

NORTH AMERICAN UPPER CRETACEOUS CORALS OF THE GENUS MICRABACIA.

By LLOYD WILLIAM STEPHENSON.

INTRODUCTION.

Corals are meagerly represented in the Upper Cretaceous deposits of North America, and much of the material is in a poor state of preservation and can not be satisfactorily identified, either generically or specifically. It is important, therefore, to place on record descriptions and illustrations of some well-preserved corals of the genus *Micrabacia* from the Atlantic and Gulf Coastal Plain and from the western interior of the United States. The specimens from the Coastal Plain, with the exception of those from New Jersey and one lot from Mississippi, are in a much better state of preservation than those I have seen from either the western interior or Europe, though most of them are soft and to insure their safe handling it was found best to harden them with a dilute solution of white shellac.

Seven species and two varieties have been recognized. All are new with the exception of *Micrabacia americana* Meek and Hayden, which was originally described from poorly preserved specimens found in South Dakota. They are all represented by small, free, disk-shaped, simple (that is, not colony forming) corallites, not exceeding 10 millimeters in diameter. On account of their small size it is necessary to study the specimens under a lens of moderately high power, and to figure them adequately it is necessary to enlarge them four to eight times.

One of the new species, *M. cribraria*, occurs in the upper part of the Black Creek formation in North Carolina and the lower part of the Ripley formation in Alabama. Poorly preserved specimens, questionably referred to this species, have been found in the lower part of the Selma chalk in Mississippi, and specimens in a still poorer state of preservation but appar-

ently having the same type of basal sculpture occur in the Woodbury clay in New Jersey. The strata exposed at all these localities are of approximately the same age and occur in the upper part of the zone of *Exogyra ponderosa*, a fossil zone which has been traced from New Jersey to Mexico. So far as known, therefore, this species is confined within narrow stratigraphic limits and will probably prove to be a valuable index fossil.

All the other Atlantic and Gulf coast species occur in the zone of *Exogyra costata*, which overlies the *Exogyra ponderosa* zone and which also has been traced from New Jersey to Mexico. *Micrabacia americana* Meek and Hayden and its variety *multicostata* are found in the upper part of the Montana group of the western interior of the United States, in beds that correspond in age to the zone of *Exogyra costata*. None of these forms are known to have a very wide geographic range, but within faunal subprovinces they will probably prove to be useful horizon indicators.

Little is known of the race history of the genus. The oldest species referred to it is *M. beaumontii* Milne-Edwards and Haime, from the lower part of the Lower Cretaceous (Neocomian), Caussols, Department of Var, France. If this species was correctly identified the genus therefore ranges through the Cretaceous, but its pre-Cretaceous ancestors are unknown, and apparently it became extinct before the beginning of the Eocene.

The type species of the genus is *M. coronula* (Goldfuss), from the chalk of Essen, Germany. Milne-Edwards and Haime¹ have described one species, *M. beaumontii*, from the Neocomian of

¹ Annales sci. nat., 3d ser., vol. 15, p. 90, 1851.

Caussols, Department of Var, France; Duncan ¹ has described a species, *M. fittoni*, from the Gault (Albian) of Folkestone, England; and Bölsche ² has described a species, *M. senoniensis*, from the Upper Senonian of Gehrden, Germany, where it is associated with *Belemnitella mucronata* Schlotheim. I have compared the American material with typical specimens of the type species, *M. coronula* (Goldfuss), and have confirmed their generic identity. Examples of *M. beaumontii*, *M. fittoni*, and *M. senoniensis* are not available for comparison, and the figures are poor, so that I have not been able to verify the correctness of their reference to *Micrabacia*.

In 1905 T. Wayland Vaughan (see synonymy, below) made the genus the type of the new family Micrabaciidae, under which he also included the genera *Diafungia* Duncan, *Microsmillia* Koby, *Podoseris* Duncan, and *Antilloseris* Vaughan. This paper has been prepared under the supervision of Mr. Vaughan, to whom I am indebted for references to literature and for constructive criticism in regard to the generic relations, the classificatory value of the coral characters, and the use of terms.

Mr. T. W. Stanton has informed me of the stratigraphic position of the specimens from the western interior, most of which were inadequately labeled.

The specimens of *Micrabacia* from Maryland were collected by Messrs. Stanley Worden and M. I. Goldman; those from North Carolina, by me; those from the Chattahoochee region and Alabama, by Mr. Stanton and me; those from Mississippi, by me; those from Texas, by Mr. R. H. Bruce; and those from the western interior by Messrs. Stanton, F. H. Knowlton, Homer Squyer, H. M. Robinson, V. H. Barnett, C. J. Hares, C. E. Siebenthal, and W. C. Knight.

¹ British fossil corals, 2d ser., pt. 2, p. 37, pl. 14, figs. 6-9: Paleontographical Society, vol. 23, 1870.

² Deutsch. geol. Gesell. Zeitschr., Band 18, pp. 472, 473, pl. 9, fig. 1, 1866.

SYSTEMATIC DESCRIPTIONS.

Genus MICRABACIA Milne-Edwards and Haime.

- 1816. Cyclolites. William Smith (not Lamarck), *Strata identified by organic fossils*, p. 15.
- 1826. Fungia. Goldfuss, *Petrefacta Germaniæ*, vol. 1, p. 50, pl. 14, fig. 10.
- 1840. Fungia. F. A. Roemer (not Lamarck), *Die Versteinerungen des norddeutschen Kreidegebirges*, p. 25.
- 1849. Micrabacia. Milne-Edwards and Haime, *Compt. Rend. Paris Acad. Sci.*, vol. 29, p. 71.
- 1850. Micrabacia. Milne-Edwards and Haime, *A monograph of the British fossil corals*, p. xlvii, Paleontographical Society.
- 1851. Micrabacia. Milne-Edwards and Haime, *Annales sci. nat.*, 3d ser., Zoologie, vol. 15, p. 88.
- 1860. Micrabacia. Milne-Edwards, *Histoire naturelle des coralliaires*, vol. 3, p. 29 (amended).
- 1869. Micrabacia. Duncan, *A monograph of the British fossil corals*, 2d ser., pt. 2, p. 24, Paleontographical Society, vol. 22.
- 1876. Micrabacia. Meek and Hayden, *A report on the invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. and Geog. Survey Terr. Rept.*, vol. 9, p. 1.
- 1884. Micrabacia. Duncan, *Linnean Soc. London Jour., Zoology*, vol. 18, p. 143.
- 1905. Micrabacia. Vaughan, *U. S. Nat. Mus. Proc.*, vol. 28, p. 387.

Type species, *Fungia coronula* Goldfuss.

The most complete previous description of the genus is that given by Duncan:

Corallum simple, free, lenticular, broader than high, convex above, slightly concave at the base, which has a circular outline. Calice with a small shallow axial depression, filled by a false columella, from which the principal septa radiate, being joined with those of the higher orders toward the circumference. Septa numerous, solid, imperforate, arched above, with a perpendicular outer edge. Costæ distinct on the base, bifurcating at the edge, a process from two costæ forming a septum. Intercostal spaces continuous with the line of direction of the septa, crossed by synaptacula in concentric rows, and perforate between the synaptacula. Interseptal loculi crossed by large and small synaptacula, which radiate from the base in discontinuous lines, bounding canalicular spaces continuous below with the intercostal openings and above with the interseptal loculi high up. Costæ granular. Septa crenulate or minutely denticulate.

*Key to species of the genus Micrabacia.*¹

Costæ absent in a sievelike central area of the base, which includes about 60 per cent of the basal diameter. Denticulations on septal edges ten to 1 millimeter..... *M. cribaria* Stephenson (p. 117, Pl. XX, figs. 1-3).

Costæ extending to center of base:

Costæ of last cycle long (20 to 30 per cent of diameter in adults), thick at terminus:

Costæ acute, denticulate:

Costæ 96..... *M. americana* Meek and Hayden (p. 118, Pl. XX, figs. 4-5).

Costæ more than 96..... *M. americana* var. *multicostata* Stephenson (p. 119, Pl. XX, fig. 6).

Costæ smooth. Denticulations on septal edges eight or nine to 1 millimeter.

M. rotatilis Stephenson (p. 119, Pl. XXI, figs. 1-4).

Costæ faintly beaded. Denticulations on septal edges nine or ten to 1 millimeter.

M. rotatilis var. *georgiana* Stephenson (p. 120, Pl. XXI, figs. 5-8).

Costæ of last cycle short (7 to 18 per cent of diameter of base), thin at terminus:

Costæ subacute, distinctly denticulate:

Denticulations of costæ medium coarse. Corallum relatively high; sides steep. Denticulations on septal edges ten to 1 millimeter..... *M. hilgardi* Stephenson (p. 120, Pl. XXII, figs. 1-6).

Denticulations of costæ coarser than in *M. hilgardi*. Corallum large; sides evenly rounded. Septal edges alternate in prominence on the sides. Denticulations on septal edges ten to 1 millimeter.

M. marylandica Stephenson (p. 121, Pl. XXII, figs. 7-10).

Denticulations of costæ coarse. Denticulations on septal edges twelve to 1 millimeter. Lengths of costæ of last cycle more irregular and average length greater than in the two preceding species.

M. mineolensis Stephenson (p. 122, Pl. XXIII, figs. 6-8).

Costæ flattish, faintly beaded:

Corallum low, sides straight, inclined inward. Denticulations on septal edges eleven or twelve to 1 millimeter..... *M. mississippiensis* Stephenson (p. 123, Pl. XXIII, figs. 9-11).

Corallum high, sides nearly or quite vertical. Denticulations on septal margins seven to 1 millimeter.

M. coronula Goldfuss (p. 124, Pl. XXIII, figs. 1-5).

Micrabacia cribaria Stephenson, n. sp.

Plate XX, figures 1-3.

Corallum subdiscoidal; base nearly flat, upper surface convex, with axial depression slightly less than 1 millimeter deep. Dimensions of the type: Diameter 6.5 millimeters, height 2.5 millimeters.

The under side of the wall or base to a radial distance from the center of about 2 millimeters is irregularly tuberculated and presents numerous sievelike perforations roughly arranged in radial rows corresponding to the positions of the septa. The rough central area merges into a costate marginal band, the costæ numbering 96 and alternating with the septa. The costæ are thicker than the intercostal loculi, are roughly tuberculated, and on the periphery project prowlike somewhat beyond the edges of the septa. In each intercostal loculus are synapticulæ separated by elongated perforations.

The septa are thin and form five complete cycles, arranged in six groups, one group in each of the interspaces between the six primaries. Total number of septa 96. The secondaries extend to the columella; the tertiaries fuse against the secondaries near

the columella; the two outer quaternaries of the group fuse against the tertiaries nearer the center than the two inner ones; the two outer quaternaries of each of the two subgroups formed about the tertiaries fuse against the quaternaries nearer the center than the two inner quaternaries of each subgroup. The primary septa are slightly higher than the members of the higher cycles, and their upper margins curve sharply downward into the central depression; the secondaries are slightly lower than the primaries, and the tertiaries, quaternaries, and quaternaries each become progressively slightly lower. The margins of the septa are finely denticulate, the number being about ten to 1 millimeter. Synapticulæ are numerous; striæ are present on the sides of the septæ at the upper margins, apparently arranged fanlike, though only partly exposed.

Columella elliptical in cross section, spongy, trabecular, a certain number of the trabeculæ terminating in more or less scattered, irregularly distributed papillæ; length of cross section about one-fifth the diameter; width about one-tenth the diameter.

This species differs from the other species of American *Micrabacia* in the arrangement of the basal costæ, which instead of extending to the center merge into a perforated, irregularly calcified, noncostate, sievelike area.

¹ Excluding the species *M. beaumontii* Milne-Edwards and Haime, *M. fittoni* Duncan, and *M. senoniensis* Bölsche, the descriptions of which are inadequate.

Type.—Collection of the United States National Museum, catalogue No. 31996. From Whiteley Creek Landing, Neuse River, N. C. (5354).¹

Distribution.—North Carolina: Snow Hill marl member of Black Creek formation (upper part of *Exogyra ponderosa* zone), Whiteley Creek Landing, Neuse River (5354); Kerrs Cove, Black River (5362). Alabama: Lower part of Ripley formation (upper part of *Exogyra ponderosa* zone), Union Springs at "Concuh Falls" (6820); Central of Georgia Railway cut half a mile west of Union Springs (6815). Mississippi: Lower part of Selma chalk (upper part of *Exogyra ponderosa* zone), questionably on the Tupelo road 8 miles west of Fulton, Lee County (6452).

***Micrabacia americana* Meek and Hayden.**

Plate XX, figures 4-5.

1860. *Microbacia coronula*. Meek and Hayden, Philadelphia Acad. Nat. Sci. Proc., vol. 12, p. 430 (not *M. coronula*, Milne-Edwards and Haime).
1876. *Micrabacia americana*. Meek and Hayden, A report on the invertebrate Cretaceous and Tertiary fossils of the upper Missouri country: U. S. Geol. and Geog. Survey Terr. Rept., vol. 9, p. 1, pl. 28, figs. 1a-d.

The description given in the second paper cited above is as follows:

Corallum small, subplano-convex, or slightly concave below, and convex with a rather deep central depression above. Intercostal foramina of the mural disk oval and numerous. Rays or costæ of the under side straight, about 12 in the middle, but bifurcating so as to number near 100 around the periphery, apparently denticulate. Septa few at the center, but increasing by the intercalation of smaller ones between, so as to equal the number of costæ, with which they alternate on the periphery, very finely and sharply denticulate on the upper and lateral edges.

This description can hardly be improved so far as the type material is concerned, but that material is so poorly preserved as scarcely to permit satisfactory identification of other material with it. The number of costæ is probably 96 on the periphery, and the grouping of the costæ and septa is probably the same as in all the species described in this paper, with the exception of *M. americana* var. *multicostata*, which has a greater number of costæ and a slightly modified arrangement of the costæ within the groups.

Specimens from one locality in Wyoming and several localities in Montana, all from the

upper part of the Montana group, are referred to this species, and one of them with well-preserved costæ, associated in the same piece of rock with *M. americana* var. *multicostata*, is figured in Plate XX, figure 4. In this figured specimen the costæ, which number 96, are arranged in six groups, 16 in a group; they are acute, becoming thicker on the periphery, and are distinctly and rather finely denticulate. The bifurcations of the separate cycles are at irregular distances from the center; the costæ of the highest cycle are relatively long (1.5 to 2 millimeters), in this respect resembling those of *M. rotatilis*. The synapticulæ in the intercostal loculi extending to the center number 12 or more and are separated by radially elongated perforations. The synapticulæ and perforations are not definitely arranged in concentric rows. Other fragments in the same matrix indicate that the septa are thin and correspond in number to the costæ, with which they alternate; on the sides of the septa are striæ and rows of synapticulæ and tubercles radiating fanlike from a point near the base of the columella. The septa are attached to the wall by a row of synapticulæ that connect with the intercostal synapticulæ.

The strongly denticulate costæ serve to distinguish this species from *M. rotatilis* and *M. rotatilis* var. *georgiana*, its nearest allies in the Coastal Plain.

Type.—Collection of United States National Museum, Catalogue No. 456. From Moreau River, S. Dak.

Occurrence.—Fox Hills sandstone, Moreau River, S. Dak. (U. S. N. M. catalogue No. 456); questionably identified from the Bearpaw shale, Forsyth project, sec. 26, T. 1 N., R. 34 E., Montana (8133); questionably identified from the Pierre shale (upper part), 4 miles northeast of Moorcroft, Wyo. (7208); questionably identified from the Montana group (probably upper part), 20 miles southwest of Mingusville, Mont. (Homer Squyer collection, U. S. N. M. catalogue No. 22976); and from "Montana," probably from the Montana group (upper part), and perhaps from the locality 20 miles southwest of Mingusville (Homer Squyer collection, U. S. N. M. catalogue No. 21896).

Range.—Upper part of the Montana group, including the upper part of the Pierre shale and the Fox Hills sandstone.

¹ Numbers in parentheses refer to United States Geological Survey collection numbers, unless otherwise indicated.

Micrabacia americana var. **multicostata** Stephenson, n. var.

Plate XX, figure 6.

This variety is based on one specimen 7 millimeters in diameter, showing only the under side of the wall (base). In the same matrix are other specimens and fragments which probably belong to *M. americana* Meek and Hayden. The costæ are acute, sharply defined, distinctly and finely denticulate and number 123 at the periphery; two costæ fail to reach the margin, being suppressed or crowded out by adjacent ones. In general appearance the sculpture of the base resembles that of *M. americana* Meek and Hayden. The costæ are separable into six groups, but the number of costæ extending to the margins of the group is not uniform, some of the cycles not being complete. The number of costæ in the six groups taken in succession about the disk are 22, 22, 20, 22, 19, and 18; one costa is crowded out in each of the last two groups. The bifurcations of each cycle are at very irregular distances from the center. The intercostal loculi are crossed by synapticulæ, which in the loculi extending to the center number 12 or more. The synapticulæ are separated by radially elongated perforations.

This variety differs from all the known species of *Micrabacia* in that it possesses 123 instead of 96 costæ. The lack of uniformity in the number of costæ in the groups and the obvious crowding out of one costa in each of two groups suggests that the type specimen may be abnormal. The fact that three of the six groups of costæ number 22 suggests that the total number of costæ in a normal specimen would be 132, though this would mean at least one incomplete cycle of costæ.

Type.—Collection of United States National Museum, catalogue No. 31997.

Occurrence.—Cretaceous of "Montana," probably from the upper part of the Montana group, and perhaps from the locality 20 miles southwest of Mingusville (Homer Squyer collection).

Micrabacia rotatilis Stephenson.

Plate XXI, figures 1-4.

1916. *Micrabacia rotatilis*. Stephenson, Maryland Geol. Survey, Upper Cretaceous, pp. 753-755, pl. 49, figs. 1-4.

Corallum subdiscoidal; moderately high, with flat to rather strongly concave base; sides steep

below, rounding evenly into the subflattish top; axial depression 1.5 to 2 millimeters deep. Dimensions of the type: Diameter 9 millimeters, height about 4 millimeters.

The costæ on the base are thin and sharply defined and alternate with the septa; they start with six at the center and by successive bifurcations increase to 96 on the periphery; they are nearly smooth and increase slightly in thickness from the center to the periphery. The costæ are in six groups corresponding to the groups of septa. Each group starts with one costa (first cycle), which bifurcates near the center to form two costæ (second cycle); these bifurcate 0.5 millimeter from the center to form four costæ (third cycle); the four bifurcate about 1 millimeter from the center and produce eight costæ (fourth cycle); and the eight bifurcate 1.5 to 2 millimeters from the center, producing 16 costæ (fifth cycle); in the last cycle the bifurcations producing the two outer and the two middle pairs of the group take place nearer the center than those of the other four pairs; in the largest specimens the pairs of costæ in the last cycle are 2.5 to 3 millimeters long. The ends of the costæ are prowlike but scarcely project beyond the edges of the septa. The intercostal loculi are narrow and are crossed by small synapticulæ separated by radially elongated perforations; in the type the perforations in the intercostal loculi extending to the center number 18; the intercostal synapticulæ and perforations are roughly arranged in concentric rows.

The septa are thin and form five complete cycles arranged in six groups, one group in each of the interspaces between the primary septa. Total number of septa 96. The secondaries extend to the columella; the tertiaries fuse against the secondaries near the columella; the two outer quaternaries of the group fuse against the tertiaries nearer the center than the two inner ones; the two outer quaternaries of each of the subgroups formed about the tertiaries fuse against the quaternaries nearer the center than the two inner ones. The primary septa are a little higher than the members of the higher cycles, and the septa of each of the succeeding cycles appear to be a little lower than those of the preceding cycles. The edges of the septa are finely and distinctly denticulate, the number of denticulations being eight or nine to 1 millimeter; the inner edges of the primaries and

secondaries are bifid, each presenting a trough-like depression with serrated margins descending to the top of the columella; sides of septa with striæ, tubercles, and rows of synapticulæ radiating fanlike from a point near the base of the columella. Each septum is joined to the wall (base) by synapticulæ that connect with the intercostal synapticulæ. These are separated by perforations that connect with the intercostal perforations.

Columella elliptical in cross section, spongy, trabecular, some of the trabeculæ terminating above in more or less scattered, irregularly distributed small papillæ; length of cross section about one-sixth the diameter; width about one-twentieth the diameter.

This species differs from other species of *Micrabacia* from the Coastal Plain in the greater sharpness and smoothness of the basal costæ, the greater irregularity in the distance of the bifurcations of the several cycles from the center, the greater length of the costæ of the last cycle, the greater number of intercostal perforations, and the greater size attained by the adults. It is distinguishable from *M. rotatilis* var. *georgiana* by its smoother and slightly thicker costæ. *M. americana* Meek and Hayden and its variety, *multicostata*, have more strongly denticulate bases. In *M. cornula* (Goldfuss), of the European Cretaceous, the denticulations of the septal edges are markedly coarser than those of any of the American species.

Type.—Collection of the Maryland Geological Survey, on deposit in the United States National Museum. From a locality seven-eighths of a mile southwest of Brightseat, Md.

Distribution.—Prince Georges County, Md., Monmouth formation (*Exogyra costata* zone), bed of small branch about seven-eighths of a mile southwest of Brightseat and three-eighths of a mile south of the Sheriff road; near McNeys Corners, about a mile west of Friendly; questionably near Seat Pleasant.

Range.—The three localities enumerated are within the *Exogyra costata* zone.

Micrabacia rotatilis var. *georgiana* Stephenson, n. var.

Plate XXI, figures 5-8.

This variety is based on four nearly complete specimens and several fragments from Mercers Mill Creek near Georgetown, Quitman County, Ga., which possess most of the specific charac-

ters of *M. rotatilis* except that the costæ are thinner and sharper, producing a more open effect, and instead of being nearly smooth are rather faintly denticulated, though strongly enough to produce a rougher appearance than that of the more typical members of the species. The synapticulæ on the sides of the septa seem also to be a little coarser, and there is a tendency for the striæ to be replaced by rows of small tubercles. The number of denticulations on the margins of the septa is nine or ten to 1 millimeter. Dimensions of the type (Pl. XXI, figs. 5-7): Diameter, 6.5 millimeters; height, 2.75 millimeters.

Type.—Collection of United States National Museum, catalogue No. 31998.

Occurrence.—Upper part of Ripley formation (upper part of *Exogyra costata* zone), Mercers Mill Creek near Georgetown, Quitman County, Ga. (5417).

Micrabacia hilgardi Stephenson, n. sp.

Plate XXII, figures 1-6.

Corallum somewhat variable, but in general moderately high, subdiscoidal, with steep, only slightly convex sides, suggesting a truncated cone; base flat, slightly convex or slightly concave; axial depression small and about 1 millimeter deep in the type, with steep sides. Dimensions of the type (Pl. XXII, figs. 4-6): Diameter 5.5 millimeters, height 3 millimeters.

The costæ on the base or wall start with six and by successive bifurcations reach 96 on the periphery; they alternate with the septa. Each of the six original costæ (first cycle) is the focus of a group; the original divides near the center into two (second cycle); these split about 0.5 millimeter from the center to form four (third cycle); the four split 1.25 to 1.5 millimeters from the center to form eight (fourth cycle); and finally the eight split on the periphery to form 16 (fifth cycle). The bifurcations of each cycle are at rather markedly irregular distances from the center. Up to the fourth cycle the costæ are coarsely denticulate; those of the last cycle are thin, sharp, and finely denticulate, and form a narrow band bordering the periphery; they project slightly beyond the periphery. In the narrow intercostal loculi are synapticulæ numbering 12 in the loculi extending to the center, separated by slightly elongated perforations; the intercostal synap-

ticulæ and perforations are arranged in concentric rows.

The septa are thin and are separable into six groups, each group occupying the interspace between two of the six primaries. Total number of septa 96. The secondaries extend to the columella; the tertiaries are fused against the secondaries near the columella; the two outer quaternaries of each group are fused against the tertiaries nearer the center than the two inner ones; and the two outer quaternaries of each subgroup formed about the tertiaries are fused against the quaternaries nearer the center than the two inner ones. The primary septa are slightly higher than the secondaries, and their inner edges descend steeply to the top of the columella; the members of each of the succeeding cycles are slightly lower than those of the preceding cycles. Margins of the septa finely denticulate, the denticulations numbering about twelve to 1 millimeter. Sides of septa with striæ, tubercles, and synapticulæ radiating fanlike from a point near the base of the columella. Each septum is joined to the wall (base) by synapticulæ that connect with the intercostal synapticulæ; these are separated by perforations that connect with the intercostal perforations.

Columella elliptical, spongy, trabecular, certain of the trabeculæ terminating above in more or less scattered, irregularly distributed papillæ; length of the cross section a little less than one-fifth the diameter; width a little less than one-tenth the diameter.

This species differs from *M. marylandica* in size and form, being smaller and having straighter sides, which incline slightly more toward the center; the costæ are not quite so thick, the costal denticulations are a little finer, the bifurcations of the separate cycles are at more irregular distances from the center, and the edges of the septa on the sides of the corallum do not alternate in prominence. In *M. cribraria* the corallum is flatter and only the outer cycle of basal costæ are clearly distinguishable, the other cycles being obscured by calcification; in *M. rotatilis* the corallum is flatter and the costæ are thinner, sharper, and much smoother, and the costæ of the last cycle are much longer; in *M. americana* Meek and Hayden the corallum is flatter, the basal costæ are thinner, and the costæ of the last cycle are much longer and not so thin at the extremities;

in *M. mississippiensis* the corallum is flatter, the basal costæ are thinner and smoother, and the bifurcations of the separate cycles are at less regular distances from the center. In the European species *M. coronula* (Goldfuss) the denticulations on the margins of the septa are markedly coarser.

Type.—Collection of United States National Museum, catalogue No. 32001. From Lee's old mill site, Union County, Miss. (6873). Named in honor of Prof. E. W. Hilgard, former State geologist of Mississippi.

Distribution.—Mississippi: Ripley formation (*Exogyra costata* zone), Lee's old mill site, 2 miles northeast of Keownville, Union County (6873). Chattahoochee region: Upper part of Ripley formation (*Exogyra costata* zone), Eufaula, Ala. (854); Mercers Mill Creek near Georgetown, Ga. (5417); Chattahoochee River, 2 miles below Eufaula (857).

Range.—*Exogyra costata* zone.

Micrabacia marylandica Stephenson.

Plate XXII, figures 7-10.

1916. *Micrabacia marylandica*. Stephenson, Maryland Geol. Survey, Upper Cretaceous, pp. 755-757, pl. 48, figs. 1-4.

This species is based on seven good specimens and a few fragments from the Monmouth formation of Maryland.

Corallum low to moderately high, subdiscoidal, base flat or slightly convex, top evenly convex with a small axial depression about 1.25 millimeters deep in the type. Dimensions of the type (Pl. XXII, fig. 10): Diameter 7 millimeters, height 3 millimeters.

The under side of the base or wall is ornamented with a system of radiating bifurcating costæ which alternate with the septa; the system starts with six costæ, which by successive bifurcations form cycles of 12, 24, 48, and 96 costæ. Each of the original six costæ (first cycle) is the focus of a group; the original of each group splits near the center into two (second cycle); these split 0.5 millimeter from the center into four (third cycle); about 1.5 to 1.75 millimeters from the center the four costæ divide, to form eight (fourth cycle); and about 2.5 millimeters from the center in the type the eight divide, producing 16 costæ (fifth cycle) on the outer rim. The bifurcations of each cycle are at nearly equal distances from the center. The costæ up to the fourth cycle

are relatively thick and coarsely nodular; those of the last cycle are thin, finely denticulate, and form a band about 0.75 millimeter wide, bordering the outer margin; they appear not to project beyond the edges of the septa. The intercostal loculi are very narrow and are occupied by 12 or 13 synapticulæ separated by perforations, most of which are slightly elongated radially; the synapticulæ and perforations are arranged in concentric rows.

The septa are very thin and are arranged in six groups, one group in each of the interspaces between the primary septa. Total number of septa 96. The secondaries extend to the columella; the tertiaries fuse against the secondaries near the columella; the two outer quaternaries of the group fuse against the tertiaries nearer the center than the two inner ones; in each of the two subgroups formed about the tertiaries the two outer quaternaries fuse against the quaternaries nearer the center than the two inner ones. The primary septa are slightly higher than the members of the higher cycles, which appear to be of about equal height. On the sides of the corallum the septa distinctly alternate in prominence. Margins of the septa finely denticulate, the number of denticulations being about ten to 1 millimeter. Sides of septa with striæ and rows of synapticulæ and tubercles radiating from a point near the base of the columella.

Columella elliptical, spongy, trabecular, some of the trabeculæ terminating in more or less scattered, irregularly distributed, small papillæ; length of cross section between one-fifth and one-sixth the diameter; width about one-tenth the diameter.

Micrabacia hilgardi differs from this species in size, form, and ornamentation of the base; its corallum is smaller, the sides straighter and more inclined, and the septal edges on the sides of the corallum do not alternate in prominence; the bifurcations of its separate cycles of costæ are at more irregular distances from the center, and the costæ are thinner and more finely denticulate. In *M. cribraria* the costæ and perforations of the base are largely obscured by irregular calcification, and the costæ project more prominently on the periphery. In *M. mississippiensis* the basal costæ are narrower, smoother, and flatter, the bifurcations of each cycle are more irregularly spaced with reference to the center, and the

profile of the side of the corallum is not so steep and is slightly truncated. In *M. rotatilis* the basal costæ are thinner, sharper, and much smoother. In *M. americana* Meek and Hayden the costæ are narrower and sharper, and the bifurcations producing the last cycle are much nearer the center and at less regular distances from the center. In *M. coronula* (Goldfuss) the corallum is higher and the septal denticulations coarser.

Type.—Collection of the Maryland Geological Survey, on deposit in the United States National Museum. Found seven-eighths of a mile southwest of Brightseat, Prince Georges County, Md.

Occurrence.—Monmouth formation (*Exogyra costata* zone), bed of small branch seven-eighths of a mile southwest of Brightseat and three-eighths of a mile south of the Sheriff road, Prince Georges County, Md.; half a mile west of Friendly, Prince Georges County, Md.

Micrabacia mineolensis Stephenson, n. sp.

Plate XXIII, figures 6-8.

The description of this species is based on two imperfect specimens, of which the one shown in Plate XXIII, figure 6, is taken as the type.

The corallum is crushed in both specimens but appears to be of moderate height, with steep to nearly vertical, gently convex sides; axial depression of moderate size and about 0.75 millimeter deep in the type; base slightly concave in both specimens. Dimensions of the type: Diameter 5.5 millimeters, height 2.5 millimeters (?).

The costæ on the base start with six at the center and by successive bifurcations reach 96 on the periphery; they alternate with the septa. The costæ are in six groups, each group having as its focus one of the original six costæ (first cycle); the original divides near the center into two (second cycle); the two divide about 0.5 millimeter from the center to form four (third cycle); these divide about 1 to 1.25 millimeters from the center to form eight (fourth cycle); and the eight divide 1.25 to 2 millimeters from the center to form 16 (fifth cycle). The costæ of the fifth cycle are 0.75 to 1.5 millimeters long. The bifurcations forming the costæ of the third, fourth, and fifth cycles are at rather markedly irregular distances from the center. Up to and including the fourth cycle the costæ

are thick and coarsely denticulate; those of the fifth cycle are thin, sharp, and finely denticulate and project a little beyond the edges of the septa. The interseptal synapticulæ, which number 12 or 13 in the loculi extending to the center, are separated by radially elongated perforations.

The septa are thin and are separable into six groups, each group occupying the interspace between two of the six primaries. Total number of septa 96. The secondaries extend to the columella; the tertiaries fuse against the secondaries near the columella; the two outside quaternaries of each group fuse against the tertiaries nearer the center than the two inner quaternaries; and the two outside quaternaries of each subgroup formed about the tertiaries are fused against the quaternaries nearer the center than the two inner ones. The primary septa are slightly more prominent than the secondaries, their inner edges descending steeply to the top of the columella; the members of each of the succeeding cycles appear to be slightly lower than those of the preceding ones. Margins of the septa finely denticulate, the beads numbering 12 to 1 millimeter. Sides of septa not uncovered.

Columella elliptical, the length of the cross section at the top being about one-fifth the diameter and the width about one-tenth the diameter. The columella is spongy and trabecular, certain of the trabeculæ terminating above in more or less scattered, irregularly distributed papillæ.

This species is most nearly related to *M. hilgardi* and *M. marylandica*, from which it may be distinguished by its coarser and more roughly denticulated base and by the greater average length of the costæ of the last cycle.

Type.—Collection of United States National Museum, catalogue No. 32006.

Occurrence.—Probably Navarro formation (*Exogyra costata* zone), well of Hoard Oil & Gas Co., 7 miles east of Mineola, Wood County, Tex.; collected at a depth of 3,146 to 3,160 feet (9369).

***Micrabacia mississippiensis* Stephenson, n. sp.**

Plate XXIII, figures 9–11.

This species is based on one specimen from the Ripley formation of Mississippi. Coral-lum low, subdiscoidal, with flat base, moder-

ately steep, slightly convex sides, and axial depression about 0.75 millimeter deep. Dimensions: Diameter, 6 millimeters; height, 2 millimeters.

Under side of wall (base) ornamented with sharply defined, moderately thick, flattish, coarsely but rather faintly nodular costæ which alternate with the septa; they start with six at the center and by successive bifurcations reach 96 on the periphery. Each of the original six costæ is the center of a group. The original (first cycle) of the group divides near the center into two (second cycle), and these divide to form four (third cycle) at less than 0.5 millimeter from the center; of the four costæ the two outside ones divide about 1 millimeter and the two inside ones about 1.5 millimeters from the center, forming eight (fourth cycle); of the eight costæ the two outside ones divide about 1.75 millimeters, the two middle ones about 2.25 millimeters, and the other four about 2.5 millimeters from the center, forming 16 (fifth cycle). The distances of the bifurcations of each cycle from the center are thus rather markedly irregular. The costæ of the last cycle are thinner than those of the lower cycles, their ends are prowlike, and they project slightly beyond the septa. The narrow intercostal loculi are crossed by concentrically arranged synapticulæ numbering 12 or 13 in the loculi extending to the center; the synapticulæ are separated by radially elongated perforations.

The septa are thin and are arranged in six groups with six primaries and four complete higher cycles, making a total of 96 on the periphery. Each group occupies one of the interspaces between two of the primaries. The secondaries extend to the columella; the tertiaries are fused to the secondaries near the columella; the two outside quaternaries of each group are fused to the tertiaries nearer the center than the two inner ones; in each of the subgroups formed about the tertiaries the two outer quaternaries are fused against the quaternaries nearer the center than the two inner ones. The primary septa are slightly higher than the members of the higher cycles, and those of each of the succeeding cycles are slightly lower than those of the preceding cycles. The margins of the septa are set with beadlike denticulations, the number being about 11 or 12 to 1 millimeter. The inner

edges of the primaries where they descend to the top of the columella are set with a double row of denticulations. The sides of the septa are not well exposed except in one small area near the top, on which are rows of prominent tubercles radiating fanlike from within.

Columella elliptical in cross section, spongy, trabecular, some of the trabeculae terminating in more or less scattered, irregularly distributed nodular processes. Length of cross section about one-sixth the diameter; width about one-tenth the diameter.

The other American species of *Micrabacia* differ from this species in the following characters: In *M. cribraria* the irregular calcification has obscured all but the last cycle of basal costae; the corallum of *M. hilgardi* is higher, the sides are steeper, and the costae of the last cycle are shorter; in *M. marylandica* the bifurcations of the separate cycles of costae are at more regular distances from the center, and the average length of the costae of the last cycle is less; in *M. americana* Meek and Hayden and *M. rotatilis* the costae are thinner and sharper, and the costae of the last cycle are markedly longer. The septal denticulations of *M. coronula* (Goldfuss) of the European Cretaceous are coarser than in any of the American species.

Type.—Collection of United States National Museum, catalogue No. 32008.

Occurrence.—Ripley formation (*Exogyra costata* zone), Lee's old mill site, 2 miles northeast of Keownville, Union County, Miss. (6873).

Micrabacia coronula (Goldfuss).

Plate XXIII, figures 1-5.

- 1826. *Fungia coronula*. Goldfuss, Petrefacta Germaniae, vol. 1, p. 50, pl. 14, fig. 10.
- 1840. *Fungia coronula*. F. A. Roemer, Die Versteinerungen des norddeutschen Kreidegebirges, p. 25.
- 1849. *Micrabacia coronula*. Milne-Edwards and Haime, Compt. Rend., vol. 29, p. 71.
- 1850. *Micrabacia coronula*. Milne-Edwards and Haime, A monograph of the British fossil corals, p. 60, pl. 10, figs. 4, 4a-c (with a synonymy), Paleontographical Society.
- 1860. *Micrabacia coronula*. Milne-Edwards, Histoire naturelle des coralliaires, vol. 2, p. 29 (with synonymy).
- 1862. *Fungia coronula*. Goldfuss, Petrefacta Germaniae, 2d ed., vol. 1, p. 47, pl. 14, fig. 10.
- 1884. *Micrabacia*. Duncan, Linnean Soc. London Jour., Zoology, vol. 18, p. 143.
- 1905. *Micrabacia*. Vaughan, U. S. Nat. Mus. Proc., vol. 28, p. 387 (Duncan's description quoted).

An account and illustrations of *Micrabacia coronula* (Goldfuss) are included for purposes of reference and comparison. The description of Milne-Edwards and Haime is quoted in full below:

Corallum simple, lenticular, short; its under surface horizontal or slightly concave; its upper surface somewhat convex. Mural disk completely naked and regularly perforated by small intercostal pores. Costae closely set, almost straight, equally narrow, not prominent, and but slightly echinulated; only 12 of them arise in the center of the disk, but these soon bifurcate, and the 24 costae so formed soon divide again; at about half the distance from the center to the circumference of the disk each costa bifurcates once more, and the two terminal costae so formed are grouped two by two toward the periphery of the disk. The granulations which form all these costae are not very distinct and are arranged in single lines. Calicular fossula small and not very deep, but well marked and rather elongated laterally. Columella very small, oblong, and subpapillose. Septa forming five complete cycles, and corresponding to the intercostal spaces; those of the last cyclum quite rudimentary; the others tall, thin, straight, and united by subspiniiform trabiculae. Those of the first cyclum larger than the others and augmenting slightly in thickness toward the middle; the secondary ones almost as large; all delicately denticulated along their upper edge, and much thinner toward their outer and inferior angle than in any other part. Diameter, three or sometimes four lines; height, one line and a half.

The above-described fossils were found in the Greensand at Warminster, in Wiltshire, and according to William Smith, who was the first author that mentions this fossil, are also met with at Chute Farm and Puddle Hill, near Dunstable.

By an attentive comparison with the specimens described by Goldfuss and belonging to the Poppelsdorff Museum at Bonn, we have ascertained the specific identity of this British coral with the *Fungia coronula* found in the chalk of Essen. Specimens exist in Mr. Bowerbank's cabinet and in the collections belonging to the Geological Society, the Museum of Paris, the Museum of Bonn, and M. DeFrance at Sceaux, who has designated it by the unpublished name of *Fungia dubia*.

Duncan's description of the genus, which amounts to a nearly complete description of the species, is quoted on page 116. To these descriptions I may add that, as in the American species, the septa probably start with six instead of 12, and by successive intercalations in four additional complete cycles increase to 96 in the adult. Likewise the basal costae start with six and by successive bifurcations in five complete cycles reach 96 on the periphery.

Compared with the American forms the denticulations on the edges of the septa are somewhat coarser (seven to 1 millimeter), the axial depression is shallower, the adults attain a larger size, and, though somewhat variable in

form, the profile is in general more nearly vertical on the sides.

The specimens in the two lots indicated below, which are supposed to be typical of *M. coronula* (Goldfuss), are in very different states of preservation; those from the British Museum are filled with matrix; those from Holland are free from matrix, but the costæ are missing and the margins of the septa are imperfect, so that they are scarcely specifically identifiable with the other material.

Distribution.—According to Goldfuss the species occurs in the "Mergelgrand" at Essen, Prussia, and Milne-Edwards and Haime state that in England it occurs in the [upper] Greensand (Albian). (See quotation, p. 124.) Milne-Edwards gives the occurrence and distribution as "Group de la craie tuffeau: Le Maus, Essen, Warminster." Specimens in the collection of the United States National Museum are labeled as follows:

U. S. N. M. Cat. No. 155214. Folx-les-Caves, Holland, Cretaceous, Group de la craie tuffeau.

U. S. N. M. Cat. No. 156436. Obtained from the British Museum (no locality given).

Three specimens from the first locality, figured on Plate XXIII, figures 3, 4, and 5, are renumbered catalogue Nos. 32002 and 32003; two specimens from the second lot, figured on Plate XXIII, figures 1 and 2, are renumbered catalogue Nos. 32004 and 32005.

UNIDENTIFIED SPECIMENS OF MICRABACIA.

Specimens of *Micrabacia* too poorly preserved for satisfactory specific identification have been found in the western interior at the following localities: Pierre shale (upper part), 5 miles southwest of Marmarth, N. Dak.

(7971), and about 3 miles southeast of Moorcroft, Wyo., approximately 75 feet below the Fox Hills sandstone (6520); Montana group (upper part), Old Cooper Creek Crossing, Laramie Plains, Wyo. (U. S. N. M. catalogue No. 28528); Montana group (upper part), Ben Gaugh's ranch, Cooper Creek, 20 miles northwest of Laramie, Wyo. (3479).

Specimens of *Micrabacia* referred by Weller¹ to *M. americana* Meek and Hayden have been found in New Jersey at the following localities:

Merchantville clay, near Matawan; Woodbury clay, Lorillard, near Matawan and near Haddonfield; Wenonah sand, near Crawfords Corner.

Through the courtesy of Dr. H. B. Kümmel I have examined Weller's figured specimens from the Woodbury clay near Lorillard, and the lots from the Woodbury clay and from the Merchantville clay near Matawan, all of which appear to be too poorly preserved for satisfactory specific identification. Squeezes made from prints of the bases of the specimens from Lorillard suggest the type of sculpture exhibited by *M. cribraria* rather than that of *M. americana*.

Dr. Weller states, in a letter recently received, that the material from Haddonfield examined by him was in the collection of the Academy of Natural Sciences of Philadelphia. Dr. H. A. Pilsbry, in response to a letter of inquiry, states that he can not find these specimens in the collection, and apparently they have been lost, a most unfortunate circumstance, because, according to Dr. Weller, they were preserved intact, and not in the form of molds, as were the other New Jersey specimens.

¹ Weller, Stuart, Cretaceous paleontology of New Jersey: New Jersey Geol. Survey, Paleontology, vol. 4, p. 271, pl. 5, figs. 14-17, 1907.



PLATES XX-XXIII.

PLATE XX.

Micrabacia cribraria Stephenson, n. sp. (p. 117).

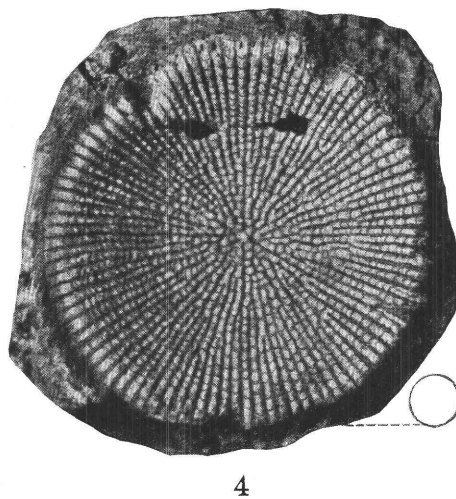
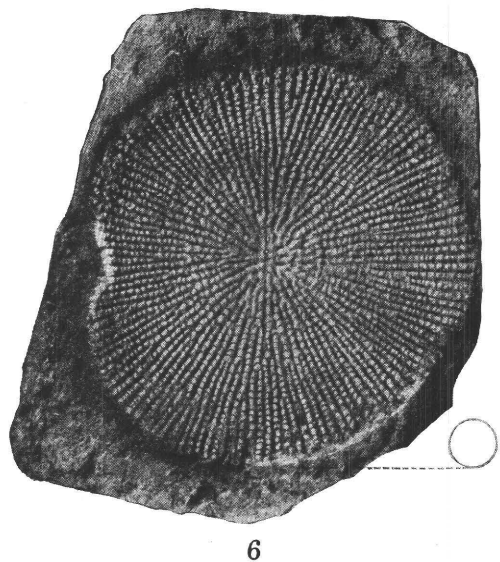
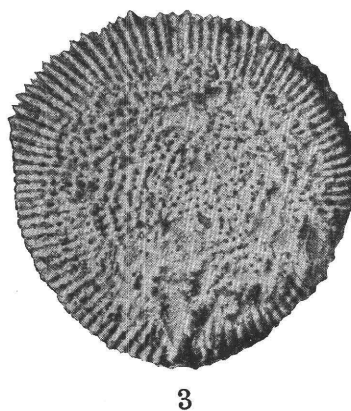
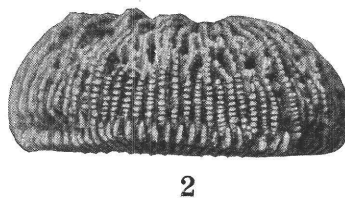
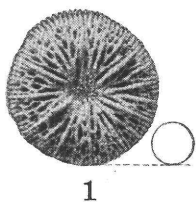
- FIGURE 1. Calicular view of the type, $\times 4$, from the Snow Hill marl member of the Black Creek formation (upper part of *Exogyra ponderosa* zone), Whiteley Creek Landing, Neuse River, N. C. (U. S. G. S. collection 5354; U. S. N. M. catalogue No. 31996.) The periphery and margins of all the septa are imperfect.
2. Side view of the type, $\times 8$; the upper portions of the septal edges are imperfect.
3. Basal view of the type, $\times 8$; the ends of the costae and portions of the surface are imperfect.

Micrabacia americana Meek and Hayden (p. 118).

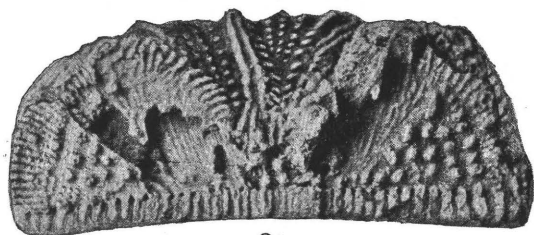
- FIGURE 4. Basal view of a specimen, $\times 8$, from "Montana," probably from the upper part of the Montana group, and perhaps from a locality 20 miles southwest of Mingusville. (Homer Squyer collection, U. S. N. M. catalogue No. 21896.)
5. View of a broken specimen in the same collection, partly restored by retouching, showing the profile through the center and faint indications of the characters on the sides of the septa. (U. S. N. M. catalogue No. 21896.)

Micrabacia americana var. *multicostata* Stephenson, n. var. (p. 118).

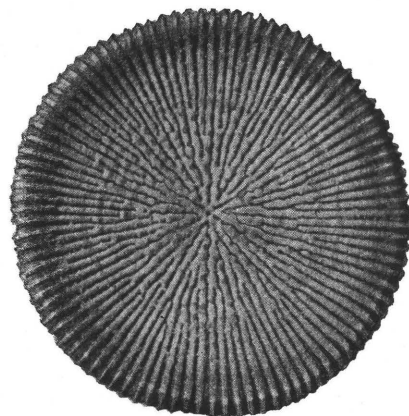
- FIGURE 6. Basal view of the type, $\times 8$, from "Montana," probably from the upper part of the Montana group, and perhaps from a locality 20 miles southwest of Mingusville. (Homer Squyer collection, U. S. N. M. catalogue No. 31997.)



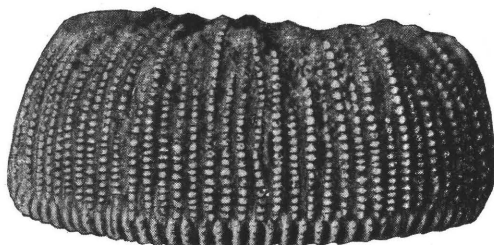
SPECIES OF MICRABACIA.



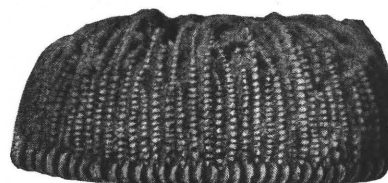
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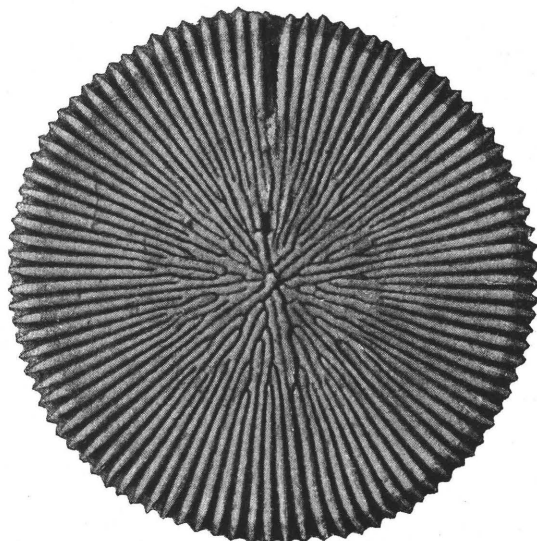
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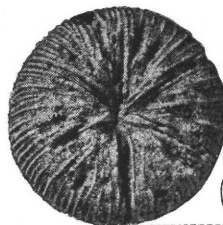
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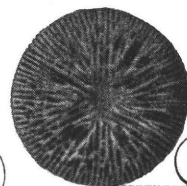
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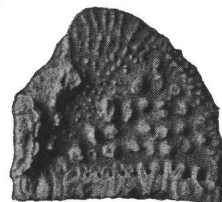
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SPECIES OF MICRABACIA.

PLATE XXI.

***Micrabacia rotatilis* Stephenson (p. 119).**

- FIGURE 1. Calicular view of the type, $\times 4$, from the Monmouth formation (*Exogyra costata* zone), bed of a small branch about seven-eighths of a mile southwest of Brightseat, and three-eighths of a mile south of the Sheriff road, Prince Georges County, Md. (Collection of the Maryland Geological Survey, on deposit in the United States National Museum.) The septal edges are imperfect and the interseptal loculi are filled with matrix.
2. Side view of the type, $\times 8$; the interseptal loculi are filled with matrix and the upper part of the corallum is imperfect.
 3. Vertical internal cross section of the type, $\times 8$; broken through the center, showing the sides of septa, the spongy columella, and the intercostal perforations of the base.
 4. Basal view of the type, $\times 8$, showing the character and grouping of the costæ.

***Micrabacia rotatilis* var. *georgiana* Stephenson, n. var. (p. 120).**

- FIGURE 5. Calicular view of the type, $\times 4$, from the upper part of the Ripley formation (*Exogyra costata* zone), Mercers Mill Creek near Georgetown, Ga. (U. S. G. S. collection 5417; U. S. N. M. catalogue No. 31998.) The upper edges of the septa are imperfect.
6. Side view of the type, $\times 8$; the interseptal loculi are filled with matrix, and the upper part of the corallum is imperfect.
 7. Basal view of the type, $\times 8$, showing the character and grouping of the septa.
 8. Vertical internal cross section of a fragmentary specimen from the type locality (U. S. G. S. collection 5417; U. S. N. M. catalogue No. 31999), showing the side of a septum and the intercostal perforations of the base.

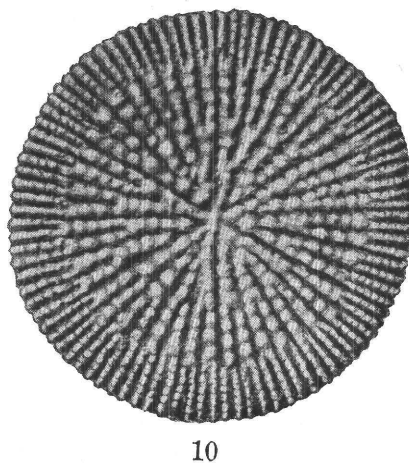
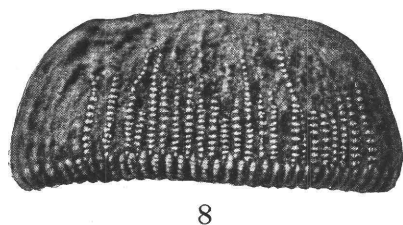
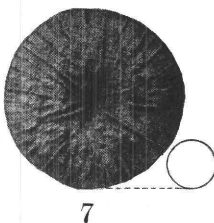
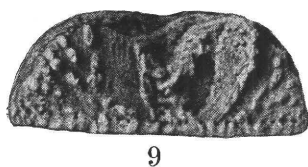
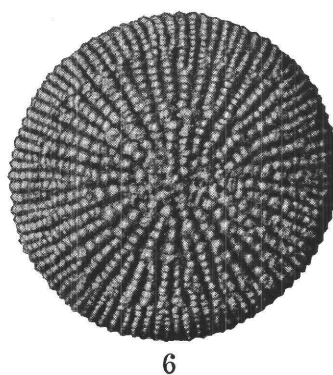
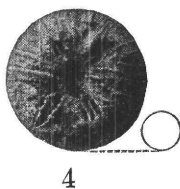
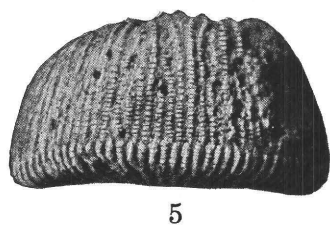
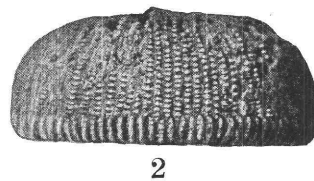
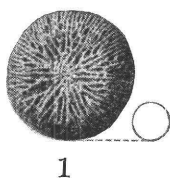
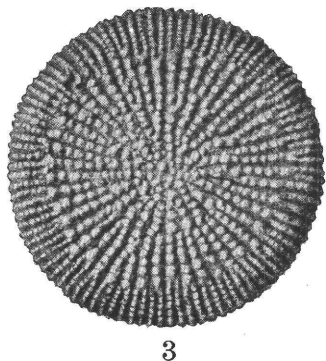
PLATE XXII.

Micrabacia hilgardi Stephenson, n. sp. (p. 120).

- FIGURE 1.** Calicular view, $\times 4$, of a specimen from the upper part of the Ripley formation (*Exogyra costata* zone), Mercers Mill Creek near Georgetown, Quitman County, Ga. (U. S. G. S. collection 5417; U. S. N. M. catalogue No. 32000.) The upper edges of the septa are imperfect.
2. Side view of the same specimen, $\times 8$, showing the septal margins and the prowlike ends of the costæ.
 3. Basal view of the same specimen, showing the character and grouping of the costæ.
 4. Calicular view of the type, $\times 4$, from the Ripley formation (*Exogyra costata* zone), Lee's old mill site, 2 miles northeast of Keownville, Union County, Miss. (U. S. G. S. collection 6873; U. S. N. M. catalogue No. 32001.) The edges of the septa are imperfect and the interseptal loculi are filled with matrix.
 5. Side view of the type, $\times 8$, showing the septal edges and the prowlike ends of the costæ.
 6. Basal view of the type, $\times 8$, showing the character and grouping of the costæ.

Micrabacia marylandica Stephenson (p. 121).

- FIGURE 7.** Calicular view of a specimen, $\times 4$, from the Monmouth formation (*Exogyra costata* zone), bed of a small branch about seven-eighths of a mile southwest of Brightseat, and three-eighths of a mile south of the Sheriff road, Prince Georges County, Md. (Collection of the Maryland Geological Survey, on deposit in the United States National Museum.) The edges of the septa are imperfect and the interseptal loculi are filled with matrix.
8. Side of the same specimen, $\times 8$, showing the septal edges and the prowlike ends of the costæ.
 9. Vertical cross section of a specimen, $\times 8$, in the same collection, showing the sides of the septa, the spongy columella, and the intercostal perforations of the base.
 10. Basal view of the type, $\times 8$, in the same collection, showing the character and grouping of the costæ.



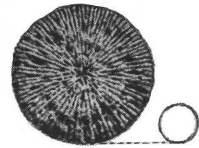
SPECIES OF MICRABACIA.



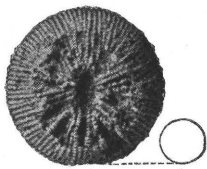
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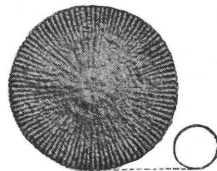
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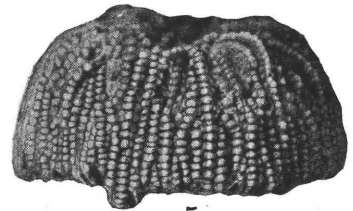
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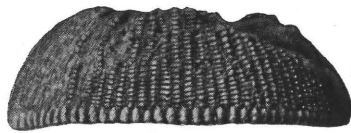
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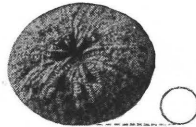
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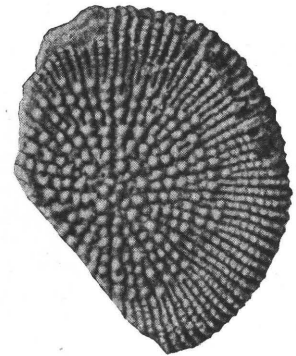
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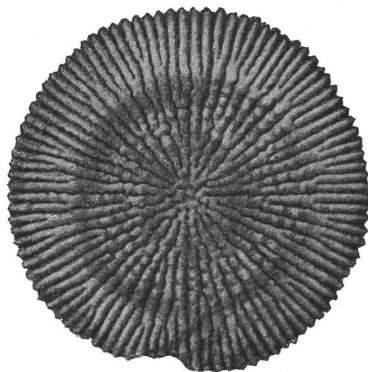
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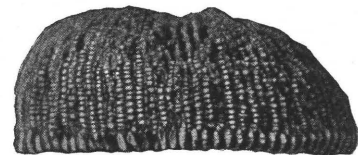
7



6



11



8

SPECIES OF MICRABACIA.

PLATE XXIII.

Micrabacia coronula (Goldfuss) (p. 124).

- FIGURE 1. Side view of a specimen, $\times 4$, from the British Museum, locality not stated on the label. The septal edges are imperfect and the interseptal loculi are filled with matrix. (U. S. N. M. catalogue No. 32004.)
2. Basal view of a specimen, $\times 4$, from the same locality. (U. S. N. M. catalogue No. 32005). The costæ are very much worn and imperfect.
- 3, 4. Calicular view and basal view, $\times 4$, of a specimen from the "Cretaceous, Group de la craie tuffeau, Folx-les-Caves, Holland." (U. S. N. M. catalogue No. 32002.) The edges of the septa are imperfect, and the costæ are gone from the base, leaving only the lower edges of the septa showing.
5. Side view of a specimen, $\times 4$, from the same locality. (U. S. N. M. catalogue No. 32003.) The ends of the costæ are missing.

Micrabacia mineolensis Stephenson, n. sp. (p. 122).

- FIGURE 6. Basal view of the type, $\times 8$, from the Navarro formation (?), well of Hoard Oil & Gas Co., 7 miles east of Mineola, Wood County, Tex., collected at a depth of 3,146-3,160 feet. (U. S. G. S. collection 9369; U. S. N. M. catalogue No. 32006.) Shows the character and grouping of the costæ.
7. Calicular view of a crushed specimen, $\times 4$, in the same collection. (U. S. N. M. catalogue No. 32007.)
8. Side view of the specimen illustrated in figure 7; shows the septal edges and the prowlike ends of the basal costæ.

Micrabacia mississippiensis Stephenson, n. sp. (p. 123).

- FIGURE 9. Calicular view of the type, $\times 4$, from the Ripley formation (*Exogyra costata* zone), Lee's old mill site, 2 miles northeast of Keownville, Union County, Miss. (U. S. G. S. collection 6873; U. S. N. M. catalogue No. 32008.) The upper edges of the septa are imperfect.
10. Side view of the type, $\times 8$, showing the septal edges and the prowlike ends of the costæ.
11. Basal view of the type, $\times 8$, showing the character and grouping of the costæ.