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**New Genera and Species of the Families
Verneuilinidae and Valvulinidae and
of the Subfamily Virgulininae**

BY

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NEW GENERA AND SPECIES OF THE FAMILIES
VERNEUILINIDAE AND VALVULINIDAE AND
OF THE SUBFAMILY VIRGULININAE

By JOSEPH A. CUSHMAN

Through the aid of the Penrose Fund of the Geological Society of America, two large manuscripts of several hundred pages and seventy and forty-seven plates, respectively, have been prepared, the first giving the results of a monographic study of the families Verneuilinidae and Valvulinidae, and the second of the subfamily Virgulininae of the family Buliminidae. These contain all the known species, fossil and recent, of these groups together with many new ones. As the publication of these large papers has been delayed for a considerable time, permission has been granted by the Society to publish now the new genera and species in order that they may be available for workers on foraminifera pending publication of the larger paper.

Family VERNEUILINIDAE

VERNEUILINA ANGLICA Cushman, n. sp. (Pl. 1, figs. 1 a, b)

Test triserial, elongate, tapering, greatest breadth formed by the last whorl of chambers, angles prominent, slightly rounded, sides flat or slightly concave; chambers numerous, of rather uniform shape, increasing gradually in size as added, slightly inflated; sutures distinct, slightly depressed, oblique; wall distinctly arenaceous, surface slightly roughened; aperture elongate, low, at inner margin of last-formed chamber. Length 0.80 mm.; breadth 0.45 mm.

Holotype (Cushman Coll. No. 19224) from the Jurassic, Kimmeridge clay of Culham, near Abingdon, England.

This species differs from those figured by Terquem from the Lias of France in the more angled test and oblique sutures.

VERNEUILINA LIMBATA Cushman, n. sp. (Pl. 1, fig. 2)

Test elongate, tapering, sharply triangular in transverse section, sides flattened or concave, microspheric form rapidly enlarging in size, megalospheric form tapering gradually; chambers fairly distinct, not inflated, of uniform shape, regularly increasing in size; sutures distinct, usually limbate, raised, strongly curved, angles somewhat carinate; wall finely arenaceous, smoothly finished; aperture a high narrow opening at inner margin of last-formed chamber sometimes nearly separated from the margin and with a very slight lip. Length 1.00-1.30 mm.; breadth 0.40-0.80 mm.

Holotype (Cushman Coll. No. 19225) from the Cretaceous, Craie Blanche, of Dieppe, France.

This species, characteristic of the upper Senonian of Europe, may be distinguished from *V. tricarinata* with which it has been confused by the more strongly curved and limbate sutures, more definite, often carinate angles, and by the aperture which is high and rounded, rather than low and slit-like. ~

VERNEUILINA PARALLELA Cushman, n. sp. (Pl. 1, figs. 5 a, b)

Test elongate, triserial, early portion slightly tapering, later portion with sides nearly parallel, in transverse section roughly triangular, angles broadly rounded and somewhat truncate; chambers distinct, higher than broad in adult, slightly inflated, of uniform shape, increasing gradually in size; sutures fairly distinct, slightly depressed, slightly oblique; wall arenaceous, roughly finished; aperture a narrow high slit, running into the apertural face. Length 1.00-1.15 mm.; breadth 0.30-0.50 mm.

Holotype (Cushman Coll. No. 19270) from the Upper Cretaceous, Craie Blanche, of Bougival, France.

This small species seems to be distinct from the others of the Paris Basin region. The chambers are very much higher and fewer than in either *V. tricarinata* or *V. limbata*, sides nearly parallel throughout, and apertural characters distinctive.

VERNEUILINA PARRI Cushman, n. sp. (Pl. 1, figs. 3 a, b)

Verneuilina spinulosa HOWCHIN (not REUSS), Geol. Surv. W. Australia, Bull. 27, 1907, p. 40.—CHAPMAN, I. C., Bull. 72, 1917, p. 13.

Test elongate, triserial, earliest portion rapidly increasing in size from the rounded initial end, trihedral, sides flattened, angles rounded; later chambers more prominent and loosely triserial; sutures of early portion indistinct, later distinct and depressed; wall coarsely arenaceous but smoothly finished; aper-

ture in adult tending to become somewhat higher than in early stages, extending further into the wall and often with a slight lip. Length 0.80 mm.; breadth 0.45 mm.

Holotype (Cushman Coll. No. 19235) from the Cretaceous, Gingin chalk, near Gingin, about 60 miles NE of Perth, Western Australia.

It differs from *V. polystropha* Reuss in the more inflated later chambers and the deep aperture.

VERNEUILINA NOVO-ZEALANDICA Cushman, n. sp. (Pl. 1, figs. 4 a, b)

Test elongate, slender, sharply triangular throughout, angles slightly keeled, sides flattened or slightly concave; chambers distinct, of rather uniform shape, increasing slightly in size as added; sutures distinct, slightly depressed; wall coarsely arenaceous, roughly finished; aperture a low arched opening. Length 1.80 mm.; breadth 0.80 mm.

Holotype (Cushman Coll. No. 19354) from the Miocene of Motatura, New Zealand.

This species differs from *V. münsteri* Reuss in the depressed sutures and more elongate test.

TRITAXIA MACFADYENI Cushman, n. sp. (Pl. 1, figs. 6 a, b)

Test elongate, triserial, somewhat fusiform, greatest breadth in middle of test, end view with central portion triangular, angles rounded, sides slightly concave, adult with terminal chamber projecting and inflated; chambers distinct, of regular shape, increasing in size, last chamber inflated, rounded in section, covering end of test; sutures distinct, oblique, at an angle of nearly 45° with elongate axis, slightly depressed; wall coarsely arenaceous, with much cement, smoothly finished; aperture in adult terminal, rounded, somewhat projecting. Length 1.10-2.00 mm.; breadth 0.50-0.85 mm.

Holotype (Cushman Coll. No. 19236) from the Cretaceous, Chalk marl, Saxon Cement Works, near Cambridge, England.

This species differs from *T. pyramidata* in the rounded angles and fusiform test.

TRITAXIA PLUMMERAE Cushman, n. sp. (Pl. 1, figs. 7 a, b)

Tritaxia pyramidata PLUMMER (not REUSS), Univ. Texas Bull. 3101, 1931, p. 133, pl. 10, figs. 18-21.

Test elongate, triserial, fusiform, greatest breadth at about the middle, triangular in section in middle, with sharp angles and concave sides, apertural end in adult somewhat contracted

rounded; chambers distinct, not inflated, of uniform shape, terminal chamber in adult elongated, inflated, central; sutures distinct, slightly depressed, strongly oblique; wall coarsely arenaceous, smoothly finished, with much cement; aperture in adult, terminal, rounded, without a distinct neck. Length up to 1.20 mm.; breadth 0.50 mm.

Holotype (Cushman Coll. No. 19470) from the Lower Cretaceous, Duck Creek formation, bluff of W side of Ammonite Creek, SW of Fort Worth, Tarrant Co., Texas.

This species differs from *T. pyramidata* in the very oblique angle of the sutures and more elongated terminal chambers.

TRITAXIA FRANKEI Cushman, n. sp. (Pl. 1, figs. 8 a, b)

Test small, triserial, fusiform, rapidly tapering, greatest width at about the middle, later contracted toward apertural end, angles sharp, often almost keeled, sides slightly concave; chambers distinct, of uniform shape, increasing gradually in size, last-formed ones terminal, nearly covering earlier ones in end view; sutures distinct, slightly depressed, sharply angled; wall arenaceous, with much cement, smoothly finished; aperture in adult terminal, rounded, without a neck. Length 0.60 mm.; diameter 0.30 mm.

Holotype (Cushman Coll. No. 19240) from the Cretaceous, lower Senonian, Granulaten Kreide of Hoheneggelsen, Hannover, Germany.

This species differs from *T. pyramidata* in the shorter test and strongly inflated sutures.

TRITAXIA JARVISI Cushman, n. sp.

Tritaxia pyramidata CUSHMAN and JARVIS (not REUSS), Proc. U. S. Nat. Mus., vol. 80, art. 14, 1932, p. 16, pl. 4, figs. 4 a, b.

. Test large, triserial, elongate, tapering, greatest breadth toward apertural end, triangular in transverse section, sides flat; chambers distinct, numerous, of regular shape, increasing regularly in size, not inflated, last-formed one in adult terminal, nearly covering preceding chambers; sutures distinct, slightly depressed, strongly oblique; wall coarsely arenaceous but fairly smoothly finished; aperture in adult terminal, rounded, with slight neck. Length up to 2.20 mm.; breadth up to 1.10 mm.

Holotype (Cushman Coll. No. 15292) from the Upper Cretaceous of Trinidad, British West Indies.

This species differs from *T. pyramidata* in the oblique sutures and distinct neck.

TRITAXIA ELLISORAE Cushman, n. sp. (Pl. 1, figs. 9 a, b)

Test elongate, slender, slightly tapering, triangular in transverse section, sides flattened or slightly concave, angles slightly keeled; chambers fairly distinct, high, of rather uniform shape, increasing gradually in size; sutures distinct, slightly depressed; wall arenaceous but the surface only slightly roughened; aperture a low opening in a semicircular depression of the inner chamber margin. Length up to 1.25 mm.; diameter 0.45 mm.

- Holotype (Cushman Coll. No. 20196) from the Upper Cretaceous, Pecan Gap chalk, near Rockwall, Texas.

This species differs from *T. pyramidata* in the strongly oblique sutures, and in the narrower, less tapering test.

GAUDRYINA HAWKINSI Cushman, n. sp. (Pl. 1, figs. 10 a, b)

Early portion triserial, triangular in transverse section, sides somewhat concave, angles rounded, later chambers biserial, somewhat compressed; sutures fairly distinct, in the triserial portion slightly depressed forming a small angle with the horizontal; wall coarsely arenaceous, exterior more or less roughened, with sand grains of irregular size; aperture in adult elongate, narrow, running into the terminal face. Length 0.75 mm.; breadth 0.30 mm.

Holotype (Cushman Coll. No. 19266) from the Jurassic, Kimmeridge clay, Culham, near Abingdon, England.

This species differs from *G. rugosa* d'Orbigny in the much smaller size and less inflated later chambers.

GAUDRYINA SUBCRETACEA Cushman, n. sp. (Pl. 1, figs. 11 a, b)

Test elongate, tapering, initial end subacute, larger portion of test triserial, triangular in section with prominent, subacute angles, later and smaller portion of test much compressed, biserial, usually showing but one pair of chambers; chambers of early portion indistinct, much compressed; sutures indistinct between later chambers where they are slightly depressed; wall coarsely arenaceous, with a few large sand grains, exterior smoothly finished; aperture in adult elongate, in median line, extending into apertural face. Length 0.90 mm.; breadth 0.30 mm.

Holotype (Cushman Coll. No. 19268) from the Lower Cretaceous, Duck Creek formation, from bank of Duck Creek, 2 1/2 miles NW of Dennison, Texas.

This species differs from *G. rugosa* in the smoother finish and more compressed, fewer-chambered biserial portion.

Test elongate, greatest width quickly reached in early portion, with distinct, subacute angles, biserial portion of but few chambers forming the smaller part of test, compressed, sides of test nearly parallel; chambers distinct, in early portion high, not inflated, later biserial ones somewhat inflated but compressed; sutures distinct, in early portion strongly oblique, later ones much depressed; wall finely arenaceous, with a large amount of calcareous cement, smoothly finished; aperture in adult tending to become terminal, elliptical. Length 1.30 mm.; breadth 0.40 mm.

Holotype (Cushman Coll. No. 19267) from the Lower Cretaceous, lower Duck Creek formation, W side of Ammonite Creek, 500 feet S of road marking northern boundary of Municipal Golf Course, Fort Worth, Tarrant Co., Texas.

This species differs from *G. rugosa* in the nearly parallel sides, more slender form, smaller and more compressed biserial portion.

GAUDRYINA QUADRANS Cushman, n. sp. (Pl. 1, figs. 12 a, b)

Test elongate, sometimes slightly twisted, tapering, more or less pyramidal, greatest breadth toward apertural end which is quadrate, usually rhomboid, truncate, early portion triangular, triserial, later quadrate, biserial; chambers distinct except in earliest portion, very slightly inflated; sutures distinct, slightly depressed; wall arenaceous, exterior usually smoothly finished; aperture a low opening in an indentation of the inner margin. Length up to 1.20 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 19601) from the Cretaceous, Taylor marl, ¼ mile N of Castrovilla road, Bexar Co., Texas.

This species differs from *G. rugosa* in the smoother surface, lower chambers, and less angular early portion.

GAUDRYINA REYNOLDSI Cushman, n. sp. (Pl. 1, figs. 16 a, b)

Test conical, nearly as broad as long, earliest stage triserial, later biserial, rather evenly increasing in size, greatest breadth at the apertural end, rounded in transverse section; chambers fairly distinct, slightly, if at all, inflated; sutures fairly distinct, slightly depressed; wall coarsely arenaceous but smoothly finished; aperture low, narrow, in a semicircular re-entrant at the inner margin. Length 1.00 mm.; diameter 0.80 mm.

Holotype (Cushman Coll. No. 19331) from the Eocene of Biarritz, France.

This species somewhat resembles a *Dorothia* but no more than

three chambers to a whorl have been found in the early stages. It differs from *G. difformis* Halkyard from the same locality in its rounded section, and short conical form.

GAUDRYINA QUADRILATERA Cushman, n. sp. (Pl. 1, figs. 11 a, b)

Test elongate, initial portion tapering, pyramidal, triserial, later quadrangular, biserial, sides nearly parallel, apertural end truncate; chambers distinct, somewhat inflated, of rather uniform size and shape; sutures distinct, depressed; wall finely arenaceous, with some large angular fragments, smoothly finished; aperture a low opening in a distinct re-entrant of the inner margin. Length 1.40 mm.; diameter 0.55 mm.

Holotype (Cushman Coll. No. 20010) from the Eocene, Bartonian, Val di Lonte, Italy.

This species differs from *G. difformis* Halkyard, in the much smoother surface, distinct and lower chambers, and depressed sutures.

GAUDRYINA SCHMITTI Cushman, n. sp. (Pl. 1, figs. 15 a, b)

Test elongate, two or three times as long as broad, early portion triserial, angles somewhat rounded, sides flattened, biserial and longer portion with sides slightly tapering, lobulate, in end view rounded; chambers of earlier portion indistinct, later distinct and inflated, four or five pairs in adult; sutures of early portion indistinct, later depressed and slightly oblique; wall coarsely arenaceous, roughly finished; aperture a low opening in a distinct re-entrant at the inner margin. Length up to 1.60 mm.; breadth 0.85 mm.; thickness 0.80 mm.

Holotype (Cushman Coll. No. 19335) from the lower Oligocene of Calbe, near Magesburg, Germany.

This species differs from *G. difformis* Halkyard in the strongly tapering test throughout, and the less distinctly projecting final chambers.

GAUDRYINA PAALZOWI Cushman, n. sp. (Pl. 1, figs. 17 a, b)

Test elongate, very earliest portion triserial, almost entire test biserial, early portion tapering, later portion with sides nearly parallel, contracted in old-age specimens near the apertural end rounded in transverse section, in early portion somewhat compressed toward the margin; chambers fairly distinct, slightly inflated in biserial portion, especially in later growth, becoming somewhat higher as added; sutures distinct, slightly depressed, somewhat directed forward toward the periphery; wall rather

coarsely arenaceous, roughly finished; aperture elongate, low, in a slight indentation at the inner margin. Length up to 2.25 mm.; breadth 1.00 mm.; thickness 0.90 mm.

Holotype (Cushman Coll. No. 1315) from the Miocene of Kostej, Banat region of Hungary.

This species differs from *G. difformis* Halkyard in the very short triserial stage, compressed test, and upwardly curved sutures.

GAUDRYINA KARRERIANA Cushman, n. sp. (Pl. 1, figs. 18 a, b)

Test somewhat longer than broad, tapering throughout, early portion triserial, triangular, sides flattened, periphery broadly rounded, biserial portion with sides nearly parallel; chambers rather indistinct, biserial portion much the larger, composed of a few high, somewhat inflated chambers; sutures obscured by the rough surface, slightly depressed, nearly horizontal; wall coarsely arenaceous, roughly finished; aperture a narrow, high opening in a slight indentation of the inner margin. Length 1.85 mm.; breadth 1.00 mm.; thickness 0.90 mm.

Holotype (Cushman Coll. No. 19303) from the Miocene of Kostej, Banat region of Hungary.

This species differs from *G. asperita* Cushman and Barbat in the horizontal sutures, and less compressed test.

GAUDRYINA LAPUGYENSIS Cushman, n. sp. (Pl. 1, figs. 19 a, b)

Test elongate, early portion triserial, triangular in section, sides concave, angles bluntly rounded, biserial portion with sides nearly parallel, chambers biserial and quadrangular in end view, angles rounded; chambers in early portion indistinct, later very distinct and inflated, slightly overlapping; sutures distinct, in later portion depressed, horizontal or directed upward toward the periphery; wall arenaceous, smoothly finished; aperture narrow, low, in a slight indentation of the inner margin. Length 1.50 mm.; breadth 0.65 mm.; thickness 0.45 mm.

Holotype (Cushman Coll. No. 19309) from the Miocene of Lapugy, Hungary.

This species somewhat resembles *G. flintii* Cushman, but the chambers are more compressed, and the entire test is more elongate and usually more rounded in section.

GAUDRYINA COLLINSI Cushman, n. sp. (Pl. 2, figs. 2 a, b)

Test elongate, triserial portion rapidly increasing in breadth, with bluntly rounded angles, biserial portion of nearly uniform

width throughout, rounded or broadly oval in transverse section; chambers high, very slightly overlapping in biserial portion; sutures indistinct except in triserial portion, there slightly depressed, slightly oblique; wall particularly of biserial portion coarsely arenaceous, roughly finished; aperture high, narrow, in a deep re-entrant of the inner margin. Length up to 2.00 mm.; diameter 0.75 mm.

Holotype (Cushman Coll. No. 19298) from the Miocene of Western Beach, Geelong, Victoria, Australia.

This species differs from *G. asperita* in the blunt angles of the triserial portion, and greater number of biserial chambers.

GAUDRYINA COLLINSI Cushman, n. sp., var. **ROBUSTIOR** Cushman, n. var.
(Pl. 2, figs. 3 a, b)

Variety differing from the typical in the larger size and more prominent triserial portion.

Holotype (Cushman Coll. No. 1285) from *Albatross* station D5582, in 890 fathoms, near Darvel Bay, Borneo.

GAUDRYINA SICILIANA Cushman, n. sp. (Pl. 2, figs. 1 a-c)

Test short, stout, broader than long, early triserial stage short, later portion conical, quadrangular or rounded in end view; chambers fairly distinct, slightly inflated, basal angle tending to become somewhat raised; sutures rather indistinct, slightly depressed; wall coarsely arenaceous, roughly finished except the apertural face which is smooth; aperture elongate, low, in a slight re-entrant of the inner chamber margin. Length 0.45 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 19326) from the Pliocene of Calabria, Sicily.

This species differs from *G. triangularis* Cushman in the shorter, more rounded form, and very short triserial stage.

GAUDRYINA WICKENDENI Cushman, n. sp. (Pl. 2, figs. 4 a, b)

Gaudryina triangularis CUSHMAN and WICKENDEN (not CUSHMAN, 1911), Proc. U. S. Nat. Mus., vol. 75, art. 9, 1929, p. 2, pl. 1, figs. 1 a, b.

Test small, short and stout, usually less than twice as long as broad, periphery rounded, initial end triserial, later and largest portion biserial; chambers distinct, inflated, particularly in the later biserial portion; sutures distinct, in the adult nearly horizontal; wall of fine sand with a few coarser grains and much cement, smoothly finished; aperture a narrow slit at the inner

margin. Length 0.35 mm.; breadth 0.18-0.20 mm.; thickness 0.12 mm.

Holotype (U. S. N. M. No. 26174) from Cumberland Bay, Juan Fernandez Island, Chile.

This species differs from young stages of *G. quadrangularis* Bagg in the fewer and higher chambers, and more smoothly finished wall.

GAUDRYINA TENUIS Cushman, n. sp. (Pl. 2, figs. 5 a, b)

Gaudryina attenuata CUSHMAN (not CHAPMAN, 1902), Proc. U. S. Nat. Mus., vol. 44, 1913, p. 636; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 152, pl. 30, fig. 4.

Test elongate, composed of numerous chambers, early portion triserial, triangular in cross section with sharp angles, biserial chambers numerous, nearly as high as broad, in later development each chamber running nearly or quite to the opposite side of the test; wall rough, composed of rough sand grains and sponge spicules roughly cemented; aperture at first textularian, becoming more nearly circular in the last-formed chambers; color light gray. Length about 3.00 mm.

Holotype (U. S. N. M. No. 8508) from *Albatross* station D5259, off northwestern Panay, 312 fathoms.

This species differs from *G. gracilis* Cushman and Laiming in the larger size, and tendency to become uniserial.

Subgenus SIPHOAUDRYINA Cushman, new subgenus

Subgenotype, *Gaudryina (Siphogaudryina) stephensoni* Cushman

Test with the early stages triserial, usually triangular with sharp angles, one of the ridges becoming divided and forming a quadrangular test with four distinct angles, usually somewhat compressed with two narrow sides and two broad sides, one of which is somewhat wider than the other, the angles frequently expanded into fistulose processes, which become broken on the exterior, showing a row of openings along the angles of the test, end view usually quadrangular.—Upper Cretaceous to Recent.

GAUDRYINA (SIPHOAUDRYINA) AUSTINANA Cushman, n. sp. (Pl. 2, figs. 6 a, b)

Test somewhat longer than broad, early portion triserial and triangular, later portion biserial, somewhat compressed, keel of one side dividing so that a generally quadrangular test results, angles sharp or somewhat rounded; chambers fairly distinct, especially in later portion, and somewhat inflated; sutures fairly distinct, oblique, later ones slightly depressed; wall acenaceous,

with much cement, smooth or slightly roughened; aperture small, low, in a deep, semicircular re-entrant. Length up to 2.00 mm.; breadth 1.00 mm.

Holotype (Cushman Coll. No. 19556) from the Upper Cretaceous, Austin chalk, 3.4 miles toward Farmersville from the McKinney Court House, Collin Co., Texas.

This species resembles *G. (Siphogaudryina) carinata* Franke but the species is much less coarse, has a much smoother surface, and the angles are less prominent.

GAUDRYINA (SIPHOGAUDRYINA) TUMIDULA Cushman, n. sp. (Pl. 2, figs. 7 a, b)

Test short and broad, somewhat compressed, periphery subacute, earliest portion triserial, triangular in section, biserial portion making up nearly the entire test; chambers numerous, fairly distinct, increasing regularly in size, in end view triangular, basal angle expanded into an irregular, lip-like projection; sutures distinct, depressed, nearly horizontal; wall arenaceous, rather rough; aperture elongate, low, in a distinct re-entrant of the inner margin. Length 1.25 mm.; breadth 0.80 mm.; thickness 0.60 mm.

Holotype (Cushman Coll. No. 19311) from the Miocene of Kostej, Banat region of Hungary.

This species differs from *G. (Siphogaudryina) glabrata* (Cushman) in the rougher surface and crenulate edge of the chambers.

GAUDRYINA (SIPHOGAUDRYINA) INTERJUNCTA Cushman, n. sp. (Pl. 2, figs. 8 a, b)

Test elongate, tapering, early triserial portion short, more rapidly expanding than the later biserial portion which has the sides nearly parallel, even slightly contracted toward the apertural end, triserial portion triangular, sides somewhat concave, angles bluntly keeled, biserial portion rounded or quadrangular; chambers distinct, basal border strongly lobed, with two or more backwardly projecting lobes at each side; sutures much depressed, somewhat obscured by the highly ornate surface, nearly horizontal in biserial portion; wall arenaceous, exterior highly ornamented by more or less regular depressions made by the lobes of the chambers; aperture elongate, low, in a slight, broad depression of the inner margin. Length up to 2.00 mm.; breadth 0.80 mm.; thickness 0.75 mm.

Holotype (Cushman Coll. No. 19306) from the Miocene of Kostej, Banat region of Hungary.

It is somewhat related to such forms as *G. (Siphogaudryina)*

rugulosa Cushman from the Pacific but differs in the highly ornate lobular surface.

GAUDRYINA (SIPHOGAUDRYINA) VICTORIANA Cushman, n. sp. (Pl. 2, figs. 16 a, b)
Gaudryina rugosa HERON-ALLEN and EARLAND (not D'ORBIGNY), Journ.
Roy. Mic. Soc., 1924, p. 142, pl. 8, figs. 23-25.

Test elongate, early portion triserial, triangular in cross section, sides flattened, angles subacute, biserial portion much larger, roughly quadrangular in section, sides nearly parallel; chambers numerous, indistinct in triserial portions, later inflated, with distinct basal lobes, one or two on each side; sutures of later portion distinct, much depressed, nearly horizontal; wall coarsely arenaceous, ornamented raised portions of each chamber, and the backwardly projecting lobes forming a series of deep depressions; aperture low, elongate, at the inner margin. Length up to 1.40 mm.; breadth 0.55 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 19322) from the Miocene of Filter Quarry, Moorabool River, Batesford, Victoria, Australia.

This species differs from *G. (Siphogaudryina) rugulosa* Cushman in the more rounded periphery and more highly ornate surface.

GAUDRYINA (SIPHOGAUDRYINA) RHODIENSIS Cushman, n. sp. (Pl. 2, figs. 9 a, b)

Test elongate, tapering, earliest portion triserial, much larger portion biserial, tapering rather rapidly at initial end, later much more gradually, the sides often almost parallel, end view quadrangular; chambers distinct, inflated, particularly the lower angle which is lobed, slightly overlapping; sutures distinct, strongly depressed, usually sloping upward toward the periphery; wall arenaceous, smoothly finished, much sculptured; aperture low, elongate, in a slight re-entrant. Length up to 2.00 mm.; breadth nearly 1.00 mm.; thickness 0.85 mm.

Holotype (Cushman Coll. No. 19318) from the Pliocene of the Isle of Rhodes.

This species differs from *G. (Siphogaudryina) rugulosa* Cushman in the quadrangular section and the knob-like raised areas.

Subgenus PSEUDOGAUDRYINA Cushman, new subgenus

Subgenotype, *Gaudryina (Pseudogaudryina) atlantica* (Bailey)

Test in early portion triserial and triangular in section with distinct angles, in adult, biserial and triangular in section, peripheral margin of one series of chambers being squarely truncate.

those of the opposite side ending in a distinct angle, usually one of the three flattened faces narrower than the other and marked by simple horizontal sutures representing the line of meeting between the series of chambers with truncate periphery, the other two sides usually broader and marked by a series of zigzag lines representing the alternating chambers.—Upper Cretaceous to Recent.

GAUDRYINA (PSEUDOGAUDRYINA) ELLISORAE Cushman, n. sp. (Pl. 2, figs. 12 a, b)

Test slightly longer than broad, earliest stage triserial and triangular, later compressed, sides having the zigzag line between the chambers much broader than the third side with horizontal sutures, angles sharp, chambers distinct, slightly if at all inflated; sutures indistinct, later ones slightly depressed; wall arenaceous, variable in texture, either coarsely arenaceous and roughened, or with much cement, finely arenaceous and smooth; aperture a high opening in an elongate, rounded, re-entrant. Length 0.80 mm.; breadth 0.55 mm.

Holotype (Cushman Coll. No. 20199) from the Upper Cretaceous, Taylor marl, ditch along Austin-Manor road, 0.2 mile E of Big Walnut Creek, 5.8 miles W by S of Manor, Texas.

This species differs from *G. (Pseudogaudryina) pyramidata* Cushman in the much more compressed test and the chambers not excavated above the sutures.

GAUDRYINA (PSEUDOGAUDRYINA) BAVARIANA Cushman, n. sp. (Pl. 2, figs. 14 a, b)

Test short, broad, roughly triangular in section throughout, angles bluntly keeled, sides slightly concave; chambers distinct, slightly inflated, of uniform shape, increasing rapidly in size; sutures fairly distinct, curved on the two broader faces, slightly depressed below the overhanging basal edge of the chamber; wall coarsely arenaceous, roughened; aperture elongate, low, in a squarish indentation of the margin. Length 1.20 mm.; breadth 1.05 mm.; thickness 0.75 mm.

Holotype (Cushman Coll. No. 19401) from the Cretaceous, upper Senonian, of Gotzreuther Graben, near Siegsdorf, upper Bavaria, Germany.

This species differs from *G. (Pseudogaudryina) pyramidata* Cushman in the rougher surface and curved sutures.

GAUDRYINA (PSEUDOGAUDRYINA) HÄRRINGENSIS Cushman, n. sp.
(Pl. 2, figs. 13 a, b)

Test elongate, almost entirely triserial, angles subacute, sides slightly concave, last chambers tending to become biserial, on

larged, giving a clavate appearance to the test; chambers distinct, last two or three inflated; sutures distinct, slightly depressed; wall arenaceous, smoothly finished; aperture low, arched, in a nearly circular re-entrant. Length 1.00 mm.; breadth 0.60 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 19334) from the Eocene of Haering in the Tyrol.

This species differs from *G. (Pseudogaudryina) jacksonensis* Cushman in the long triserial stage and smooth surface.

GAUDRYINA (PSEUDOGAUDRYINA) ALAZANENSIS Cushman, n. sp.
(Pl. 2, figs. 17 a, b)

Test elongate, early portion distinctly triserial, triangular, sides flattened or slightly concave, angles somewhat rounded, later and larger portion biserial, with two to four pairs of inflated chambers, broadly oval in end view; chambers of early portion indistinct, later inflated, high; sutures indistinct in early portion, depressed in later portion, nearly horizontal; wall coarsely arenaceous, roughly finished; aperture high, narrow, in a nearly semicircular re-entrant. Length 2.10 mm.; breadth 0.95 mm.; thickness 0.65 mm.

Holotype (Cushman Coll. No. 19329) from the lower Oligocene, Rio Buena Vista, above Rio Tuxpam, Vera Cruz, Mexico.

This species differs from *G. (Pseudogaudryina) jacksonensis* Cushman in the more inflated later chambers, rounded section and angles less prominent.

GAUDRYINA (PSEUDOGAUDRYINA) CRESPIINAE Cushman, n. sp. (Pl. 2, figs. 15 a, b)

Test elongate, larger portion triserial, triangular, sides flattened, angles slightly rounded, biserial portion short, of one to two pairs of slightly inflated chambers, roughly triangular in section; chambers distinct, in the triserial portion of uniform shape, increasing slightly in size, biserial ones inflated, periphery lobulate; sutures distinct, slightly depressed in triserial portion, more so in biserial; wall finely arenaceous, smoothly finished; aperture small, elongate, low, in a slight re-entrant. Length 1.00 mm.; breadth 0.45 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 19321) from the Oligocene, Balcombian, Balcomb Bay, Mornington, Victoria, Australia.

This species differs from *G. (Pseudogaudryina) hastata* Parr in the more regular form, broader end view and lower chambers.

GAUDRYINA (PSEUDOGAUDRYINA) PARRI Cushman, n. sp. (Pl. 2, figs. 11 a, b)

Test elongate, narrow, triserial portion triangular, sides flat or slightly concave, angles bluntly angled, biserial portion with sides nearly parallel, lobulate, roughly triangular; chambers distinct, those of early portion not inflated, later much inflated, of uniform shape, increasing slightly in size, in adult with a tendency to develop a slight lobe on the inner end of the basal line; sutures distinct, slightly depressed in triserial portion, strongly so in biserial portion, directed slightly forward toward the periphery, in last-formed portion, sigmoid; wall finely arenaceous with a few coarse grains, smoothly finished; aperture elongate, low, in a decided re-entrant. Length 0.60 mm.; breadth 0.20 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 19328) from the lower Miocene, lower beds of Muddy Creek, Hamilton, Victoria, Australia.

This species differs from *G. (Pseudogaudryina) hastata* Parr in the much greater relative length and more biserial chambers.

GAUDRYINA (PSEUDOGAUDRYINA) PLEIONENSIS Cushman, n. sp. (Pl. 2, figs. 1 a, b)

Test elongate, one side narrow and truncate, others broader, showing the alternating chambers, angles bluntly keeled, earliest part of test triserial, biserial portion much the larger part; chambers fairly distinct, not inflated, increasing regularly in size; sutures distinct, slightly depressed except in later portion; wall coarsely arenaceous, with much cement, fairly smoothly finished; aperture in adult terminal, with a slight neck. Length up to 1.40 mm.; breadth 0.60 mm.; thickness 0.50 mm.

Holotype (Cushman Coll. No. 19280) from the Miocene of Pleiona, Bulgaria.

This species differs from *G. (Pseudogaudryina) jacksonensis* particularly in the aperture which becomes rounded and terminal, suggesting *Heterostomella*.

GAUDRYINA (PSEUDOGAUDRYINA) JARVISI Cushman, n. sp. (Pl. 2, figs. 2 a, b)

Test small, triangular in section throughout, with definite keels, whole test evenly tapering from the initial end to the greatest breadth at the apertural end, faces slightly concave, ones with zigzag lines somewhat broader than the third face; chambers not inflated, rather uniform in size and shape in the biserial portion; sutures distinct, slightly curved, very slightly raised; wall finely arenaceous, smoothly finished; aperture low, narrow, in a very slight re-entrant. Length 0.65 mm.; breadth 0.40 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 19296) from the Miocene, 1/2 mile E of Buff Bay, Jamaica.

This species differs from *G. (Pseudogaudryina) atlantica* (Bailey) in the smooth surface, raised sutures and evenly tapering form.

GAUDRYINA (PSEUDOGAUDRYINA) BULLBROOKI Cushman, n. sp. (Pl. 2, figs. 16 a, b)

Test tapering, triangular, with definite blunt keels, early chambers triserial, later biserial, rapidly increasing in width at base, then gradually increasing toward the apertural end; chambers distinct, not inflated; sutures distinct, in early portion oblique, later slightly curved, slightly depressed; wall arenaceous, roughly finished; aperture low, in slight re-entrant. Length up to 1.40 mm.; breadth 0.75 mm.

Holotype (Cushman Coll. No. 19290) from the Miocene, 8 3/8 miles on Guaico-Tamana road, Trinidad, B. W. I.

This species differs from *G. (Pseudogaudryina) atlantica* (Bailey) in the smaller size and the more definite keels throughout.

GAUDRYINA (PSEUDOGAUDRYINA) EXCOLATA Cushman, n. sp. (Pl. 3, figs. 3 a, b)

Test elongate, about twice as long as broad, triangular throughout, early portion triserial, later and larger portion biserial, angles subcarinate, slightly lobulate, sides slightly concave, faces nearly equal in size; chambers distinct, not inflated, of uniform shape, increasing gradually in size; sutures distinct, slightly limbate, flush with the surface, strongly curved; wall finely arenaceous, very smoothly finished, almost polished; aperture long, low, occupying half the inner margin in a slight re-entrant. Length 1.00 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 19338) from Recent material dredged in the Gulf of Oman.

This species differs from *G. (Pseudogaudryina) atlantica* (Bailey) in the sooth surface, sharp keels, and curved, slightly limbate sutures.

Genus PSEUDOCLAVULINA Cushman, new genus

Genotype, *Clavulina clavata* Cushman

Clavulina (part) of authors.

Test with early chambers triserial, test usually triangular in transverse section, angles acute or rounded, later portion uniserial, usually nodose, rounded in transverse section; chambers

of early portion usually indistinct, of uniserial portion often strongly inflated; wall variable in texture, arenaceous, frequently with roughly finished exterior; aperture in adult terminal, rounded, often with a distinct neck.—Upper Cretaceous to Recent.

This genus is apparently directly derived from *Gaudryinella*, or from those forms of *Gaudryina* with inflated chambers. There is often a considerable difference in size of microspheric and megalospheric forms, the microspheric ones being much the larger. There is no tooth in the aperture, although the aperture itself may be somewhat lobed. Usually there is a distinct apertural neck.

This genus may be distinguished from true *Clavulinas* of the Valvulinidae by the absence of the large valvular tooth, which is one of the characteristic structures of true *Clavulina*.

PSEUDOCLAVULINA AMORPHA (Cushman), var. **INCRUSTATA** Cushman, n. var.

Clavulina amorpha CUSHMAN (not 1926), Journ. Pal., vol. 5, 1931, p. 302, pl. 34, figs. 9 a, b.

Variety differing from the typical in the very coarsely arenaceous exterior which obscures the arrangement of the chambers and the structure.

Holotype of variety (Cushman Coll. No. 15599) from the Saratoga chalk, Saratoga, Arkansas.

This variety is particularly characteristic of the Saratoga chalk in the type region of Arkansas.

PSEUDOCLAVULINA EGGERI Cushman, n. sp. (Pl. 3, figs. 4 a, b)

Clavulina tripleura EGGER (not REUSS), Abh. Kon. bay. Akad. Wiss. München, Cl. II, vol. 21, pt. 1, 1899, p. 43, pl. 16, figs. 47-49.

Test very elongate, early portion triserial, sharply triangular, uniserial portion with the chambers rounded and inflated; chambers, distinct, particularly in the last-formed portion; sutures distinct, in the uniserial portion strongly depressed; wall arenaceous, with much cement, smoothly finished; aperture terminal, often with several lobes. Length 2.00 mm. or more; diameter 0.45-0.50 mm.

Holotype (Cushman Coll. No. 20026) from the Upper Cretaceous, Senonian, Gotzreuther Graben, near Siegsdorf, Germany.

This species differs from *P. clavata* Cushman in the larger triserial stage with sharp angles and the shorter chambers.

Clavulina communis SHERBORN and CHAPMAN (not D'ORBIGNY), Journ. Roy. Micr. Soc., ser. 2, vol. 6, 1886, p. 743, pl. 15, fig. 1.

Test elongate, subcylindrical, early portion triangular, sides flattened or slightly concave, later portion with chambers circular in transverse section, uniserial; chambers fairly distinct, in early triserial portion not well marked, later ones becoming more inflated and distinct; sutures indistinct except in the later uniserial portion, there becoming deeply depressed; wall coarsely arenaceous, roughly finished; aperture terminal, rounded. Length up to 2.00 mm.; diameter 0.50-0.60 mm.

Holotype (Cushman Coll. No. 20030) from the Eocene, London clay, Clapham Suburb, SW of London, from an excavation 100 feet above the base of the London clay.

This species differs from *P. clavata* in the larger triserial portion and lower chambers in the uniserial portion.

PSEUDOC LAVULINA COCOAENSIS Cushman, n. sp. (Pl. 3, figs. 6 a, b)

Test elongate, slender, earliest portion triserial, later uniserial, rounded in transverse section; chambers fairly distinct, early triserial ones often not well marked, later becoming uniserial, nodose, inflated, somewhat pyriform; sutures of later portion very distinct, of triserial portion usually indistinct; wall arenaceous, variable in roughness; aperture terminal, rounded, with a slight neck. Length up to 1.30 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 20037) from the Eocene, Cocoa sand, near Cocoa Post Office, Alabama.

This species differs from *P. clavata* in the less tapering form and broader, early stage.

PSEUDOC LAVULINA BULLBROOKI Cushman, n. sp. (Pl. 3, figs. 7 a, b)

Test elongate, slender, earliest portion triserial, roughly triangular in section, somewhat larger than the later uniserial portion which is rounded in section; chambers fairly distinct, those of the uniserial portion becoming somewhat inflated toward the apertural end; sutures fairly distinct, slightly depressed, more so toward the apertural end; wall coarsely arenaceous, usually very roughly finished; aperture rounded, terminal. Length up to 1.40 mm.; diameter 0.25-0.30 mm.

Holotype (Cushman Coll. No. 20041) from the Miocene of Trinidad, 8 $\frac{3}{4}$ miles out on the Guaico-Tamana road.

This somewhat resembles *Pseudoclavulina mexicana* (Cushman) but is a much smaller, more slender species, and the initial

portion instead of being sharply triangular with acute angles is very much more rounded.

PSEUDOCALVULINA PLEIONENSIS Cushman, n. sp. (Pl. 2, figs. 10 a, b)

Test elongate, slender, early triserial portion usually of a larger diameter than the later uniserial portion; chambers few, early ones triserial, triangular, angles rounded, sides flattened, uniserial chambers few, usually not more than three, somewhat inflated, usually longer than broad; sutures of early portion somewhat indistinct, later distinct and depressed; wall coarsely arenaceous, somewhat roughened on the exterior; aperture rounded, terminal. Length 0.90 mm.; breadth 0.25 mm.

Holotype (Cushman Coll. No. 20044) from the Miocene of Pleiona, Bulgaria.

This species differs from *P. humilis* (H. B. Brady) in the fewer uniserial chambers which are less well marked, shorter triserial stage and lack of an apertural neck.

PSEUDOCALVULINA CRUSTATA Cushman, n. sp. (Pl. 2, figs. 12 a, b)

Test stout, large, early portion triserial, roughly triangular in section, later rounded in uniserial portion; chambers and sutures mostly indistinct, due to the very rough surface of the test which is coarsely arenaceous; aperture terminal, small, rounded, with a distinct valvular tooth and a slight neck. Length 3.00 mm.; diameter 0.65 mm.

Holotype (Cushman Coll. No. 20071) from Hydra Channel, off Greece.

This species differs from *P. humilis* (H. B. Brady) in the coarser, rougher wall, shorter triserial stage, and the sutures much less depressed.

PSEUDOCALVULINA JUNCEA Cushman, n. sp. (Pl. 3, figs. 8 a, b)

Test elongate, slender, earliest portion with flattened or slightly concave sides, angles rounded, uniserial portion forming the larger part of the test, rounded in section; chambers fairly distinct in the uniserial portion, slightly inflated, increasing slightly in height but diameter uniform throughout; sutures distinct in the uniserial portion, slightly depressed; wall arenaceous, roughly finished; aperture terminal, small, rounded, with a slight neck. Length 2.00 mm.; diameter 0.30 mm.

Holotype (Cushman Coll. No. 1391) from *Albatross* station, D5201, Sogod Bay, off southern Leyte Island, Philippines, at 55 fathoms.

This is a very much longer, more slender species than *P. humilis* (H. B. Brady) and has no apertural neck.

PSEUDOCALVULINA SCABRA Cushman, n. sp. (Pl. 3, figs. 11 a, b)

Test elongate, the early portion triserial, roughly triangular, the angles somewhat rounded, sides slightly concave, later portion uniserial, circular in section; chambers of later portion distinct, in triserial portion obscure, in uniserial portion more distinct, somewhat inflated, of rather uniform size; sutures distinct only in the later portion; wall very coarsely arenaceous, very roughly finished; aperture rounded, terminal. Length 1.20 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 21088) from *Albatross* station D5230, from between Bohol and Leyte Islands, Philippines, 118 fathoms.

This is a much coarser, rougher species than *P. juncea* and is easily distinguished from *P. humilis* (H. B. Brady) in lack of apertural neck, coarser surface and less inflated later chambers.

Genus CLAVULINOIDES Cushman, new genus

Genotype, *Clavulina trilatera* Cushman

Clavulina (part) of authors.

Test elongate, in most species triangular, in some with the latest chambers rounded, earliest portion triserial, triangular, frequently with an early biserial stage following the triserial portion, in which one of the three sides is narrower than the other two, adult uniserial; chambers in many species distinct, in a few somewhat obscure, particularly in the early portion; wall coarsely to finely arenaceous, amount of cement variable, surface either smooth or somewhat roughly finished; aperture in the adult becoming terminal, rounded, or with radiating portions toward the angles of the test, without a distinct tooth.—Upper Cretaceous to Recent.

This genus has been directly derived from *Gaudryina*, particularly from the subgenus *Pseudogaudryina*. Some Cretaceous species, as well as later ones, show in early stages a definite tendency toward *Pseudogaudryina*, with one angle of the test narrower than the other two.

CLAVULINOIDES AUSTRIACA Cushman, n. sp. (Pl. 3, figs. 13 a, b)

Test short and broad, microspheric form increasing rapidly in diameter toward the apertural end, megalospheric form with the

sides in the adult nearly parallel, triangular in section, angles prominent, bluntly rounded, sides concave in both forms; chambers distinct, in uniserial portion slightly inflated, increasing gradually in size; sutures distinct, strongly depressed in the adult, particularly the microspheric form, strongly curved backward at the angles; wall very coarsely arenaceous, surface roughened; aperture terminal, with a slight neck, rounded in megalospheric form, in the microspheric with slight lobes directed toward the angles. Length 2.00 mm.; breadth 1.20 mm.

Holotype (Cushman Coll. No. 20261) from the Upper Cretaceous of Edelbachgraben, Gosau, Austria.

This species differs from most others such as *C. insignis* (Plummer) in the very coarse, rough surface and the broad megalospheric form.

CLAVULINOIDES PARRI Cushman, n. sp. (Pl. 3, figs. 14 a-c)

Test with the earliest stage triserial, triangular, angles rounded, later and much the larger portion uniserial, much compressed; chambers distinct, slightly inflated, increasing gradually in size; sutures distinct, particularly in later portion where they are somewhat depressed; wall coarsely arenaceous, somewhat roughly finished; aperture terminal, rounded, with a slight neck. Length 1.30 mm.; breadth 0.30 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 20263) from the Cretaceous, Gingin chalk, Gingin, western Australia.

This species is a unique one, very different from any of the others known. It somewhat suggests the form described by Chapman from the same locality as *Bigenerina compressiuscula*. That form, however, seems to have a distinct biserial stage and apparently lacks the triserial initial chambers.

CLAVULINOIDES MIDWAYENSIS Cushman, n. sp. (Pl. 3, figs. 9, 15)

Clavulina angularis PLUMMER (not D'ORBIGNY), Univ. Texas Bull. 2644, 1927, p. 70, pl. 3, figs. 4, 5.

Test in microspheric form rapidly increasing in diameter toward apertural end, in megalospheric form with sides parallel in adult, in last-formed chambers with diameter decreasing, triangular throughout or in megalospheric form later portion rounded, sides concave, in megalospheric form in adult becoming convex; chambers distinct, not inflated except in last chambers of megalospheric form; sutures distinct, very slightly depressed in earlier portions and in microspheric form, but in megalospheric

form becoming deeply depressed in adult; wall coarsely arenaceous, often roughly finished; aperture in megalospheric form rounded, in microspheric form with somewhat irregular lobes projecting toward the angles of the test. Length up to 1.25 mm.; diameter 0.30-0.60 mm.

Holotype (Cushman Coll. No. 20269) from the Midway Eocene, from a shallow ditch at road corner, SE of New Corsicana Reservoir, on road to Mildred, Navarro Co., Texas.

This species differs from *C. insignis* (Plummer) in the rougher surface, more regularly tapering microspheric form and more inflated chambers in the megalospheric.

CLAVULINOIDES ALPINA Cushman, n. sp. (Pl. 3, fig. 16)

Test about twice as long as broad, triangular in section throughout, sides flattened or slightly concave; chambers triserial in early portion, adult with two or three uniserial chambers, slightly inflated; sutures distinct, slightly depressed, particularly in later portion; wall finely arenaceous, with much cement, smoothly finished; aperture rounded, terminal, without a distinct tooth. Length up to 1.60 mm.; diameter 0.70-0.80 mm.

Holotype (Cushman Coll. No. 20276) from the Eocene of Gassino, near Turin, Italy.

This species differs from *C. guayabalensis* (Cole) in the less concave sides, shorter, stouter form and smoother surface.

CLAVULINOIDES HAERINGENSIS Cushman, n. sp. (Pl. 3, figs. 17 a, b)

Test short and broad, rapidly tapering from base to greatest width near apertural end, triangular in section throughout, sides ceous, rather smoothly finished; aperture rounded, at end of a flattened or slightly concave, angles rather sharp; chambers indistinct, not inflated; sutures indistinct; wall coarsely arenaceous.

Holotype (Cushman Coll. No. 20280) from the Eocene of Haering, Tyrol, Austria.

distinct, short, cylindrical neck. Length up to 1.25 mm.; diameter up to 0.90 mm.

This species differs from *C. triangularis* (Nuttall) in the more tapering shape, more distinct angles and distinct neck.

CLAVULINOIDES SZABOI (Hantken), var. VICTORIENSIS Cushman, n. var.
(Pl. 3, figs. 19, 22)

Clavulina angularis CHAPMAN (not D'ORRIGNY), Journ. Linn. Soc. Zool., vol. 30, 1907, p. 29, pl. 4, figs. 68-73.

Variety differing from typical in the much rougher finished

surface, less distinct chambers and the apertural end which is not produced into so definite a neck as in the typical form.

Holotype of variety (Cushman Coll. No. 19197) from the Oligocene, Balcombian, of Balcombe Bay, Mornington, Victoria, Australia.

CLAVULINOIDES JARVISI Cushman, n. sp. (Pl. 3, figs. 18 a, b)

Test triangular throughout, early portion triserial, last few chambers uniserial, of fairly uniform diameter except at base, tapering, angles slightly rounded; chambers distinct, very slightly inflated; sutures distinct, depressed; wall arenaceous, smoothly finished; aperture terminal, rounded. Length up to 1.60 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 20296) from the Miocene of Trinidad, British West Indies, from Cipero Section No. 11, collected by P. W. Jarvis.

This species differs from *C. indiscreta* (H. B. Brady) in its smaller size, less regular form, and more prominent angles.

CLAVULINOIDES ORIENTALIS Cushman, n. sp. (Pl. 3, figs. 21 a, b)

Test elongate, slender, triangular throughout, sides concave, angles projecting; chambers distinct except in earliest triserial portion, not inflated; sutures distinct but very slightly depressed; wall finely arenaceous, smoothly finished; aperture small, rounded, terminal, with a very short neck, without a valvular tooth. Length up to 1.25 mm.; diameter 0.30 mm.

Holotype (Cushman Coll. No. 20298) from *Albatross* station D5590, off Borneo, in 310 fathoms.

This species differs from *C. indiscreta* (H. B. Brady) in the smaller, more slender elongate form and more prominent angles.

Genus PSEUDOGAUDRYINELLA Cushman, new genus

Genotype, *Gaudryinella capitosa* Cushman

Gaudryinella (part) CUSHMAN (not PLUMMER), Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 52.

Test in earliest stages triserial, triangular in section, angled, later becoming biserial, with chambers in two distinct series, one with a truncate periphery, the other with an angular periphery, two broader sides with the sutures showing a zigzag line, other narrower side with sutures simple, nearly horizontal, adult with chambers becoming typically uniserial, inflated, rounded

transverse section; aperture in biserial stage in a distinct re-entrant, in adult becoming rounded and terminal—Upper Cretaceous.

This genus is directly derived from the subgenus *Pseudo-gaudryina* of the genus *Gaudryina*. No species have been recorded from elsewhere than in the Gulf Coastal Plain region of the United States.

HETEROSTOMELLA AMERICANA Cushman, n. sp. (Pl. 3, fig. 20)

Heterostomella foveolata CUSHMAN (not MARSSON), Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 111, pl. 16, figs. 9-12; Journ. Pal., vol. 6, 1932, p. 333.

Test in microspheric form fusiform, rounded in transverse section, in megalospheric form with greatest breadth toward apertural end, somewhat compressed; chambers largely obscured by longitudinal ridges of the surface, which are numerous; wall finely arenaceous, much roughened, due to surface ridges; aperture terminal, usually without much development of a neck. Length 0.75 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 20200) from the Upper Cretaceous, middle Taylor marl, 3 miles W of Rogers, Bell Co., Texas.

This species, probably derived from *H. austinana* Cushman, has the chambers more obscured by the more prominent ridges.

HETEROSTOMELLA MEXICANA Cushman, n. sp. (Pl. 3, figs. 23 a, b)

Test elongate, distinctly tapering at the base, later gradually tapering to greatest breadth toward apertural end which is contracted and rounded, triangular in section, angles usually not eroded; chambers of early portion triserial, indistinct, later ones biserial, also indistinct, later ones slightly inflated; sutures indistinct throughout; wall coarsely arenaceous, smoothly finished; aperture in adult terminal, rounded, with a short neck. Length 0.80-1.05 mm.; breadth 0.35-0.40 mm.

Holotype (Cushman Coll. No. 19251) from the Cretaceous, Mendez shale, near Rancho Nuevo, Tamuin River, Mexico.

This species differs from *H. boyncensis* Wickenden by the lack of fistulose ridges and more distinctly triangular test.

Family VALVULINIDAE

VALVULINA RUGIDIA Cushman, n. sp. (Pl. 4, figs. 1 a, b)

Test elongate, of rather irregular shape, tapering, greatest breadth toward apertural end, triserial throughout, early portion

sharply triangular, later loosely coiled and nodose; chambers distinct, particularly those of the later portion which are inflated; sutures of later portion distinct, in early portion indistinct; wall coarsely arenaceous, roughly finished, usually with angular fragments; aperture in a distinct depression, with a large, somewhat triangular, valvular tooth. Length up to 1.30 mm.; breadth 0.70 mm.

Holotype (Cushman Coll. No. 19351) from the Eocene Lutetien, Chaussy (Seine et Oise), France.

This species differs from *V. pupa* d'Orbigny in the more irregular form, rougher surface and more deeply re-entrant aperture.

VALVULINA ITALIANA Cushman, n. sp. (Pl. 4, figs. 2 a, b)

Test stout, short, broad, triserial throughout, sharply triangular except last whorl which becomes somewhat rounded, greatest breadth at apertural end; chambers distinct, becoming inflated in adult; sutures distinct, depressed; wall coarsely arenaceous, roughly finished; aperture at inner margin, large, with a large, flat, valvular tooth.

Holotype (Cushman Coll. No. 19348) from the middle Oligocene of Castel Gomberto, Italy.

This species differs from *V. oviedoiana* d'Orbigny in the rougher surface, more deeply cut aperture, and more elongate valvular tooth.

VALVULINA CHAPMANI Cushman, n. sp. (Pl. 4, figs. 3 a, b)

Test elongate, early portion triserial, later with as many as four chambers in a whorl, initial portion triangular, later rounded; chambers distinct, slightly inflated; sutures distinct, slightly depressed; wall finely arenaceous with a few larger fragments, smoothly finished; aperture large, in slight depression of inner margin, with a large valvular tooth. Length up to 1.30 mm.; breadth 0.70 mm.

Holotype (Cushman Coll. No. 19344) from the Miocene of Oamaru, New Zealand.

This species differs from *V. ocalana* Cushman in the smooth surface, larger number of chambers in the adult whorl and larger aperture.

CLAVULINA DIFFORMIS H. B. Brady, var. **ORNATA** Cushman, n. var. (Pl. 4, figs. 4 a, b)

Variety differing from the typical in the very deeply excavated lower side of the chambers, with consequent shoulder-like

overhanging ridge, and very distinct division between triserial and uniserial portions.

Holotype of variety (Cushman Coll. No. 20354) from the Pleistocene (Posidonia deposit), St. Vincent Gulf, South Australia.

ARENOBULIMINA MACFADYENI Cushman, n. sp. (Pl. 4, figs. 6 a, b)

Bulimina orbigny CHAPMAN (not REUSS), Journ. Roy. Micr. Soc., 1892, p. 754, pl. 12, fig. 2.

Test elongate, sharply and evenly tapering from greatest breadth near apertural end to the subacute initial end, last-formed whorl making about one-half the surface of the test, apertural face obliquely truncate; chambers distinct, slightly inflated, of uniform shape, increasing gradually in size, four making up the last-formed whorl; sutures distinct, slightly if at all depressed, often slightly limbate; wall coarsely arenaceous, smoothly finished, exterior somewhat polished; aperture narrow, loop-shaped, often with a prominent tooth, at base of apertural face. Length up to 0.75 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 20431) from the Lower Cretaceous, Gault of Folkestone, England.

This species differs from *A. d'orbigny* Reuss in the very smooth surface, chambers not projecting and more elongate aperture.

ARENOBULIMINA CHAPMANI Cushman, n. sp. (Pl. 4, figs. 7 a, b)

Bulimina prestli CHAPMAN (not REUSS), Journ. Roy. Micr. Soc., 1892, p. 755, pl. 12, fig. 4.

Test elongate, rapidly tapering to the acute initial end, last whorl making up more than half the surface of the test; chambers distinct, inflated, four or five in last-formed whorl, of rather uniform shape, increasing slightly in size, apertural face truncate; sutures distinct, depressed; wall coarsely arenaceous, surface roughened; aperture broad, loop-shaped, at the inner margin, sometimes with a distinct tooth. Length up to 1.00 mm.; breadth 0.65 mm.

Holotype (Cushman Coll. No. 20430) from the Lower Cretaceous, Gault of Folkestone, England.

This species differs from *A. sabulosa* (Chapman) in the less roughened surface, more elongate, tapering form and less definite aperture.

ARENOBULIMINA ANGLICA Cushman, n. sp. (Pl. 4, figs. 8 a, b)

Test conical, slightly longer than broad, last-formed whorl making up two-thirds of the area of the test, apertural end broadly convex; chambers distinct, inflated, in megalospheric form tending to becoming uniserial, last-formed one very much inflated; sutures distinct, depressed; wall coarsely arenaceous, surface only slightly roughened; aperture in early stages broadly loop-shaped, often with a distinct tooth, in adult becoming elliptical, connecting with the border by a very narrow depression. Length up to 1.40 mm.; diameter 1.00 mm.

Holotype (Cushman Coll. No. 20434) from the Cretaceous, Chalk marl, of Charing, England.

This species differs from *A. preslii* (Reuss) in the larger size, with a larger and more nearly terminal aperture.

ARENOBULIMINA FRANKEI Cushman, n. sp. (Pl. 4, figs. 5 a, b)

Test elongate, tapering, greatest breadth below apertural end, regularly triserial, last-formed whorl making up less than one-half the area of the test, apertural end strongly convex; chambers distinct, inflated, increasing rather rapidly in size toward the apertural end; sutures distinct, somewhat depressed; wall rather coarsely arenaceous of rather evenly-sized fragments; aperture elongate, elliptical, in adult tending to become terminal. Length 1.10 mm.; diameter 0.60 mm.

- Holotype (Cushman Coll. No. 20433) from the Cretaceous, Cenomanian, just East of Hildesheim, Germany.

This species differs from *A. preslii* (Reuss) in the more elongate form, more definitely tapering and tendency for the aperture to become terminal.

ARENOBULIMINA AMERICANA Cushman, n. sp. (Pl. 4, figs. 9 a, b)

Arenobulimina preslii CUSHMAN (not REUSS), Journ. Pal., vol. 5, 1931, p. 303, pl. 34, figs. 13 a, b; vol. 6, 1932, p. 334.

Test small, short and broad, apertural end truncate, somewhat concave, last-formed whorl making up almost the entire surface of the test; chambers fairly distinct, slightly inflated, usually four making up the adult whorl; sutures fairly distinct, very slightly depressed; wall finely arenaceous, rather smoothly finished; aperture small, loop-shaped, at base of apertural face. Length up to 0.60 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 15601) from the Cretaceous, Saratoga chalk near Saratoga, Arkansas.

This species is widely distributed in the American Cretaceous of the Coastal Plain region. It differs from *A. preslii* Reuss in its shorter, broader form, more depressed area of the apertural face and truncate apertural end.

DOROTHIA ALEXANDERI Cushman, n. sp. (Pl. 4, figs. 13 a, b)

Test elongate, distinctly tapering, compressed, earliest whorl with four or five chambers, later triserial, adult distinctly biserial with lobular periphery; chambers of earlier portion indistinct, later distinct and inflated, compressed in adult; sutures of later portion distinct, somewhat depressed, slightly oblique; wall coarsely arenaceous, rather roughly finished; aperture large, rounded. Length up to 1.00 mm.; breadth 0.45-0.50 mm.; thickness 0.25-0.30 mm.

Holotype (Cushman Coll. No. 20841) from the Upper Cretaceous, middle Brownstown, ditch East of Commerce-Paris Highway, 2.9 miles S of Paris, Lamar Co., Texas.

This species differs from *D. pupa* (Reuss) in the compressed test, larger aperture, oblique sutures and roughened surface.

DOROTHIA STEPHENSONI Cushman, n. sp. (Pl. 4, fig. 15)

Test distinctly tapering, greatest breadth near apertural end, rounded in section, sides somewhat lobate, earliest whorl with four or five chambers, later triserial, adult biserial; earliest chambers indistinct, later ones slightly inflated, somewhat overlapping; sutures distinct, particularly in later portion, slightly depressed, nearly horizontal; wall finely arenaceous, smoothly finished; aperture low, at inner margin, sometimes with a slight lip. Length up to 1.00 mm.; diameter 0.45 mm.

Holotype (Cushman Coll. No. 21215) from the lower Taylor marl, 3½ miles (air line) SE of Converse, Bexar Co., Texas.

This species in some respects resembles *D. pupa* (Reuss) but continues its tapering form throughout and is usually also somewhat twisted.

DOROTHIA EOCENICA Cushman, n. sp. (Pl. 4, figs. 14 a, b)

Test elongate, slender, early portion distinctly tapering, adult with sides nearly parallel, broadly rounded in section, earliest whorl with four or five chambers, later three, adult biserial; chambers distinct, slightly inflated, high; sutures distinct, slightly depressed, nearly horizontal in adult; wall coarsely arenaceous, somewhat roughly finished; aperture high, rounded, at inner margin. Length up to 1.60 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 20867) from the Eocene of Biarritz, France.

This species differs from *D. asiphonia* (Andreae) in the rougher surface, the aperture higher and more rounded, not tending to become terminal.

DOROTHIA NUTTALLI Cushman, n. sp. (Pl. 4, figs. 12 a, b)

Gaudryina asiphonia NUTTALL (not ANDRAEA), Journ. Pal., vol. 6, 1932, p. 7, pl. 2, fig. 3.

Test elongate, slightly tapering throughout, slightly compressed, periphery broadly rounded, earliest portion with four or five chambers in a whorl, later triserial, adult biserial; chambers distinct, strongly inflated, rather high, strongly overlapping; sutures distinct, depressed, nearly horizontal in adult; wall finely arenaceous, slightly roughened, almost hispid; aperture high, rounded. Length 0.60-0.65 mm.; diameter 0.30-0.35 mm.

Holotype (Cushman Coll. No. 20876) from the lower Oligocene, Western Asuncion, Vera Cruz, Mexico.

This species was described by Nuttall from the Oligocene of Mexico where it is often very abundant. It is a much smaller species than *D. asiphonia* (Andreae) and has a much more finely arenaceous wall which is peculiarly hispid.

DOROTHIA GERMANICA Cushman, n. sp. (Pl. 5, figs. 18 a, b)

Test elongate, somewhat fusiform in front view, somewhat compressed, periphery broadly rounded, earliest whorls with four or five chambers, later triserial, adult biserial; chambers strongly inflated, high, slightly overlapping; sutures distinct, depressed, nearly horizontal or slightly oblique in adult; wall finely arenaceous, surface slightly roughened; aperture narrow, high. Length up to 1.10 mm.; breadth 0.45 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 20881) from the middle Oligocene, Septarienthon of Hermsdorf near Berlin, Germany.

This species differs from *D. asiphonia* (Andreae) in the broader test, more inflated chambers and lack of tendency to have the aperture terminal.

DOROTHIA PARRI Cushman, n. sp. (Pl. 4, figs. 19 a, b)

Test large, broadly oval in front view, circular in end view, earliest stage with four or five chambers, then triserial, adult biserial; chambers comparatively few, two pairs making up the larger part of the adult test, distinct, inflated, high as broad, somewhat overlapping; sutures fairly distinct, slightly depressed,

horizontal or slightly oblique in adult; wall coarsely arenaceous, surface somewhat roughened; aperture elongate, low. Length 1.60 mm.; diameter 1.10 mm.

Holotype (Cushman Coll. No. 19173) from the Miocene of Campbell's Point, Lake Connewarre near Geelong, Victoria, Australia.

This species differs from *D. gibbosa* (d'Orbigny) in the larger size, rougher surface and the greater height of the chambers.

DOROTHIA ALLENI Cushman, n. sp. (Pl. 4, figs. 16 a, b)

Test short, broad, somewhat compressed, initial whorl with four or five chambers, followed by a triserial stage, adult biserial; chambers fairly distinct, slightly inflated, two pairs usually making up nearly the entire test, high, much overlapping; sutures fairly distinct, slightly depressed, slightly oblique; wall coarsely arenaceous, with numerous large grains, much cement, surface fairly smooth; aperture elongate, low. Length up to 0.85 mm.; breadth 0.75 mm.; thickness 0.60-0.65 mm.

Holotype (Cushman Coll. No. 20894) from the Pliocene of Sutton, England.

This species differs from *D. gibbosa* (d'Orbigny) in the very short, broad form and much coarser texture of the wall.

DOROTHIA EARLANDI Cushman, n. sp. (Pl. 5, figs. 1 a, b)

Test elongate, tapering, greatest breadth near apertural end, earliest whorl with four or five chambers, later triserial, adult biserial, broadly rounded in section; chambers fairly distinct, slightly inflated, slightly overlapping; sutures distinct, slightly depressed, nearly horizontal; wall coarsely arenaceous, of angular sand grains, with comparatively little cement, roughly finished; aperture low, arched. Length up to 2.00 mm.; breadth 1.10 mm.

Holotype (Cushman Coll. No. 20912) from *Porcupine* station 16, in 994 fathoms, off Ireland.

This species differs from *D. scabra* (H. B. Brady) in the tapering form throughout, the truncate apertural end, and rougher surface.

DOROTHIA EXILIS Cushman, n. sp. (Pl. 4, figs. 17 a, b)

Gaudryina filiformis H. B. BRADY (not BERTHELIN), Rep. Voy. *Chalenger*, Zoology, vol. 9, 1884, p. 380, pl. 46, figs. 12 a-c.

Test very elongate, slender, small, very slightly tapering, initial whorl with five chambers, later triserial, adult biserial; chambers very numerous, distinct, inflated, of rather uniform

shape and size in adult, slightly overlapping, high; sutures distinct, depressed, nearly horizontal in adult; wall distinctly arenaceous but smoothly finished; aperture small, arched. Length 0.40-0.60 mm.; diameter 0.08-0.10 mm.

Holotype (Cushman Coll. No. 20906) from *Challenger* station 24, off Culebra Island, in 390 fathoms.

This is a very small, slender species quite different from the forms that have been referred to it and to which I gave the name of *Gaudryina pseudofiliformis*.

DOROTHIA BRADYANA Cushman, n. sp. (Pl. 5, figs. 2 a, b)

Gaudryina subrotundata H. B. BRADY (not SCHWAGER), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 380, pl. 46, figs. 13 a-c.

Test large, stout, elongate, initial portion tapering, adult with sides nearly parallel, slightly compressed, periphery broadly rounded, earliest whorl with four or five chambers, later triserial, adult biserial; chambers distinct, slightly inflated, uniform in shape and size in adult, slightly overlapping; sutures distinct, depressed, nearly horizontal in adult; wall arenaceous, with large angular grains, exterior rather smoothly finished; aperture low, arched. Length up to 3.00 mm.; diameter 1.00 mm.

Holotype (Cushman Coll. No. 20925) from *Challenger* station 23, off Sombrero Island, West Indies, in 450 fathoms.

This is a larger, stouter species than *D. subrotundata* (Schwager) and has a larger, more open aperture.

DOROTHIA CARIBAEA Cushman, n. sp. (Pl. 5, figs. 3 a-c)

Test rather short and stout, initial end broadly rounded, sides nearly parallel, slightly compressed, earliest whorl with four or five chambers, later triserial, adult biserial; chambers fairly distinct, slightly if at all inflated, slightly overlapping; sutures fairly distinct, somewhat oblique; wall coarsely arenaceous, surface slightly roughened; aperture low, arched. Length up to 2.00 mm.; diameter up to 1.00 mm.

Holotype (Cushman Coll. No. 20909) from *Atlantis* station 1573, off Cape Cruz, Cuba, in 305 fathoms.

This species differs from *D. scabra* (H. B. Brady) in the shorter, broader form with nearly parallel sides, higher chambers and more oblique sutures.

DOROTHIA IRANIA Cushman, n. sp. (Pl. 5, figs. 4 a, b)

Test elongate, slender, early portion tapering, adult with nearly parallel sides, strongly lobate; chambers distinct, inflated

high, slightly overlapping, of rather uniform size and shape in adult; sutures distinct, depressed, nearly horizontal in adult; wall coarsely arenaceous, roughly finished; aperture arched. Length 2.00 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 20923) from the Persian Gulf, in 284 meters.

This species differs from *D. asiphonia* in the very rough surface, much larger size and wanting a tendency to have the aperture terminal.

DOROTHIA ARENATA Cushman, n. sp. (Pl. 5, figs. 11 a-c)

Test short, stout, rounded in section, tapering, sides lobate, early whorls with five chambers, later triserial, adult biserial; chambers distinct, inflated, slightly overlapping; sutures distinct, depressed, slightly oblique; wall very coarsely arenaceous, with large fragments and a small amount of cement, earlier portion roughly finished, adult chambers with a fairly smooth surface; aperture high, narrow, arched. Length 2.25 mm.; diameter 1.10 mm.

Holotype (Cushman Coll. No. 20919) from *Albatross* D5236, in 494 fathoms, off Mindanao, Philippines.

This species differs from *D. curta* (Cushman) in the more elongate, tapering test and very rough surface.

PLECTINA EOCENICA Cushman, n. sp. (Pl. 5, figs. 5 a, b)

Clavulina gandryinoides HALKYARD (not FORNASINI), Mem. Proc. Manchester Lit. Philos. Soc., vol. 62, 1917-18 (1919), p. 46, pl. 3, figs. 1-3.

Test elongate, initial end slightly tapering, remainder of test with sides nearly parallel, somewhat nodose, nearly circular in section, earliest whorl with more than three chambers, then triserial, adult biserial, last-formed portion tending toward a uniserial condition; early chambers indistinct, later ones inflated; sutures indistinct except in adult, there somewhat depressed; wall coarsely arenaceous, with large sand grains making up a large proportion of the wall, roughly finished; aperture in adult nearly terminal, rounded, without a neck. Length up to 1.50 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 20717) from the Eocene of Biarritz, France.

This species is characteristic of the Eocene of southern Europe. It differs from *P. dalmatina* (Schubert) in the more elongate form, rough surface and more irregular shape.

Test elongate, generally cylindrical, early portion somewhat tapering, rounded in section, earliest chambers obscure, later becoming triserial, uniserial in the adult; chambers and sutures obscure; wall arenaceous, of fine material with numerous coarser fragments; aperture large, rounded, terminal, in a slight depression. Length 1.75 mm.; diameter 0.75 mm.

Holotype (Cushman Coll. No. 19221) from the Cretaceous, Gingin chalk of Gingin, West Australia.

This species differs from the American Cretaceous *G. rugulosa* Cushman in the stouter, shorter form, less distinct chambers and larger aperture.

Test elongate, two to three times as long as broad, earlier portion tapering, later cylindrical, earliest whorl of four or five chambers, later triserial, then biserial, adult uniserial; chambers rather indistinct, in the later portion slightly inflated; sutures indistinct in early portion, more distinct and depressed in adult; wall coarsely arenaceous, roughly finished, with large angular fragments; aperture large, rounded, terminal. Length 1.50 mm.; diameter 0.60-0.75 mm.

Holotype (Cushman Coll. No. 20691) from the Eocene, lowest marl of Hospital Hill, Trinidad, B. W. I.

This species differs from *G. patens* (Cushman and Laiming) in the shorter, relatively stouter form, less inflated chambers and much rougher surface.

Test elongate, microspheric form tapering throughout, megalospheric form with adult portion generally cylindrical, first whorl with more than three chambers, later three, then two, and adult uniserial; chambers numerous, indistinct except in the adult, there slightly inflated; sutures mostly indistinct except in adult, there slightly depressed; wall finely arenaceous, with a few coarse, angular grains, particularly about the aperture, smoothly finished, vacuolar, with a large amount of cement; aperture large, terminal, rounded. Length up to 2.65 mm.; diameter 1.15 mm.

Holotype (Cushman Coll. No. 21191) from the upper middle Miocene, "*Cyclammia* clay," Forest clay series, well of Apex Company, at 1720 feet, Fyzabad, Trinidad.

This species differs from *G. flintiana* (Cushman) in the somewhat chitinous, flexible wall which is vacuolar.

GOSELLA FLINTII Cushman, n. sp. (Pl. 5, fig. 5)

Vernoullina scabra CUSHMAN (not WILLIAMSON), Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 137.

Test in earliest stages with four or five chambers in a whorl, rapidly reducing to three, adult usually with a short biserial stage followed by a few uniserial chambers, often only one to three; chambers distinct, inflated; sutures distinct, depressed; wall very coarsely arenaceous, with large angular fragments, rather smoothly finished; aperture in adult large, rounded. Length up to 1.50 mm.; diameter 0.50-0.60 mm.

Holotype (Cushman Coll. No. 13928) from 185 fathoms, off San Pedro, California.

The species differs from *G. obscura* (Chaster) in the fewer uniserial chambers, longer triserial stage and stouter form.

GOSELLA PARRI Cushman, n. sp. (Pl. 5, figs. 7 a, b)

Test in early stages with more than three chambers to a whorl, rapidly reducing to three, adult uniserial, cylindrical, apertural end slightly tapering, initial triserial portion greater in diameter than the later uniserial part; chambers distinct in uniserial portion, earlier ones obscure; sutures in later portion fairly distinct, slightly depressed; wall finely arenaceous, smoothly finished; aperture irregularly elliptical, terminal. Length 1.00 mm.; diameter 0.20-0.25 mm.

Holotype (Cushman Coll. No. 21087) from *Challenger* station 185, off Raine Island, in the Pacific.

This species differs from *G. obscura* (Chaster) in the very slender, elongate form, and smooth surface.

Genus CRIBROGOESSELLA Cushman, new genus

Genotype, *Bigennerina robusta* H. B. Brady

Bigennerina H. B. BRADY (not D'ORBIGNY), Rep. Vol. *Challenger*, Zoology, vol. 9, 1884, p. 371.

Test elongate, subcylindrical, early portion tapering, later portion with sides nearly parallel, rounded in section, earliest whorl with four or five chambers, rapidly reducing to three, then to a biserial stage which continues for a considerable period, adult with uniserial chambers, interior undivided; wall arenaceous;

aperture in biserial portion at the inner margin, in the uniserial portion becoming terminal, central, gradually increasing from one opening in the early stage to many in the adult, occupying the central portion of the terminal face.—Miocene to Recent.

This genus apparently is derived from *Goëssella* by the addition of the apertural characters, having a cribrate terminal face with the apertures represented by numerous, small, rounded openings in the middle portion.

CRIBROGOESSELLA JARVISI Cushman, n. sp. (Pl. 5, figs. 13 a, b)

Test longer than broad, earliest portion tapering, generally triangular, angles rounded, sides somewhat concave in the middle, later adult portion subcylindrical, earliest whorl with four or five chambers, later triserial for a considerable period, then later biserial, adult uniserial; sutures slightly depressed, rather indistinct; wall coarsely arenaceous, with much cement, exterior fairly smooth; aperture in adult formed by several rounded openings in the middle portion of the somewhat convex terminal face. Length 2.50 mm.; diameter 1.20 mm.

Holotype (Cushman Coll. No. 20704) from the Miocene of Trinidad, in 4390 foot sample from San Francique well.

This species differs from *C. robusta* (H. B. Brady) in the longer triserial stage and shorter biserial stage and the apertural face convex instead of concave.

KARRERIELLA CALVA Cushman, n. sp. (Pl. 5, figs. 17 a, b)

Test elongate, early portion tapering, later with sides nearly parallel, somewhat lobulate, slightly compressed, earliest whorl with four or five chambers, later triserial, adult biserial throughout, somewhat twisted; chambers very distinct, inflated, of rather uniform size and shape in the adult, slightly overlapping, outer end strongly projecting; sutures distinct, depressed, slightly oblique; wall finely arenaceous, smooth; aperture elongate, with a distinct lip, slightly above the base of the apertural face. Length up to 1.15 mm.; breadth 0.50 mm.

Holotype (Cushman Coll. No. 20943) from the Eocene of Gassino, near Turin, Italy.

This species differs from *K. chilostoma* (Reuss) in the more nearly parallel sides, slightly oblique sutures and high apertural face.

Test elongate, tapering, greatest breadth toward apertural end, slightly compressed, periphery broadly rounded, earliest whorl with four or five chambers, later triserial, adult rather regularly biserial or slightly twisted; chambers distinct, slightly inflated, increasing gradually in size, of rather uniform shape, high, very slightly overlapping; sutures distinct, depressed, horizontal in the adult; wall rather coarsely arenaceous, surface slightly roughened; aperture elongate, with a distinct lip, somewhat above base of last-formed chamber, in some specimens becoming almost terminal. Length 1.20 mm.; diameter 0.45 mm.

Holotype (Cushman Coll. No. 20962) from the Eocene, Blue Marl of Biarritz, France.

This species differs from *K. siphonella* (Reuss) in the somewhat rougher surface, less definite neck and more tapering form.

KARRERIELLA FRANKEI Cushman, n. sp. (Pl. 5, figs. 12 a, b)

Test elongate, subcylindrical, sides nearly parallel, early portion somewhat tapering, earliest whorl with four or five chambers, later triserial, adult regularly biserial, somewhat twisted; chambers fairly distinct, slightly inflated, high, slightly overlapping; sutures fairly distinct, slightly depressed; wall coarsely arenaceous, roughly finished; aperture elongate, with a distinct lip, somewhat above the inner margin. Length 2.00 mm.; breadth 0.60 mm.

Holotype (Cushman Coll. No. 20951) from the Oligocene of Egisheim, Germany.

This species differs from *K. gaudryinoides* (Fornasini) in the larger size, less distinct chambers and much rougher surface.

KARRERIELLA HANTKENIANA Cushman, n. sp. (Pl. 5, figs. 19 a, b)

Test elongate, slender, three to four times as long as broad, rounded in section, adult with nearly parallel sides, initial portion rapidly tapering, earliest whorl with four or five chambers, later triserial for a considerable period, the adult biserial; chambers distinct in later portion, high, slightly overlapping; sutures distinct, slightly depressed; wall coarsely arenaceous, roughly finished; aperture elliptical, with a distinct lip, somewhat above the inner margin. Length 2.50 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 20953) from the lower Oligocene of Ofen near Budapest, Hungary.

This species differs from *K. siphonella* (Reuss) in the larger, coarser test and more fusiform early portion.

KARRERIELLA BARRATI Cushman, n. sp. (Pl. 5, figs. 14, 15)

Gaudryina subrotundata CUSHMAN and BARRAT (not SCHWAGER),
Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 34, pl. 5, figs. 8, 9.

Test elongate, early portion conical, later with sides nearly parallel or slightly diverging, rounded in section, earliest whorl with as many as five chambers, later triserial, adult biserial throughout; chambers distinct except in early portion, slightly inflated, somewhat overlapping; sutures in biserial portion distinct, slightly depressed, nearly at right angles to periphery; wall finely arenaceous, smoothly finished; aperture elongate, elliptical, slightly above the inner margin, with a distinct lip. Length up to 1.40 mm.; diameter 0.50 mm.

Holotype (Cushman Coll. No. 16111) from the Miocene, Temblor formation, Barnsdall No. 1 at a depth of 2093-2103 feet, located in the SW corner of Section 20, T. 27 S, R. 28 E, Mount Diablo Base Line and Meridian, California.

This species differs from *K. gaudryinoides* (Fornasini) in the more fusiform early stage, lower, broader chambers and more depressed sutures.

KARRERIELLA NOVO-ZEALANDICA Cushman, n. sp. (Pl. 5, figs. 18 a, b)

Test elongate, slightly tapering, rounded in section or slightly compressed, sides nearly parallel in adult, somewhat lobulate, earliest whorl with four or five chambers, later triserial, adult biserial; chambers distinct, inflated, increasing slightly in size. high, slightly overlapping; sutures distinct, somewhat depressed, slightly oblique in adult; wall arenaceous, rather smoothly finished; aperture elongate, with a distinct lip, somewhat above the inner margin. Length 1.40 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 21022) from the Miocene of Motatura, New Zealand.

This species differs from *K. chilostoma* (Reuss) in the more tapering form, high apertural face and pointed apertural end.

KARRERIELLA WRIGHTI Cushman, n. sp. (Pl. 6, figs. 1 a, b)

Test elongate, slightly tapering, circular in section, sides in adult nearly parallel, slightly lobulate, earliest whorl with four or five chambers, later triserial, adult biserial, tending to become uniserial in old age-specimens; chambers few, slightly inflated; sutures of later portion distinct, slightly depressed; wall coarsely arenaceous, roughly finished; aperture elliptical, with a distinct lip, slightly above the inner margin, in a depression. Length 2.10 mm.; diameter 0.70 mm.

Holotype (Cushman Coll. No. 21005) from *Porcupine* station 16, in 994 fathoms off northwest Ireland.

This species in some respects resembles *K. gaudryinoides* (Fornasini) but the wall is much coarser and much more roughly finished, and the appearance of the test is quite different.

LISTERELLA MUNSTERI Cushman, n. sp. (Pl. 6, figs. 7 a, b)

Clavulina irregularis MÜNSTER (not DEBHAYES), in Roemer, Neues Jahrb. für Min., 1838, p. 387, fig. 40.

Test elongate, slightly tapering, greatest breadth at the apertural end, circular in section; chambers distinct in later portion, somewhat irregularly biserial, becoming uniserial but somewhat irregular; sutures slightly depressed; wall arenaceous, surface slightly roughened; aperture terminal, rounded, with a slight neck. Length up to 1.60 mm.; diameter 0.45-0.60 mm.

Holotype (Cushman Coll. No. 17157) from the Oligocene of Osnabrück, Germany.

This species differs from *L. curta* (Galloway and Morrey) in the rougher surface, less tapering initial end and the more oblique sutures in the adult.

LISTERELLA RHUMBLERI Cushman, n. sp. (Pl. 6, figs. 4 a, b)

Test small, somewhat tapering, greatest breadth at apertural end, circular in section; chambers and sutures somewhat obscured by roughness of the exterior, earliest chambers forming a bulbous initial stage, followed by three to five uniserial ones which are somewhat inflated, increasing in size rather regularly; wall coarsely arenaceous, roughly finished; aperture terminal, rounded, with a comparatively long neck. Length 0.80 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 21182) from the middle Oligocene, Septarienthon, Hermsdorf near Berlin, Germany.

This species differs from *L. bramlettei* (Cushman) in the more slender test, less expanded initial portion, rough surface and less inflated chambers.

LISTERELLA HOWCHINI Cushman, n. sp. (Pl. 6, figs. 3 a, b)

Test short and stout, circular in section, early expanded portion continued to nearly half the length of the test, earliest whorl with four or five chambers, later distinctly triserial, followed by a distinct and somewhat twisted biserial portion, adult uniserial stage of three or four chambers; chambers fairly distinct, not inflated; sutures distinct, not depressed; wall coarsely

arenaceous, surface roughened; aperture terminal, rounded or elliptical, with a slight, often flaring neck. Length up to 2.00 mm.; diameter 0.50-0.60 mm.

Holotype (Cushman Coll. No. 21186) from the Oligocene of Balcombe Bay, Mornington, Victoria, Australia.

This species differs from *L. bramlettei* in the long triserial and biserial stages, fusiform shape and less inflated chambers.

LISTERELLA KARRERI Cushman, n. sp. (Pl. 6, figs. 8 a, b)

Test elongate, tapering, slender, greatest breadth at apertural end, circular in section, earliest chambers somewhat obscure, later biserial, adult irregularly uniserial; chambers of later portion distinct, becoming strongly inflated; sutures distinct, becoming deeply depressed; wall coarsely arenaceous, roughly finished; aperture terminal, elliptical, with a distinct neck. Length 2.00 mm.; diameter 0.40 mm.

Holotype (Cushman Coll. No. 21029) from the Miocene of Kostej, Hungary.

This species differs from *L. pallida* (Cushman) in the rougher surface, less definite uniserial portion, higher chambers and elliptical aperture.

LISTERELLA NOVO-ZEALANDICA Cushman, n. sp. (Pl. 6, figs. 6 a, b)

Test elongate, slender, early portion somewhat compressed, later portion circular in section; chambers distinct, inflated in adult, with a long biserial series, irregularly uniserial in adult; sutures distinct, depressed, deeply so in later portion; wall coarsely arenaceous, with much cement, rather smoothly finished; aperture terminal, rounded, with a slight neck. Length 1.50 mm.; diameter 0.35-0.40 mm.

Holotype (Cushman Coll. No. 21030) from the lower Miocene of Pukeuri, New Zealand.

This species differs from *L. pallida* (Cushman) in the long biserial stage, oblique sutures throughout, lack of definite cylindrical neck and rougher surface.

LISTERELLA VICTORIENSIS Cushman, n. sp. (Pl. 6, figs. 2 a, b)

Test elongate, slender, rounded in section, greatest breadth toward the apertural end, initial whorl with four or five chambers, later triserial, adult loosely biserial or uniserial at the apertural end; chamber distinct, slightly inflated, strongly so in later portion; sutures distinct, depressed; wall coarsely arenaceous but exterior smoothly finished; aperture in adult, terminal, rounded.

with a distinct tubular neck. Length up to 1.75 mm.; diameter 0.45 mm.

Holotype (Cushman Coll. No. 21028) from the lower Miocene, road cutting S of Moorabool Viaduct near Geelong, Victoria, Australia.

This species differs from *L. pallida* (Cushman) in the tapering test with greatest breadth near the apertural end, long biserial stage and oblique sutures.

LISTERELLA COMMUNIS (d'Orbigny), var. *GRACILLIMA* Cushman, n. var.
(Pl. 6, figs. 9 a, b)

Variety differing from the typical in the greatly reduced early portion and elongate tapering adult stage which is often irregularly biserial for a considerable period, greatest breadth formed by the last chamber.

Holotype of variety (Cushman Coll. No. 21180) from the Miocene of Orlau, Austria.

LISTERELLA COMMUNIS (d'Orbigny), var. *PERPARVA* Cushman, n. var.
(Pl. 6, figs. 5 a, b)

Variety differing from the typical in the very small size and the apertural end which is convex, with a very long neck.

Holotype of variety (Cushman Coll. No. 21179) from the Pliocene, Blue Clay of Ponticello di Savena, near Bologna, Italy.

LISTERELLA BRADYANA Cushman, n. sp. (Pl. 6, fig. 11)

Clavulina communis H. B. BRADY (part) (not d'ORBIGNY), Rep. Voy. Challenger, Zoology, 1884, p. 394, pl. 48, figs. 1, 2, 5 (not 3, 4, 7-12).
—CUSHMAN, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 16, pl. 4, figs. 3 a, b.—CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 51, pl. 1, figs. 5, 6.

Test elongate, cylindrical, not tapering; chambers numerous, fairly distinct, increasing somewhat in height as added, apertural face strongly convex; sutures fairly distinct, slightly if at all depressed; wall arenaceous, slightly roughened on the exterior; aperture terminal, central, with a distinct neck. Length up to 2.60 mm.; diameter 0.30 mm.

Holotype (U. S. N. M. No. 22383) from *Albatross* station H3816, Latitude 15° 16' 50" S., Longitude 147° 52' 30" W., in 450 fathoms.

This species differs from *L. pallida* (Cushman) in the high chambers, very short triserial and biserial stages and strongly convex apertural face.

LISTERELLA ANTILLARUM Cushman, n. sp. (Pl. 6, figs. 12 a, b)

Clavulina communis FLINT (part) (not D'ORBIGNY), Ann. Rep't. U. S. Nat. Mus., 1897 (1899), p. 288, pl. 34, fig. 3 a.

Test elongate, cylindrical, initial end somewhat enlarged, later portion with sides nearly parallel, circular in section, earliest whorl with four or five chambers, later triserial, adult uniserial; chambers distinct, somewhat inflated, slightly overlapping; sutures distinct, depressed; wall coarsely arenaceous, usually roughly finished, often with sponge spicules; aperture terminal, rounded or slightly lobed, usually without a definite neck. Length up to 2.50 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 21189) from *Atlantis* station 1573, off Cape Cruz, Cuba, 430 fathoms.

This species differs from *L. communis* (d'Orbigny) in the stouter form, lower chambers and very rough surface.

LISTERELLA MILLETTI Cushman, n. sp. (Pl. 6, figs. 10 a, b)

Test large, elongate, slender, early bulbous portion small compared to the size of the test, circular in section; chambers distinct, later ones somewhat inflated, slightly overlapping, increasing gradually in height toward the apertural end; sutures distinct, becoming somewhat more strongly depressed toward the apertural end; wall coarsely arenaceous, somewhat roughly finished; aperture terminal, rounded, with a distinct neck. Length up to 4.00 mm.; diameter 0.60-0.65 mm.

Holotype (Cushman Coll. No. 21188) from Macassar Strait, in 1181 fathoms, *Albatross* station D5670.

This species differs from *L. communis* (d'Orbigny) in the very numerous uniserial chambers, very short triserial stage and rougher surface.

TRITAXILINA HANTKENI Cushman, n. sp. (Pl. 6, figs. 13 a, b)

Gaudryina reussi HANTKEN (not STACHE), Magyar. Földt. Tars. Munkalatai, vol. IV, 1868, p. 83, pl. 1, figs. 2 a, b; A magy. kir. földt. int. evkonyve, vol. IV, 1875 (1876), p. 11, pl. 1, fig. 5; Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, vol. IV, 1875 (1881), p. 14, pl. 1, fig. 5.

Test elongate, slightly fusiform, greatest breadth above the middle, initial end elongate, tapering, apertural end obliquely truncate, rounded in section; chambers distinct, early ones in whorls of five, later developing a definite stage of four to a whorl, followed quickly by a three-chambered stage, then in the adult two chambers to a whorl, the last-formed chamber in the

adult tending somewhat to become terminal; sutures distinct, frequently somewhat raised especially in the four-chambered stage, chamber surface between, depressed; wall rather coarsely arenaceous but smoothly finished, of coarse sand grains, with a small amount of calcareous cement; aperture in adult semi-elliptical, at base of inner margin. Length up to 2.00 mm.; diameter 0.90-1.00 mm.

Holotype (Cushman Coll. No. 23250) from the lower Oligocene of Neustift, Ofen, Hungary.

This species differs from *T. pupa* (Gümbel) in the more fusiform shape and less prominently raised costae in the later portion.

TRITAXILINA PLEIONENSIS Cushman, n. sp. (Pl. 6, figs. 14 a, b)

Test elongate, early portion rapidly enlarging, later portion with sides nearly parallel and somewhat contracted toward the apertural end which is truncate; chambers distinct in later portion, earlier portion indistinct, chambers in early stages with four or five to a whorl, later triserial, then biserial, finally in the adult a tendency to become uniserial; sutures of early portion indistinct, later more definite, often somewhat raised; wall arenaceous, often roughly finished; aperture rounded, at the inner margin, or in extreme adults tending to become terminal. Length 1.40 mm.; breadth 0.60 mm.

Holotype (Cushman Coll. No. 19248) from the Miocene clays of Pleiona, Bulgaria.

This species differs from *T. caperata* (H. B. Brady) in the less regularly fusiform shape, coarser wall and less conspicuously raised sutures.

LIEBUSELLA HANTKENI Cushman, n. sp. (Pl. 6, figs. 15 a, b)

Clavulina cylindrica HANTKEN (not D'ORBIGNY), Magy. kir. földt. int. evkonyve, vol. IV, 1875 (1876), p. 14, pl. 1, fig. 8; Mitth. u. d. Jahrb. k. ungar. geol. Anstalt, vol. IV, 1875 (1881), p. 18, pl. 1, fig. 8.

Test elongate, fusiform, circular in section, earliest whorl with four or five chambers, later irregularly triserial or biserial, adult uniserial; chambers indistinct, not inflated, slightly overlapping, only three or four in the uniserial portion; sutures indistinct; wall coarsely arenaceous, rather smoothly finished; aperture central, terminal, simple or lobed, even tending to become multiple. Length up to 2.50 mm.; diameter 1.00 mm.

Holotype (Cushman Coll. No. 15774) from the lower Oligocene ? of Kiscell, near Budapest, Hungary.

This species differs from *L. byramensis* (Cushman) in the indistinct sutures and chambers, fusiform test and more complex aperture. As in some of the other species of the genus the chambers are subdivided.

HAGENOWELLA ADVENA Cushman, n. sp. (Pl. 6, figs. 21, a, b)

Test short, broad, last-formed coil making up almost the entire surface of the test, apertural end obliquely truncate; chambers comparatively few, somewhat inflated, four in the last-formed whorl, apertural face convex, with a distinct depression about the aperture, interior in the adult subdivided by numerous radial partitions running part way in from the periphery; sutures indistinct, not depressed; wall coarsely arenaceous, with coarser material somewhat segregated at base of chamber, rather smoothly finished; aperture loop-shaped, with a distinct tooth, at base of apertural face. Length 0.80 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 20436) from the Cretaceous, upper Senonian of Junz near Commin, Pommerania, Germany.

This species has the internal characters of *Hagenowella*, but the chambers are much less inflated, and the shape of the test is quite distinct from *H. gibbosa* (d'Orbigny).

ATAXOPHRAGMIUM BEISSELI Cushman, n. sp. (Pl. 6, figs. 22 a, b)

Haplophragmium inflatum BEISSEL (not KARRER), Abhandl. kön. Preuss. geol. Landes, vol. 3, 1891, p. 19, pl. 4, figs. 41-45.

Test large, stout, rounded, earliest portion forming a broad trochoid whorl, later tending to become uniserial; chambers indistinct, not inflated; sutures indistinct; wall coarsely arenaceous, only slightly roughened; aperture rounded, elongate, running into the base of the apertural face. Length 2.00 mm.; diameter 1.25 mm.

Holotype (Cushman Coll. No. 23249) from the Upper Cretaceous, Mukronatenkreide, Friedrichsburg near Aachen, Germany.

This species differs from *A. variabile* d'Orbigny in its larger size, coarser test and more primitive characters in failing to develop a very definite uniserial stage.

MARSSONELLA OZAWAI Cushman, n. sp. (Pl. 4, figs. 10 a, b)

Test elongate, early portion rapidly tapering, adult with sides nearly parallel, nodose, earliest whorl with four or five chambers, later triserial, adult biserial, rounded in section; chambers distinct, inflated, in the adult with a prominent ridge toward the

base and deeply undercut below, increasing gradually in size; sutures distinct, depressed; wall coarsely arenaceous, roughly finished; aperture elongate, low, at the inner margin. Length 1.00-1.20 mm.; diameter 0.50-0.70 mm.

Holotype (Cushman Coll. No. 20630) from the Cretaceous, chalk marl, Saxon Cement Works, near Cambridge, England; collected by the late Professor Ozawa.

This species differs from *M. oxycona* (Reuss) in the prominent ridges of the basal part of each chamber and the nearly parallel sides in the adult.

MARSSONELLA ELLISORAE Cushman, n. sp. (Pl. 4, figs. 11 a, b)

Test elongate, slender, earliest portion tapering, later adult portion with sides nearly parallel, rounded in section, earliest whorls with four or five chambers, later triserial, adult biserial; chambers distinct, slightly inflated, of rather uniform shape and size; sutures distinct, slightly depressed; wall arenaceous, smoothly finished; aperture low, in a re-entrant of the inner margin. Length 1.00 mm.; diameter 0.35 mm.

Holotype (Cushman Coll. No. 20652) from the Cretaceous, Pecan Gap chalk, Brazos Falls, Texas.

This species differs from *M. indentata* (Cushman and Jarvis) in the more slender form, simple sutures, more numerous uniserial chambers and distinctly truncate apertural end.

TEXTULARIELLA PAALZOWI Cushman, n. sp. (Pl. 6, figs. 18 a-c)

Test large, elongate, tapering, rounded or somewhat quadrangular in section, greatest breadth at or toward the apertural end, in old-age specimens with diameter slightly reduced in last-formed chambers, earliest whorl with four or five chambers, later a short triserial stage, main body of test biserial; chambers divided toward periphery by radial partitions, comparatively few in number; sutures in later portion depressed, in earlier part indistinct; wall coarsely arenaceous, somewhat roughly finished, rather coarsely perforate; aperture arched, at base of inner margin. Length 4.00 mm.; diameter 1.10 mm.

Holotype (Cushman Coll. No. 21187) from the Miocene of Kostej, Banat region of Hungary.

This species differs from *T. cretosa* (Cushman) in the less tapering, more fusiform shape, depressed sutures and coarser wall.

Test elongate, conical, evenly tapering to greatest breadth at apertural end which is truncate and slightly convex; earliest whorl with four or five chambers, later a very short triserial stage, adult biserial, circular in section; chambers distinct, not inflated, of uniform shape, increasing regularly in size, slightly if at all overlapping; sutures distinct, slightly depressed; wall coarsely arenaceous, coarsely perforate, exterior with a thin, finely imperforate, outer layer, smoothly finished; aperture broad, low, at inner margin. Length 1.50 mm.; diameter 0.85 mm.

Holotype (Cushman Coll. No. 21166) from the Miocene, Cipero section, station No. 11, Trinidad, B. W. I.; collected by P. W. Jarvis.

This species differs from *T. barrettii* (Jones and Parker) in the more tapering form, coarser wall and smaller size.

TEXTULARIELLA MIOCENICA Cushman, n. sp. (Pl. 6, figs. 17, 19)

Test elongate, three or four times as long as broad, initial portion rapidly expanding, adult with sides nearly parallel or sometimes slightly contracted toward the apertural end, earliest whorl with four or five chambers, later triserial, adult biserial; chambers distinct, only the later ones somewhat inflated, of uniform shape, increasing in height toward apertural end, distinctly overlapping, incompletely divided toward the periphery; sutures distinct, slightly limbate, in earlier portion slightly raised, later slightly depressed; wall arenaceous, coarsely perforate, apparently with a very thin outer layer; aperture low, arched, at the inner margin. Length 2.00 mm.; diameter 0.60 mm.

Holotype (Cushman Coll. No. 21170) from the middle Miocene, "Sagrina beds," Lothian's Estate, Trinidad, B. W. I.

This species differs from *T. barrettii* in the more slender test, somewhat fusiform shape and the subdivision of the chambers showing through the thin outer wall.

TEXTULARIELLA SIMPLEX Cushman, n. sp. (Pl. 6, figs. 20 a, b)

Test conical, rapidly tapering at initial end, adult with the sides becoming nearly parallel, circular in section, earliest whorl with four or five chambers, later with a short triserial stage, adult biserial throughout, apertural face truncate, flattened; chambers distinct in biserial portion, in adult of nearly uniform size and shape, not overlapping, showing little trace of subdivision; wall coarsely arenaceous, with much cement, finely por-

porate, smoothly finished; aperture low, broad, at inner margin. Length up to 2.50 mm.; diameter 1.35 mm.

Holotype (Cushman Coll. No. 21163) from *Albatross* station D4900, Eastern Sea of Japan, 139 fathoms.

This species differs from *T. barrettii* in the more elongate form and more coarsely arenaceous surface of the test.

Subfamily VIRGULININAE

VIRGULINA PRIMITIVA Cushman, n. sp. (Pl. 7, figs. 1 a-c)

Test small, tapering, strongly twisted, about $3\frac{1}{2}$ times as long as broad, later portion slightly compressed, early portion spiral, last few chambers biserial, particularly in megalospheric form which is slightly more compressed and spreading; chambers distinct, somewhat inflated, slightly overlapping, except for the last pair usually only slightly longer than broad; sutures distinct, depressed, nearly horizontal or slightly sloping in the biserial portion; wall smooth, finely perforate; aperture fairly large, at base of inner margin. Length 0.20 mm.; diameter 0.07-0.09 mm.

Holotype (Cushman Coll. No. 21285) from the Lower Cretaceous, upper Goodland formation, E bank of North Fork of Marys Creek at concrete bridge, $11\frac{1}{2}$ miles W of Fort Worth, Texas.

This species differs from *V. tegulata* Reuss in the smaller size, strongly twisted test and more rounded aperture.

VIRGULINA SUBCRETACEA Cushman, n. sp. (Pl. 7, figs. 2 a, b)

Test comparatively small, usually twisted, about $2\frac{1}{2}$ times as long as broad, early portion triserial, rounded, later biserial, somewhat compressed, periphery broadly rounded, end view broadly elliptical; chambers distinct, strongly inflated, slightly longer than broad in the adult; sutures distinct, oblique to the periphery, depressed; wall smooth, finely perforate; aperture fairly large, at base of inner margin. Length 0.40 mm.; diameter 0.15-0.18 mm.

Holotype (Cushman Coll. No. 21282) from the Lower Cretaceous, upper Goodland formation, Westover Hills, near Fort Worth, Tarrant Co., Texas.

This species differs from *V. tegulata* in the shorter, stouter form, strongly spiral test and inflated chambers.

Test small, slender, gradually tapering from the rounded base, in adult with sides nearly parallel, somewhat lobulate, later portion somewhat compressed, about 3 times as long as broad, periphery broadly rounded; chambers numerous, distinct, inflated, in adult slightly longer than broad; sutures distinct, depressed, strongly oblique to the periphery; wall smooth, finely perforate; aperture narrow, elongate, at inner margin. Length 0.25 mm.; breadth 0.08 mm.; thickness 0.06 mm.

Holotype (Cushman Coll. No. 21280) from the Lower Cretaceous, upper Grayson, Denton Creek, 3½ miles NE of Roanoke, Denton Co., Texas.

This species differs from *V. tegulata* in the much smaller size and the more numerous and lower chambers.

VIRGULINA RECTA Cushman, var. HOWEI Cushman, n. var. (Pl. 7, fig. 4)

Variety differing from the typical in the ornamentation of the wall, consisting of fine longitudinal costae, and the basal angles of the chambers which often distinctly overhang.

Holotype of variety (Cushman Coll. No. 21473) from upper Eocene, Jackson, upper bed at Danville Landing, Ouachita River, Catahoula Parish, Louisiana.

VIRGULINA HALKYARDI Cushman, n. sp. (Pl. 7, figs. 5 a, b)

Virgulina schreibersiana HALKYARD (not CZJZEK), Mem. Proc. Manchester Lit. Philos. Soc., vol. 62, pt. 2, 1918 (1919), p. 48, pl. 8, fig. 5.

Test elongate, slender, about 3½ times as long as broad, strongly compressed, periphery broadly rounded, early portion spirally twisted, later adult portion with 3 or 4 pairs of biserial chambers, sides nearly parallel for most of adult portion; chambers distinct, somewhat inflated, higher than broad, somewhat overlapping; sutures distinct, slightly depressed; wall smooth, finely perforate; aperture narrow, elongate, in adult not reaching base of chamber, slightly expanded at outer end. Length 1.15 mm.; breadth 0.20-0.25 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 21455) from the Eocene, Blue marl of Biarritz, France.

This species differs from *V. dibollensis* Cushman and Applin in the fewer and slightly higher chambers, broader form, and more elongate aperture.

VIRGULINA VICKSBURGENSIS Cushman, n. sp. (Pl. 7, figs. 6 a, b)

Virgulina sp. (?) CUSHMAN, Prof. Paper 129-E, U. S. Geol. Survey, 1922, p. 92, pl. 16, figs. 2, 3.

Test elongate, distinctly compressed, gradually tapering from subacute initial end to greatest breadth formed by last two chambers, thence tapering to the rounded apertural end, periphery slightly lobulated, rounded; chambers distinct, numerous, increasing in relative length as added, slightly inflated; sutures distinct, depressed, strongly oblique in adult; wall smooth, finely perforate; aperture elongate, narrow, running from base of apertural face nearly to apex of chamber. Length 1.25 mm.; breadth 0.30 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 21453) from the lower Oligocene, Vicksburg, Byram marl of Byram, Mississippi.

This species differs from *V. schreibersiana* Czjzek in the shorter spiral stage, more overlapping chambers and greater compression.

VIRGULINA COLEI Cushman, n. sp. (Pl. 7, figs. 7 a, b)

Virgulina compressa COLE and GILLESPIE (not BAILEY), Bull. Amer. Pal., vol. 15, No. 57b, 1930, p. 11, pl. 2, fig. 8.

Test elongate, slender, early portion rapidly increasing in breadth from the subacute initial end, adult portion with sides nearly parallel, slightly compressed, periphery broadly rounded, initial portion strongly spiral; chambers distinct, those of early portion somewhat more elongate than in the adult which are slightly inflated and high; sutures distinct, those of early portion little if at all depressed, in adult more distinctly depressed, strongly oblique or somewhat sigmoid; wall smooth, finely perforate; aperture very narrow, elongate, running from base of apertural chamber to the apex. Length 0.55 mm.; breadth 0.15 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21454) from the Oligocene, Meson, between km. posts 18-18.5, Aguila Petroleum Co. RR., between Potrero and Tanhujio, Mexico.

This species differs from *V. schreibersiana* in the less elongate spiral chambers, greater number of biserial chambers and broader aperture.

VIRGULINA EARLANDI Cushman, n. sp. (Pl. 7, figs. 8 a-c)

Virgulina schreibersiana MILLETT (not CZJEK). Journ. Roy. Micr. Soc., 1900, p. 280, pl. 11, figs. 13 a, b.—HERON-ALLEN and EARLAND. Trans. Zool. Soc. London, vol. 20, 1915, p. 642, pl. 49, figs. 1-12.

Test elongate, strongly tapering, greatest breadth formed by last two chambers, about three times as long as broad, strongly compressed, periphery lobulate, rounded; chambers distinct, strongly inflated, increasing rapidly in size as added, later ones biserial; sutures distinct, strongly depressed; wall smooth, finely perforate; aperture terminal, very narrow, elongate, with a distinct lip, not reaching base of inner margin. Length 0.50 mm.; breadth 0.12 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 21594) from Station 2A, Kerimba Archipelago, Maiyapa Bay, between Ras Afunji and Ras Nondo, off SE Africa, in 10 fathoms.

This species differs from *V. complanata* Egger in the shorter, broader test and very elongate, narrow aperture.

VIRGULINA FIJIENSIS Cushman, n. sp. (Pl. 7, figs. 9 a-c)

Test very elongate, slender, 6 or 7 times as long as broad, slightly compressed, somewhat twisted throughout, later portion becoming more definitely biserial, periphery broadly rounded, slightly lobulate; chambers distinct, numerous, inflated; sutures distinct, depressed, oblique; wall smooth, finely perforate; aperture narrowly elongate, slightly curved, continuing to base of inner margin. Length 1.60 mm.; breadth 0.25 mm.; thickness 0.18-0.20 mm.

Holotype (Cushman Coll. No. 17555) from off Nairai, Fiji, in 12 fathoms.

This species differs from *V. complanata* in the very long, slender test with nearly parallel sides and little compression and in the chambers which are much more inflated.

BOLIVINA CRETOSA Cushman, n. sp. (Pl. 7, fig. 10)

Bolivina sp. CUSHMAN, Bull. 41, Tenn. Geol. Survey, 1931, p. 50, pl. 8, fig. 7.

Test fusiform, small, about twice as long as broad, much compressed, periphery acute; chambers distinct, low and broad, very slightly overlapping, increasing in breadth as added; sutures distinct, slightly if at all depressed, often somewhat limbate, strongly oblique, slightly curved; wall smooth or with occasional lines of coarse punctae arranged in longitudinal lines; aperture nar-

row, elongate. Length 0.20-0.30 mm.; breadth 0.12-0.15 mm.; thickness 0.05 mm.

Holotype (Cushman Coll. No. 15232) from the Upper Cretaceous, Selma chalk, $\frac{1}{2}$ mile W of Guys, McNairy Co., Tennessee.

This species differs from *B. watersi* Cushman in the more oblique sutures which are not sigmoid and lack of lobes on the ventral chamber margins.

BOLIVINA ANGLICA Cushman, n. sp. (Pl. 7, figs. 11 a, b)

Test elongate, about 3 times as long as broad, rather strongly compressed, periphery rounded, tapering, biserial throughout, greatest breadth formed by last two chambers; chambers distinct, not depressed, increasing rather regularly in size, becoming relatively higher in adult; sutures distinct, very slightly depressed, strongly oblique; wall finely perforate, smooth; aperture broad, loop-shaped, reaching to base of inner margin. Length 0.35 mm.; breadth 0.12 mm.; thickness 0.05-0.06 mm.

Holotype (Cushman Coll. No. 21496) from the London clay, Picadilly, excavation on Regent Street, London, England.

This species differs from *B. nuda* Terquem in the higher chambers, more oblique sutures and broader aperture.

BOLIVINA MIDWAYENSIS Cushman, n. sp. (Pl. 7, figs. 12 a, b)

Test elongate, very slightly tapering, much compressed, periphery rounded, biserial throughout; chambers distinct, slightly inflated, low and broad, very slightly overlapping, of rather uniform shape throughout; sutures distinct, slightly depressed, strongly oblique, forming an angle of at least 45° with the horizontal, slightly curved; wall smooth, very finely perforate; aperture an oval opening, tending very slightly to be somewhat removed from the inner margin. Length up to 0.85 mm.; breadth 0.15-0.18 mm.; thickness 0.08-0.10 mm.

Holotype (Cushman Coll. No. 5335) from the lower Eocene, Midway, from a shallow ditch at road corner SE of New Corsicana Reservoir, on road to Mildred, Navarro Co., Texas.

This species differs from *B. nuda* in the more elongate, less tapering form and very oblique sutures.

BOLIVINA CRENULATA Cushman, n. sp. (Pl. 7, figs. 13 a, b)

Test about twice as long as broad, tapering, greatest breadth near apertural end, periphery subacute, slightly lobulate; chambers numerous, rather indistinct, later ones slightly inflated, about twice as broad as high; sutures rather indistinct, sigmoid.

slightly oblique; wall finely perforate, ornamented by distinct, longitudinal ridges, base of chambers crenulate, forming a pattern of irregularly rounded depressions. Length 0.40 mm.; breadth 0.20 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 21497) from the upper Eocene, Kleinzellner Tegel, clay pit near Budapest, Hungary.

This species differs from *B. jacksonensis* Cushman and Applin in the shorter, broader, less compressed form, rhomboid end view, strongly lobed bases of the chambers and very coarse perforations.

BOLIVINA STRIATO-CARINATA Cushman, n. sp. (Pl. 7, figs. 14 a, b)

Test elongate, 3 to 3½ times as long as broad, tapering throughout, greatest breadth near apertural end, much compressed, periphery distinctly carinate; chambers distinct, slightly overlapping, nearly as high as broad; sutures distinct, slightly limbate, in adult portion depressed, in early portion somewhat raised and confluent with the peripheral keel, strongly oblique, slightly curved, forming an angle of about 45° or even more in the adult; wall finely perforate, lower half or more and sometimes entire test with numerous longitudinal costae independent of the individual chambers; aperture broadly oval, opening at base of inner margin. Length up to 1.30 mm.; breadth 0.40 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21493) from the upper Eocene, Bartonian, of Val di Lonte, Italy.

This species differs from *B. jacksonensis* in the strongly carinate margin and the elongate costae.

BOLIVINA MISSISSIPPIENSIS Cushman, var. **COSTIFERA** Cushman, n. var.
(Pl. 7, figs. 15 a, b)

Variety differing from the typical in having the early portion of the test marked by a few, very distinct, longitudinal costae.

Holotype of variety (Cushman Coll. No. 5548) from the lower Oligocene, Byram marl, Byram, Mississippi.

BOLIVINA FASTIGIA Cushman, n. sp. (Pl. 7, figs. 17 a, b)

Test 1½ to 2 times as long as broad, much compressed, central portion thickest, thence tapering to the subacute, initial end, only slightly curved, periphery rhomboid in end view, early portion rather rapidly tapering from the rounded initial end, sides in adult nearly parallel; chambers distinct, except when obscured by the ornamentation of the surface, low and broad throughout.

with a very distinct lobe in the ventral inner angle, particularly in the adult, little if at all inflated; sutures distinct, somewhat limbate, strongly curved, forming an angle of about 45° with the horizontal; wall finely perforate, with usually a definite median longitudinal ridge and supplementary longitudinal costae generally parallel to the periphery, most strongly developed near the initial end, occasionally forming a definite reticulation; aperture rather broad, with a wide opening at the inner margin. Length 0.35-0.50 mm.; breadth 0.20 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21870) from the upper Oligocene, Doberg, near Bunde, Westphalia, Germany.

This species differs from *B. dilatata* Reuss in the carinate periphery, limbate sutures with distinct lobes, median carina and supplementary costae.

BOLIVINA SUBLOBATA Cushman, n. sp. (Pl. 7, figs. 16 a, b)

Test somewhat longer than broad, rather strongly compressed, periphery broadly rounded, sublobate, greatest width toward apertural end, gradually tapering to the subacute initial end; chambers numerous, increasing rather uniformly in size, only slightly inflated, slightly more so toward apertural end; sutures fairly distinct, especially in later portion where they are slightly depressed, rather strongly oblique forming an angle of about 45° with horizontal; wall finely perforate, roughened, particularly in early portion and along peripheral and basal portions of each chamber; aperture broadly oval at inner margin of last-formed chamber. Length 0.30 mm.; breadth 0.15-0.18 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 5549) from Oligocene, Clifton Bank, near Hamilton, Victoria, Australia.

This species differs from *B. dilatata* in the broader, less compressed form and much roughened surface.

BOLIVINA PAPULATA Cushman, n. sp. (Pl. 7, figs. 21 a, b)

Test elongate, about 2½ times as long as broad, much compressed, periphery subacute, gradually tapering from the bluntly pointed initial end to greatest breadth toward apertural end; chambers distinct, 2 or 3 times as broad as high, of rather uniform shape throughout, increasing rather regularly in size, little if at all inflated; sutures distinct, slightly limbate, nearly straight, gently curved, later ones tending to become somewhat sigmoid; wall rather coarsely perforate, with a peculiar surface

like a series of small pits and raised blisters giving a very unusual appearance of roughness to the exterior; aperture narrow, elongate, somewhat wider at inner end, with a slightly raised, rounded lip. Length 0.45-0.55 mm.; breadth 0.25 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21895) from the Miocene of Vöslau, near Vienna, Austria.

This species differs from *B. marginata* Cushman in the non-carinate periphery, straighter and less oblique sutures and peculiarly ornamented surface.

BOLIVINA HEBES Macfadyen, var. **VICTORIENSIS** Cushman, n. var. (Pl. 7, figs. 18 a, b)

Variety differing from the typical in the more elongate test, with later chambers more loosely arranged, and basal portion of chambers in adult with very prominent lobes and re-entrants.

Holotype of variety (Cushman Coll. No. 21896) from the Miocene, Janjukian of Curlewis, Victoria, Australia.

BOLIVINA SCALPRATA Schwager, var. **RETIFORMIS** Cushman, n. var. (Pl. 7, figs. 19 a, b)

Bolivina reticulata MACFADYEN (not HANTKEN), Geol. Survey Egypt, 1930 (1931), p. 62, pl. 4, figs. 23 a, b.

Variety differing from the typical in the ornamentation of the surface, consisting of a fine network of raised costae, irregular in arrangement and covering a large portion of the surface, the longitudinal costae being stronger than the transverse ones.

Holotype (Cushman Coll. No. 21505) from the Miocene of Wadi Sudr, Egypt, Lat. 29° 41' 45" N., Long. 32° 51' 00" E.; collected by W. A. Macfadyen.

BOLIVINA OBSCURANTA Cushman, n. sp. (Pl. 7, figs. 20 a, b)

Test short and broad, only slightly longer than broad, gradually increasing in breadth from the broadly rounded apertural end to the greatest breadth formed by the last two chambers. periphery rounded or subacute, somewhat compressed; chambers fairly distinct, broad and low, increasing gradually in size, general form rather constant, basal portion in adult with a series of lobes and re-entrants; sutures fairly distinct, slightly if at all depressed, strongly oblique, slightly curved toward the periphery; wall with two longitudinal, raised ridges and often with fine plications in addition; aperture small, narrow, in the median line. Length 0.45-0.55 mm.; breadth 0.30-0.35 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21879) from the Miocene, La

Canela, south side of Rio Yaque del Norte, 15 kms. W of Santiago, Province of Santiago, Santo Dominica.

In some respects this species resembles *Bolivina plicata* d'Orbigny, but is a broader, flatter species than is that of d'Orbigny.

BOLIVINA ACEROSA Cushman, n. sp. (Pl. 8, figs. 1 a, b)

Test very elongate, slender, 4 or 5 times as long as broad, somewhat compressed, periphery rounded, very gradually tapering from the acute initial end, with greatest breadth formed by last pair of chambers, last part of test often with nearly parallel sides; chambers distinct, not inflated, increasing very gradually and regularly in size, increasing somewhat in relative height toward apertural end; sutures distinct, not depressed, nearly straight, forming an angle of nearly 45° with the horizontal; wall finely perforate, early portion with a series of fine longitudinal costae, later half smooth; aperture narrow, elongate. Length 0.35-0.45 mm.; breadth 0.08-0.12 mm.; thickness 0.05-0.07 mm.

Holotype (Cushman Coll. No. 21889) from the Miocene, Gurabo formation, right bank of Rio Gurabo, 500 feet below lower ford at Gurabo adentro, Province of Monte Cristi, Santo Dominica.

This species differs from *B. catanensis* Seguenza in the narrower, less tapering form, higher chambers and costate early portion.

BOLIVINA DIRECTA Cushman, n. sp. (Pl. 7, figs. 22 a, b)

Test elongate, narrow, about 3½ times as long as broad, straight, very regularly but gradually enlarging from the broadly rounded initial end to the greatest breadth formed by the last pair of chambers, somewhat compressed, periphery rounded; chambers very distinct, numerous, in early portion very low and broad, increasing somewhat in relative height, inflated very slightly toward apertural end; sutures strongly limbate, very distinct, earlier ones gently curved, later ones strongly oblique, in last portion tending to become sigmoid, inner end of chamber developing a slight, pointed lobe; wall smooth, finely perforate; aperture very broadly oval with a wide opening at base. Length 0.40-0.45 mm.; breadth 0.12 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 21897) from the Miocene, stream bed, Mayo Quarry, Trinidad, B. W. I.

In some respects the general shape of this species resembles *Bolivina arta* Macfadyen, but the chambers and sutures are very different.

BOLIVINA VICTORIANA Cushman, n. sp. (Pl. 8, figs. 2 a, b)

Test elongate, $2\frac{1}{2}$ to 3 times as long as broad, somewhat compressed, periphery broadly rounded, very gradually tapering from the rounded initial end, sides in last half of test nearly parallel; chambers comparatively few, distinct, very slightly inflated, of rather uniform shape throughout, somewhat broader than high, increasing gradually in size; sutures very distinct, slightly limbate, very slightly depressed, gently curved, forming an angle of about 35° with the horizontal; wall smooth, distinctly perforate; aperture rather broadly oval with a narrow opening at inner margin of chamber. Length 0.50 mm.; breadth 0.15 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21898) from the Miocene, Janjukian, of Torquay Bore at 160', 15 miles S of Geelong, Victoria.

This species differs from *B. catanensis* in the fewer, higher chambers and more rounded periphery.

BOLIVINA CRESPIINAE Cushman, n. sp. (Pl. 8, figs. 3 a, b)

Test elongate, slender, about $3\frac{1}{2}$ to 4 times as long as broad, usually somewhat curved, slightly compressed, periphery broadly rounded, sides nearly parallel; chambers very distinct, earliest ones about twice as broad as high, gradually increasing in relative height until in the adult the height is greater than the breadth, last-formed ones often slightly inflated; sutures somewhat limbate, very distinct, slightly depressed, nearly straight, forming a very slight angle with the horizontal; wall smooth, distinctly perforate; aperture narrow, elongate, narrowed somewhat at opening at the inner margin. Length 0.45-0.50 mm.; breadth 0.12-0.15 mm.; thickness 0.08-0.10 mm.

Holotype (Cushman Coll. No. 21899) from Miocene Janjukian, Torquay Bore No. 1, at 160', 15 miles S of Geelong, Victoria.

This species differs from *B. goudkoffi* Ranken in the much higher chambers, more rounded periphery and strongly limbate sutures.

BOLIVINA CISTINA Cushman, n. sp. (Pl. 8, figs. 4 a, b)

Test short and broad, rapidly tapering from the subacute initial end to greatest breadth formed by last two chambers, rhomboid in end view, sides slightly concave, angles subacute; chambers distinct, somewhat inflated, especially in later portion, low and broad, increasing somewhat in relative height in adult.

basal portion in adult sometimes with a series of indentations and backwardly projecting lobes; sutures distinct, those of later portion strongly depressed, only slightly oblique, nearly straight; wall coarsely perforate, otherwise unornamented; aperture, a semi-elliptical opening running a short way into apertural face, without a lip. Length 0.28-0.30 mm.; diameter 0.15 mm.

Holotype (Cushman Coll. No. 21875) from the lower Pliocene of Gravitelli, near Messina, Sicily.

This species differs from *B. modeloensis* Cushman and Kleinpell in the shorter, broader chambers, more rhomboid end view and much broader test.

BOLIVINA SILVESTRINA Cushman, n. sp. (Pl. 8, figs. 5 a, b)

Test elongate, slender, gradually tapering from the somewhat rounded initial end to greatest breadth formed by last pair of chambers, somewhat twisted, only slightly compressed, periphery broadly rounded; chambers numerous, distinct, inflated, about as high as broad, in adult earlier ones somewhat overlapping, of rather uniform shape throughout, increasing in size; sutures distinct, depressed, nearly straight or slightly curved, forming an angle of about 25° with the horizontal; wall coarsely perforate, otherwise smooth; aperture broadly elliptical, narrow at the base, and with a slightly rounded lip. Length 0.50-0.60 mm.; breadth 0.15-0.18 mm.; thickness 0.10-0.15 mm.

Holotype (Cushman Coll. No. 21877) from the Pliocene, Castel Arquato, Italy.

This species differs from *B. catanensis* in the much higher, strongly inflated chambers, less oblique sutures and broader aperture.

BOLIVINA ITALICA Cushman, n. sp. (Pl. 8, figs. 6 a, b)

Test elongate, somewhat fusiform, greatest breadth usually somewhat below the last-formed chambers, in adult slightly compressed, periphery broadly rounded, initial end typically with a short, stout spine; chambers distinct, inflated, about as high as broad, increasing rather uniformly in size; sutures distinct, very strongly depressed throughout, nearly horizontal or forming a slight angle; wall coarsely perforate, otherwise smooth; aperture very broadly rounded, often nearly circular with a slight lip. Length 0.40-0.50 mm.; breadth 0.15-0.18 mm.; thickness 0.12 mm.

Holotype (Cushman Coll. No. 21881) from the Pliocene of Girgenti, Sicily.

This species differs from *B. subadvena* Cushman in the more tapering form, less compressed test, higher chambers and basal spine.

BOLIVINA PARRI Cushman, n. sp. (Pl. 8, figs. 7 a, b)

Test short and broad, $1\frac{1}{2}$ to 2 times as long as broad, only slightly compressed, median line somewhat excavated, periphery broadly rounded, early portion rapidly tapering from the sub-acute initial end which sometimes has a basal spine; sides in adult usually nearly parallel, slightly lobulate; chambers fairly distinct, comparatively few, in early portion much broader than high, in adult with height and breadth about equal, later ones slightly inflated; sutures distinct, limbate, later ones slightly depressed, in early portion straight, oblique, forming an angle of about 20° with the horizontal, in adult becoming almost horizontal; wall coarsely perforate, in early portion often with a definite, coarse, reticulate pattern, becoming somewhat finer in adult, with upper portion in last-formed chambers smooth; aperture elongate, elliptical, tending to become slightly removed from inner margin in adult. Length 0.45-0.50 mm.; breadth 0.15-0.20 mm.; thickness 0.12-0.15 mm.

Holotype (Cushman Coll. No. 21883) from the Pliocene, Castlecliffian, of Castlecliff, Wanganui, New Zealand.

This species differs from *B. subadvena* in the more rounded end view, more tapering test, median excavation, limbate sutures and basal spine.

BOLIVINA TORTUOSA H. B. Brady, var. **ATLANTICA** Cushman, n. var. (Pl. 8, figs. 8 a, b)

Bolivina tortuosa H. B. BRADY (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 420, pl. 52, figs. 33, 34 (not 31, 32).—EGGER (part), Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 298.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1911, p. 317, pl. 10, figs. 3, 4; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 66, pl. 5, fig. 1.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 49, pl. 9, fig. 5.

Variety differing from the typical in the much more elongate test, greater number of chambers and lobulate margin.

BOLIVINA SUBTENUIS Cushman, n. sp. (Pl. 8, fig. 10)

Bolivina tenuis H. B. BRADY (not MARSSON), Quart. Journ. Micr. Sci., vol. 21, 1881, p. 57; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 419, pl. 52, fig. 29.—CUSHMAN, Publ. 342, Carnegie Inst. Washington, 1924, p. 17, pl. 5, figs. 7, 8.

Test much compressed, nearly as broad as long, greatest width

just above middle, periphery subacute, not keeled; chambers distinct, very broad and low, slightly inflated, increasing very rapidly in size, comparatively few, inner portion often appearing as though separated from main portion; sutures distinct, strongly curved, slightly depressed; wall smooth, finely perforate; aperture somewhat at one side, rounded, with a very slight lip and often with radiating lines above the aperture itself. Length 0.25-0.30 mm.; breadth 0.20 mm.; thickness 0.05 mm.

Holotype (Cushman Coll. No. 1102) from Pago Pago Harbor, Samoa.

This species differs from *B. nitida* H. B. Brady in the broader form, strongly curved sutures and more rounded aperture.

BOLIVINA SPINEA Cushman, n. sp. (Pl. 8, figs. 11 a, b)

Test less than twice as long as broad, rapidly tapering, greatest breadth made by last pair of chambers, initial end acute, with a large, stout spine, periphery in end view broadly rounded, almost truncate; chambers distinct, somewhat inflated, about twice as broad as high, middle area of each expanded into coarse spinose projections; sutures distinct, strongly depressed, straight, oblique, forming an angle of 25°-30° with the horizontal in adult, more strongly oblique in early stages; wall distinctly perforate; aperture elongate with a slightly expanded opening at base of inner margin. Length 0.60 mm.; breadth 0.35 mm.; thickness 0.20 mm.

Holotype (Cushman Coll. No. 21900) from 40-50 fathoms off Fiji.

In some respects this species resembles *B. simpsoni* Heron-Allen and Earland, but it is much more coarsely spinose.

BOLIVINA ZANZIBARICA Cushman, n. sp. (Pl. 8, figs. 12 a, b)

Test about twice as long as broad, somewhat compressed, periphery in end view broadly rounded, tapering throughout, from the subacute initial end to the greatest breadth formed by the last two chambers; chambers distinct, somewhat inflated, earlier ones about twice as broad as high, gradually increasing in relative height as added, in adult with height and breadth about equal; sutures distinct, those of early portion somewhat limbate and often raised, later ones depressed, nearly straight, oblique, forming an angle of about 25-35° with the horizontal; wall ornamented with numerous small, short, blunt, spinose projections, particularly on the lower half of the chamber; aperture

elongate, elliptical, with a distinct, raised lip. Length 0.30 mm.; breadth 0.15 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21920) from Recent dredgings off Zanzibar.

This species differs from *B. subspinescens* Cushman in the more rapidly tapering form, less lobulate margin and raised sutures in the early portion.

BOLIVINA STRIATULA Cushman, var. *SPINATA* Cushman, n. var. (Pl. 8, figs. 9 a, b)

Variety differing from the typical in the more rapidly tapering initial end which develops a very distinct acerosc spine.

Holotype of variety (U. S. N. M. No. 26212) from north of Puerto Rico, Johnson-Smithsonian Expedition, Station 104, Lat. 18° 30' 50" N. to 18° 30' 10" N.; Long. 66° 13' 20" W. to 66° 13' 50" W. at a depth of 80-120 fathoms.

LOXOSTOMA PLUMMERAE Cushman, n. sp. (Pl. 8, figs. 12 a, b)

Test small, elongate, $3\frac{1}{2}$ to 4 times as long as broad, very slightly compressed, early portion biserial, later strongly tending to become uniserial; chambers distinct, somewhat inflated throughout, more strongly so in adult; sutures distinct, depressed, nearly at right angles to periphery; wall distinctly perforate, smooth; aperture in adult terminal, elongate, elliptical, with a slight lip. Length 0.40 mm.; breadth 0.10-0.12 mm.

Holotype (Cushman Coll. No. 21490) from the lower Eocene, Midway, Dry Creek, $\frac{3}{4}$ mile above bridge on first road E of Travis-Bastrop County line, Bastrop Co., Texas.

This species differs from *L. wilcoxense* Cushman and Ponton in the shorter, broader form, less compressed, straighter, nearly horizontal sutures and more lobulate periphery.

LOXOSTOMA CLAIBORNENSE Cushman, n. sp. (Pl. 8, figs. 15 a, b)

Test elongate, about 3 times as long as broad, somewhat compressed, periphery broadly rounded, gradually tapering to greatest breadth near apertural end; chambers distinct, very slightly inflated, distinctly overlapping, in early portion much broader than high, in adult with height and breadth about equal; sutures distinct, slightly limbate, sigmoid, slightly oblique, more strongly so in early portion; wall very coarsely perforate, otherwise smooth; aperture rounded, with a distinct lip, tending to become terminal. Length up to 0.40 mm.; breadth 0.10 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 5337) from the Claiborne of Liberty Co., Texas.

This species differs from *L. wilcoxense* in the sigmoid sutures, and very coarsely perforate wall.

LOXOSTOMA TERETUM Cushman, n. sp. (Pl. 8, figs. 14 a, b)

Test slender, elongate, about 4 times as long as broad, very slightly tapering, slightly compressed; chambers comparatively few, much higher than broad in adult, slightly if at all inflated, increasing slightly in height and size; sutures fairly distinct, not depressed, slightly limbate, slightly oblique, forming an angle of about 20°-25° with the horizontal; wall finely perforate, ornamented with very numerous, close-set costae, covering most of the test but strongest toward the base; aperture elongate, oval, tending to become terminal. Length 0.35-0.40 mm.; breadth 0.10 mm.

Holotype (Cushman Coll. No. 21503) from the middle Oligocene of Lobsann, Alsace.

This species somewhat remotely resembles *Bolivina semistriata* and *B. nobilis* Hantken from the upper Eocene of Hungary. However, this species is much smaller, has fewer chambers, and the shape of the test and of the individual chambers is quite different.

LOXOSTOMA SINUOSUM Cushman, n. sp. (Pl. 8, figs. 16 a, b)

Test elongate, slender, somewhat compressed, sides for the most part nearly parallel, early portion entire, later portion strongly lobulate, periphery rounded; chambers distinct, in early portion much broader than high, gradually increasing in relative height in adult where they are higher than broad and tend to become uniserial; sutures distinct, slightly limbate in early portion, nearly straight, and only slightly oblique, in adult becoming depressed and very curved, giving a sinuous appearance; wall coarsely perforate, otherwise smooth; aperture irregularly elliptical, terminal in the adult. Length 0.60-0.70 mm.; breadth 0.15 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 21885) from the Pliocene, Crag noir, near Antwerp, Belgium.

This species differs from *L. digitale* (d'Orbigny) in the very highly arched sutures, more inflated chambers, and lack of costae.

Test about 2 to 2½ times as long as broad, early stages biserial and rapidly tapering, later adult portion uniserial and sub-cylindrical; chambers distinct, biserial ones increasing in relative height as added, uniserial ones of rather uniform size and shape, deeply excavated at base; sutures distinct, depressed, those of early biserial portion very slightly oblique; wall ornamented with a coarse irregular reticulation with the depressed areas rounded and deep; aperture nearly circular, terminal, with a distinct lip. Length 0.50 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 21908) from the Miocene, lower Aquitanien, RR. cut, La Brède, France.

This species differs from *B. fimbriata* Millett in the broader form, more rounded aperture, fewer chambers and coarsely reticulate surface.

BIFARINA ZANZIBARENSIS Cushman, n. sp. (Pl. 8, fig. 18)

Test about twice as long as broad, early portion somewhat compressed, biserial, later portion nearly circular in section, uniserial; chambers distinct, somewhat inflated, low and broad; sutures distinct, depressed, in biserial portion straight, slightly oblique; wall ornamented with a single row of elongate raised areas about the middle portion of each chamber; aperture in adult terminal, circular, with a slight lip. Length 0.25 mm.; diameter 0.10 mm.

Holotype (Cushman Coll. No. 21916) from Recent material off Zanzibar.

This species differs from *B. fimbriata* in the shorter form, less deeply excavated sutures and double row of papillae on the adult chambers.

Genus GEMINARICTA Cushman, new genus

Genotype, *Bolivinella virgata* Cushman

Bolivinella CUSHMAN (part), Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 33.

Test in early stages biserial, compressed, in adult uniserial; wall calcareous, perforate; aperture in adult consisting of a pair of small rounded openings well separated from one another toward the ends of an elongate, elliptical depression in the terminal wall.—Miocene.

As far as known, this genus is a specialized one developed in the Miocene of southern France. The twinned apertures are a constant character, and are usually easily determined.

GERMINARICTA VIRGATA (Cushman), var. **COSTIFERA** Cushman, n. var.
(Pl. 8, figs. 19 a, b)

Variety differing from the typical in the ornamentation of the surface which has the sutures raised into heavy costae, and the entire surface roughened.

Holotype of variety (Cushman Coll. No. 21904) from the Miocene, St. Paul de Dax, Landes, France.

GERMINARICTA VIRGATA (Cushman), var. **SPINATA** Cushman, n. var.
(Pl. 8, figs. 20 a, b)

Variety differing from the typical in the ornamentation of the surface which in early portion has the sutures raised, continued out at the ends into short, blunt spines, and the surface of the test irregularly reticulate.

Holotype of variety (Cushman Coll. No. 21903) from the Miocene, St. Paul de Dax, Landes, France.

BITUBULOGENERINA RETICULATA Cushman, n. sp. (Pl. 8, figs. 21 a, b)

Test about twice as long as broad, slightly compressed. periphery broadly rounded, tapering, greatest breadth formed by last pair of chambers, initial end with a short, stout, acerose spine; chambers comparatively few, distinct, somewhat inflated, about as high as broad, increasing uniformly in size; sutures depressed, straight, in early stages oblique, gradually becoming nearly horizontal in adult; wall with a rather coarsely and evenly spaced reticulation covering the entire test; aperture broadly elliptical with a distinct rounded lip. Length 0.35-0.40 mm.; breadth 0.15-0.18 mm.; thickness 0.10 mm.

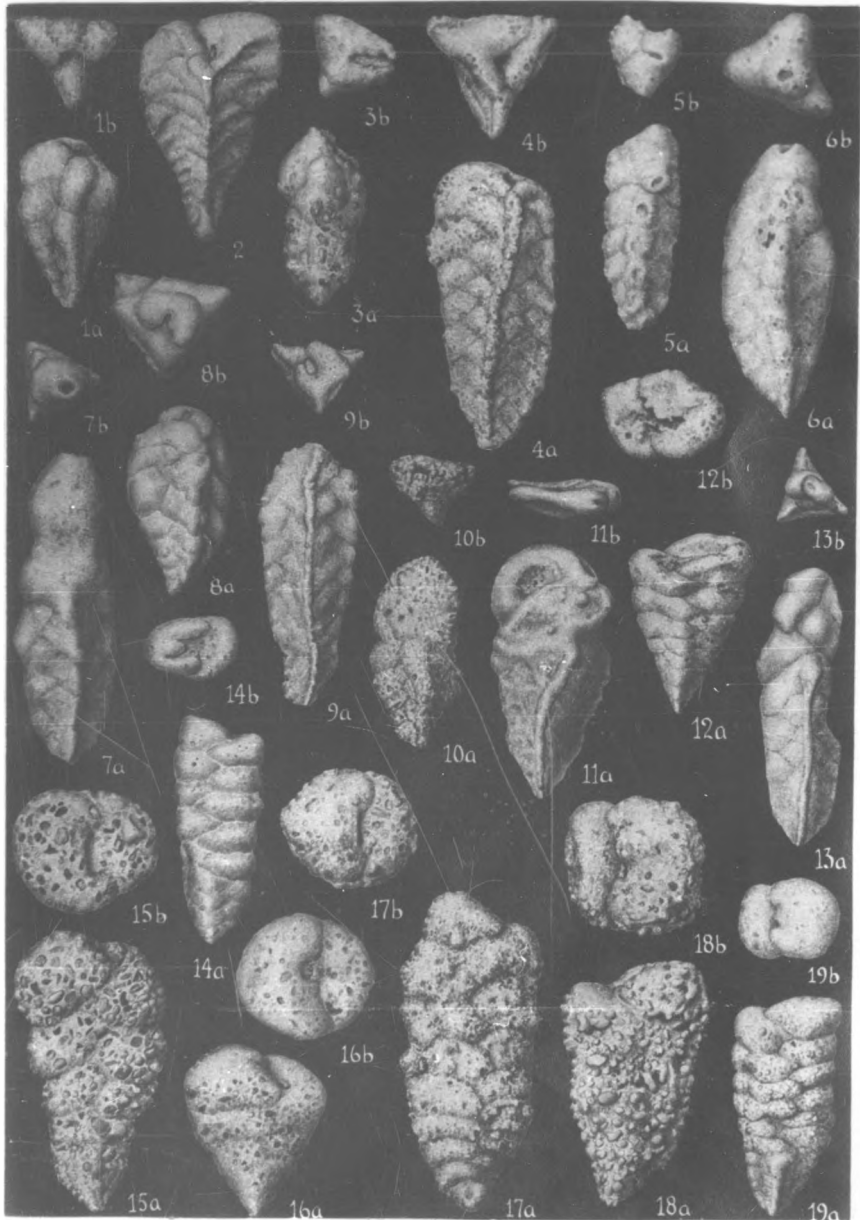
Holotype (Cushman Coll. No. 21901) from the Miocene of Kostej, Banat, Hungary.

This species differs from *B. howei* Cushman in the more oblique sutures, basal spine and coarsely reticulate surface.

EXPLANATION OF PLATE 1

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3.	<i>V. parri</i> Cushman, n. sp. × 35.....	2
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13.	<i>G. alexanderi</i> Cushman, n. sp. × 35.....	6
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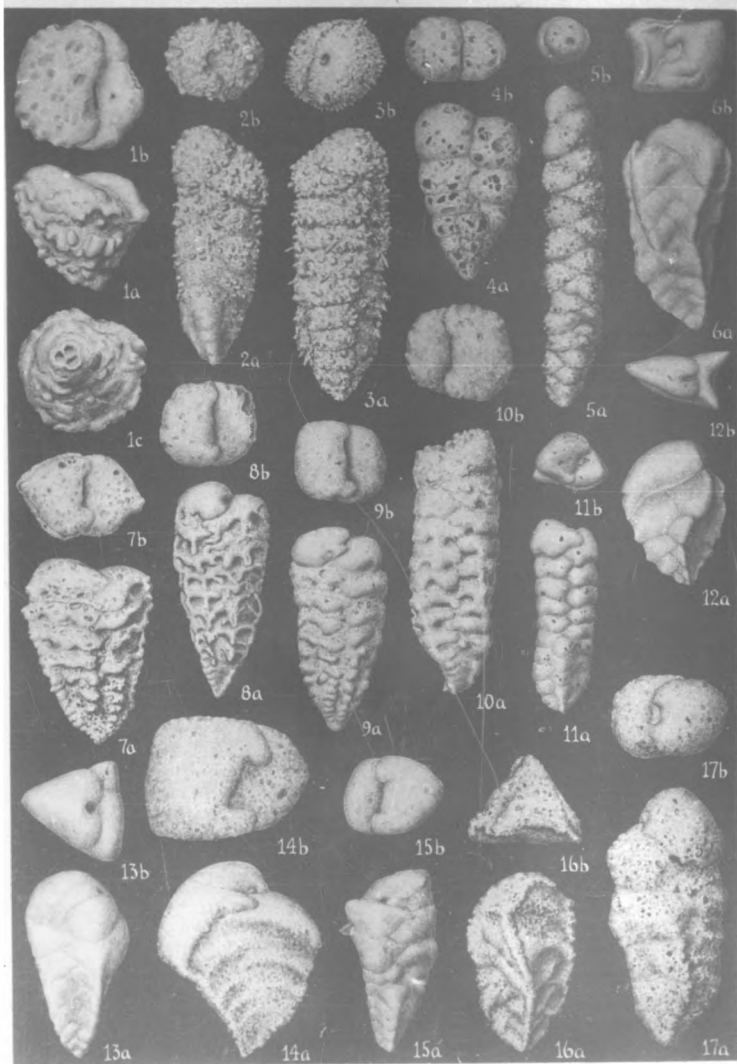
In all figures, *a*, front view; *b*, apertural view.



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14.	<i>G. (Pseudogaudryina) bavariana</i> Cushman, n. sp. × 28.....	13
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In all figures, *a*, front view; *b*, apertural view.

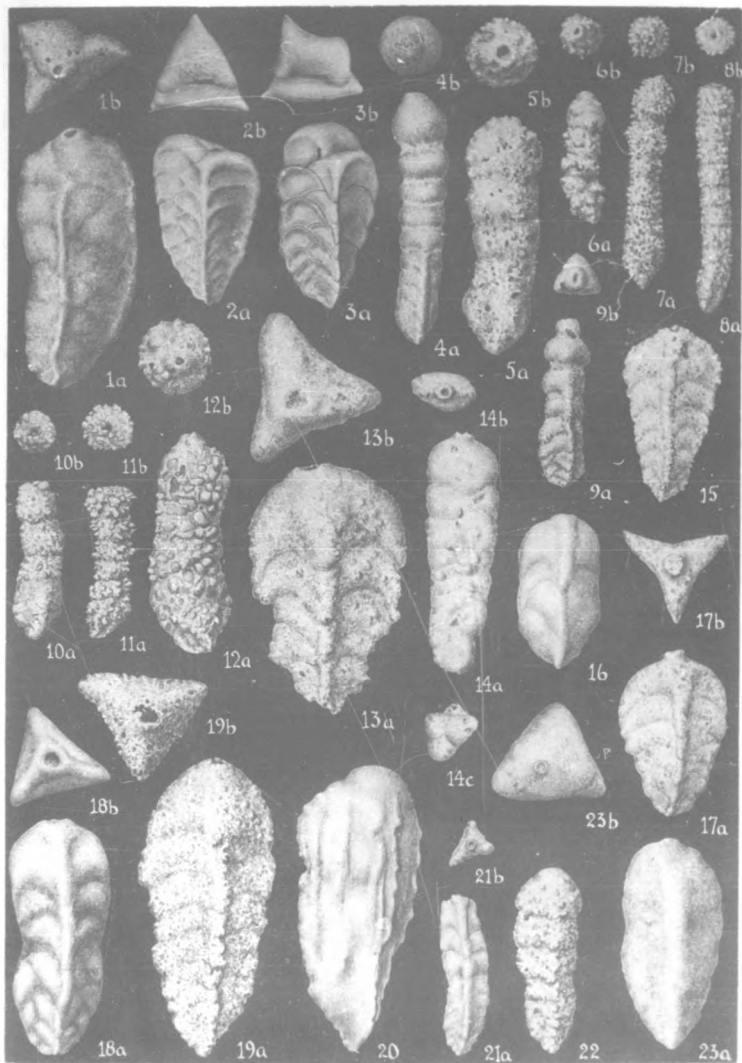


NEW SPECIES OF VERNEULINIDAE

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1.	<i>Gaudryina (Pseudogaudryina) pleionensis</i> Cushman, n. sp. × 35.....	15
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23.	<i>Heterostomella mexicana</i> Cushman, n. sp. × 50.....	24

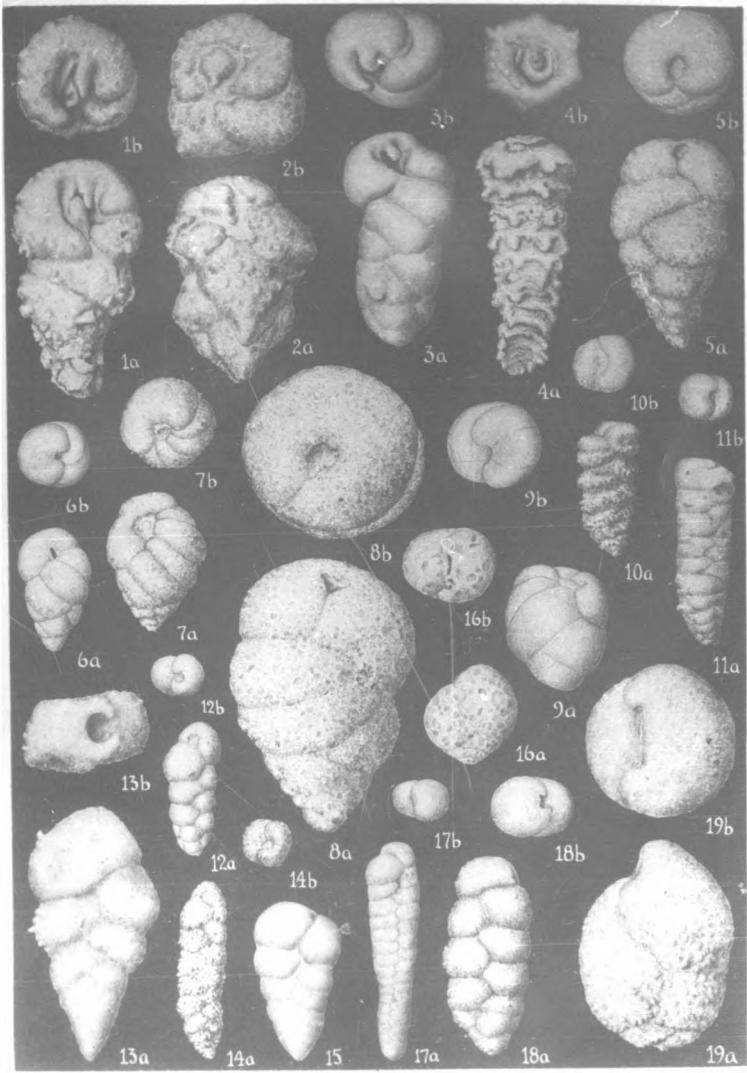
In all figures, *a*, front view; *b*, apertural view.



EXPLANATION OF PLATE 4

FIG.		PAGE
1.	<i>Valvulina rugidia</i> Cushman, n. sp. × 30.....	24
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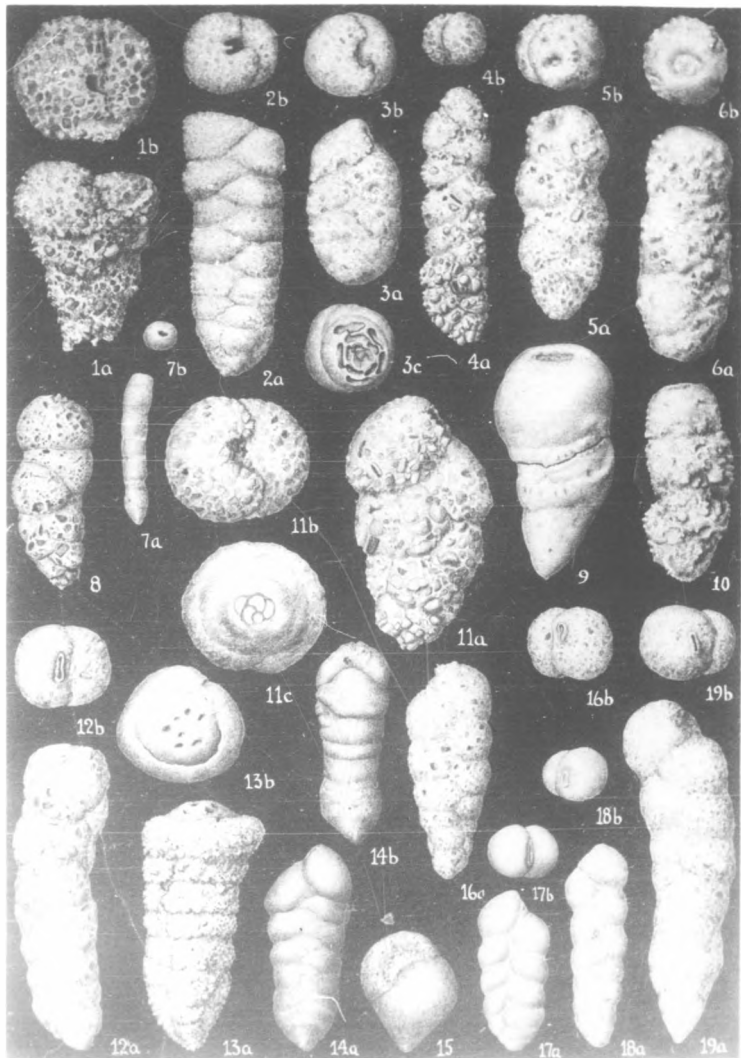
In all figures, *a*, front view; *b*, apertural view.



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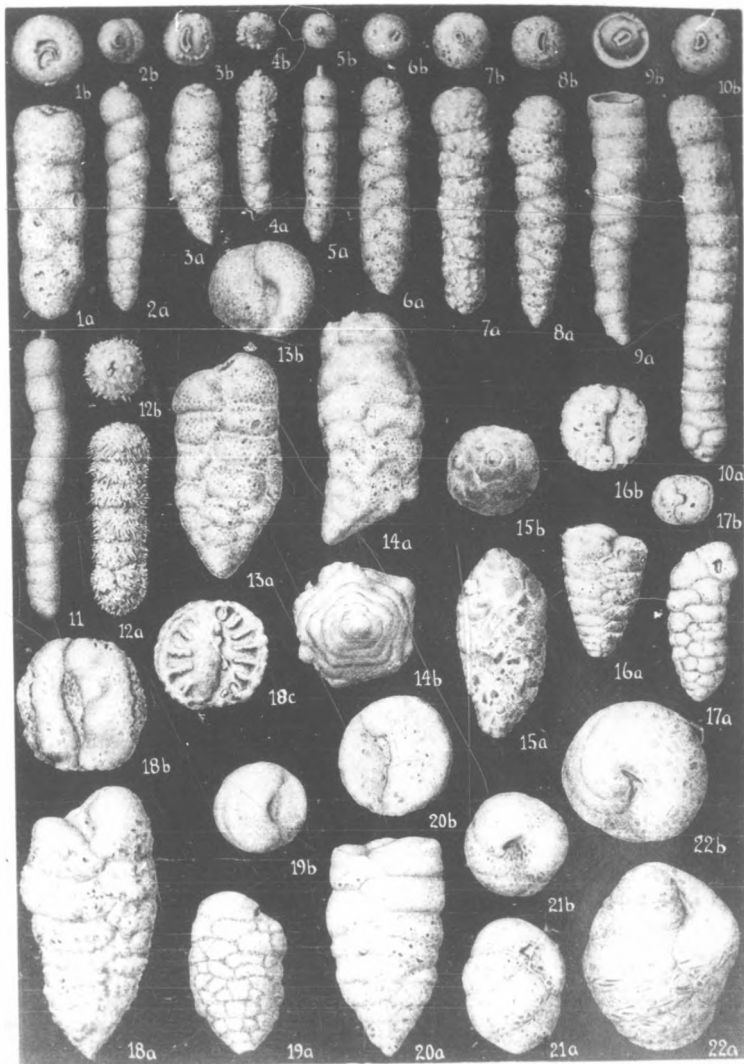
Unless otherwise stated, a, front view; b, apertural view.



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Unless otherwise stated, a, front view; b, apertural view.

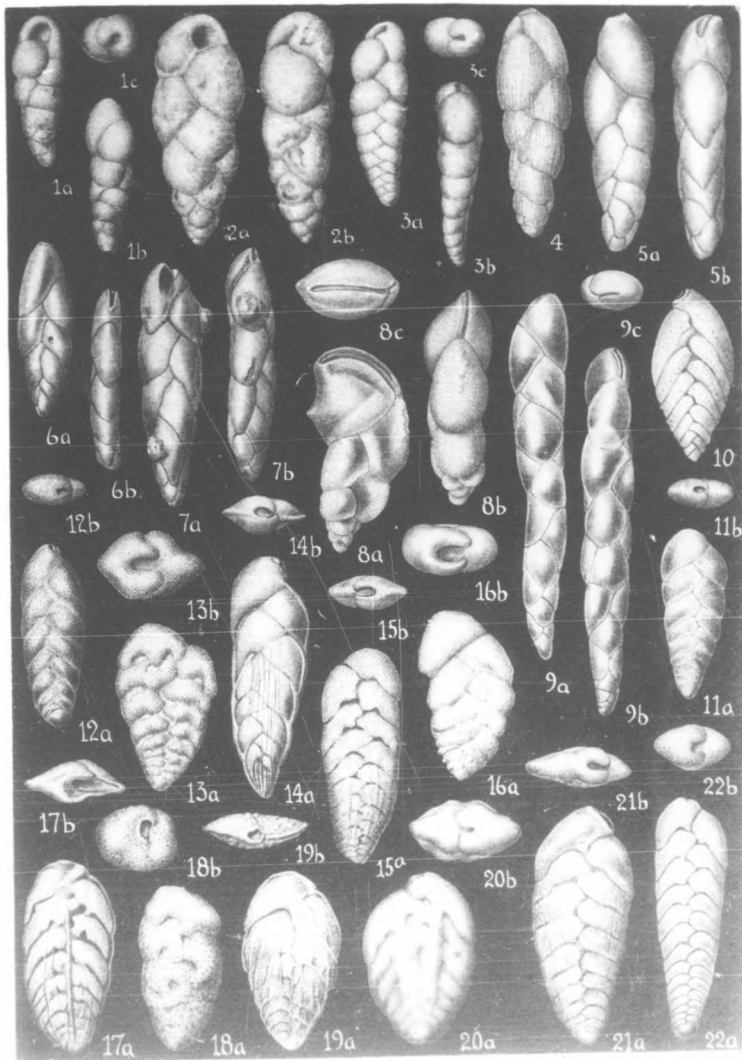


NEW SPECIES OF VALVULINIDAE

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In all figures, unless otherwise noted: *a*, front view; *b*, apertural view.



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Unless otherwise noted: *a*, front view; *b*, apertural view.

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