CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

172. SOME AMERICAN CRETACEOUS SPECIES OF ELLIPSONODOSARIA AND CHRYSALOGONIUM*

By JOSEPH A. CUSHMAN

In the study of the Cretaceous Nodosarias and Dentalinas a number of species have been found which evidently belong to the genus *Ellipsonodosaria* and one to the genus *Chrysalogonium*. Most of these have very definite and comparatively short ranges. They should be of use as stratigraphic markers.

ELLIPSONODOSARIA EXILIS Cushman, n. sp. (Pl. 9, figs. 1, 2)

Test very elongate, slender, slightly curved, initial end with a straight acerose spine, diameter increasing very little if at all from the proloculum to the apertural end; chambers distinct, increasing rather gradually and uniformly in length as added, very slender, inflated; sutures distinct, slightly limbate, in some specimens very slightly depressed; wall smooth, thin; aperture terminal with a crescentic opening and indication of a slight tooth. Length up to 3.00 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 23251) from the Upper Cretaceous near base of upper part of Taylor marl, road cut 14.4 miles south of Paris, 0.9 mile north of Lake City, Delta Co., Texas.

This species also occurs in the Annona chalk. It may be distinguished from *E. granti* (Plummer) in the much more slender test and very thin wall.

ELLIPSONODOSARIA (?) GRANTI (Plummer) (Pl. 9, figs. 3-5)

Nodosaria granti PLUMMER, Bull. 2644, Univ. Texas, 1927, p. 83, pl. 5, figs. 9 *a-d*.

There are in the Upper Cretaceous, Navarro clays rather large forms evidently belonging to this genus which resemble the

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species described by Mrs. Plummer from the lower Eocene, Midway of Texas. This is referred to this species with some question as the aperture was originally described as "round and radiate." The figured specimens are from the Navarro clay pit of the Corsicana Brick Company, 2 miles N. of Corsicana Court House, Corsicana, Texas. It also occurs in the Arkadelphia clay 4 miles E. of Washington and ½ mile N. of Reeds Store, Arkansas.

ELLIPSONODOSARIA ALEXANDERI Cushman, n. sp. (Pl. 9, figs. 6-9)

Test elongate, straight or slightly curved, microspheric form increasing rather rapidly in diameter from the small proloculum, the megalospheric form with the proloculum having nearly as great a diameter as the last-formed chambers; chambers distinct, inflated, increasing rather gradually in length, the adult ones about twice as long as broad; sutures distinct, strongly depressed; wall ornamented with short backwardly pointing spines, in the early stages of the microspheric form with a single ring of spines slightly below the middle of the chamber, in the adult with numerous spines rather irregularly scattered over the surface; aperture a semi-circular opening with a single tooth, with a distinct neck and slightly raised lip. Length up to 2.00 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 23254) from the Upper Cretaceous, Taylor marl, road cut 14.4 miles south of Paris, 0.9 mile north of Lake City, Delta Co., Texas.

This species is rather characteristic of the upper portion of the Taylor marl but somewhat similar specimens occur also in the upper Navarro. It differs from *E. granti* (Plummer) in the much shorter chambers and ornamentation of the surface.

ELLIPSONODOSARIA STEPHENSONI Cushman, n. sp. (Pl. 9, figs. 10-15)

Test slightly elongate, tapering, slightly arcuate; chambers distinct, increasing rather rapidly in diameter and increasing much in length as added, slightly pyriform in adult, greatest breadth toward the base, somewhat inflated; sutures distinct, depressed, somewhat limbate; wall smooth except for a ring of very short backwardly pointing spines near the base of the chamber, in the adult occasionally with a few scattered spines above, early chambers smooth; aperture with a distinct ring and slight lip, the opening itself, when well preserved, crescentic, with a distinct tooth. Length up to slightly more than 1 mm.; diameter 0.08-0.10 mm.

Holotype (Cushman Coll. No. 23256) from Taylor marl 7.5 miles from Terrell on road to Crandall, Kaufman Co., Texas.

This species is widely distributed in the upper part of the Taylor marl and also occurs in the Navarro formation of Texas. This species may be distinguished from *E. annulifera* Cushman and Bermudez in the spines of the basal portion of the chambers and in the chambers which are more pyriform in shape.

ELLIPSONODOSARIA (?) JARVISI Cushman, n. sp. (Pl. 9, figs. 16-18)

Dentalina cf. *adolphina* CUSHMAN (not D'ORBIGNY), Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 97, pl. 14, fig. 6.—CUSHMAN and JARVIS, Proc. U. S. Nat. Mus., Bull. 80, Art. 14, 1932, p. 30, pl. 10, fig. 1.

Test elongate, tapering, rapidly increasing in diameter from the subacute initial end, slightly arcuate; chambers distinct in the early portion, somewhat broader than long, in the adult with the length and breadth about equal becoming much inflated and subspherical; sutures distinct except in the earliest portion becoming more and more depressed at the apertural end in the adult; wall ornamented by slightly developed longitudinal costae occasionally showing traces of spines at the lower end and occupying the middle portion of the chamber; aperture terminal, broadly crescentic with a slight tooth, a distinct short neck and broad lip which is marked with radial striations. Length 1.50 mm.; diameter 0.25 mm.

Holotype (Cushman Coll. No. 9705) from the Upper Cretaceous, pit at Lizard Springs, near Guayaguayare, southeastern Trinidad.

This was referred to d'Orbigny's species but is a much stouter, thicker keeled form with very little trace of actual spines and the apertural lip very broad and distinct.

ELLIPSONODOSARIA HORRIDENS Cushman, n. sp. (Pl. 9, figs. 19-21)

Dentalina adolphina CUSHMAN (not D'ORBIGNY), Bull. 41, Tennessee Geol. Surv., p. 30, pl. 3, figs. 10-12.

Test elongate, slightly tapering, straight or very slightly arcuate; chambers pyriform, increasing somewhat in length as added, diameter increasing slightly; sutures distinct, strongly depressed; wall ornamented by numerous short, sharp, backwardly pointing spines on the lower half of each chamber; aperture apparently

crescentic with a slight tooth. Length probably up to 3 or 4 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 15163) from the Upper Cretaceous, Selma chalk, New Corinth Highway, 13.5 miles south of Selmer, McNairy Co., Tennessee.

This species differs from *E. adolphina* in the much more elongate chambers and the less regularly arranged spines.

ELLIPSONODOSARIA DENTATA-GLABRATA Cushman, n. sp. (Pl. 9, figs. 22, 23)

Test elongate, slightly tapering, slightly arcuate, initial end without a spine; chambers distinct, increasing gradually in diameter and length as added, in the adult becoming inflated; sutures distinct, somewhat limbate, becoming more depressed in the adult; wall smooth except in the median portion where the chamber has a ring of a few closely appressed spines, wanting in the early portion and also on the adult chambers; aperture rounded with a slight neck and tooth. Length 1.00-1.25 mm.; diameter 0.15 mm.

Holotype (Cushman Coll. No. 22732) from the Cretaceous, Navarro group, Neylandville marl, (*Exogyra-Cancellata*) zone, gully, west of Paris Highway, 7¼ miles northeast of Cooper, Delta Co., Texas.

This species differs from *E. annulifera* Cushman and Bermudez

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EXPLANATION OF PLATE 9

FIGS. 1, 2. *Ellipsonodosaria exilis* Cushman, n. sp. × 33. Fig. 1, paratype. Fig. 2, holotype.

FIGS. 3–5. *Ellipsonodosaria* (?) *granti* (Plummer). × 33.

FIGS. 6–9. *Ellipsonodosaria alexanderi* Cushman, n. sp. × 30. Fig. 9, holotype. Figs. 6, 7, microspheric young stages. Figs. 8, 9, megalospheric.

FIGS. 10–15. *Ellipsonodosaria stephensoni* Cushman, n. sp. × 33. Fig. 10, holotype. Figs. 11-15, paratypes.

FIGS. 16–18. *Ellipsonodosaria* (?) *jarvisi* Cushman, n. sp. × 40. Fig. 17, holotype. Figs. 16, 18, paratypes.

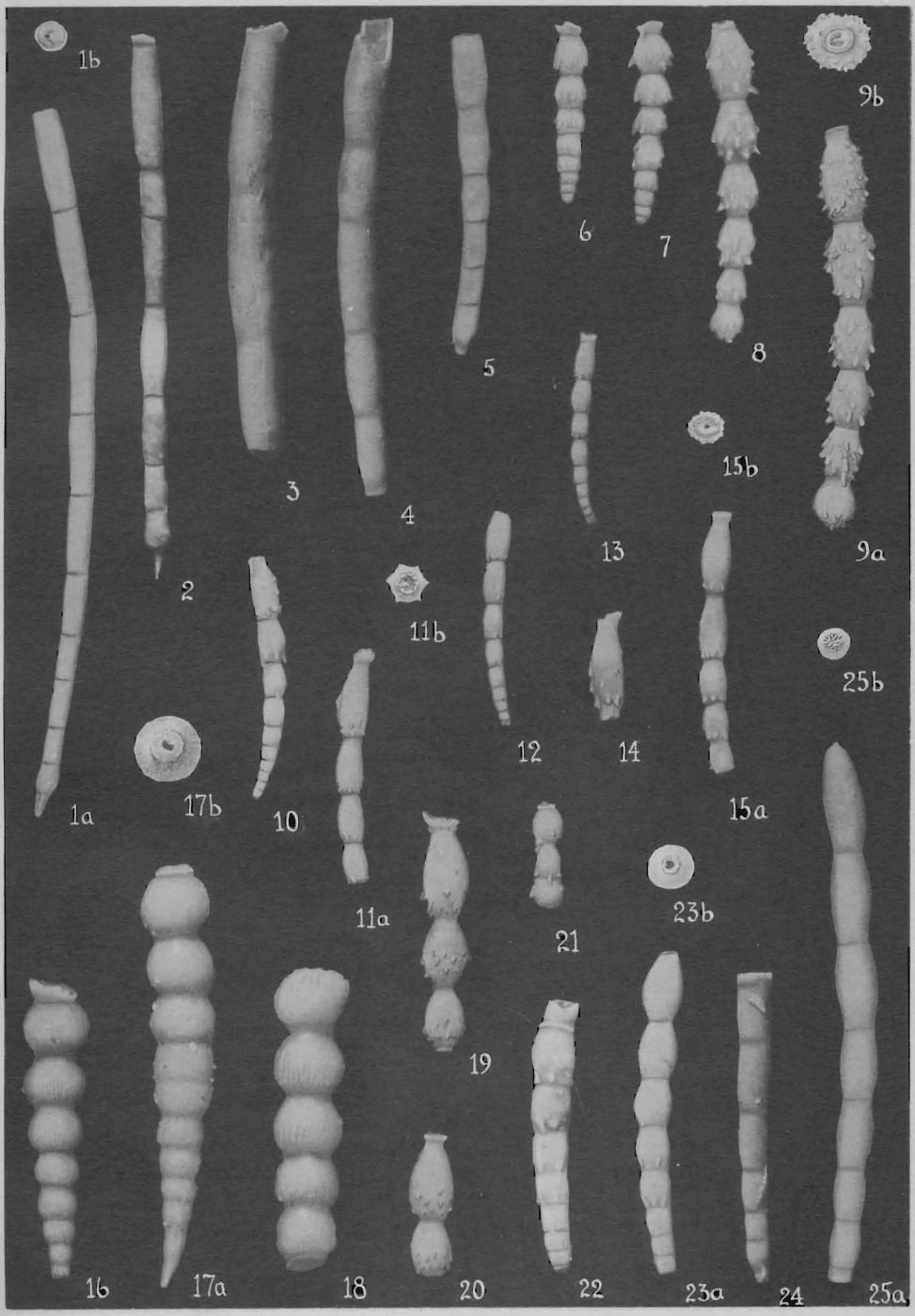
FIGS. 19–21. *Ellipsonodosaria horridens* Cushman, n. sp. × 33. Fig. 19, holotype. Figs. 20, 21, paratypes.

FIGS. 22, 23. *Ellipsonodosaria dentata-glabrata* Cushman, n. sp. × 50. Fig. 22, paratype. Fig. 23, holotype.

FIGS. 24, 25. *Chrysalogonium texanum* Cushman, n. sp. × 40. Fig. 24, paratype. Fig. 25, holotype.

In all specimens: *a*, front view; *b*, apertural view.

Figures from photographs retouched by Ann Shepard.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in the less limbate sutures, lack of initial spine and the few appressed spines in the median portion.

CHRYSALOGONIUM TEXANUM Cushman, n. sp. (Pl. 9, figs. 24, 25)

Test very elongate, slender, very slightly tapering, slightly arcuate; chambers distinct, somewhat inflated, increasing in length as added, in the adult at least three times as long as broad; sutures distinct, slightly limbate, slightly depressed; wall smooth; aperture in the adult a sieve plate, slightly raised into a small terminal projection. Length 2.00 mm.; diameter 0.15 mm.

Holotype (Cushman Coll. No. 23262) from the Upper Cretaceous, lower part of Taylor marl, Cooper road, 6 miles south of Paris, Texas.

This species differs from *C. laeve* Cushman and Bermudez in the more slender test and more elongate chambers. It differs from the Cretaceous species of California, *C. cretaceum*, in the much smaller size and more slender form.

173. ADDITIONAL NEW SPECIES OF FORAMINIFERA AND A NEW GENUS FROM THE EOCENE OF CUBA

By JOSEPH A. CUSHMAN and PEDRO J. BERMUDEZ

The following descriptions and figures are of a further number of new things found in a continued study of the rich Eocene faunas of Cuba. Their relationships to the Tertiary of the Coastal Plain of the United States and other West Indian regions are also interesting and will be taken up in a more comprehensive paper at a later date.

GAUDRYINELLA CUBANA Cushman and Bermudez, n. sp. (Pl. 10, figs. 1, 5, 6)

Test in the microspheric form nearly twice as long as broad, rapidly tapering in the early portion, later becoming irregularly quadrate in section, megalospheric form more slender, less rapidly tapering and much less distinctly quadrate; chambers fairly distinct, earlier ones triserial, later biserial and in the adult tending to become uniserial; sutures fairly distinct, slightly depressed; wall rather coarsely arenaceous but fairly smoothly finished; aperture in the adult terminal, rounded, with a slight neck. Length 1.50-1.90 mm.; breadth 0.90-1.05 mm.

Holotype (Cushman Coll. No. 23264) from the Eocene, lower Principe formation, lower beds of "El Husillo" Quarry, Puentes Grandes, Havana, Cuba (Bermudez Sta. 312).

This species differs from *G. pseudoserrata* Cushman in the more entire margin, less developed neck and the compression of the test.

GAUDRYINA CUBANA Cushman and Bermudez, n. sp. (Pl. 10, figs. 2, 10, 11)

Test about twice as long as broad, generally triserial for the most part, last two or three chambers becoming biserial, early portion sharply angled, rather rapidly tapering from the subacute initial end, later biserial portion roughly quadrangular in end view; chambers distinct, very slightly inflated, increasing rather regularly in size as added; sutures distinct, slightly depressed, earliest ones forming angles of about forty-five degrees with the elongate axis, becoming much less oblique and nearly horizontal in the adult; wall rather coarsely arenaceous, surface slightly roughened; aperture rounded at the base of the inner margin of the apertural face. Length 0.85-1.20 mm.; breadth 0.40-0.60 mm.

Holotype (Cushman Coll. No. 23267) from the Eocene, lower Principe formation, lower beds of "El Husillo" Quarry, Puentes Grandes, Havana, Cuba (Bermudez Sta. 312).

This species differs from *G. trinitatensis* Nuttall in the much greater proportion of triserial chambers, more quadrate apertural view and the much rougher surface.

GAUDRYINA (PSEUDOGAUDRYINA) RUTTENI Cushman and Bermudez, n. sp. (Pl. 10, figs. 15, 16)

Test only slightly longer than broad, much compressed, quadrate in end view, the broader sides distinctly concave, biserial portion making up almost the entire test; chambers distinct, in the later portion slightly inflated, increasing rather rapidly in height and breadth as added; sutures fairly distinct, strongly depressed; wall rather coarsely arenaceous but smoothly finished; aperture a low, elongate opening in a distinct re-entrant at the inner margin of the last-formed chamber. Length 1.00 mm.; breadth 0.70 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 23278) from the Eocene, lower Principe formation, under Library of Havana University, Cuba (Bermudez Sta. 257).

This species differs from *G.* (*Pseudogaudryina*) *jacksonensis* Cushman in the much shorter form, more quadrate end view and much greater compression of the test.

DOROTHIA PRINCIPENSIS Cushman and Bermudez, n. sp. (Pl. 10, figs. 3, 4)

Test small, elongate, about two and one-half times as long as broad, very slightly compressed, biserial portion making up nearly the entire test, periphery lobulate; chambers distinct except in the earliest portion, of rather uniform size throughout, becoming slightly more inflated toward the apertural end; sutures distinct, depressed, in the biserial portion nearly at right angles to the vertical axis; wall finely arenaceous, smoothly finished; aperture a low, arched opening at the inner margin of the last-formed chamber. Length 0.80 mm.; diameter 0.30 mm.

Holotype (Cushman Coll. No. 23270) from the Eocene, lower Principe formation, Loma Principe, Avenida de los Presidentes, Vedado, Havana, Cuba (Bermudez Sta. 20).

This species differs from *D. nuttalli* Cushman in the more numerous, lower chambers and in the much more elongate and lower aperture.

PLECTINA CUBENSIS Cushman and Bermudez, n. sp. (Pl. 10, figs. 7-9)

Test comparatively short and broad, the breadth about two-thirds the length, tapering throughout, greatest breadth toward the apertural end; chambers of the early portion somewhat obscure, in the adult distinct, inflated, biserial; sutures rather indistinct, only slightly depressed except in the last-formed portion; wall rather coarsely arenaceous, roughly finished; aperture circular, somewhat above the inner margin of the last-formed chamber. Length 0.95-1.05 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 23272) from the Eocene, lower Principe formation, lower beds of "El Husillo" Quarry, Puentes Grandes, Havana, Cuba (Bermudez Sta. 312).

This species differs from *P. eocenica* Cushman in the relatively broader, more tapering test and less roughened surface.

PLECTINA TORREI Cushman and Bermudez, n. sp. (Pl. 10, figs. 12-14)

Test small, tapering, greatest breadth toward the apertural end, about one and one-half to two times as long as broad; chambers fairly distinct except in the early triserial portion, in the adult biserial portion inflated; sutures fairly distinct, depressed;

wall very finely arenaceous, smoothly finished; aperture in the adult nearly terminal, small, rounded. Length 0.25-0.80 mm.; diameter 0.45 mm.

Holotype (Cushman Coll. No. 23275) from the upper Eocene, Alturas de Almendares Quarry, Havana, Cuba (Bermudez Sta. 18).

This species differs from *P. eocenica* in the shorter, stouter form and in the very finely arenaceous, smoothly finished wall.

PLECTINA ELONGATA Cushman and Bermudez, n. sp. (Pl. 10, figs. 22-24)

Test elongate, about two and one-half times as long as broad, generally circular in transverse section, sides nearly parallel for most of the length, initial end broadly rounded; chambers somewhat indistinct, the early triserial ones obscure, biserial ones more inflated and tending to become uniserial in the adult; sutures rather indistinct except in the last-formed portion where they are depressed; wall rather coarsely arenaceous but rather smoothly finished with much cement; aperture nearly terminal, circular. Length 1.25 mm.; breadth 0.55 mm.

Holotype (Cushman Coll. No. 23285) from the Eocene, lower Principe formation, under Library of Havana University, Cuba (Bermudez Sta. 257).

This species differs from *P. eocenica* in the smoothly finished wall, its large proportion of cement and more inflated chambers.

GOESELLA CUBENSIS Cushman and Bermudez, n. sp. (Pl. 10, figs. 17, 18)

Test short and stout, circular in end view, sides for the most part nearly parallel, slightly lobulate, initial end broadly rounded; apertural end truncate; chambers rather indistinct except in the last uniserial ones which are somewhat inflated, the three or four adult uniserial chambers making up a very large proportion of the test; sutures indistinct except between the last two or three chambers where they are distinctly depressed; wall coarsely arenaceous, roughly finished; aperture rounded, terminal. Length 1.25-1.40 mm.; diameter 0.75 mm.

Holotype (Cushman Coll. No. 23280) from the Eocene, lower Principe formation, Loma Principe, Avenida de los Presidentes, Vedado, Havana, Cuba (Bermudez Sta. 20).

This species differs from *G. trinitatensis* Cushman in the broader, shorter form, much more rounded initial end and shorter, broader uniserial chambers.

PSEUDORBITOLINA CUBENSIS Cushman and Bermudez, n. sp. (Pl. 10, figs. 27-30)

Test plano-convex, dorsal side varying from a slightly rounded to a somewhat conical shape, ventral side with the periphery rounded and the central portion deeply concave; chambers fairly distinct showing best in eroded specimens, earliest ones in the megalospheric form with three chambers later becoming biserial and finally annular in the adult, subacute, numerous chamberlets first in a single row, then double and in the adult with more than two rows; sutures rather indistinct except in eroded specimens; wall finely arenaceous, smoothly finished with an outer, very fine, secondary coating, particularly on the dorsal side; apertures in a single row about the periphery at the base. Diameter 1.10-1.70 mm.; height 0.60-1.00 mm.

Holotype (Cushman Coll. No. 23293) from the Eocene, 4.5 kms. W. of Guanajay on the road to Mariel, Pinar del Rio Province, Cuba (Bermudez Sta. 337A).

This species differs from *P. marthae* Douvillé in the somewhat higher test.

UVIGERINA HAVANENSIS Cushman and Bermudez, n. sp. (Pl. 10, figs. 19-21)

Test slender, elongate, about two and one-half times as long as broad, initial end with several short acicular spines, test tapering, greatest breadth at the last-formed chambers, periphery lobulate; chambers distinct, somewhat inflated, increasing rather gradually in size, later ones tending to become uniserial; sutures distinct, depressed; wall ornamented by numerous high, raised costae, sharp and plate-like, those of each chamber independent of adjacent ones; aperture nearly terminal with a very short neck and distinct lip. Length 1.15-1.25 mm.; diameter 0.40-0.45 mm.

Holotype (Cushman Coll. No. 23282) from Eocene, 1 km. N. of Arroyo Arenas, on road to Jaimanitas (water well), Havana Province, Cuba (Bermudez Sta. 31).

This species differs from *U. jacksonensis* Cushman in the much more elongate, slender form with the greatest breadth toward the apertural end instead of in the middle and the more numerous high costae.

GONATOSPHAERA PRINCIPENSIS Cushman and Bermudez, n. sp. (Pl. 11, figs. 7-9)

Test elongate, tapering, about twice as long as broad, initial end subacute, gradually enlarging to the last-formed chamber, circular in transverse section; chambers indistinct except the last-formed one, distinctly inflated; sutures indistinct; wall ornamented with a few, eight to twelve, longitudinal costae running

from the last-formed chamber and uniting at the initial end; aperture elongate, narrow, terminal, with a slightly rounded lip. Length 1.00-1.25 mm.; diameter 0.50-0.60 mm.

Holotype (Cushman Coll. No. 23300) from the Eocene, lower Principe formation, Loma Principe, Avenida de los Presidentes, Vedado, Havana, Cuba (Bermudez Sta. 20).

This species differs from *G. alternicostata* Cushman and Bermudez in the much more elongate, tapering test and fewer, higher costae.

EXPLANATION OF PLATE 10

FIGS. 1, 5, 6. *Gaudryinella cubana* Cushman and Bermudez, n. sp. × 30. Fig. 1, holotype. Microspheric form, front view. Figs. 5, 6, paratypes. Megalospheric form. Fig. 5, front view. Fig. 6, apertural view.

FIGS. 2, 10, 11. *Gaudryina cubana* Cushman and Bermudez, n. sp. × 30. Fig. 2, holotype. Figs. 10, 11, paratypes. Fig. 10, front view. Fig. 11, apertural view.

FIGS. 3, 4. *Dorothia principensis* Cushman and Bermudez, n. sp. × 30. Fig. 4, holotype, front view. Fig. 3, paratype, apertural view.

FIGS. 7–9. *Plectina cubensis* Cushman and Bermudez, n. sp. × 33. Fig. 7, holotype. Figs. 8, 9, paratypes. Fig. 8, front view. Fig. 9, apertural view.

FIGS. 12–14. *Plectina torrei* Cushman and Bermudez, n. sp. × 30. Fig. 12, holotype. Figs. 13, 14, paratypes. Fig. 13, apertural view. Fig. 14, front view.

FIGS. 15, 16. *Gaudryina* (*Pseudogaudryina*) *rutteni* Cushman and Bermudez, n. sp. × 30. Fig. 15, holotype. Fig. 16, paratype, apertural view.

FIGS. 17, 18. *Goësella cubensis* Cushman and Bermudez, n. sp. × 30. Fig. 17, holotype. Fig. 18, paratype, vertical section.

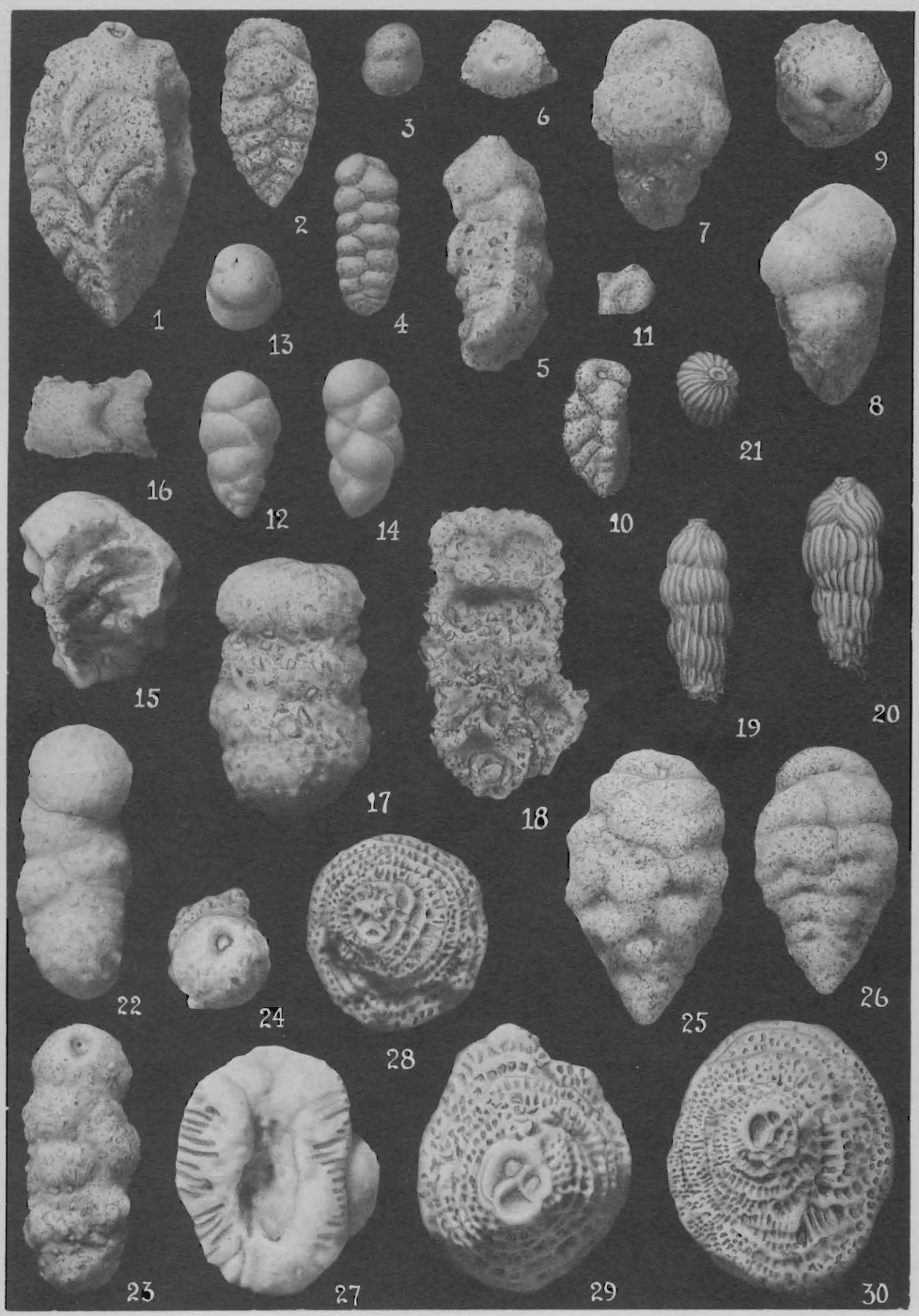
FIGS. 19–21. *Uvigerina havanensis* Cushman and Bermudez, n. sp. × 30. Fig. 19, holotype. Figs. 20, 21, paratypes. Fig. 20, front view. Fig. 21, apertural view.

FIGS. 22–24. *Plectina elongata* Cushman and Bermudez, n. sp. × 33. Fig. 23, holotype. Figs. 22, 24, paratypes. Fig. 22, front view. Fig. 24, apertural view.

FIGS. 25, 26. *Tritaxilina cubensis* Cushman and Bermudez, n. sp. × 33. Fig. 25, holotype. Fig. 26, paratype.

FIGS. 27–30. *Pseudorbitolina cubensis* Cushman and Bermudez, n. sp. × 28. Fig. 30, holotype. Figs. 27-29, paratypes. Fig. 27, ventral view. Figs. 28-30, eroded specimens, dorsal views.

Figures from photographs retouched by Patricia G. Edwards.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ELLIPSOLAGENA SCULPTURATA Cushman and Bermudez, n. sp. (Pl. 11, figs. 10, 11)

Test subglobular, slightly longer than broad, base broadly rounded or slightly truncate, apertural end slightly elongate, wall of the lower two-thirds ornamented by numerous low costae, upper third smooth; aperture narrow, elongate, with an internal tube. Length 0.80 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 23303) from the Eocene, lower Principe formation under Library of Havana University, Cuba (Bermudez Sta. 257).

This species differs from *E. bidens* Cushman in the more rounded transverse section, lack of basal spines and the distinct ornamentation of the surface.

PLECTOFRONDICULARIA PALMERAE Cushman and Bermudez, n. sp. (Pl. 11, figs. 20-24)

Test variable, elongate, slender or fusiform, tapering with the greatest breadth toward aperture, very much compressed, periphery acute, slightly keeled; chambers of early portion biserial, soon becoming uniserial with the chambers increasing rapidly in size as added; sutures distinct, somewhat limbate, in the later portion slightly depressed; wall smooth; aperture terminal, rounded, with a slight neck and a lip which is sometimes serrate. Length 1.20-2.00 mm.; breadth 0.50-1.00 mm.

Holotype (Cushman Coll. No. 23316) from the Eocene, lower Principe formation, under Library of Havana University, Cuba (Bermudez Sta. 257).

This species differs from *P. packardi* Cushman and Schenck in the lack of ornamentation in the early portion, the distinctly keeled periphery and greater compression.

CYCLOLOCULINA CUBENSIS Cushman and Bermudez, n. sp. (Pl. 11, figs. 15, 16)

Test discoid, sides flattened, periphery rounded; chambers of the earliest portion spiral, later very elongate and becoming annular; sutures indistinct except toward the periphery where they are slightly depressed; wall ornamented by radial depressions, those of each chamber independent of the adjacent ones and giving a crenulate appearance to the inner margins of the chambers. Diameter 0.90-1.10 mm.

Holotype (Cushman Coll. No. 23308) from the Eocene, 4.5 kms. W. of Guanajay on the road to Mariel, Pinar del Rio Province, Cuba (Bermudez Sta. 337A).

This species differs from *C. jarvisi* Cushman in the distinct crenulate margin of the chambers and radial depressions.

SIPHONINA PUSTULATA Cushman and Bermudez, n. sp. (Pl. 11, figs. 1, 2)

Test trochoid, very much compressed, periphery lobulate, serrate, dorsal side flattened or slightly concave, ventral side very slightly convex; chambers distinct, about five in the last-formed whorl, increasing gradually as added, very slightly inflated; sutures distinct, depressed, oblique, slightly curved; wall ornamented by numerous short broad spines or pustules rather evenly scattered over the entire surface; aperture elongate, narrow with a distinct short neck and enlarged lip. Length 0.70 mm.; breadth 0.55-0.60 mm.

Holotype (Cushman Coll. No. 23294) from the Eocene, 4.5 kms. W. of Guanajay on the road to Mariel, Pinar del Rio Province, Cuba (Bermudez Sta. 337A).

This species differs from *S. jacksonensis* Cushman and Applin in the much rougher, more pustulate surface and lobulate periphery.

SIPHONINA NUDA Cushman and Bermudez, n. sp. (Pl. 11, figs. 3-6)

Test biconvex, trochoid, periphery subacute; chambers of the last-formed whorl only are distinct, low, elongate; sutures of the ventral side nearly radial, slightly curved, slightly depressed on the dorsal side, strongly oblique, slightly, if at all, depressed; wall smooth, distinctly perforate; aperture elliptical, peripheral, with a very slight neck and distinct lip. Length 0.60-0.80 mm.; breadth 0.50-0.70 mm.

Holotype (Cushman Coll. No. 23296) from the Eocene, 4.5 kms. W. of Guanajay on the road to Mariel, Pinar del Rio Province, Cuba (Bermudez Sta. 337A).

This species differs from *S. advena* Cushman in the smaller, somewhat more oblique sutures and less projecting neck.

ANOMALINA CRASSISEPTA Cushman and Siegfus, var. CARIBAEA Cushman and Bermudez, n. var. (Pl. 11, figs. 12-14)

Variety differing from typical in the somewhat broader, shorter raised portions of the dorsal side and the broader periphery without any trace of keel. Length 0.65-0.80 mm.; breadth 0.55-0.60 mm.; thickness 0.40 mm.

Holotype of variety (Cushman Coll. No. 23305) from the Eocene, lower Principe formation, under Library of Havana University, Cuba (Bermudez Sta. 257).

Genus CRIBROGLOBOROTALIA Cushman and Bermudez, n. gen.

Genoholotype, *Cribrogloborotalia marielina* Cushman and Bermudez, n. sp.

Test trochoid, all the chambers visible from the dorsal side, only those of the last-formed whorl from the ventral side; wall calcareous, finely perforate; apertures numerous, forming a cribrate plate over the inner portion of the ventral face of the last-formed chamber. This genus is closely related to the genus *Globorotalia* and differs from it in the cribrate aperture.

CRIBROGLOBOROTALIA MARIELINA Cushman and Bermudez, n. sp. (Pl. 11, figs. 17-19)

Test plano-convex, trochoid, dorsal side flattened or very slightly convex, ventral side very strongly convex, periphery subacute; chambers distinct, four making up the last-formed whorl, increasing very rapidly in size as added, very slightly inflated, dorsally; sutures distinct, on the dorsal side slightly depressed, curved, ventrally slightly depressed, nearly radiate; wall smooth; aperture consisting of numerous large circular pores covering the inner portion of the ventral face of the last-formed chamber. Length 1.10 mm.; breadth 0.80-0.90 mm.; thickness 0.70 mm.

Holotype (Cushman Coll. No. 23312) from the Eocene, 4.5 kms. W. of Guanajay on the road to Mariel, Pinar del Rio Province, Cuba (Bermudez Sta. 337A).

174. SOME NEW SPECIES OF NONION

By JOSEPH A. CUSHMAN

Through the aid of the Penrose Fund of the Geological Society of America, manuscript and plates are partially completed of a monographic study of the Nonionidae. Permission has been granted for the publication of some of the new species that have been obtained. Descriptions and figures follow:

NONION HALKYARDI Cushman, n. sp. (Pl. 12, figs. 1 a, b)

Test small, in the adult becoming rapidly broader than in the early stages, biumbilicate, periphery broadly rounded; chambers 10-12 in the final coil, distinct, little if at all inflated, increasing

gradually in size as added, but rapidly expanding in breadth; sutures distinct, radial, limbate, not depressed; wall smooth, distinctly perforate; aperture, a distinctly arched opening at the base of the apertural face. Diameter 0.35-0.40 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 23224) from the Upper Eocene, Blue Marl, of Biarritz, France.

This species differs from *N. soldanii* (d'Orbigny) in the larger number of chambers and more rapidly expanding test.

NONION TURGESCENS Cushman, n. sp. (Pl. 12, figs. 2 a, b)

Test much compressed, with a broad, rounded keel, and a distinct, rounded umbo; chambers very distinct, 8-10 in the adult coil, increasing very gradually in size as added, only slightly inflated; sutures very distinct, slightly sigmoid; wall ornamented by raised, pyriform areas in the central portion of the adult chambers, tapering to a point near the umbo; aperture very narrow, highly arched opening at the base of the last-formed chamber. Diameter 0.30 mm.; thickness 0.15 mm.

EXPLANATION OF PLATE 11

FIGS. 1, 2. *Siphonina pustulata* Cushman and Bermudez, n. sp. × 33. Fig. 1, holotype. Fig. 2, paratype.

FIGS. 3–6. *Siphonina nuda* Cushman and Bermudez, n. sp. × 33. Fig. 3, holotype. Figs. 4-6, paratypes. Figs. 3, 6, dorsal views. Figs. 4, 5, ventral views.

FIGS. 7–9. ~~*Pseudoglandulina*~~ *Globospheara principensis* Cushman and Bermudez, n. sp. × 30. Fig. 7, holotype. Figs. 8, 9, paratypes. Fig. 8, front view. Fig. 9, apertural view.

FIGS. 10, 11. *Ellipsolagena sculpturata* Cushman and Bermudez, n. sp. × 30. Fig. 10, holotype. Fig. 11, paratype, apertural view.

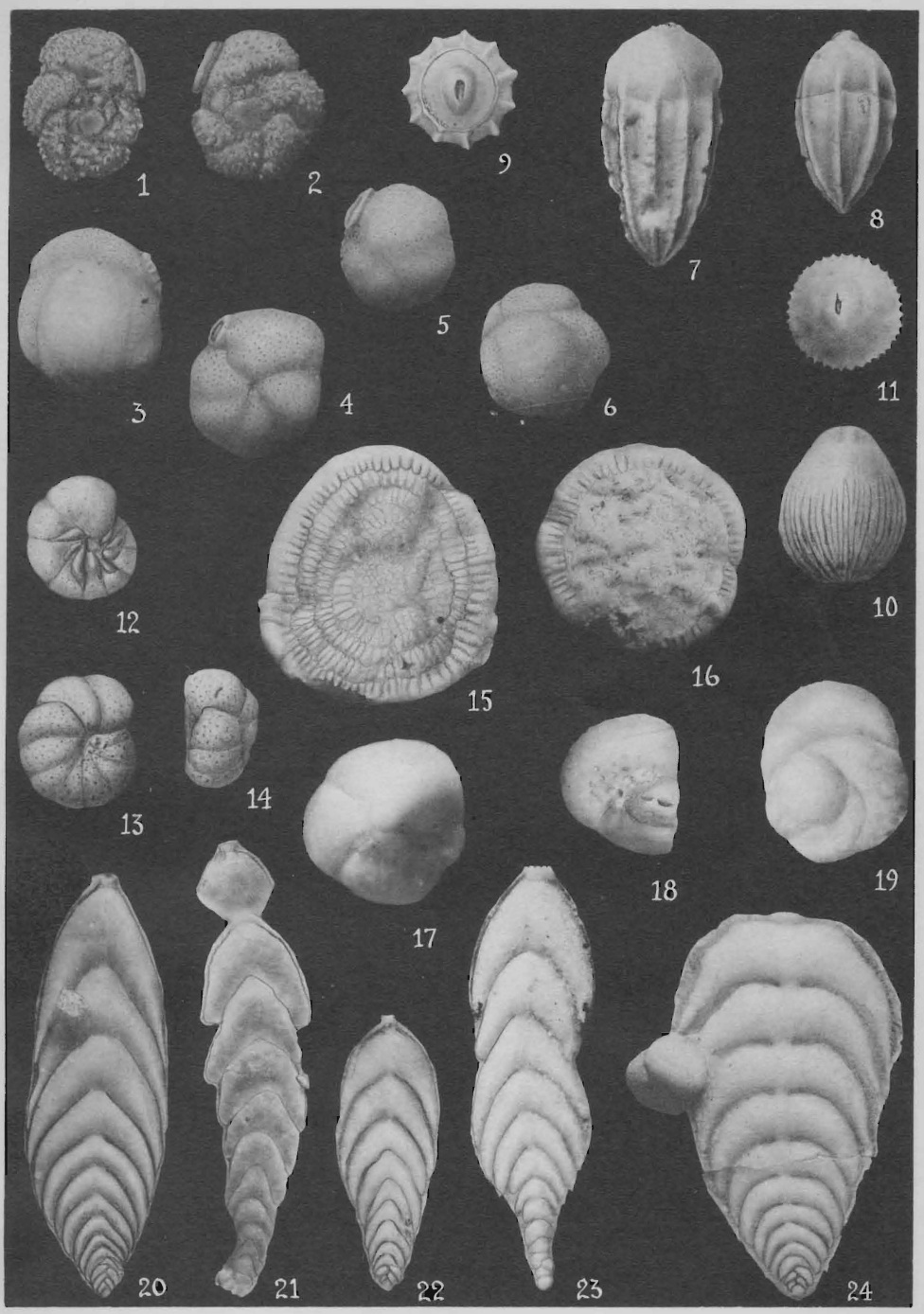
FIGS. 12–14. *Anomalina crassisepta* Cushman and Siegfus, var. *caribaea* Cushman and Bermudez, n. var. × 30. Fig. 12, holotype, dorsal view. Figs. 13, 14, paratypes. Fig. 13, ventral view. Fig. 14, peripheral view.

FIGS. 15, 16. *Cycloloculina cubensis* Cushman and Bermudez, n. sp. × 33. Fig. 15, holotype. Fig. 16, paratype.

FIGS. 17–19. *Cribrogloborotalia marielina* Cushman and Bermudez, n. gen. and n. sp. × 30. Fig. 19, holotype, dorsal view. Figs. 17, 18, paratypes. Fig. 17, ventral view. Fig. 18, peripheral view.

FIGS. 20–24. *Plectofrondicularia palmerae* Cushman and Bermudez, n. sp. × 33. Fig. 23, holotype. Figs. 20-22, 24, paratypes.

Figures from photographs retouched by Patricia G. Edwards.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Holotype (Cushman Coll. No. 23318) from the Oligocene of Weinkein b. Alzey, Mainz Basin, Germany.

This species differs from *N. laeve* (d'Orbigny) in having fewer chambers and the raised areas restricted to the middle of the chambers.

NONION ROEMERI Cushman, n. sp. (Pl. 12, figs. 3 a, b)

Test somewhat compressed, umbilical regions slightly depressed, periphery broadly rounded; chambers distinct, very slightly inflated, increasing rather rapidly but evenly in size and height as added, 8-10 in the adult coil; sutures very distinct, slightly depressed, distinctly curved; wall smooth except the umbilical region which has a distinct filling of secondary shell material running out slightly over the inner end of the sutures; aperture consisting of a line of small rounded openings at the basal margin of the inner face of the last-formed chamber. Length 0.35-0.40 mm.; breadth 0.30-0.35 mm.; thickness 0.18-0.20 mm.

Holotype (Cushman Coll. No. 23319) from Upper Oligocene, Ahnatal, near Cassel, Germany.

This species differs from *N. elongata* (d'Orbigny) in the shorter, stouter, form, fewer chambers, and more rounded periphery.

NONION DOLLFUSI Cushman, n. sp. (Pl. 12, figs. 4 a, b)

Test much compressed, with a large, flat, slightly raised umbo, periphery with a distinct, rounded keel, sharply set off from the rest of the test; chambers very distinct, numerous, 15-18 in the adult coil, of uniform shape, increasing very gradually in size; sutures very distinct, deeply depressed, slightly sigmoid in the adult; wall smooth except for the depressions of the sutures; aperture consisting of a few small pores at the base of the inner margin of the last-formed chamber. Length 1.00-1.15 mm.; breadth 0.90-1.00 mm.; thickness 0.40 mm.

Holotype (Cushman Coll. No. 23320) from the Miocene, Burdigalien superieur, Merignac, Gironde, France.

This species differs from *N. laeve* (d'Orbigny) in the more compressed test, larger number of chambers, and more distinct keel.

NONION DINGDENI Cushman, n. sp. (Pl. 12, figs. 5 a, b)

Test slightly longer than broad, somewhat compressed, periphery in early stages subacute or slightly keeled, later

rounded, umbilical region slightly depressed; chambers distinct, about ten in the last-formed coil, distinctly inflated toward the inner end, increasing rather rapidly in height in the last portion; sutures distinct, deeply depressed toward the umbilicus, curved; wall smooth except for the umbilical region which is filled with granular, secondary shell material; aperture very low, narrow, at the base of the inner margin of the last-formed chamber. Length 0.60 mm.; breadth 0.50 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 23321) from Miocene of Dingden, Germany.

This species differs from *N. elongata* (d'Orbigny) in the fewer chambers, inflated at the inner ends.

NONION NOVOZEALANDICUM Cushman, n. sp. (Pl. 12, figs. 6 a, b)

Test compressed, umbilical region deeply excavated, periphery broadly rounded; chambers distinct, very slightly inflated, of uniform shape, increasing very gradually in size as added; sutures distinct, strongly limbate, thickening strongly toward the umbilicus, slightly curved; wall smooth, coarsely perforate; aperture, an elongate, low opening at the base of the inner margin of the last-formed chamber. Length 0.90 mm.; breadth 0.80 mm.; thickness 0.45 mm.

Holotype (Cushman Coll. No. 23322) from the Miocene of Motatura, New Zealand.

This species differs from *N. galeata* Cushman in the more strongly curved and limbate sutures, deeper umbilicus, and less expanded final chamber.

NONION STACHEI Cushman, n. sp. (Pl. 12, figs. 7 a, b)

Test slightly longer than broad, compressed, periphery subacute, umbilical region with an umbonate mass of granular secondary shell-material; chambers distinct, numerous, 15-18 in the adult coil, slightly if at all inflated; sutures distinct, limbate, slightly curved, expanded and raised toward the umbilicus; wall smooth except for the central umbonate mass, and slightly raised sutures; aperture small, low, at the base of the last-formed chamber. Length 0.80 mm.; breadth 0.70 mm.; thickness 0.30 mm.

Holotype (Cushman Coll. No. 23323) from the Miocene, Shell bed, Target Gully, Oamaru, New Zealand.

This species differs from *N. elongata* (d'Orbigny) in the larger umbonal mass, and the expansion of the inner ends of the sutures.

NONION SCHWAGERI Cushman, n. sp. (Pl. 12, figs. 8 a, b)

Test slightly compressed, umbilical region slightly depressed, periphery broadly rounded; chambers few, about eight in the adult coil, of uniform shape, and increasing very slightly in size, very slightly if at all inflated; sutures distinct, slightly curved or irregularly sigmoid, slightly if at all depressed; wall smooth; aperture consisting of a row of small, rounded openings at the base of the inner margin of the last-formed chamber. Length 0.25 mm.; breadth 0.22 mm.; thickness 0.17 mm.

Holotype (Cushman Coll. No. 23324) from the Pliocene of Kar Nicobar.

This species differs from *N. planatum* (Cushman and Thomas) in the more irregular sutures, lack of umbilical depression and broader peripheral view.

NONION NICOBARENSIS Cushman, n. sp. (Pl. 12, figs. 9 a, b)

Test slightly longer than broad, slightly umbilicate, periphery rounded; chambers distinct, 10-12 in the adult coil, of rather uniform shape, not inflated; sutures distinct, curved, strongly limbate, fusing in a ring about the umbilicus, not depressed; wall smooth, coarsely perforate; aperture, a low, broad opening with a distinct lip at the base of the inner margin of the last-formed chamber. Length 0.35 mm.; breadth 0.28 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 23325) from the Pliocene of Kar Nicobar.

This species differs from *N. soldanii* (d'Orbigny) in the less prominent umbilical opening, larger number of chambers and more compressed test.

NONION VICTORIENSE Cushman, n. sp. (Pl. 12, figs. 10 a, b)

Test slightly longer than broad, strongly compressed, particularly toward the subacute periphery, umbilical region not depressed; chambers distinct, curved, of rather uniform shape, not inflated; sutures distinct, strongly curved, limbate, not depressed; wall smooth except for the umbilical region which has numerous small, raised beads which also run across the base of the apertural face; aperture, a series of small rounded openings at the base of the inner margin of the last-formed chamber. Length 0.70 mm.; breadth 0.50 mm.; thickness 0.30 mm.

Holotype (Cushman Coll. No. 23326) from Lower Pliocene, near Lake Bunga, Eastern Victoria, Australia.

This species differs from *Nonion elongatum* (d'Orbigny) in the more definite beads of the umbilical region, and the much greater compression of the peripheral area.

NONION ANGUSTUM Cushman, n. sp. (Pl. 12, figs. 11 a, b)

Test about as long as broad, umbilical region slightly depressed, periphery rounded; chambers distinct, about twelve in the adult coil, of uniform shape, and increasing very gradually in size, slightly inflated; sutures distinct, slightly depressed, gently curved, slightly sigmoid in the last portion; wall smooth, distinctly perforate; aperture low, elongate, at the base of the inner margin of the last-formed chamber. Length 0.50 mm.; breadth 0.45 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 23327) from the Pliocene of Lanarka, Island of Cyprus.

This species differs from *N. formosum* (Seguenza) in the more broadly rounded periphery, lack of a definite umbilical opening, and more strongly curved sutures.

NONION IBERICUM Cushman, n. sp. (Pl. 12, figs. 12, 13)

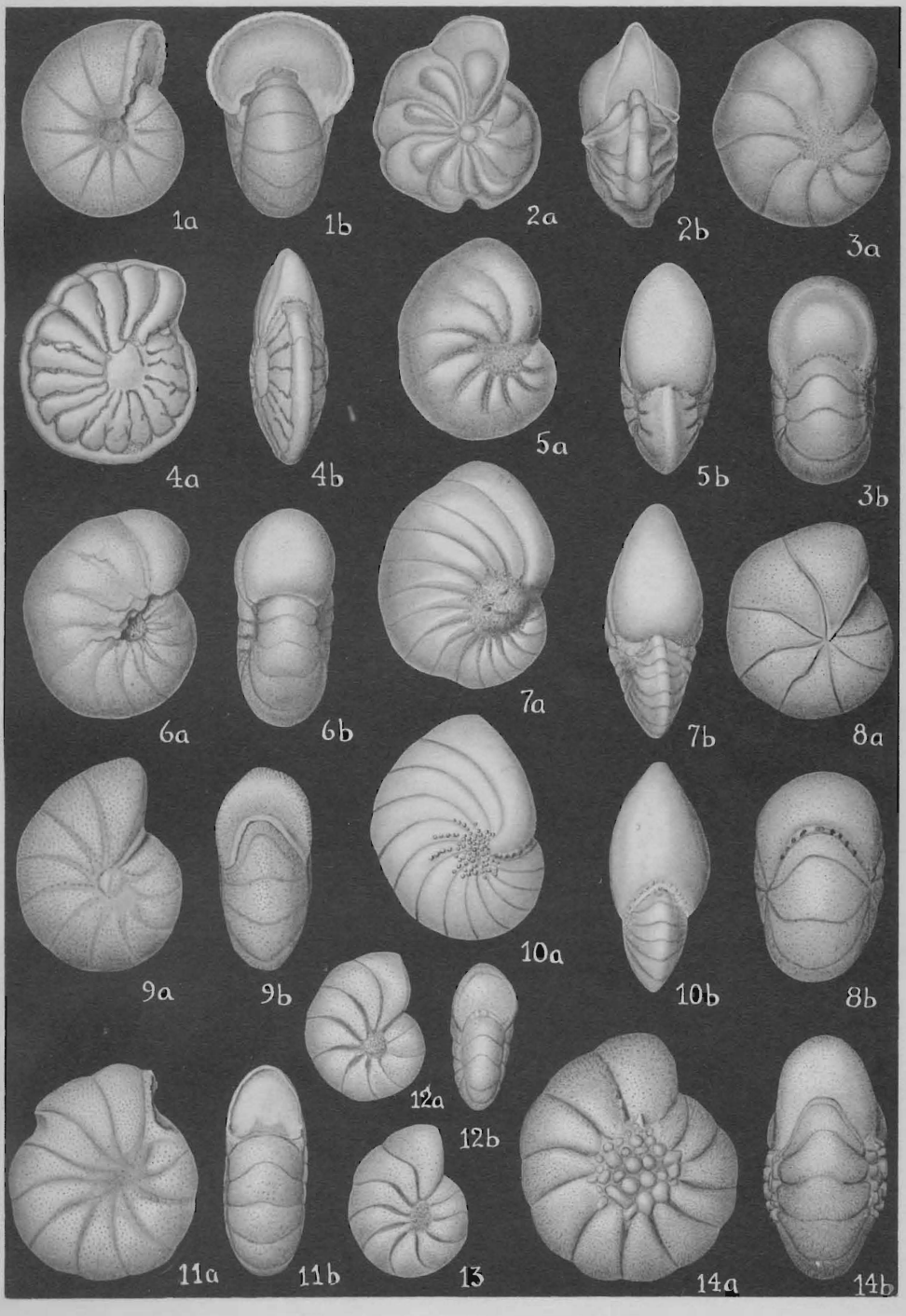
Test small, slightly longer than broad, periphery rounded, umbilical area slightly depressed but filled with granular, secondary shell material; chambers distinct, about ten in the adult coil, of

EXPLANATION OF PLATE 12

FIG. 1. *Nonion halkyardi* Cushman, n. sp. × 80.
FIG. 2. *Nonion turgescens* Cushman, n. sp. × 100.
FIG. 3. *Nonion roemeri* Cushman, n. sp. × 80.
FIG. 4. *Nonion dollfusi* Cushman, n. sp. × 30.
FIG. 5. *Nonion dingdeni* Cushman, n. sp. × 40.
FIG. 6. *Nonion novozealandicum* Cushman, n. sp. × 33.
FIG. 7. *Nonion stachei* Cushman, n. sp. × 40.
FIG. 8. *Nonion schwageri* Cushman, n. sp. × 100.
FIG. 9. *Nonion nicobarensis* Cushman, n. sp. × 80.
FIG. 10. *Nonion victoriense* Cushman, n. sp. × 50.
FIG. 11. *Nonion angustum* Cushman, n. sp. × 60.
FIGS. 12, 13. *Nonion ibericum* Cushman, n. sp. × 100.
FIG. 14. *Nonion ornatissimum* Cushman, n. sp. × 50.

In all figures: *a*, side view; *b*, apertural view.

Figures drawn by Ann Shepard.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uniform shape, increasing slightly in size as added; sutures distinct, limbate, curved, sigmoid in the adult, slightly depressed; wall smooth, except for the granulation of the umbilical region; aperture, a low, broad opening at the base of the inner margin of the last-formed chamber. Length 0.20 mm.; breadth 0.15 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 23328) from the Pleistocene of Malaga, Spain.

This species differs from *N. elongatum* (d'Orbigny) in the much smaller size, fewer chambers, and the limbate and sigmoid sutures.

NONION ORNATISSIMUM Cushman, n. sp. (Pl. 12, figs. 14 a, b)

Test about as long as broad, periphery rounded, umbilical region thickest, occupied by a series of large, rounded bosses; chambers distinct, slightly inflated, of uniform shape and increasing very slightly in size as added, about twelve in the adult coil; sutures distinct, depressed, slightly curved; wall smooth except for the ornamentation of the umbilical region, distinctly perforate; aperture, an elongate, low opening at the base of the inner margin of the last-formed chamber. Length 0.70-0.75 mm.; breadth 0.65 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 23329) from the Eocene of Kressenberg, Upper Bavaria, Germany.

This species differs from *N. graniferum* (Terquem) in the fewer and larger bosses of the umbilical region, and larger number of chambers in the adult coil.

RECENT LITERATURE ON THE FORAMINIFERA

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

Franke, Adolf. Die Foraminiferen des deutschen Lias.—Abhandl. Preuss. Geol. Landes., Heft 169, 1936, 138 pp., 12 pls., 2 text figs.—327 species and varieties, 112 new. One new genus *Saracenella.*

Palmer, Dorothy K. New Genera and Species of Cuban Oligocene Foraminifera.—Mem. Soc. Cubana Hist. Nat., vol. X, No. 2, May 10, 1936, pp. 123-128, pl. 5, text figs. 1-3.—New genera and species: *Cubanina,* n. gen., *C. alavensis,* n. sp.; *Matanzia,* n. gen., *M. bermudezi,* n. sp.; *Nonion? marielensis,* n. sp.

Koch, Richard E. Namensänderung einiger Tertiär-Foraminiferen aus Niederländisch Ost-Indien.—Eclogae geol. Helvetiae, vol. 28, No. 2, 1935, pp. 557, 558.—Several new names proposed for species published in 1923 and 1926.

Howe, Henry V. The Foraminiferal Genus *Palmula* Isaac Lea, 1833.—Journ. Pal., vol. 10, No. 5, July, 1936, pp. 415, 416, text figs. 1, 2.

Van de Geyn, W. A. E. and I. M. van der Vlerk. A Monograph on the Orbitoididae, occurring in the Tertiary of America, compiled in connection with an examination of a collection of Larger Foraminifera from Trinidad.—Leidsche Geol. Med., Deel VII, 1935, pp. 221-272, 9 pls.—One new species, *Lepidocyclina (Nephrolepidina) lehneri.* A new genus, *Orbitoina,* is erected with new subgenera: *Isorbitoina, Pliorbitoina,* and *Polyorbitoina.*

Colom, G. Los foraminiferos de las margas azules de Enguera (prov. de Valencia).—Bol. Soc. Espanola Hist. Nat., vol. 36, 1936, pp. 205-226, pls. XXV-XXIX, text figs. 1-9.—One new variety, *Rotalia beccarii* (Linné), var. *globula.*

Dunbar, Carl O. and John W. Skinner. *Schwagerina* versus *Pseudoschwagerina* and *Paraschwagerina.*—Journ. Pal., vol. 10, No. 2, March, 1936, pp. 83-91, pls. 10, 11.—The last two names represent new genera.

Mawson, D. and F. Chapman. The Occurrence of a Lower-Miocene Formation on Bougainville Island.—Trans. Roy. Soc. So. Australia, vol. lix, 1935, pp. 241-242, pl. III.—The plates show sections of orbitoid foraminifera.

Huzimoto, H. Science Reports of the Tokyo Bunrika Daigaku, Section C, No. 2. Stratigraphical and Palaeontological Studies of the Titibu System of the Kwanto Mountainland, Part 2.—Palaeontology, vol. 1, April 25, 1936, pp. 29-125, pls. I-XXVI.—70 species and varieties noted, 13 new.

Earland, Arthur. Foraminifera, Part IV. Additional Records from the Weddell Sea Sector from Material Obtained by the S. Y. 'Scotia.'—*Discovery* Reports, vol. XIII, 1936, pp. 1-59, pl. I.—There are 228 species and varieties noted, 4 new: *Thurammina corrugata, Haplophragmoides weddellensis, Trochammina soldanii, Eponides weddellensis.*

Umbgrove, J. H. F. *Heterospira,* a New Foraminiferal Genus from the Tertiary of Borneo.—Leidische Geol. Meded., Deel VIII, Aflev. 1, 1936, pp. 115-159, 1 pl.

Heron-Allen, Edward. The Genus *Keramosphaera,* Brady.—Journ. Roy. Micr. Soc., vol. LVI, 1936, pp. 113-119, pl. I.

Schenck, Hubert G. and Don L. Frizzell. Subgeneric Nomenclature in Foraminifera.—Amer. Journ. Sci., vol. XXXI, June, 1936, pp. 464-466.

J. A. C.