

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 (Bermúdez 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 Bermúdez, 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 (Bermúdez 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 Bermúdez, 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 (Bermúdez 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.

GOESSELLA 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.

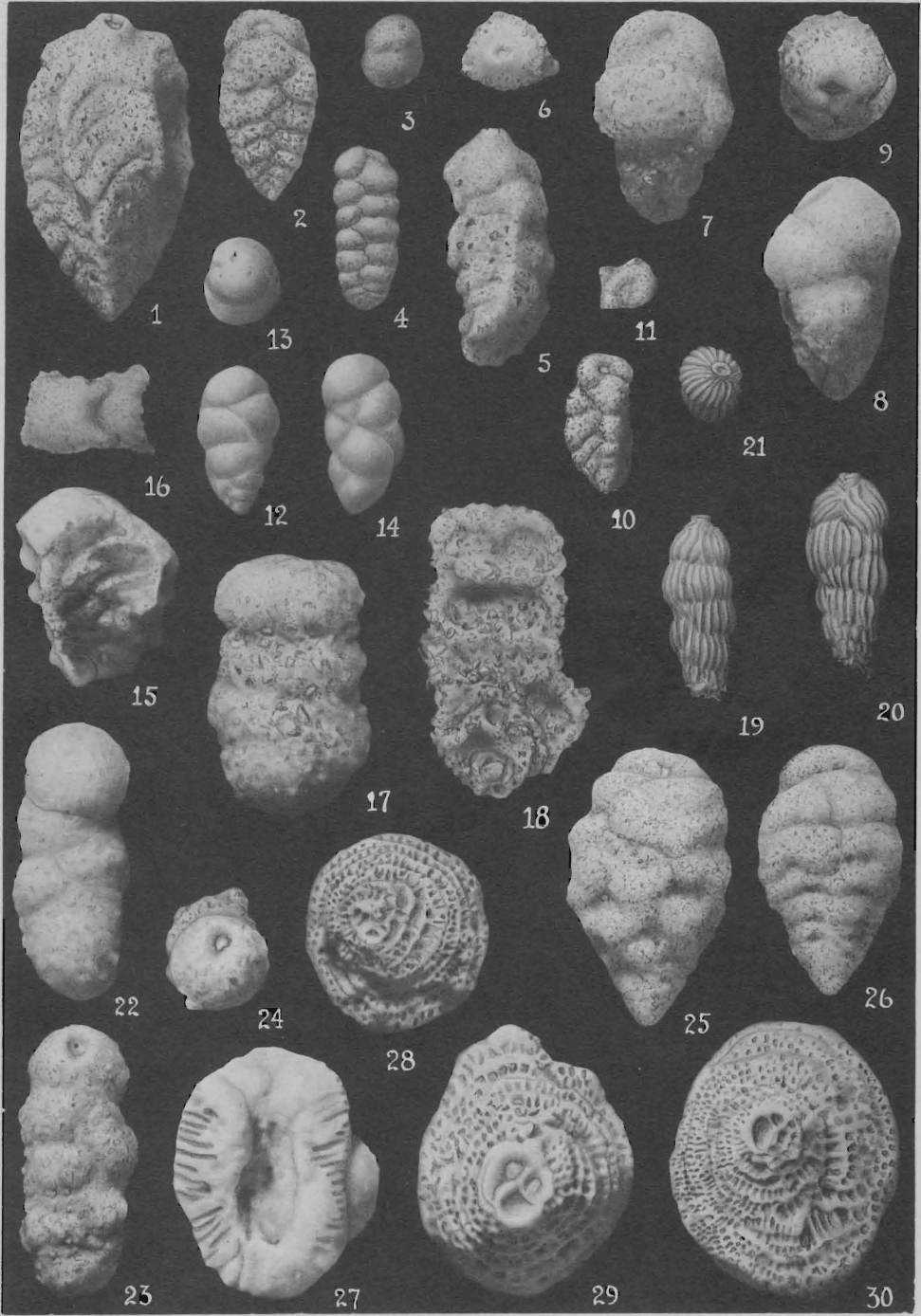
Holotype (Cushman Coll. No. 23300) from the Eocene, lower Principe formation, Loma Principe, Avenida de los Presidentes, Vedado, Havana, Cuba (Bermudez Sta. 20).

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. $\times 30$. 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. $\times 30$. 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. $\times 30$. Fig. 4, holotype, front view. Fig. 3, paratype, apertural view.
- FIGS. 7-9. *Plectina cubensis* Cushman and Bermudez, n. sp. $\times 33$. 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. $\times 30$. Fig. 12, holotype. Figs. 13, 14, paratypes. Fig. 13, apertural view. Fig. 14, front view.
- FIGS. 15, 16. *Gaudryina (Pseudogaudryina) ruttleri* Cushman and Bermudez, n. sp. $\times 30$. Fig. 15, holotype. Fig. 16, paratype, apertural view.
- FIGS. 17, 18. *Goësella cubensis* Cushman and Bermudez, n. sp. $\times 30$. Fig. 17, holotype. Fig. 18, paratype, vertical section.
- FIGS. 19-21. *Uvigerina havanensis* Cushman and Bermudez, n. sp. $\times 30$. 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. $\times 33$. 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. $\times 33$. Fig. 25, holotype. Fig. 26, paratype.
- FIGS. 27-30. *Pseudorbitolina cubensis* Cushman and Bermudez, n. sp. $\times 28$. 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.



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