation, 19′-22′ sample, below second rock layer, Marlboro Point, Stafford Co., Va.

This species in some respects resembles *A. gallowayi* Cole from the Guayabal formation of Mexico, but has more concave sides and a more tapering and ornamented test. It is also somewhat like the form recorded from Trinidad as *Angulogerina* cf. *parvula* (Cushman and Thomas) (Cushman and Renz, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 9, pl. 2, fig. 10), but is not the same. The species is not common in the Virginia material, but occurs at stations 6, 7, and 11.

Family ROTALIIDAE

Genus DISCORBIS Lamarck, 1804

DISCORBIS sp.

Rare specimens of this genus occur in the Virginia material, but

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EXPLANATION OF PLATE 4

(All figures × 50)

FIG. 1. *Robulus* cf. *knighti* Toulmin. 2. *R.* sp. 3. *Darbyella wilcoxensis* Cushman and Garrett. 4. *Marginulina* sp. 5. *Vaginulina plumoides* Plummer, var. *virginiana* Cushman, n. var. Holotype. 6. *Marginulina* cf. *exquisita* (Toulmin). 7. *Dentalina* cf. *communis* d'Orbigny. 8, 9. *D. virginiana* Cushman, n. sp. 8, Holotype. 9, Paratype. 10. *D. wilcoxensis* Cushman. 11. *D.* cf. *hexacostata* Howe. 12. *Lagena clavata* (d'Orbigny). 13. *L. costata* (Williamson). 14. *Guttulina* cf. *problema* d'Orbigny. 15. *Sigmomorphina semitecta* (Reuss), var. *terquemiana* (Fornasini). 16. *Pyrulina* sp. 17, 18. *Globulina gibba* d'Orbigny. 19. *Pseudopolymorphina wilcoxensis* Cushman and Ponton. 20. *Glandulina laevigata* d'Orbigny, var. 21, 22. *Bulimina ovata* d'Orbigny. 23. *Angulogerina virginiana* Cushman, n. sp. Holotype. *a, b,* opposite sides; *c,* apertural view. 24. *Virgulina wilcoxensis* Cushman and Ponton. 25. *Lamarckina wilcoxensis* Cushman. 26. *Valvulineria wilcoxensis* Cushman and Ponton. 27. *V. scrobiculata* (Schwager). 28. *Cibicides praecursorius* (Schwager). 29. *C. howelli* Toulmin. 30. *Anomalina umbonifera* (Schwager). 31. *Stichocibicides* sp. 32. *Pulvinulinella obtusa* (Burrows and Holland).

usually as single specimens and not well enough characterized to identify specifically.

Genus LAMARCKINA Berthelin, 1881

LAMARCKINA WILCOXENSIS Cushman (Pl. 4, fig. 25)

Lamarckina wilcoxensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 9, pl. 1, fig. 3.—CUSHMAN and PONTON, l. c., vol. 8, 1932, p. 70, pl. 9, fig. 4.—GLAESSNER, Problems of Paleontology, Moscow Univ., vols. 2-3, 1937, p. 381, pl. 2, fig. 29.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 12, pl. 1, figs. 32-35.

This is a characteristic species of the Wilcox Eocene, recorded from the Bashi formation and Tuscahoma sand in Alabama. Glaessner recorded it from the Eocene of the Caucasus region. It is very common at station 7 in the Virginia material, and less so at station 6.

Genus VALVULINERIA Cushman, 1926

VALVULINERIA WILCOXENSIS Cushman and Ponton (Pl. 4, fig. 26)

Valvulineria wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 70, pl. 9, fig. 6.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 85, pl. 15, figs. 1, 2.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 13, pl. 1, figs. 36, 37.

This is a characteristic species of the Wilcox Eocene. The types were from the Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala., and it has also been recorded from the Bashi formation at Woods Bluff and from near Yellow Bluff, Ala. It is by far the most abundant species in the Virginia material, occurring commonly at stations 1, 2, 3, 4, 5, 6, 7, 8, and 11.

VALVULINERIA SCROBICULATA (Schwager) (Pl. 4, fig. 27)

Anomalina scrobiculata SCHWAGER, Palaeontographica, vol. 30, 1883, Pal. Theil, p. 129, pl. 29 (6), fig. 18.

Valvulineria scrobiculata CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 70, pl. 9, fig. 5.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 85, pl. 14, figs. 32, 33.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 13, pl. 2, figs. 1, 2.

The types of this species are from the middle Eocene of northern Africa. It has been recorded from the Wilcox Eocene, Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, Ala., and from the Bashi formation at Woods Bluff and near Yellow Bluff, Ala. While not as common as the preceding species, it occurs at stations 1, 2, 3, and 7 in considerable numbers.

Genus EPONIDES Montfort, 1808

EPONIDES LOTUS (Schwager)

(For references see these Contributions, vol. 18, 1942, p. 40)

This species is recorded from the Eocene of widely separated re-

gions. In America it occurs in the Wilcox Eocene, Tuscahoma sand and Bashi formation, of Alabama as well as in the Naheola formation of the Paleocene, Midway group of Alabama. It is rare in the Virginia material at stations 7 and 11.

Genus SIPHONINA Reuss, 1850

SIPHONINA WILCOXENSIS Cushman

Siphonina wilcoxensis CUSHMAN, Proc. U. S. Nat. Mus., vol. 72, Art. 20, 1927, p. 3, pl. 2, figs. 1-3.—CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 70, pl. 9, fig. 7.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 86, pl. 15, figs. 7-9.—ISRAELSKY, Proc. 6th Pac. Sci. Congress, 1939, p. 578, pl. 7, fig. 3. —TOULMIN, Journ. Pal., vol. 15, 1941, p. 605, pl. 81, figs. 15, 16.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 14, pl. 2, figs. 3, 4.

This species is a good index fossil for the Wilcox Eocene. There are numerous records for it in Alabama from the Tuscahoma sand, the Bashi formation, and the Salt Mountain formation. It is very rare in the Virginia material, occurring only at station 11.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA OBTUSA (Burrows and Holland) (Pl. 4, fig. 32)

(For references see these Contributions, vol. 18, 1942, p. 42)

This species has a wide range in the Paleocene and Eocene, occurring in the Midway, Wilcox, and Claiborne. It is fairly common in the Virginia material, occurring at stations 1, 3, 6, 7, 8, 9, and 11.

Family GLOBIGERINIDAE

A very few specimens, mostly not well preserved as to details, occur in the Virginia material.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA WILCOXENSIS Cushman and Ponton

Globorotalia wilcoxensis CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 71, pl. 9, fig. 10.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 88, pl. 15, figs. 21, 22.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 15, pl. 2, figs. 14, 15.

This species is recorded from the Wilcox Eocene, Tuscahoma sand and Bashi formation, of Alabama. In the Virginia material it is very rare at station 7.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA UMBONIFERA (Schwager) (Pl. 4, fig. 30)

Discorbina umbonifera SCHWAGER, Palaeontographica, vol. 30, 1883, Pal. Theil, p. 126, pl. 27 (4), fig. 14.

Anomalina umbonifera CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 72, pl. 9, fig. 11.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 15, pl. 2, figs. 18, 19.

This species was described from the middle Eocene of northern Africa. It is recorded from the Wilcox Eocene of Alabama, from the Tuscahoma sand, RR. cut, 1 mi. N. of Ozark, and from the Bashi formation near Yellow Bluff. In the Virginia material it is fairly common, occurring at stations 1, 5, 6, 7, 9, and 11.

Genus CIBICIDES Montfort, 1808

CIBICIDES PRAECURSORIUS (Schwager) (Pl. 4, fig. 28)

(For references see these Contributions, vol. 18, 1942, p. 45)

This species, described from the middle Eocene of northern Africa, is a characteristic one of the Midway Paleocene and Wilcox Eocene, particularly of Alabama. It also occurs in the Eocene of Trinidad, and has recently been recorded from the Bashi formation near Yellow Bluff, Alabama. (Cushman, Amer. Journ. Sci., vol. 242, 1944, p. 18, pl. 2, figs. 23, 24). Like many species of the genus which were probably attached, specimens vary considerably in the regularity of the last-formed chambers. Specimens are common in the Virginia material at station 11, and less so at stations 7, 9, and 10.

CIBICIDES HOWELLI Toulmin (Pl. 4, fig. 29)

Cibicides cf. *pseudoungerianus* CUSHMAN and GARRETT, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 88, pl. 15, figs. 25, 26.

Cibicides howelli TOULMIN, Journ. Pal., vol. 15, 1941, p. 609, pl. 82, figs. 16-18.—CUSHMAN and RENZ, Contr. Cushman Lab. Foram. Res., vol. 18, 1942, p. 13, pl. 3, fig. 10.—CUSHMAN, Amer. Journ. Sci., vol. 242, 1944, p. 18, pl. 2, figs. 21, 22.

Like the above species, this one shows a considerable range of variation. It is recorded from the Wilcox Eocene of Alabama and the Paleocene of Trinidad. In the Virginia material it is fairly common at station 8, but was not found elsewhere.

Genus STICHOCIBICIDES Cushman and Bermudez, 1936

STICHOCIBICIDES sp. (Pl. 4, fig. 31)

A single specimen from station 10 very evidently belongs to this genus, the type species of which was described from the Eocene of Cuba. More specimens are needed to give the full characters.