

321. ADDITIONAL SPECIES OF PALEOCENE FORAMINIFERA
FROM THE MADRUGA FORMATION OF CUBA

BY JOSEPH A. CUSHMAN and PEDRO J. BERMUDEZ

Some of the species of the Madruga formation of Cuba have already been published in the preceding issue of these Contributions (vol. 24, pt. 3, September 1948, pp. 68-75, pls. 11, 12). The present species are an additional group of new ones not included in the previous paper. A list is given of some of the already known species which help to show the stratigraphic relationship of the Madruga formation with other formations of the same age elsewhere.

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA INSUETA Cushman and Bermudez, n. sp. (Pl. 14, figs. 7-9)

Test trochoid, biconvex, dorsal side nearly flat, ventral side strongly convex, slightly umbilicate, periphery broadly rounded; chambers few, 4 or 5 in the adult whorl, inflated, increasing very gradually in size as added; sutures distinct, depressed, curved; wall smooth; aperture at the ventral margin of the last-formed chamber with a distinct lip, partially covering the umbilicus. Length of holotype 0.55 mm.; breadth 0.47 mm.; thickness 0.32 mm.

Holotype (Cushman Coll. No. 58458) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species resembles *V. advena* Cushman and Siegfus, but differs in the slightly larger number of chambers, the last-formed one making up much less of the surface, and the lip much less prominent.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA MADRUGAENSIS Cushman and Bermudez, n. sp. (Pl. 14, figs. 10-12)

Test small, about as broad as long, thick, ventral side slightly umbilicate, dorsal side depressed in the center, periphery broadly rounded; chambers distinct, somewhat inflated, about six in the final whorl, increasing very gradually in size as added, on the dorsal side with a lobular extension, partially filling the central depression; sutures distinct, slightly depressed, ventrally somewhat sinuate, dorsally slightly curved; wall smooth; aperture a low opening at the ventral margin of the last-formed chamber extending from just below the periphery nearly to the umbilical area. Length 0.30-0.35 mm.; breadth 0.25-0.28 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 58460) from the Paleocene, Madruga

formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *G. subangulata* (Plummer) in the fewer chambers to the whorl and very depressed dorsal side with an extension of the chambers over this area.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA PRAESPISSIFORMIS Cushman and Bermudez, n. sp. (Pl. 15, figs. 1-3)

Test fairly small, strongly compressed, about equally biconvex, periphery rounded, ventral side umbilicate, dorsal side slightly depressed in the earlier portion; chambers distinct, 10-12 in the adult whorl, of uniform shape, increasing very gradually in size as added, very slightly inflated; sutures distinct, very slightly depressed, curved; wall smooth; aperture at the base of the peripheral margin of the last-formed chamber extending over onto the ventral side, with a very slight lip. Length of holotype 0.47 mm.; breadth 0.40 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 58463) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species strongly resembles *Anomalina alazanensis* Nuttall, var. *spissiformis* Cushman and Stainforth from the Oligocene of Trinidad but differs in the smaller size, fewer chambers, and more strongly curved sutures.

ANOMALINA MADRUGAENSIS Cushman and Bermudez, n. sp. (Pl. 15, figs. 4-6)

Test of medium size, nearly bilaterally symmetrical, dorsal and ventral sides both depressed in the middle area, periphery rounded; chambers distinct, somewhat inflated, about 6 in the adult whorl, of uniform shape, very gradually increasing in size as added; sutures distinct, depressed, very slightly curved; wall smooth, coarsely perforate; aperture at the base of the peripheral margin of the last-formed chamber, extending slightly onto the ventral side, with a slight lip. Length of holotype 0.70 mm.; breadth 0.57 mm.; thickness 0.30 mm.

Holotype (Cushman Coll. No. 58466) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species resembles some of the forms that have been referred to *A. grosserugosa* (Schwager) but differs from the typical form of that species in the bilaterally symmetrical test and fewer chambers.

ANOMALINA CUBANA Cushman and Bermudez, n. sp. (Pl. 15, figs. 7-9)

Test unequally biconvex, dorsal side nearly flattened in the central

area or slightly convex, ventral side more strongly convex with a distinct umbilical depression, periphery broadly rounded; chambers fairly distinct, slightly inflated on the dorsal side, strongly so on the ventral side, 5 or 6 in the adult whorl, increasing rather rapidly but uniformly in size as added; sutures fairly distinct and slightly depressed on the dorsal side, strongly depressed ventrally, sinuous; wall smooth, distinctly perforate; aperture at the base of the final chamber extending from near the periphery slightly onto the ventral side, without a definite lip. Length of holotype 0.85 mm.; breadth 0.70 mm.; thickness 0.40 mm.

Holotype (Cushman Coll. No. 58469) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species differs from *A. madrugaensis* Cushman and Bermudez, n. sp. in the smoother wall, more sinuous sutures, and the aperture largely ventral and without a lip.

Genus *CIBICIDES* Montfort, 1808

CIBICIDES MADRUGAENSIS Cushman and Bermudez, n. sp. (Pl. 15, figs. 10-12)

Test rather small, nearly equally biconvex, ventral side slightly more convex than the dorsal, periphery angled, but slightly rounded, ventral side distinctly umbonate; chambers fairly distinct, little if at all inflated, 6 to 8 in the final whorl, of rather uniform size and shape; sutures distinct, strongly curved, little if at all depressed, distinctly limbate on the ventral side; wall smooth, finely perforate; aperture narrow, at the basal margin of the last-formed chamber, extending very slightly on the ventral side but nearly the length of the chamber on the dorsal side. Length of holotype 0.40 mm.; breadth 0.37 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 58472) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Habana Province, Cuba.

This species differs from *C. allenii* (Plummer) in the smaller size, more umbonate ventral side and smooth dorsal side.

CIBICIDES REPRIMATUS Cushman and Bermudez, n. sp. (Pl. 15, figs. 13, 14)

Test plano-convex, dorsal side flattened, ventral side strongly convex, periphery subacute, ventral margins slightly concave, ventral side with a slight umbilical boss; chambers fairly distinct, especially in the later portion, increasing very gradually in size as added, on the dorsal side with a distinct oral depression in the middle of the inner margin; sutures fairly distinct, very slightly depressed in the later portion of the ventral side and all of the dorsal side, ventrally curved, slightly sinuous, dorsally irregular with distinct lobular projections; wall smooth except for the

depressions of the dorsal side; aperture at the peripheral margin extending onto the dorsal side, with a slight lip at the peripheral portion. Length of holotype 0.77 mm.; breadth 0.70 mm.; thickness 0.40 mm.

Holotype (Cushman Coll. No. 58475) from the Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba.

This species is peculiar in its dorsal side differing from *C. madrugaensis* Cushman and Bermudez, n. sp. in the more plano-convex form, very small umbilical boss, and the indentations of the dorsal side.

CIBICIDES MIRIFICUS Cushman and Bermudez, n. sp. (Pl. 16, figs. 1-3)

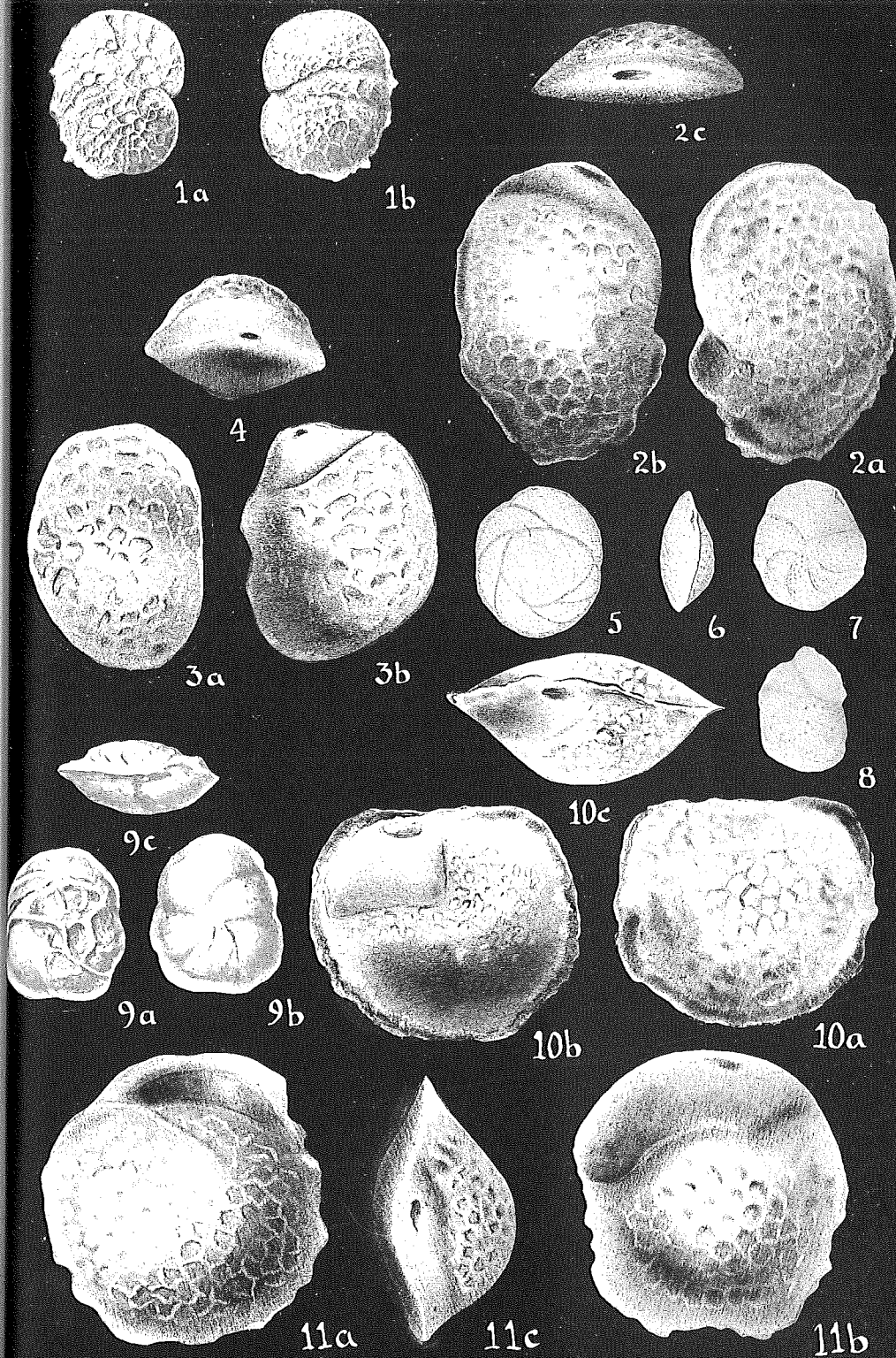
Test compressed, nearly equally biconvex, ventral side slightly more convex than the dorsal side, periphery angled, subacute, ventral side with a small but distinct umbonal boss, dorsal side with the central portion depressed in a close spiral; chambers distinct, 11-13 in the adult whorl, of uniform size, very gradually increasing in size as added, little if at all inflated; sutures distinct, not depressed except the last few on the ventral side, slightly curved; wall smooth, finely perforate; aperture at the base of the last-formed chamber, a small but distinct raised opening at the periphery, then extending over onto the dorsal side, with a very slight lip near the periphery. Length of holotype 0.52 mm.; breadth 0.47 mm.; thickness 0.23 mm.

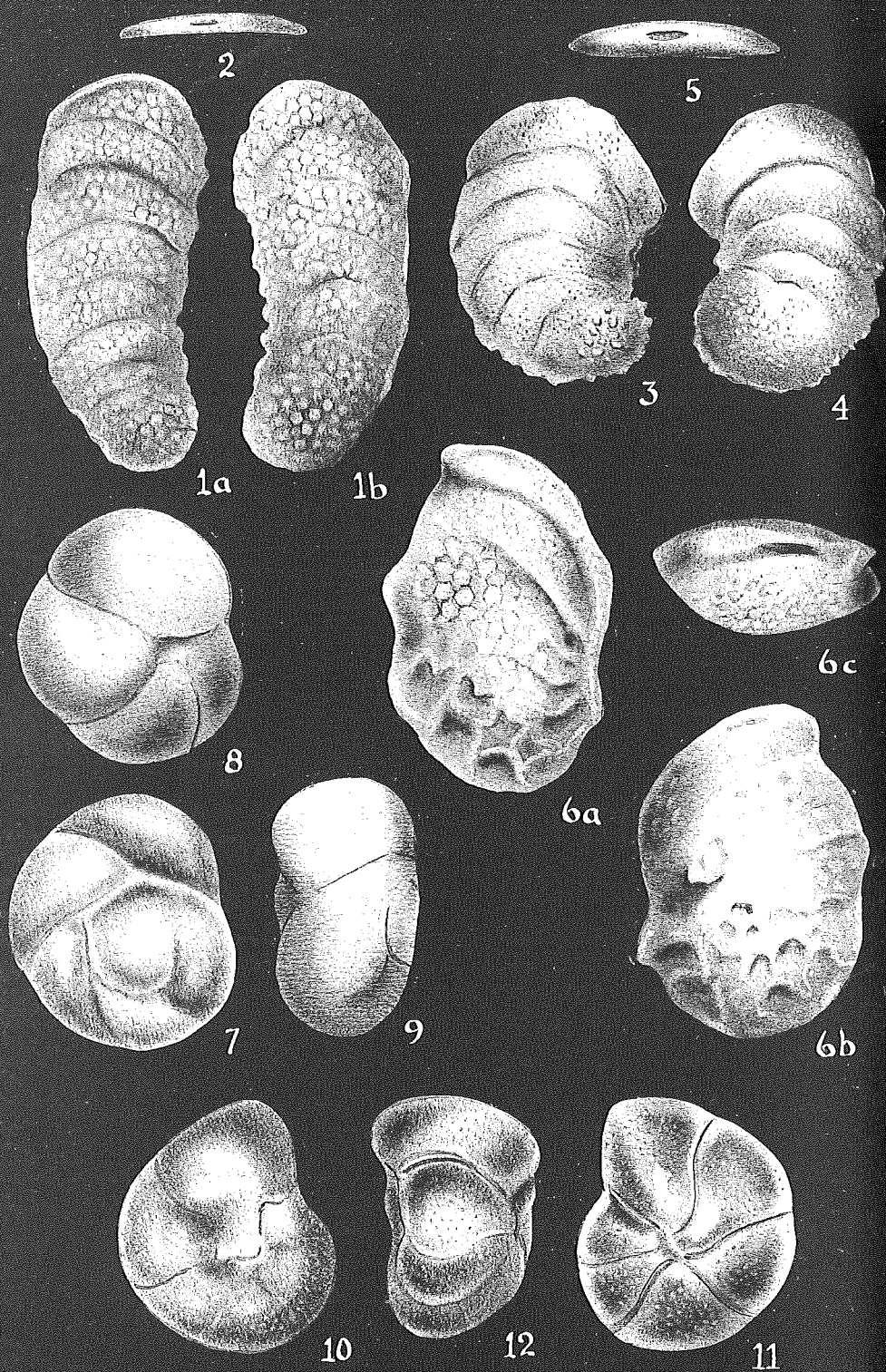
Holotype (Cushman Coll. No. 58477) from the Paleocene, Madruga formation, San Juan y Martinez, Pinar del Rio Province, Cuba.

This species differs from *C. madrugaensis* Cushman and Bermudez, n. sp. in the more compressed test, sharper peripheral angle, larger number of chambers, larger proportion of the dorsal side taken up by the last-formed whorl.

EXPLANATION OF PLATE 13

FIGS. 1-4. *Coleites reticulosus* (Plummer). 1a, b, Types. From Paleocene, shallow ditch at road corner southeast of new Corsicana Reservoir on the road to Mildred, Navarro Co., Texas. (After Plummer). $\times 40$. a, dorsal view; b, ventral view. 2a-c, From Plummer loc. 70, Paleocene, 5 miles SW. of Lytton Springs from 5 to 20 feet above the basal greensand of the Midway formation, Caldwell Co., Texas. $\times 70$. a, dorsal view; b, ventral view; c, peripheral view. 3, 4, From Paleocene, Madruga formation San Juan y Martinez, Pinar del Rio Province, Cuba. $\times 75$. 3a, dorsal view; 3b, ventral view. 4, Peripheral view of another specimen. 5-8. *C. laevigatus* Toulmin. From the Wilcox Eocene, Salt Mountain limestone, Richmond Branch, $\frac{1}{2}$ mi. N. of Salt Mountain, Ala. (After Toulmin). 5, 8, Paratypes. 6, 7, Peripheral and ventral views of holotype. $\times 27$. 5, Dorsal view. $\times 37$. 8, Ventral view. $\times 18$. 9. *C. danicus* Brotzen. Type. From Paleocene, Ystad, Sweden. (After Brotzen). $\times 75$. a, dorsal view; b, ventral view; c, peripheral view. 10, 11. *C. cancellatus* (Cushman and Bermudez). 10, From the upper Eocene, Jabaco formation, Pinar del Rio Province, Cuba, $\times 42$. 11, From the Paleocene of Rio Pasion, Peten Province, Guatemala, $\times 77$. a, a, dorsal views; b, b, ventral views; c, c, peripheral views.





Numerous already known species in the Madruga formation seem to confirm its Paleocene age, as follows:

Angulogerina wilcoxensis Cushman and Ponton

Anomalina acuta Plummer

Bulimina arkadelphia Cushman and Parker, var. *midwayensis* Cushman and Parker

Bulimina (Desinobulimina) quadrata Plummer

Cibicides allenii (Plummer)

Cibicides blanpiedi Toulmin

Cibicides praecursorius (Schwager)

Cibicides vulgaris (Plummer)

Coleites reticulosus (Plummer)

Eouwigierina excavata Cushman

Frondicularia naheolensis Cushman and Todd

Globigerina pseudobulloides Plummer

Globorotalia crassata (Cushman), var. *aequa* Cushman and Renz

Globorotalia wilcoxensis Cushman and Ponton, var. *acuta* Toulmin

Nodosaria affinis Reuss

Nodosaria longiscata d'Orbigny

Palmula delicatissima (Plummer)

Pseudouwigierina naheolensis Cushman and Todd

There are many other species present in the Madruga formation, a number of which were described or noted in the previous issue of these Contributions.

EXPLANATION OF PLATE 14

FIGS. 1, 2. *Coleites abuillotensis* Cushman and Bermudez, n. sp. From the lower Eocene, Abuillot River, Central Plain, Haiti. $\times 52$. 1, Holotype, *a*, dorsal view; *b*, ventral view. 2, Paratype, peripheral view. 3-5. *C. guatemalensis* Cushman and Bermudez, n. sp. From lower Eocene, Rio Pasion, Peten Province, Guatemala. $\times 40$. 3, Holotype, dorsal view. 4, Paratype, ventral view. 5, Paratype, peripheral view. 6. *C. pasionensis* Cushman and Bermudez, n. sp. From lower Eocene, Rio Pasion, Peten Province, Guatemala. $\times 47$. Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 7-9. *Valvulineria insueta* Cushman and Bermudez, n. sp. From Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba. $\times 70$. 7, Holotype, dorsal view. 8, Paratype, ventral view. 9, Paratype, peripheral view. 10-12. *Gyroidina madrugensis* Cushman and Bermudez, n. sp. From Paleocene, Madruga formation, under highway bridge on Central San Antonio, Madruga, Habana Province, Cuba. $\times 125$. 10, Holotype, dorsal view. 11, Paratype, ventral view. 12, Paratype, peripheral view.

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