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RUGOSE CORALS OF THE SILICA FORMATION (MIDDLE DEVONIAN)
OF NORTHWESTERN OHIO AND SOUTHEASTERN MICHIGAN

BY
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MUSEUM OF PALEONTOLOGY
THE UNIVERSITY OF MICHIGAN
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VOLUME 22

1. New species of Porocrinidae and brief remarks upon these unusual crinoids, by Robert V. Kesling and Christopher R. C. Paul. Pages 1-32, with 8 plates and 14 text-figures.
2. Two unusually well-preserved trilobites from the Middle Devonian of Michigan and Ohio, by Erwin C. Stumm. Pages 33-35, with 1 plate.
3. The corals of the Middle Devonian Tenmile Creek Dolomite of northwestern Ohio, by Erwin C. Stumm. Pages 37-44, with 3 plates.
4. Mouth frame of the ophiuroid *Onychaster*, by Philip R. Bjork, Paul S. Goldberg, and Robert V. Kesling. Pages 45-60, with 4 plates and 4 text-figures.

RUGOSE CORALS OF THE SILICA FORMATION (MIDDLE DEVONIAN) OF NORTHWESTERN OHIO AND SOUTHEASTERN MICHIGAN

ERWIN C. STUMM

ABSTRACT—The Silica Formation of Middle Devonian age, located in northwestern Ohio and southeastern Michigan, contains, in its lower part, a rich fauna of rugose corals. Four species of simple corals were previously reported from the formation. Four species of the compound genus *Hexagonaria* and one species of the compound genus *Billingsastraea* have been previously described. This paper reviews these species and describes a new species of *Stereolasma*, two new species of *Heliophyllum*, a species of *Cylindrophyllum*, one of *Cystiphyllodes*, and two new species of *Cayugaea*.

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INTRODUCTION

THE SILICA FORMATION is intermittently exposed in small areas in northwestern Ohio and southeastern Michigan. The type locality is in the quarry of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio, a location about 2 miles south of the Michigan border. Other Ohio outcrops occur along a southwest trending line. The first of these is the abandoned quarry of the Whitehouse Stone Company at Whitehouse, Lucas County (Stewart, 1938, p. 13); then the recently developed quarry of the Consolidated Cement Company, about 2 miles northwest of Paulding, Paulding County; and finally two

or three, largely covered, exposures in the bed of the Maumee River at Antwerp, Paulding County, just east of the Indiana border (Stewart, 1938, p. 13). Westward across northern Indiana the formation is completely covered by glacial drift.

In Michigan the only permanent outcrop is in the dump piles of the abandoned quarry of the Martin-Marietta Company northeast of Milan in Augusta Township, Washtenaw County. A former outcrop occurred at a well drilling, 1 mile south of Cone, Monroe County, and another occurred during the drilling of the intake at Waterworks Park in Detroit (Stumm, 1967, p. 88-90). Everywhere else in south-

eastern Michigan the formation is covered by 30 to 150 feet of drift.

In the type locality the formation has been divided into 25 units (Ehlers, Stumm, & Kesling, 1951). The basal units 1-6 are limestone, known informally as the "blue" limestone member. It contains many corals, and all the compound rugose corals are restricted to it. The simple rugose corals extend into the basal part of the lowest shale (unit 7) and are not present above that level. This is quite in contrast to the tabulate corals which extend throughout most of the overlying shale units (Stumm, 1967). Apparently the rugose corals were much more sensitive to the influx of shale than the tabulates.

ACKNOWLEDGMENTS

I wish to thank Mrs. Ruth Berner Chilman for the gift to the Museum of Paleontology of many of the specimens figured herein. My thanks are also due to Drs. C. A. Arnold and R. V. Kesling for critically reviewing the manuscript.

SYSTEMATIC DESCRIPTIONS

Family STREPTELASMATIDAE

Genus HETEROPHRENTIS Billings

HETEROPHRENTIS SIMPLEX (Hall)

Pl. 1, figs. 3-4; pl. 2, figs. 7-8; pl. 4, figs. 1-4

Strombodes simplex Hall, 1843, p. 209, pl. 48, fig. 6.

Zaphrentis simplex Hall, 1876, *partim*, pl. 21, figs. 5, 8-10 only; Stewart, 1927, pp. 17-18, pl. 1, fig. 2, *non* fig. 1.

Heterophrentis simplex Stewart, 1938, *partim* (specimens from Tenmile Creek Dolomite and Silica Shale only; Stumm, 1964, p. 21, pl. 11, fig. 19; pl. 14, figs. 5-6.

For description see Stumm (1964, p. 21).

Remarks.—This widespread species is common throughout the "blue" limestone member (units 1-6) and in the basal part of unit 7 of Ehlers, Stumm, & Kesling (1951, p. 18-20).

Occurrence.—Middle Devonian Silica Formation, units 1-7, northwestern Ohio and southeastern Michigan.

Types.—Hypotypes nos. 52933, 52935, 52937, 55064, 55065, and 55081.

Family METRIOPHYLLIDAE Hill

Genus STEREOLASMA Simpson

STEREOLASMA BETHAE n. sp.

Pl. 2, figs. 3-4; pl. 4, figs. 5-6

Description.—Corallum small, ceratoid, holotype measuring 29 mm in length and 15 mm in maximum diameter. Exterior with a transversely wrinkled epitheca through which the interseptal ridges typically cannot be seen. Calyx shallow with a maximum depth of 4 mm. Calyx walls gently sloping. No peripheral platform present. Septa 40-50, major extending to the axis, forming an axial stereozone. Minor septa present as short, weakly developed peripheral ridges. Tabulae irregularly spaced, distally convex. No dissepiments present.

Remarks.—This species differs from *S. rectum* (Hall) in having low sloping instead of erect walls and in having fewer septa. The only other species with which *S. bethae* can be compared with is *S. gallicar* (Davis) but the latter species also has erect calyx walls. The species is named after my wife Elizabeth C. Stumm.

Occurrence.—Middle Devonian Silica Formation, basal part of unit 7; quarry of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Holotype no. 56707; paratype no. 52939.

Family ZAPHRENTIDAE Edwards & Haime

Genus HELIOPHYLLUM Hall

HELIOPHYLLUM BATHYCALYX n. sp.

Pl. 1, figs. 7-8; pl. 2, figs. 9-10, 14

Description.—Corallum ceratoid to trochoid, most specimens with a prominent basal attachment scar where they adhered to fragments of brachiopods. Annulations fine and closely set; interseptal ridges barely visible. Calyx bell shaped, without a peripheral plat-

EXPLANATION OF PLATE 1

All specimens × 1

FIGS. 1-2—*Bethanyphyllum robustum* (Hall). 1, stereogram of calyx showing fossula, peripheral platform and wide axial pit. Hypotype no. 52917. Silica Formation, base of unit 7, quarry of the Medusa Portland Cement at Silica, 1½ miles southwest of Sylvania, Lucas Co., Ohio. 2, side view of same specimen.

3-4—*Heterophrentis simplex* (Hall). 3, stereogram of a calyx with well-preserved walls. Hypotype no. 52937. Same occurrence as original of figs. 1-2. 4, side view of same specimen.

5-6—*Heliophyllum microcarinatum* n. sp. 5, stereogram of a calyx showing small spinose carinae. Holotype no. 52916. Same occurrence as original of figs. 1-2. 6, side view of same specimen.

7-8—*Heliophyllum bathycalyx* n. sp. 7, stereogram of deep calyx showing bead-shaped carinae. Holotype no. 52920. Same occurrence as original of figs. 1-2. 8, side view of same specimen showing basal attachment scar.

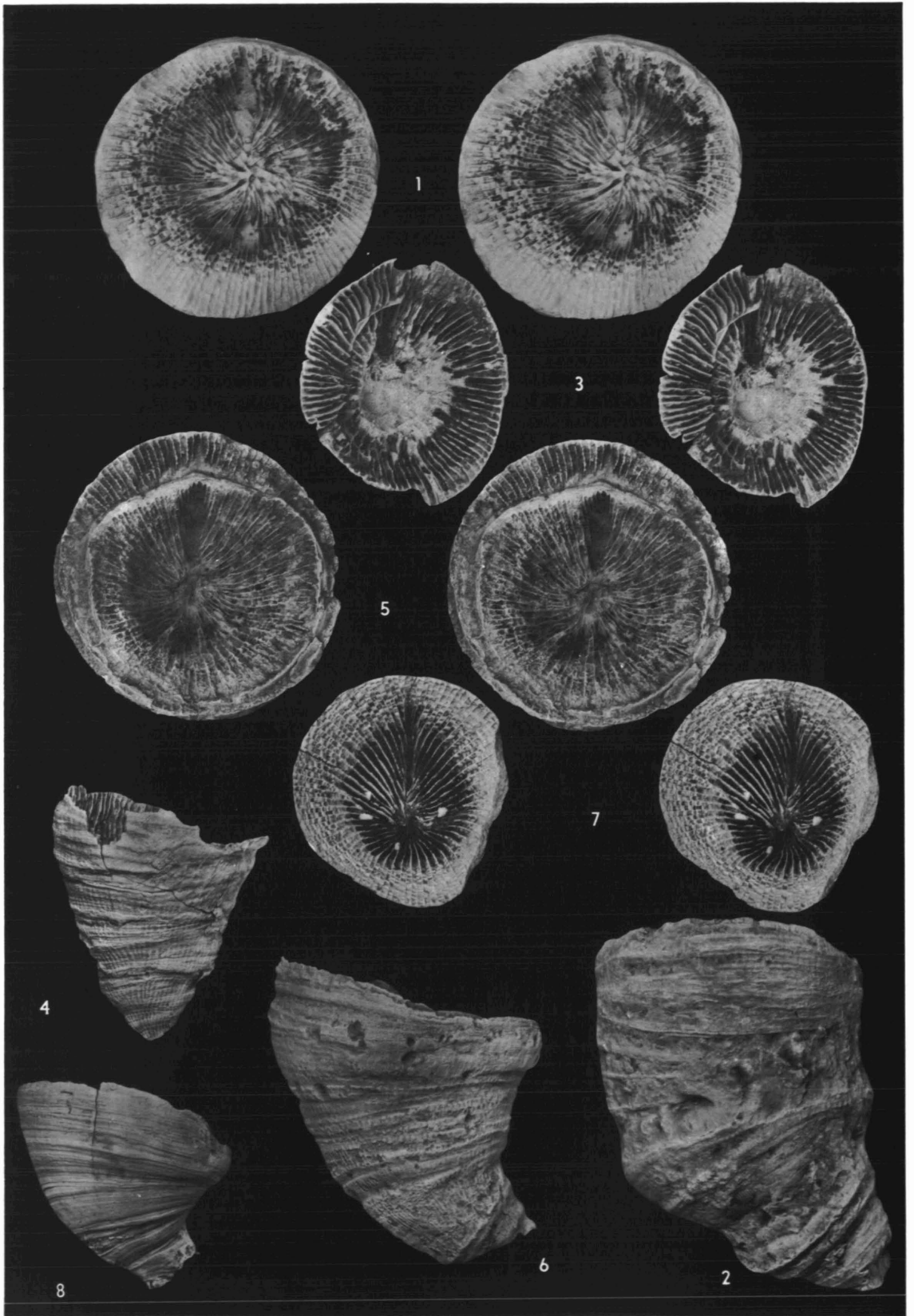


PLATE 1

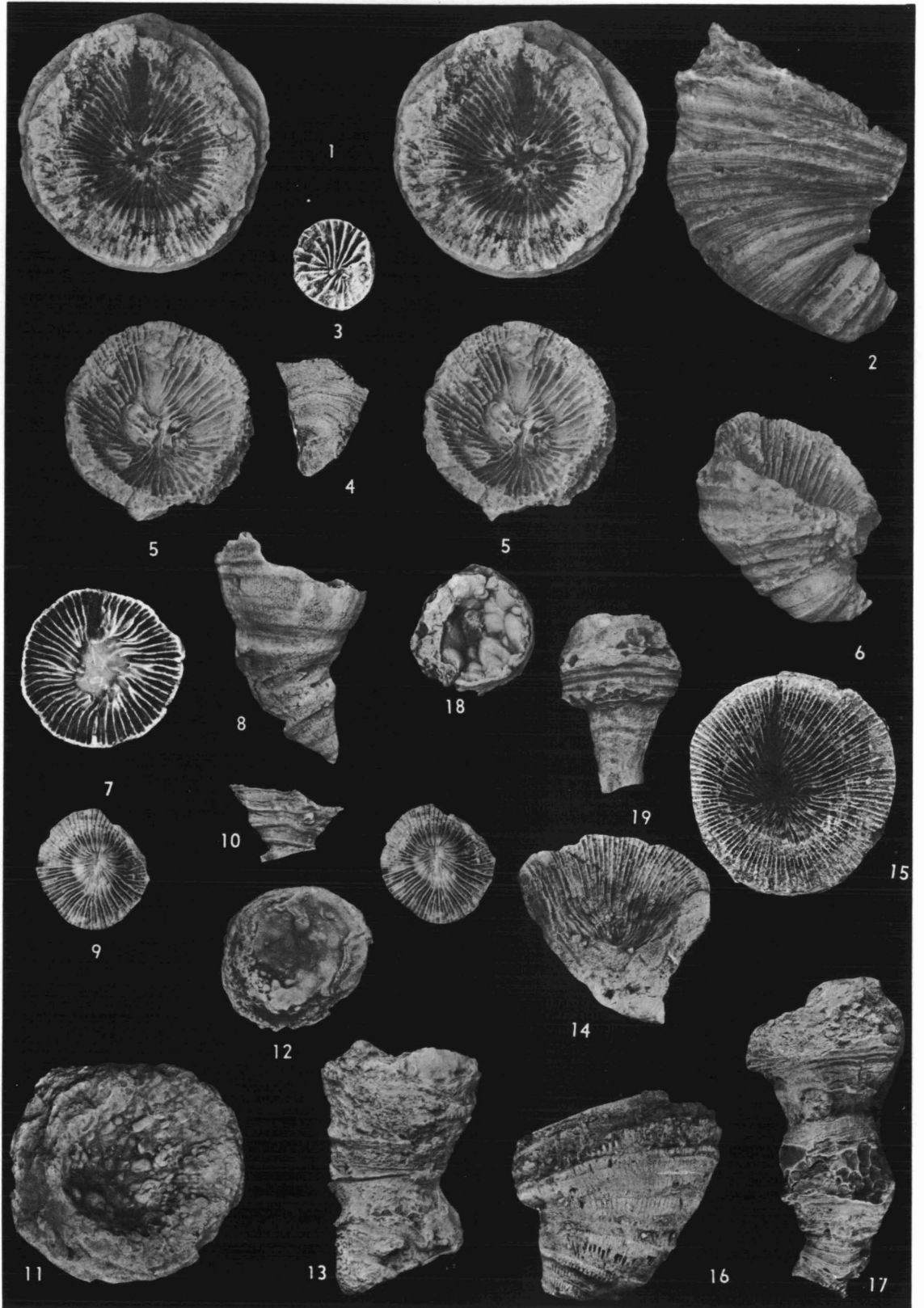


PLATE 2

form, very deep, extending almost to base of corallum.

Septa 96 to 100, major extending to base of calyx, minor about two-thirds as long. All septa thin with short, thickened carinae in peripheral region. Cardinal fossula prominent, narrow and long. Dissepiments small, globose, axially inclined, in two or three rows. Tabulae few, very thin, typically incomplete.

Remarks.—This species is distinctive in its very deep calyx, bead shaped carinae, and large basal attachment scar.

Occurrence.—Middle Devonian Silica Formation, unit 7 of Ehlers, Stumm, & Kesling, 1951, pp. 18–20; quarry of the Medusa Portland Cement Company, at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Holotype no. 52920; paratypes nos. 52922, 56770.

HELIOPHYLLUM MICROCARINATUM n. sp.

Pl. 1, figs. 5–6; pl. 2, figs. 1–2; pl. 3, figs. 3–4, 10–11; pl. 4, figs. 7–8

Zaphrentis prolifica Stewart, 1927, p. 16–17, pl. 1, fig. 1, non *Z. prolifica* Billings.

Heliophyllum halli Stewart, 1927, p. 19, pl. 1, fig. 3; non *H. halli* Edwards & Haime.

Description.—Corallum cornute, typically with a pointed base. Holotype 7 cm long, with a maximum diameter of almost 5 cm. Paratype slightly smaller. Exterior with closely set rugae and finely set interseptal ridges. Peripheral margins of septa visible on worn surfaces. Calyx with a distinct peripheral platform and a wide,

rounded axial pit with a maximum depth of 2.5 cm. Calcycinal rejuvenation present in both specimens. Cardinal fossula prominent. Septa ranging from 98 to 112 in number, thin, denticulate, or with very small offset carinae. No yardarm carinae present. Tabulae thin, typically incomplete, relatively horizontal. Dissepimentarium narrow, filled with axially inclined, very small globose dissepiments.

Remarks.—This species has been referred to *Heliophyllum halli* by several authors, but is distinct from that species in the nature and size of the carinae.

Occurrence.—Middle Devonian Silica Formation, "blue" limestone member and unit 7 of Ehlers, Stumm, & Kesling, 1951, p. 18–20; quarry of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Holotype no. 52916; paratypes nos. 52914, 52919, 52929, and 55076.

GENUS BETHANYPHYLLUM

BETHANYPHYLLUM ROBUSTUM (Hall)

Pl. 1, figs. 1–2; pl. 2, figs. 5–6, 15–16; pl. 3, figs. 7–9

Cyathophyllum robustum Hall, 1876, pl. 32, figs. 1–2, 59. Stewart, 1938, p. 34, pl. 6, figs. 1–2.

Bethanyphyllum robustum Stumm, 1949, p. 18, pl. 8, figs. 1–4 (after Hall and Stewart); 1964, p. 40, pl. 30, figs. 3–4; pl. 35, figs. 4–10.

For description see Stumm (1964, p. 40).

Remarks.—The septa, previously reported as being 120 to 150 are extended to range from 100 to 150. This is the most common simple

EXPLANATION OF PLATE 2

All specimens × 1

- FIGS. 1–2—*Heliophyllum microcarinatum* n. sp. 1, stereogram of calyx with well-preserved peripheral platform. Paratype no. 52919. Silica Formation, base of unit 7; quarry of the Medusa Portland Cement Co. at Silica, 1½ miles southwest of Sylvania, Lucas Co., Ohio. 2, side view of same specimen.
- 3–4—*Stereolasma bethae* n. sp. 3, view of shallow calyx with low sloping walls and axial stereozone. Holotype no. 56707. Same occurrence as original of figs. 1–2. 4, side view of same specimen.
- 5–6—*Bethanyphyllum robustum* (Hall). 5, stereogram of calyx of a small specimen. Holotype no. 52918. Same occurrence as original of figs. 1–2. 6, side view of same specimen.
- 7–8—*Heterophrentis simplex* (Hall). 7, calyx view of a specimen with broken walls. Hypotype no. 52935. Same occurrence as original of figs. 1–2. 8, side view of same specimen.
- 9–10—*Heliophyllum bathycalyx* n. sp. 9, stereogram of deep calyx. Paratype no. 52922. Same occurrence as originals of figs. 1–2. 10, side view of same specimen with wide basal attachment scar.
- 11—*Cystiphyllodes americanum* (Edwards & Haime). Calyx view of a typical specimen showing septal crests. Hypotype no. 52930. Same occurrence as original of figs. 1–2.
- 12–13—*Cayugaea ? transitorius* n. sp. 12, view of shallow, cone shaped calyx, partly obscured by attached bryozoan. Paratype no. 55063. Same occurrence as original of figs. 1–2. 13, side view of same specimen with very wide basal attachment scar.
- 14—*Heliophyllum bathycalyx* n. sp. Natural longitudinal section with internal structures partly destroyed by pyritization. Paratype no. 56770. Same occurrence as original of figs. 1–2.
- 15–16—*Bethanyphyllum robustum* (Hall). Calyx and side views of a well preserved small specimen. Hypotype no. 56708. Same occurrence as original of fig. 1.
- 17–19—*Cayugaea intermittens* n. sp. 17, side view of a specimen showing irregular constrictions and basal attachment scar. Paratype no. 56709. Same occurrence as original of figs. 1–2. 18–19, calyx and side views of a small specimen showing tabellae and periodic expansion. Paratype no. 56701. Same occurrence as original of fig. 1.

rugose coral in the Silica Formation and has a great range in size.

Occurrence.—Middle Devonian Silica Formation, "blue" limestone member and base of unit 7; quarry of the Medusa Portland Cement Company at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Hypotypes nos. 50622, 52917, 52918, 56708, and 52631.

Family PHILLIPSASTRAEIDAE
Genus CYLINDROPHYLLUM Simpson
CYLINDROPHYLLUM DELICATULUM
Ehlers & Stumm

Pl. 4, figs. 9–10

Cylindrophyllum delicatulum Ehlers & Stumm, 1949, p. 23, pl. 6, figs. 7–12.

For description see Ehlers & Stumm (1949).

Remarks.—One specimen of this species was found in unit 6, top of the "blue" limestone member of the Silica Formation. The holotype is from the Rockport Quarry Limestone of the Traverse Group.

Occurrence.—Same as original of fig. 1.

Type.—Hypotype no. 55073.

Genus HEXAGONARIA Gürich
HEXAGONARIA ANNA (Whitfield)

For description see Stumm (1948, p. 25, pl. 5, fig. 3; pl. 11, figs. 1–3).

Remarks.—This widespread species is common in the upper part of the Dundee Limestone, the "blue" limestone member of the Silica Formation (units 1–6), and in the Bell Shale, Rockport Quarry Limestone, and Ferron Point Formation of the Traverse Group.

HEXAGONARIA STEWARTAE Stumm

For description see Stumm (1948, p. 16–17, pl. 6, figs. 6–7).

Remarks.—Stewart (1938) described this as *Prismatophyllum whitfieldi* n. sp. This name was preoccupied by *Acervularia whitfieldi* Fenton & Fenton 1924 from the Hackberry Group of Iowa. The holotype of *H. stewartae* was collected from the "blue" limestone member of the Silica Formation; Antwerp, Paulding County, Ohio.

HEXAGONARIA TRUNCATA (Stewart)

For description see Stumm (1948, p. 28–29, pl. 12, figs. 7–8).

Occurrence.—Silica Formation, "blue" limestone member; abandoned quarry of the Whitehouse Stone Company, Whitehouse, Lucas County, Ohio.

HEXAGONARIA TABULATA Stumm

For description see Stumm (1948, p. 30–31, pl. 5, fig. 1; pl. 11, figs. 7–8, pl. 13, figs. 3–6).

This species and its subspecies *H. tabulata convexa* Stumm are common in the "blue" limestone member of the Silica Formation. The holotype of *H. tabulata* is from the abandoned Whitehouse Quarry, Whitehouse, Lucas County, Ohio, and the holotype of the subspecies is from the quarry of Medusa Portland Cement Company.

Genus BILLINGSASTRAEA Grabau
BILLINGSASTRAEA LONGICARINATA
Ehlers & Stumm

For description see Ehlers & Stumm (1953, p. 8, pl. 2, fig. 5).

Remarks.—The species is known only from the holotype, which was found in the "blue" limestone member of the Silica Formation in the quarry of the Whitehouse Stone Company, Whitehouse, Lucas County, Ohio.

EXPLANATION OF PLATE 3

All figures × 1½ except figures 5–6 which are × 2

FIGS. 1–2—*Cystiphyllodes americanum* (Edwards & Haime). Transverse and longitudinal sections of a typical specimen. Hypotype no. 52926. Silica Formation, base of unit 7, quarry of the Medusa Portland Cement Co. at Silica, 1½ miles southwest of Sylvania, Lucas Co., Ohio.

3–4, 10–11—*Heliophyllum microcarinatum* n. sp. 3–4, transverse and longitudinal sections of an average sized specimen with carinae visible on left side of longitudinal section. Paratype no. 52914. 10–11, transverse and longitudinal sections of specimen figured on pl. 2, figs. 1–2, with weakly developed carinae. Paratype no. 52919. All same occurrence as original of figs. 1–2.

5–6—*Cayugaea ? transitorius* n. sp. Transverse and longitudinal sections showing narrow dissepimentarium and wide tabularium. Paratype no. 55073. Same occurrence as originals of figs. 1–2.

7–9—*Bethanyphyllum robustum* (Hall). 7, transverse section of a large specimen showing the thin, smooth septa. Hypotype no. 50622. 8–9, longitudinal and transverse sections of a specimen of medium size. Hypotype no. 52631.

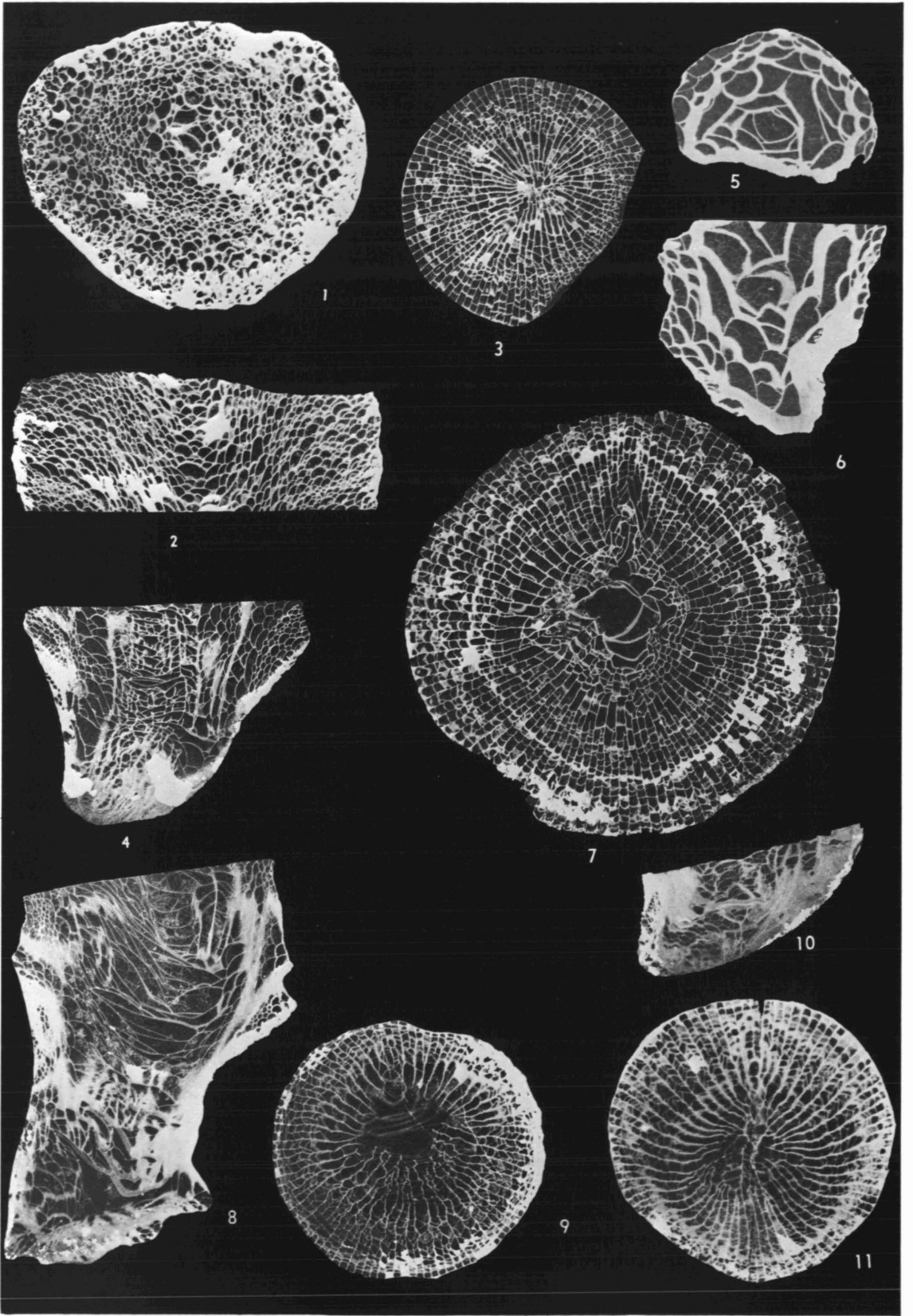


PLATE 3

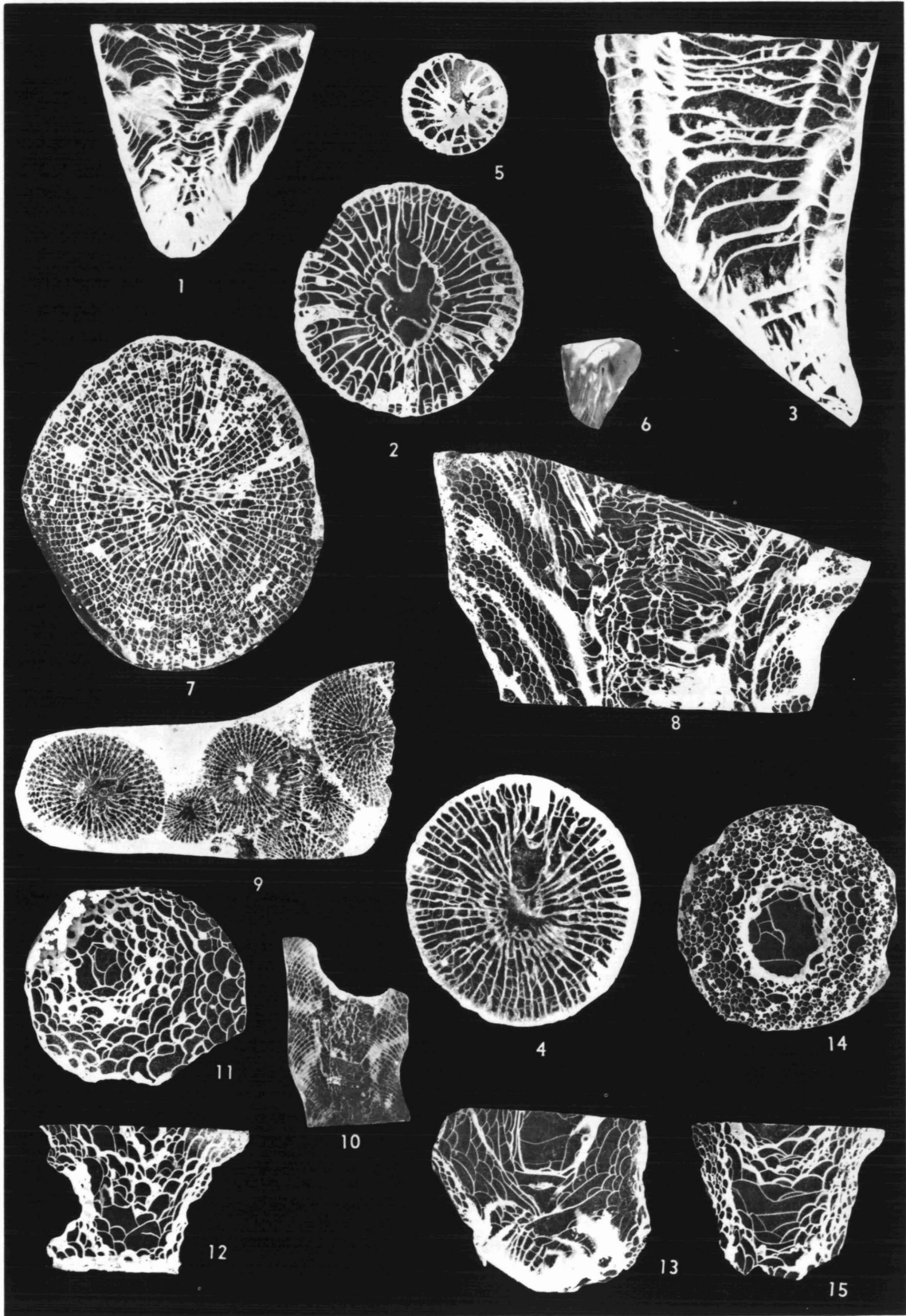


PLATE 4

Family DIGONOPHYLLIDAE

Genus CAYUGAEA Lambe

CAYUGAEA INTERMITTENS n. sp.

Pl. 2, figs. 17-19; pl. 4, figs. 13-15

Description.—Corallum subcylindroid to ceratoid with intermittent increases and decreases in diameter. Length ranging from 3 to 5 cm, diameter from .5 to 3 cm. Prominent basal attachment scar present. Some specimens with abrupt changes in direction of growth. Exteriors with intermittently developed, transversely wrinkled epitheca. Calyxes relatively shallow, showing large convex tabellae. Interior with relatively large peripheral dissepimentarium and an axial tabularium. Dissepimentarium composed of elongate, small to medium sized axially convex dissepiments. Tabularium with zones of complete and incomplete tabulae interspersed with zones of distally convex tabellae. In some specimens distally convex tabellae occupy larger part of tabularium. In others the tabulae are more numerous. A few spinose septal crests are visible in the dissepimentarium.

Remarks.—This is a highly variable species, but is consistent in external growth form and in the distinct characters of the dissepimentarium and tabularium. The growth form is very distinct from the other two known species of *Cayugaea*, *C. whiteavesiana* Lambe and *C. subcylindrica* Stumm, both of Onesquethaw age.

Occurrence.—Middle Devonian Silica Formation, unit 7. All known specimens from the Quarry of the Medusa Portland Cement Company, at Silica, 1½ miles southwest of Sylvania, Lucas County, Ohio.

Types.—Holotype no. 55077; paratypes nos. 56701, 56709, and 56728.

CAYUGAEA ? TRANSITORIUS n. sp.

Pl. 2, figs. 12-13; pl. 3, figs. 5-6; pl. 4, figs. 11-12

Descriptions.—Corallum subcylindroid, typically with a very wide basal attachment scar equalling the maximum diameter of the corallum in some specimens. Exterior with thin epitheca and closely set annulations. A complete specimen measures 4 cm in length with a maximum diameter of 2.7 cm. Calyxes cone shaped less than 1 cm deep, filled with dissepiments and small tabellae. Interior with a narrow dissepimentarium composed of 2 to 3 rows of small, axially convex dissepiments. Tabularium wide, composed of distally convex tabellae with an occasional incomplete tabula. No septal crests visible.

Remarks.—This species combines features of *Cayugaea* and *Cystiphyllodes*. It is tentatively placed in the former genus because of the relatively complete separation of dissepimentarium and tabularium.

EXPLANATION OF PLATE 4

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

- FIGS. 1-4—*Heterophrentis simplex* (Hall). 1, longitudinal section of a specimen of average size. Hypotype no. 55064. 2, transverse section of another specimen. Hypotype no. 55065. 3, longitudinal section of a large specimen with a greater proportion of complete tabulae. Hypotype no. 55081. 4, transverse section of a specimen with a prominent fossula. Hypotype no. 52933. Middle Devonian, Silica Formation; figs. 1-3, from top of "blue" limestone (unit 6); fig. 4 from base of unit 7. All from quarry of the Medusa Portland Cement Co., at Silica, 1½ miles southwest of Sylvania, Lucas Co., Ohio.
- 5-6—*Stereolasma bethae* n. sp. Transverse and longitudinal sections showing axial stereozone and distally convex tabula. Paratype no. 52939. Same occurrence as original of fig. 4.
- 7-8—*Heliophyllum microcarinatum* n. sp. 7, transverse section of an average sized specimen with carinae very weakly developed. Paratype no. 52929. 8, longitudinal section of a large specimen with intermittently developed carinae. Paratype no. 55076. Silica Formation, transverse section from base of unit 7, longitudinal from top of "blue" limestone member (unit 6), same occurrence as original of fig. 1.
- 9-10—*Cylindrophyllum delicatulum* Ehlers & Stumm. Transverse and longitudinal sections showing thin septa and prominent carinae. Hypotype no. 55073. Top of "blue" limestone member (unit 6), same occurrence as original of fig. 1.
- 11-12—*Cayugaea ? transitorius* n. sp. Transverse and longitudinal section of a well-preserved specimen with a wide basal attachment scar. Holotype no. 56727. Same occurrence as original of fig. 4.
- 13-15—*Cayugaea intermittens* n. sp. 13, longitudinal section with relatively large dissepiments. Paratype no. 56728. Silica Formation top of "blue" limestone member (unit 6); 14-15, transverse and longitudinal sections of a well-preserved specimens. Holotype no. 55077, base of unit 7. Same occurrence as originals of figs. 1-4.

Occurrence.—Middle Devonian Silica Formation, base of unit 7; quarry of the Medusa Portland Cement Quarry at Silica, 1½ miles southwest of Sylvania, Ohio.

Types.—Holotype no. 56727, paratypes nos. 55063 and 55073.

Genus *CYSTIPHYLLOIDES* Chapman
CYSTIPHYLLOIDES AMERICANUM
 (Edwards & Haime)

Pl. 2, fig. 11; pl. 3, figs. 1–2

For synonymy see Stumm (1964, p. 54–55).

Remarks.—This widespread species is represented by many specimens in the basal part of unit 7 and is present also in the "blue" limestone member.

Occurrence.—Middle Devonian Silica Formation, units 6 and 7; quarry of the Medusa Portland Cement Company, at Silica, 1½ miles from Sylvania, Lucas County, Ohio.

Types.—Hypotypes nos. 52926 and 52930.

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