CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

140. NEW AND UNRECORDED FORAMINIFERA FROM THE CALIFORNIA MIOCENE

By J. A. CUSHMAN and R. M. KLEINPELL

The following species and varieties are here placed on record and figures given so that they may be available for workers, particularly those working on the Miocene of California. More detailed information in regard to the distribution of these various forms will be discussed in a later paper by the junior author. Our thanks are here expressed to the United States Geological Survey and to the Geology Department of Stanford University for the use of their material.

BATHYSIPHON SANCTAECRUCIS Cushman and Kleinpell, n. sp. (Pl. 1, figs. 1, 2)

Test elongate, slender; wall composed of sand grains and fine amorphous material, rather thick, easily collapsed, exterior smoothly finished. Diameter 0.15-0.20 mm.

Holotype (Cushman Coll. No. 20111) from the Miocene, Vaqueros formation, Big Basin, East of Bloom's Mill, N.W. ¼ of S.E. ¼, Sec. 9, T. 9 S., R. 3 W., California; coll. by H. W. Weddle.

All specimens of this species are small fragments, but they show the general shape of the test which is more slender than that of other Tertiary species, and fragments of it should be easily distinguished.

DOROTHIA CALIFORNICA Cushman and Kleinpell, n. sp. (Pl. 1, figs. 18 a, b)

Test small, elongate, tapering, conical, the later portion slightly compressed; chambers numerous, earlier portion triserial, adult chambers biserial, very slightly inflated, of uniform shape, gradually increasing in size as added; sutures distinct, very

slightly depressed, nearly horizontal in the adult; wall finely arenaceous, with a large proportion of cement, smoothly finished; aperture, a low elongate opening, at the inner margin of the apertural face which is somewhat excavated. Length 0.50 mm.; breadth 0.20 mm.; thickness 0.16 mm.

Holotype (Cushman Coll. No. 20128) from the Miocene, 200 feet stratigraphically above top of 10-foot thick prominent chert bed exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This is a small species evidently a *Dorothia*. The very early chambers are very difficult to make out, but seem to be more than three in the earliest whorl.

ROBULUS COLORATUS (Stache) (Pl. 1, figs. 3 a, b)

Cristellaria colorata STACHE, *Novara*-Exped., Geol. I, 1864, p. 229, pl. 23, figs. 9 *a*, *b*.

The specimen here figured seems to be identical with the species described by Stache from the Miocene of New Zealand. It has about five chambers in the adult whorl with a very broad keel which is usually notched due to breakage, and the sutures rather strongly curved in the earlier stages, becoming more nearly straight later. The figured specimen (Cushman Coll. No. 20113) is from the Miocene, Vaqueros formation, near divide between Waddell Creek and Boulder Creek drainage, N.W. ¼, Sec. 10, T. 9 S., R. 3 W., on road from Boulder Creek to East gate of California Redwood Park, California; coll. by H. G. Schenck, H. D. Hobson, and R. M. Kleinpell.

It is possible that some of the other species described by Stache from the Miocene of New Zealand also are to be included under this specific name.

ROBULUS BRANNERI Cushman and Kleinpell, n. sp. (Pl. 1, figs. 4 a, b)

Test comparatively large, periphery subacute, sides in apertural view nearly parallel, slightly umbilicate, periphery very slightly lobulate; chambers few, typically about eight in the adult coil, of rather uniform size and shape, increasing slightly in size as added, and becoming slightly more inflated in the adult; sutures distinct, very slightly if at all depressed, gently curved; wall smooth, calcareous, very finely perforate; aperture somewhat projecting, radiate, below the periphery. Diameter up to 1.15 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 20114) from the Miocene, Monterey shale, Henry Ranch, Graves Creek, San Luis Obispo Co., California; coll. by J. C. Branner.

This species is distinguished by the completely involute test, the forward projecting aperture well below the periphery, and the nearly parallel sides in the apertural view.

PLANULARIA sp.(?) (Pl. 1, figs. 5 a, b)

The specimens of this rare form are incomplete as is often the case in species of this genus. The last-formed chambers are usually thin and much spread out, forming a weak test. In the figured specimen there are evidences that there was another whorl which is now broken away. The full description of this species must await the finding of complete specimens.

The figured specimen (Cushman Coll. No. 20115) is from the Miocene, 539 feet stratigraphically above the top of 10-foot thick prominent chert bed exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

FLABELLINA CRASSA Cushman and Kleinpell, n. sp. (Pl. 1, figs. 6 a, b)

Test much compressed, early portion acute or somewhat keeled at the periphery, somewhat tumid in the middle; chambers fairly distinct, the earliest ones close coiled, later spreading and assuming an inverted V-shape, very much compressed; sutures distinct, somewhat limbate, not depressed; wall smooth, in later chambers becoming thin and translucent; aperture radiate, terminal. Length of holotype 0.80 mm.; breadth 0.60 mm.; thickness 0.18 mm.

Holotype (Cushman Coll. No. 20116) from the Miocene, 6,930 feet stratigraphically below "McKittrick-Maricopa" contact as exposed on the South side of bed of Chico-Martinez Creek, in S.E. ¼, Sec. 2, T. 29 S., R. 20 E., California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

While the specimens of this species are usually incomplete due to the very thin wall of adult chambers, it can be recognized from the figures given here.

NODOSARIA TORNATA Schwager (Pl. 1, figs. 7 a, b)

The figured specimen (Cushman Coll. No. 20117) while it does not show the apertural characters due to attached matrix, is very

similar indeed to the specimen figured under this name by Schwager (*Novara*-Exped., Geol. II, 1866, p. 222, pl. 5, fig. 51) from the Pliocene of Kar Nicobar. Our specimen is from the Miocene, 5,909 feet stratigraphically below "McKittrick-Maricopa" contact as exposed on the South side of bed of Chico-Martinez Creek, in S.E. ¼, Sec. 2, T. 29 S., R. 20 E., California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

NONION cf. N. LABRADORICUM (Dawson) (Pl. 1, figs. 8 a, b)

The figured specimen (Cushman Coll. No. 20118) which is from the Miocene of Carneros Creek, California, 260 feet stratigraphically above the base of the Temblor formation, coll. by J. E. Mahoney, is very close indeed to the Recent *N. labradoricum*, which occurs widely distributed in cooler waters, and occurs off the West coast of the United States. The specimen lacks the very broad final chamber which characterizes this species in the adult, but is very close indeed to the earlier stages.

NONION PIZARRENSIS W. Berry (Pl. 1, figs. 9 a, b)

The figured specimen (Cushman Coll. No. 20119) which is from the Miocene of the Henry Ranch locality, seems to belong definitely to this species known from Recent collections off the West coast of America, and also found in the Miocene of Florida.

NONION PIZARRENSIS W. Berry, var. MULTICAMERATUM Cushman and Kleinpell, n. var. (Pl. 1, figs. 10 a, b)

Variety differing from the typical in the greater number of chambers and more open umbilical region.

Holotype of variety (Cushman Coll. No. 20120) from the Miocene, Monterey shale, 35 feet stratigraphically above contact with quartz diorite as exposed in Cayote Canyon, North side of Carmel Valley, California; coll. by M. N. Bramlette.

Similar forms also occur with the typical in the Miocene of Florida.

BULIMINELLA HENRYANA Cushman and Kleinpell, n. sp. (Pl. 1, figs. 11 a, b)

Test comparatively short, about twice as long as broad, the periphery somewhat lobulate; chambers distinct, four or five in the adult whorl, of rather uniform shape but increasing gradually in size and length as added; sutures distinct, very slightly depressed, somewhat limbate, especially toward the upper end;

wall smooth, finely perforate; aperture an elongate, comma-shaped opening in a depression of the somewhat obliquely truncated apertural face. Length 0.40 mm.; breadth 0.20 mm.

Holotype (Cushman Coll. No. 20121) from the Miocene, Monterey shale, Henry Ranch, Graves Creek, San Luis Obispo Co., California; coll. by J. C. Branner.

This species resembles *Buliminella californica* Cushman, but is a shorter, stouter form with more inflated chambers.

BULIMINA CARNEROSENSIS Cushman and Kleinpell, n. sp. (Pl. 1, figs. 12 a, b)

Test short and broad, somewhat compressed, periphery lobulate, greatest breadth toward the apertural end; chambers fairly distinct, somewhat inflated, increasing in height in the adult; sutures distinct, somewhat depressed, very slightly oblique, becoming nearly horizontal in the last-formed portion; wall ornamented by longitudinal costae independent of the individual chambers, lapping over the outer end of the last two chambers; aperture elongate, nearly straight, running well into the terminal face. Length 0.40 mm.; breadth 0.25 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 20122) from the Miocene, Carneros Creek, California, 295 feet stratigraphically above the base of the Temblor formation; coll. by J. F. Mahoney.

BULIMINA CARNEROSENSIS Cushman and Kleinpell, n. sp., var. MAHONEYI Cushman and Kleinpell, n. var. (Pl. 1, figs. 13 a, b)

Variety differing from the typical in the larger size, particularly in the greater length, and in the sutures which become somewhat more oblique in the adult than in the earlier stages.

Holotype of variety (Cushman Coll. No. 20123) from the Miocene, Carneros Creek, California, 310 feet stratigraphically above the base of the Temblor formation; coll. by J. F. Mahoney.

This varietal form is evidently a development from the earlier typical form. The early stages of the variety are very similar to the typical in their size, shape, and the angles of the sutures, but the varietal form in the adult has the sutures much more oblique, and attains a much greater length.

BULIMINA UVIGERINAFORMIS Cushman and Kleinpell, n. sp. (Pl. 1, figs. 14 a, b)

Test fusiform, greatest breadth near the middle, rounded in transverse section, periphery somewhat lobulate; chambers distinct, inflated, triserial; sutures distinct, depressed; wall ornamented by longitudinal costae, rather high and thin, more or less

independent on each chamber, somewhat broken at the sutures; aperture in the adult elongate, somewhat curved, with a slight lip, sometimes not quite reaching to the base of the chamber. Length 1.10 mm.; breadth 0.45 mm.

Holotype (Cushman Coll. No. 20124) from the Miocene, 335 feet stratigraphically above top of 10-foot thick, prominent chert bed exposed at base of ocean bluffs, immediately East of mouth

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EXPLANATION OF PLATE 1

FIGS. 1, 2. *Bathysiphon sanctaecrucis* Cushman and Kleinpell, n. sp. × 60. Fig. 1, Holotype. Fig. 2, Paratype.

FIGS. 3 *a, b.* *Robulus coloratus* (Stache). × 35. *a*, side view; *b*, apertural view.

FIGS. 4 *a, b.* *Robulus branneri* Cushman and Kleinpell, n. sp. × 25. *a*, side view; *b*, apertural view.

FIGS. 5 *a, b.* *Planularia* sp(?). × 40. *a*, side view; *b*, apertural view.

FIGS. 6 *a, b.* *Flabellina crassa* Cushman and Kleinpell, n. sp. × 35. *a*, side view; *b*, apertural view.

FIGS. 7 *a, b.* *Nodosaria tornata* Schwager. × 35. *a*, front view; *b*, apertural view.

FIGS. 8 *a, b.* *Nonion* cf. *N. labradoricum* (Dawson). × 50. *a*, side view; *b*, apertural view.

FIGS. 9 *a, b.* *Nonion pizarrensis* W. Berry. × 50. *a*, side view; *b*, apertural view.

FIGS. 10 *a, b.* *Nonion pizarrensis* W. Berry, var. *multicameratum* Cushman and Kleinpell, n. var. × 35. *a*, side view; *b*, apertural view.

FIGS. 11 *a, b.* *Buliminella henryana* Cushman and Kleinpell, n. sp. × 60. *a*, side view; *b*, apertural view.

FIGS. 12 *a, b.* *Bulimina carnerosensis* Cushman and Kleinpell, n. sp. × 60. *a*, side view; *b*, apertural view.

FIGS. 13 *a, b.* *Bulimina carnerosensis* Cushman and Kleinpell, n. sp., var. *mahoneyi* Cushman and Kleinpell, n. var. × 60. *a*, side view; *b*, apertural view.

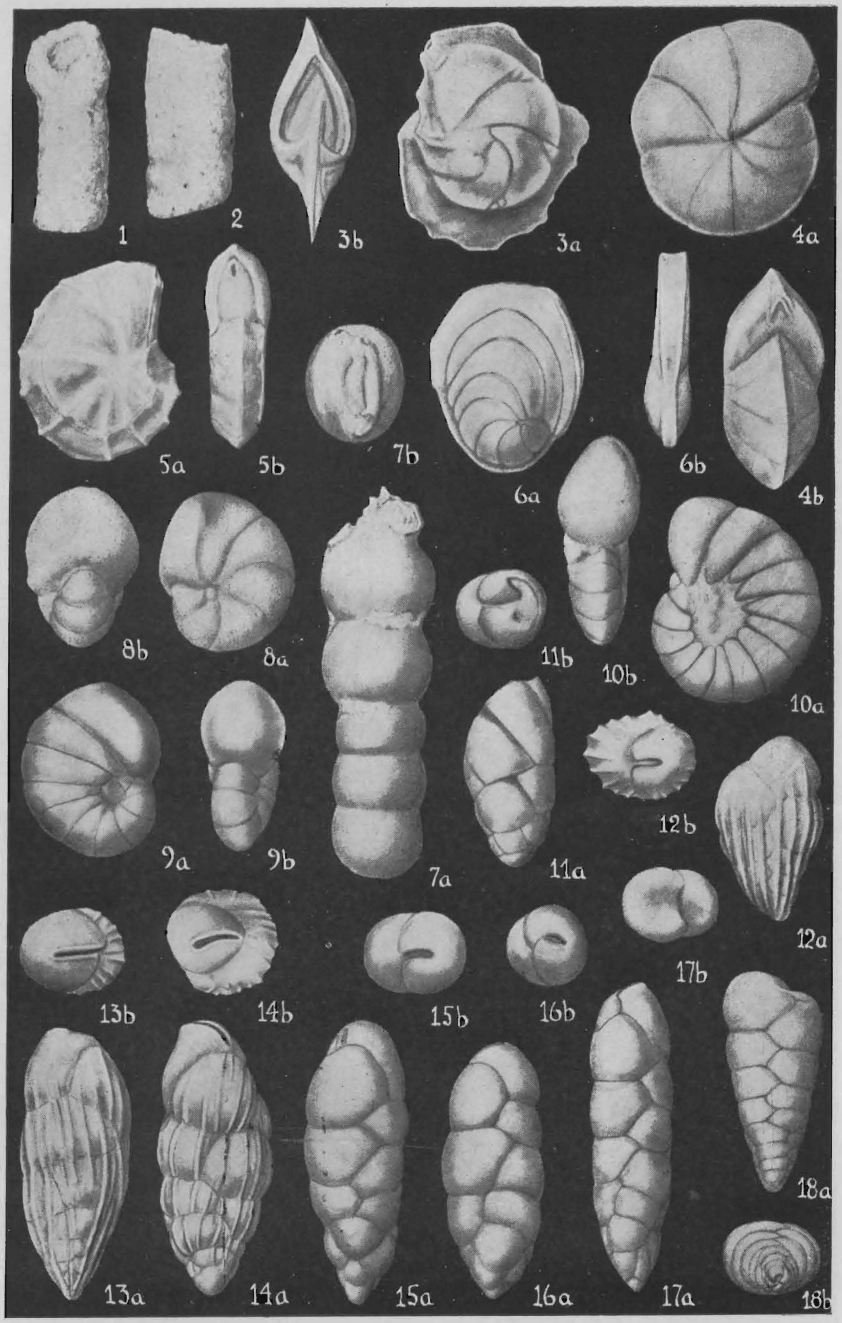
FIGS. 14 *a, b.* *Bulimina uvigerinaformis* Cushman and Kleinpell, n. sp. × 35. *a*, side view; *b*, apertural view.

FIGS. 15, 16. *Virgulina californiensis* Cushman, var. *grandis* Cushman and Kleinpell, n. var. × 50. Fig. 15, Holotype. Fig. 16, Paratype. *a, a*, side views; *b, b*, apertural views.

FIGS. 17 *a, b.* *Virgulina californiensis* Cushman, var. *ticensis* Cushman and Kleinpell, n. var. × 50. *a*, side view; *b*, apertural view.

FIGS. 18 *a, b.* *Dorothia californica* Cushman and Kleinpell, n. sp. × 60. *a*, front view; *b*, basal view.

Figures drawn by Margaret S. Moore.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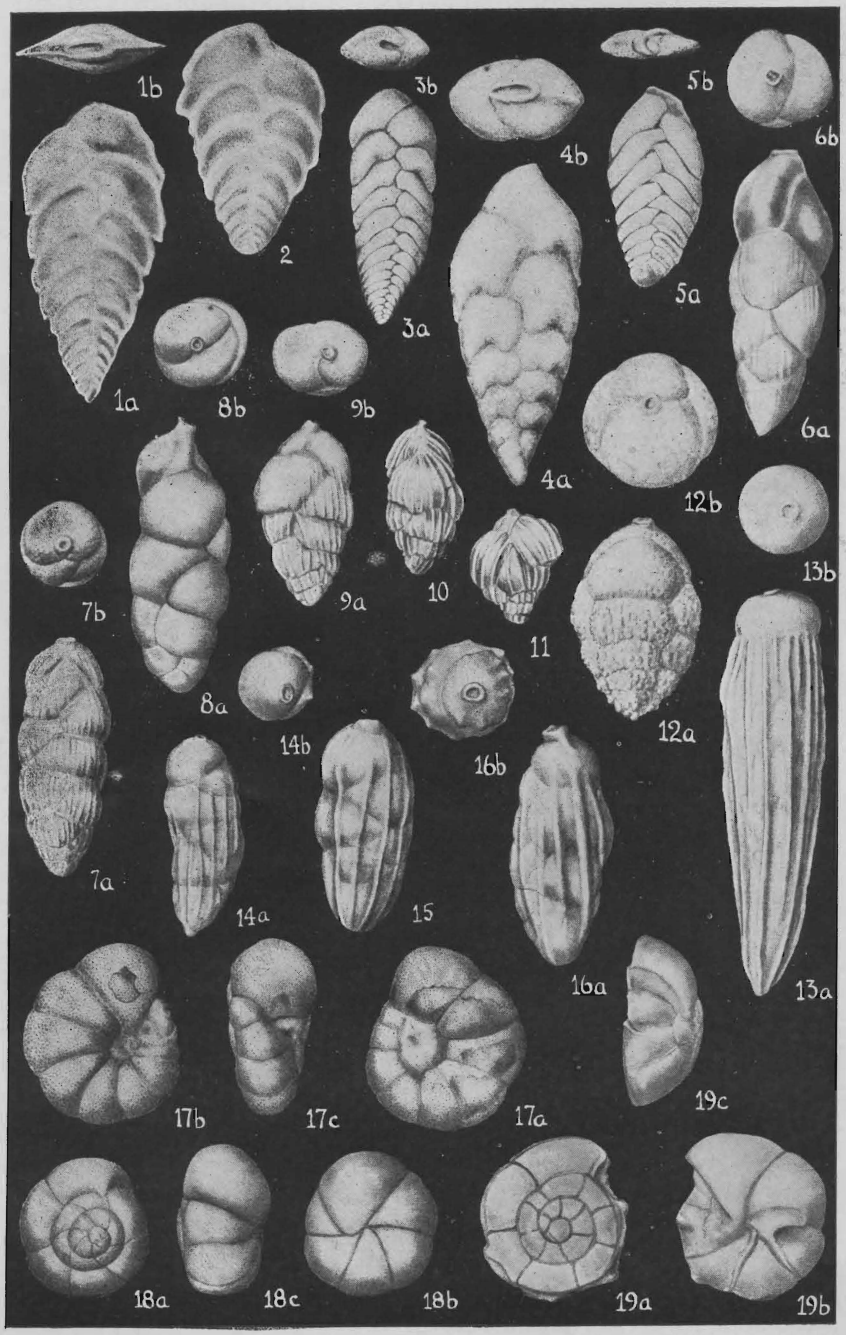
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of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This species is distinctive with its very coarse costae, fusiform shape, and particularly the apertural characters.

VIRGULINA CALIFORNIENSIS Cushman, var. GRANDIS Cushman and Kleinpell, n. var.
(Pl. 1, figs. 15, 16)

Variety differing from the typical in the larger size of the test, and the larger proportion of biserial chambers.

EXPLANATION OF PLATE 2

FIGS. 1, 2. *Bolivina marginata* Cushman, var. *adelaidana* Cushman and Kleinpell, n. var. × 60. Fig. 1, Holotype. *a*, front view; *b*, apertural view. Fig. 2, Paratype.

FIGS. 3 *a, b*. *Bolivina marginata* Cushman, var. *gracilis* Cushman and Kleinpell, n. var. × 60. *a*, front view; *b*, apertural view.

FIGS. 4 *a, b*. *Bolivina modeloensis* Cushman and Kleinpell, n. sp. × 60. *a*, front view; *b*, apertural view.

FIGS. 5 *a, b*. *Bolivina barbarana* Cushman and Kleinpell, n. sp. × 60. *a*, front view; *b*, apertural view.

FIGS. 6 *a, b*. *Uvigerinella californica* Cushman, var. *gracilis* Cushman and Kleinpell, n. var. × 60. *a*, front view; *b*, apertural view.

FIGS. 7 *a, b*. *Uvigerina carmeloensis* Cushman and Kleinpell, n. sp. × 35. *a*, front view; *b*, apertural view.

FIGS. 8 *a, b*. *Uvigerina modeloensis* Cushman and Kleinpell, n. sp. × 35. *a*, front view; *b*, apertural view.

FIGS. 9–11. *Uvigerina subperegrina* Cushman and Kleinpell, n. sp. × 35. Fig. 9, Holotype. *a*, front view; *b*, apertural view. Figs. 10, 11, Paratypes.

FIGS. 12 *a, b*. *Uvigerina proboscidea* Schwager (?). × 50. *a*, front view; *b*, apertural view.

FIGS. 13 *a, b*. *Siphogenerina tenua* Cushman and Kleinpell, n. sp. × 25. *a*, front view; *b*, apertural view.

FIGS. 14 *a, b*. *Siphogenerina pseudococoaensis* Cushman and Kleinpell, n. sp. × 25. *a*, front view; *b*, apertural view.

FIGS. 15, 16. *Siphogenerina nodifera* Cushman and Kleinpell, n. sp. × 25. Fig. 16, Holotype. *a*, front view; *b*, apertural view. Fig. 15, Paratype.

FIGS. 17 *a–c*. *Valvulineria joaquinensis* Cushman and Kleinpell, n. sp. × 35. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 18 *a–c*. *Eponides rosaformis* Cushman and Kleinpell, n. sp. × 60. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 19 *a–c*. *Eponides tenera* (H. B. Brady). × 60. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

Figures drawn by Margaret S. Moore.

Holotype of variety (Cushman Coll. No. 20125) from the Miocene, Rodeo shale, about 30 feet above middle of formation, North side of highway between Rodeo and Pinole, California; coll. by M. N. Bramlette and R. M. Kleinpell.

VIRGULINA CALIFORNIENSIS Cushman, var. TICENSIS Cushman and Kleinpell, n. var.
(Pl. 1, figs. 17 a, b)

Variety differing from the typical in the very slender test and very long biserial portion.

Holotype of variety (Cushman Coll. No. 20127) from the Miocene, Tice shale, second prominent road cut, North of West end of San Pablo dam, Contra Costa Co., California; coll. by M. N. Bramlette and R. M. Kleinpell.

This slender variety is common in the Tice shale, and so far has been found only in Contra Costa County.

BOLIVINA MARGINATA Cushman, var. ADELAIDANA Cushman and Kleinpell, n. var.
(Pl. 2, figs. 1, 2)

Variety differing from the typical in the strongly raised and limbate sutures and the tendency of the chambers to become somewhat spinose at the basal angle.

Holotype of variety (Cushman Coll. No. 20129) from the Miocene, 1,100 feet North and 200 feet West of S.E. corner of Sec. 7, T. 26 S., R. 10 E., Adelaida Quadrangle, California; coll. by N. L. Taliaferro and H. G. Schenck.

BOLIVINA MARGINATA Cushman, var. GRACILIS Cushman and Kleinpell, n. var.
(Pl. 2, figs. 3 a, b)

Variety differing from the typical in the much larger number of chambers, the sutures slightly depressed and slightly limbate, and the somewhat more elongate and slender form of the test. Length 0.50 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Holotype of variety (Cushman Coll. No. 20131) from the Miocene, lowermost Modelo, Dry Canyon road, South of Calabasas, near North line of Sec. 35, T. 1 N., R. 17 W., California; coll. by M. N. Bramlette and R. M. Kleinpell.

BOLIVINA MODELOENSIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 4 a, b)

Test elongate, tapering, fusiform, greatest breadth toward the apertural end; chambers distinct, inflated, high, of uniform shape, gradually increasing in size as added, the inner basal margin of each with a distinct inflated lobe, and the peripheral

basal angle extending strongly backward but not spinose; sutures distinct, depressed, sinuate; wall somewhat roughened, distinctly perforate; aperture tending to become terminal. Length 0.70 mm.; breadth 0.30 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 20132) from the Miocene, lowermost Modelo, Dry Canyon road, South of Calabasas, near North line of Sec. 35, T. 1 N., R. 17 W., California; coll. by M. N. Bramlette and R. M. Kleinpell.

This species has some of the characteristics of *B. floridana*, but the general shape of the test, particularly the form of the chambers, is distinctive.

BOLIVINA BARBARANA Cushman and Kleinpell, n. sp. (Pl. 2, figs. 5 a, b)

Test much compressed, about twice as long as broad, periphery subacute; chambers distinct, numerous, low and broad, only slightly overlapping; sutures distinct, very slightly depressed, strongly oblique, nearly straight; wall smooth, finely perforate. Length 0.45 mm.; breadth 0.20 mm.; thickness 0.07 mm.

Holotype (Cushman Coll. No. 20133) from the Miocene, 468 feet stratigraphically above top of 10-foot thick, prominent chert bed, exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

UVIGERINELLA CALIFORNICA Cushman, var. GRACILIS Cushman and Kleinpell, n. var. (Pl. 2, figs. 6 a, b)

Variety differing from the typical in the more elongate form and the very finely striate surface.

Holotype of variety (Cushman Coll. No. 20134) from the Miocene, Monterey shale, Henry Ranch, Graves Creek, San Luis Obispo Co., California; coll. by J. C. Branner.

UVIGERINA CARMELOENSIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 7 a, b)

Test elongate, slender, the sides nearly straight for most of the length, slightly lobate; chambers distinct, inflated, of rather uniform size and shape; sutures distinct, depressed, slightly oblique; wall ornamented with numerous low costae, those of each chamber independent of the others; aperture terminal, rounded, with a short neck. Length 1.00 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 20135) from the Miocene, Monterey shale, 35 feet stratigraphically above contact with

quartz diorite as exposed in Coyote Canyon, North side of Carmel Valley, California; coll. by M. N. Bramlette.

UVIGERINA MODELOENSIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 8 a, b)

Test elongate, slender, the sides nearly parallel, rounded in transverse section; chambers inflated, large, high, only slightly overlapping; sutures distinct, depressed; wall smooth; aperture small, terminal, rounded, with a distinct, slender neck running down the inner face of the chamber. Length 1.10 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 20136) from the Miocene, lower Modelo formation, 250 feet stratigraphically above the base, on Girard-Mohn Spring road, California; coll. by M. N. Bramlette and K. E. Lohman. Microspheric forms of this large species often have a greatly increased diameter in the later portion of the test, and thus a more tapering outline.

UVIGERINA SUBPEREGRINA Cushman and Kleinpell, n. sp. (Pl. 2, figs. 9-11)

Test small, fusiform, often slightly compressed; chambers distinct, inflated; sutures distinct, depressed, slightly oblique; wall ornamented by numerous fine costae, as many as ten to a chamber, those of each chamber independent of adjacent ones, last-formed chambers somewhat smooth; aperture terminal, small, with a short neck. Length 0.60-0.70 mm.; diameter 0.30-0.40 mm.

Holotype (Cushman Coll. No. 20137) from the Miocene, 232 feet stratigraphically above top of 10-foot thick prominent chert bed exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This species differs from *U. peregrina* in the more regular and somewhat lower costae which are entire and not jagged as in that species. It is close to a form referred to in the Miocene of Florida as "*U.* cf. *pigmea* d'Orbigny."

UVIGERINA PROBOSCIDEA Schwager (?) (Pl. 2, figs. 12 a, b)

The figured specimen (Cushman Coll. No. 20139) from the Monterey shale, road from Monterey to Pebble Beach, ¾ mile below Toll House, California; coll. by E. W. Galliher, seems to be very close if not identical with Schwager's species.

SIPHOGENERINA TENUA Cushman and Kleinpell, n. sp. (Pl. 2, figs. 13 a, b)

Test very long, slender, about four times as long as broad; chambers rather high, somewhat indistinct; sutures obscured by the ornamentation of the surface; wall ornamented by numerous, long, raised costae, about ten in number, with smaller intermediate costae toward the apertural end, final chamber smooth; aperture rounded, terminal, with a very short neck. Length 2.00 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 20140) from the Miocene, 550 feet above base of Temblor formation, Carneros Creek, California; coll. by J. F. Mahoney.

This is a very elongate form, keeping its characteristics closely, and rather strictly limited in its stratigraphic range.

SIPHOGENERINA NODIFERA Cushman and Kleinpell, n. sp. (Pl. 2, figs. 15, 16)

Test elongate, about 2½ times as long as broad, periphery somewhat lobate, triserial, except toward the apertural end; chambers distinct, inflated, last-formed one or two becoming terminal; sutures fairly distinct, depressed; wall ornamented by a few, 10-12, longitudinal costae, running the entire length of the test; aperture terminal, with a short neck. Length 1.20 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 20141) from the Miocene, 160+ feet stratigraphically above base of Temblor formation, Carneros Creek, California; coll. by J. F. Mahoney.

This species shows rather distinctly the development of *Siphogenerina* from *Uvigerina*, and the species is included in the former genus as it has the final chambers arranged in a uniserial manner.

SIPHOGENERINA PSEUDOCOCOAENSIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 14 a, b)

Test elongate, slender, increasing in diameter in the earliest portion, then keeping the same diameter or even reducing this in the adult; chambers distinct, somewhat inflated, nearly all loosely spiral, last one or two uniserial, more inflated; sutures fairly distinct, somewhat depressed; wall ornamented in the earliest portion by numerous longitudinal costae, four or six visible in side view, independent of the chambers, becoming obsolescent on the uniserial chambers; aperture in the adult terminal, circular, with a slight neck. Length 1.00 mm. or more; diameter 0.35 mm.

Holotype (Cushman Coll. No. 20143) from the Miocene, Car-

neros Creek, 260 feet stratigraphically above base of Temblor formation, California; coll. by J. F. Mahoney.

Adults often have one more chamber than that shown in the type figure.

VALVULINERIA JOAQUINENSIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 17 a-c)

Test trochoid, the spire greatly depressed, and the test somewhat excavated in the middle on both sides, periphery slightly lobulate; chambers numerous, 8-10 in the last-formed whorl, of rather uniform shape, increasing regularly in size as added; sutures distinct, depressed, slightly curved, nearly radial, becoming less curved as growth progresses; wall finely perforate, smooth; aperture indistinct in available material. Diameter 0.75 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 20144) from the Miocene, 5,813 feet stratigraphically below "McKittrick-Maricopa" contact as exposed on the South side of bed of Chico-Martinez Creek, in S.E. ¼, Sec. 2, T. 29 S., R. 20 E., California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This species is very close to *Valvulineria araucana* (d'Orbigny).

EPONIDES ROSAFORMIS Cushman and Kleinpell, n. sp. (Pl. 2, figs. 18 a-c)

Test small, rounded, forming a low spire on the dorsal side, ventrally inflated; chambers distinct, those in the adult whorl increasing only slightly in size as added; sutures distinct, on the dorsal side slightly curved, ventrally nearly radial; wall smooth, finely perforate; aperture, a low opening on the ventral side between the periphery and the umbilicus. Diameter 0.30 mm.; height 0.20 mm.

Holotype (Cushman Coll. No. 20145) from the Miocene, 5,934 feet stratigraphically below "McKittrick-Maricopa" contact as exposed on the South side of bed of Chico-Martinez Creek, in S.E. ¼, Sec. 2, T. 29 S., R. 20 E., California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

EPONIDES KEENANI Cushman and Kleinpell, n. sp. (Pl. 3, figs. 10, 11)

Test subglobular, periphery broadly rounded, not lobulated, dorsal side somewhat flattened, ventrally broadly rounded; chambers fairly distinct, not inflated, of rather uniform shape, tending to become somewhat longer in the adult, six or seven to

a whorl; sutures dorsally slightly oblique, not depressed, somewhat limbate, ventrally nearly radiate; wall smooth, finely perforate; aperture, a small, low, arched opening about midway of the ventral margin of the last-formed chamber. Diameter 0.45 mm.; height 0.20 mm.

Holotype (Cushman Coll. No. 20156) from the Miocene, 250 feet stratigraphically above base of Modelo formation as exposed on road North of Mohn Spring, Santa Monica Mountains, California; coll. by M. N. Bramlette and K. E. Lohman.

This small species is rather constant in its characters.

EPONIDES TENERA (H. B. Brady) (Pl. 2, figs. 19 a-c)

The figured specimen (Cushman Coll. No. 20146) which shows the characteristic sigmoid sutures on the ventral side is from S.E. ¼, Sec. 26, T. 26 S., R. 10 E., on Las Tablas Creek, where it crosses East line of Sec. 26, Adelaida Quadrangle, California; coll. by Robert R. Wilson.

EPISTOMINA RAMONENSIS Cushman and Kleinpell, n. sp. (Pl. 3, figs. 1 a-c)

Test strongly and equally biconvex, periphery entire, subacute; chambers fairly distinct, numerous, about ten in the adult whorl; sutures distinct, somewhat limbate, slightly curved, ending on the ventral side in a distinct umbo; aperture indistinct. Diameter 1.00 mm.; thickness 0.55 mm.

Holotype (Cushman Coll. No. 20147) from the Miocene, shale parting, 3 feet above base of "Kirker" tuffaceous sandstone, road cut in East side of private road running S.E. from Bear Creek—Pinole Creek road, just South of Lawson Hill—Oursan Ridge divide, Contra Costa Co., California; coll. by M. N. Bramlette and R. M. Kleinpell.

The numerous chambers and strongly biconvex test will distinguish this species.

CANCRIS BAGGI Cushman and Kleinpell, n. sp. (Pl. 3, figs. 2 a-c)

Test strongly biconvex, somewhat longer than broad, periphery keeled, spire on dorsal side somewhat convex, ventrally strongly convex; chambers distinct, inflated, particularly on the ventral side, seven or eight in the last-formed whorl, enlarging rapidly in size and length as added; sutures distinct, depressed, particularly on the ventral side, curved, slightly limbate; wall smooth, finely perforate; aperture ventral, low, toward the

umbilicus. Length 1.05 mm.; breadth 0.85 mm.; thickness 0.65 mm.

Holotype (Cushman Coll. No. 20148) from the Miocene, Monterey shale, Henry Ranch, Graves Creek, San Luis Obispo Co., California; coll. by J. C. Branner.

This form referred to by Bagg as *auricula* is more inflated and convex than that species.

PULVINULINELLA CAPITANENSIS Cushman and Kleinpell, n. sp. (Pl. 3, figs. 3 a-c)

Test much compressed, somewhat longer than broad; chambers distinct, about eight in the last-formed whorl, increasing rather regularly in size as added; sutures distinct, slightly curved, slightly depressed; wall smooth, finely perforate; aperture, an elongate opening in the median line, occupying nearly the entire length of the apertural face. Length 0.55 mm.; breadth 0.40 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 20149) from the Miocene, 232 feet stratigraphically above top of 10-foot thick, prominent chert bed exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This species is unusual in the genus in its very strong compression and the elongate form of the test.

CASSIDULINA BARBARANA Cushman and Kleinpell, n. sp. (Pl. 3, figs. 5 a, b)

Test rounded, thick, periphery broadly rounded; chambers typically five on each side of the adult coil, not inflated; sutures distinct, slightly limbate, not depressed; wall smooth, distinctly perforate; aperture, a short narrow opening in the median line. Diameter 0.35 mm.; thickness 0.30 mm.

Holotype (Cushman Coll. No. 20150) from the Miocene, 539 feet stratigraphically above top of 10-foot thick, prominent chert bed exposed at base of ocean bluffs, immediately East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This is a very small, very rounded species in some respects apparently related to *C. margareta* Karrer.

CASSIDULINA MONICANA Cushman and Kleinpell, n. sp. (Pl. 3, figs. 4 a, b)

Test nearly circular in side view, in peripheral view nodose, bi-umbilicate; chambers distinct, inflated, five pairs making up the last-formed whorl, increasing rather regularly in size as

added; sutures distinct, strongly depressed, radial; wall smooth, finely perforate; aperture, an elongate, somewhat curved, high opening in the axis of coiling. Diameter 0.50 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 20151) from the lowest Miocene, 40 feet stratigraphically above base, on Girard-Mohn Spring road, Sec. 31, T. 1 N., R. 16 E., California; coll. by M. N. Bramlette and R. M. Kleinpell.

This is a very distinctive species with its very strongly inflated chambers and nodose appearance.

The following species described by Mr. W. D. Rankin have been included in this paper by his kind permission in order that figures and descriptions of them might be available for workers.

DENTALINA BARNESI Rankin MS., n. sp. (Pl. 3, figs. 6 a, b)

Test elongate, tapering, slightly curved; chambers numerous, distinct, not inflated, increasing gradually in height and size as added; sutures distinct, nearly horizontal, not depressed, slightly limbate; wall translucent or nearly transparent, fairly thick, ornamented by high, thin, longitudinal costae, 4-6 in the young with additional ones coming in between in the adult. Length 0.85 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 20152) from the Miocene, 200 feet stratigraphically above top of a prominent 10-foot thick chert bed at base of ocean bluffs East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This species is somewhat similar to *Dentalina quadrulata* Cushman and Laiming, but the later portion is very different.

BOLIVINA GIRARDENSIS Rankin MS., n. sp. (Pl. 3, figs. 7 a, b)

Test small, rhomboid in front view, greatest width at about the middle in the adult, much compressed, periphery subacute, slightly lobulated in adult; chambers numerous, slightly inflated, increasing somewhat in height and greatly in breadth as added; sutures distinct, slightly limbate, slightly oblique in early stages, very strongly oblique in adult; wall smooth, finely perforate; aperture, a broad opening into the base of the apertural face. Length 0.45-0.50 mm.; breadth 0.25-0.30 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 20153) from the Miocene, 392 feet stratigraphically above top of a prominent 10-foot thick

chert bed at base of ocean bluffs East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This is a very distinctive species in the rapid change in shape of chambers and inclination of the sutures.

BOLIVINA HOOTSI Rankin MS., n. sp. (Pl. 4, figs. 1 a, b)

Test stout, broadly elliptical in end view, the sides broadly rounded, sides only slightly tapering in the adult; chambers comparatively few, high, slightly inflated, much overlapping, increasing only slightly in size as added; sutures distinct, slightly depressed, forming a low angle with the horizontal; wall distinctly perforate, particularly at the basal half of each chamber, the upper half clear; aperture slightly curved, narrow, with a slightly thickened lip. Length 0.50 mm.; breadth 0.20 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 20191) from the Miocene, strati-

EXPLANATION OF PLATE 3

FIGS. 1 *a–c.* *Epistomina ramonensis* Cushman and Kleinpell, n. sp. × 35. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 2 *a–c.* *Cancris baggi* Cushman and Kleinpell, n. sp. × 25. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 3 *a–c.* *Pulvinulinella capitanensis* Cushman and Kleinpell, n. sp. × 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 4 *a, b.* *Cassidulina monicana* Cushman and Kleinpell, n. sp. × 60. *a*, side view; *b*, peripheral view.

FIGS. 5 *a, b.* *Cassidulina barbarana* Cushman and Kleinpell, n. sp. × 60. *a*, side view; *b*, peripheral view.

FIGS. 6 *a, b.* *Dentalina barnesi* Rankin MS., n. sp. × 60. *a*, front view; *b*, apertural view.

FIGS. 7 *a, b.* *Bolivina girardensis* Rankin MS., n. sp. × 60. *a*, front view; *b*, apertural view.

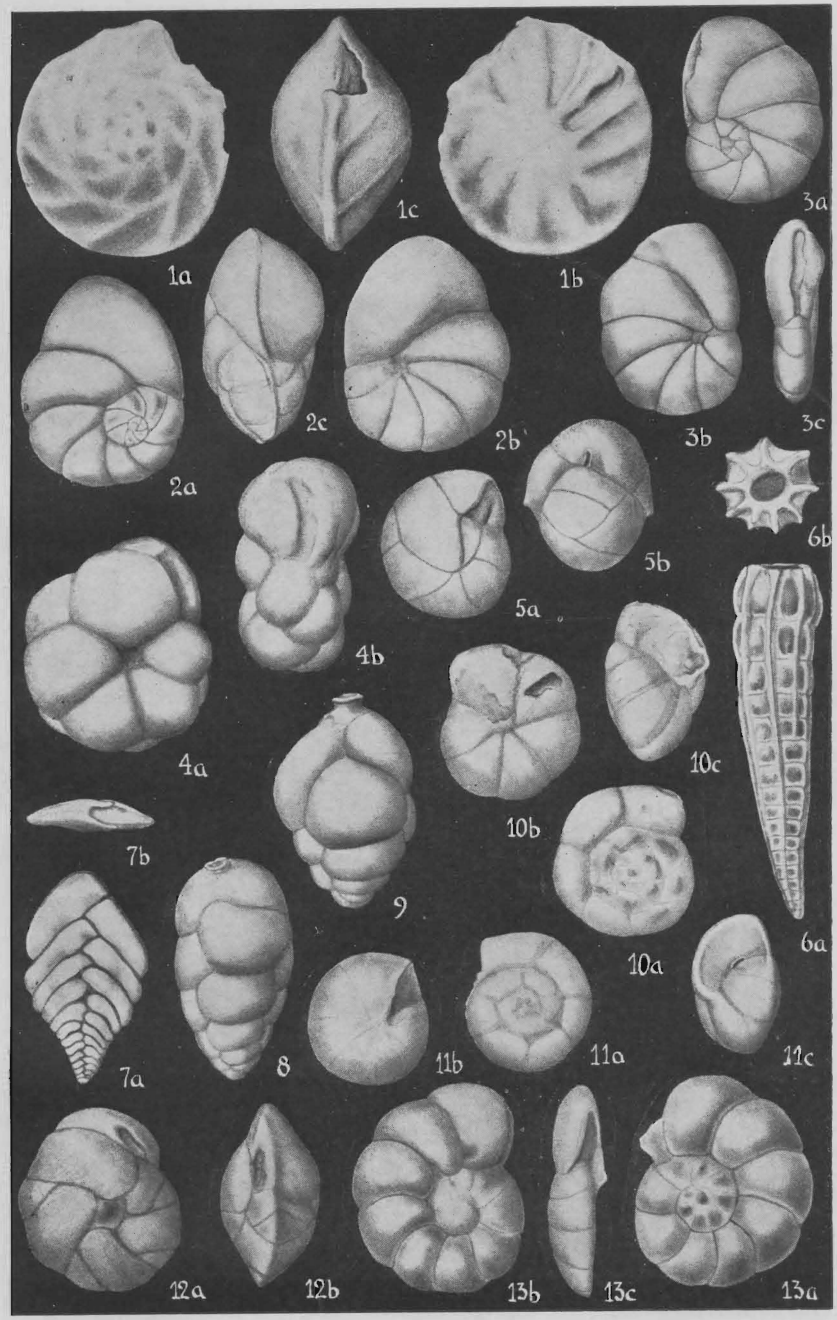
FIGS. 8, 9. *Uvigerina hootsi* Rankin MS., n. sp. × 50. Fig. 8, Holotype. Fig. 9, Paratype.

FIGS. 10, 11. *Eponides keenani* Cushman and Kleinpell, n. sp. × 50. *a, a*, dorsal views; *b, b*, ventral views; *c, c*, peripheral views. Fig. 10, Holotype. Fig. 11, Paratype.

FIGS. 12 *a, b.* *Cassidulina modeloensis* Rankin MS., n. sp. × 50. *a*, side view; *b*, peripheral view.

FIGS. 13 *a–c.* *Anomalina hughesi* Rankin MS., n. sp. × 60. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

Figures drawn by Margaret S. Moore.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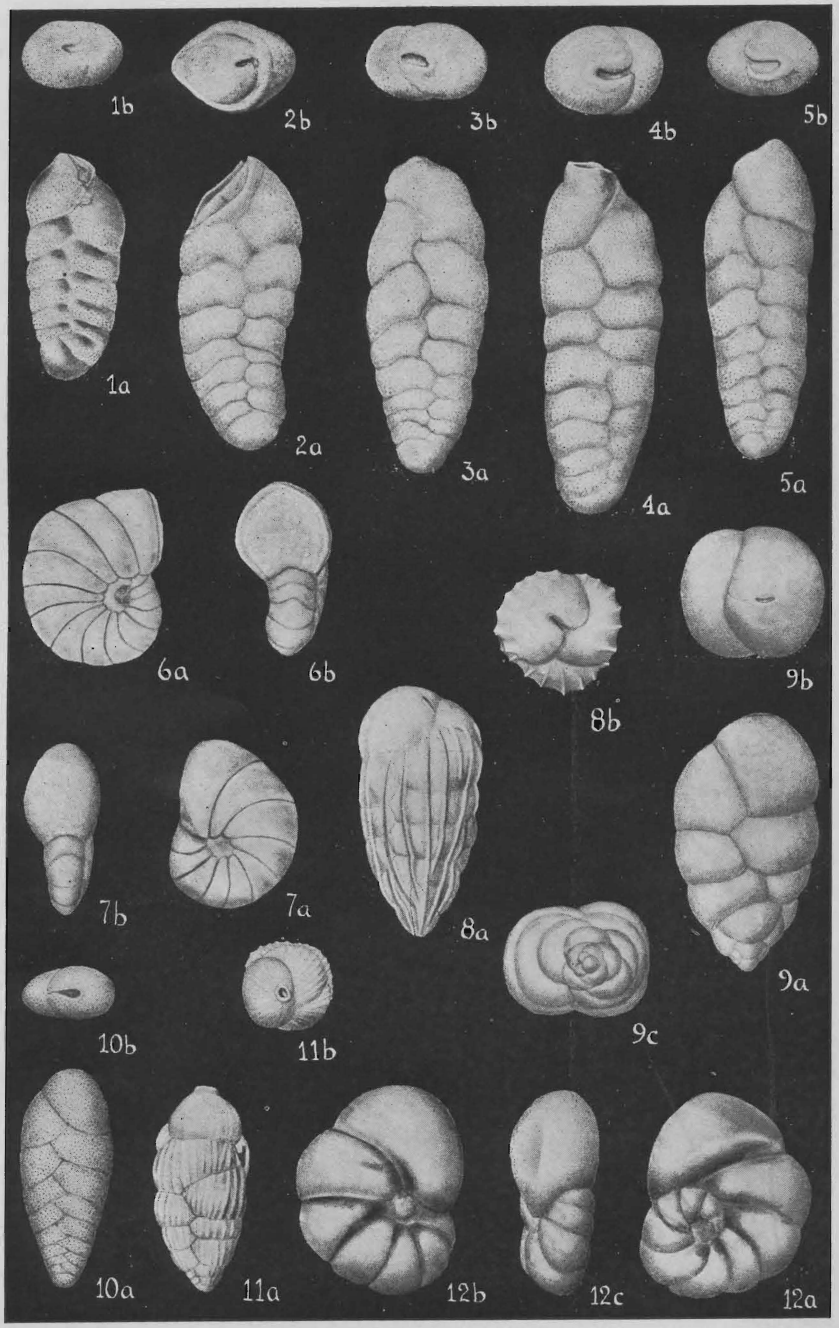
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graphically 2,040 feet above base of Modelo formation as exposed along road from Girard to Mohn Spring, Santa Monica Mountains, California; coll. by M. N. Bramlette and K. E. Lohman.

This species is related to *Bolivina seminuda* Cushman described from the Pacific.

BOLIVINA GRANTI Rankin MS., n. sp. (Pl. 4, figs. 2, 3)

Test elongate, slightly tapering, often contracted toward the apertural end, frequently somewhat twisted, transverse section tending to become somewhat rhomboid; chambers distinct, very slightly inflated, rather high but somewhat irregularly overlapping, giving a lack of uniformity to the shape and size; sutures distinct, slightly depressed, rather irregular in their angle with the horizontal, with a trace of a lobe at the inner end in the adult; wall rather coarsely perforate; aperture elongate, elliptical and slightly curved, with a slight neck. Length 0.70 mm.; breadth 0.25 mm.; thickness 0.18-0.20 mm.

Holotype (Cushman Coll. No. 20192) from the Miocene, strati-

EXPLANATION OF PLATE 4

FIGS. 1 *a, b.* *Bolivina hootsi* Rankin MS., n. sp. × 60. *a*, front view; *b*, apertural view.

FIGS. 2, 3. *Bolivina granti* Rankin MS., n. sp. × 60. Fig. 2, Holotype. Fig. 3, Paratype. *a, a*, front views; *b, b*, apertural views.

FIGS. 4, 5. *Bolivina goudkoffi* Rankin MS., n. sp. × 60. Fig. 4, Holotype. Fig. 5, Paratype. *a, a*, front views; *b, b*, apertural views.

FIGS. 6 *a, b.* *Nonion montereyanum* Cushman and Galliher, n. sp. × 50. *a*, side view; *b*, apertural view.

FIGS. 7 *a, b.* *Nonion montereyanum* Cushman and Galliher, n. sp., var. *carmeloensis* Cushman and Galliher, n. var. × 50. *a*, side view; *b*, apertural view.

FIGS. 8 *a, b.* *Bulimina delreyensis* Cushman and Galliher, n. sp. × 35. *a*, front view; *b*, apertural view.

FIGS. 9 *a–c.* *Virgulina delmonteensis* Cushman and Galliher, n. sp. × 60. *a*, front view; *b*, apertural view; *c*, basal view.

FIGS. 10 *a, b.* *Bolivina hughesi* Cushman, var. *parva* Cushman and Galliher, n. var. × 60. *a*, front view; *b*, apertural view.

FIGS. 11 *a, b.* *Uvigerina segundoensis* Cushman and Galliher, n. sp. × 35. *a*, front view; *b*, apertural view.

FIGS. 12 *a–c.* *Valvulineria grandis* Cushman and Galliher, n. sp. × 25. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

Figures drawn by Margaret S. Moore.

graphically 2,040 feet above base of Modelo formation as exposed along road from Girard to Mohn Spring, Santa Monica Mountains, California; coll. by M. N. Bramlette and K. E. Lohman.

This species may be distinguished in this material by the peculiar irregularity of the chambers and sutures together with the somewhat twisted form of the test. It is apparently related to *Bolivina hughesi* Cushman.

BOLIVINA GOUDKOFFI Rankin MS., n. sp. (Pl. 4, figs. 4, 5)

Test elongate, broadly elliptical in transverse section, periphery broadly rounded, sides nearly parallel or very slightly tapering, somewhat contracted toward the apertural end which distinctly projects; chambers distinct, slightly inflated, high, strongly overlapping except the last three chambers; sutures distinct, slightly limbate, very slightly depressed, somewhat sigmoid, forming a slight angle with horizontal, the inner margin with a distinct lobe; wall finely but distinctly perforate, with a tendency for the upper portion of the chamber to become clear; aperture large, broad, with a distinct, raised lip. Length 0.70-0.80 mm.; breadth 0.25-0.28 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 20194) from the Miocene, stratigraphically 2,040 feet above base of Modelo formation as exposed along road from Girard to Mohn Spring, Santa Monica Mountains, California; coll. by M. N. Bramlette and K. E. Lohman.

This species somewhat resembles *B. hootsi*, but the chambers are less inflated and the sutures are very different.

UVIGERINA HOOTSI Rankin MS., n. sp. (Pl. 3, figs. 8, 9)

Test about twice as long as broad, greatest width above the middle; chambers very distinct, strongly inflated, of uniform shape, gradually increasing in size as added; sutures very distinct, depressed; wall smooth, matte, or the earliest portion slightly costate; aperture very small, with a very short cylindrical neck with a thin flaring lip. Length 0.65 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 20154) from the Miocene, phosphatic shale, 232 feet stratigraphically above top of prominent 10-foot thick chert bed at base of ocean bluffs East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This is close to some of the material referred by various authors to *U. canariensis* d'Orbigny, but that species, if the original figure and description are accurate, is very different. The apertural characters are distinctive although somewhat like other species of this general region, as *U. senticosa* Cushman which, however, differs in the wall characters.

CASSIDULINA MODELOENSIS Rankin MS., n. sp. (Pl. 3, figs. 12 a, b)

Test biconvex, umbos prominent, periphery sharply angled, slightly keeled, or the base of each chamber slightly projecting; chambers distinct, not inflated, about five pairs in the adult whorl, gradually increasing in size, ends of opposite chambers forming a relatively large triangle; sutures distinct, somewhat limbate, curved, not depressed; wall smooth, finely perforate; aperture elongate, with a distinct tooth, in the axis of coiling. Diameter 0.55 mm.; thickness 0.30 mm.

Holotype (Cushman Coll. No. 20158) from the Miocene, 2,040 feet stratigraphically above base of Modelo formation as exposed on road from Girard to Mohn Spring, Santa Monica Mountains, California; coll. by M. N. Bramlette and K. E. Lohman.

This species is variable in its periphery, sometimes keeled and varying to a serrate edge like *C. corbyi* Cushman and Hughes. The umbo is translucent as in *C. translucens* Cushman and Hughes, but otherwise very different.

ANOMALINA HUGHESI Rankin MS., n. sp. (Pl. 3, figs. 13 a-c)

Test much compressed, slightly trochoid, periphery slightly lobulated, slightly rounded, evolute on both sides, more completely so on the dorsal side which is the more convex; chambers distinct, slightly inflated, of uniform shape, increasing gradually in size as added, eight or nine in the adult whorl; sutures distinct, slightly depressed, limbate; wall smooth, very finely perforate; aperture, a small, low, slightly arched opening, at the base of the apertural face at the periphery. Diameter 0.50 mm.; height 0.10 mm.

Holotype (Cushman Coll. No. 20159) from the Miocene, 539 feet stratigraphically above top of prominent chert bed at base of ocean bluffs East of mouth of Dos Pueblos Creek, West of Naples, California; coll. by M. N. Bramlette, K. E. Lohman, and R. M. Kleinpell.

This is a well characterized but small species.

141. ADDITIONAL NEW FORAMINIFERA FROM THE MIOCENE OF CALIFORNIA

By J. A. CUSHMAN and E. W. GALLIHER

The following new forms are here figured and described so that they may be made available to workers on the Miocene of this and related regions.

NONION MONTEREYANUM Cushman and Galliher, n. sp. (Pl. 4, figs. 6 a, b)

Test somewhat asymmetrical, variable, periphery rounded, becoming more broadly so in the adult; chambers numerous, 12-14 in the adult whorl, of rather uniform shape, low and broad in side view, increasing gradually in size and breadth as added, later ones usually much thickened laterally and becoming nearly circular in section; sutures distinct, very slightly depressed, strongly curved; aperture, a low opening at or near the periphery at the base of the apertural face. Diameter 0.55 mm.; thickness 0.25 mm.

Holotype (Cushman Coll. No. 20162) from the Miocene, Monterey shale, East fork Canyon Segundo, 50 feet stratigraphically below a point 2 mm. (on map) West and 3 mm. (on map) North of intersection of Long. 121° 50′ and North line of James Meadows Tract, Monterey Quadrangle, California; coll. by R. M. Kleinpell.

This species is variable in the amount of the asymmetry developed. On the ventral side the chambers often end in distinct points.

NONION MONTEREYANUM Cushman and Galliher, n. sp., var. CARMELOENSIS Cushman and Galliher, n. var. (Pl. 4, figs. 7 a, b)

Variety differing from the typical in the much more compressed test, lack of inflation in the later portion of the whorl, and somewhat fewer and slightly higher chambers.

Holotype of variety (Cushman Coll. No. 20164) from the Miocene, Monterey shale, East fork Canyon Segundo, 90 feet stratigraphically below a point 2 mm. (on map) West and 3 mm. (on map) North of intersection of Long. 121° 50′ and North line

of James Meadows Tract, Monterey Quadrangle, California; coll. by R. M. Kleinpell.

BULIMINA DELREYENSIS Cushman and Galliher, n. sp. (Pl. 4, figs. 8 a, b)

Test about twice as long as broad, tapering from the subacute initial end to the greatest breadth at the last whorl, rounded in section; chambers distinct, slightly inflated, increasing uniformly in size as added; sutures distinct, very slightly depressed; wall ornamented with a few, distinct, longitudinal costae, independent of the chambers with secondary costae coming in between the primary ones as growth progresses, terminal face smooth; aperture very narrow, elongate, from the inner edge of the chamber. Length 1.00 mm.; breadth 0.50 mm.

Holotype (Cushman Coll. No. 20166) from the Miocene, Monterey shale, Diatomite Quarry, 4 miles East of Del Monte, South side of Canyon Del Rey, California; coll. by E. W. Galliher.

This is somewhat similar to *Bulimina buchiana* d'Orbigny, but is quite different from that species as developed in the Vienna Basin.

VIRGULINA DELMONTEENSIS Cushman and Galliher, n. sp. (Pl. 4, figs. 9 a-c)

Test short and stout, less than twice as long as broad, rounded in transverse section, biserial chambers making up much the larger portion of the test; chambers distinct, inflated, increasing rather rapidly in size as added in the biserial portion; sutures distinct, depressed, nearly horizontal; wall smooth; aperture very narrow, elongate, the portion toward the base of the chamber nearly closed, leaving a narrow elliptical opening which appears terminal. Length 0.55 mm.; diameter 0.33 mm.

Holotype (Cushman Coll. No. 20160) from the Miocene, Monterey shale, Diatomite Quarry, 4 miles East of Delmonte, California; coll. by E. W. Galliher.

This is a very short, stout form and distinct from any of the other California Miocene species.

BOLIVINA HUGHESI Cushman, var. PARVA Cushman and Galliher, n. var. (Pl. 4, figs. 10 a, b)

Variety differing from the typical in the smaller size and less twisted form, and the chambers in the adult portion lower.

Holotype of variety (Cushman Coll. No. 20161) from the Miocene, Monterey shale, West fork of Canyon Segundo, 108.7 mm. East, 105 mm. (on map) North of intersection Lat. 36° 30′ N.,

Long. 121° 55′ W., Monterey Quadrangle, California; coll. by E. W. Galliher.

Occasionally this variety occurs with the typical form and then becomes somewhat difficult to distinguish, but usually it occurs without the typical.

UVIGERINA SEGUNDOENSIS Cushman and Galliher, n. sp. (Pl. 4, figs. 11 a, b)

Test stout, fusiform, rounded in section, greatest thickness just above the middle, periphery somewhat lobulate; chambers numerous, distinctly inflated, especially in the adult, increasing rather regularly in size as added, last whorl of chambers tending to become somewhat more loosely spiral; sutures distinct, depressed; wall ornamented by numerous, low, longitudinal costae, earlier ones continuous over adjacent chambers, later those of each chamber independent; aperture broadly elliptical with a short neck and thickened rim forming a very slight lip. Length 0.85 mm.; breadth 0.40 mm.

Holotype (Cushman Coll. No. 20167) from the Miocene, Monterey shale, East fork of Canyon Segundo, 2 mm. (on map) West and 3 mm. (on map) North of intersection of Long. 121° 50′ and North line of James Meadows Tract, Monterey Quadrangle, California; coll. by R. M. Kleinpell.

Some of the specimens have more globular and more loosely arranged chambers in the adult.

VALVULINERIA GRANDIS Cushman and Galliher, n. sp. (Pl. 4, figs. 12 a-c)

Test comparatively large, compressed, periphery rounded, lobulate, trochoid, dorsal side with a depressed spire, ventral side umbilicate; chambers very distinct, becoming strongly inflated in the adult, increasing rapidly in size in the adult whorl; sutures very distinct, deeply depressed in the adult, more strongly curved in the earlier stages; aperture, a low opening into the umbilical region, covered by a semicircular extension of the chamber wall. Length 1.00 mm.; breadth 0.65-0.80 mm.; thickness 0.45 mm.

Holotype (Cushman Coll. No. 20168) from the Miocene, Monterey shale, branch of East fork of Canyon Segundo, 2 mm. (on map) East and 7.5 mm. (on map) South of intersection of Long. 120° 50′ and South line of Saucito Tract, Monterey Quadrangle, California; coll. by R. M. Kleinpell.

This species is variable in the breadth of the test, but is rather constant in other characters. Final chambers are strongly inflated.