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CORALS OF THE TRAVERSE GROUP OF MICHIGAN  
PART XI, *TORTOPHYLLUM*, *BETHANYPHYLLUM*,  
*AULACOPHYLLUM*, AND *HALLIA*

BY  
ERWIN C. STUMM

FROM THE  
EDWARD PULTENEY WRIGHT MEMORIAL VOLUME



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THE UNIVERSITY OF MICHIGAN  
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# CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

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1. Morphology and Taxonomy of the Cystoid *Cheirocrinus anatiformis* (Hall), by Robert V. Kesling. Pages 1-21, with 4 plates.
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4. Two New Genera of Stricklandid Brachiopods, by A. J. Boucot and G. M. Ehlers. Pages 47-66, with 5 plates.
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8. Corals of the Traverse Group of Michigan, Part XI, *Tortophyllum*, *Bethanyphyllum*, *Aulacophyllum*, and *Hallia*, by Erwin C. Stumm. Pages 135-155, with 10 plates.

CORALS OF THE TRAVERSE GROUP OF MICHIGAN  
PART XI, *TORTOPHYLLUM*, *BETHANYPHYLLUM*,  
*AULACOPHYLLUM*, AND *HALLIA*<sup>1</sup>

BY  
ERWIN C. STUMM

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INTRODUCTION

IN Part XI of the study of the corals of the Traverse group of Michigan, species of the simple rugose coral genera *Tortophyllum*, *Bethanyphyllum*, *Aulacophyllum*, and *Hallia* are described. The common species *Tortophyllum cysticum* (Winchell), *Bethanyphyllum geniculatum* (Rominger), *Aulacophyllum scyphus* (Rominger), *Aulacophyllum hemicrassatum* Sloss, and *Hallia vesiculata* Sloss are redescribed or reillustrated, and their stratigraphic ranges extended. *Tortophyllum milleri* Pitrat from the Cedar Valley limestone of Iowa is recognized in the Traverse group. A new species of *Tortophyllum*, one of *Bethanyphyllum*, and one of *Aulacophyllum* are described. An unnamed species of *Aulacophyllum* is described and illustrated.

<sup>1</sup> Part I is published in Vol. VII, No. 8; Part II in Vol. VIII, No. 3; Part III in Vol. VIII, No. 8; Part IV in Vol. IX, No. 3; Part V in Vol. XIV, No. 11; Part VI in Vol. XVI, No. 4; Part VII in Vol. XVII, No. 9; Part VIII in Vol. XVII, No. 10; Part IX in Vol. XVII, No. 12; and Part X in Vol. XVII, No. 14, of the *Contributions from the Museum of Paleontology, The University of Michigan*.

## PREVIOUS WORK

Alexander Winchell (1866) described *Zaphrentis cystica* from the Gravel Point formation of the Little Traverse Bay region.

Carl Rominger (1876) described *Cyathophyllum scyphus* from the Genshaw formation, and *Cyathophyllum geniculatum* from the Thunder Bay limestone of the Thunder Bay region.

A. W. Grabau (1922) designated Rominger's *Cyathophyllum scyphus* the type species of his new genus *Pinnatophyllum*.

L. L. Sloss (1939) in a study of the rugose corals of the Little Traverse Bay region designated Winchell's *Zaphrentis cystica* as the type species of his new genus *Tortophyllum*. He also described three new species of *Aulacophyllum* and two of *Hallia*.

## ACKNOWLEDGMENTS

I wish to thank Dr. J. Marvin Weller and Mr. Matthew Nitecki of the Walker Museum of Paleontology, The University of Chicago for the loan of Sloss's types of rugose corals from the Little Traverse Bay region. I am indebted to Dr. L. B. Kellum, Dr. C. A. Arnold, and Dr. R. V. Kesling for critically reading the manuscript of this paper. My thanks are also due to Dr. G. M. Ehlers, who either prepared or supervised the preparation of a part of the thin sections used in this paper and in parts VII to X of the *Corals of the Traverse Group of Michigan*.

The types catalogued with the prefix UC are in the Walker Museum of Paleontology, The University of Chicago. All other type specimens are in the Museum of Paleontology, The University of Michigan.

## LOCALITIES

1. (Grabau locality). Quarries, northern end of Alpena, SE $\frac{1}{4}$  sec. 14 (Fox Quarry), SW $\frac{1}{4}$  sec. 13 (Collins Quarry), T.31 N., R.8 E., Alpena County.
- 7c. Ledges and bluffs along Lake Michigan extending from point on shore at locality 7a to point  $\frac{1}{2}$  mile north, Charlevoix Co., NE $\frac{1}{4}$  sec. 27, and SE $\frac{1}{4}$  sec. 22, T.33 N., R.9 W.
14. Quarry of the Penn-Dixie Cement Co. (formerly the Petoskey Portland Cement Company quarry), about  $1\frac{1}{2}$  miles west of Petoskey, Emmet County, SW $\frac{1}{4}$  sec. 2, and SE $\frac{1}{4}$  sec. 3., T.34 N., R.6 W.
- 14e. Abandoned Bell quarry and ledges on shore of Lake Michigan about 2 miles east of Bay Shore, Emmet County, near NE corner, sec. 8, T.34 N., R.6 W.
21. Abandoned Kegomic Quarry on south shore of Mud Lake just east of Harbor Springs Road (M. 131) about  $\frac{1}{4}$  mile north of its termination on U.S. 31, 1 mile east of Bay View, Emmet County, SE $\frac{1}{4}$  SW $\frac{1}{4}$  sec. 27, T.35 N., R.5 W.
- 21a. Highway shoulder and creek bed on south side of U.S. 31 (Bay View-Alanson Road), 200 feet east of junction with M. 131 (Harbor Springs Road) and about 1 mile east of Bay View, Emmet County, near center of N line sec. 34, T.35 N., R.5 W.

31. Quarry of Michigan Limestone and Chemical Division of U.S. Steel Corporation at Calcite, Presque Isle County. Ten sections in SE part of T.35 N., R.5 E., and adjacent townships.
35. Bluffs on northeast shore of Partridge Point, 4 miles south of Alpena, Alpena County. Extends into SE $\frac{1}{4}$ , sec. 11, T.30 N., R.8 E.
38. Abandoned quarry of Kelley's Island Lime and Transport Co. (Great Lakes Stone and Lime Company) at Rockport, Alpena County, Sec. 6, T.32 N., R.9 E.
40. Quarry of Michigan Alkali Company, eastern edge of Alpena, Alpena County. Sec. 13, T.31 N., R.8 E.
53. Abandoned quarry of Thunder Bay Quarries Company, eastern edge of Alpena, Alpena County. SE $\frac{1}{4}$ , Sec. 14, T.31 N., R.8 E.
58. Ditches beside road at south end of Long Lake, Alpena County. NE $\frac{1}{4}$  sec. 22, T.32 N., R.8 E.
68. Small shale pit at northwest corner of Alpena Cemetery (Evergreen Cemetery), Alpena County. SW $\frac{1}{4}$  sec. 21, T.31 N., R.8 E.
90. Excavations at the Alpena City Waterworks and ledges outcropping on beach at Stony Point, south edge of city of Alpena, Alpena County. Near NW corner, sec. 34, T.31N., R.8 E.

## SYSTEMATIC DESCRIPTIONS

Phylum COELENTERATA

Class ANTHOZOA

Order RUGOSA

Suborder STREPTELASMATINA

Superfamily Zaphrenticae

Family Zaphrentidae

Genus *Tortophyllum* Sloss*Tortophyllum* Sloss, 1939, p. 54.

*Type species*.—By original designation, *Zaphrentis cystica* Winchell, 1866, p. 90.

*Diagnosis*.—(Sloss, 1939, p. 54.)

"Solitary corals with numerous steeply inclined rows of globose dissepiments, tabulae differentiated into a horizontal periaxial series and an inclined axial series, which is reflected in the calyx by a low calicular boss. The major septa extend to the center, where they are twisted and joined together into a loosely knit axial complex. Minor septa characteristically long; dissepimentarium correspondingly wide. The corallum is without apparent symmetry and lacks a cardinal fossula, thus differing from *Phaulactis* Ryder (1926, p. 385)."

*Tortophyllum cysticum* (Winchell)

(Pl. I, Figs. 1-2, 4-6; Pl. II, Fig. 9; Pl. IV, Figs. 1, 4-5)

*Zaphrentis cystica* Winchell, 1866, p. 90.

*Tortophyllum cysticum* Sloss, 1939, pp. 54-58.

*Remarks.*—For description of the species see Sloss (1939, pp. 54–58). Some specimens present a remarkable set of attachment talons (Pl. I, Fig. 5). The species is widespread in the middle and upper parts of the Traverse group.

*Occurrence.*—Gravel Point formation, localities 14 and 14e; Petoskey limestone, localities 21 and 21a; Alpena limestone, localities 40 and 53; locality 1 of Grabau; Potter Farm formation, locality 68.

*Types.*—Lectotype No. 14355; hypotypes nos. UC 38624, UC 38725, UC 38726, UC 38727, UC 38728, UC 38729, 26254, 35250, 35308, 44724, 47096, and 47097.

*Tortophyllum magnum*, sp. nov.

(Pl. V, Figs. 1–2)

*Description.*—Corallum large, subcylindrical to ceratoid. Epithea worn off on holotype, exposing peripheral edges of septa. Holotype measuring over 13 cm long with a maximum diameter of 6 cm. Epithea coarsely annulated where present, worn off on parts of holotype. Calyx obscured by matrix, but apparently shallowly cup-shaped without a distinct peripheral platform.

In transverse section, septa 128, major septa approaching but not reaching axis, with a slight axial whorl. Minor septa about one-half as long. All septa irregularly thickened in dissepimentarium, thin in tabularium. No cardinal fossula visible.

In longitudinal section, tabularium composed of small, cystose, axially convex tabellae. Dissepimentarium composed of small, axially convex, globose dissepiments crossed by horizontal bands of stereoplasm representing the intercepted parts of the thickened septa.

*Remarks.*—The species is distinguished from *T. cysticum* by the much greater size, larger number of septa, shorter major septa, and irregular thickening of the major septa in the dissepimentarium.

*Occurrence.*—Middle Devonian Traverse group, Potter Farm formation, locality 90.

*Type.*—Holotype No. 35268.

*Tortophyllum milleri* Pitrat

(Pl. I, Fig. 7; Pl. IV, Figs. 2–3)

*Tortophyllum milleri* Pitrat, 1962, pp. 1158–59, Pl. 158, Figs. 7–10.

*Remarks.*—For description of species see Pitrat (1962, pp. 1158–59). A hypotype from Michigan is ceratoid, with a length of 6.4 cm and a maximum diameter of 4.8 cm. The specimen has a fairly well-preserved calyx with a steeply sloping wall and a rounded base. The upper third of

the calyx wall slopes at a slightly lower angle than the lower two-thirds. The internal structures of the specimen appears identical with those described by Pitrat. Pitrat's specimens are from the Cedar Valley limestone of Iowa.

*Occurrence*.—Middle Devonian, Traverse group, upper Petoskey limestone (*Schizophoria* bed), locality 7c.

*Type*.—Hypotype No. 45104.

#### Genus *Bethanyphyllum* Stumm

*Bethanyphyllum* Stumm, 1949, p. 18.

*Type species*.—By original designation, *Cyathophyllum robustum* Hall, 1876, Pl. 22, Figs. 1-2, 4-9, 14, *non* Fig. 3 which is a specimen of *Heliophyllum halli*.

*Diagnosis*.—Simple, ceratoid to trochoid, rugose corals with radially arranged thin septa. Major septa approaching axis without development of axial whorl. Minor septa about one-half as long. Cardinal fossula weakly to prominently developed.

*Remarks*.—*Bethanyphyllum* differs from *Tortophyllum* in the absence of an axial whorl and in the presence of a cardinal fossula. It differs from the Halliidae in not having pinnate development of septa in the cardinal quadrants and in not having dilated septa beyond the brephic stage.

#### *Bethanyphyllum geniculatum* (Rominger)

(Pl. I, Fig. 3; Pl. V, Figs. 3-4; Pl. VI, Figs. 1-4)

*Cyathophyllum geniculatum* Rominger, 1876, pp. 103-4, Pl. 36, lower tier.

*Description*.—Corallum large, simple ceratoid typically irregularly twisted; holotype measuring over 14 cm long with a maximum diameter of 6.5 cm. Exterior with typical horizontal growth wrinkles and interseptal ridges. Calyx with distinct, relatively horizontal peripheral platform measuring over 1 cm in diameter and a wide, cup-shaped axial and periaxial pit measuring about 4 cm in diameter and a little over 2 cm deep. Cardinal fossula well developed.

In transverse section, septa averaging 110, thin, radially arranged, and relatively straight. Major septa extending almost to axis with little twisting in axial area. Minor septa about one-half as long as major. Cardinal fossula distinct.

In longitudinal section, tabularium averaging 2 cm wide, composed of small, horizontal, or distally convex tabellae. Dissepimentarium averaging 1.5 cm wide, composed of small or medium-sized, globose, axially and distally convex dissepiments.

*Remarks*.—Rominger figures the back view of the holotype at natural

size (1876, Pl. 36, lower tier). The calyx was originally filled with calcareous shale but was cleaned out by me to reveal calycinal features not accessible to Rominger.

*Occurrence.*—Middle Devonian, Traverse group, Alpena limestone (possibly Four Mile Dam formation) locality 53; Potter Farm formation, localities 68 and 90; Thunder Bay limestone, locality 35.

*Types.*—Holotype no. 8571; hypotypes nos. 35256, 35273, and 35278.

*Bethanyphyllum bellense*, sp. nov.

(Pl. II, Figs. 3-4; Pl. VII, Figs. 5-8)

*Description.*—Corallum simple; relatively small, narrowly curved ceratoid; holotype measuring 5.8 cm in length and 2.7 cm in maximum diameter. Exterior with fine, closely set annulations and faintly developed interseptal ridges. Calyx without peripheral platform; walls sloping steeply to axial pit. Depth of calyx 12 mm, width of axial pit about 9 mm. Cardinal fossula distinctly developed.

In transverse section, septa ranging from 96 to 112, thin, radially arranged; major septa extending to or almost to axis; minor about one-half as long. In the neanic stage septa thickened and cardinal fossula prominent (Pl. VII, Fig. 8); in ephebic stage septa thin and cardinal fossula less prominent or obscure (Pl. VII, Fig. 6).

In longitudinal section, tabularium composed of small, axially convex tabellae; dissepimentarium composed of small, globose, distally and axially convex dissepiments.

*Remarks.*—This small species is quite distinct and is easily recognized by its narrow ceratoid growth form and cup-shaped calyx.

*Occurrence.*—Middle Devonian, Traverse group, Bell shale, localities 31 and 38.

*Types.*—Holotype no. 46895, paratypes nos. 35147, 35149, and 35163.

Family *Halliidae*

Genus *Aulacophyllum* Edwards and Haime

*Aulacophyllum* Edwards and Haime, 1850, p. lxxvii; 1861, p.

*Pinnatophyllum* Grabau, 1917, p. 199 (*nomen nudum*), and 1922, pp. 13, 66.

*Type species.*—By original designation, *Caninia sulcata* d'Orbigny, 1850, p. 105, Middle Devonian, Jeffersonville limestone, Falls of the Ohio, Louisville, Kentucky.

*Diagnosis.*—Simple rugose corals with strong pinnate development of the septa in the cardinal quadrants and radial development in the counter quadrants. Septal dilation decreasing upward from periphery to axis first in



the counter quadrants, later in the cardinal quadrants. Tabulae or tabellae and dissepiments present.

*Aulacophyllum scyphus* (Rominger)

(Pl. I, Figs. 8–11; Pl. III, Figs. 1, 4–7; Pl. VII, Fig. 1; Pl. VIII, Figs. 2–7)

*Cyathophyllum scyphus* Rominger, 1876, p. 103, Pl. 35, lower tier, two right-hand specimens (erroneously designated as "two left-hand specimens" on explanation of plate).

*Pinnatophyllum scyphus* Grabau, 1922, p. 66.

*Aulacophyllum scyphus* Stumm, 1951, Card 70.

*Description*.—Corrallum curved ceratoid; largest specimen measuring 10 cm long and 5 cm in maximum diameter. Lectotype, an immature specimen, measuring 4.5 cm long and 3.7 cm in maximum diameter. Calyxes cup-shaped with steeply sloping walls and rounded base. Peripheral platform typically absent or weakly developed. Cardinal fossula on convex side of corallum, well developed, narrow, deep, extending from margin to base of calyx. Septa pinnately directed toward fossula in cardinal quadrants; radially arranged in counter quadrants. Septa in cardinal quadrants longer than those in counter.

In transverse section, septa ranging from 96 to 130, major extending to axis, minor about one-half as long. In brephic stage septa dilated and in lateral contact. In early neanic stage (Pl. VIII, Fig. 2) septa attenuate peripherally, dilated periaxially and axially. In later neanic stage septa attenuate in counter quadrants, dilated axially and periaxially in cardinal quadrants (Pl. VIII, Fig. 3). In ephebic stage septa attenuate except for axial ends of those in cardinal quadrants (Pl. VIII, Fig. 4). In a few specimens septa completely attenuate in late ephebic stage (Pl. VIII, Fig. 7).

In longitudinal section, tabularium composed of typically incomplete, relatively horizontal tabulae interspersed with cystose, distally convex tabellae. Dissepimentarium relatively wide, composed of small, cystose, axially convex dissepiments.

*Remarks*.—The selective attenuation of the septa in this species is characteristic of all species of *Aulacophyllum* and other genera of the family Halliidae. It is unfortunate that single transverse sections cut through specimens at different growth stages have misled some workers into believing that those with septal dilation in all quadrants were a distinct species from those in which the dilation was confined to the cardinal quadrants, and from those in which the septa had become attenuate in all quadrants.

*Occurrence*.—Middle Devonian, Traverse group, Ferron Point formation, locality 38; lower part of Genshaw formation in almost all outcrop areas.

*Types*.—Lectotype No. 8568; hypotypes Nos. 19343, 35223, 35224, 44748, 44751, 44754, 45100, 45101, 45102, and 45103.

*Aulacophyllum hemicrassatum* Sloss

(Pl. II, Figs. 5, 8; Pl. III, Figs. 2-3; Pl. IV, Figs. 6-7; Pl. IX, Figs. 4-5, 7;  
Pl. X, Figs. 3-10)

*Aulacophyllum hemicrassatum* Sloss, 1939, p. 64-65, Pl. 9, Figs. 9-10, Text-fig. 6;  
Stumm, 1951, Card 57; Pitrat, 1962, p. 1157-68, Pl. 158, Figs. 1-4.

*Aulacophyllum bilaterale* Sloss, 1939, p. 64, Pl. 9, Figs. 18-20, Text-fig. 5 (*non A. bilaterale* Hall, 1882).

*Aulacophyllum mesodilatatum* Sloss, 1939, p. 65, Pl. 9, Figs. 11-13; Stumm, 1951, Card 59.

*Aulacophyllum symmetricum* Sloss, 1951, p. 415 (*pro A. bilaterale* Sloss, 1939);  
Stumm, 1951, Card 52.

*Description*.—Corallum curved ceratoid to curved trochoid ranging from 5 to 10 cm long and from 4 to 6 cm in maximum diameter. Exterior with typical horizontal growth annulations. Calyx cap-shaped with steeply to moderately sloping walls and a rounded base. A low axial boss produced by elevated axial ends of the major septa present in most specimens. Fossula prominent, of variable width, extending from margin to base of calyx.

In transverse section, septa ranging from 92 to 124, those of cardinal quadrants pinnate, of counter quadrants radiate; major septa extending to axis, typically twisted at axial ends; minor septa about one-half as long. In brephic stage septa thickened and in lateral contact. In early neanic stage septa attenuate peripherally thickened periaxially and axially (Pl. X, Fig. 3). In late neanic or early ephebic stages septa thickened only in axial and periaxial parts of cardinal quadrants (Pl. X, Fig. 5). In late ephebic stage septa thin in all quadrants except for slightly thickened remnants in the periaxial region in some specimens (Pl. X, Figs. 8-10).

In longitudinal section, tabularium composed of incomplete, relatively horizontal tabulae interspersed with cystose, distally convex tabellae. Dissepimentarium composed of small to medium-sized, axially convex dissepiments.

*Remarks*.—The species closely resembles *A. scyphus* Rominger in all its developmental stages. The growth form of *A. hemicrassatum* is more nearly trochoid, the calyx shows a small axial boss, and the tabulae are less complete and are typically more interrupted by tabellae.

*Occurrence*.—Middle Devonian, Traverse group, Gravel Point formation, lower and upper blue shales, locs. 14 and 14e; Petoskey limestone, localities 21 and 21a; Potter Farm formation, locality 68, and Thunder Bay limestone, loc. 35.

*Types*.—Holotype No. UC 38709; hypotypes Nos. UC 38704, UC 38710, 35252, 35281, 35298, 45099, 46390, 46391, 46392, and 46394.

*Aulacophyllum alpenense*, sp. nov.

(Pl. III, Fig. 8; Pl. X, Figs. 1-2)

*Description*.—Corallum large, curved ceratoid; holotype measuring 12.7 cm long and 6.4 cm in maximum diameter. Epitheca thin, moderately annulated, worn off in basal half of holotype; septal grooves clearly defined on holotype. Calyx of holotype filled with limestone.

In transverse section, 162 septa present, major extending to axis, moderately twisted at axial ends, minor about one-half as long. In ephebic stage axial one-third to one-half of major septa moderately to strongly thickened in cardinal quadrants, very slightly thickened in counter quadrants. Cardinal fossula very poorly defined.

In longitudinal section, axial region composed of small horizontal or axially convex tabellae. Dissepimentarium composed of small to medium-sized axially convex dissepiments.

*Remarks*.—The species is known only from the holotype. The most characteristic feature is the number of septa which totals at least 40 more than in related species of *Aulacophyllum*.

*Occurrence*.—Middle Devonian Traverse group, Alpena limestone, one-foot shale bed 20 feet above base of formation, locality 40.

*Type*.—Holotype No. 35257.

*Aulacophyllum* sp. A

(Pl. VII, Figs. 2-4; Pl. VIII, Fig. 1)

*Description*.—Species known from 2 incomplete specimens. Corallum ceratoid, length unknown. Larger specimen measuring 4 cm in maximum diameter. Epitheca 1 mm thick, moderately annulated; septal grooves poorly defined. Calyx filled with limestone.

In transverse section, 96 septa present, major extending to axis where their ends become more or less fused to adjacent and opposite septa to form a small axial pseudocolumella; minor septa about one-half as long. Some sections showing septal thickening primarily in axial region of cardinal quadrants with less thickening, if any, in counter quadrants.

In longitudinal section, tabularium composed of small, distally convex tabellae; dissepimentarium composed of medium-sized to large axially or distally convex dissepiments.

*Remarks*.—This species is characterized by having some major septa fused in the axial zone, producing a more- or less-well-defined columella-like structure.

*Occurrence.*—Middle Devonian Traverse group, upper part of Genshaw formation, loc. 40.

*Figured specimens.*—Nos. 35220 and 35221.

Genus *Hallia* Edwards and Haime, 1850

*Hallia*, Edwards and Haime, 1850, p. lxvii; 1851, p. 353.

*Type species.*—By original designation, *Hallia insignis* Edwards and Haime, 1850, p. lxvii; 1851, p. 353, Pl. VI, Fig. 3, Columbus limestone?, Columbus, Ohio.

*Diagnosis.*—Simple rugose corals similar to *Aulacophyllum* but with a longer cardinal septum and with septal attenuation typically occurring in early neanic growth stages.

*Hallia vesiculata* Sloss

(Pl. II, Figs. 1–2, 6–7; Pl. IX, 1–3, 6)

*Hallia vesiculata* Sloss, 1939, pp. 62–63, text-fig. 3 on p. 62; Pl. 12, Figs. 1–16.

?*Hallia zonata* Sloss, 1939, p. 63, text-fig. 4 on p. 63; Pl. 12, Figs. 17–21.

*Remarks.*—For description of this common species see Sloss, 1939, pp. 61–62. The species differs from *Aulacophyllum hemicrassatum* in the narrower fossula, longer cardinal septum and by the attenuation of the septa at a much earlier growth stage. In some specimens (Pl. IX, Fig. 2) septal dilation persists in the axial region into the ephebic stage, but in most specimens (Pl. IX, Figs. 1, 6) the septa are attenuate after the early neanic stage. The genus *Hallia* is distinguished from *Aulacophyllum* on the basis of a more persistent cardinal septum, a feature to me of doubtful generic rank. The species *Hallia zonata* is apparently based on a specimen in which septal dilation has persisted into the ephebic stage.

*Occurrence.*—Middle Devonian, Traverse group, Petoskey limestone, locs. 21 and 21a; Potter Farm formation, loc. 68.

*Types.*—Holotype UC 38738; paratypes Nos. UC 38739, UC 38740, UC 38741, UC 38742, UC 38743 (holotype of *H. zonata*), UC 38753; hypotypes nos. 23561, 44749, and 45098.

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PLATES

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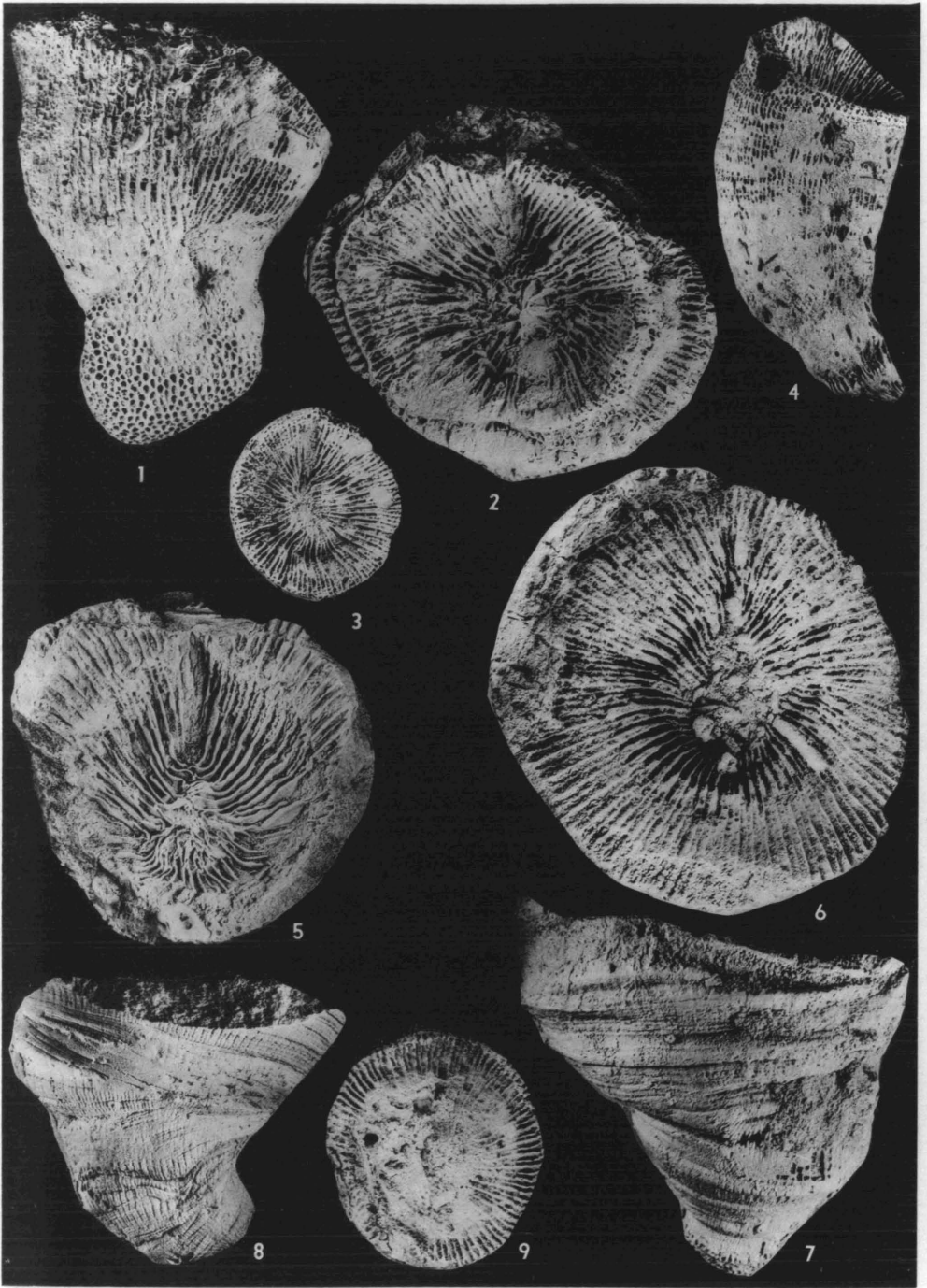
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PLATE II





## EXPLANATION OF PLATE II

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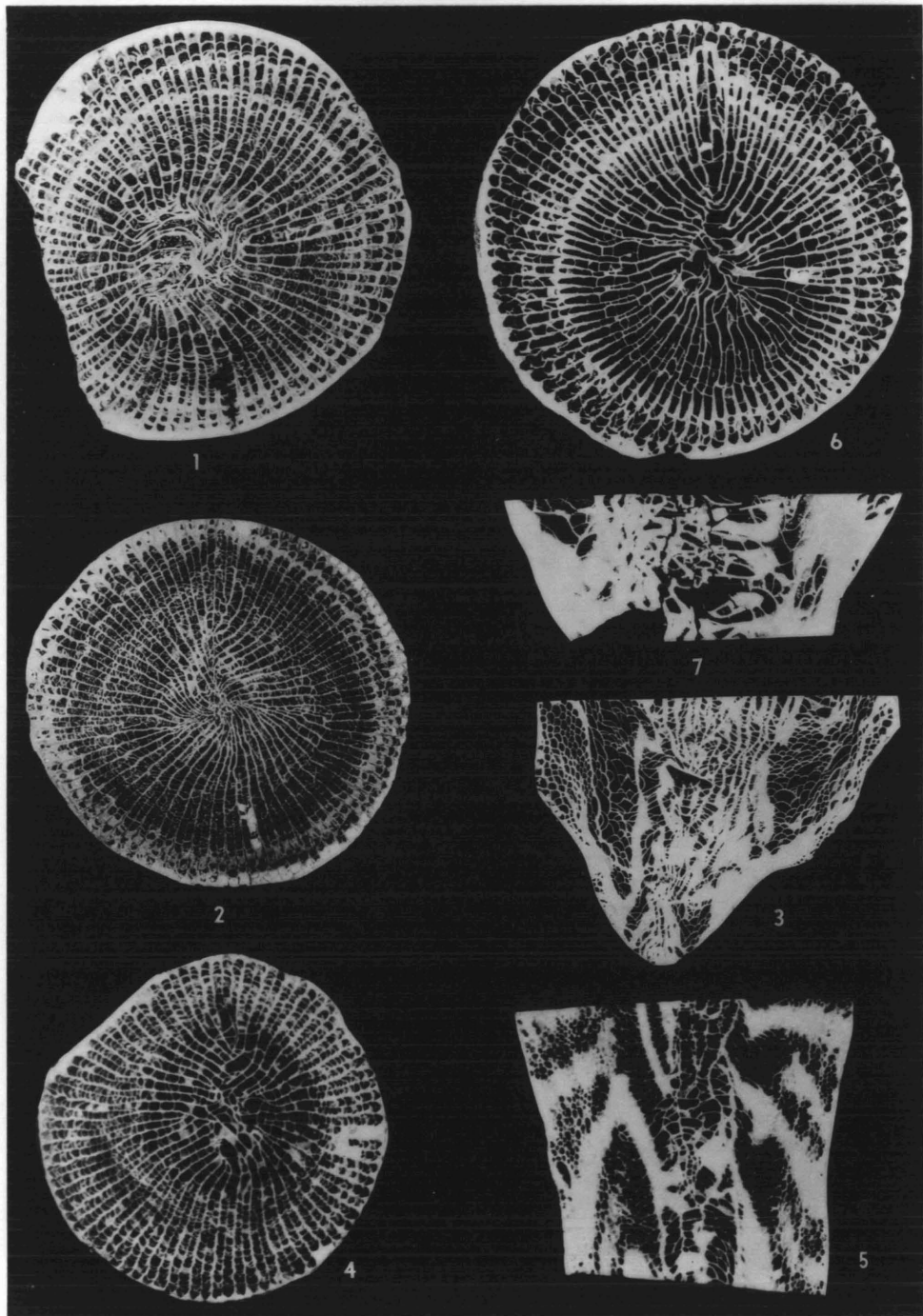
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PLATE III



PLATE IV



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PLATE V

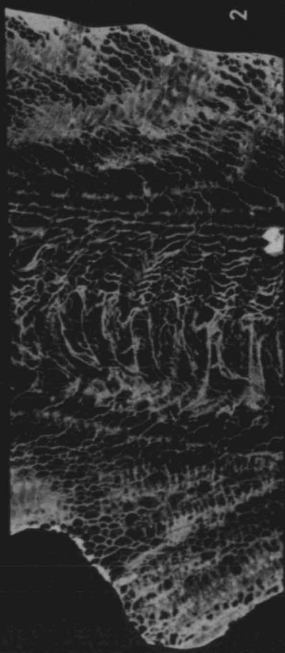
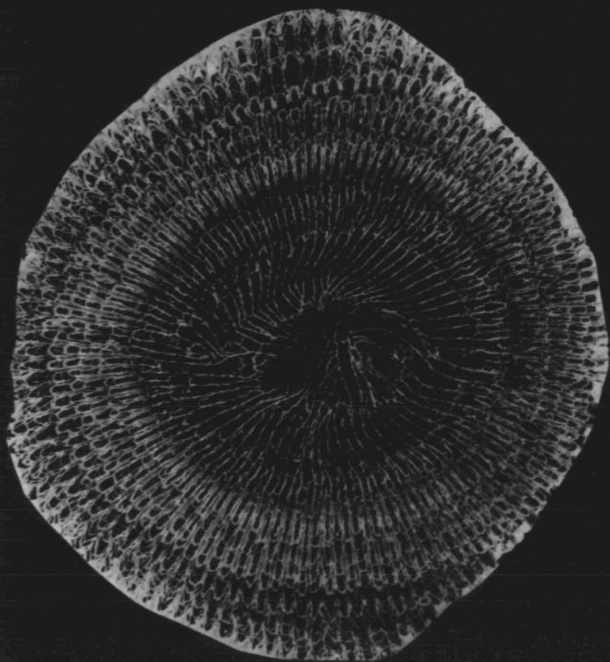
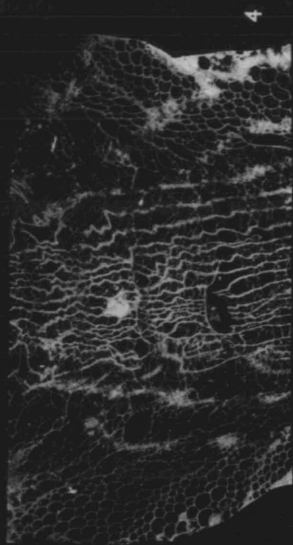
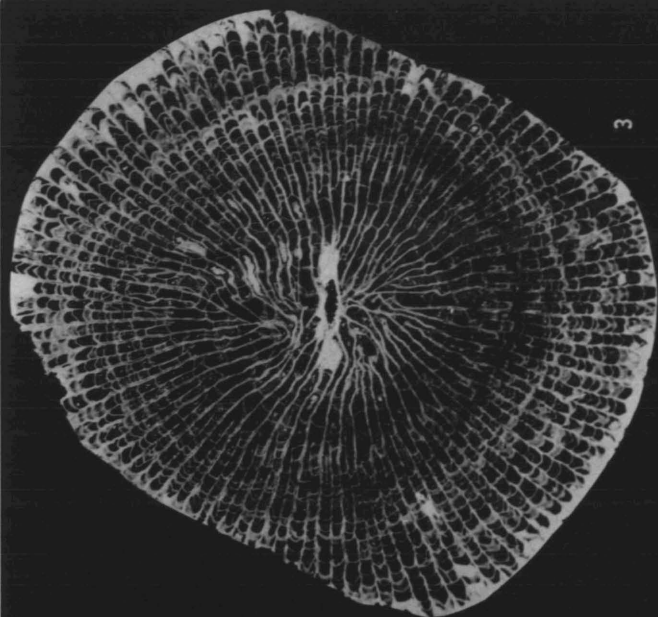
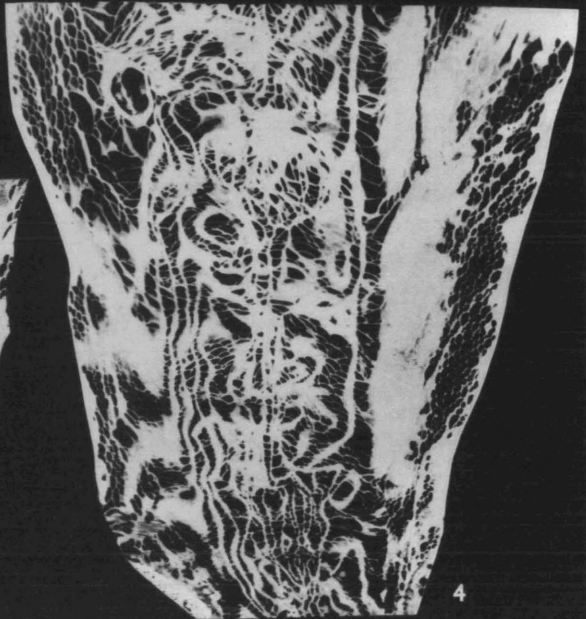
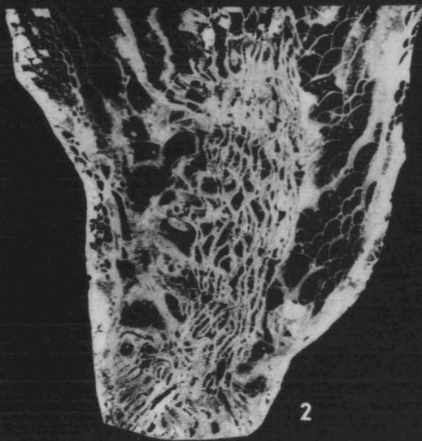
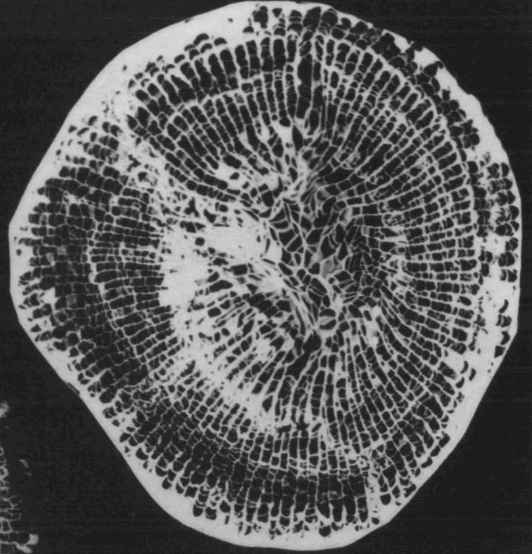
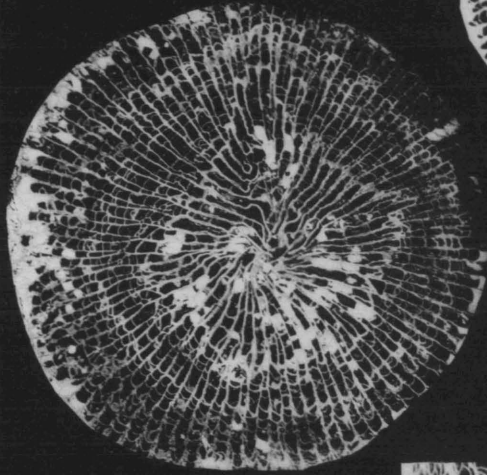


PLATE VI





## EXPLANATION OF PLATE VI

(All figures  $\times 1\frac{1}{2}$ )

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PLATE VII

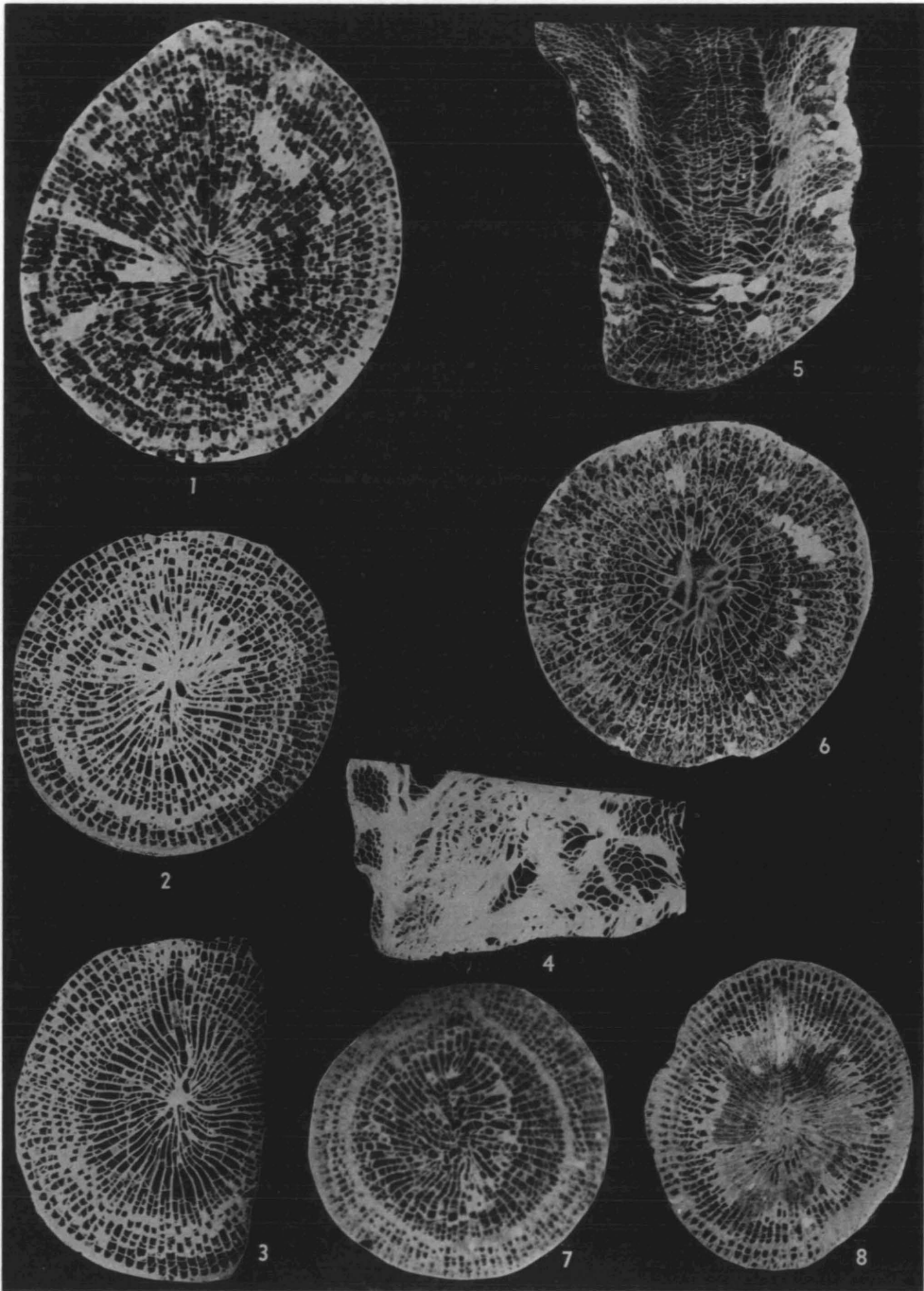
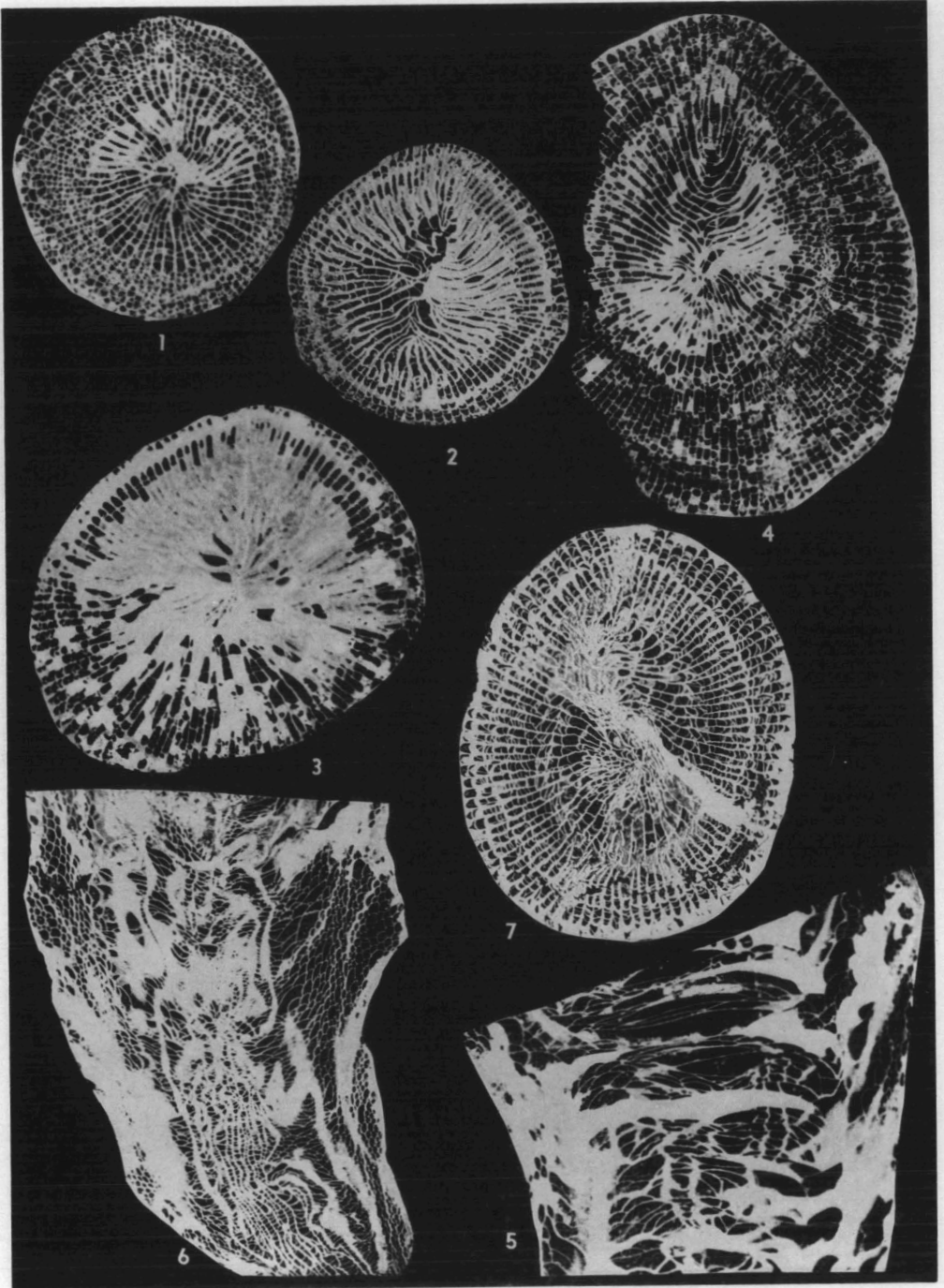


PLATE VIII



## EXPLANATION OF PLATE VIII

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PLATE IX

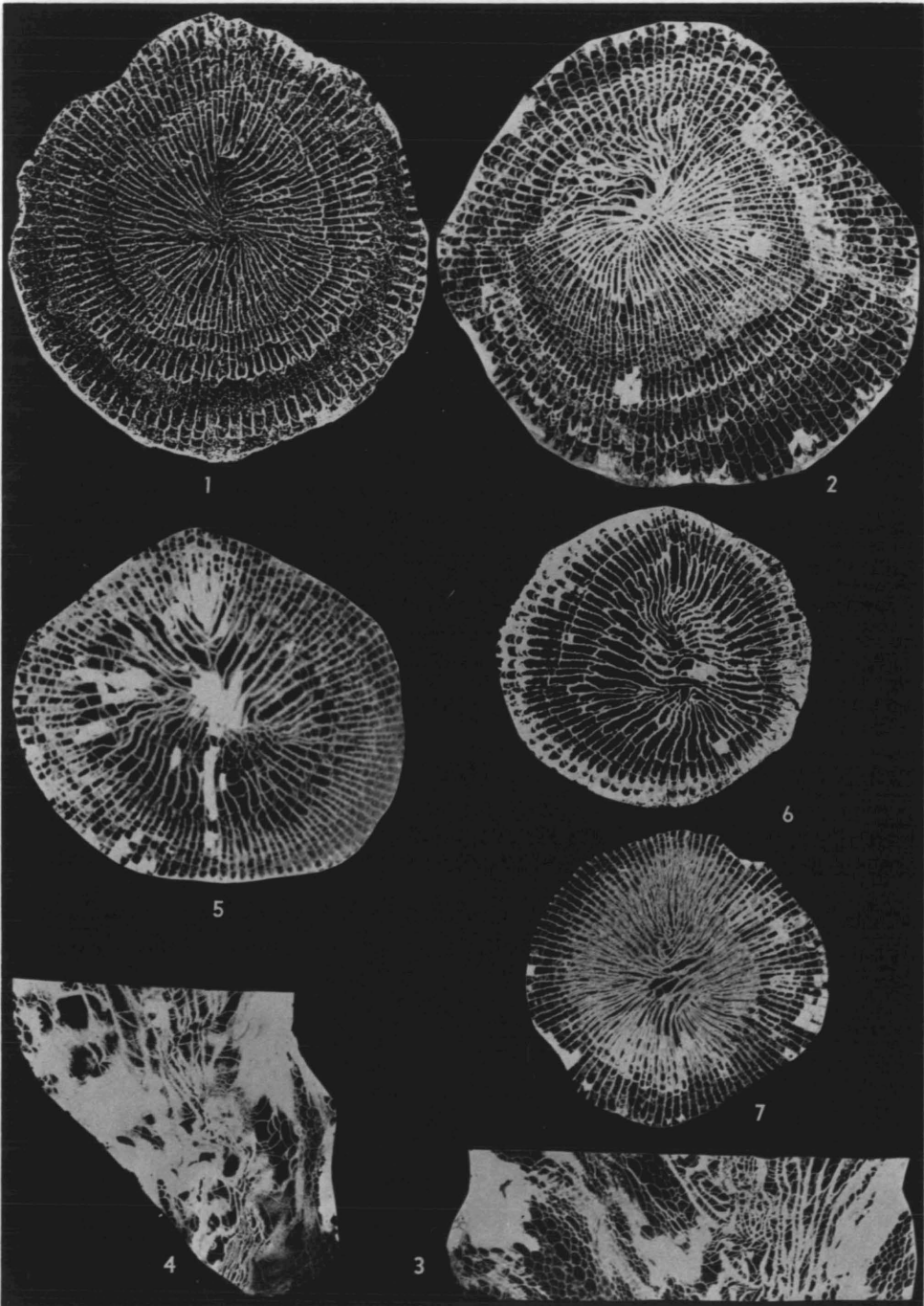
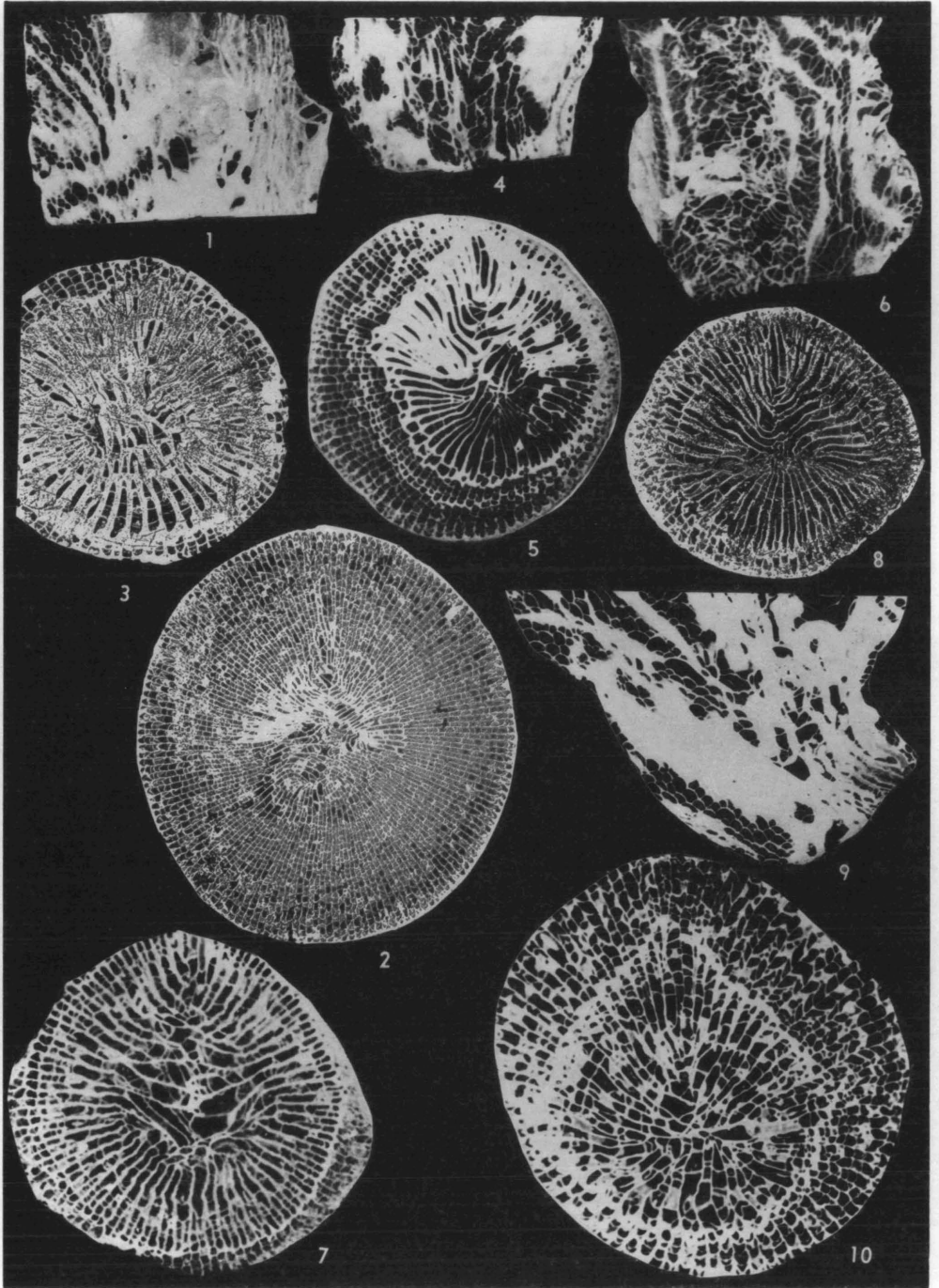


PLATE X





## EXPLANATION OF PLATE X

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