CONTRIBUTIONS

FROM THE

CUSHMAN LABORATORY

FOR

FORAMINIFERAL RESEARCH

VOLUME 23, PART 1
March, 1947

Contents

SHARON, MASSACHUSETTS, U. S. A.
1947

CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

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CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

288. A FORAMINIFERAL FAUNA FROM THE SANTA ANITA FORMATION OF VENEZUELA

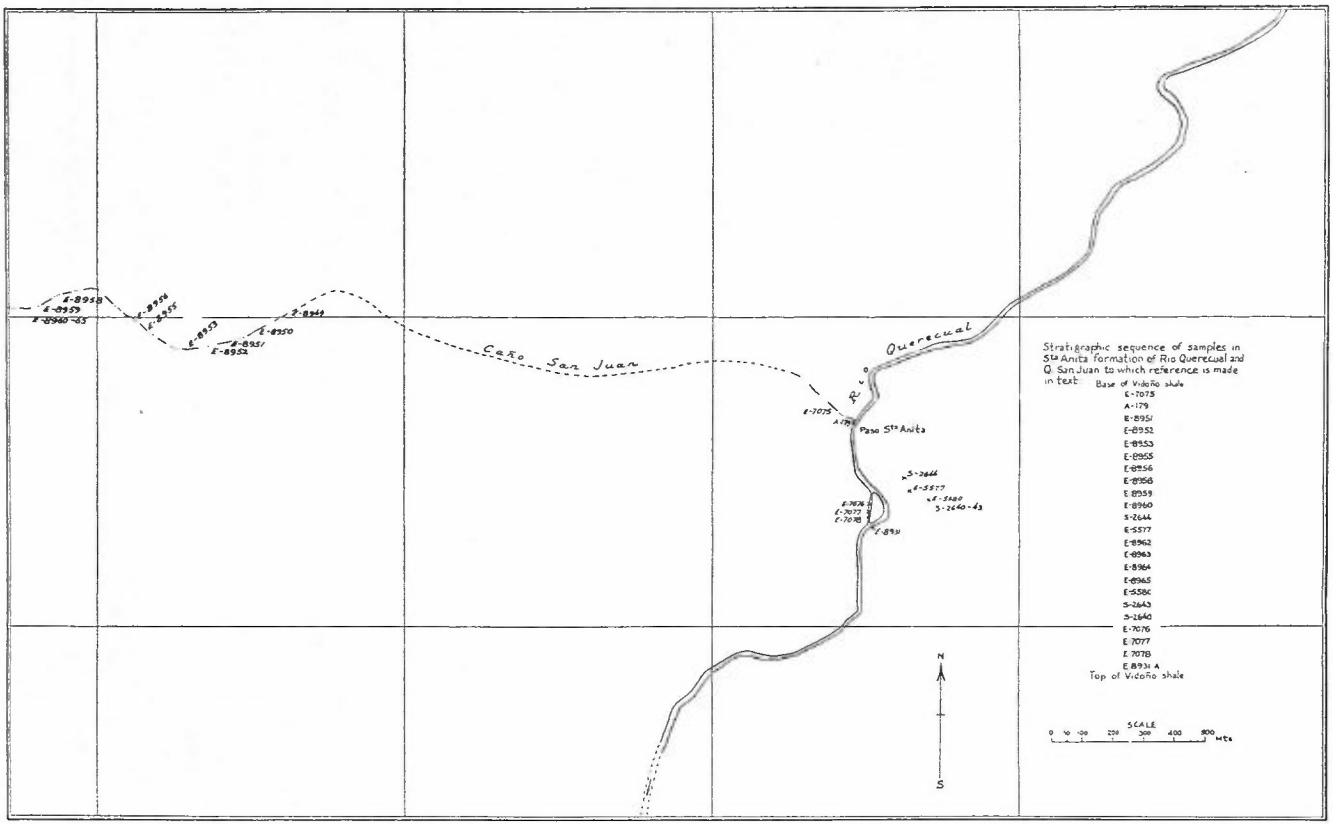
By Joseph A. Cushman

The foraminiferal fauna of the Santa Anita formation is related to the Upper Cretaceous faunas of Trinidad and Mexico. The fauna is fairly rich in the number of species, and notes are given to show the relationships to other regions where the same species are found. Two of the species are new.

The samples to which reference is made come from the Vidoño shale member of the Santa Anita formation in the Barcelona-Bergantin region of northeastern Venezuela from collections made by Hollis D. Hedberg and A. Pyre. Many of the samples are from the type section of the Santa Anita formation on Rio Querecual and its tributary Quebrada San Juan. Others are from the vicinity of Puerto la Cruz. Samples A243, A244, and A246 are on the southwest side of La Borracha Island near Puerto la Cruz. The Santa Anita formation or group of this region has been described in some detail (Hedberg, Bull. Geol. Soc. Amer., vol. 48, 1937, pp. 1971-2024, and Hedberg and Pyre, Bull. Amer. Assoc. Petr. Geol., vol. 28, 1944, pp. 1-28). It probably includes sediments of both Late Cretaceous and Early Tertiary age. The Vidoño shale unit appears to belong largely to the uppermost Cretaceous though possibly in part to the Paleocene. The accompanying map gives the location of the samples.

My thanks are here acknowledged to my friend, Hollis D. Hedberg, for his kindness in supplying the material and stratigraphic data for this paper.

To save space in synonymies, reference is made to U. S. Geol. Survey Prof. Paper 206, 1946, and to Special Publ. 18, Cushman Lab. Foram. Res., 1946, the latter on the Cretaceous, Lizard Springs formation of Trinidad.


E-8958
E-8959
E-8960-63
E-8954
E-8955
E-8953
E-8952
E-8951
E-8950
E-8949
Cerro San Juan
Querecual
Qv
E-7075
A-179
Paso Sta Anita
S-2644
E-5577
E-5580
S-2640-43
E-7076
E-7077
E-7078
E-8931
N
S
Stratigraphic sequence of samples in Sta Anita formation of Rio Querecual and Q. San Juan to which reference is made in text:
Base of Vidoño shale
E-7075
A-179
E-8951
E-8952
E-8953
E-8955
E-8956
E-8958
E-8959
E-8960
S-2644
E-5577
E-8962
E-8963
E-8964
E-8965
E-5580
S-2643
S-2640
E-7076
E-7077
E-7078
E-8931 A
Top of Vidoño shale
SCALE
0 50 100 200 300 400 800 Mts

Family ASTRORHIZIDAE

Genus RHABDAMMINA M. Sars, 1869

RHABDAMMINA DISCRETA H. B. Brady (Pl. 1, fig. 1)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 14.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 12, pl. 1, fig. 1.

A very few incomplete specimens, similar to that figured, occurred in sample E8958. The species is recorded from the Upper Cretaceous of Trinidad and from the Navarro, Prairie Bluff chalk, of Mississippi.

Family SACCAMMINIDAE

Genus PELOSINA H. B. Brady, 1879

PELOSINA COMPLANATA Franke (Pl. 1, fig. 2)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 15.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 13, pl. 1, fig. 8.

A few specimens, all crushed, occurred in sample A190. The species was described from the Upper Cretaceous of Germany and has been recorded from the Upper Cretaceous, Lizard Springs marl and Hobson clay, of Trinidad; Velasco shale of Mexico; Mal Paso shale of Peru; and from the Taylor marl and Austin chalk of Texas.

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX sp.

Reophax sp. CUSHMAN and JARVIS, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 86, pl. 12, fig. 2; Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 7, pl. 1, fig. 13.—CUSHMAN, U. S. Geol. Survey Prof. Paper 206, 1946, p. 17, pl. 1, fig. 26.—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 14, pl. 1, figs. 14, 25.

A few broken specimens from sample E5577 are very similar to the form figured from Trinidad. No specimens have been found that give enough details to warrant a specific determination.

Family AMMODISCIDAE

Genus AMMODISCUS Reuss, 1861

AMMODISCUS GLABRATUS Cushman and Jarvis (Pl. 1, fig. 3)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 17.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 14, pl. 1, fig. 26.

This species has previously been known only from the Upper Cretaceous, Lizard Springs marl and Hobson clay, of Trinidad. Somewhat imperfect but typical specimens occur in samples E8910 and E8922.

AMMODISCUS PENNYI Cushman and Jarvis (Pl. 1, fig. 4)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 17.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 14, pl. 1, fig. 27.

This species described from Trinidad occurs in the Lizard Springs marl; in the Velasco shale of Mexico; the Colon shale of Venezuela; and

in the Navarro, Corsicana marl, of Texas. It is a large species with a thick arenaceous wall, wide coils, and a rather rough surface. It occurred in samples E5580, E7075, E8910, A179, and A190.

Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910

HAPLOPHRAGMOIDES EGGERI Cushman (Pl. 1, fig. 5)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 20.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 18, pl. 1, fig. 35.

This species has been recorded in America from the Lizard Springs marl of Trinidad; Velasco shale of Mexico; from the Navarro, Corsicana marl of Texas, and Prairie Bluff chalk of Mississippi; and from the Taylor, Annona chalk, of Texas. The Venezuela specimens are nearly all more or less crushed. They are from samples E8953, E8955, and E8962.

Genus CRIBROSTOMOIDES Cushman, 1910

CRIBROSTOMOIDES TRINITATENSIS Cushman and Jarvis (Pl. 1, figs. 6, 7)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 22.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 19, pl. 2, figs. 4, 5.

This species described from the Lizard Springs marl of Trinidad and recorded from the Tarouba formation of southern Trinidad, has not been known elsewhere. Specimens are common and in typical form in samples E8910, E8921, E8922, and E8965.

Genus AMMOBACULITES Cushman, 1910

AMMOBACULITES JARVISI Cushman and Renz (Pl. 1, figs. 10-12)

Ammobaculites jarvisi CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 19, pl. 2, figs. 8, 9.

This large species seems identical with the form described from the Lizard Springs marl of Trinidad. Our specimens are very well preserved, and occasional ones show as many as three uniserial chambers. It occurred in samples E8910, E8921, E8922, E8965, A70, and A190.

AMMOBACULITES sp. (Pl. 1, fig. 9)

The figured specimen from sample E7076 is not well enough preserved to warrant a specific identification. It is unlike any of the species known from Trinidad, and more and better preserved specimens are needed.

Genus CYCLAMMINA H. B. Brady, 1876

CYCLAMMINA ELEGANS Cushman and Jarvis (Pl. 1, fig. 8)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 26.)

This species was described from the Upper Cretaceous of Trinidad and, while the Venezuela specimens are usually distorted, they seem to belong to this species. It occurred in samples A190, A196, E8249, E8952,

and E8957. Rare specimens from sample E7078 are less typical but may represent young stages of this species.

CYCLAMMINA GARCILASSOI Frizzell (Pl. 1, figs. 13-17)

Cyclammina garcilassoi FRIZZELL, Journ. Pal., vol. 17, 1943, p. 338, pl. 55, fig. 11.

Cyclammina cf. *garcilassoi* CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 19, pl. 2, fig. 11.

This species was described from the Upper Cretaceous, Mal Paso shale, of Peru. The Santa Anita specimens have been compared with the holotype and seem identical. Our series of figured specimens shows the different stages in the development. Somewhat similar specimens occur in the Lizard Springs marl of Trinidad. Specimens occurred in some numbers in samples E7077, E7078, E8248, and E8910.

CYCLAMMINA cf. SCHENCKI Cushman (Pl. 1, fig. 18)

Cyclammina schencki CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 70, pl. 9, fig. 5.

A few large specimens from sample E8910 are somewhat like this species described from the Cretaceous of California. The type is very much compressed but the number of chambers and other characters are very similar. No specimens were found which would seem to connect these large specimens with *C. garcilassoi* Frizzell.

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA cf. SEMICOMPLANATA (Carsey) (Pl. 2, fig. 1)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 28.)

A very few poorly preserved specimens may possibly belong to this species. They are from samples A190, A196, and E8249.

SPIROPLECTAMMINA EXCOLATA (Cushman) (Pl. 2, fig. 2)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 27.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 20, pl. 2, fig. 13.

A single specimen from sample E8965 seems related to this species described from the Velasco shale of Mexico and recorded from the Lizard Springs marl of Trinidad.

SPIROPLECTAMMINA GRZYBOWSKII Frizzell (Pl. 4, figs. 12, 13)

Spiroplectammina grzybowskii FRIZZELL, Journ. Pal., vol. 17, 1943, p. 339, pl. 55, figs. 12, 13.—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 20, pl. 5, figs. 34-38.

Specimens to be referred here occur commonly in the Santa Anita formation in samples A190, A198, E5580, E8248, E8249, E8921, E8922, and E8931. The species occurs in the Lizard Springs marl of Trinidad, the Velasco shale of Mexico, and the Mal Paso shale of Peru. There is

still some question as to the relationships of this species and those that have been placed under *Bolivinopsis clotho* Grzybowski.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA LAEVIGATA Franke (Pl. 2, figs. 3-6)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 33.)

A number of specimens may be referred to this widely distributed species. Some of the younger stages somewhat resemble *Gaudryina (Pseudogaudryina) pyramidata* Cushman, recorded from the Lizard Springs marl of Trinidad, but the more elongate adult specimens are more like *G. laevigata* Franke. They are from samples S2644, E5577, E5580, E8949, and E8958.

GAUDRYINA HEDBERGI Cushman, n. sp. (Pl. 2, fig. 7)

Test elongate, early portion triserial, triangular in transverse section, angles acute and slightly keeled, adult portion biserial, irregularly triangular in transverse section, one side slightly concave, the other two sides slightly convex; chambers numerous, very slightly if at all inflated; sutures slightly depressed; wall arenaceous but with a considerable proportion of cement and rather smoothly finished; aperture a small, nearly circular opening at the base of the inner margin of the last-formed chamber. Length 1.50-2.00 mm.; breadth 0.55-0.80 mm.

Holotype (Cushman Coll. No. 47903) from the Upper Cretaceous, Santa Anita formation, Vidoño shale member, west end of Cerro Papelon, about 1 kilometer west of Puerto la Cruz, northeastern Venezuela (sample A70H).

This species differs from *Gaudryina rugosa* d'Orbigny in the acute angles of the test, the more slender and straighter form, and the smooth surface. It is common in the Santa Anita material, occurring in samples A70J, A190, A195, A196, and A198.

The species is named for Hollis D. Hedberg who supplied the material for this paper.

Genus CLAVULINOIDES Cushman, 1936

CLAVULINOIDES TRILATERA (Cushman) (Pl. 2, fig. 13)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 38.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 22, pl. 2, fig. 24.

A few specimens with a smoother test and more acute angles than *C. aspera* (Cushman) occur in the collections and may be referred to this species. They are from samples E7075, E8922, E8951, E8952, and E8953. The species was described from Mexico where it occurs in the Velasco and Mendez shales. Other records include the Lizard Springs

marl of Trinidad and the Navarro group, Saratoga chalk of Arkansas and Corsicana marl of Texas.

CLAVULINOIDES ASPERA (Cushman) (Pl. 2, fig. 15)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 38.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 22, pl. 2, fig. 25.

This species was also described from the Upper Cretaceous of Mexico and recorded from the Lizard Springs marl of Trinidad. It is widely recorded from the United States Upper Cretaceous in formations of Navarro, Taylor, and Austin age. It is smaller and less tapering than the variety *whitei*. Numerous specimens referable to this species occurred in samples A190, E8910, E8921, E8962, and E8965.

CLAVULINOIDES ASPERA (Cushman), var. WHITEI Cushman and Jarvis (Pl. 2, fig. 14)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 39.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 22, pl. 2, fig. 26.

This variety was described from the Lizard Springs marl of Trinidad and has not been recorded elsewhere. It occurs in considerable numbers in the Santa Anita material in samples A190, E7076, E7078, E8248, and E8249.

Family VALVULINIDAE

Genus ARENOBULIMINA Cushman, 1927

ARENOBULIMINA cf. AMERICANA Cushman (Pl. 2, fig. 9)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 42.)

The single specimen figured is somewhat distorted in fossilization but probably belongs to this widely distributed Cretaceous species. It is from sample A70H. The species is recorded from the Upper Cretaceous of Mexico (Velasco and Mendez shales) and from many localities in the United States in formations of Navarro, Taylor, and Austin age.

Genus MARSSONELLA Cushman, 1933

MARSSONELLA OXYCONA (Reuss), var. TRINITATENSIS Cushman and Renz (Pl. 2, fig. 8)

Gaudryina oxycona CUSHMAN and JARVIS (not REUSS) (part), Proc. U. S. Nat. Mus., vol. 80, Art. 14, 1932, p. 18, pl. 5, fig. 2 (not fig. 1).

Marssonella oxycona (REUSS), var. *trinitatensis* CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 22, pl. 2, fig. 29.

A somewhat compressed and distorted specimen from sample E7078 seems to belong to this variety described from the Lizard Springs marl of Trinidad.

MARSSONELLA INDENTATA (Cushman and Jarvis) (Pl. 2, fig. 16)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 44.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 23, pl. 2, fig. 28.

Rare specimens from sample A196 are to be referred to this species known from the Upper Cretaceous of Trinidad and Mexico.

Genus TEXTULARIELLA Cushman, 1927

TEXTULARIELLA TRINITATENSIS Cushman and Renz (Pl. 2, figs. 11, 12, 17)

Textulariella trinitatensis Cushman and Renz, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 23, pl. 3, figs. 1-3.

Numerous specimens from the Santa Anita material are evidently identical with this species described from the Lizard Springs formation of Trinidad. They are from samples A244, E5577, E5580, E8249, E8922, E8949, and S2644.

TEXTULARIELLA TRINITATENSIS Cushman and Renz, var. SUBCYLINDRICA Cushman and Renz (Pl. 2, fig. 10)

Textulariella trinitatensis Cushman and Renz, var. *subcylindrica* Cushman and Renz, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 23, pl. 3, fig. 4.

The slender form here figured is very similar to the types of this variety described from the Lizard Springs formation of Trinidad. It occurred in samples A70H, A190, A195, A196, A198, A243, and E7076.

Genus PLECTINA Marsson, 1878

PLECTINA cf. WATERSI Cushman (Pl. 2, fig. 18)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 47.)

Numerous, rather poorly preserved specimens are probably to be assigned to this species. They are from samples E8249, E8910, E8921, and E8922. In the American Cretaceous this species seems to be confined to beds of Navarro age, particularly those of the upper part.

Genus ORBIGNYNA Hagenow, 1842

ORBIGNYNA PYREI Cushman, n. sp. (Pl. 2, figs. 19, 20)

Test in the early stages irregularly trochoid, later nearly planispiral, involute, periphery broadly rounded; chambers rather indistinct, about 8 in the adult whorl, slightly inflated, increasing gradually in size as added, periphery subdivided by radiating partitions; sutures very slightly depressed, radiate; wall rather coarsely arenaceous, but smoothly finished; aperture in the adult slightly elliptical, in the middle of the apertural face. Length 1.25-1.35 mm.; breadth 0.90-1.20 mm.

Holotype (Cushman Coll. No. 47953) from the Upper Cretaceous, Santa Anita formation, Vidoño shale member, Rio Querecual, northeastern Venezuela (sample E7077). It also occurs in sample E8249.

This species differs from *Orbignyna ovata* Hagenow of the Upper

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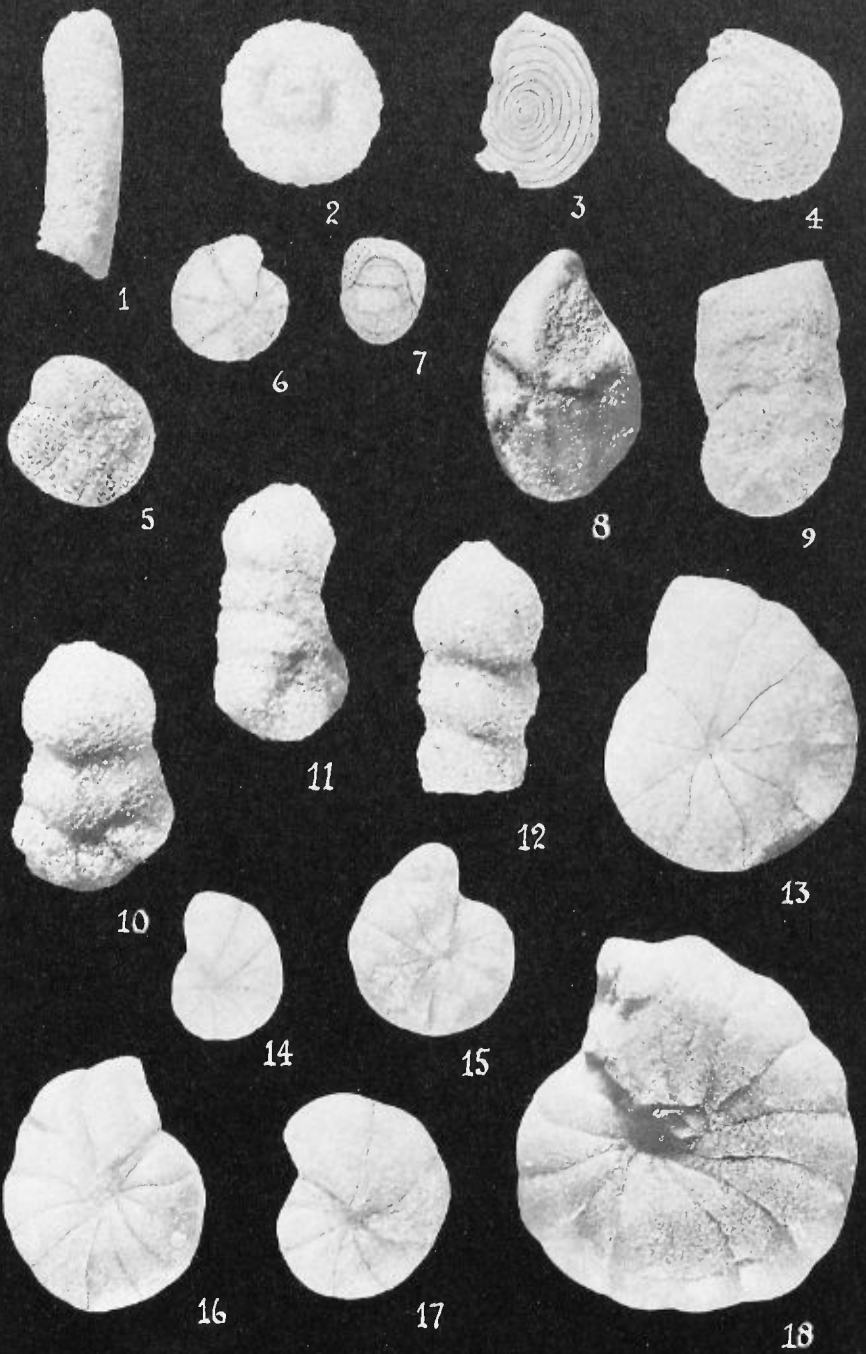
EXPLANATION OF PLATE 1

Fig. 1. *Rhabdammina discreta* H. B. Brady. × 30. 2. *Pelosina complanata* Franke. × 27. 3. *Ammodiscus glabratus* Cushman and Jarvis. × 40. 4. *A. pennyi* Cushman and Jarvis. × 40. 5. *Haplophragmoides eggeri* Cushman. × 27. 6, 7. *Cribrostomoides trinitatensis* Cushman and Jarvis. × 27. 9. *Ammobaculites* sp. × 27. 8. *Cyclammina elegans* Cushman × 27. 13-17. *Cyclammina garcilassoi* Frizzell. × 27. 10-12. *A. jarvisi* Cushman and Renz. × 20. 18. *C.* cf. *schencki* Cushman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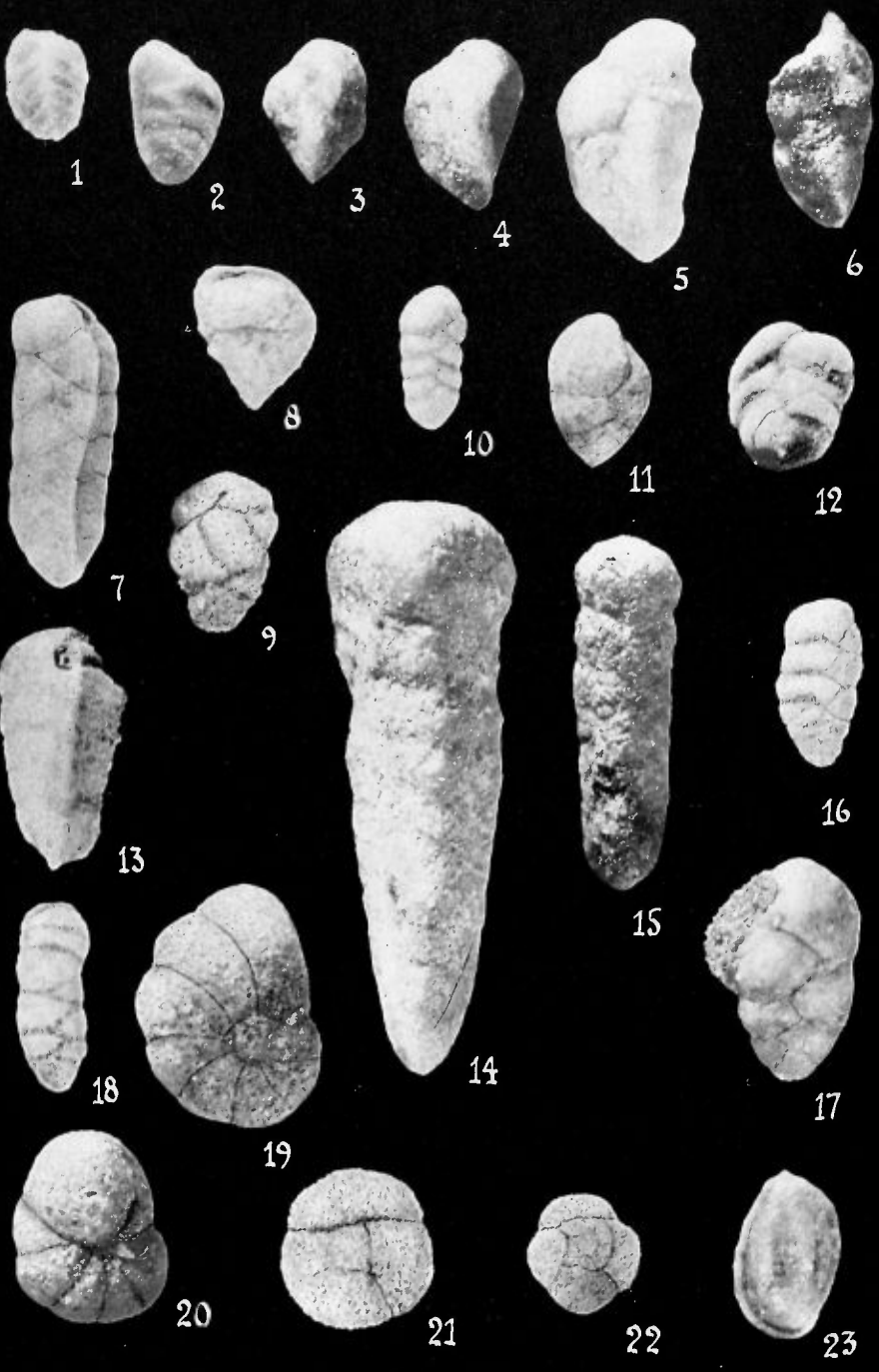
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Cretaceous of Rügen, Germany, in the more flattened test, larger number of chambers in the whorl and a more elongate aperture.

This species is named for Augustin Pyre who collected some of this material.

Family SILICINIDAE

Genus RZEHAKINA Cushman, 1927

RZEHAKINA EPIGONA (Rzehak), var. LATA Cushman and Jarvis (Pl. 2, fig. 23)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 47.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 23, pl. 3, fig. 6.

The single specimen here figured is from sample E8965 and is the only representative of this variety in the Santa Anita material. It is common in the Lizard Springs marl of Trinidad and also occurs in the Upper Cretaceous of Mexico and Texas. It is also recorded from Cretaceous dredgings taken from Burdwood Bank, south of the Falkland Islands.

Family TROCHAMMINIDAE

Genus TROCHAMMINA Parker and Jones, 1859

TROCHAMMINA GLOBIGERINIFORMIS (Parker and Jones) (Pl. 2, figs. 21, 22)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 51.)

The specimens referred to this species are very badly crushed and few in number, occurring only in samples E8910 and E8921. The species has been recorded from the Upper Cretaceous of Trinidad and from the Mal Paso shale of Peru. This form may be the variety *altiformis* Cushman and Renz from the Lizard Springs marl of Trinidad, but the specimens are too distorted to show the original shape of the tests.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS MACRODISCUS (Reuss) (Pl. 3, figs. 1, 2)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 54.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 25, pl. 3, fig. 14.

This is a widely distributed species, described from the Upper Cretaceous of Europe and recorded from Trinidad and Mexico and from

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EXPLANATION OF PLATE 2

FIG. 1. *Spiroplectammina* cf. *semicomplanata* (Carsey). × 30. 2. *S. excolata* (Cushman). × 30. 3-6. *Gaudryina laevigata* Franke. × 27. 7. *G. hedbergi* Cushman, n. sp. × 27. 8. *Marssonella oxycona* (Reuss), var. *trinitatensis* Cushman and Renz. × 27. 9. *Arenobulimina* cf. *americana* Cushman. × 27. 10. *Textulariella trinitatensis* Cushman and Renz, var. *subcylindrica* Cushman and Renz. × 30. 11, 12, 17. *T. trinitatensis* Cushman and Renz. × 27. 13. *Clavulinoides trilatera* (Cushman). × 27. 14. *C. aspera* (Cushman), var. *whitei* Cushman and Jarvis. × 27. 15. *C. aspera* (Cushman). × 27. 16. *Marssonella indentata* (Cushman and Jarvis). × 27. 18. *Plectina* cf. *watersi* Cushman. × 40. 19, 20. *Orbignyna pyrei* Cushman, n. sp. × 27. 19, Holotype. 20, Paratype. 21, 22. *Trochammina globigeriniformis* (Parker and Jones). × 30. 23. *Rzehakina epigona* (Rzehak), var. *lata* Cushman and Jarvis. × 40.

Upper Cretaceous deposits from the canyons of Georges Bank. It is one of the commonest species in the Santa Anita formation. There are specimens from samples A70H, A70J, A179, A190, A196, A198, S2643, E5580, E7075, E7076, E8249, E8922, E8949, E8951, E8952, E8953, E8955, E8956, E8958, E8959, E8960, E8962, E8963, and E8964.

ROBULUS DISCREPANS (Reuss) (Pl. 3, fig. 3)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 54.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 25, pl. 3, figs. 15-17.

The only previous American record for this species is from the Lizard Springs marl of Trinidad. It is less common than the preceding species in the Santa Anita material but specimens are present from samples A190, E5580, E7075, E7078, E8952, E8959, and E8960.

ROBULUS OLIGOSTEGIUS (Reuss) (Pl. 3, figs. 4, 6)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 54.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 25, pl. 3, fig. 18.

Like many other species of the Santa Anita fauna, this also occurs in the Lizard Springs marl of Trinidad and the Velasco shale of Mexico. It was found only in samples E7075, E7078, and E8249. The specimen, pl. 3, fig. 6, is apparently an internal cast and from the number and shape of the chambers and the character of the sutures seems to belong here.

Genus LENTICULINA Lamarck, 1804

LENTICULINA NAVICULA (d'Orbigny) (Pl. 3, fig. 7)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 56.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 26, pl. 3, fig. 26.

The figured specimen seems to belong to this species which has been recorded from the Upper Cretaceous of America, only in the Lizard Springs marl of Trinidad and the Velasco shale of Mexico. It is from sample E8949.

Genus SARACENARIA Defrance, 1824

SARACENARIA TRIANGULARIS (d'Orbigny) (Pl. 4, fig. 1)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 58.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 30, pl. 4, fig. 27.

A few rather poorly preserved specimens from samples E5580, E8952, and E8965 may be referred to this widely recorded species.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA BULLATA Reuss (Pl. 3, fig. 8)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 62.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 27, pl. 3, fig. 32; pl. 4, fig. 3.

Rare specimens evidently belonging to this species occurred only in samples E8952 and E8963.

MARGINULINA DECORATA (Reuss) (Pl. 3, fig. 5)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 63.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 27, pl. 3, fig. 31.

Specimens of this species are rather rare but occurred in samples A70H, A196, A198, and E8962. The only other American records seem to be those from the Lizard Springs marl of Trinidad.

MARGINULINA cf. GRATA (Reuss) (Pl. 3, fig. 10)

The figured specimen from sample A243 is the only one found in this material and may be referred to this species with some question.

MARGINULINA JARVISI Cushman

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 63.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 27, pl. 3, figs. 27, 28; pl. 4, figs. 5, 6.

A single specimen from sample E7075 seems to be identical with this species which is somewhat variable in its general shape.

MARGINULINA sp. (Pl. 3, fig. 9)

This peculiar specimen with a trace of a basal spine does not seem to be recorded from the American Cretaceous. It is from sample E8951 and more specimens must be found before a definite identification can be made.

Genus DENTALINA d'Orbigny, 1826

DENTALINA MEGALOPOLITANA Reuss (Pl. 3, figs. 11-13)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 67.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 28, pl. 4, fig. 11.

This species is widely distributed in Europe and America, including the Lizard Springs marl of Trinidad and Velasco shale of Mexico, as well as numerous records from beds of Navarro and Taylor age in the southern United States. It usually shows considerable variation. Specimens occurred only in samples E8956 and E8965.

DENTALINA CONFLUENS Reuss (Pl. 3, figs. 14, 15)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 68.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 28, pl. 4, figs. 14-16.

Specimens from samples E8249 and E8965 seem to belong to this ornamented species. It is recorded from the Lizard Springs marl of Trinidad and from numerous localities in the United States in material of Navarro and Taylor age.

DENTALINA cf. CONSOBRINA d'Orbigny (Pl. 3, figs. 16, 17)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 69.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 28, pl. 4, fig. 19.

Similar forms occur in the Lizard Springs marl of Trinidad, Velasco shale of Mexico, Eocene of Colombia, Mal Paso of Peru, and in beds of

Navarro and Taylor age in Texas and Tennessee. The only specimens in the Santa Anita collections referable to it are from sample E8962.

Genus NODOSARIA Lamarck, 1812

NODOSARIA AFFINIS Reuss (Pl. 3, fig. 25)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 70.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 30, pl. 5, fig. 1.

A single specimen from sample A70H seems related to this species which is so widely recorded from the Upper Cretaceous.

NODOSARIA MONILE Hagenow (Pl. 3, figs. 18-21)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 75.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 30, pl. 4, fig. 26.

This species is rather rare in the Santa Anita material and mostly represented by fragmentary specimens. It occurs in sample A190 and E8951. The species also occurs in the Lizard Springs marl of Trinidad and the Velasco shale of Mexico.

NODOSARIA PAUPERCULA Reuss (Pl. 3, figs. 22-24)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 75.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 30, pl. 5, figs. 2, 3.

This species is common in the Santa Anita formation but the specimens are usually broken. It occurs in the following samples: A190, E7076, E7077, E8949, E8951, E8953, E8958, E8962, E8963, and E8964. It is also found in the Lizard Springs marl of Trinidad, the Velasco shale of Mexico, and the Upper Cretaceous of Colombia.

NODOSARIA LIMONENSIS Cushman (Pl. 3, fig. 26)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 74.)

This species occurs in but few samples but is fairly common where it is found. It occurs in samples A179, A196, and E5580. The types are from the Velasco shale of Mexico.

Genus CHRYSALOGONIUM Schubert, 1907

CHRYSALOGONIUM CRETACEUM Cushman and Church (Pl. 3, fig. 27)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 75.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 30, pl. 5, fig. 4.

The single specimen figured is from sample E7075 and seems to belong to this species described from the Upper Cretaceous of California and recorded from the Lizard Springs marl of Trinidad.

Genus VAGINULINA d'Orbigny, 1826

VAGINULINA CRETACEA Plummer (Pl. 4, fig. 2)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 80.)

This species is widely distributed in the southern United States in beds of Navarro age. It has apparently not been recorded from the Upper Cretaceous of Trinidad or Mexico. It is rather common in the

Santa Anita formation, occurring in samples E8952, E8953, E8955, E8957, E8958, E8959, E8960, E8962, E8963, E8964, and E8965.

Genus PALMULA Lea, 1833

PALMULA SEMIRETICULATA (Cushman and Jarvis) (Pl. 4, fig. 5)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 85.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 31, pl. 5, figs. 8, 9.

This species has been found in the Lizard Springs marl of Trinidad and in the Velasco shale of Mexico. It is very rare in the Santa Anita material, occurring only in sample E8953.

Genus FRONDICULARIA Defrance, 1826

FRONDICULARIA MUCRONATA Reuss (Pl. 4, fig. 3)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 87.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 34, pl. 5, fig. 17.

The single specimen figured from sample E7075 is the only one found. The elongate proloculum and earlier chambers are typical of this species, but it broadens out later to resemble somewhat the form of *F. cordata* Roemer. It has been recorded from the Lizard Springs marl of Trinidad.

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

The single fragmentary specimen from sample E8922 is difficult to place specifically until more specimens to show the full characters can be found.

Genus LAGENA Walker and Jacob, 1798

LAGENA APICULATA (Reuss) (Pl. 4, fig. 6)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 94.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 34, pl. 5, fig. 18.

The single specimen figured from sample E8952 evidently belongs to this species recorded from the Lizard Springs marl of Trinidad and elsewhere. The apertural end is broken.

Family POLYMARPHINIDAE

Genus RAMULINA Rupert Jones, 1875

RAMULINA ACULEATA (d'Orbigny) (Pl. 4, figs. 7, 8)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 100)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 35, pl. 5, fig. 28.

Rare fragmentary specimens from samples E8922 and E8953 probably should be placed in this species. It is recorded from the Lizard Springs marl of Trinidad where it is also represented only by fragmentary specimens.

Family HETEROHELICIDAE

Genus GÜMBELINA Egger, 1899

GÜMBELINA ULTIMATUMIDA White (Pl. 4, fig. 36)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 107.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 36, pl. 6, figs. 1, 2.

A single specimen, probably the young of this species, occurred in sample E8962. The species was described from the Upper Cretaceous of Mexico and occurs in the Lizard Springs marl of Trinidad and elsewhere.

Genus VENTILABRELLA Cushman, 1928

VENTILABRELLA CARSEYAE Plummer (Pl. 4, figs. 9, 10)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 112.)

This species is apparently limited to beds of Navarro age. It occurred in samples A179, E7075, E8952, and E8953.

Genus SIPHOGENERINOIDES Cushman, 1927

SIPHOGENERINOIDES PARVA Cushman (Pl. 4, fig. 14)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 118.)—STONE, Journ. Pal., vol. 20, 1946, p. 471, pl. 71, figs. 11, 12.

A number of specimens occur in samples E8949 and E8951 but are not very well preserved. Previous records include the Colon shale of Quebrada Honda, Venezuela, and the Colon shale and Mito Juan shale of Santander del Norte, Colombia.

SIPHOGENERINOIDES sp. (Pl. 4, fig. 15)

The single specimen figured from sample E8953 has a smooth surface and does not seem to be like any of the recorded Cretaceous species. More specimens must be obtained to give the full characters.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA PETROLEANA Cushman and Hedberg (Pl. 4, figs. 18, 19)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 125.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 37, pl. 6, fig. 12.

Specimens referable to this species occurred in samples S2640, E5580, E8952, and E8953. It was described from the Colon shale of Colombia and is recorded from the Lizard Springs marl of Trinidad and from the Upper Cretaceous of California.

BULIMINA ASPERA Cushman and Parker (Pl. 4, fig. 17)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 121.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 37, pl. 6, fig. 10.

This species is recorded from the Lizard Springs marl of Trinidad, the Mal Paso shale of Peru, and many localities of Navarro and Taylor age in the Gulf Coastal region of the United States. In the Santa Anita material it occurs in samples A70H, A243, E7075, E8951, E8952, E8953, E8962, and E8965.

BULIMINA (DESINOBULIMINA) SUTERI Cushman and Renz (Pl. 4, fig. 16)

Bulimina (Desinobulimina) suteri CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 38, pl. 6, fig. 15.

A single specimen from sample E5580 seems to be identical with this species described from the Lizard Springs marl of Trinidad.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA INCRASSATA Reuss (Pl. 4, fig. 20)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 127.)

A few specimens referable to this species occurred in samples A243 and E8953. The species is widely distributed in America in beds of Navarro and Taylor age.

Family ELLIPSOIDINIDAE

Genus ELLIPSONODOSARIA A. Silvestri, 1900

ELLIPSONODOSARIA ALEXANDERI Cushman, var. IMPENSIA Cushman (Pl. 4, figs. 21, 22)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 136.)

A few fragmentary specimens from sample E5580 seem to belong to this variety which is characteristic of the upper formations of Navarro age. It also occurs in the Mal Paso shale of Peru.

Genus ELLIPSOGLANDULINA A. Silvestri, 1900

ELLIPSOGLANDULINA EXPONENS (H. B. Brady) (Pl. 4, fig. 11)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 137.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 43, pl. 7, figs. 10-12.

This species is known only from the Upper Cretaceous of Trinidad. Typical specimens occurred in the Santa Anita formation in samples A243, E8955, E8959, and E8964.

Family ROTALIIDAE

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA DEPRESSA (Alth)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 139.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 44, pl. 7, figs. 16, 17.

A single specimen from sample E5580 may be the young of this species. It is quite distinct from var. *colombiana*.

GYROIDINA DEPRESSA (Alth), var. COLOMBIANA Cushman and Hedberg (Pl. 4, fig. 24)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 140.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 44, pl. 7, figs. 18, 19.

This variety was described from the Upper Cretaceous, Colon shale, of Colombia and is recorded from the Lizard Springs marl of Trinidad. It is very common in sample E8960 but was not found in any of the other samples.

GYROIDINA GLOBOSA (Hagenow) (Pl. 4, fig. 23)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 140.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 44, pl. 7, fig. 15.

This species occurred in samples A243, E8949, and E8951. It is com-

mon in the Lizard Springs marl of Trinidad, the Colon shale of Colombia, and also occurs in the Upper Cretaceous of Mexico and in beds of Navarro and Taylor age in the southern United States.

GYROIDINA BEISSELI White (Pl. 4, fig. 27)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 141.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 44, pl. 7, figs. 21, 22.

A single specimen from sample E5580 is the only one of this species found in the Santa Anita collections. It occurs in the Mendez and Velasco shales of Mexico and in the Lizard Springs marl of Trinidad.

Genus EPONIDES Montfort, 1808

EPONIDES BOLLII Cushman and Renz (Pl. 4, fig. 25)

Eponides bollii CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 44, pl. 7, fig. 23.

A few specimens from sample E8962 seem identical with this species described from the Lizard Springs marl of Trinidad. It is quite distinct from *E. bronnimanni.*

EPONIDES BRONNIMANNI Cushman and Renz

Eponides bronnimanni CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 45, pl. 7, fig. 24.

A single specimen from sample A243 is very similar to this species described from the Lizard Springs marl of Trinidad.

EPONIDES BRONNIMANNI Cushman and Renz, var. MERA Cushman and Renz (Pl. 4, fig. 26)

Eponides bronnimanni CUSHMAN and RENZ, var. *mera* CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 45, pl. 7, fig. 25.

The single specimen figured from sample A198 seems to belong to this variety also described from the Lizard Springs marl of Trinidad.

Family CHILOSTOMELLIDAE

Genus CHILOSTOMELLA Reuss, 1850

CHILOSTOMELLA cf. OVOIDEA Reuss (Pl. 4, fig. 28)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 146.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 47, pl. 8, fig. 8.

A few specimens from samples E8952 and E8953 seem close to this

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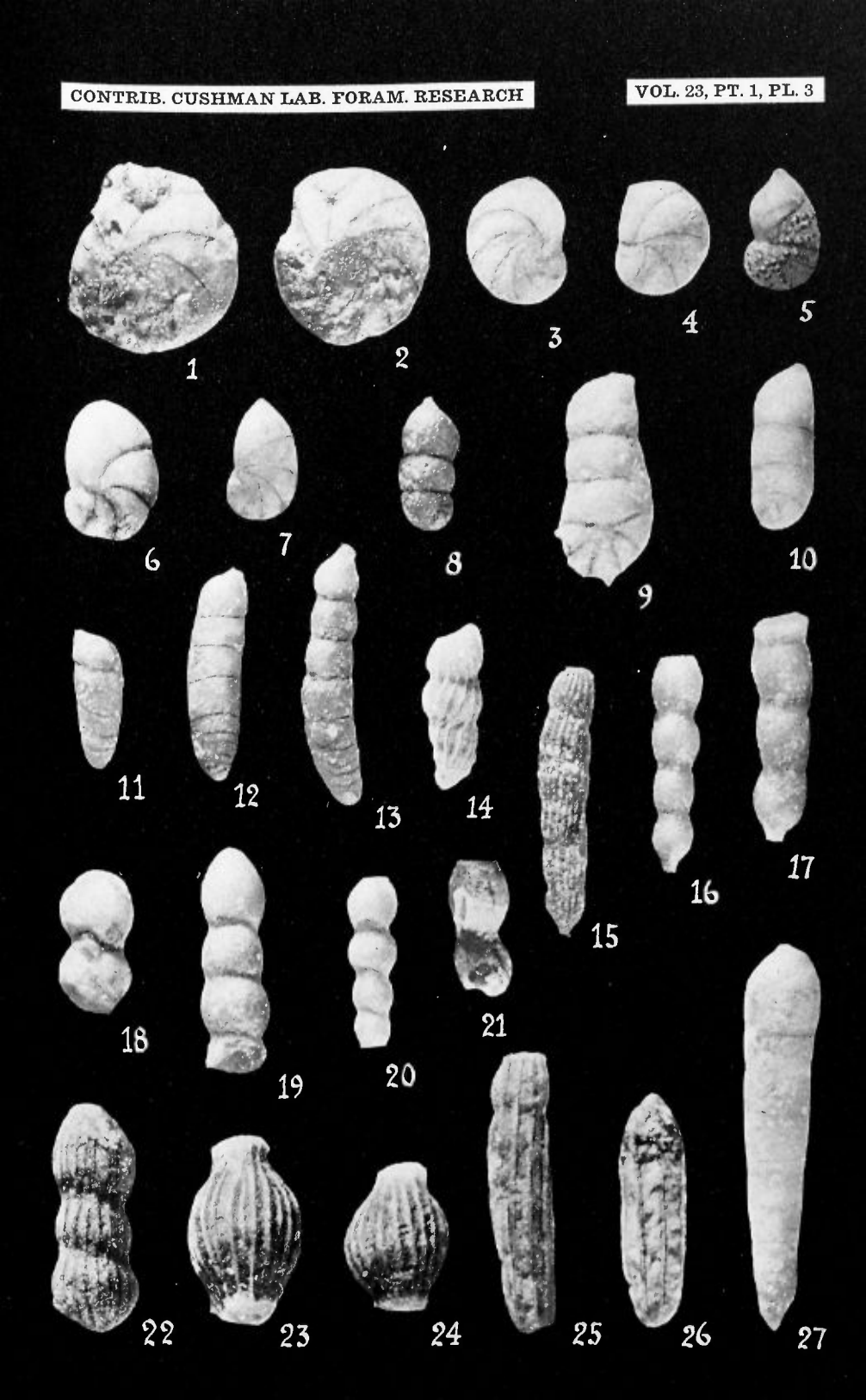
EXPLANATION OF PLATE 3

FIGS. 1, 2. *Robulus macrodiscus* (Reuss). × 27. 3. *R. discrepans* (Reuss). × 27. 4, 6. *R. oligostegius* (Reuss). × 27. 5. *Marginulina decorata* (Reuss). × 30. 7. *Lenticulina navicula* (d'Orbigny). × 40. 8. *Marginulina bullata* Reuss. × 27. 9. *Marginulina* sp. × 27. 10. *M.* cf. *grata* (Reuss). × 27. 11-13. *Dentalina megalopolitana* Reuss. × 30. 14, 15. *D. confluens* Reuss. × 30. 16, 17. *D.* cf. *consobrina* d'Orbigny. × 40. 18-21. *Nodosaria monile* Hagenow. × 27. 22-24. *N. paupercula* Reuss. × 27. 25. *N. affinis* Reuss. × 40. 26. *N. limonensis* Cushman. × 27. 27. *Chrysalogonium cretaceum* Cushman and Church. × 40.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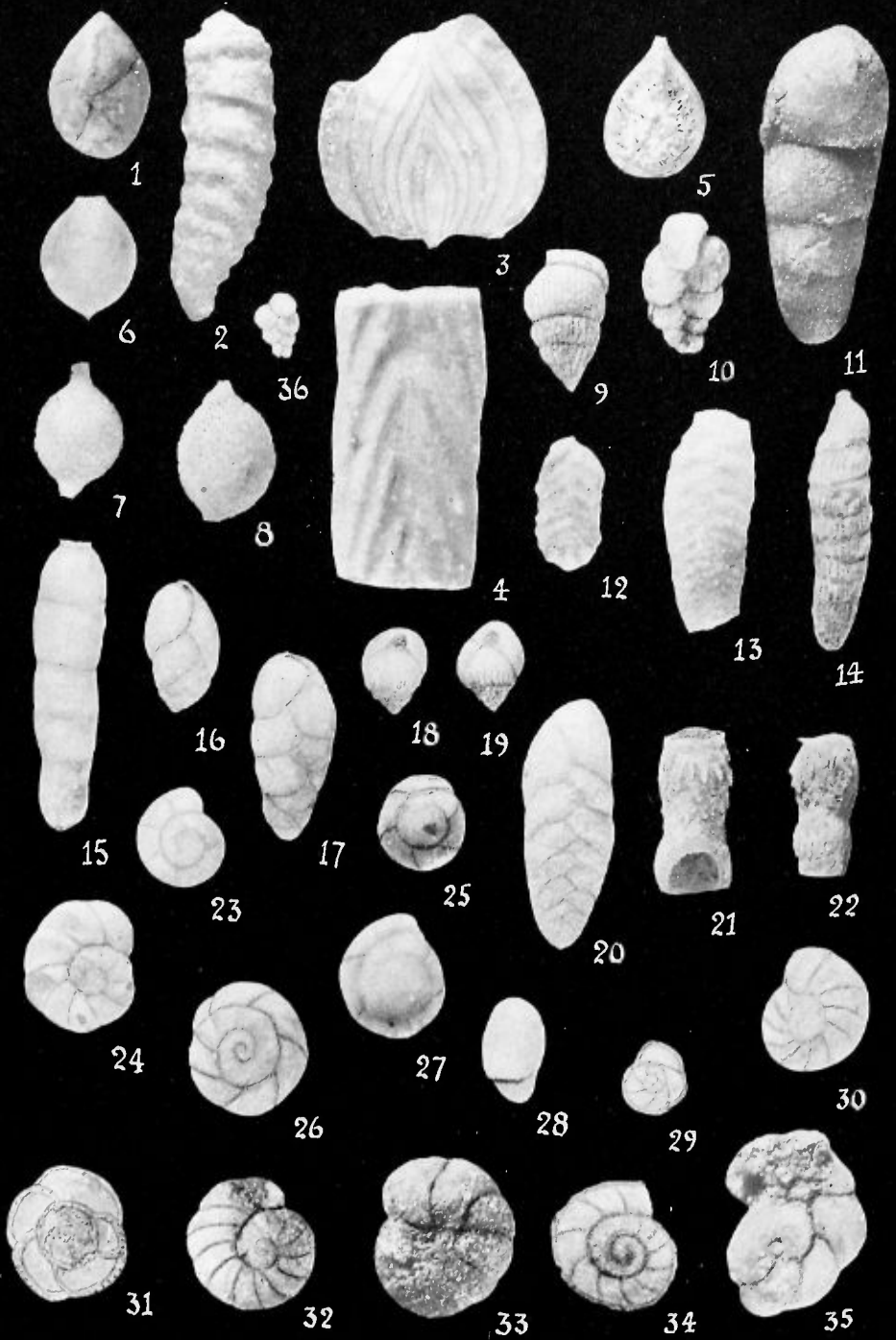
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species. Similar specimens occur in the Colon shale of Colombia and the Lizard Springs marl of Trinidad.

Genus PULLENIA Parker and Jones, 1862

PULLENIA CORYELLI White

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 147.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 47, pl. 8, fig. 9.

Specimens from samples A190, E5580, E7076, and E8248 may be referred to this species. They are not very well preserved. The species is known from the Velasco shale of Mexico, the Lizard Springs marl of Trinidad and from the Navarro and Taylor of Arkansas.

Family GLOBIGERINIDAE

A number of specimens belonging to this family were found in the Santa Anita material but as the species are not well worked out as yet, no attempt has been made to assign specific names.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

GLOBOTRUNCANA ARCA (Cushman) (Pl. 4, fig. 31)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 150.)

Specimens which seem to belong to this species occurred in samples A179, E8951, and E8953.

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA sp. (Pl. 4, fig. 29)

The single small specimen is figured for the record but no specific name can be assigned to it.

EXPLANATION OF PLATE 4

FIG. 1. *Saracenaria triangularis* (d'Orbigny). × 30. 2. *Vaginulina cretacea* Plummer. × 40. 3. *Frondicularia mucronata* Reuss. × 27. 4. *Frondicularia* sp. × 27. 5. *Palmula semireticulata* (Cushman and Jarvis). × 40. 6. *Lagena apiculata* (Reuss). × 40. 7, 8. *Ramulina aculeata* (d'Orbigny). × 30. 9, 10. *Ventilabrella carseyae* Plummer. × 40. 11. *Ellipsoglandulina exponens* (H. B. Brady). × 27. 12, 13. *Spiroplectammina grzybowskii* Frizzell. × 40. 14. *Siphogenerinoides parva* Cushman. × 30. 15. *Siphogenerinoides* sp. × 40. 16. *Bulimina (Desinobulimina) suteri* Cushman and Renz. × 30. 17. *B. aspera* Cushman and Parker. × 40. 18, 19. *B. petroleana* Cushman and Hedberg. × 40. 20. *Bolivina incrassata* Reuss. × 30. 21, 22. *Ellipsonodosaria alexanderi* Cushman, var. *impensia* Cushman. × 30. 23. *Gyroidina globosa* (Hagenow). × 40. 24. *G. depressa* (Alth), var. *colombiana* Cushman and Hedberg. × 40. 25. *Eponides bollii* Cushman and Renz. × 40. 26. *E. bronnimanni* Cushman and Renz, var. *mera* Cushman and Renz. × 40. 27. *Gyroidina beisseli* White. × 40. 28. *Chilostomella* cf. *ovoidea* Reuss. × 40. 29. *Globorotalia* sp. × 40. 30. *Anomalina* sp. × 40. 31. *Globotruncana arca* (Cushman). × 40. 32. *Anomalina* cf. *henbesti* Plummer. × 40. 33. *A. rubiginosa* Cushman. × 40. 34. *Cibicides* cf. *harperi* (Sandidge). × 40. 35. *C. beaumontianus* (d'Orbigny). × 27. 36. *Gümbelina ultimatumida* White. × 40.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA RUBIGINOSA Cushman (Pl. 4, fig. 33)

(For earlier references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 156.)—CUSHMAN and RENZ, Special Publ. 18, Cushman Lab. Foram. Res., 1946, p. 48, pl. 8, figs. 17, 18.

Specimens from samples A243, E8952, E8956, and E8958 are apparently of this species but show some variation. It is a common species in the Velasco shale of Mexico and the Lizard Springs marl of Trinidad.

ANOMALINA cf. HENBESTI Plummer (Pl. 4, fig. 32)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 155.)

A few specimens from samples E8949, E8953, and E8963 may belong to this species. It is recorded from beds of Navarro and Taylor age in the southern United States.

ANOMALINA sp. (Pl. 4, fig. 30)

The figured specimen somewhat resembles *Planulina spissocostata* Cushman, but does not have the full characters of that species and most of the specimens are not very well preserved as to full details. They are from samples A196, E5580, E7077, E8959, and E8962.

Genus CIBICIDES Montfort, 1808

CIBICIDES cf. HARPERI (Sandidge) (Pl. 4, fig. 34)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 159.)

Specimens from samples A198, A246, E8249, and E8951 resemble somewhat this species known only from upper beds of Navarro age in Texas and Alabama.

CIBICIDES BEAUMONTIANUS (d'Orbigny) (Pl. 4, fig. 35)

(For references, see U. S. Geol. Survey Prof. Paper 206, 1946, p. 160.)

The figured specimen from sample E8965 seems to belong to this species. In the American Cretaceous it is found in beds of Navarro and Taylor age.

289. *LINGULINA NAHEOLENSIS* CUSHMAN, A NEW NAME

BY JOSEPH A. CUSHMAN

The name *Lingulina minuta* was used by Franke for a Jurassic species in 1936 making invalid the name *L. minuta* Cushman used in these Contributions (vol. 20, 1944, p. 38, pl. 6, fig. 10). The following name is therefore proposed:

LINGULINA NAHEOLENSIS Cushman, new name

Lingulina minuta CUSHMAN (not FRANKE), Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 38, pl. 6, fig. 10.

Test minute, about twice as long as broad, compressed, tapering from the acute initial end to the greatest breadth at the middle of the last-formed chamber, thence narrowing to the bluntly angled, apertural end; chambers few, increasing rapidly in size as added, strongly overlapping; sutures distinct, not depressed, at right angles to the long axis of the test; wall smooth; aperture terminal, radiate, not projecting.

Length of holotype, 0.35 mm.; breadth 0.15 mm.; thickness 0.12 mm.

Holotype (Cushman Coll. No. 40404) from the Paleocene, Coal Bluff marl member of Naheola formation, creek bottom, just W. of store at Caledonia, about ¼ mi. S. of center of sec. 29, T. 11 N., R. 10 E., Wilcox Co., Ala.

This species differs from *L. glabrata* Hantken from the Eocene of Hungary, which it resembles, in its much smaller size, more tapering and less compressed test, and relatively higher chambers.

RECENT LITERATURE ON THE FORAMINIFERA

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

de Albear, Jesus F. Stratigraphic Paleontology of Camagüey District, Cuba.—Bull. Amer. Assoc. Petr. Geol., vol. 31, No. 1, January 1947, pp. 71-91, 1 map.—Numerous lists of foraminifera are given.

Cushman, J. A. and **H. B. Gray.** A Foraminiferal Fauna from the Pliocene of Timms Point, California.—Special Publ. No. 19, Cushman Lab. Foram. Res., Dec. 10, 1946, pp. 1-46, pls. 1-8.—The following species and varieties are new: *Vaginulina pliocenica* n. sp.; *V. advena* Cushman, var. *pauciloculata* n. var.; *Lagena laevis* (Montagu), var. *baggi* n. var.; *L. pliocenica* Cushman and Gray, var. *discrepans* n. var.; *L. striato-punctata* Parker and Jones, var. *tricosta* n. var.; *L. submagnifica* n. sp.; *Entosolenia sigmoidella* (Cushman), var. *timmsensis* n. var.; *Bolivina subadvena* Cushman, var. *acuminata* Natland, Ms.

Grimsdale, T. F. Some American Fossil Foraminifera and Corals.—Nature, vol. 158, Nov. 16, 1946, pp. 718-720.—A review of Vaughan's paper on "American Paleocene and Eocene Larger Foraminifera."

Hanzawa, Shoshiro. The Stratigraphical Relation between the Carboniferous and Permian Formations in Manchuria, Korea, and Japan Proper.—Jap. Journ. Geol. Geogr., vol. 18, No. 3, 1942, pp. 97-108.—A number of foraminifera mentioned, mostly Fusulinidae.

Parafusulina yabei n. sp. from Tomuro, Simotuke Province, Japan.—L. c., vol. 18, No. 4, 1942, pp. 127-131, pls. 13, 14.

Stratigraphic Distribution of the Fusulinid Foraminifera found in South Manchuria and Japan.—L. c., vol. 19, 1944, pp. 1-10, chart.

Notes on Some Miocene Foraminifera from the Sagara Oil Field, Japan.—Journ. Geol. Soc. Japan, vol. 50, No. 595, April 20, 1943, pp. 126-135, pls. 7-11 (4-8).—A number of species described and figured, none new.

Hanzawa, S. and **K. Asano.** Notes on Some Lepidocyclines from Palmalt, Tamismolon, Vera Cruz, Mexico.—Jap. Journ. Geol. Geogr., vol. 18, No. 4, 1942, pp. 119-126, pls. IX-XII.—Several species described and figured, none new.

Johnson, J. Harlan. Nubecularia from the Pennsylvanian and Permian of Kansas.—Journ. Pal., vol. 21, No. 1, 1947, pp. 41-45, pl. 17.—The occurrences of specimens referred to *Nubecularia* are figured in section.

Majzon, Ladislaus. Furolaboratoriumi Foraminifera-Vizsgalatok (Foraminiferenuntersuchungen des Bohr-Laboratoriums).—M. kir. Fold. Int. Evi Jelentesei az 1933-1935, 1939, pp. 1023-1045.—Numerous lists and occurrences given.

Budapestkörnyeki Kattiai-Retegek Foraminiferai (Foraminiferen der Chattien-Schichten in der Umgebung von Budapest).—L. c., pp. 1047-1120.—Numerous lists and occurrences given.

A Bükkszeki Melyfurasok (Die Tiefbohrungen von Bükkszek).—Mitt. Jahrb. K. Ungar. Geol. Anstalt, vol. 34, 1940, pp. 275-386, pls. 1-4.—Numerous lists of foraminifera given.

Ujabb Adatok az Egri Oligocen Retegek Faunajahoz es a Paleogen-Neogen Hatarkerdes (Neuere Beiträge zur Fauna der Oligozänschichten von Eger).—Földt. Közlöny, vol. 72, 1942, pp. 29-47.—Foraminifera listed.

Adatok Egyes Karpataljai Flis-Retegekhez, Tekintettel a Globotruncanakra (Beiträge zur Kenntnis Einiger Flysch-Schichten des Karpatenvorlandes mit Besonderer Rücksicht auf die Globotruncanen).—Mitt. Jahrb. K. Ungar. Geol. Anstalt, vol. 37, 1943, pp. 1-169, pls. 1, 2.—Thirty species described and figured with the following new genera and species: *Placentammina* Majzon 1940, nov. gen.; *P. gutta* nov. nom.; *Ammodiscus eggeri* nov. nom.; *Thalmannina* Majzon 1941, nov. gen.; *T. nothi* nov. nom.; *Glomospira saturniformis* nov. nom.; *Trochamminoides transitus* nov. sp.; *T. körösmezöensis* nov. sp.; *Haplophragmoides loczyi* nov. sp.; *Cyclammina subkarpatica* nov. nom.; *Pleurostomelloides* Majzon 1941, nov. gen.; *P. andreasi* nov. sp.; *Uvigerinammina* Majzon 1941, nov. gen.; *U. jankoi* nov. sp.; *Nodosarella* (?) *brevis* nov. sp.

A Clavulina szaboi Hantk. Elöfordulasai Eszakerdelyben (Die Vorkommen von Clavulina Szaboi Hantk. in Nordsiebenbürgen).—M. kir. Fold. Int. Evi Jelentesenek Függeleke, 1944, pp. 1-24, 1 pl., 2 text figs.—Foraminifera listed.

Schijfsma, E. The Foraminifera from the Hervian (Campanian) of Southern Limburg.—Med. Geol. Stichting, ser. C-V, No. 7, 1946, pp. 1-174, pls. 1-10.—Many species figured and described, the following new: *Ammodiscus cretaceus* (Reuss), var. *rugosa* n. var.; *Tritaxia compressa* n. sp.; *Ataxogyroidina dufouri* n. sp.; *A. pseudoglobosa* n. sp.; *Trochammina spiralis* n. sp.; *T. undulosa* n. sp.; *Lenticulina mariae* n. sp.; *L. multinodosa* n. sp.; *L. ordinaris* n. sp.; *Vaginulina daini* n. sp.; *Discorbis supracretacea* n. sp.; *D. sigmoidalis* n. sp.; *Eponides beisseli* n. sp.; *Gyroidina tendami* n. sp.; *Anomalina daini* n. sp.; var. *arenacea* n. var.; *Cibicides voltziana* (d'Orbigny), var. *plana* n. var.; *C. minimalis* n. sp.

Selli, Raimondo. Sulla Struttura della *"Cristellaria" serpens* Seguenza.—Giornale di Geologie, Ann. Mus. Geol. Bologna, ser. 2, vol. 14, 1939-40, pp. 1-12, pl. 3, 2 text figs.—Figures are given of exterior and sections and a new generic name, *Cribrobulina,* erected, with one new variety, *C. serpens* (Seguenza), var. *subcarenata* n. var.

Ciottoli con Foraminiferi Paleogenici nel Subappennino Emiliano.—L. c., ser. 2, vol. 15, 1941, pp. 1-13, pls. 1, 2.—Lists of species are given and figures of thin sections.

Una Microfauna Eocenica Inclusa nelle Argille Scagliose del Passo dell' Abbadessa (Ozzano-Bologna).—L. c., ser. 2, vol. 17, 1943-44 (1944), pp. 33-91, pls. 1, 2.—Numerous species described and figured, the following new: *Clavulina (Clavulinoides) fantinii* n. sp.; *Gaudryina (Pseudogaudryina) claternae* n. sp.; *Planularia* n. sp., *Nodosaria* n. sp.; *N. boffalorae fantinii* n. var.; *Lagena scarenaensis depressula* n. var.; var. *glabrata* n. var.; *L. gortanii* n. sp.; *Bolivina capdevilensis gortanii* n. var.; *Bulimina abatissae* n. sp.; *Ellipsopleurostomella schlichti silvestrii* n. var.; *E. labiata fantinii* n. var.; *Pulvinulina abatissae* n. sp.

Rilevamenti geologici nell'Alto Bacino dell'Isonzo La Conca di Versenico e la Zona di Nascali a Oriente de Plezzo (Gorizia).—Atti Reale Istit. Veneto scienze, lettere ed arti, Ann. Accad. 1941-42, vol. 101, pt. 2, 1942, pp. 649-666, pls. 1, 2 (map and sections).—Lists of a few foraminifera are given.

Sigal, J. Étude de la microfaune du chantier de Gensac (H^te^-Garonne).—Revue Mensuelle, vol. 1, No. 1, Oct. 1946, pp. 16-32, pls. 1-10.—Charts the distribution of many species of foraminifera.

Stainforth, Robert M. and **Frank V. Stevenson.**—Three new foraminifera from the Tertiary of Ecuador.—Journ. Pal., vol. 20, No. 6, November 1946, pp. 560-565, pl. 86.—*Technitella archaeonitida* n. sp.; *Planulina wheeleri* n. sp.; *Palmerinella thalmanni* n. sp.

ten Dam, A. Arenaceous Foraminifera and Lagenidae from the Neocomian (Lower Cretaceous) of the Netherlands.—L. c., pp. 570-577, pls. 87, 88.—Twenty-two forms are described and figured, of which the following are new: *Triplasia grosserugosa* n. sp.; *Verneuilina chapmani* n. sp.; *Saracenaria frankei* n. sp.; *Planularia guttata* n. sp.; *Vaginulina subrotunda* n. sp.; *Vaginulinopsis reticulosa* n. sp.; *V. pachynota* n. sp.; *Nodosaria rugosa* n. sp.; *Tristix acutangula* (Reuss), var. *lamellosa* n. var.; *T. crassa* n. sp.; *Frondicularia simplicissima* n. sp.; *Lingulina praelonga* n. sp.; *Marginulina hechti* n. sp.

On Foraminifera of the Netherlands No. 8. Een Nieuwe Soort uit het Geslacht Ammodiscus Reuss in het Rhaet bij Winterswijk.—Geol. Mijnbouw, 7^e^ Jahrgang, No. 3-4, Sept.-Oct. 1945, p. 24, fig. in text.—Describes a new species, *A. parvulus* ten Dam, from the Jurassic of a deep well boring in the Netherlands.

Weaver, Charles E. Stratigraphy and Paleontology of the Tertiary Formations at Coos Bay, Oregon.—Univ. Washington (Seattle) Publ. in Geol., vol. 6, No. 2, 1945, pp. 31-62, tables, charts, maps.—Gives a list of foraminifera and their distribution on p. 49.

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