THE CORAL FAUNA OF THE MIDWAY EOCENE OF TEXAS

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The coral fauna of the Midway Eocene of Texas includes thirteen separate species and varieties. Only two of the species, each represented in a single locality by a single specimen, belong to the colonial types. The remaining eleven species, containing probably 95 per cent of the specimens, are all of solitary forms. Evidently the Texas Midway seas did not afford conditions favorable to the growth of reef-building corals.

Eight of the thirteen species and varieties are new and have not been reported outside of Texas. Of the remaining five, one may prove to be identical with a doubtful single specimen described from the Midway of Alabama; the remaining four are represented in beds of Midway and Wilcox age outside of Texas. These four are: *Flabellum conoideum, Flabellum conoideum* var. *matthewsense, Balanophyllia ponderosa,* and *Haimesiastraea conferta.*

Flabellum conoideum, which is fairly abundant and widespread in the Texas Midway, is reported from both the Sucarnoochee clay and Naheola formation of Alabama; *F. conoideum* var. *matthewsense,* also well represented in Texas, appears to be restricted outside of Texas to the beds of the Naheola formation at Matthews Landing, Alabama; *Balanophyllia ponderosa,* represented in several localities in Texas by the varietal form *texana,* is reported elsewhere only from beds of the Clayton in the vicinity of Prairie Creek, Wilcox County, Alabama; while *Haimesiastraea conferta,* appearing in the Clayton, persists until Wilcox time, being found in formations referred to that epoch in Alabama; South Carolina, and Maryland.

Five of the eight genera to which the Texas Midway corals are referred are represented among living species. These five genera—*Flabellum, Caryophyllia, Trochocyathus, Paracyathus,* and *Balanophyllia*—are all of wide geographic distribution, some being practically cosmopolitan. They appear in the deeper and colder seas as well as in the shallower waters. No very definite testimony as to

the conditions of depth or temperature under which the Texas Midway sediments were deposited is thus offered by the contained coral fauna.

FLABELLUM CONOIDEUM Vaughan

Pl. 3, fig. 1

1894. *Flabellum conoideum* Vaughan nom. nud., Rept. Geol. Coastal Plain Alabama, Geol. Survey Alabama, p. 248.

1900. *Flabellum conoideum* Vaughan, U. S. Geol. Survey, Mon. 39, p. 56, pl. 3, figs. 1–4.

In 1900, Vaughan (29aa, p. 56) described this species as follows:

Attached by a small short pedicel. Slightly compressed conical in shape. No lateral wing or lateral processes. Cross section elliptical, rounded at the ends of the longer transverse axis, not angular, as is usually the case with the others of our Eocene species of *Flabellum*. Obscure costae correspond to the primary and secondary septa. Lines of growth are well marked; sometimes corresponding to them are girdling, rather shallow, depressions. The wall is thin at its upper edge, but thick in its lower portion, owing to internal calcareous deposit. Epitheca well developed, extending to the upper edge of the corallum wall. Septa slightly exsert, margins entire; inner free portion undulated, sides granulate. In the adult there are 16 principal septa. Septal arrangement four complete cycles, members of the fifth cycle appearing near the ends of the longer transverse axis. . . . The columella is typical for the genus, *i.e.*, is formed by the fusion of septal trabeculae. Calice not very deep. . . .

Dimensions of a specimen from U.S.G.S. Sta. 11946.—Altitude, 13.3 millimeters; greater diameter of calice, 11.2 millimeters; lesser diameter of calice, 9.0 millimeters.

Type locality.—Prairie Creek, Wilcox County, Alabama.

Types.—U. S. Nat. Mus. No. 157851.

Outside of Texas this species of *Flabellum* is abundantly represented in the Midway Eocene beds in the vicinity of Prairie Creek and Matthews Landing, Wilcox County, Alabama. The Texas forms are, on the average, perhaps slightly more elongate and more slender than the Alabama specimens, but this difference is not a constant one.

Occurrence.—Midway group. *Navarro County:* U.S.G.S. Sta. 10846, about 4 miles south of Wortham. *Limestone County:* U.S. G.S. Sta. 11948, Tehuacana (top member of Kincaid formation), Mexia. *Williamson County:* U.S.G.S. Sta. 10796, upper bed on Dry Brushy Creek 6 miles south of Thrall, on Taylor-Beaukiss road.

Bastrop County: U.S.G.S. Sta. 11913, Colorado River, 2 miles below Travis-Bastrop County line. *Caldwell County:* U.S.G.S. Sta. 10794, about 4.6 miles west and a little north of Lockhart in gully at jog in secondary road.

FLABELLUM CONOIDEUM var. MATTHEWSENSE Vaughan

Pl. 3, fig. 2

1900. *Flabellum conoideum* var. *matthewsense* Vaughan, U. S. Geol. Survey, Mon. 39, p. 58, pl. 3, figs. 5–6a.

Vaughan characterized this variety as follows:

Differs from typical *F. conoideum* in having well-developed costae, corresponding to the first and second cycles of septa, but grades directly into the typical form of the species.

All of the specimens of this variety that were examined have only 12 principal septa each. The epitheca is decidedly of the character of that of *F. lerchi*. It is highly probable that the latter species is a descendant of this variety.

Dimensions of a specimen from U.S.G.S. Sta. 10527.—Altitude, 14.9 millimeters; greater diameter of calice, 10.0 millimeters; lesser diameter of calice, 8.6 millimeters.

Type.—U. S. Nat. Mus. No. 157853.

Type locality.—Matthews Landing, Wilcox County, Alabama.

The only reported occurrence of this variety outside of Texas is from the type locality.

Occurrence.—Kincaid formation (lower Midway). *Navarro County:* U.S.G.S. Sta. 10846, about 4 miles south of Wortham. *Williamson County:* U.S.G.S. Sta. 11903, Dry Brushy Creek on Harvey Henson farm, 5 miles southeast of Coupland; U.S.G.S. Sta. 10420, Dry Brushy Creek, 6 miles south of Thrall, Taylor-Beaukiss road. *Bastrop County:* U.S.G.S. Sta. 11697, gully south of Cedar Creek, Lytton Springs road, 1 mile south of Cedar Creek; U.S.G.S. Sta. 11696, Colorado River, 1½ miles below Travis-Bastrop County line; and U.S.G.S. Sta. 10527, Colorado River, one-fourth mile above mouth of Dry Creek, about 4½ miles downstream from Webberville. *Guadalupe County:* U.S.G.S. Sta. 11702, 1½ miles southwest of Fentress.

FLABELLUM TEXENSE Vaughan and Popenoe new species

Pl. 3, figs. 3–5

Corallum compressed-conical in shape, base with a slight pedicel, not very sharply set off from the rest of the corallum. Cross section

subelliptical with a pronounced angle at the two ends of the greater diameter of the calice. Margin of the corallum in the longitudinal plane through the greater diameter of the calice, crenate and convexly curved. Outline in the longitudinal plane through the lesser diameter, almost straight or slightly concave.

Septa 48 in number in four complete cycles. Septa of the first and second cycles rather thick, those of the first cycle being somewhat the thicker, both cycles reaching the columella and fusing with it. Septa of the third and fourth cycles thin, and free on their inner margins. Septal faces sparsely granulate. Columella typical for the genus.

Costae opposite the first two cycles of septa, prominent at the rim of the corallum, those opposite the first cycle of septa prominent to the base. Margins along the ends of the major axis of the calice produced into a narrow keeled or winglike process which is transversely wavy in outline. Epitheca thin and polished, extending to the rim of the corallum.

Dimensions of the type.—Altitude, 9.5 millimeters; greater diameter of the calice, 7.6 millimeters; lesser diameter of the calice, 6.5 millimeters.

Type.—U. S. Nat. Mus. No. 371034.

Type locality.—U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line, Bastrop County, Texas.

Flabellum texense finds its closest analogues in the varieties of *F. cuneiforme* Lonsdale, common in the middle and upper Eocene of the Gulf Coastal Plain. The closest resemblance is between *F. texense* and *F. cuneiforme* var. *pachyphyllum* Gabb and Horn, represented in beds of lower Claiborne age from Alabama to Texas. The Claiborne variety is so similar, in the character of its costae and epitheca, in the appearance of its lateral wings, and in its general shape, to *F. texense* as to suggest that the latter species represents an ancestral form of *F. cuneiforme* and its varieties. The features distinguishing *F. texense* from *F. cuneiforme* var. *pachyphyllum* are its smaller size, fewer septa, with only 12 principal ones, fewer prominent costae, narrower basal portion, and more broadly ovate calicular outline.

Occurrence.—Kincaid formation. *Bastrop County:* U.S.G.S. Sta. 11696, Colorado River, 1½ miles below the Travis-Bastrop County

line; and U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line.

TROCHOCYATHUS COLORADOENSIS Vaughan and Popenoe new species

Pl. 3, figs. 6, 7

Corallum small, simple, subconical, with a blunted, laterally compressed, and overturned base. Calicular outline broadly elliptical to circular. Fossa shallow.

Septa exsert, 36 in number in the larger specimens, in three complete cycles with some septa of the fourth cycle present. Septa of the first cycle stouter than the remainder, reaching the center of the calice and fusing there to form the columella. Septa of the second cycle reaching nearly to the center of the calice and fusing by their inner margins to the faces of the septa of the first cycle on either side. Septa of the second cycle not so stout as those of the first cycle but much stouter than those of the third and fourth cycles, which are narrow, thin, and free on their inner margins. Pali in two crowns before the first two cycles of septa, the narrower pali being before the septa of the first cycle. Septal faces granulate. Septal upper margins entire, rounded.

Costae corresponding in number to the septa, prominent at the rim of the corallum, inverted V-shaped in cross section, coarsely granulate on the crests and sides, becoming more obscure, lower, and more rounded in outline toward the base. Intercostal areas deep at the rim, shallower lower down on the corallum wall. The center of each area usually ornamented with a fine, raised, granulate stria extending from the calicular rim nearly to the base.

Dimensions of a cotype.—Altitude, 5.0 millimeters; diameter, 4.5 millimeters.

Dimensions of a second cotype.—Altitude, 7.0 millimeters; diameter of calice at the widest part, 6.0 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371035.

Type locality.—U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line, Bastrop County, Texas. Above the *Venericardia bulla* zone.

Trochocyathus coloradoensis bears a superficial resemblance to *T. speciosus* (Gabb and Horn) from the Midway Eocene of Hardeman

County, Tennessee, in the general shape of the corallum and in the shape and granulation of the costae. *T. speciosus* is a larger coral than is *T. coloradoensis*, however, possesses more costae and septa, and has a fascicular columella with a pronouncedly depressed summit, while the columella of *T. coloradoensis* consists merely of the thickened and fused inner edges of the pali opposite the first and second cycles of septa, and lies very slightly below the level of the top of the cup. *T. woolmani* from the Matawan group (Upper Cretaceous) of New Jersey is also similar in superficial appearance to *T. coloradoensis*, and apparently approaches it closely in size. *T. woolmani* has only three cycles of septa, however, slender and inconspicuous pali, a fascicular columella, and distinct rows of granules along the costal crests, while *T. coloradoensis* usually has more than three cycles of septa, rather large and conspicuous pali, and small, scattered granules irregularly distributed over the costae.

Occurrence.—Kincaid formation. *Kaufman County:* U.S.G.S. Sta. 11665?, Water Hill, 5 miles northeast of Kemp. *Williamson County:* U.S.G.S. Sta. 10420, Dry Brushy Creek, 6 miles south of Thrall on Taylor-Beaukiss road. *Bastrop County:* U.S.G.S. Sta. 11696, Colorado River, 1½ miles below the Travis-Bastrop County line; and U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line.

TROCHOCYATHUS UBER Vaughan and Popenoe new species

Pl. 3, figs. 8, 9

Corallum large, simple, mammiform, with a short nipple-like base. Calice nearly circular in outline, axial fossa round, not very deep.

Septa 58 to 60 in number in most specimens, in four complete cycles with some septa of the fifth cycle; exsert, those of the first and second cycles sometimes projecting as much as 2.0 millimeters above the top of the wall. Septa of the first and second cycles reaching the columella, those of the first cycle slightly stouter than those of the second. Septa of the third cycle thinner than those of the second, extending about two-thirds of the way from the wall to the columella, and fusing by their inner margins to the faces of the septa of the second cycle lying beside them. A few of the septa of the fourth cycle fusing by their inner margins to the faces of the third-cycle septa beside them. Pali before all of these. Remaining

septa narrow and thin and free on their inner margins. Septal upper margins arcuate, thinner and dentate toward the wall, thicker and smoother toward the columella. Almost vertical rows of granules ornamenting the septal faces, sometimes fusing near the upper margins to form short striae and alternating in position on opposite sides of the septal wall, giving a laterally wavy cross section to the septum when viewed from above. Septa noticeably thicker at the wall. Columella depressed below the level of the calicular rim, papillate on the summit.

Costae corresponding to the septa in number. Those opposite the first two cycles of septa the most prominent and projecting farthest above the top of the cup. Those of the third cycle not so prominent as those of the first two cycles but larger and more prominent than those opposite the fourth and fifth cycles. All costae granulate on the sides and crests.

Epitheca prominent and thick over the lower two-thirds of the corallum wall, with irregular encircling growth lines, thinner above, and consisting of discontinuous encircling shreds and wisps.

Dimensions of a cotype.—Altitude, 11.2 millimeters; diameter of calice, 17.3 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371032.

Type locality.—U.S.G.S. Sta. 10846, 3½ to 4 miles south of Wortham, Navarro County, Texas.

This species greatly resembles *T. hyatti* Vaughan from the Midway Eocene beds at Black Bluff and Prairie Creek, Alabama, in its general features and septal arrangement. *T. hyatti* is more acutely conical in shape than the Texas species, however, has straighter sides, fewer septa, and usually is covered farther up the wall with epithecal deposit. In addition, all of the specimens of *T. hyatti* in the National Museum collections are much smaller than the smallest specimen of *T. uber*.

Occurrence.—Kincaid formation. *Navarro County:* U.S.G.S. Sta. 10846, about 4 miles south of Wortham. *Limestone County:* U.S. G.S. Sta. 11948, Tehuacana (top member of Kincaid formation), Mexia.

PARACYATHUS BASTROPENSIS Vaughan and Popenoe new species

Pl. 3, figs. 10, 11

Corallum simple, obtusely conical, usually slightly curved in the plane of the longer calicular diameter. Outline of the calice broadly elliptical. Fossa fairly deep.

Septa 48 in number, arranged in four complete cycles, the septa of the first three cycles reaching the columella, the septa of the fourth cycle reaching nearly to the columella and fusing by their inner margins to the lateral faces of the septa of the third cycle. Pali numerous before the first three cycles of septa. Those before the first two cycles subequal, stout, rather narrow. Those before the third cycle thinner and wider than those before the first two cycles. Lateral faces of the septa ornamented with minute, rather closely crowded, irregularly distributed spines. Summit of the columella depressed and papillate.

Costae corresponding to septa. Those opposite the first three cycles of septa low, narrow, subequal, bearing a single row of granules on the crests and extending to the base of the corallum. Those opposite the fourth cycle of septa less prominent than the costae opposing the first three cycles of septa but similarly ornamented. Wall smooth and slightly polished.

Dimensions of a cotype.—Altitude, 6.6 millimeters; greater diameter of calice, 7.6 millimeters; lesser diameter of calice, 6.7 millimeters.

Dimensions of a second cotype.—Altitude, 5.9 millimeters; greater diameter of calice, 7.3 millimeters; lesser diameter of calice, 5.9 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371040.

Type locality.—U.S.G.S. Sta. 11696, Colorado River, 1½ miles below the Travis-Bastrop County line, Bastrop County, Texas.

Occurrence.—Kincaid formation. *Bastrop County:* U.S.G.S. Sta. 11696, Colorado River, 1½ miles below the Travis-Bastrop County line; and U.S.G.S. Sta. 10527, Colorado River, one-fourth mile above the mouth of Dry Creek, 4¼ to 4¾ miles downstream from Webberville.

CARYOPHYLLIA MEDIAVIA Vaughan and Popenoe new species

Pl. 3, figs. 12, 13

Corallum simple, subconical, with a small subpedicellate base usually, though not always, curved in the plane of the greater diameter, set off from the rest of the corallum by a constriction and terminating with a small scar of attachment. Calicular outline broadly elliptical. Margins at the ends of the major calicular axes somewhat lower than the margins near the ends of the minor axes. Corallum encircled with three or four depressed zones.

Septa about 40 in number, 20 reaching the columella and being alternately thicker and thinner, 20 alternating septa being thin, narrow, and free on their inner margins. Pali in a single crown, opposing the ten thinner members of the principal septa, broad, thin, projecting slightly above the columellar summit, and each terminating on the inner margin in a twisted lamella. Septal faces granular. Columella trabeculate with a depressed summit.

Costae corresponding to the septa, the more prominent costae opposing the thicker septa, prominent at the calicular rim, obscure toward the base. Cross section of costae at rim inverted V-shaped with prominent granulae on the crests and sides, cross section below the calicular margin a low, rounded arch. Crests finely granular. Wall smooth.

Dimensions of the type.—Altitude, 10.4 millimeters; greater diameter of calice, 9.4 millimeters; lesser diameter of calice, 8.3 millimeters.

Type.—U. S. Nat. Mus. No. 371041.

Type locality.—U.S.G.S. Sta. 10527, Colorado River, one-fourth mile above the mouth of Dry Creek, Bastrop County, Texas.

Caryophyllia mediavia is almost identical in its general appearance and septal arrangement with *Trochocyathus cingulatus* Vaughan, described from a unique specimen from beds of probable Midway age in the vicinity of Prairie Creek, Wilcox County, Ala. This single specimen is incomplete, the top of the calice being broken away and the upper septal margins being lacking. For this reason the palar characters of *T. cingulatus* cannot be certainly determined, but such characters as are present suggest that *T. cingulatus* may prove to be *Caryophyllia* rather than *Trochocyathus* and that *T. cingulatus* and *C. mediavia* are varieties of the same species. Until

specimens of *T. cingulatus* are available which will determine its genus definitely, however, the species must be considered separate.

Occurrence.—Kincaid formation. *Williamson County:* U.S.G.S. Sta. 11903, Dry Brushy Creek on Harvey Henson farm, about 5 miles southeast of Coupland. *Bastrop County:* U.S.G.S. Sta. 10527, Colorado River, one-fourth mile above mouth of Dry Creek, about 4½ miles downstream from Webberville. *Caldwell County:* U.S. G.S. Sta. 10794, about 4½ miles west and a little north of Lockhart in gully in secondary road. *Maverick County:* U.S.G.S. Sta. 11873?, 4 miles northwest of Burke ranch house and 3.3 miles southeast of Chilipitin tank.

CARYOPHYLLIA DUMBLEI Vaughan and Popenoe new species

Pl. 3, figs. 14–16

Corallum cornute, nearly straight to slightly curved in the plane of the longer diameter of the calice, encircled from base to top with three or four shallow, smooth, regular constrictions lying in the plane perpendicular to the axis of the columella. Base subpedicellate with a small scar of attachment in the younger forms, apparently free in the larger specimens. Cross section of corallum ovate or elliptical. Fossa shallow.

Septa 40 in number, 10 being rather stout, and reaching to and fusing with the columella; an alternate 10 also reaching to and fusing with the columella, but not quite so stout; the remaining 20 septa alternating with the principal 20, thin, narrow, fragile, apparently free on their inner margins. Septa ornamented on the lateral faces with ascending rows of granules passing inward from the wall to the columella, the larger granules in each row being nearer the columella.

Costae corresponding in number and size to the septa, those opposite the 10 stoutest septa being prominent, irregular, transversely wrinkled along the crests, and extending to the base of the corallum, those opposite the secondary group of 10 septa being not so prominent as those opposite the 10 stoutest septa, and not extending to the base of the cup but being similar to the larger costae in ornamentation, those costae opposite the 20 small septa being obscure, and indicated usually only by a low granular or transversely wrinkled stria opposite each septum. Costae apparently not the outer edges of the septa, appearing rather to be longitudinal

folds or wrinkles of the outer wall opposite the outer septal margins. Wall rather thick. Intercostal areas smooth and lustrous, or finely pustulate.

Dimensions of a cotype.—Altitude, 14.0 millimeters; greater diameter of the calice, 9.5 millimeters; lesser diameter of the calice, 8.4 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371036.

Type locality.—U.S.G.S. Sta. 11948, Tehuacana (top member of Kincaid formation), Mexia, Limestone County, Texas.

This fine coral appears to be quite distinct from any other of our American species of *Caryophyllia.* The species is named for the late Edwin T. Dumble, an outstanding pioneer figure in geological work in East Texas.

Occurrence.—Kincaid formation. *Kaufman County:* U.S.G.S. Sta. 11665, Water Hill, 5 miles northeast of Kemp. *Navarro County:* U.S.G.S. Sta. 10846, about 4 miles south of Wortham. *Limestone County:* U.S.G.S. Sta. 11948, Tehuacana member, Mexia. *Milam County:* U.S.G.S. Sta. 11926, Milam Bluff, Brazos River (bed No. 4), 0 to one-fourth mile below the Milam-Falls County line. *Williamson County:* U.S.G.S. Sta. 11903, Dry Brushy Creek on Harvey Henson farm, about 5 miles southeast of Coupland. *Bastrop County:* U.S. G.S. Sta. 10527, Colorado River, one-fourth mile above mouth of Dry Creek, about 4½ miles downstream from Webberville; and U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line. *Caldwell County:* U.S.G.S. Sta. 11699, William Mercer well, 2 miles southwest of Joliet, 8 miles (air line) due south of Lockhart.

CARYOPHYLLIA CONSTRICTA Vaughan and Popenoe new species

Pl. 3, figs. 17, 18

Corallum small, slender, elongate-conical, with a rather prominent, expanded base set off from the rest of the corallum by a constriction and slightly bent to one side. Scar of attachment preserved. Longitudinal outline of the corallum uneven because of several irregularly alternating encircling constrictions and swellings on the outside of the wall. Cross section of corallum circular.

Septa 24 in number, arranged in three complete cycles. Septa of the first cycle reaching the center of the calice, their inner margins apparently fusing to form the columella. The septa of the second

cycle reaching very nearly to the center of the calice and fusing by their inner margins to the lateral faces of the septa of the first cycle lying on either side of them. The septa of the third cycle reaching about two-thirds of the distance from the wall to the center of the calice and fusing by pairs to the opposite sides of the septa of the second cycle lying between each pair. Septa subequal in thickness with little or no thickening at the wall. Septal faces ornamented with numerous short blunt spines. Pali in one crown before the second cycle of septa, thin, rather wide, with bent upper edges.

Costae corresponding in number to the septa, thin, ragged, uneven in height and thickness, occasionally obscured by the epitheca along the depressed zones of the external surface of the corallum but elsewhere usually projecting up through the epithecal layer. Wall thin. Epitheca prominent, showing fine growth lines slightly higher along the sides of the costae than in the middle of the intercostal area, thus giving a festooned appearance to the outside of the corallum.

Dimensions of a cotype.—Altitude, 5.6 millimeters; diameter, 3.1 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371033.

Type locality.—U.S.G.S. Sta. 10420, lower bed, Dry Brushy Creek, 6 miles south of Thrall, Williamson County, Texas.

This species appears to be quite distinct from any other described species of Eocene corals. Its small size, thin and ragged costae, and peculiar irregularly swollen appearance are its most distinctive characters.

Occurrence.—Kincaid formation. *Williamson County:* U.S.G.S. Sta. 10420, Dry Brushy Creek, 6 miles south of Thrall, Taylor-Beaukiss road. *Bastrop County:* U.S.G.S. Sta. 10527, Colorado River, one-fourth mile above mouth of Dry Creek, about 4½ miles downstream from Webberville.

PLATYTROCHUS PRIMAEVUS Vaughan and Popenoe new species

Pl. 3, figs. 19, 20

Corallum small, simple, compressed-conoidal in form, with a slender pedicellate base. Cross section elliptical. Margins at the ends of the major axes of the calice depressed somewhat below the level of the margins along the broader faces.

Septa 44 in number, 22 reaching to and fusing with the columella, being stouter than the remainder, 22 thinner and narrower septa

alternating with the principal ones fusing in pairs to opposite faces of the principal septum lying between each pair, each alternate septum of the 22 principal ones thus having a smaller septum fused to each of its lateral faces. Septal faces granular, the rows of granules roughly parallel to the upper septal margins. Septal upper margins smooth, exsert, arcuate. Columella elongate and narrow with a papillate summit.

Costae corresponding in number to the septa, thin, prominent, rather high at the rim of the corallum, lower and slightly more rounded over the crests toward the base of the cup. Twelve costae opposite twelve of the principal septa slightly higher and more prominent than the remainder and extending to the base of the corallum. Twelve costae alternating in position with the larger twelve not so prominent, and extending on the corallum wall about two-thirds of the distance from the rim toward the base. Costae corresponding to the smallest septa extending about one-third of the distance from the corallum rim to the base. Costal crests slightly dentate near the rim of the corallum, and on the costae near the ends of the major axis of the calice. Costae toward the base of the corallum usually discontinuous, and represented by short rows of a few prominent granules, particularly at the basal ends of the costae near the major calicular axes. Intercostal areas smooth or superficially pitted. Epitheca apparently absent.

Dimensions of the holotype.—Altitude, 4.7 millimeters; greater diameter of the calice, 5.6 millimeters; lesser diameter of calice, 3.6 millimeters.

Dimensions of the paratype.—Altitude, 4.6 millimeters; greater diameter of calice, 5.0 millimeters; lesser diameter of calice, 3.4 millimeters.

This species is described from two specimens from two different localities. The holotype has been broken at one end of the major calicular axis, and the paratype has had the lower portion of the base broken away; thus the dimensions given above are not those of perfect specimens.

Holotype.—U. S. Nat. Mus. No. 371031; paratype: U. S. Nat. Mus. No. 371030.

Type locality.—U.S.G.S. Sta. 11913, Colorado River, 2 miles below the Travis-Bastrop County line, Bastrop County, Texas.

This pretty little coral is quite distinct from the other species of *Platytrochus* reported from the American Eocene, and is the earliest reported occurrence of the genus. Some immature specimens of *P. claibornensis* de Gregorio from the Claiborne Eocene of Alabama resemble *P. primaevus* in having nearly smooth costal ridges on the broad face of the cup, and in their septal number and arrangement. They are to be immediately distinguished from *P. primaevus*, however, by their more broadly rounded and more densely granular bases, their wider costae with correspondingly narrower and shallower intercostal spaces, and in their more elongate appearance.

Occurrence.—Kincaid formation. *Bastrop County:* U.S.G.S. Sta. 11902, Wilbarger Creek, one-half mile below Travis-Bastrop County line; and U.S.G.S. Sta. 11913, Colorado River section.

HAIMESIASTRAEA CONFERTA Vaughan

Pl. 4, figs. 1, 2

1900. *Haimesiastraea conferta* Vaughan, U. S. Geol. Survey, Mon. 39, p. 145, pl. 15, figs. 6–9; pl. 16, all figs.

1922. *Haimesiastraea conferta* Vaughan, Corals from the Eocene deposits of Peru: The geology and paleontology of northwest Peru, Section D, pp. 125, 131, pl. 22, figs. 1, 1a.

In 1900, Vaughan (29aa, p. 145) described this species as follows:

Colony rather massive, ramous. Corallites crowded together, rather shallow, subhexagonal in outline; calices circular, 1.5 mm. in diameter; the margins project very slightly above the rather dense coenenchyma. The coenenchymal walls between the calices frequently 1 mm. thick on the older portions of the colony. Costae distinct, corresponding to all cycles of the septa, granulate. The costae of one calice meet those of the adjoining calices. The line of the junction usually indicated by a delicate ridge. The whole outer surface of the coenenchyma is minutely granulate. The axial portions of the branches are spongy. In the axial portion the corallites are joined to one another directly by their walls or costae, or are separated by exotheca. As the colony grows older, the corallites bend outward, so that ultimately their axes are nearly at right angles to the external surface. Septa in three cycles; those of the first and second cycles reach the columella; margins entire; surfaces smooth; inner ends of those of the first and second cycles somewhat thickened. From the sides of the septa wing-like processes are developed, which extend across the interseptal loculi and fuse, thus forming the endotheca. The dissepiments are often inclined; are very abundant. No pali. Columella well developed, false, formed by the fusion of the internal margins of the septa of the first and second cycles. Its upper surface is not seen from above in perfect calices, and it is not revealed until a section of the corallite is made.

Type.—U. S. Nat. Mus. No. 158303.

Type locality.—Greggs Landing, Ala.

A single fragment of a corallum from Indio Wells represents the only recorded occurrence of this species in Texas. The surface of the corallum is considerably eroded so that the costae are distinguished with difficulty and the calices appear shallower than in well preserved specimens of *H. conferta.* The corallites are rather closely crowded, the intercorallite areas averaging about 0.8 millimeters in width.

Haimesiastraea conferta is one of the most widespread of our American Eocene coral species. Specimens referred to this species are found at various horizons in the Midway and Wilcox groups of Alabama; in the Black Mingo formation (probably of Wilcox age) in South Carolina; and in the Aquia formation (of Wilcox age) at Upper Marlboro, Prince Georges County, Maryland.

Other species of *Haimesiastraea,* to be distinguished only with difficulty from *H. conferta,* have been described by Vaughan (29aa, p. 146) from beds of doubtful Eocene age near Martinez, Contra Costa County, California, and from middle Eocene deposits of northwest Peru (48a, p. 130). Vaughan suggests (48a, p. 125) that these occurrences indicate a possible connection between the Atlantic and Pacific oceans across Central America prior to Lutetian time. The occurrence of *Haimesiastraea* in the Eocene of Texas in a locality geographically intermediate to the reported occurrences of the other species of this genus lends support to this suggestion.

Occurrence.—Kincaid formation. *Maverick County:* U.S.G.S. Sta. 11758, about 29 miles southeast of Eagle Pass.

SEPTASTREA? KERIOIDES Vaughan and Popenoe new species

Pl. 4, figs. 3–5

Corallum incrusting. Corallites closely crowded, subhexagonal to pentagonal in outline, attached to one another directly by their walls, rather shallow, averaging about 4.0 millimeters in depth. Calicular rim projecting from 1.0 to 1.5 millimeters above the upper septal margins. Calices usually 3.5 millimeters to 4.0 millimeters in diameter. Fossa broad and shallow.

Septa 24 in number arranged in three complete cycles, and six systems, thin, almost straight in vertical section, usually slightly

wavy or undulating in cross section. Septa of the first cycle extending to, or nearly to, the center of the calice, fusing by their inner margins to form a false columella, in some individuals the septa nearest the longer calicular diameter being the only ones to reach the center of the calice, the remaining septa of the first cycle turning to one side and fusing to the faces of the longer septa slightly to one side of the center of the calice. Septa of the second cycle usually extending about halfway from the wall to the center of the calice, sometimes free on their inner margins, sometimes fused to the faces of first-cycle septa beside them. Septa of the third cycle thin, free and inconspicuous, almost rudimentary. Septal faces probably smooth, slightly undulate. No pali evident. Dissepiments probably lacking, the interseptal loculi appearing open to the bases of the corallites. Corallite walls thin, ordinarily from .3 millimeter to .4 millimeter in thickness. Juncture of the walls of adjacent corallites indicated by a fine, irregular line.

Type.—U. S. Nat. Mus. No. 371042.

Type locality.—U.S.G.S. Sta. 11937, Rocky Crossing, Little Brazos River, just below bridge on Kosse road, Limestone County.

This species is quite distinct from any other known American Tertiary coral, and probably represents a new genus. The specimen from which this study is made is an encrusting patch upon the surface of a fragment of impure limestone. The revealed surface of the corallum is much eroded, and the calices are filled nearly to the rims with a compact limy deposit so that it is necessary to work out the internal structure from sections. There is also some suggestion that the surfaces of the walls and septa have been altered by solution. These conditions have masked or destroyed structures of systematic importance, such as the ornamentation of the surface of the corallum, and of the septal faces, and the structure of the septal margins. For these reasons, and for the reason that the characteristic features of a coral are not always fully revealed in the encrusting form, it is thought best to refer this species to the genus which it appears to resemble most closely, until material is available which will permit the complete structure of the species to be determined.

Occurrence.—Kincaid formation. *Falls County:* U.S.G.S. Sta. 11937, Rocky Crossing, Little Brazos River, just below bridge on Kosse road.

BALANOPHYLLIA PONDEROSA var. TEXANA Vaughan and Popenoe new variety

Pl. 4, figs. 6-12

Corallum cornute to subconical, nearly straight in some specimens, usually curved, sometimes sharply curved near the base, the plane of curvature bearing no apparent constant relation to the planes of the calicular axes. Larger specimens usually free, smaller specimens free or with a small scar of attachment. Longitudinal outline of the corallum ordinarily marked with several irregular, encircling, constricted areas. Cross section subelliptical. Fossa, narrow and deep.

Septa usually about 65 in number, in a few specimens as many as 90, the 24 septa of the first three cycles reaching the columella and fusing to it by their inner margins, the remaining smaller septa fusing in groups of 3 or 4 to the lateral faces of alternates of the 24 principal septa, 12 of the 24 septa of the first three cycles thus having no other septa attached to them, each of the remaining alternate 12 having 3 or 4 smaller septa fused to its face. Columella spongy, summit papillate, convexly rounded, much depressed below the level of the rim of the corallum. Septal faces ornamented with sub-parallel rows of low, elongate granules, the rows apparently ascending slightly passing inward from the wall. Inner margins of the septa transversely wavy in vertical section, smooth or slightly wavy in profile at the top of the corallum, sometimes lobate just above the summit of the columella.

Costae apparently corresponding to the septa, low, flat-topped, and smooth toward the base of the corallum, farther up on the wall bearing a single row of rounded granules which seem to elongate laterally near the top of the cup and disintegrate into numerous, irregularly arranged, crowded, small granulae surmounting the costal crests. Twelve uniformly spaced costae on most of the specimens slightly more prominent than those remaining. Epitheca a thin chalky layer with thicker, irregular, encircling strands sometimes heavy enough to conceal the granular crests of the costae. Wall thick and spongy. Intercostal areas perforate.

Dimensions of a curved specimen (cotype).—Altitude, 22.5 millimeters; greater diameter at top of calice, 11.5 millimeters; lesser

diameter at top of calice, 6.6 millimeters; greater diameter, 5.0 millimeters below top of calice, 11.7 millimeters; lesser diameter, 5.0 millimeters below top of calice, 8.7 millimeters; depth of fossa, 3.8 millimeters.

Dimensions of a straight specimen (cotype).—Altitude, 25.0 millimeters; greater diameter of calice, 9.9 millimeters; lesser diameter of calice, 8.7 millimeters; depth of fossa, 4.0 millimeters.

Cotypes.—U. S. Nat. Mus. No. 371043.

Type locality.—U.S.G.S. Sta. 10846, 3½ to 4 miles south of Wortham, Navarro County, Texas.

This protean variety includes a series of forms ranging from stout, coarse, nearly straight forms very similar to typical *B. ponderosa*, through an intermediate series of stout, more or less curved individuals, to slender, curved, sometimes sharply curved, end-members. As a rule, the nearly straight stout forms reminiscent of typical *B. ponderosa*, have more than 70 septa, are free, have subequal costae, and include the largest specimens of the collection. These grade directly into a series of stout, curved forms that may be considered typical of the variety *texana*. The members of this second group are ordinarily curved evenly and moderately, have prominent encircling depressions on the corallum wall, generally show 12 evenly spaced costae more prominent than the remainder, have about 64 septa, and are free in the larger individuals. A few more slender, curved forms, some with a sharply curved basal portion, represent the extreme departure of the variety from the shape and size of typical *B. ponderosa*.

B. ponderosa var. *texana* is to be distinguished from specimens of typical *B. ponderosa* by its smaller size, fewer septa, and its usually more arcuate outline. Of the other species of *Balanophyllia* reported from the Texas Eocene, typical *B. augustinensis*, from the lower Claiborne of San Augustine, is more slender, more elongate, has a less prominent columella, and more coarsely granular costae. The several varieties of *B. irrorata* from the Texas Claiborne are to be distinguished from *B. ponderosa* var. *texana* by their very slight development of epitheca and their costae bearing a single row of coarse granules.

Occurrence.—Kincaid formation. *Bastrop County:* U.S.G.S. Sta. 11696, Colorado River, 1½ miles below the Travis-Bastrop County line. *Freestone County:* U.S.G.S. Sta. 7424, city well at Wortham. *Navarro County:* U.S.G.S. Sta. 10846, about 4 miles south of Wortham. *Limestone County:* U.S.G.S. Sta. 11948, Tehuacana (top member of Kincaid formation), Mexia.

PLATES 3–28

PLATE 3

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1. *Flabellum conoideum* Vaughan 326
   Side view of corallum; altitude, 16.9 mm.; greater diameter of calice, 11.1 mm.; lesser diameter of calice, 9.1 mm.
2. *Flabellum conoideum* var. *matthewsense* Vaughan 327
   Side view of corallum; altitude, 12.9 mm.; greater diameter of calice, 10.2 mm.; lesser diameter of calice, 8.0 mm.

3–5. *Flabellum texense* Vaughan and Popenoe new species 327

3. View of corallum, broader face (type); altitude, 9.5 mm.; greater diameter of calice, 7.6 mm.; lesser diameter of calice, 6.5 mm.
4. View of corallum, narrower face (type); altitude, 9.5 mm.; greater diameter of calice, 7.6 mm.; lesser diameter of calice, 6.5 mm.
5. Calice (type); greater diameter of calice, 7.6 mm.; lesser diameter, 6.5 mm.

6–7. *Trochocyathus coloradoensis* Vaughan and Popenoe new species 329

6. View of corallum (cotype); altitude, 5.0 mm.; diameter of calice, 4.5 mm.
7. Calice (cotype); altitude, 5.0 mm.; diameter of calice, 4.5 mm.

8–9. *Trochocyathus uber* Vaughan and Popenoe new species 330

8. View of corallum (cotype); altitude, 11.2 mm.; diameter of calice, 17.3 mm.
9. View of calice (cotype); altitude, 11.2 mm.; diameter of calice, 17.3 mm.

10–11. *Paracyathus bastropensis* Vaughan and Popenoe new species 332

10. View of corallum (cotype); altitude, 6.6 mm.; greater diameter of calice, 7.6 mm.; lesser diameter of calice, 6.7 mm.
11. View of calice (cotype); altitude, 6.6 mm.; greater diameter of calice, 7.6 mm.; lesser diameter of calice, 6.7 mm.

12–13. *Caryophyllia mediavia* Vaughan and Popenoe new species 333

12. View of corallum (type); altitude, 10.4 mm.; greater diameter of calice, 9.4 mm.; lesser diameter of calice, 8.3 mm.
13. View of calice (type); altitude, 10.4 mm.; greater diameter of calice, 9.4 mm.; lesser diameter of calice, 8.3 mm.

14–16. *Caryophyllia dumblei* Vaughan and Popenoe new species 334

14. View of corallum (cotype); altitude, 14.0 mm.; greater diameter of calice, 9.5 mm.; lesser diameter of calice, 8.4 mm.
15. View of calice of a specimen, to show septa.
16. View of costae, considerably enlarged, to show ornamentation.

17–18. *Caryophyllia constricta* Vaughan and Popenoe new species 335

17. View of corallum (cotype); altitude, 5.6 mm.; diameter of of calice, 3.1 mm.
18. View of calice (cotype); altitude, 5.6 mm.; diameter of calice, 3.1 mm.

19–20. *Platytrochus primaevus* Vaughan and Popenoe new species 336

19. View of corallum, broader side (holotype); altitude, 4.7 mm.; greater diameter of calice, 5.6 mm.; lesser diameter of calice, 3.6 mm.
20. View of calice (holotype); altitude, 4.7 mm.; greater diameter of calice, 5.6 mm.; lesser diameter of calice, 3.6 mm.

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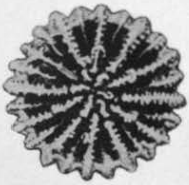

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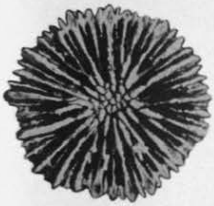

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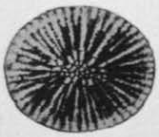

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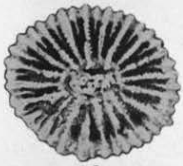

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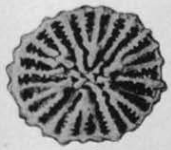

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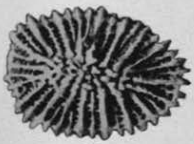

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PLATE 4

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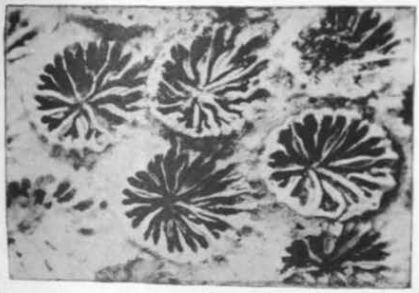

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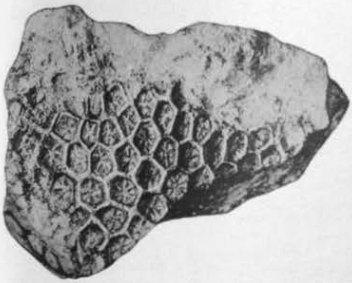

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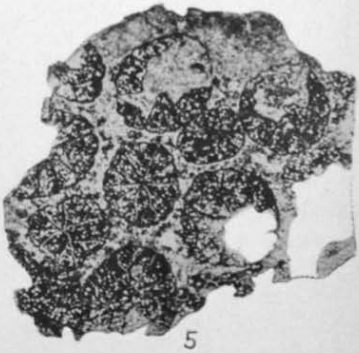

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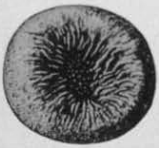

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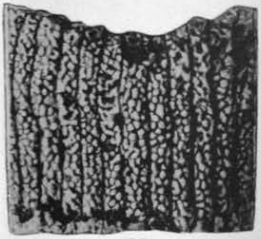

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PLATE 5

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1–8. *Argyrotheca powersi* Gardner 113

1. Detail of sculpture near margin of valve. ×6.
2. Cardinal area of ventral value. ×6.
3. Interior of dorsal valve showing median septum. ×6.
4. Ventral valve sectioned tangentially to show median septum. ×6.
5. Mold of part of ventral valve showing radial ornamentation. ×4.
6. Exterior of dorsal valve (type). Length, 4.0 mm.; width, 6.0 mm.
7. Exterior of ventral valve (outer surface decorticated). ×6.
8. Exterior of dorsal valve (outer surface decorticated). ×6.

9–11. *Conopeum damicornis* Canu and Bassler 112

9. "Three examples of the free, narrow, bilamellar, bifurcating zoarium, natural size." (After Canu and Bassler.)
10. "Zoarial surface, ×20, showing the distinct, irregular zooecia and the very irregular interopesial cavities." (After Canu and Bassler.)
11. "Tangential thin section, ×20, showing the opesial denticles." (After Canu and Bassler.)

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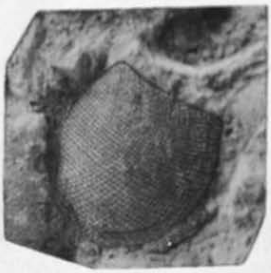

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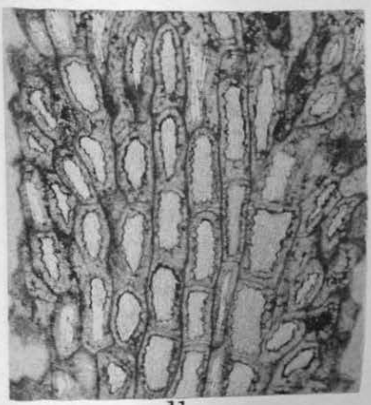

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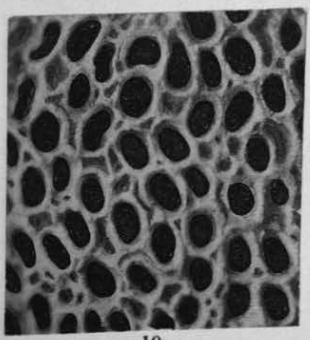

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PLATE 6

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1, 2. *Leda eoa* Gardner new species 118

1. Umbonal view of double valves of holotype; height, 6.5 mm.; length (of incomplete specimen), 11.5 mm.; convexity of double valves, 5.0 mm.
2. Profile of holotype showing left valve.

3, 4. *Leda* new species 119

3. Broken right valve showing posterior keel and sculpture. ×3.
4. Broken right valve (cast) of a more inflated individual. ×3.

5–8. *Limopsis quihi* Gardner new species 124

5. Double valves of holotype; height, 24.5 mm.; convexity, 18.7 mm.
6. Right valve of paratype; height, 23.0 mm.; length, 25.0 mm.
7. Hinge of left valve of paratype. ×2.
8. Left valve of paratype (the three paratypes representing three individuals); height, 20.0 mm.; length, 22.3 mm.

9, 10. *Breviarca stearnsii* Gardner new species 131

9. Exterior of right valve, holotype; height, 3.5 mm.; length, 4.9 mm.
10. Interior of right valve, holotype.

11. *Leda* (*Ledina*) *smirna* Dall 121

Exterior of right valve (probably a topotype); height, 10.0 mm.; length, 17.2 mm.

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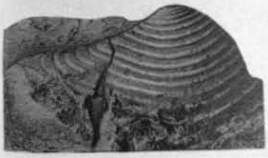

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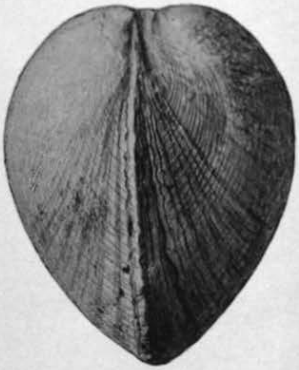

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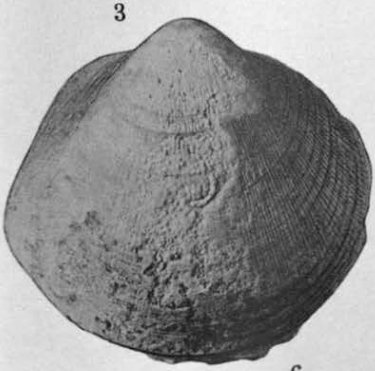

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1–4. *Cucullaea kaufmanensis* Gardner new species 129

1. Exterior of right valve (holotype); height, 25.0 mm.; length, 36.8 mm.
2. Exterior of left valve (paratype); height, 32.0 mm.; length, 41.0 mm.
3. Exterior of left valve (paratype); height, 22.5 mm.; length, 25.0± mm. ×2.
4. Cardinal area of same valve. ×2.

5. *Cucullaea macrodonta* Whitfield 125

Exterior of right valve (topotype); height, 26.0 mm.; length, 30.0 mm. (After Cooke.)

6, 7. *Cucullaea texana* Gardner 127

6. Profile of holotype showing left valve.
7. Double valves of holotype; height, 42.0 mm.; length, 47.5 mm.; convexity, 40.0± mm.

8. *Pteria deusseni* Gardner new species 134

Exterior of right valve (holotype); height, 4.5 mm.; length, 4.5 mm.

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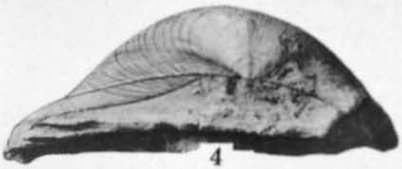

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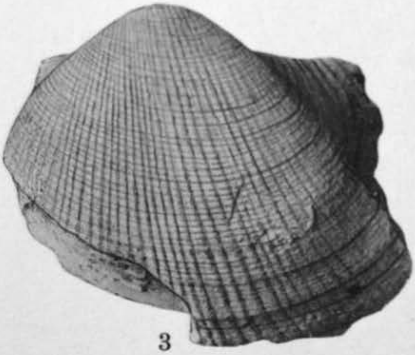

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PLATE 8

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1–5. *Ostrea kochae* Gardner new species 140

1. Exterior of right valve (cotype); height, 51.0 mm.; length, 41.5 mm.
2. Exterior of left valve (cotype); height, 50.0± mm.; length, 39.0 mm.
3. Interior of right valve (cotype).
4. Interior of left valve (cotype).
5. Hinge of left valve of paratype.

6, 7. *Corbicula texana* Gardner new species 154

6. Exterior of left valve (holotype); height, 26.0± mm.; length, 28.9 mm.
7. Interior of holotype.

8, 9. *Modiolus* (*Brachidontes*) *saffordi* (Gabb) 146

8. Exterior of left valve from limestone 7½ miles northwest of Groesbeck, Limestone County (U.S.G.S. Sta. 11935); height, 7.5 mm.; length, 4.5 mm.
9. Exterior of right valve from lower bed in Dry Creek, 7½± miles southwest of Elgin, Bastrop County (U.S.G.S. Sta. 11912); height, 10.1 mm.; length, 5.3 mm.

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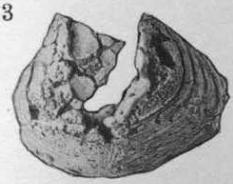

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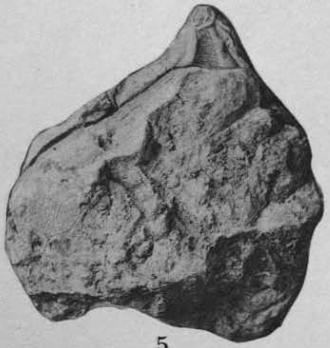

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1, 2. *Ostrea multilirata sabinalensis* Gardner new subspecies 142

1. Exterior of left valve (cotype); height, 60.0 mm.; length, 37.0 mm.
2. Exterior of right valve (cotype); height, 50.0 mm.; length, 33.0 mm.

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1. *Venericardia moa* Gardner new species 168

   Exterior of left valve of holotype; height, 30.0 mm.; length, 34.0 mm.; convexity, 20.0 mm.

2. *Ostrea crenulimarginata* Gabb 139

   Exterior of left valve from Clayton, Alabama; height, 87.0 mm.; length, 65.5 mm. (After Cooke.)

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1–6. *Crassatellites ioannes* Gardner new species 153

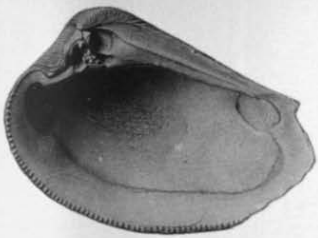
1. Interior of right valve of holotype; height, 27.0 mm.; length, 44.0 mm.
2. Exterior of left valve of holotype.
3. Interior of left valve of holotype.
4. Front view of holotype; convexity, 23.0 mm.
5. Front view of paratype; convexity, 20.0 mm.
6. Exterior of right valve of paratype; height, 25.3 mm.; length, 35.0± mm.

7, 8. *Ostrea pulaskensis* Harris 137

7. Exterior of left valve of cotype; height, 21.0 mm.; length, 17.5 mm.
8. Exterior of specimen (left valve) from 1 mile south of Livingston, Alabama, Sucarnoochee clay; height, 20.5 mm.; length, 13.5 mm. (After Cooke.)

9. *Ostrea crenulimarginata* Gabb 139

Interior of right valve from Clayton, Alabama; height, 77.5 mm.; length, 55.0 mm. (After Cooke.)



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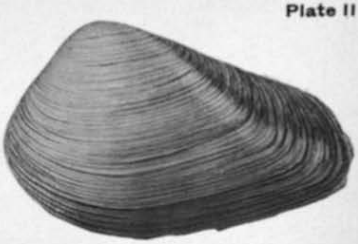

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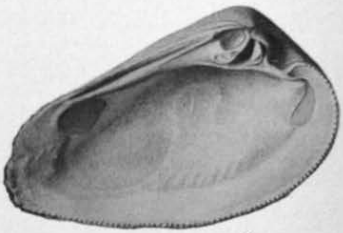

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PLATE 12

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1, 2. *Venericardia jewelli* Gardner new species 158

1. Profile of double valves (cotype); height, 65.0± mm.; length, 65.0 mm.; convexity, 45.0 mm.
2. Exterior of right valve (cotype); height, 65.0± mm.; length, 70.0 mm.

3, 4. *Venericardia smithii* Aldrich 160

3. Exterior of left valve (cotype) from the *Turritella* rock near Allenton, Wilcox County, Alabama; height, 41.0 mm.; length, 41.5 mm.
4. Interior of left valve (cotype).

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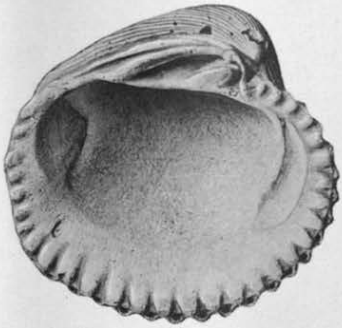

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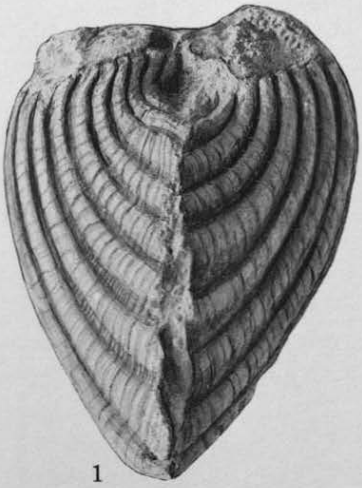

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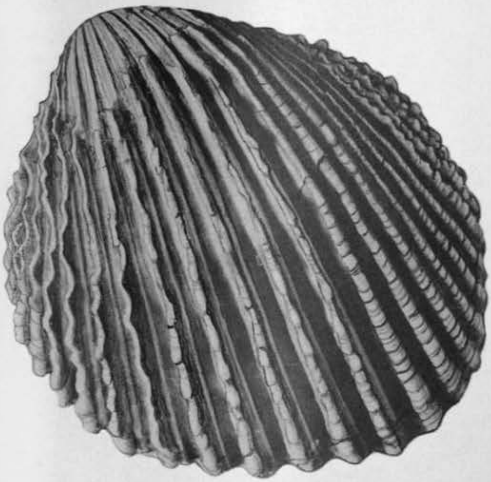
1–4. *Venericardia bulla* Dall from the *Venericardia bulla* zone on the Colorado River, about 4½ miles below Webberville 163

1. Exterior of left valve; height, 34.5 mm.; length, 34.0 mm.
2. Interior of left valve.
3. Exterior of right valve of same individual.
4. Interior of right valve.



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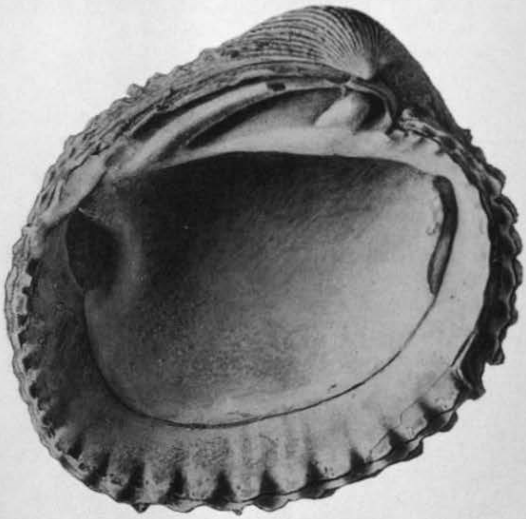

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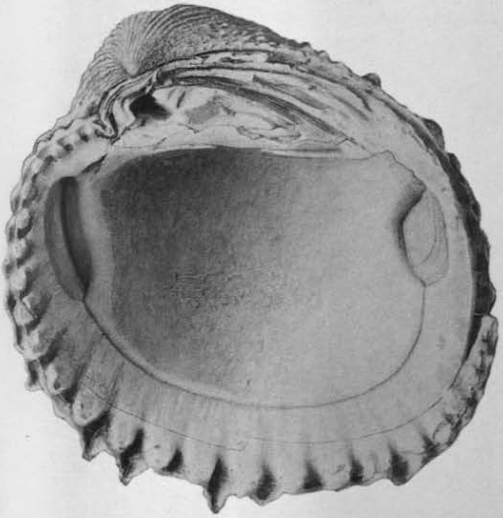

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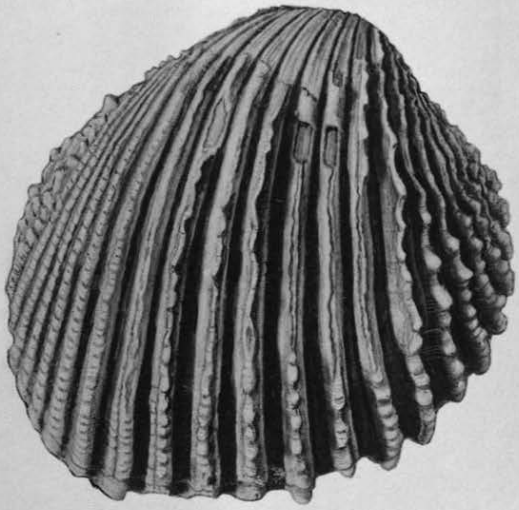

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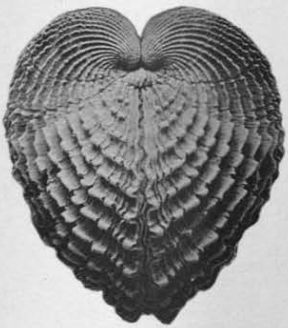

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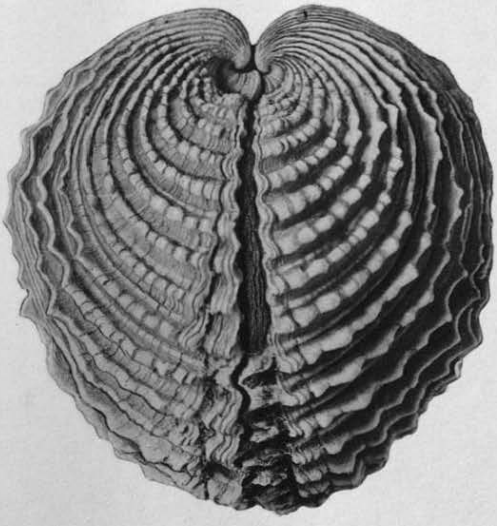

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1–2. *Venericardia crenaea* Gardner new species 167

1. Exterior of right valve (cotype); height, 22.5 mm.; length, 25.0 mm.
2. Exterior of left valve (cotype); height, 27.5 mm.; length, 27.8 mm.

3–5. *Venericardia eoa* Gardner new species 170

3. Exterior of holotype (right valve); height, 22.0 mm.; length, 23.0± mm.
4. Interior of holotype.
5. Interior of paratype (left valve) showing hinge; height and length, 26.0± mm.

6. *Venericardia* species 165

Left valve; height, 26.0 mm.; length, 34.0± mm.

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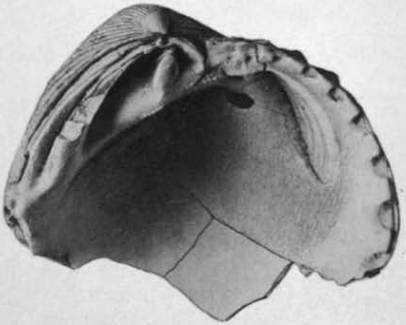

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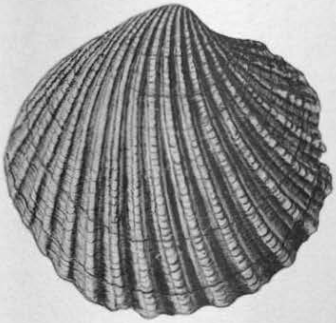

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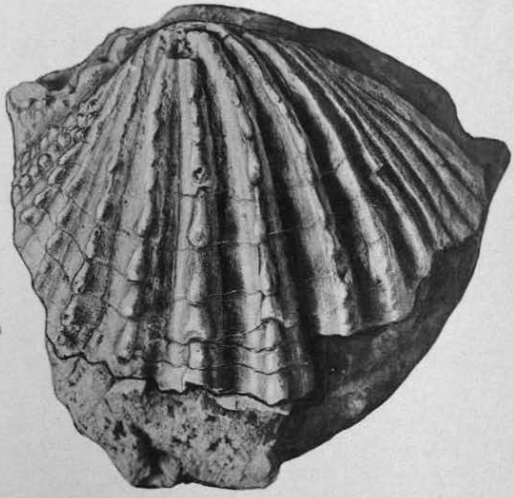

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1, 2. *Phacoides (Miltha?) albaripa* Gardner new species 173

1. Exterior of right valve of holotype; height, 17.0 mm.; length, 20.0 mm.
2. Front view of double valves of holotype; convexity, 8.4 mm.

3, 4. *Phacoides (Lucinisca) mesakta* Gardner new species 174

3. Exterior of holotype (left valve); height, 6.0 mm.; length, 7.0 mm.
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5, 6. *Kelliella? evansi* Gardner new species 177

5. Exterior of right valve (cotype); height, 2.55 mm.; length, 2.55 mm.
6. Exterior of left valve of another individual (cotype); height, 2.4 mm.; length, 2.4 mm.

7, 8. *Kelliella? aldrichi* Gardner new species 178

7. Exterior of holotype (right valve); height, 1.8 mm.; length, 2.0± mm.
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9, 10. *Protocardia quihi* Gardner new species 180

9. Exterior of holotype (left valve); height, 7.2 mm.; length, 7.5± mm.
10. Exterior of paratype (left valve); height, 5.5 mm.; length, 6.1 mm.

11. *Protocardia actia* Gardner new species 181

Exterior of holotype (left valve); height, 7.5 mm.; length, 8.5 mm.

12. *Tellina quihi* Gardner new species 187

Exterior of holotype (right valve); height, 9.0 mm.; length, 13.5 mm.

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1, 2. *Callocardia hawtofi* Gardner new species 182

1. Front view of holotype; height, 23.2 mm.; length, 25.2 mm.; convexity, 15.0 mm.
2. Exterior of left valve.

3. *Callocardia pteleina* Gardner new species 183

Fragment of left valve from 5.7 miles northwest of Castroville on the Quihi road. ×3.

4–6. *Callocardia kempae* Gardner new species 185

4. Exterior of right valve (cotype); height, 35.0± mm.; length, 36.0± mm.
5. Exterior of left valve (cotype); height, 26.8 mm.; length, 30.0± mm.
6. Hinge of right valve of paratype from 5 miles northeast of Kemp, Kaufman County.

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1, 2. *Callocardia biboraensis* Gardner new species 184

1. Exterior of left valve of holotype; height, 38.2 mm.; length, 44.0 mm.
2. Front view of holotype; convexity, 29.0 mm.

3. *Callocardia kempae* Gardner new species 185

Profile of right valve (cotype); height, 35.0± mm.; convexity, 36.0± mm.

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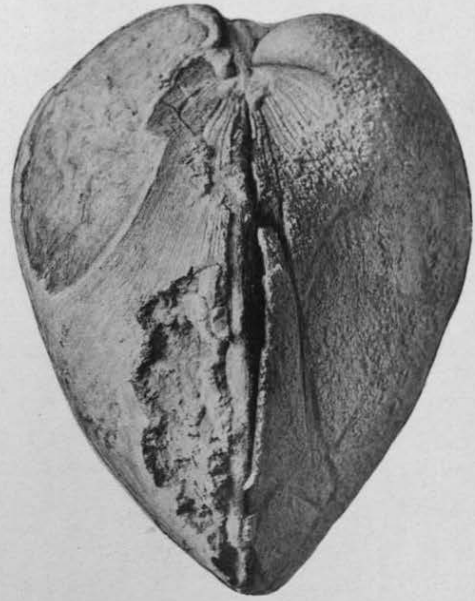

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1–3. *Callocardia pteleina* Gardner new species 183

1. Front view of double valves (U. S. Nat. Mus. No. 370919) from U.S.G.S. Sta. 10128, Verde Creek, 1¾ miles northwest of New Fountain, Medina County; height 18.0 mm.; length, 23.2 mm.; convexity, 13.0 mm.
2. Exterior of right valve (holotype); height, 16.0 mm.; length, 21.5 mm.
3. Exterior of left valve (paratype); height, 7.5 mm.; length, 10.1 mm.

4. *Corbula milium* Dall 189

Holotype from left side; height, 2.3 mm.; length, 2.2 mm.; convexity, 1.6 mm. (After Dall.)

5. *Corbula* (*Caryocorbula*) *kennedyi* Gardner new species 191

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6. *Corbula* (*Caryocorbula*) species indeterminate 194

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7–10. *Corbula* (*Caryocorbula*) *coloradoensis* Gardner new species 192

7. Exterior of right valve (cotype); height, 4.5 mm.; length, 6.5 mm.
8. Interior of right valve (cotype).
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10. Exterior of right valve (paratype); height, 4.4 mm.; length, 5.2 mm.

11, 12. *Corbula* (*Caryocorbula*) species 192

11. Exterior of left valve from Tehuacana member of Kincaid formation, Hondo River, ⅛ mile below Elstone Crossing; height, 3.1 mm.; length, 4.9 mm.
12. Exterior of left valve from the same locality; height, 3.5 mm.; length, 4.7 mm.

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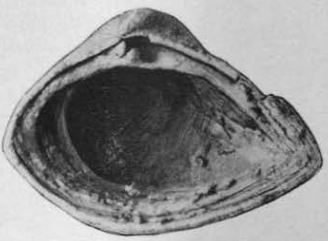

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1. *Cadulus aldrichi* Gardner new species 200
   Profile of holotype from Salado Creek, 5.3 miles south of San Antonio; Wills Point formation; height, 10.0 mm.; greatest diameter, 1.5 mm.
2. *Cadulus phoenicea* Gardner new species 199
   Profile of holotype; height, 3.0 mm.; greatest diameter, 1.0 mm.
3. *Acteocina?* species 204
   Apertural view of juvenile showing protoconch; height, 1.7 mm.
4. *Tornatellaea quercollis* Harris 202
   Apertural view of holotype; height, 7.4 mm.; greatest diameter, 3.4 mm.
5. *Tornatellaea texana* Gardner new species 202
   Apertural view of holotype; height, 7.1 mm.; greatest diameter, 4.0 mm.
6, 7. *Cylichnina emoryi* Gardner new species 206
   6. Apertural view of holotype; height, 8.5 mm.; greatest diameter, 5.0 mm.
   7. Rear view of holotype.
8, 9. *Gilbertina texana* Gardner new species 212
   8. Apertural view of holotype; height, 2.8 mm.; greatest diameter, 2.5 mm.
   9. Apertural view of holotype, showing columellar plaits and labial callous.
10. *Levifusus lithae* Gardner new species 225
   Apertural view of holotype; height of incomplete specimen, 18.0 mm.; greatest diameter, 13.5 mm.
11, 12. *Orthosurcula phoenicea* Gardner new species 219
   11. Apertural view of holotype; height, 10.8 mm.; greatest diameter, 3.5 mm.
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13, 14. *Mangelia schotti* Gardner new species 222
   13. Rear view of holotype; height, 5.5± mm.; greatest diameter, 2.0 mm.
   14. Apertural view of holotype.
15. *Orthosurcula longipersa tobar* Gardner new subspecies 217
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   16. Apertural view of holotype; height, 4.3± mm.; greatest diameter, 2.0 mm.
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18, 19. *Exilia pergracilis* Conrad? 224
   18. Apertural view of U. S. Nat. Mus. No. 373062 from U.S.G.S. Sta. 12112, Colorado River, Kincaid formation; height of incomplete specimen, 23.0 mm.; greatest diameter, 4.8 mm.
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   Apertural view of topotype; height, 15.8 mm.; greatest diameter, 6.7 mm.
21. *Orthosurcula francescae* Gardner new species 218
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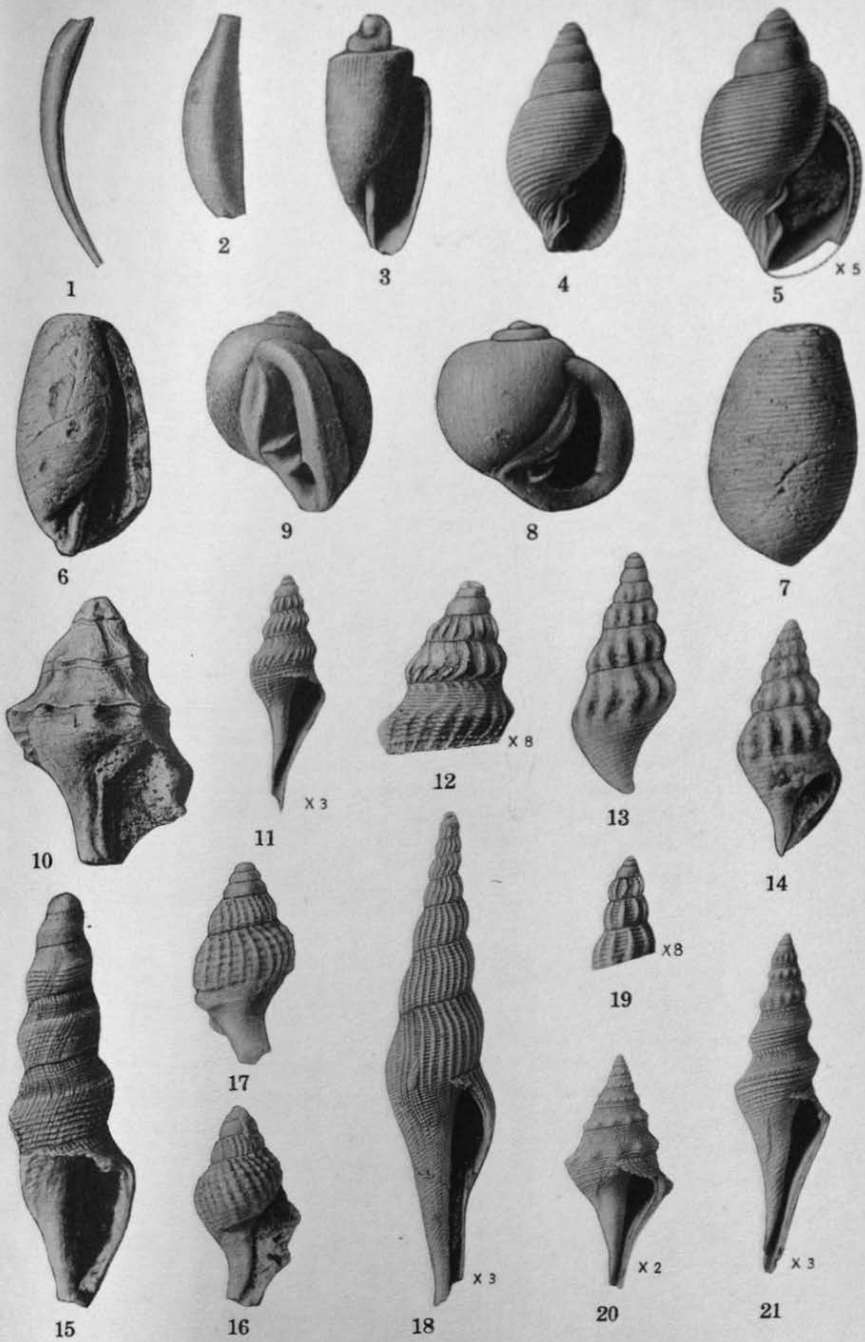
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1, 2. *Volutocorbis texana* Gardner new species 235

1. Apertural view of holotype; height, 28.0 mm.; greatest diameter, 12.5 mm.
2. Rear view of holotype.

3, 4. *Volutocorbis rugata* (Conrad)? 233

3. Apertural view of topotype? from Matthews Landing, Alabama; height, 38.0 mm.; greatest diameter, 15.3 mm.
4. Rear view of the same individual. (After Cooke.)

5. *Falsifusus ottonis* (Aldrich)? 248

Apertural view of U. S. Nat. Mus. No. 90935 from Matthews Landing, Alabama; height of specimen from which the extremity of the anterior canal has been broken, 27.5 mm.; greatest diameter, 8.6 mm.

6. *Laevibuccinum constrictum* (Aldrich)? 253

Apertural view of holotype (Johns Hopkins University) from Matthews Landing, Alabama; height, 34.6 mm.; greatest diameter, 16.7 mm.

7. *Volutocorbis limopsis* (Conrad) 238

Apertural view of topotype? from Matthews Landing, Alabama; height, 26.0 mm.; greatest diameter, 12.0 mm. (After Cooke.)

8. *Falsifusus tobar* Gardner new species 250

Spire of holotype; height of incomplete individual, probably little more than half the height of the perfect shell, 18.0 mm.; greatest diameter, 7.5 mm.

9, 10. *Tritonium* (*Colubraria*) *cedri* Gardner new species 262

9. Apertural view of holotype; height, 9.1 mm.; greatest diameter, not including the terminal varix, 3.2 mm.
10. Rear view of holotype.

11. *Latirus?* (*Polygona*) *stephensoni* Gardner new species 245

Apertural view of holotype; height of spire, 25.0± mm.; greatest diameter, 20.0 mm.

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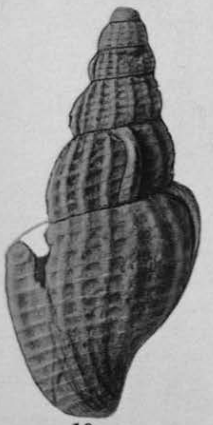

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1–3. *Fasciolaria? plummeri* Gardner new species 246

1. Apertural view of holotype; height (of broken specimen), 93.0 mm.; greatest diameter, 50.0 mm.
2. Rear view of holotype.
3. Apertural view of adolescent?; height (of broken specimen), 53.0 mm.; greatest diameter, 29.0 mm.

4. *Fasciolaria* new species 247

Height (of broken specimen), 58.0 mm.; greatest diameter, 56.0 mm.

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1, 2. *Ranularia hula* Gardner new species 260

1. Apertural view of holotype; height, 33.5 mm.; greatest diameter, 15.0 mm.
2. Rear view of holotype.

3–6. *Murex* (*Argobuccinum*) *mansfieldi* Gardner new species 258

3. Apertural view of cotype; height (of incomplete specimen), 22.0 mm.; greatest diameter, 11.6 mm.
4. Apertural view of cotype; height, 15.5 mm.; greatest diameter, including the terminal varix, 9.0 mm.
5. Rear view of same cotype.
6. Spire of cotype with well preserved sculpture; greatest diameter, 8.0 mm.

7. *Epitonium* (*Ferminoscala?*) *dolosum* (Aldrich) 278

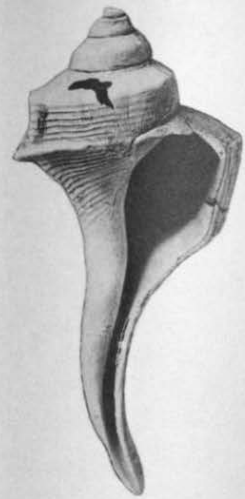
Apertural view of holotype (Johns Hopkins University) from Grave Yard Hill, Wilcox County, Alabama; height, 7.8 mm.; greatest diameter, 4.5 mm.

8, 9. *Epitonium cookii* Gardner new species 276

8. Rear view of holotype; height (of incomplete specimen), 12.5 mm.; greatest diameter, 7.5 mm.
9. Apertural view of holotype.

10. *Epitonium* species 277

Rear view of two last whorls; greatest diameter, 11.2 mm.



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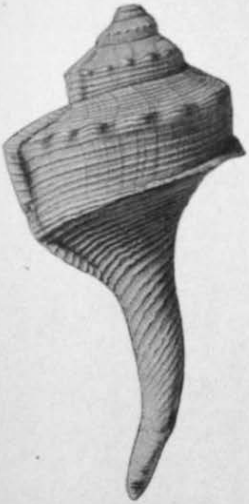

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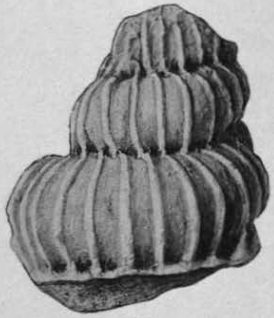

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1–3. *Calyptraphorus aldrichi* Gardner new species 268

1. Apertural view of holotype U. S. Nat. Mus. No. 373063 from Matthews Landing, Alabama; height, 38.4 mm.; greatest diameter, 16.0 mm. (After Cooke.)
2. Rear view of holotype. (After Cooke.)
3. Apertural view of U. S. Nat. Mus. No. 373064, from U.S.G.S. Sta. 11696, Colorado River, Kincaid formation; height, 70.0± mm.; greatest diameter, 25.8 mm.

4. *Calyptraphorus popenoe* Gardner new species 269

Apertural view of juvenile from the type locality, Indio Ranch, 6 miles south of the McFarland sheep pens, Maverick County; greatest diameter, 8.6 mm.

5. *Calyptraphorus* species cf. *C. popenoe* Gardner 270

Apertural view of juvenile from 3½ miles southwest of Thornton, Limestone County; greatest diameter, 6.0 mm.

6–8. *Calyptraphorus popenoe* Gardner new species 269

6. Apertural view of juvenile from the type locality; greatest diameter, 7.5 mm.
7. Unveiled spire of paratype; greatest diameter, 16.0 mm.
8. Apertural view of holotype (incomplete specimen); height, 48.0 mm.; greatest diameter, 21.0 mm.

9. Genus and species indeterminate 266

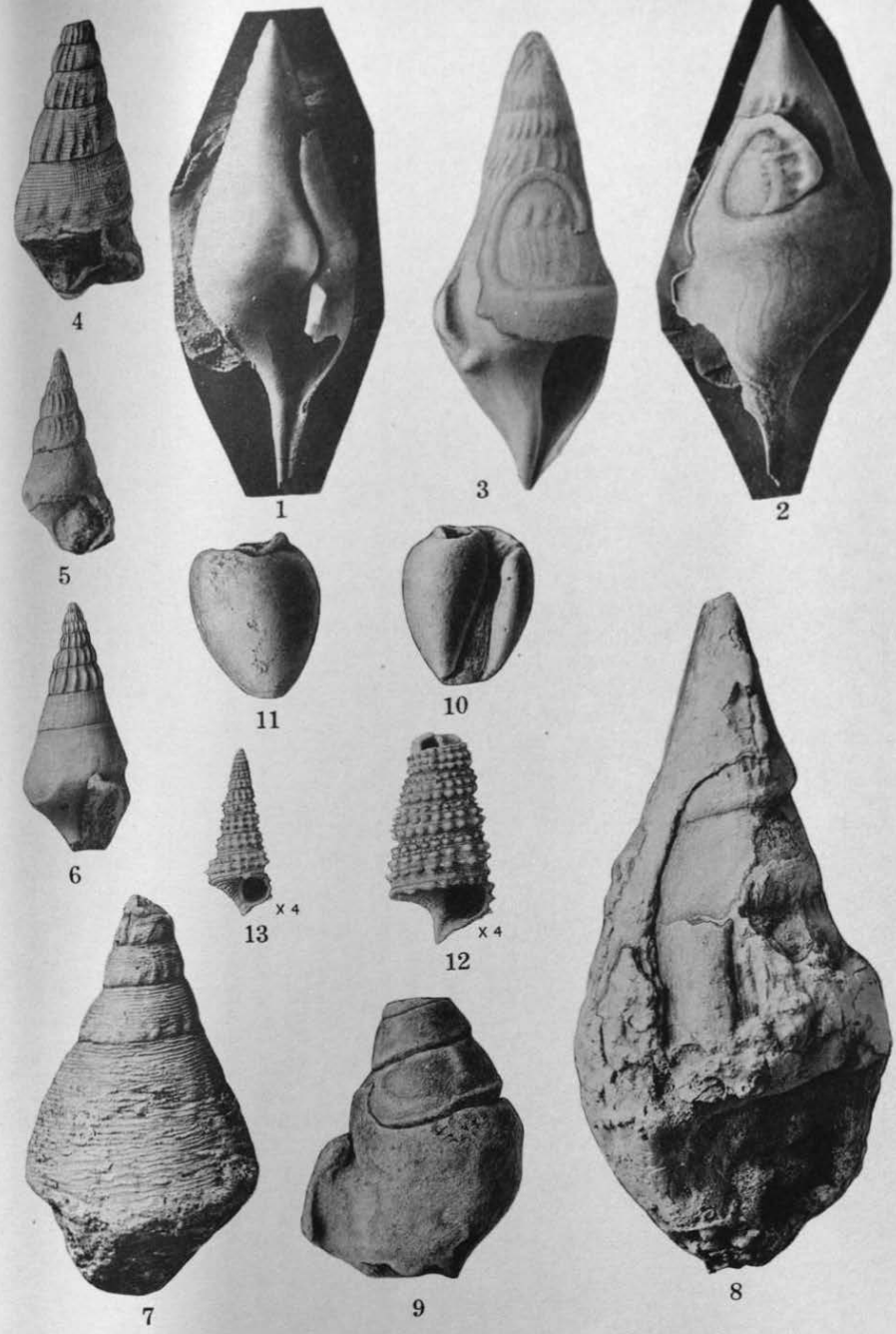
Rear view; height (of incomplete specimen), 40.0 mm.; greatest diameter, including terminal flange, 31.0 mm.

10, 11. *Cypraea?* species 264

10. Apertural view; height (of incomplete specimen), 22.2 mm.; greatest breadth, 17.0 mm.
11. Dorsal view of the same individual.

12, 13. *Bittium* (*Bittium*) *estellensis* (Aldrich) 274

12. Apertural view of U. S. Nat. Mus. No. 373065, from U.S.G.S. Sta. 11914, Colorado River, Kincaid formation; greatest diameter, 3.7 mm.
13. Apertural view of U. S. Nat. Mus. No. 373066, from U.S.G.S. Sta. 11915, Colorado River, Kincaid formation; height of juvenile, 5.7 mm.; greatest diameter, 2.5 mm.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1, 2. *Turritella* sp. cf. *T. humerosa* Conrad 288

1. Broken spire from U.S.G.S. Sta. 11754, Maverick County, Wills Point formation; greatest diameter, 8.3 mm.
2. Broken spire from U.S.G.S. Sta. 11936, 2½ miles northwest of Groesbeck, Limestone County, Kincaid formation; greatest diameter, 11.0 mm.

3. *Turritella biboraensis* Gardner new species 290

Spire of holotype; height (of incomplete specimen), 42.4 mm.; greatest diameter, 15.9 mm.

4–6. *Turritella hilli* Gardner new species 292

4. Two later whorls (paratype) showing outline and sculpture detail; greatest diameter, 12.6 mm.
5. Early whorls (paratype) showing outline and sculpture detail; greatest diameter, 7.3 mm.
6. Apertural view of holotype; height of incomplete specimen, 36.0 mm.; diameter of holotype, 13.0 mm.

7, 8. *Mesalia mavericki* Gardner new species 295

7. Two late whorls of specimen from type locality; greatest diameter, 17.5 mm.
8. Apertural view of holotype; height (of incomplete specimen), 32.0 mm.; greatest diameter, 17.0 mm.

9. *Mesalia* species cf. *M. mavericki* Gardner new species 296

Apertural view of U. S. Nat. Mus. No. 370990, of specimen from Stranger School, 7½ miles northwest of Kosse, Limestone County; height, 20.0 mm.; greatest diameter, 12.0 mm.

10. *Turritella* species cf. *T. humerosa* Conrad 288

Later whorls of spire from U.S.G.S. Sta. 11754, Maverick County, Wills Point formation; greatest diameter, 12.3 mm.

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1–5. *Tubulostium tobar* Gardner new species 281

1. Umbilical view of holotype; height, 2.0 mm.; greatest diameter, 6.0 mm.
2. Apical view of holotype.
3. Apertural view of holotype.
4. Apical view of U. S. Nat. Mus. No. 373166 from U.S.G.S. Sta. 12109, Cedar Creek, Bastrop County, Wills Point formation; height, 2.0 mm.; greatest diameter, 6.0 mm.
5. Apertural view of U. S. Nat. Mus. No. 373166.

6, 7. *Architectonica phoenicea* Gardner new species 301

6. Apertural view of holotype; height, 2.1 mm.; greatest diameter, 6.6 mm.
7. Umbilical view of holotype.

8–10. *Teinostoma eoa* Gardner new species 313

8. Apical view of holotype; height, 0.8 mm.; greatest diameter, 1.5 mm.
9. Apertural view of holotype.
10. Umbilical view of holotype.

11, 12. *Lemintina? gonioides* Gardner new species 279

11. Holotype. ×3.
12. Another detail from the same mass as that shown in Figure 11.

13, 14. *Solariorbis proius* Gardner new species 314

13. Apical view of cotype; height, 1.2 mm.; greatest diameter, 2.5 mm.
14. Umbilical view of cotype; height, 1.3 mm.; greatest diameter, 2.8 mm.

15. *Polinices harrisii* Gardner new species 306

Apertural view of holotype; height, 17.7 mm.; greatest diameter, 15.5 mm.

16, 17. *Lacunaria lithae* Gardner new species 307

16. Rear view of holotype; height, 16.5 mm.; greatest diameter, 11.0 mm.
17. Apertural view of paratype; height (of incomplete specimen), 12.8 mm.

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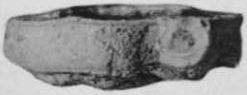

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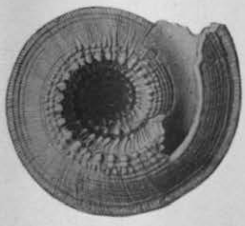

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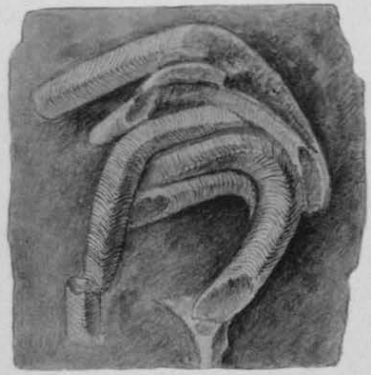

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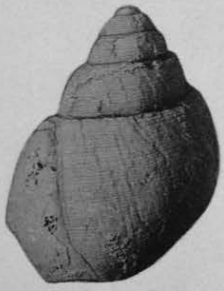

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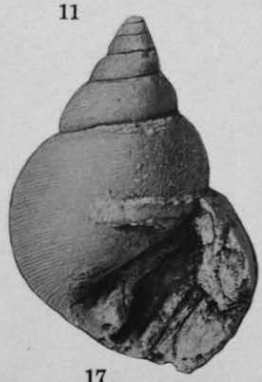

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PLATE 27

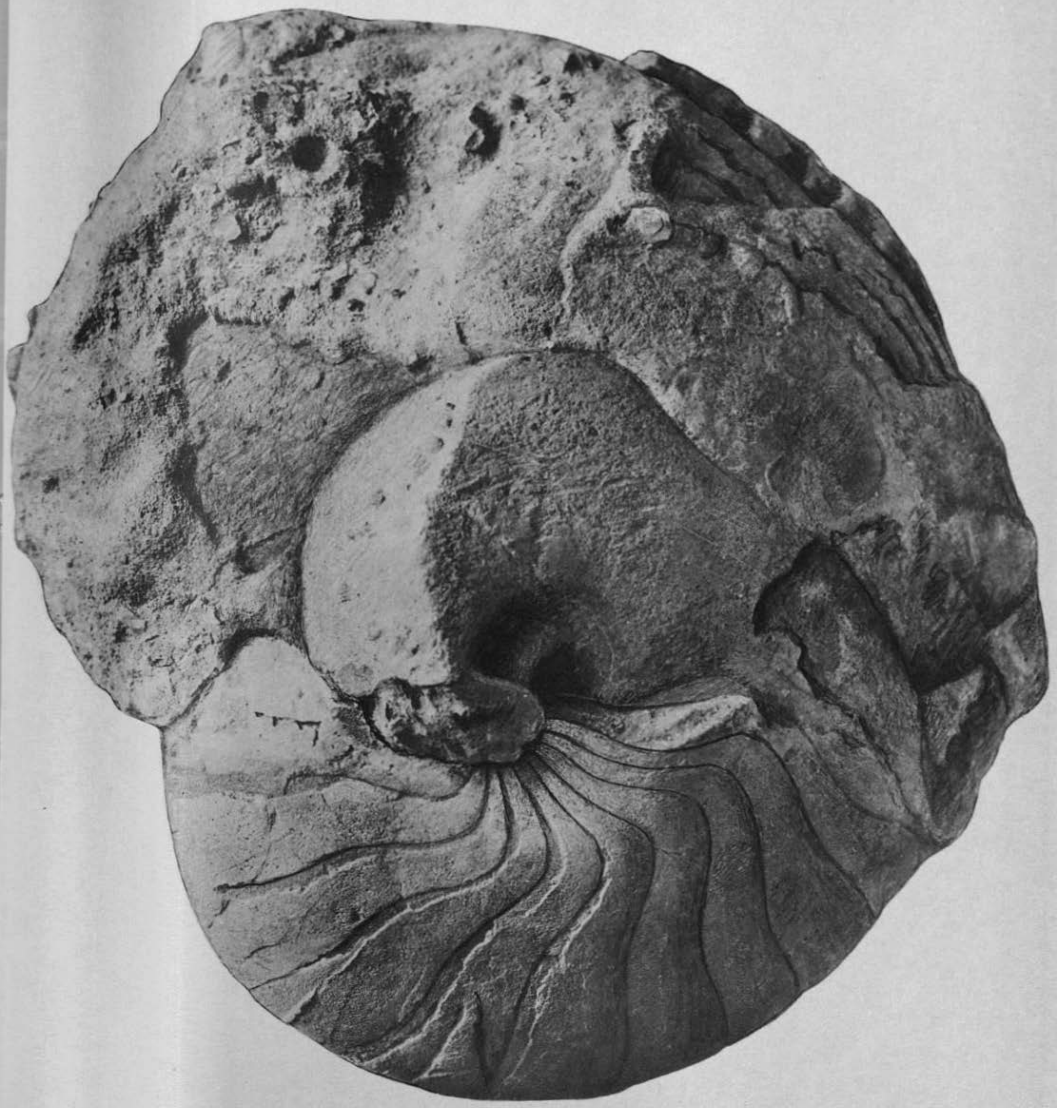
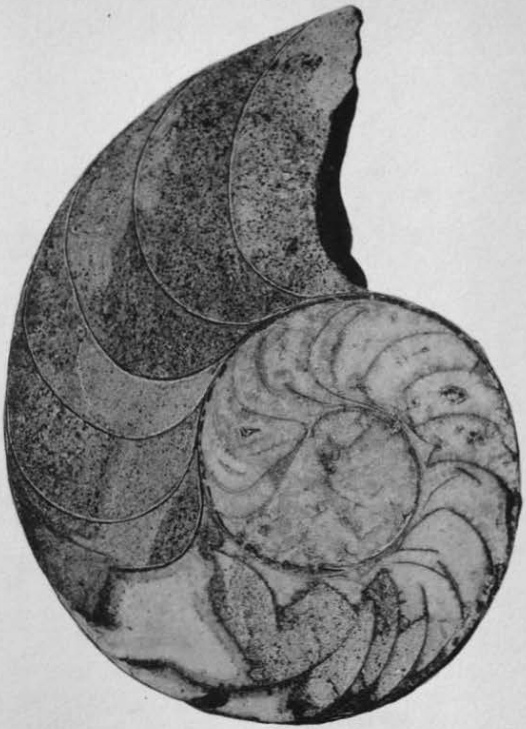


PLATE 28

Figures— Page

1, 2. *Hercoglossa vaughani* Gardner 322

1. Cross section of paratype; greatest diameter, 93.0± mm.; diameter at right angles to greatest diameter, 64.0 mm.; thickness before sectioning, 73.0 mm.
2. Apertural view of paratype.



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