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UPPER PENNSYLVANIAN CONEMAUGH CORALS FROM
OHIO

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ABSTRACT

Corals occur in three marine limestones—Lower Brush Creek, Upper Brush Creek, and Ames Limestones—in the Upper Pennsylvanian Conemaugh of Athens County, Ohio. Four new species of corals belonging to the lophophyllidid genus *Stereostylus* and one unnamed form are characterized on the basis of a study of more than 400 specimens.

INTRODUCTION

Upper Pennsylvanian Conemaugh strata crop out in a belt approximately 25 miles wide that trends northeastward across southeastern Ohio (Fig. 1). Corals for this study were collected in Athens County, Ohio, from marine limestones (Ames, Upper Brush Creek, and Lower Brush Creek Limestones) which make up a relatively small part of the Conemaugh section in this area (Fig. 2). More than 400 specimens of corals were collected from 19 localities; transverse and longitudinal thin sections were prepared from approximately 150 corallites.

Corals from the Pennsylvanian of Ohio have been described as a minor part of several large faunal studies and on the basis of external features alone were referred to the genus *Lophophyllum* (MARK in CONDIT, 1912, p. 261-320; MORNINGSTAR, 1922). JEFFORDS (1942) described a few specimens from the Lower Mercer Limestone of the Allegheny Series in Ohio and illus-

trated the internal features of the coral *Lophophyllum profundum* (FOERSTE). The present paper describes for the first time a Pennsylvanian coral fauna from Ohio based on a detailed analysis of a large number of specimens. *Stereostylus* is the only genus represented in this collection; however, C. T. CALVIN of Ohio University has reported (personal communication to R. M. JEFFORDS) finding two specimens, one each from the Lower Brush Creek and Portersville Limestones, that are possibly assignable to *Lophophyllum*.

ACKNOWLEDGMENTS

Sincere appreciation is expressed to M. L. THOMPSON, now of the Illinois State Geological Survey, for first suggesting the problem; to M. T. STURGEON, Ohio University, who accompanied me in the field and supplied the stratigraphic information at each locality; and to R. M. JEFFORDS, Esso Production Research Company, who critically reviewed the manuscript. The types and figured thin sections are filed in the U.S. National Museum.

SYSTEMATIC PALEONTOLOGY

Family LOPHOPHYLLIDIIDAE

Moore & Jeffords, 1945

Genus STEREOSTYLUS Jeffords, 1947

STEREOSTYLUS OHIOENSIS Bebout, n. sp.

Description.—*Stereostylus ohioensis* includes small and conical corallites which are straight or slightly curved in the apical region. The curva-

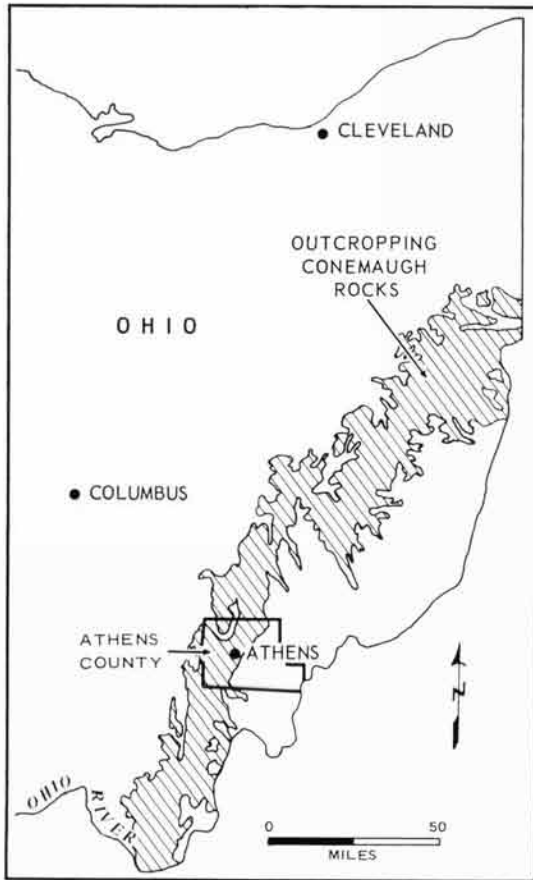


FIG. 1. Index map showing the Conemaugh outcrop belt and location of the area of study. (After U.S. Geological Survey, Geological Map of the United States, 1932).

ture is not restricted to any one plane of septal insertion. The moderately thick theca of well-preserved specimens bears well-defined, low, rounded interseptal ridges and shallow septal grooves; low transverse wrinkles are common. The calyx is deep. The length and maximum diameter of the type specimen are 14 mm. and 7.6 mm., respectively. Radicles or "rootlets" occur on a few of the specimens.

The major septa in early immature stages are long, distinctly rhopaloid, and moderately thick, and they meet with the column in the axial region. The counter cardinal septum is expanded to two or three times its normal thickness to form the axial column. The partial abortion of the cardinal septum takes place after the insertion of 16 to 20 septa, about halfway between the apex and the calyx. The septal formula in the imma-

ture region of the type specimen after the insertion of 14 septa is K3A2C2A3K. Just below the base of the calyx the rhopaloid septa withdraw from the column because at this stage the diameter of the corallite continues to increase, whereas length of the septa does not increase. In the lower part of the calyx the septa are nonrhopaloid and the counter cardinal septum becomes much shorter than other major septa. The septal formula of the type specimen in the region of 21 septa is K6A3C3A5K. Minor septa do not appear until high in the calyx, the first appearing on either side of the counter cardinal septum. The median laminae, which are present in all septa, extend almost completely through the theca. Stereoplasm occurs in all specimens, but the quantity varies considerably depending upon the position of the section in relation to the tabulae; stereoplasm is heavier just above the tabulae. The septa commonly are connected to the column by stereoplasm.

Throughout the lower part of the corallite the outline of the column is pear-shaped to elliptical. In the calyx, as the major septa withdraw, the column becomes distinctly elliptical; higher in the calyx, as the counter cardinal becomes short, the column is strongly compressed laterally. A median lamina is present, but radiating laminae are lacking. The irregularly spaced tabulae slope steeply upward toward the column. The tabulae are very thin and commonly are extremely difficult to see where the stereoplasm is thick. The cardinal fossula is large and distinct. Alar pseudo-fossulae are not well developed.

Discussion.—The elliptical to pear-shaped axial column, small size, presence of stereoplasm, and rhopaloid septa are the distinguishing characteristics of *Stereostylus ohioensis*. The species is separated easily from *S. sturgeoni*, n. sp., by its more-distinct axial column, consistently smaller size, and relatively thinner theca. The rhopaloid septa and the greater quantity of stereoplasm of *S. ohioensis* serve to distinguish it from *S. brushensis*, n. sp., with which it is associated, and from *S. amesensis*, n. sp. The lack of radiating laminae in the column, late appearance of minor septa, and more conical form of *S. ohioensis* distinguish this species from *Lophophyllidium proliferum*. *S. ohioensis* is somewhat similar to the specimens illustrated by ROWETT & SUTHERLAND (1964) as *L. idonium* MOORE & JEFFORDS but differs from

this species in having fewer septa at all growth stages.

Illustrations.—Plate 1, figures 1-6.—Fig. 1. Type specimen O-11-34; *1a,c*, transv. secs., $\times 5$; *1b*, long. sec., $\times 5$; *1d*, ext. view, $\times 2.5$.—Fig. 2. Specimen O-11-28; *2a-d*, transv. secs., $\times 5$.—Fig. 3. Specimen O-11-77; *3a-c*, transv. secs., $\times 5$; *3d*, long. sec., $\times 5$; *3e*, ext. view, $\times 2.5$.—Fig. 4. Specimen O-11-42; *4a-d*, transv. secs., $\times 5$.—Fig. 5. Specimen O-11-39; *5a,c*, transv. secs., $\times 5$; *5b*, long. sec., $\times 5$.—Fig. 6. Specimen O-11-5; *6a-c*, transv. secs., $\times 5$. [Short lines indicate locations of major septa: above, counter cardinal; lateral, alar; below, cardinal.]

Occurrence.—Lower Brush Creek Limestone (localities O-5, O-8, O-11).

Type.—No. O-11-34 from locality O-11.

STEREOSTYLUS BRUSHENSIS Bebout, n. sp.

Description.—*Stereostylus brushensis* comprises a relatively large conical corallite which is slightly curved in the immature region. The thin theca bears broad interseptal ridges and shallow septal grooves; transverse growth wrinkles are indistinct. The length of the type specimen is not determinable, as the lower part of the immature region is missing. The maximum diameter of the type specimen is 10.4 mm.

The long, thin major septa in the early immature stages converge toward the axial region, but few septa reach the column. The major septa commonly are joined to one another so as to leave an open space between the inner edges of the septa and the column. The septa are weakly rhopaloid to nonrhopaloid. The septal formula of the type specimen in the immature region of 20 septa is K6A3C3A4K. At this stage the cardinal septum is only half the length of other major septa. In the mature region the septa are of unequal lengths and are very thin. After the addition of 24 to 25 major septa the column separates from the counter cardinal septum and minor septa appear as low ridges. The cardinal septum is very short in mature stages. The septal formula of the type specimen in the mature region of 25 septa is K6A4C4A7K. A median lamina runs through the center of each septum.

The column is very thin, commonly not thicker than the counter cardinal septum, and separation from the counter cardinal septum does not occur until late stages of growth. The median

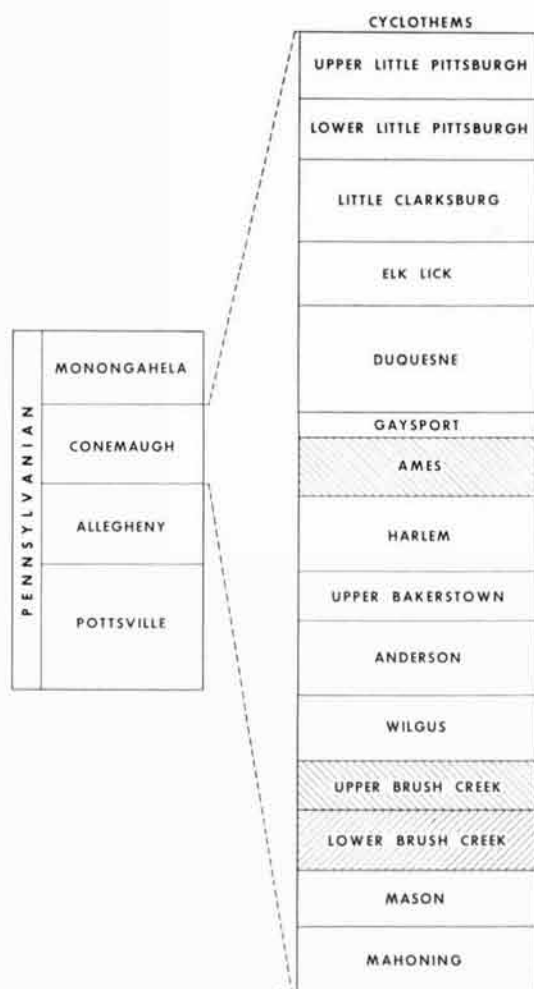


FIG. 2. Columnar section of Conemaugh cyclothem in Athens County, Ohio. Hachured intervals are those from which corals were studied. (After Sturgeon & Associates, 1958).

lamina is distinct; radiating laminae are lacking. Irregularly spaced tabulae are relatively abundant; they are steeply arched from the periphery to the column. An extremely large cardinal fossula results from the withdrawal of the thin cardinal septum. Alar pseudofossulae are poorly developed.

Discussion.—The large conical form, the nonrhopaloid to weakly rhopaloid septa, most of which do not reach the column, and the absence of stereoplasm are distinguishing characteristics of *Stereostylus brushensis*. In the Conemaugh of Ohio, this species is associated with *S. ohioensis* and *S. amesensis*. *S. brushensis* is distinguished from *S. ohioensis* and *S. sturgeoni* by its lack of

stereoplasm, absence of distinctly rhopaloid septa, and thinner skeletal elements. The numerous tabulae, failure of the major septa to reach the column in early stages, and the larger size of *S. brushensis* serve to distinguish it from *S. amensis*.

Illustrations.—Plate 2, figures 1-3.—Fig. 1. Type specimen O-6-1; 1a-d, transv. secs., $\times 5$; 1e, ext. view, $\times 2.5$.—Fig. 2. Specimen O-11-70; 2a, transv. sec., $\times 5$; 2b, long sec. $\times 5$.—Fig. 3. Specimen O-3-1; 3a-d, transv. secs., $\times 5$. [Short lines indicate locations of major septa: above, counter cardinal; lateral, alar; below, cardinal.]

Occurrence.—Upper Brush Creek Limestone (localities O-3 and O-12) and Lower Brush Creek Limestone (localities O-6, O-8, O-11).

Type.—No. O-6-1 from locality O-6.

STEREOSTYLUS sp.

Description.—*Stereostylus* sp. is represented by a single individual which is conical in the early portions of the corallite and becomes cylindrical in maturity. The curvature is in the alar plane. The relatively thick theca bears very low interseptal ridges and shallow septal grooves. Periods of rejuvenation are responsible for prominent transverse wrinkles and variations in thickness of the theca. The calyx is shallow relative to the size of the individual. The length and width are 28 mm. and 8 mm., respectively.

The long, relatively thick septa in the apical region are joined to each other and are commonly connected to the column. The septal formula in the apical region of 17 septa is K4A3C2A4K. The column is only slightly thicker than the counter cardinal septum. Higher in the corallite the septa become markedly thinner and withdraw from the column. In the mature region of 24 septa the septal count is K7A3C3A7K. The septa are relatively short and extend less than half the distance to the column; the cardinal septum is approximately one-half the length of the other major septa. In early maturity the thin, laterally compressed column separates from the counter cardinal septum. The septa are not rhopaloid at any stage. Low, indistinct minor septa appear only in late stages near the top of the calyx. A median lamina is present in all septa. Secondary deposits of stereoplasm are lacking. The column is thin and bladelike throughout the corallite. Because the column is quite crooked, in longitudinal sec-

tion it appears to be discontinuous. A median lamina is present in all sections; radiating laminae are lacking. Tabulae are numerous and spaced about 0.8 mm. apart in the mature region. They are steeply arched near the theca but flatten out in the axial region. The cardinal fossula is conspicuous. Alar pseudofossulae are distinct in early sections but are poorly developed higher in the corallite.

Discussion.—The corallite of *Stereostylus* sp. is characterized by the conical immature region, cylindrical mature region, and strongly wrinkled theca. The thin theca, bladelike column, and thin nonrhopaloid septa are the distinguishing internal features. *S. sp.* is distinguished from *S. lenis* JEFFORDS (1947, p. 40) by its thick theca, thin nonrhopaloid septa, and thin crooked column. The tabulae are not as irregular and do not rise as steeply toward the center as do those of *S. lenis*. *S. sp.* resembles *S. milichus* JEFFORDS (1947, p. 52) in its general features but differs by having fewer and more widely spaced tabulae, thick theca, and crooked column. The counter cardinal septum separates from the column at an early stage in *S. sp.*, long before the insertion of the minor septa, whereas in *S. milichus* and *S. lenis* this separation does not occur until just below the calyx, after insertion of the minor septa.

Although this specimen appears to be distinct from other known species of *Stereostylus*, naming this form does not seem desirable until additional specimens are available.

Illustrations.—Plate 2, figure 4. Specimen O-4-1; 4a, long. sec.; 4b-e, transv. secs.; all $\times 5$. [Short lines indicate locations of major septa: above, counter cardinal; lateral, alar; below, cardinal.]

Occurrence.—Ames Limestone (locality O-4).

STEREOSTYLUS STURGEONI *Bebout, n. sp.*

Description.—Relatively large, conical corallites which may be slightly curved in the apical region are included in *Stereostylus sturgeonii*. The theca is very thick. Interseptal ridges generally are angular and septal grooves are relatively deep; transverse wrinkles are low and indistinct. The calyx is deep. The length and width of the type specimen are 25 mm. and 14 mm., respectively.

In the apical region the long, thick rhopaloid septa converge near the axis. The septal formula of the type specimen in the apical region of 22

septa is K7A2C3A6K. The cardinal septum is short and does not reach the column; the counter cardinal septum is slightly thicker than other major septa and gradually expands toward the axial edge to form the column. In mature stages the major septa extend half the distance to the axis of the corallite and are not rhopaloid. The cardinal septum is considerably shorter than other major septa. The column disappears shortly after it separates from the counter cardinal septum in the calyx. The septal formula of the type specimen in the late stages of 24 septa is K7A3C4A6K. Minor septa appear only in late maturity after the major septa are reduced to mere ridges. The massive appearance of sections of the immature region is apparently due to thickness of the septa and not to secondary deposits of stereoplasm.

Throughout the corallites the column is represented by a very gradual thickening of the counter cardinal septum. A median lamina is present in the column, but radiating laminae are lacking. The irregularly spaced tabulae commonly are very thin, are moderately to steeply arched, and, because of the thick septa, are difficult to detect in transverse section. The cardinal fossula is large and prominent; alar pseudofossulae are weakly developed throughout the corallite.

Discussion.—The thick, massive skeletal elements, insertion of numerous septa in early growth stages, and large size of the corallite are the distinguishing characteristics of *Stereostylus sturgeonii*. This is the most abundant coral in the Ames Limestone and the largest lophophyllidid reported from the Conemaugh. *S. sturgeonii* is associated with *S. amesensis* and *S. sp.* but differs notably from them and from *S. brushensis* and *S. ohioensis* in its larger size and thicker theca and septa. *S. sturgeonii* is very similar to a form identified by ROWETT & SUTHERLAND (1964) as *Lophophyllidium ignotum* MOORE & JEFFORDS but differs from it in that *S. sturgeonii* has fewer septa and a much thicker theca.

Illustrations.—Plate 3, figures 1-3; Plate 4, figure 1.—Pl. 3, fig. 1. Type specimen O-19-2; 1a-c, transv. secs., $\times 5$; 1d, ext. view, $\times 2.5$.—Pl. 3, fig. 2. Specimen O-19-3; 2a-c, transv. secs., $\times 5$; 2d, long. sec., $\times 5$; 2e, ext. view, $\times 2.5$.—Pl. 3, fig. 3. Specimen O-19-26; 3a-d, transv. secs., $\times 5$.—Pl. 4, fig. 1. Specimen O-17-3; 1a-d, transv. secs., $\times 5$. [Short lines indicate locations

of major septa: above, counter cardinal; lateral, alar; below, cardinal.]

Occurrence.—Ames Limestone (localities O-1, O-4, O-9, O-17, O-19).

Type.—No. O-19-2 from locality 0-19.

STEREOSTYLUS AMESENSIS Bebout, n. sp.

Description.—*Stereostylus amesensis* is characterized by a medium-sized corallite which is moderately curved in the apical region. The thin theca bears broad, semicircular interseptal ridges and narrow septal grooves; the transverse growth wrinkles are low and indistinct. The length and maximum width of the type specimen are 14 mm. and 8 mm., respectively.

In the apical region, the weakly rhopaloid septa are quite thick in relation to the diameter and converge with the column near the axis. At this stage the cardinal septum has the same characteristics as other major septa, being long and thick. The septal formula of the type specimen after the insertion of 16 septa is K4A2C2A4K. The counter cardinal septum separates from the column shortly after the insertion of 20 septa; the unequal septa of this mature region are thin and nonrhopaloid. The cardinal septum is very short, as it is just above the apical region. In the calyx the other major septa withdraw from the axial region to become equal in length to the cardinal septum. Minor septa appear as low ridges after the separation of the column from the counter cardinal septum. The septal formula of the type specimen just below the calyx in the region of 20 septa is K5A3C3A5K.

Stereoplasm is lacking or occurs in very small amounts. A few very thin tabulae are present. The outline of the column is relatively thick and club-shaped in early stages but becomes progressively thinner higher in the corallite. Shortly after separation from the counter cardinal septum, the column disappears. A median lamina is present, but radiating laminae are lacking. The cardinal fossula is very large throughout the corallite, and alar pseudofossulae are relatively large and distinct.

Discussion.—This species is characterized by the lack of well-developed tabulae, thin column, very large cardinal fossula, and disappearance of the column immediately after its separation from the counter cardinal septum. *Stereostylus ame-*

sensis is distinguished from *S. sturgeonii*, with which it is closely associated, by its thinner skeletal elements, apparent lack of secondary deposits of stereoplasm, and smaller size. *S. amesensis* closely resembles *S. ohioensis* which occurs abundantly in the Lower Brush Creek Limestone, but the thin column and nonrhopaloid to weakly rhopaloid septa distinguish *S. amesensis*. This species does not resemble closely any previously described species with the possible exception of *S. lenis* JEFFORDS (1947, p. 40). *S. amesensis* is distinguished from *S. lenis* by its lack of closely spaced tabulae and early disappearance of the column low in the calyx.

Illustrations.—Plate 4, figures 2-4.—Fig. 2. Specimen O-19-10; 2a-d, transv. secs., $\times 5$; 2e, ext. view, $\times 2.5$.—Fig. 3. Type specimen O-1-4; 3a-d, transv. secs., $\times 5$.—Fig. 4. Specimen O-19-16; 4a-c, transv. secs., $\times 5$. [Short lines indicate locations of major septa: above, counter cardinal; lateral, alar; below, cardinal.]

Occurrence.—Ames Limestone (localities O-1 and O-19).

Type.—No. O-1-4 from locality O-1.

COLLECTING LOCALITIES

All localities are in Athens County, Ohio. The numbers in parentheses following the location description refer to Ohio Geological Survey measured sections recorded by STURGEON & associates (1958).

O-1. *Ames Limestone*. Along sidewalk on Second Street, 75 yards up hill from Central Avenue in Athens (11238).

- O-3. *Upper Brush Creek Limestone*. About 50 feet above road level along Ohio 33, 0.3 mile north of junction with U.S. 50A, in the NW $\frac{1}{4}$ sec. 18, T. 9 N., R. 14 W. (11484).
- O-4. *Ames Limestone*. In grove of trees northwest of the Poston Methodist Church along U.S. 50A just south of junction with Ohio 706, in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 10 N., R. 14 W. (11308).
- O-5. *Lower Brush Creek Limestone*. About 1 foot above road level, just across railroad tracks from Fisher Station, in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 8 N., R. 14 W. (11483).
- O-6. *Lower Brush Creek Limestone*. In road and ditch, 0.5 mile north of R. Carmichael farm, in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 25, T. 9 N., R. 14 W. (11223).
- O-8. *Upper Brush Creek Limestone*. In west branch of creek just above fork, in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 3, T. 11 N., R. 15 W. (7618).
- O-9. *Ames Limestone*. Roadcut 1.5 miles south of New Marshfield, in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 14, T. 11 N., R. 15 W.
- O-11. *Lower Brush Creek Limestone*. Natural exposure near top of pasture to east of road, 0.5 mile south of Mineral on Rockcamp Creek, in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 19, T. 11 N., R. 15 W. (7598).
- O-12. *Upper Brush Creek Limestone*. Roadcut on northwest side of U.S. 50A, 1 mile from junction with Ohio 33, in the center NW $\frac{1}{4}$ sec. 12, T. 9 N., R. 14 W. (11227).
- O-17. *Ames Limestone*. Roadcut 0.5 mile southeast of junction with U.S. 50A, in the W $\frac{1}{2}$ SE $\frac{1}{4}$ sec. 1, T. 10 N., R. 14 W. (11313).
- O-19. *Ames Limestone*. Exposure on north side of road along McDougall Run, in the center sec. 33, T. 6 N., R. 14 W. (8972).

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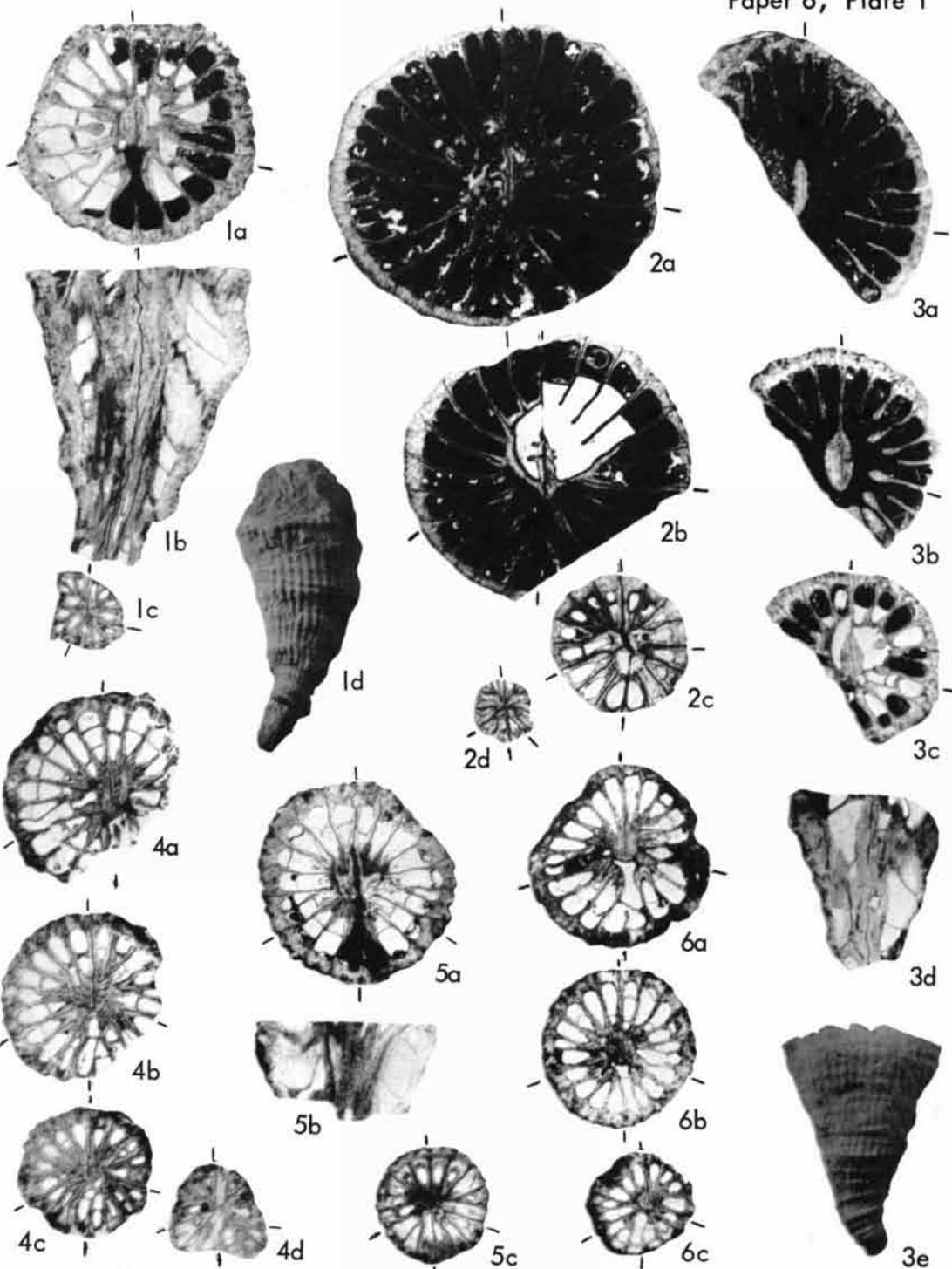
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SUMMARY OF PLATES FOR PAPER 5

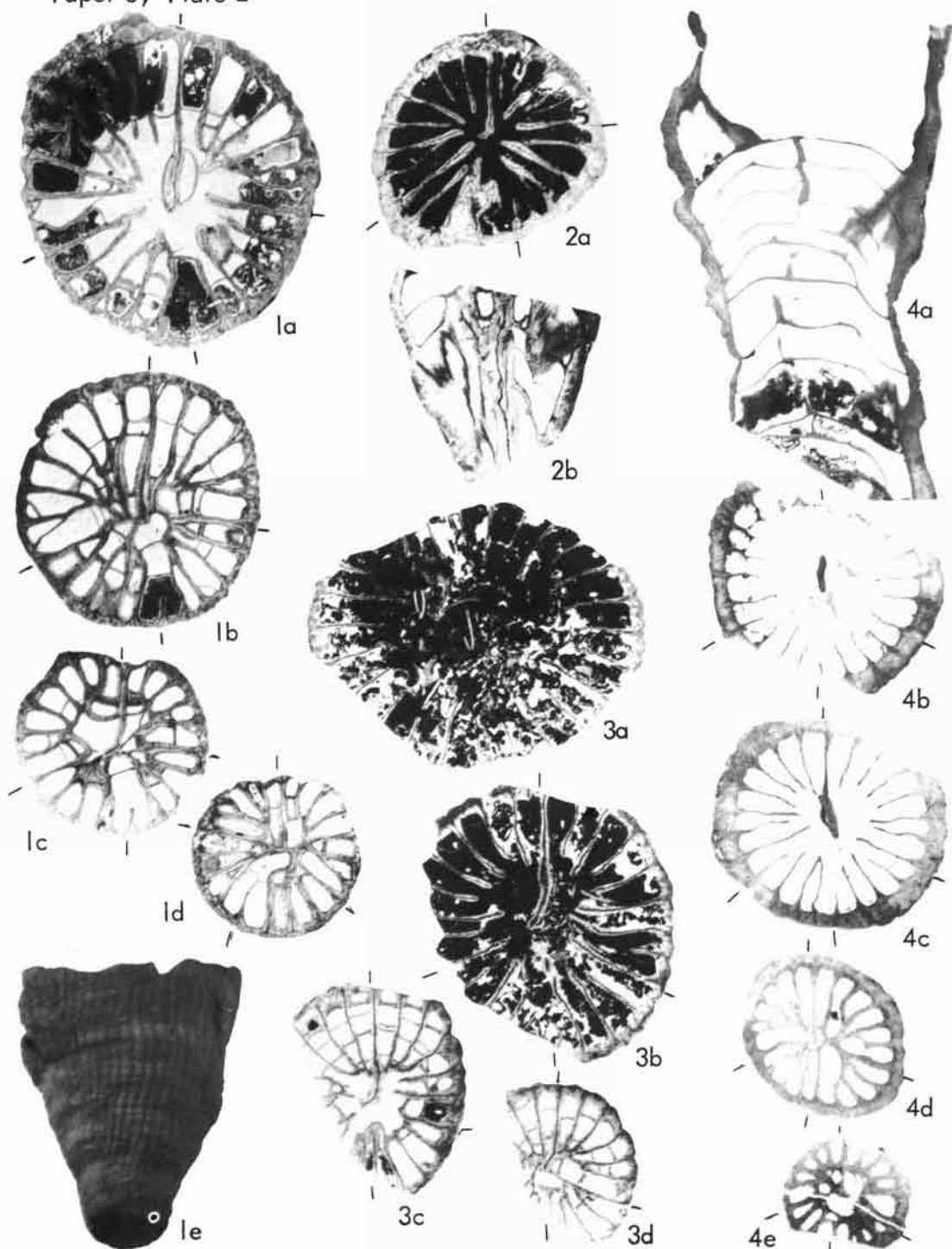
- PLATE 1.—Figures 1-2. *Calamuspollenites pertusus* ELSIK, p. 2.—Figures 3-6. *Monulcipollenites confossus* FAIRCHILD, p. 3.—Figures 7-8. *Sernapollenites duratus* FAIRCHILD, p. 3.—Figures 9-10. *Triatriopollenites dilatus* FAIRCHILD, p. 4.—Figure 11. *Holkopollenites chemardensis* FAIRCHILD, p. 6.
- PLATE 2.—Figures 1-2. *Myocolopollenites reticulatus* ELSIK, p. 4.—Figures 3-7. *Tricolpites circumstriatus* FAIRCHILD, p. 5.—Figures 8-9. *Holkopollenites chemardensis* FAIRCHILD, p. 6.
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SUMMARY OF PLATES FOR PAPER 6

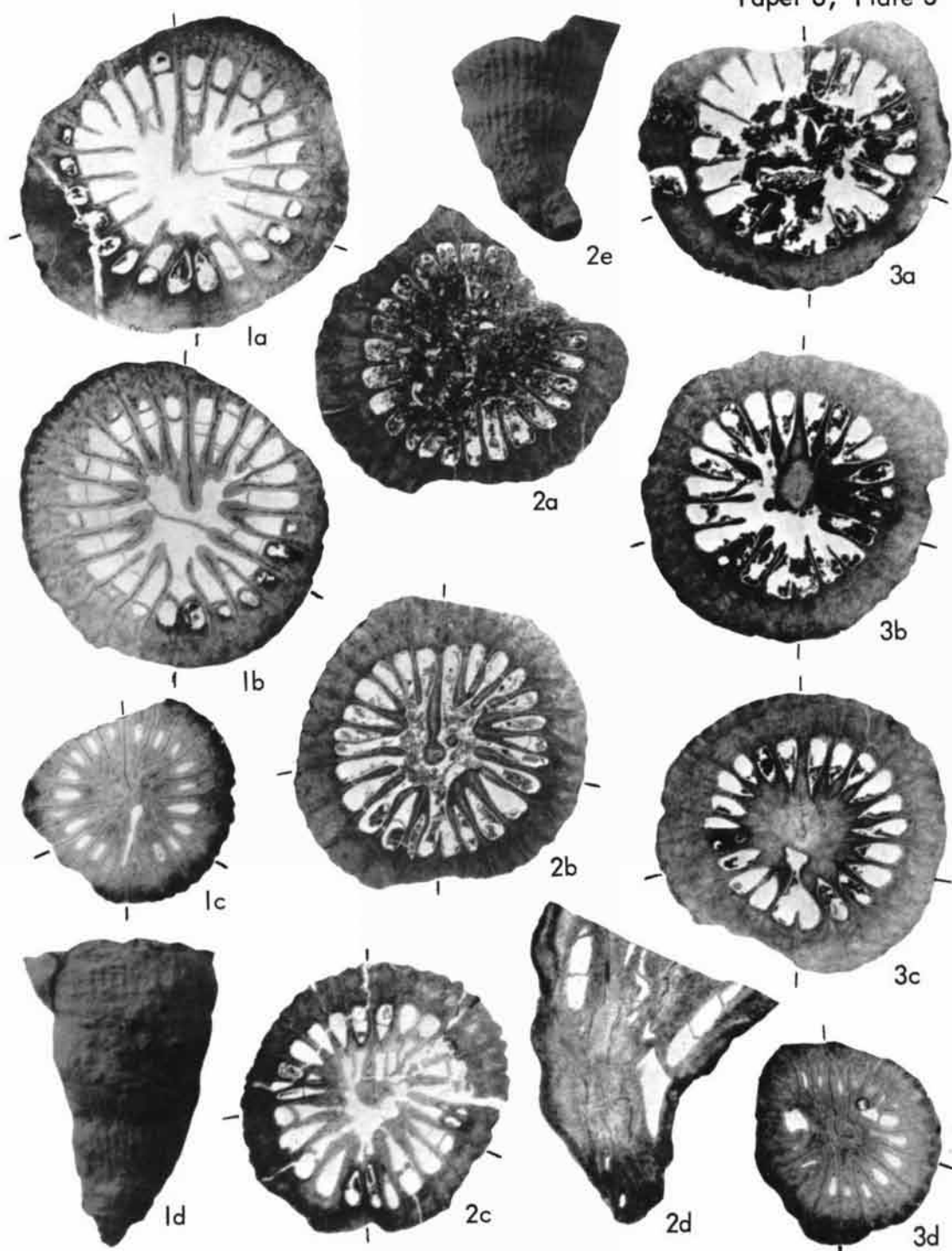
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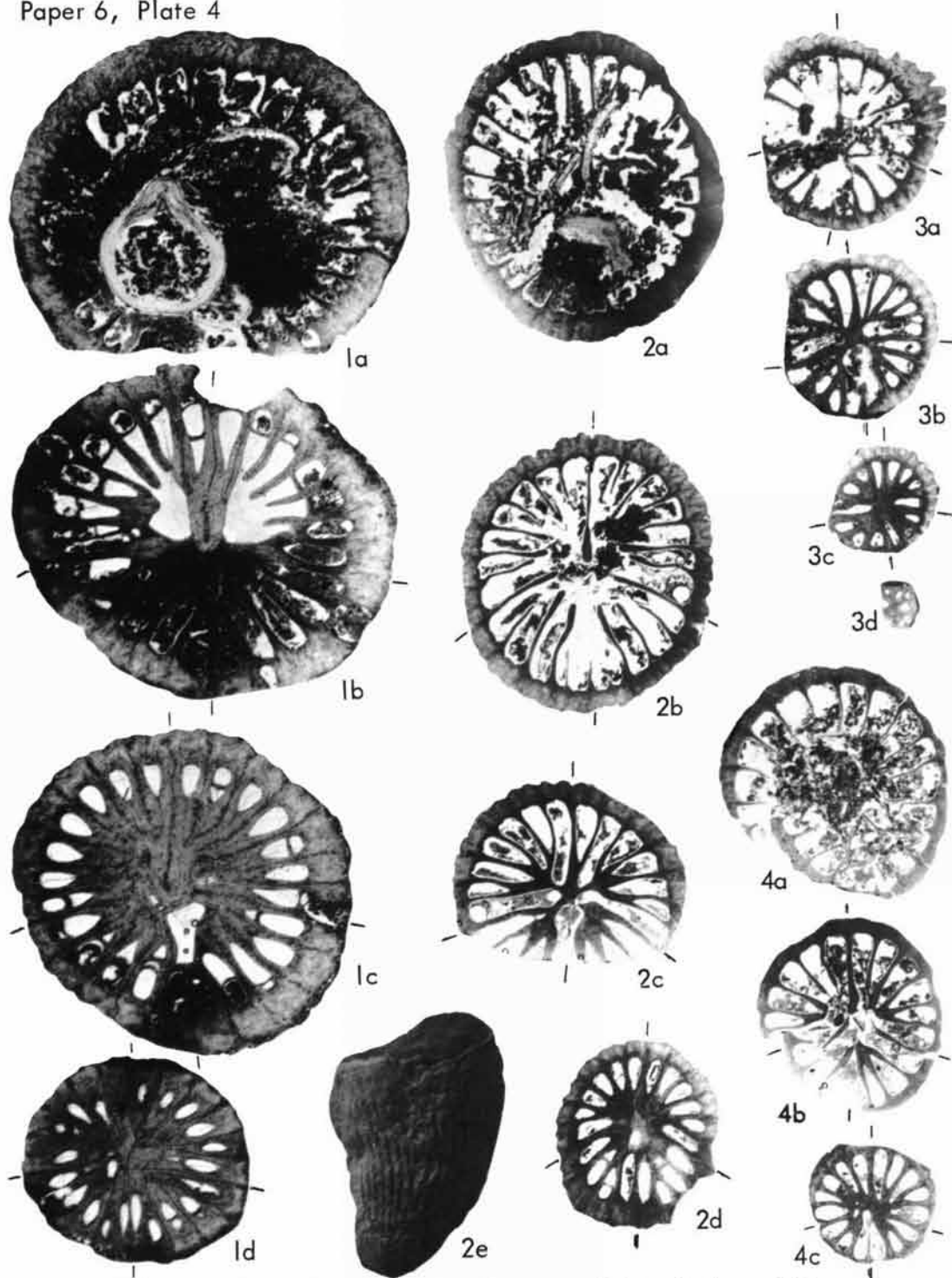
Bebout--Upper Pennsylvanian Conemaugh Corals from Ohio
Stereostylus ohioensis, n. sp. (1-6)



Bebout--Upper Pennsylvanian Conemaugh Corals from Ohio
Stereostylus brushensis, n. sp. (1-3); *Stereostylus* sp. (4)



Bebout--Upper Pennsylvanian Conemaugh Corals from Ohio
Stereostylus sturgeoni, n. sp. (1-3)



Bebout--Upper Pennsylvanian Conemaugh Corals from Ohio
Stereostylus sturgeoni, n. sp. (1); *Stereostylus amesensis*, n. sp. (2-4)