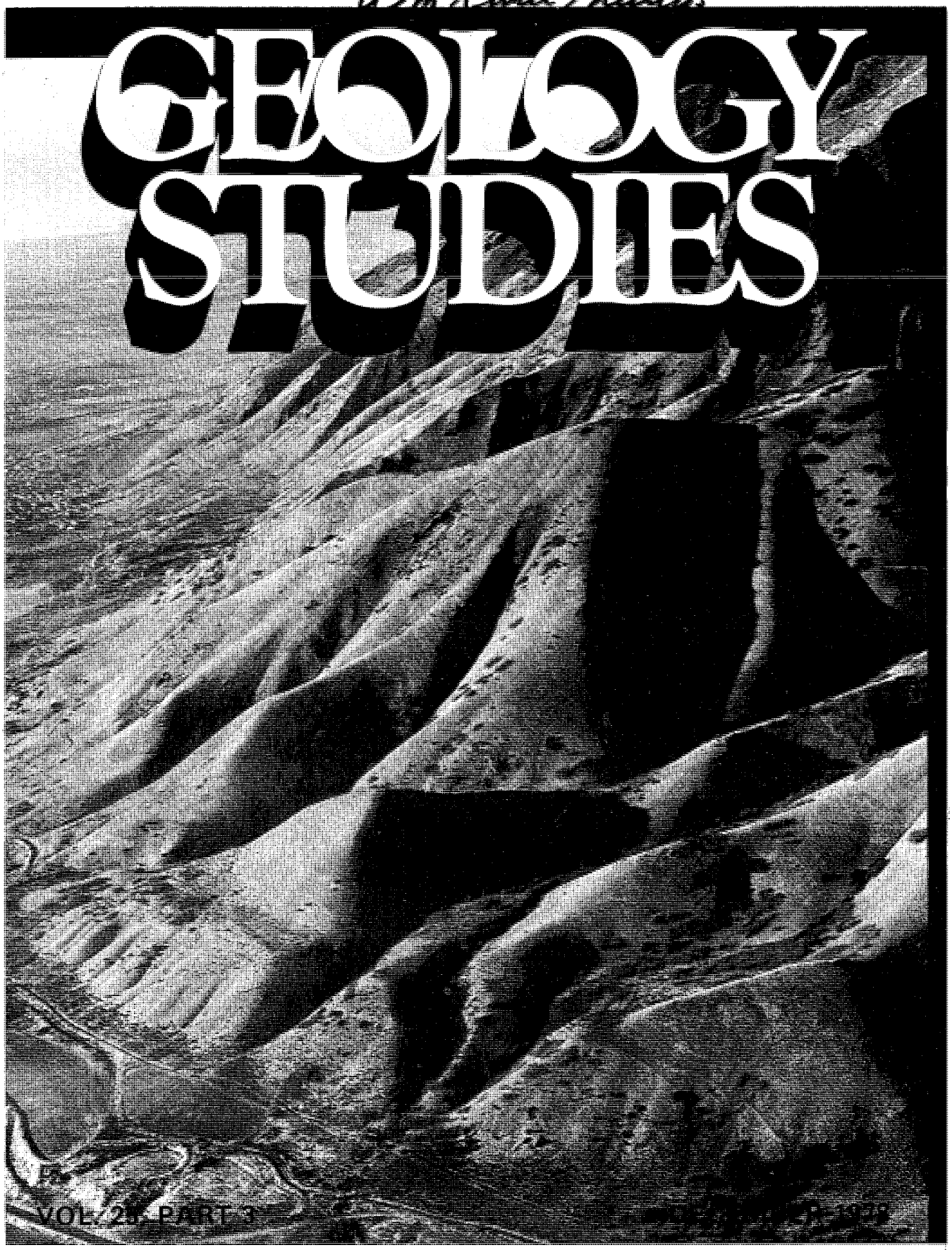
BRIGHAM YOUNG UNIVERSITY

GEOLOGY STUDIES



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CONTENTS

Cover: Compound faceted spurs along the Wasatch Mountains indicate alternating periods of fault displacement and tectonic stability.

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CONTENTS

Corals of the Devonian Guilmette Formation from the Leppy Range Near Wendover, Utah-Nevada*

KEITH J. LUKE
Phillips Petroleum Company
Bartlesville, Oklahoma

ABSTRACT.–Seventeen species of corals from the Guilmette Formation of northeast Nevada are systematically described and divided into three zones following divisions previously proposed for the Great Basin. Zone G contains the corals *Mesophyllum (Atelophyllum) nebracis, Paracanthus nevadensis, Alveolites* cf. *A. winchellana, Favosities clelandi, Favosities* cf. *F. clelandi, Favosities* n. sp., *Aulopora* cf. *A. precius, Syringopora* cf. *S. perelegans,* and a new species of *Digonophyllum (Digonophyllum).* Zone G is upper Middle Devonian (Givetian) in age. Zone H_2 contains the corals *Temnophyllum* cf. *T. turbinatum* and *Thamnopera* cf. *T. angusta.* Zone H_2 is probably Middle Devonian (Givetian) in age. Zone I contains the corals *Pachyphyllum nevadense, Phacellophyllum fenense, Disphyllum virgatum* var. *densum, Disphyllum virgatum* var. *variabile, Disphyllum virgatum* var. a, *Hexagonaria* sp. indt., *Alveolites* sp. indt., and *Sinospongophyllum* sp. Zone I is Upper Devonian (Frasnian) in age.

INTRODUCTION

The Leppy Range of northeast Nevada contains badly faulted, incomplete sections of the Devonian Guilmette Formation. The study area near the town of Wendover, Utah (fig. 1), contains a well-exposed, atypically complete section of the Guilmette Formation bounded above by the Upper Devonian Pilot Shale and below by the Middle Devonian Simonson Dolomite. The section is moderately fossiliferous and contains a typical marine fossil assemblage of corals, stromatoporoids, bivalves, brachiopods, gastropods, and algae. In this section fossils have not been extensively destroyed or altered by dolomitization or silicification. Seventeen coral genera occur in three distinct zones suitable for dividing the formation. These zones are correlative with Great Basin coral zones proposed by Merriam (1973) and show the Guilmette Formation to be upper Middle Devonian (Givetian) to Upper Devonian (Frasnian) in age.

Previous Work

Corals of the Guilmette Formation have never been systematically described. Hoggan (1975) measured and described the 645 m (2,155 ft.) of section sampled for this study. His description included some general paleontology but no detailed taxonomic identifications. Schaeffer and Anderson (1960) noted the occurrence of corals in measured and described sections of the Guilmette Formation on Silver Island, northeast of Wendover, and in the Leppy Range. R. K. Hose (1966) described a section of the Guilmette in the Confusion Range, west central Utah, where he noted the occurrence of several coral genera which are also found in the Wendover section. Corals of Devonian age strata that have been correlated with the Guilmette Formation have been described from Nevada by C. W. Merriam (1940, 1973, 1974) and from Nevada and Arizona by E. C. Stumm (1938, 1940, 1948, 1949).

Other areas of western North America have produced corals of equivalent age with very close affinities to the Guilmette forms. Notable are the corals described by Smith (1945) from the MacKenzie River region, Canada, and of McLaren and Norris (1964) from the Horn Plateau Formation, District of MacKenzie, Canada.

Corals from the eastern part of North America have shown no close relationship to the rugose corals of the Guilmette Formation; however, many of the tabulate forms show close affinities to corals described by Stumm (1964) from the Falls of the Ohio.

The corals of Australia as described by Hill (1954) show a remarkable similarity to Guilmette Formation forms although some of the corals seem to occur at different times in Australia and western North America.

Acknowledgments

I wish to thank Dr. M. S. Petersen for supervising this work and serving as committee chairman; also Dr. H. J. Bissell for serving on the committee. Gratitude is expressed to those graduates and undergraduates who helped in field collecting. Much appreciation is due to my wife, Kristine, for her encouragement and help in typing the manuscript. Partial financial support for this paper was provided by Grant G. Pitcher of Calgary International Energy, Ltd., Calgary, Alberta. W. A. Oliver, Jr., reviewed the paper and offered many useful criticisms which were incorporated and enhanced the work.

STRATIGRAPHY

In the study area the Guilmette Formation conformably overlies the Middle Devonian Simonson Dolomite. Limestones constitute the bulk of a measured section 645 m thick from which specimens were collected for this study. Fine- to coarse-textured, thin- to thick-bedded, stromatolitic limestones are characteristic of the lower part of the section. Dolomite is present in this lower section as laminated to thin-bedded slope-forming units. A marker bed of medium-bedded, massive, cliff-forming fossiliferous limestone occurs in the lower part of the section at 127 m. The upper part of the section contains no dolomite. The limestones are similar to those of the lower section but are much more fossiliferous. Near the top of the formation sandstones and sandy limestones occur. The Upper Devonian Pilot Shale overlies the formation (Hoggan 1975).

Deposition of the sediments of the Guilmette Formation occurred in shallow, quiet to slightly agitated seas (Nadjmabadi 1967). The Wendover area was probably a depocenter of slow subsidence in the north-south trending seas of the Cordilleran geosyncline. Mild fluctuations in depth account for the growth of fossils above and below wave base. The presence of sandstones in the upper part of the formation indicates the area was located in a transition zone between the deeper water of the seaway and the shoreline of the continent (Hoggan 1975).

*A thesis presented to the Department of Geology, Brigham Young University, in partial fulfillment of the requirements for the degree Master of Science, August 1974. Thesis committee chairman, Morris S. Petersen.

ZONATION

The zonation of Great Basin corals proposed by Merriam (1973) has been used in this paper. The Guilmette Formation contains corals from Merriam's zones G, H, and I (fig. 2).

Coral zone G occupies the basal 15 m of the Guilmette Formation where the genera *Digonophyllum* (*Digonophyllum*), *Mesophyllum* (*Atelophyllum*), *Paracanthus, Alveolites, Favosities, Aulopora,* and *Syringopora* are found in association with the lowermost occurrence of the brachiopod *Stringocephalus.* Zone G is highly fossiliferous, and abundant corals, brachiopods, bryozoans, algae heads, and stromatoporoids form up to 50 percent of the rock matrix. Preservation is very good, and specimens are virtually unaltered. Most fossils in this zone are abraded and unoriented, indicating accumulation above wave base (Nadjmabadi 1967). Some tabulate corals and stromatoporoids appear to be preserved in growth position and either grew below wave base or were able to survive undisturbed because of their typically low-lying, hemispherical shapes. Zone G is Upper Middle Devonian (Givetian) in age.

Coral zone H is barren of corals in the central Great Basin but is divisible into three subzones at Wendover, two of which are barren and one of which contains corals. Coral zone H is

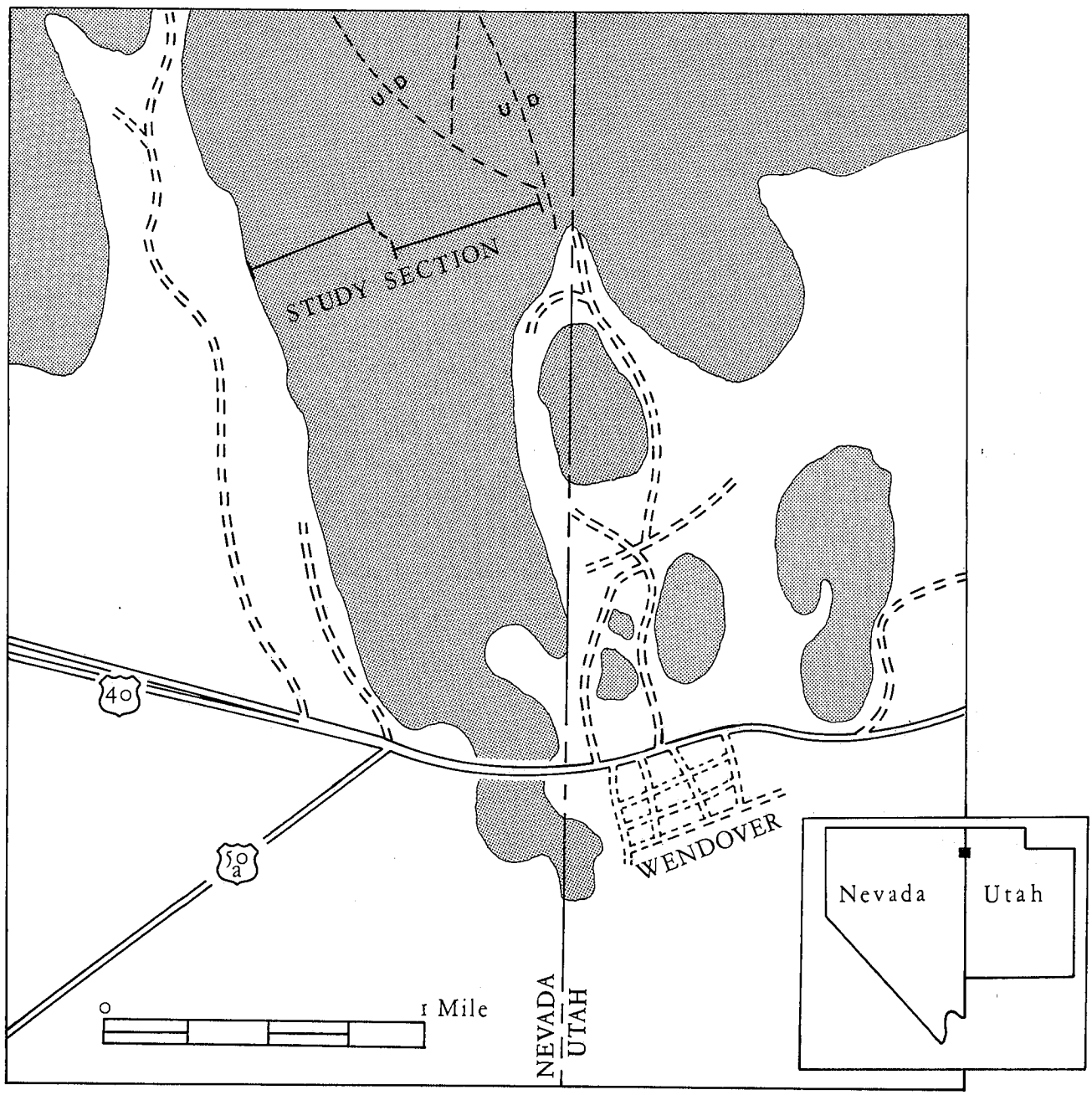


FIGURE 1.–Index map of the study area.

the thickest zone in the Guilmette Formation, containing more than 550 m of strata, of which 20 m contain corals. Zone H_1 contains a few gastropods, brachiopods, stromatoporoids, and algae, but is otherwise barren. This subzone begins at the last occurrence of corals in zone G and ends at the next coral occurrence 259 m high in the section. Zone H_2 contains the coral genera *Temnophyllum* and *Thamnopora.* Corals in this zone are located 259–279 m above the base of the Guilmette Formation and occur in association with the brachiopod *Stringocephalus* which has its uppermost occurrence 285 m above the formation base. Corals of zone H_2 appear to be Givetian in age. This subzone is moderately fossiliferous, and gastropods and stromatoporoids occur with the more abundant corals and brachiopods. Many of the fossils towards the base of this subzone have been silicified, and all but gross morphology has been destroyed. Other fossils are moderately well preserved although some have been recrystalized and portions silicified. Most of the fossils are abraded and randomly oriented, although the rugose corals towards the top of the subzone appear to be in growth position. Zone H_3 is barren of corals and begins 279 m high in the section with the last occurrence of corals of zone H_2 and continues to 565 m. Brachiopods are the dominant fauna of H_3 and occur in great abundance in some areas. Bivalves, stromatoporoids, and gastropods occur locally.

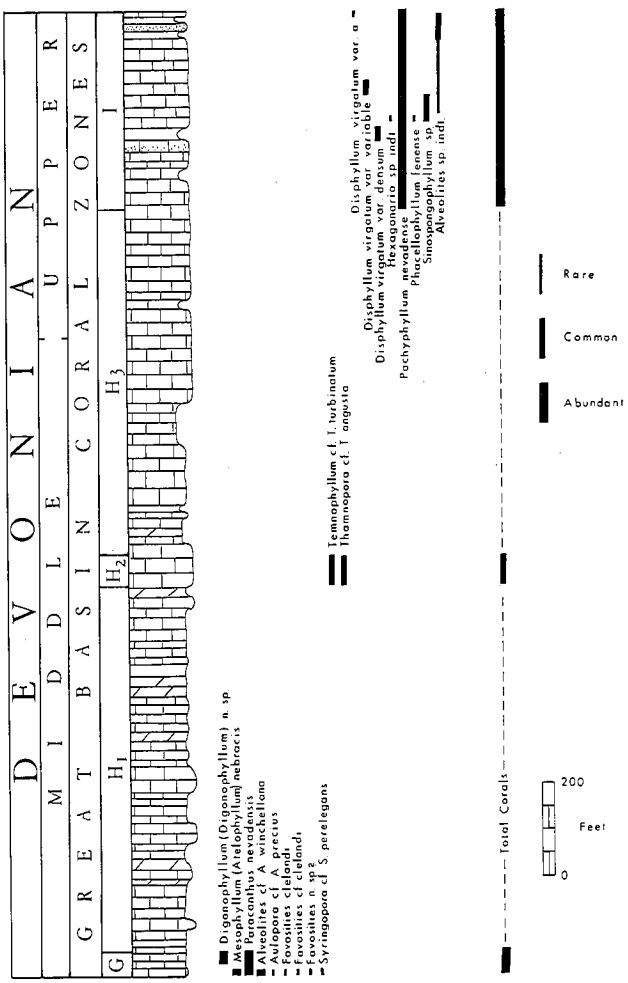


FIGURE 2.–Stratigraphic ranges of corals.

Coral zone I ranges from 565 m to the top of the Guilmette Formation at 645 m. This zone contains the genera *Pachyphyllum, Phacellophyllun, Disphyllum, Sinospongophyllum, Hexagonaria,* and *Alveolites.* Notable for its absence in this zone is the genus *Macgeea* which is found in many other areas in association with this coral suite. An unillustrated, poorly preserved group of solitary corals at the very top of the formation may belong to this genus. Corals are the dominant fossils although a few stromatoporoids, gastropods, and brachiopods are also found in this zone. Most fossils are found in growth position although a few are found lying on their sides. Many of the corals have been extensively recrystallized and are difficult to identify. Corals of this zone are unquestionably Upper Devonian (Frasnian) in age.

SYSTEMATIC PALEONTOLOGY

Order RUGOSA Milne-Edwards & Haime, 1850

Genus DIGONOPHYLLUM Wedekind, 1923

Subgenus DIGONOPHYLLUM Wedekind, 1923

DIGONOPHYLLUM (DIGONOPHYLLUM) n. sp.

Pl. 1, figs. 1–7

Material and occurrence.–Study material consists of 14 complete to fragmental specimens. Middle Devonian coral zone G, 11–15 m above the base of the Guilmette Formation.

Diagnosis.–Digonophyllidae with wide disseptimentarium merging into tabularium. Septa thickened axially. Axial stereozone always present. Zigzag carinae may be present.

External features.–Epitheca very commonly covered with stromatoporoid growths which obscure external features. Where epitheca is visible, it is very thin with occasional undulations of the surface. Septa grooves may or may not be present. Calice deep, in shape of inverted cone in mature specimens or bowl shaped in younger stages.

Transverse thin section.–Septal count 80–98 in corallites of 35–45 mm. Major septa extending about three-fourths the distance to axis. Some minor septa exceeding three-fourths the length of major septa, some much shorter. Usually one minor septum near counter septum is very long. Stereozone around axis always present. Septa dilated in tabularium, sometimes into distinct stereozone, attenuate in disseptimentarium. Zigzag carinae often present towards periphery. Discontinuous lonsdaleoid band may be present around periphery. Fossula like a keyhole with cardinal septa shorter than other major septa, recognizable in all growth stages, outlined by stereozone.

Longitudinal thin section.–Disseptiments small and globose around periphery, become larger and more steeply inclined toward tabularium. Tabellae similar to but larger than inner dissepiments. Individual trabeculae often seen.

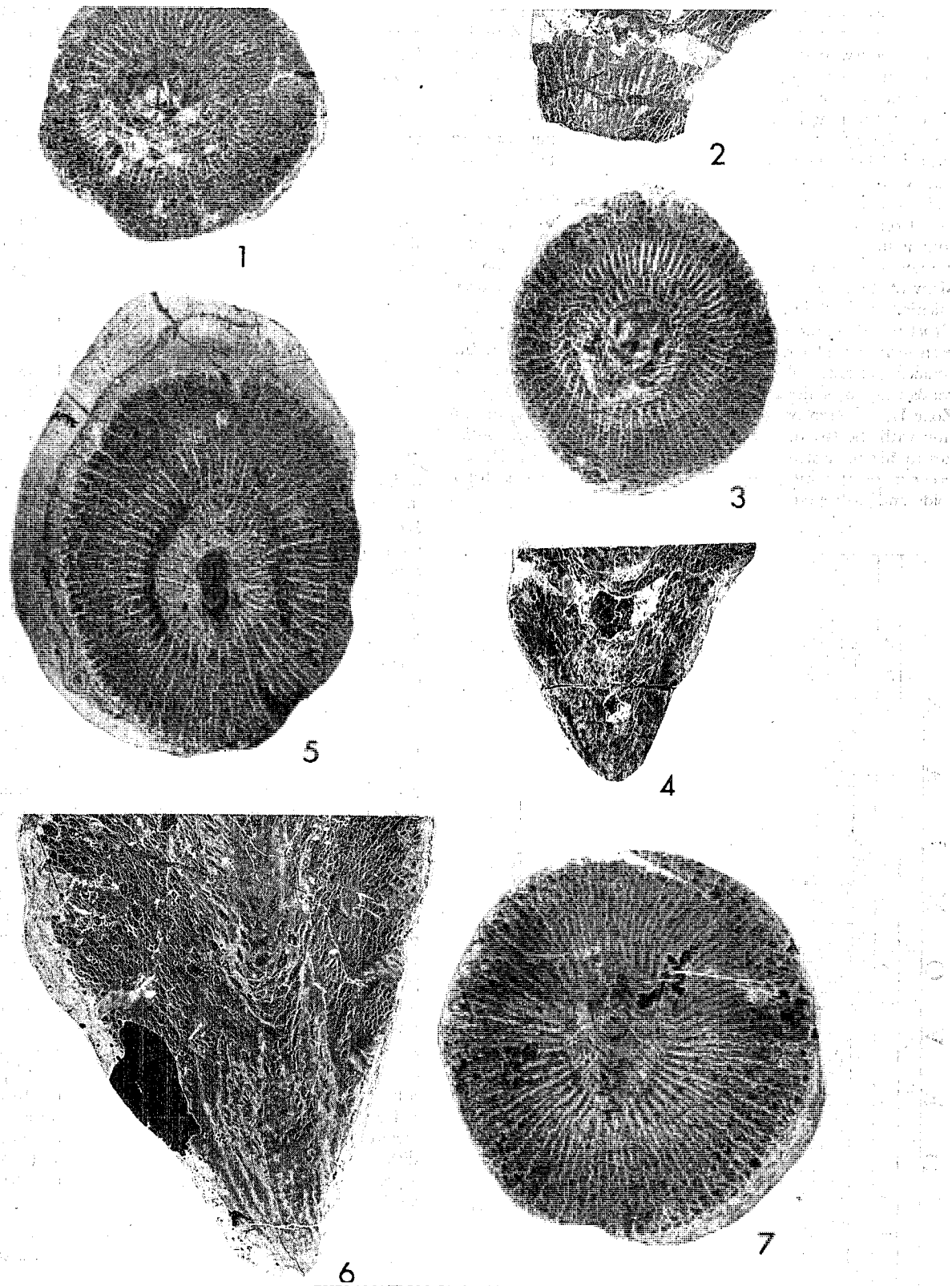
Comparisons.–A species of *Digonophyllum* (sp. c) described by Merriam (1973) is similar to the type material and probably belongs to this species. *Digonophyllum* n. sp. differs from *D. rectum* (Meek) in the form of tabulae and in lacking the constant stereozone surrounding the axial region. *Digonophyllum* n. sp. differs from *D. schulzi* (Wedekind) by having shorter major septa and zigzag carinae as opposed to the long major septa and yard-arm carinae of the latter.

Genus DISPHYLLUM de Fromentel, 1961

DISPHYLLUM VIRGATUM (Hinde) 1890 cf. var. DENSUM Hill, 1954

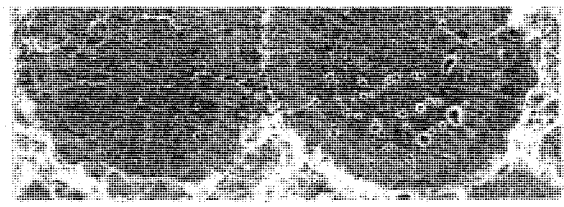
Pl. 2, fig. 6

Material and occurrence.–Two weathered fragments. Middle Devonian coral zone I, 69–79 m below the top of the Guilmette Formation.



EXPLANATION OF PLATE 1

FIGURES 1–7.–*Digonophyllum (Digonophyllum)* n. sp. 1.–Transverse peel section; BYU 2219. 2.–Longitudinal peel section; BYU 2219. 3.–Transverse peel section; BYU 2220. 4.–Longitudinal peel section; BYU 2220. 5.–Transverse peel section; BYU 2221. 6.–Longitudinal peel section; BYU 2222. 7.–Transverse peel section; BYU 222. All figures XI.25.



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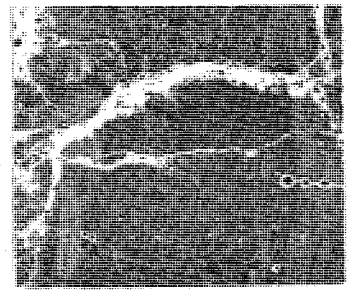

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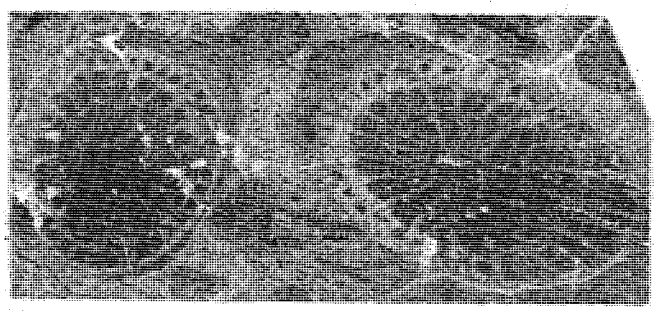

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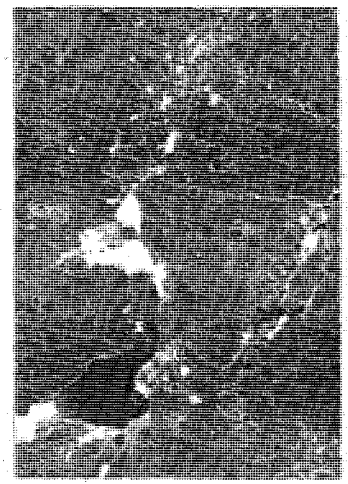

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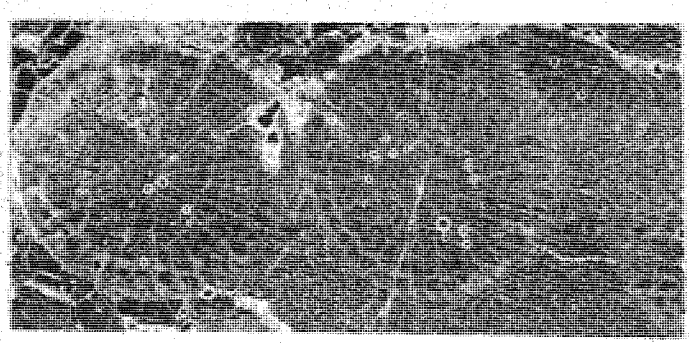

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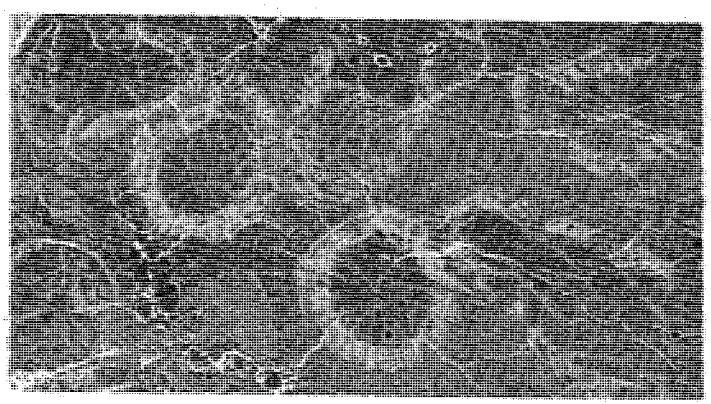

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EXPLANATION OF PLATE 2

FIGURES 1-2.—*Phacellophyllum fenense* McLaren. 1.—Transverse peel section; BYU 2235. 2.—Longitudinal peel section; BYU 2236. FIGURES 3-5.—*Disphyllum virgatum* (Hinde) var. *variabile* Hill. 3.—Transverse peel section; BYU 2237. 4.—Longitudinal peel section; BYU 2258. 5.—Longitudinal peel section; BYU 2238. FIGURE 6.—*Disphyllum virgatum* (Hinde) cf. var. *densum* Hill. Transverse peel section; BYU 2239. FIGURE 7.—*Disphyllum virgatum* (Hinde) var. a. Transverse peel section; BYU 2240. All figures. X4.

Diagnosis.—Dendroid corallum. Septa slightly to strongly dilated in dissepimentarium. Major septa may extend to axis. Tabulae complete to incomplete. One to three rows of small, horizontal to distally arched dissepiments.

External features.—Coralla severely weathered to obscure all external features.

Transverse thin section.—Corallites adjacent and joined by dissepimental tissue or separated by more than diameter of corallite. Septa 40 to 42 in corallites of 8–9 mm. Septa slightly to strongly dilated in dissepimentarium forming in parts of some corallites an almost compact stereozone. Major septa attenuate in tabularium and may reach axis where they may interfinger and form a small aulos. Minor septa end at or project slightly into tabularium.

Longitudinal thin section.—Wide tabularium. Tabulae complete to incomplete. Peripheral dissepimentarium narrow with 1 to 4 rows of small, globose dissepiments with occasional larger, more flatly curved plates extending across dissepimentarium. When only one row of dissepiments is present, they may resemble horseshoe rypes and give transverse sections a double-walled appearance.

Comparisons.—The material from the Guilmette Formation closely resembles Hill's (1954) *Disphyllum virgatum* var. *densum* from western Australia. The Australian forms are vermiform, and the axial tabellae form a low dome whereas the Guilmette corallites are parallel, and tabellae seem unordered into a definite pattern of occurrence. *Disphyllum virgatum* cf. var. *densum* differs from *Disphyllum virgatum* var. *variabile* in being somewhat larger, and its septa are not withdrawn from the axis. *D. virgatum* is larger and has more septa. *Acinophyllum fasciculum* (Meek) differs with septa which are carinate, never extend to the axis, and have only one row of small dissepiments.

Genus DISPHYLLUM de Fromentel, 1861
DISPHYLLUM VIRGATUM (Hinde) 1890 var. VARIABILE Hill, 1954
Pl.2, figs. 3–5

Material and occurrence.—Many corallites on three weathered limestone blocks. Middle coral zone I, 47–56 m below the top of the Guilmette Formation.

Diagnosis.—Dendroid corallum. septa slightly to strongly dilated in dissepimentarium, attenuate in tabularium. Major septa only occasionally extend to axis. Tabulae complete or incomplete, flat or sagging.

External features.—Corolla severely weathered to obscure all external features. Increase is lateral, divergence at acute angle, then with parallel growth.

Transverse thin section.—Corallites adjacent or separated by more than diameter of corallite. Septa 36–40 in corallites of 7–8 mm. Septa slightly to strongly dilated in dissepimentarium. Major septa withdraw from axis and attenuate in tabularium. Minor septa one-half to one-fourth length of majors. Narrow dissepimentarium with commonly only one series of dissepiments giving a double-walled appearance to some corallites.

Longitudinal thin section.—Wide tabularium. Tabulae complete to incomplete. Peripheral dissepimentarium narrow with commonly only 1 row of rather flat dissepiments, in places widening to 3 to 4 rows of small globose dissepiments.

Comparisons.—The variety differs from *Disphyllum virgatum* var. *densum* in being somewhat smaller and in having more attenuate septa withdrawn from the axis. *D. virgatum* is thicker and possesses more septa.

Genus DISPHYLLUM de Fromentel, 1861
DISPHYLLUM VIRGATUM (Hinde) 1890 var. a
Pl. 2, fig. 7

Material and occurrence.—One weathered corallum. Middle Devonian coral zone I, uppermost 4.6 m of the Guilmette Formation.

Diagnosis.—Dendroid corallum. Corallites closely packed. Septa greatly dilated and sclerenchyme deposits very thick in dissepimentarium to form a wide stereozone. Minor septa masked by stereozone. Major septa meet at axis.

External features.—Corallum severely weathered. Thick stereozone ring stands in relief on weathered corallites. Other external features obscured.

Transverse thin section.—Corallites small, closely packed, often in contact. Septa average 32 in corallites of 3–5.5 mm diameter. Septa strongly dilated in dissepimentarium, joined and covered by sclerenchyme tissue to form compact stereozone which may occasionally fill entire corallite. Trace of minor septa only occasionally seen. Major septa approach or meet axis.

Longitudinal thin section.—Wide tabularium, 2.5 mm in corallite of 4 mm diameter. Tabulae widely spaced, 20 in 5 mm, mostly complete, usually horizontal, may be slightly domed. Stereozone thick, occupying all of the dissepimentarium. Occasional dissepiment seen in stereozone, type and number of rows uncertain.

Remarks.—This coral is probably of the species *Disphyllum virgatum* (Hinde). The very thick and compact stereozone is not found in any other variety of the species, although both *Disphyllum virgatum* var. *dunsum* and var. *variabile* have portions of corallites which have thick sclerenchyme deposits.

Genus HEXAGONARIA Gurich, 1896
HEXAGONARIA sp. indt.
Pl. 3, figs. 5–6

Material and occurrence.—Two fragmentary weathered coralla. Middle Devonian coral zone I, 78 m below the top of the Guilmette formation.

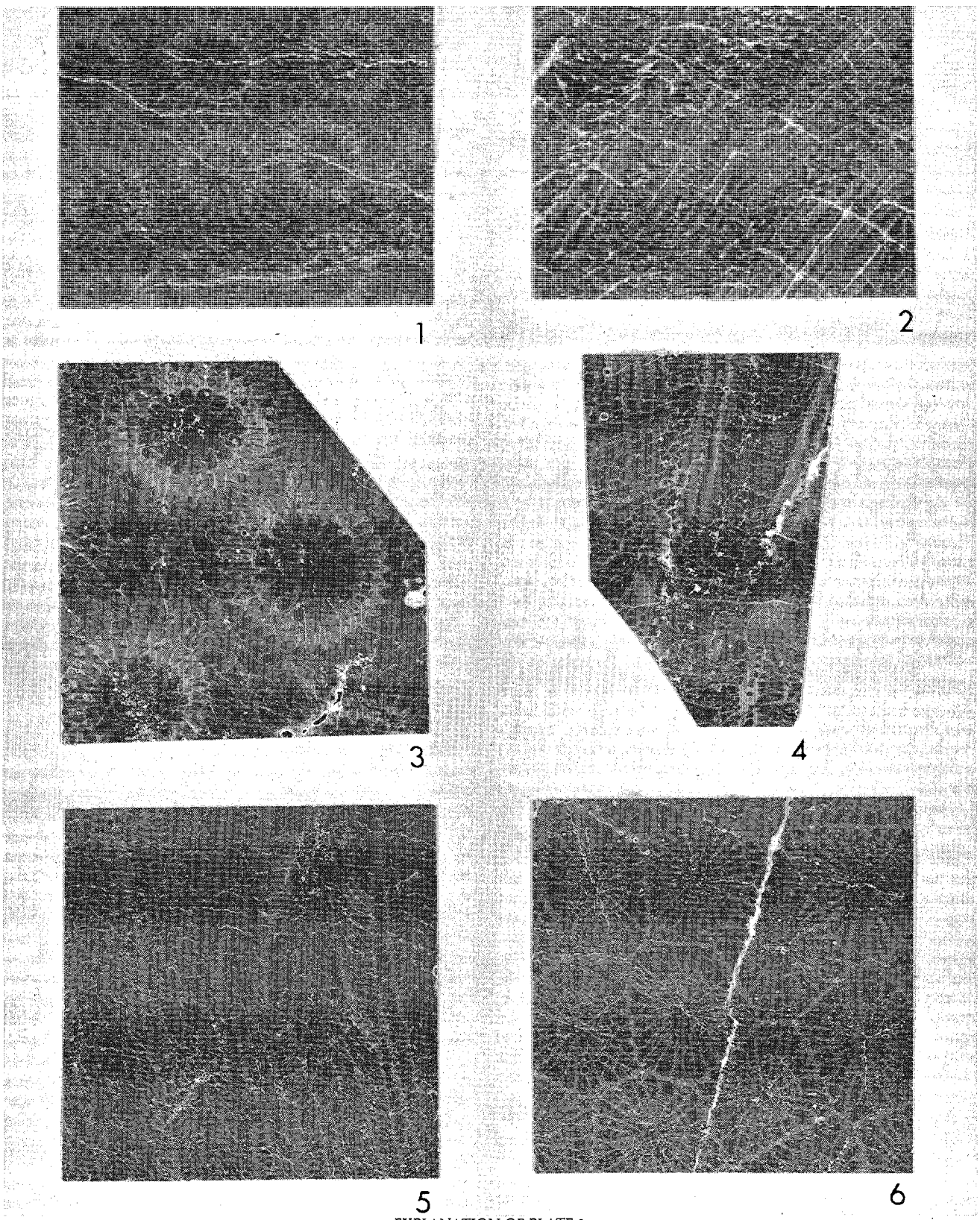
Diagnosis.—Cerioid corals with long, thickened septa, thickened zigzag wall, a moderately wide tabularium, and horizontally disposed, distally arched dissepiments.

External features.—Coralla severely weathered to obscure all external features.

Transverse thin section.—Septal count 26–28 in corallites of 5–6 mm diameter. Peripheral portions of septa dilated and may have irregular edges suggestive of carinae reinforced with sclerenchyme. Major septa attenuated in tabularium and usually terminate short of axis. Minor septa two-thirds the length to nearly as long as major septa. Wall thickened and usually distinctly zigzag. Dissepiments straight to concentric, closely spaced around tabularium.

Longitudinal thin section.—Tabularium width less than one-half the corallite diameter. Tabulae mostly complete. Dissepiments in three to five columns on each side, outermost large and nearly flat, innermost small and axially inclined.

Comparisons.—This species differs from *H. minuta* Stumm by lacking a distinctive increase of dilation of the septa at the margin of the tabularium and by shorter major septa. It differs from *Hexagonaria?* sp. h Merriam by having fewer septa, longer minor septa, and shorter termination of major septa.



EXPLANATION OF PLATE 3

FIGURES 1-4.–*Pachyphyllum nevadense* (Stumm). 1.–Transverse peel section; BYU 2241. 2.–Longitudinal peel section; BYU 2242. 3.–Transverse peel section; BYU 2243. 4.–Longitudinal peel section; BYU 2244. FIGURES 5-6.–*Hexagonaria* sp. indt. 5.–Longitudinal peel section; BYU 2245. 6.–Transverse peel section; BYU 2245. All figures X4.

Genus MESOPHYLLUM Schuter, 1889
Subgenus ATELOPHYLLUM Wedekind, 1925
MESOPHYLLUM (ATELOPHYLLUM) NEBRACIS McLaren, 1964
Pl. 4, figs. 5–8

Material and occurrence.—Eighteen complete to fragmental speciment. Middle Devonian coral zone G, basal 3 m of the Guilmette Formation.

Diagnosis.—Digonophyllidae with "septal cones" and highly variable septa. Wide dissepimentarium with small globose to elongate dissepiments which plunge proximally at a steep angle inwards and are not sharply differentiated from tabularium.

External features.—Large cylindrical corallites with fine annulations superimposed on moderately rugose epitheca. Calice deep and cone to bell shaped. Usually solitary, but two or three corals may occur in conjunction seemingly growing from a common base.

Transverse thin section.—Sections quite variable in appearance according to growth stage. In early stages short, dilated septa are present around the periphery, and a stereozone may be present axially. In later stages septa become longer and more continuous, have a tendency to dilate in the outer tabularium, withdraw from the axis to form a pear-shaped opening, and withdraw from the periphery to form a lonsdaleoid band. In early stages it is impossible to distinguish between major and minor septa. In late stages minor septa are discontinuous and may be replaced by herringbone dissepiments. In later stages there are about 45 major septa in a corallite of 40 mm. Largest corallite found had a diameter of 55 mm. Because of rejuvenation early or late stages of growth may be shown in sections cut at various intervals along the coral length. Individual sections may show characteristics of both youthful and late stages depending on which parts of the overlapping "septal cones" are cut by the section.

Longitudinal thin sections.—Dissepimentarium wide, consisting of many rows of small axially convex to elongate dissepiments that dip toward the axis at a steep angle. Dissepiments in regular rows of varying size depending on stage of septal rejuvenation. Narrow tabularium of varying types of tabellae from small globose forms not sharply differentiated from dissepiments to wider horizontal forms. Several "septal cones" visible in all longitudinal sections.

Comparisons.—Owing to the wide variability observed in *Atelophyllum nebracis* McLaren, the species can resemble in individual section a number of forms. It is very possible that other species of *Atelophyllum* may belong to *A. nebracis.* Guilmette forms are somewhat larger but conform closely to the type material of the species from the Canadian Horn Plateau Formation. *Atelophyllum nebracis* McLaren differs in morphology from other forms. *A. emsti* Wedekind, the type species, has a wider tabularium and more inflated and larger tabellae. *A. fultum* (Hill) has a wider tabularium, and published material has not described the variation seen in *A. nebracis. A. subcylindrium* (Stumm) is smaller and has fewer septa, and *A. magnum* (Stumm) has better developed minor septa.

Remarks.—*Atelophyllum nebracis* McLaren is a good index fossil for the base of the Guilmette Formation in the collection locality, even though it has not been reported in other areas. Basal exposures of the Guilmette are rare, and all samples were collected from one 9-meter-wide exposure of dark, highly fossiliferous limestone which apparently occurs as a lens in a 9-meter-wide belt of dark, thin-bedded shale which marks the Simonson Dolomite–Guilmette Formation contact in the Leppy Range.

Genus PACHYPHYLLUM Edwards and Haime, 1850
PACHYPHYLLUM NEVADENSE (Stumm), 1948
Pl. 3, figs. 1–4

Material and occurrence.—Numerous weathered corralla. Middle Devonian coral zone I, uppermost 107 m of the Guilmette Formation.

Diagnosis.—Moderately variable astreoid coralla. Septa strongly dilated at border of tabularium. Major septa may or may not extend to axis. Tabulae mostly complete. One row of horseshoe dissepiments form the tabularium wall.

External features.—Massive, subhemispherical, discoidal, or globular growths. Weathering has removed all surface features on specimens collected.

Transverse thin section.—Corallite axes are 4 to 9 mm apart. Septa vary from 22 to 30 in various specimens. Septa strongly dilated at tabularium border and may be in lateral contact. Minor septa terminate at tabularium. Major septa attenuate rapidly in tabularium and reach axis or extend inward only a short distance. Margins of tabularium with distinct double-walled appearance due to row of horseshoe dissepiments. Peripheral septa confluent with or abut against neighboring septa.

Longitudinal thin section.—Tabularia 2–5 mm in diameter, with complete or incomplete relatively horizontal tabulae. Single row of small, distally convex horseshoe dissepiments borders tabularia. Intertabulate dissepiments are larger, more horizontally disposed, and more elongate than horseshoe dissepiments.

Remarks.—A great number of specimens from various regions of Alaska, Canada, Nevada, and Arizona have been assigned to *Pachyphyllum nevadense* (Stumm 1948). The species is distinguished by including forms with a great degree of variance in size of corallites and minor details of structure. Material from the Guilmette Formation is distinguished by lack of carina and large variance in septa number in various specimens.

Genus PARACANTHUS Merriam, 1973
PARACANTHUS NEVADENSIS Merriam, 1973
Pl. 4, figs. 1–4

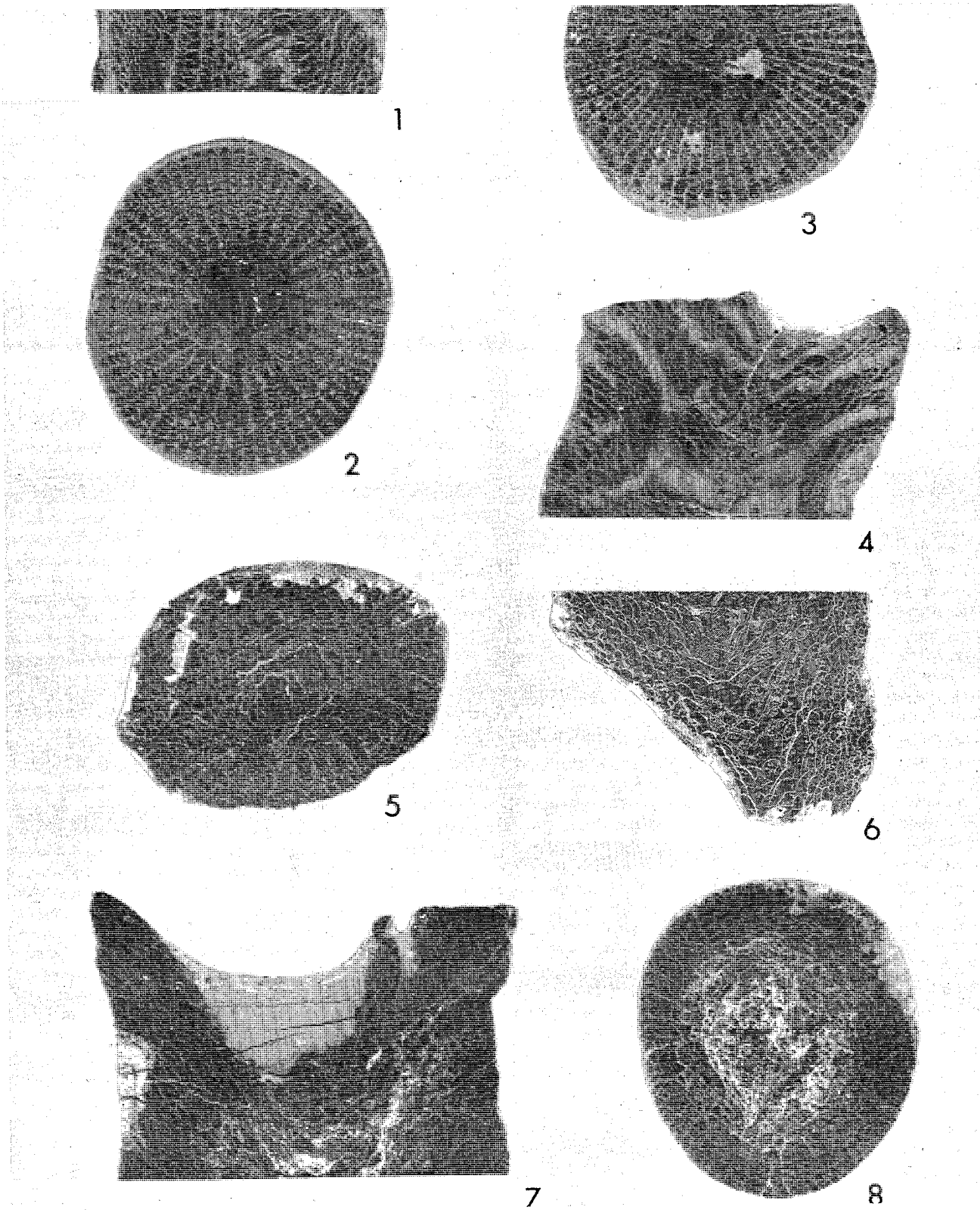
Material and occurrence.—Numerous incomplete coralla. Middle Devonian coral zone G. Lowermost 15 m of the Guilmette Formation.

Diagnosis.—Corals with commonly undulated and dilated septa with greatest thickening and undulation within the peripheral half. Carina sometimes present but may be absent or masked by septal thickening. Simple pattern or concentric-anguloconcentric dissepiments which may be crowded near the periphery.

External features.—Small solitary corals with slender, subcylindrical corallites. Thin epitheca with medium to light rugae. Corallites commonly bent. Calice with a flat to concave floor and moderately thick vertical walls. Axial increase with two offsets.

Transverse thin section.—Septal count 60–68 in corallites of 16–21 mm diameter. Septa commonly undulant and dilated in dissepimentarium, thinning towards axis. Poorly developed carina in specimens towards top of occurrence interval. Major septa may reach axis. Minor septa short to three-fourths length of major septa. Sclerenchyme thickening common near periphery. Fossula may be present.

Longitudinal thin section.—Small, vertical to steeply inclined dissepiments in 10–15 columns on each side. Tabularium of flattened, slightly domed tabulae and smaller peraxially inclined tabellae not sharply differentiated from dissepiments. Tabularium half the radius of the corallite. Large trabeculae may be evident or unapparent.



EXPLANATION OF PLATE 4

FIGURES 1–4.–*Paracanthus nevadensis* Merriam. 1.–Longitudinal peel section; BYU 2223. 2.–Transverse peel section; BYU 2223. 3.–Transverse peel section; BYU 2224. 4.–Longitudinal peel section; BYU 2225. All figures X2. FIGURES 5–8.–*Mesophyllum* (*Atelophyllum*) *nebracis* McLaren. 5.–Transverse peel section; BYU 2226. 6.–Longitudinal peel section; BYU 2226. 7.–Longitudinal peel section; BYU 2227. 8.–Transverse peel section; BYU 2257. All figures X1.33.

Remarks and Comparisons.—Merriam's (1973) figured specimens of *Paracanthus nevadensis* show much variation. Corals collected near the base of the Guilmette Formation are closest to Merriam's figured specimens. Corals towards the top of the interval which exhibit carina on undilated septa are more similar to one of Merriam's corals, USNM 166471 (pl. 4, fig. 4) which has carina. Specimens from the Guilmette Formation are typically smaller than the Nevada forms. *Paracanthus richardsoni* (Meek) from the MacKenzie River Ramparts of Canada is very similar to the Guilmette forms. Merriam (1973) has separated *Paracanthus richardsoni* (Meek) from *P. nevadensis* Merriam on the basis of its fewer septa and smaller corallites. This distinction is probably not justified in view of the Guilmette forms, and *P. richardsoni* (Meek) is probably of the same species as *P. nevadensis* Merriam. It is doubtful if a new species name is justified for the Nevada forms. Detailed study of the variation in the two species should easily resolve this question. *Mictophyllum modicum* Smith differs from *P. nevadensis* in having shorter septa with little dilation. *Cyathophyllum* (*Peripaedium*) *greteneri* McLaren closely resembles corals from the upper part of the Guilmette collection zone but differs in typically longer minor septa. This coral could very well belong in the genus *Paracanthus* as McLaren has stated its generic assignment is in doubt.

Genus PHACELLOPHYLLUM Gurich, 1909
PHACELLOPHYLLUM FENENSE McLaren, 1958
Pl. 2, figs. 1–2

Material and occurrence.—Two weathered limestone fragments, possibly from the same corallum. Middle Devonian zone 1, 78 m below the top of the Guilmette Formation.

Diagnosis.—Slender, dendroid corals with long, peripherally dilated major septa. Mostly incomplete tabulae, single inner row of horseshoe dissepiments with outer row of widely spaced dissepiments.

External features.—Coralla severely weathered to obscure all external features.

Transverse thin section.—Corallites in contact or widely separated. Septal count 44–50 in corallites or 8–11 mm diameter. Septa spindle shaped, dilated in inner dissepimentaium with double- or triple-walled appearance due to horseshoe dissepiments. Minor septa end at tabularium, major attenuate in tabularium and may reach axis. Epitheca thin.

Longitudinal thin section.—Tabulae occasionally complete, most incomplete, differentiated into axial series of horizontal plates and peripheral series of peraxial inclined plates. Dissepimentarium a single series of inner horseshoe dissepiments and a single outer series of horizontal to distally convex widely separated dissepiments.

Comparisons.—These specimens closely resemble Smith's (1945) illustrated specimens of *Phacellophyllum fenense* McLaren (described as *Disphyllum* (*Synaptophyllum*) cf. *arundinaceum*), also illustrated by Lang and Smith (1935) and included by McLaren (1958) in his synonymy of the species. The Lang and Smith (1935) forms show a thick stereozone around the periphery whereas Smith's (1945) figures show wedge-shaped septa in the dissepimentarium next to the peripheral wall.

Genus TEMNOPHYLLUM Walther, 1928
TEMNOPHYLLUM cf. T. TURBINATUM Hill, 1954
Pl. 5, figs. 1–4

Material and occurrence.—Fourteen incomplete corallites. Middle Devonian coral zone H, 259–279 m above the base of the Guilmette Formation.

Diagnosis.—Solitary, probably cylindrical corals with septa strongly dilated in dissepimentarium or in definite stereozones. Major septa long with axial ends somewhat bulbous and dilated. Tabulae incomplete, horizontal, or domed. Dissepiments usually small and globose.

External features.—No external features are preserved. In thin section some specimens are ceratoid to trochoid, other sections appear cylindrical. Undulations in the epithica are visible in longitudinal section.

Transverse thin section.—Septal count 56–60 in corals of 12–16 mm diameter. Septa strongly dilate in dissepimentarium or dilate only at periphery and inner dissepimentarium to form two stereozones. Major septa approach axis and usually interfinger without being in contact. Axial ends often dilated into a small bulb. Major septa thin somewhat in tabularium but are not attenuate. Minor septa one-fourth to one-half length of major septa and are not as strongly dilated. Small angulate plates at edge of dissepimentarium often covered with sclerenchyme tissue. Many small dissepiments present between septa with herringbone appearance where minor septa are weak.

Longitudinal thin section.—Tabularium moderately wide with tabellae domed or horizontal and incomplete. Dissepiments in inclined rows, small globose.

Comparison.—The Guilmette specimens differ from the type material of Australia in being somewhat smaller with fewer septa, and in mode of growth. There appears to be more variation in the Guilmette material, probably because of the larger set of study specimens. *Mictophyllum modium* Smith has less well-developed minor septa and typically less dilated septa. As mentioned by Hill, the species *T. turbinatum* appears close to both *Temnophyllum* and *Mictophyllum,* and the species is assigned to *Temnophyllum* only because of Hill's previous assignment.

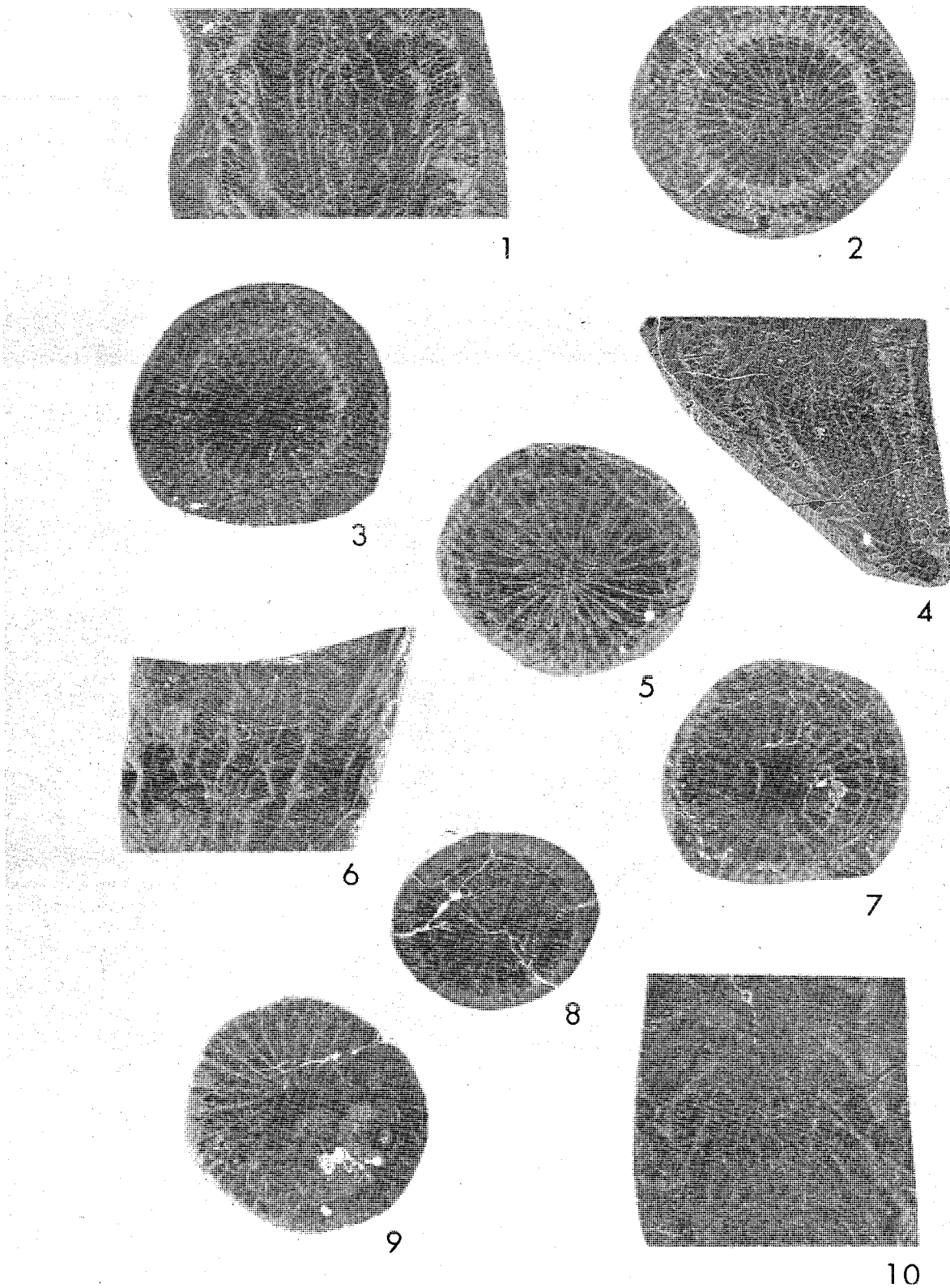
Genus SINOSPONGOPHYLLUM Yoh, 1937
SINOSPONGOPHYLLUM sp.
Pl. 5, figs. 5–10

Material and occurrence.—Study material consists of ten fragmental specimens. Middle Devonian coral zone I, 60–78 m below the top of the Guilmette Formation.

Diagnosis.—Merriam (1974, p. 56) diagnosed the genus as "a ceratoid to subcylindrical chonophyllidae" with rather closely spaced, wide to very wide tabulae which are either straight or sag axially and peripherally. Septa are amplexoid, smooth or minutely wavy, noncarinate, and usually withdrawn from axis. Minor septa are well defined. Peripheral zone has septal crests, large irregularly distributed lonsdaleoid dissepiments, and smaller normal dissepiments. Septal stereozone is narrow to moderately wide. Fossula is weak or absent.

External features.—External features are not preserved on the fragmental material. By shape of tabulae the calyx is probably deep, thin walled, and marked with a small axial depression.

Transverse thin section.—No complete coral is preserved, but shape is probably subtrochoid with rejuvenescence rugae produced on a thin epitheca. Septal count 54 in corallite of 16 mm. Major septa usually of uniform thickness, sometimes thinner in dissepimentarium, long, meeting at the axis or uniformly withdrawn. Minor septa usually very short, present in dissepimentarium as a crest on peripheral stereozone, or occasionally protruding in discontinuous fashion into tabularium. Strong herringbone dissepiments present on some specimens, which may be thickened with sclerenchyme tissue. Partial stereozone may be produced at border of tabularum.



EXPLANATION OF PLATE 5

FIGURES 1–4.–*Temnophyllum* cf. *T. turbinatum* Hill. 1.–Longitudinal peel section; BYU 2228. 2.–Transverse thin section; BYU 2228. 3.–Transverse thin section; BYU 2229. 4.–Longitudinal peel section; BYU 2229. FIGURES 5–10.–*Sinosphongophyllum* sp. 5.–Transverse peel section; BYU 2230. 6.–Longitudinal peel section; BYU 2230. 7.–Transverse peel section; BYU 2230. 8.–Transverse peel section; Paratype BYU 2232. 9.–Transverse peel section; BYU 2233. 10.–Longitudinal peel section; BYU 2234. All figures X2.5.

Longitudinal thin section.—One series of elongate, vertically inclined dissepiments in thin dissepimentarium. Tabularium very wide. Tabulae mostly complete, domed with axial sag and peripheral ends recurved.

Comparisons.—*Sinospongophyllum* differs from *Diversophyllum* in having longer septae that reach the axis, tabulae are more arched and irregular in the latter and have less tendency to produce lonsdaleioid dissepiments. *Tabulophyllum* differs from *Sinopongophyllum* in having weakly developed minor septa and a less evident septal stereozone. Stumm (1949, p. 27) considers the two as possible synonyms.

Order TABULATA Milne-Edwards & Haime, 1850
Genus ALVEOLITES Lamarck, 1801
ALVEOLITES cf. A. WINCHELLANA (Miller), 1884
Pl. 6, fig. 1

Material and occurrence.—Numerous broken coralla. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Diagnosis.—Coral variable in growth form ranging from frond-like encrusting forms to round or slightly flattened dendritic stems. Apertures lunate with distinct lower lip. Few and indistinct tabulae.

Description.—Cylindrical coralla 3–6 mm wide. Corallite apertures average .7 mm in diameter, distinctly lunate with pronounced lower lip and smooth interiors. Mural pores moderately abundant, occurring often near periphery. Tabulae thin, in axial portion only, .4 mm apart. Corallites open oblique to surface of stem, slope gently toward axis.

Comparisons.—This coral loosely resembles *Alveolites winchellana* (Miller), but may actually be representative of the genus *Coenites* (Oliver 1974 personal comm.). Pores occurring near the periphery are somewhat suggestive of *A. caudatus* Hill though the aperture type is closer to *A. winchellana* (Miller).

Genus ALVEOLITES Lamarck, 1801
ALVEOLITES sp. indt.
Pl. 6, fig. 4

Material and occurrence.—Three highly weathered fragments of limestone. Middle Devonian coral zone I, 12–94.5 m below top of Guilmette Formation.

Diagnosis.—Dendroid corals with probably rounded to sublunate apertures. Apertures opening obliquely to nearly perpendicular into corallum. Few scattered tabulae.

Description.—Cylindrical coralla, 3–9 mm wide. Corallite apertures not well preserved on the weathered fragments. In section apertures average .5 mm in diameter and appear to be round to sublunate with slightly elevated lower lip and smooth interiors. Corallites open obliquely or perpendicular to surface of stem. Tabulae few and indistinct. Mural pores present but unordered. Walls of relatively uniform thickness.

Comparisons.—This coral differs from *Alveolites* cf. *A. winchellana* (Miller) described previously in this paper by lacking pores near the periphery and having more perpendicular opening of apertures. *Cladopora ? minis* Davis is very similar in form, but the generic position of that species has not been determined definitely.

Genus AULOPORA Goldfuss, 1829
AULOPORA cf. A. PRECIUS Hall, 1876
Pl. 7, figs. 1–2

Material and occurrence.—Several short series of weathered corallites on three rock and fossil fragments. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Description.—Trumpet-shaped, usually epifaunal corals which bud laterally in a straight line or at an angle. Parent cup usually upright with diameter of 1 to 3 mm. Budding horizontal from base of cup. Diameter of new corallite about 1 mm at point of origin in corallite with cup of 3 mm. Distance between budding up to 9 mm. No spines or cysts.

Remarks.—This coral resembles in gross morphology *Aulopora precius* Hall, a typically Silurian coral. Guilmette forms have some corallite cups larger than the Silurian forms, and distance between buds is greater. These corals may represent a different species; however, poor preservation of the material makes closer comparison impossible.

Genus FAVOSITIES Lamarck, 1816
FAVOSITIES clelandi Davis, 1887
Pl. 8, figs. 3–4

Material and occurrence.—One complete corallum, globose, 60 mm wide, 60 mm high. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Diagnosis.—Corallum hemispherical. Tabulae complete, horizontal or slightly sagging. Walls moderately thick.

Transverse thin section.—Corallite 1–2 mm diameter, polygonal. Wall moderately thick. Mural pores large, in middle of corallite wall, uniserial.

Longitudinal thin section.—Tabulae complete, horizontal or slightly sagging, widely spaced, approximately 10 in 5 mm. Mural pores about 1 mm apart in corallite wall. No septa or squamulae.

Remarks.—This rather simple favositid appears to agree in all details with Davis' holotype from the Middle Devonian Jefferson Limestone.

Genus FAVOSITIES Lamarck, 1816
FAVOSITIES cf. F. CLELANDI Davis, 1887
Pl. 8, figs. 1–2

Material and occurrence.—One incomplete corallum 30 mm high, 60 mm wide. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Diagnosis.—This coral is very similar to *Favosities clelandi* Davis, but differs in having somewhat thinner walls and thinner tabulae, and the mural pores are not centered exactly in the middle of the corallite walls. Other characters are the same.

Genus FAVOSITIES Lamarck, 1816
FAVOSITIES n. sp.?
Pl. 8, figs. 5–6

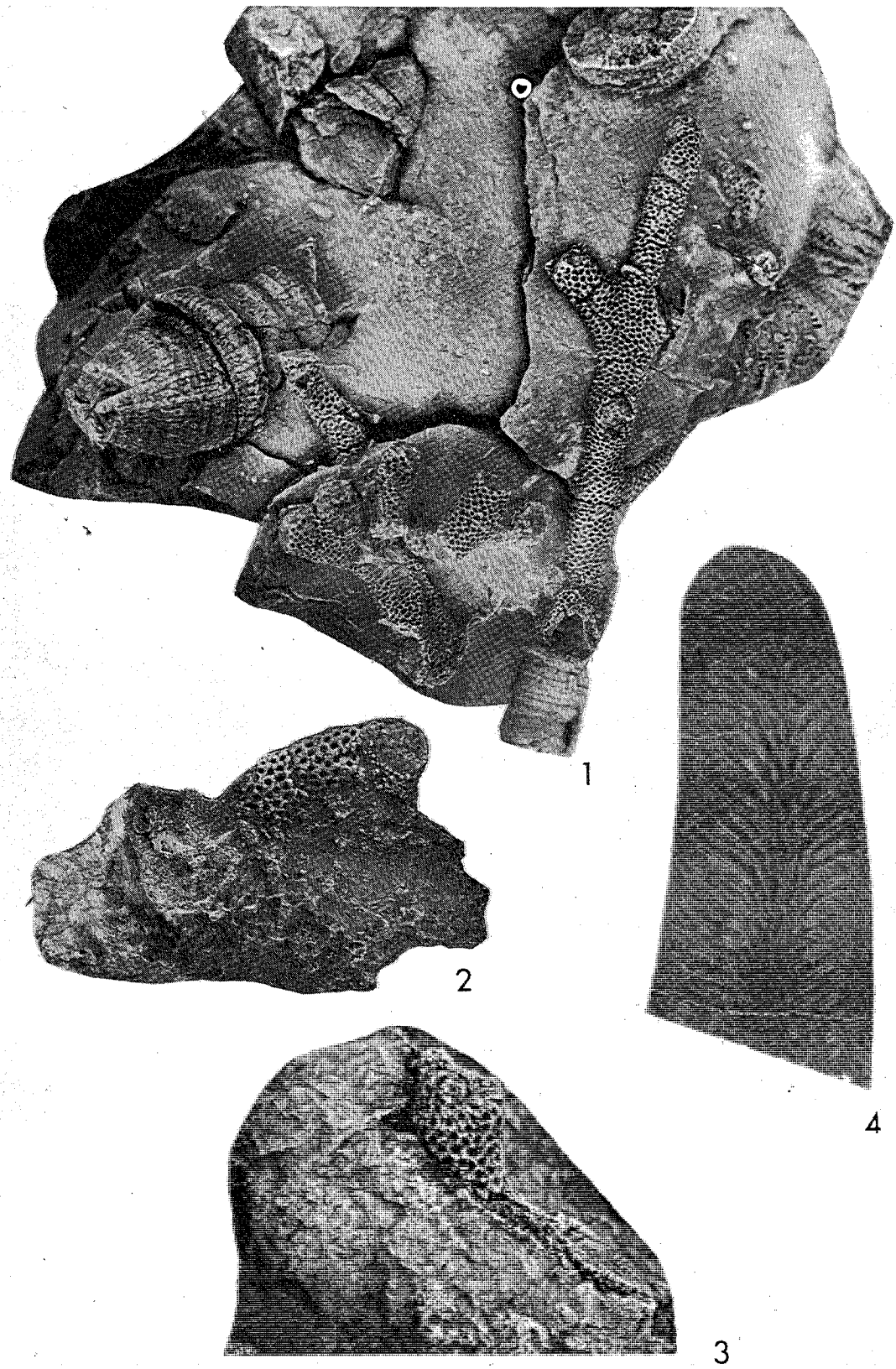
Material and occurrence.—Massive hemispherical corallum 60 mm high, 90 mm wide. Small partial corallum growing on stromatoporoid colony. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Diagnosis.—Corallum broad, low hemispherical. Corallites very small. Walls very perforate. Tabulae complete and horizontal. Corallites rounded or rather rectangular in appearance.

Transverse thin section.—Walls quite thick. Corallites very small, .4–.5 mm in diameter, and quite rounded or rectangular in appearance.

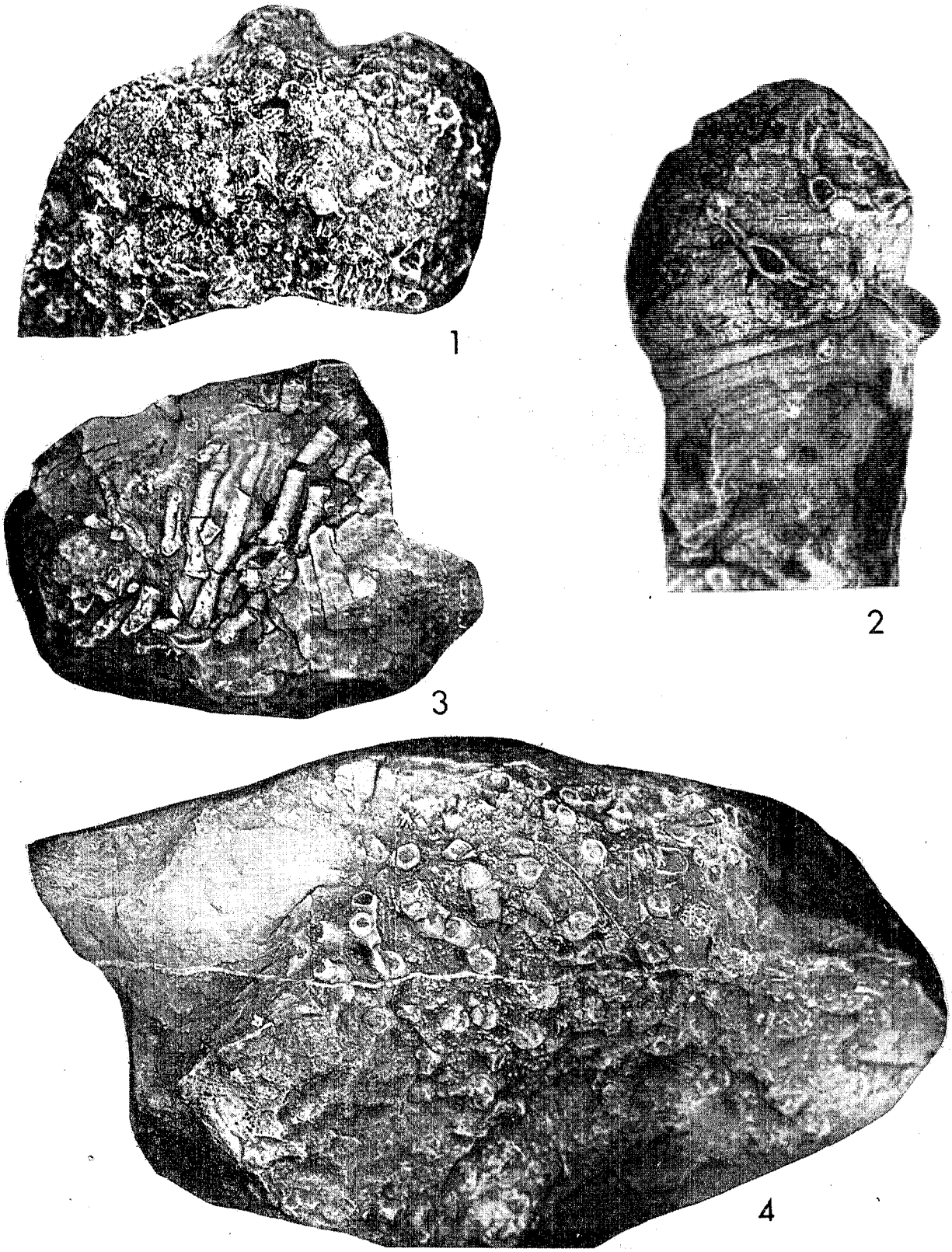
Longitudinal thin section.—Tabulae usually complete, 16 in 5 mm. Walls very perforate, mural pores about 10 per 5 mm of wall length.

Remarks.—The very small size of the corallites gives this coral a superficial resemblance to *Chaetetes*; however, the very strongly



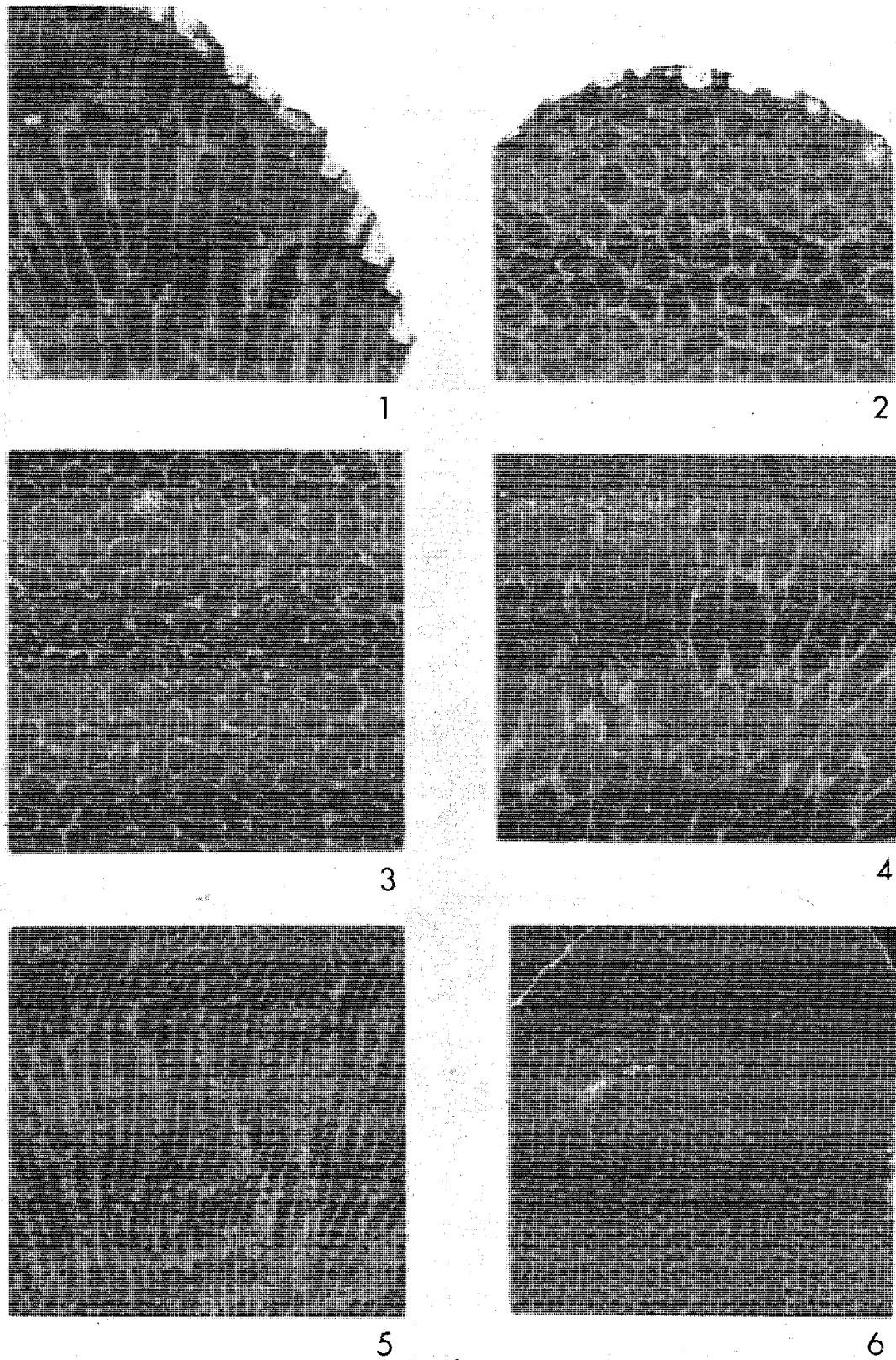
EXPLANATION OF PLATE 6

FIGURE 1.—*Alveolites* cf. *A. winchellana* (Miller). Exterior view associated with rugose corals; BYU 2249. Figure X1. FIGURES 2-3.—*Thamnopora* cf. *T. angusta* Lecompte. 2.—Exterior view; BYU 2250. 3.—Exterior view; BYU 2251. Figures X2. FIGURE 4.—*Alveolites* sp. indt. Longitudinal peel section; BYU 2252. Figure X3.75.



EXPLANATION OF PLATE 7

FIGURES 1–2.–*Aulopora* cf. *A. precius* Hall. 1.–Exterior view; BYU 2253. 2.–Exterior view of specimens parasitic on rugose coral; BYU 2254. FIGURES 3–4.–*Syringopora* cf. *S. perelegans* Billings. 3.–Exterior longitudinal view; BYU 2255. 4.–Exterior transverse view; BYU 2256. All figures X1.4.



EXPLANATION OF PLATE 8

FIGURES 1-2.–*Favosities* cf. *F. clelandi* Davis. 1.–Longitudinal peel section; BYU 2246. 2.–Transverse peel section; BYU 2246. FIGURES 3-4.–*Favosities clelandi* Davis. 3.–Transverse peel section; BYU 2247. 4.–Longitudinal peel section; BYU 2247. FIGURES 5-6.–*Favosities* n. sp.? 5.–Longitudinal peel section; BYU 2248. 6.–Transverse peel section; BYU 2248. All fixtures X3.75.

perforate walls place it in the genus *Favosities.* No similar corals have been found in the literature, but there are not enough specimens to justify a new species name.

Genus SYRINGOPORA Goldfuss, 1826
SYRINGOPORA cf. S. perelegans Billings, 1859
Pl. 7, figs. 3-4

Material and occurrence.—Two fragments of corallites not from the same corallum. Middle Devonian coral zone G, basal 3 m of Guilmette Formation.

Diagnosis.—Phaceloid coral, closely resembling *Aulopora* in beginning growth stages, becoming long and cylindrical in adult stages.

External features.—Corallum phaceloid, corallites mostly straight. Horizontal growth annulations on corallites. Connecting stolons not readily apparent. Calicular pit in unweathered corallites.

Transverse thin section.—Corallites 1-3 mm in diameter. Closely adjacent or widely separated. Offset ring structure of infundibuliform tabulae visible.

Longitudinal thin section.—Tabulae usually infundibuliform. Axial tube formed by coalescing tabulae.

Comparisons.—Specimens are very similar to *Syringopora perelegans* Billings, but more material is necessary for definite comparison. *Syringopora hisingeri* Billings, which often occurs in association with *S. perelegans* Billings, has more connecting stalons and closely set, proximally convex tabulae.

Remarks.—The two specimens were found in highly argillaceous rock material atypical of the regular rock type of the area. However, they were found loose and could possibly be float.

Genus THAMNOPORA Steininger, 1831
THAMNOPORA cf. T. angusta Lecompte, 1939
Pl. 7, figs. 2-3

Material and occurrence.—Many fragmental, highly silicified fragments and four well-preserved limestone blocks. Middle Devonian coral zone H, 259-279 m above the base of the Guilmette Formation.

Diagnosis.—Coral dendroid, branching not evident in study material. Apertures round, opening obliquely to the exterior at a moderate angle. Few and indistinct tabulae.

Description.—Cylindrical to oblique stems up to 13 mm diameter. Corallite apertures .5-1 mm in diameter, usually round. Walls near periphery moderately thick, thinning slightly near axis. Mural pores present but not abundant. Tabulae thin and very irregular. Corallites open obliquely at high angle to surface, slope steeply toward axis.

Remarks.—This species is similar to *Thamnopora angusta* Lecompte but varies in the degree of angularity at which the apertures open into the corallum. *T. angusta* opens nearly perpendicularly, whereas the Guilmette forms open much more obliquely.

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