OKLAHOMA GEOLOGICAL SURVEY

CARL C. BRANSON, *Director*

BULLETIN 109

RUGOSE CORALS OF THE HENRYHOUSE FORMATION (SILURIAN) IN OKLAHOMA

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The University of Oklahoma

Norman

1965

CONTENTS

ILLUSTRATIONS

PLATES

TEXT-FIGURES

TEXT-FIGURES

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PATRICK K. SUTHERLAND

ABSTRACT

The Henryhouse Formation is a fossiliferous marlstone of Silurian age exposed in the Arbuckle Mountains region of southern Oklahoma. Rugose corals are common locally in the formation and are referred to at least 28 species, of which 19 (14 of them new) are well enough represented to be assigned specific names. Twenty-two genera are represented, of which three are new.

Correlation of the Henryhouse coral fauna is tentative at this time because of the high percentage of new species. The fauna suggests a Wenlockian or early Ludlovian age which is in general agreement with the early Ludlovian (early Late Silurian) age indicated by graptolites and brachiopods.

The Henryhouse coral fauna compares most closely with that of the Brownsport Formation of western Tennessee, and the two faunas have at least eight species in common. Limited evidence suggests a possible correlation of the coral fauna with that of the Moccasin Springs Formation (Bainbridge Group) of southeastern Missouri.

INTRODUCTION

General statement. — The Henryhouse Formation is a fossiliferous marlstone of early Late Silurian age. It is one of the carbonate units which form the Hunton Group of Silurian and Early Devonian age in southern Oklahoma (text-fig. 1). These formations are well exposed in the Arbuckle Mountains region (text-fig. 2).

The primary purpose of this investigation has been to describe the rugose-coral fauna of the Henryhouse Formation, to study the relation of this fauna with that of the overlying Haragan Formation, and to evaluate the age of the formation upon the basis of the coral fauna. The rugose-coral fauna includes 14 families, of which one is described as new; at least 22 genera, of which three are described as new; and 28 species, of which 14 are new.

Acknowledgments. — Special gratitude is expressed to Dorothy Hill for reading the manuscript and making many helpful suggestions concerning coral classification. Thanks are also extended to William A. Oliver, Jr., for helpful discussions concerning Silurian rugose corals. Thomas W. Amsden provided helpful information concerning the stratigraphy and age of the Henryhouse Formation.

The Faculty Research Fund of The University of Oklahoma provided a travel grant which made possible a visit to the U. S. National Museum in Washington, D. C.

I am indebted to the U. S. National Museum for the loan of a large collection of unfigured rugose corals from the Henryhouse Formation in Oklahoma which was made primarily by W. E. Ham and A. R. Loeblich in 1947. The Peabody Museum at Yale University kindly lent me the entire Amsden collection of rugose corals from the Brownsport Formation of western Tennessee (Amsden, 1949), including figured and unfigured specimens. I am indebted to the Walker Museum at the University of Chicago for the loan of figured and unfigured specimens of rugose corals in the Ball and Grove (1940) collection from the Bainbridge Formation (Moccasin Springs) of Missouri.

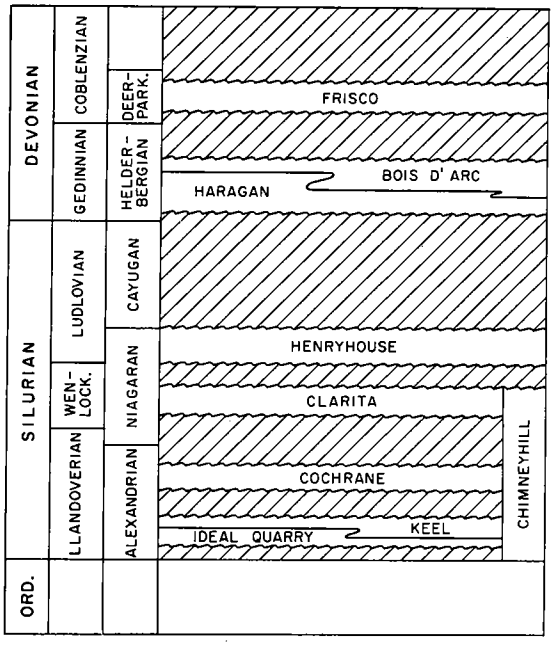
HENRYHOUSE STRATIGRAPHY

General statement. — A detailed description of the stratigraphy of the Hunton Group has been given by Amsden in a series of recent papers (1957, 1960, 1962) and only a brief review of the stratigraphic relations is presented here.

The Henryhouse Formation is primarily a silty and argillaceous calcilutite and is commonly called a marlstone. It has a wide range in thickness in southern Oklahoma. It is absent over much of the central Arbuckle region but is nearly 250 feet thick in both the western Arbuckle area and on the Lawrence uplift in the northeastern part of the area (Amsden, 1960, p. 82).

Stratigraphic relations. — The Henryhouse Formation is the youngest Silurian formation in the Arbuckle area. It is separated from older Hunton strata by an erosional unconformity and is distinctly different from them lithologically. It generally rests upon the Clarita Member of the Chimneyhill Formation (text-fig. 1), but it locally rests upon the Cochrane Member and also locally upon the Ideal Quarry Member. The contact with the underlying units is everywhere lithologically sharp.

The Henryhouse Formation is overlain by the Haragan Formation in much of its outcrop area, but it is locally overlain by the Lower Devonian Bois d'Arc Formation (text-fig. 5) or by the Woodford Shale of Late Devonian age.



Text-figure 1. Chart showing subdivisions of the Hunton Group of south-central Oklahoma, and their relative ages (after Amsden, 1962, fig. 1).

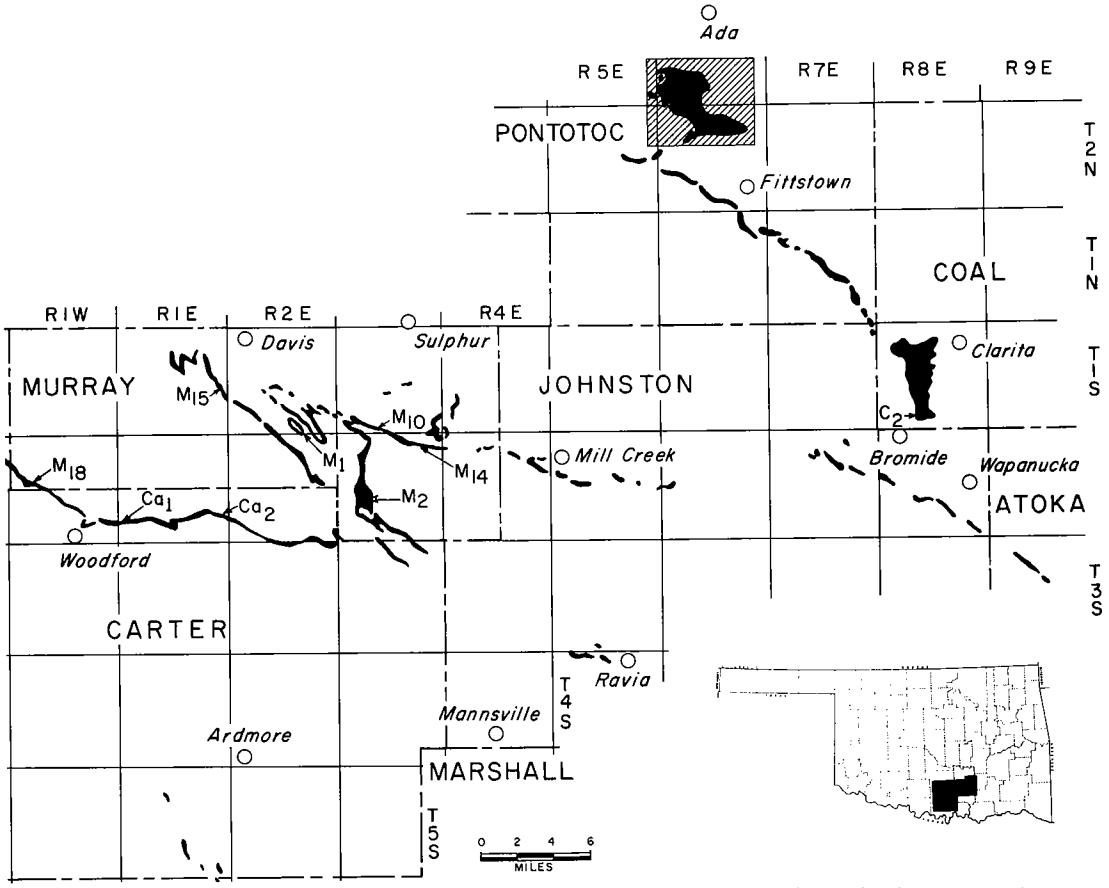
The Haragan Formation is also a marlstone and is closely similar in lithology to the subjacent Henryhouse Formation. This lithologic similarity has been noted by various authors and has been the source of considerable controversy in the interpretation of Hunton stratigraphy.

Shannon (1962) made a subsurface lithostratigraphic study of the Hunton Group in Oklahoma based upon electric-log and well-cutting studies, and he interpreted the Henryhouse Formation as either (1) a facies of the Haragan or (2) transitional with the Haragan Formation. Either of these suppositions requires continuous deposition between the two formations and is at variance with the interpretation by Amsden (1960) that the relationship between the two is everywhere unconformable in the Arbuckle region. Amsden based his interpretation upon (1) the local biostratigraphic and lithostratigraphic relations as found in surface exposures in the Arbuckle region and (2) the relative ages of the two formations as determined by regional and world-wide faunal correlations.

Amsden has found that the abundant brachiopod faunas, the dominant faunas of both formations, are everywhere distinct. Where the two formations are in contact, the faunal boundary is sharply defined and no known locality shows any evidence that transitional faunas bridge the gap between the two (Amsden, 1960, p. 75). The faunal boundary is thus a mappable contact.

Age and correlation. — A comparison of the Henryhouse and Haragan brachiopod faunas with faunal successions in other regions in North America and in Europe indicate an Early Devonian (Helderbergian; Gedinnian) age for the Haragan Formation and an early Late Silurian (early Ludlovian) age for the Henryhouse Formation (Amsden, 1960, p. 76). This evidence would suggest that the two formations are separated by a time interval covering most of the Late Silurian.

Preliminary and detailed studies of other faunal elements from the Henryhouse and Haragan Formations, now in progress, also indicate a sharp faunal break between the two formations. These



Text-figure 2. General outcrop map of the Hunton Group in the Arbuckle Mountains region. Numbers refer to rugose-coral localities. Shaded area at the top is the Lawrence uplift, illustrated in text-figure 3.
(modified from Amsden, 1960, panel 1)

include crinoids (Strimple, 1963), ostracodes (Lundin, 1965), trilobites, bryozoans, and the rugose corals of the present study.

Of particular importance in determining the age of the Henryhouse Formation is the occurrence of graptolites. Decker (1935) described 16 species of graptolites from the formation and noted a close similarity with the graptolite fauna of the lower Ludlow shales of Wales. The Henryhouse fauna includes *Monograptus nilssoni* and *M. vulgaris* and correlates with zones 32 and 33 of the Ludlovian Series of Wales.

HENRYHOUSE RUGOSE CORALS

General statement. — No rugose corals have previously been described from the Henryhouse Formation, although various faunal lists have included small numbers of species. The present study describes the following 28 species, representing 22 genera:

Rhizophyllum applanatum, new species
Rhizophyllum oklahomense, new species
Spongophylloides cockei, new species
Spongophylloides sp. X
Amsdenoides acutiannulatus (Amsden)
Enterolasma cf. *E. waynense* (Safford)
Cystiphyllum? henryhousense, new species
Entelophyllum cf. *E. angulare* (Amsden)
Entelophyllum sp. A
Micula? catilla, new species
Capnophyllum hedlundi, new species
Capnophyllum sp. A
Phaulactis? lanx, new species
Tryplasma cf. *T. radiculum* (Rominger)
Zelophyllum? sp.
Oliveria planotabulata, new species
Syringaxon adaense, new species
Syringaxon acuminatum? (Simpson)
Ditoecholasma rowetti, new species
Ditoecholasma lawrencense, new species
Saucrophyllum arbucklense, new species
Petraia? squarrosa, new species
Duncanella pontotocensis, new species
cf. *Pseudocryptophyllum* sp. A
Anisophyllum? sp.
cf. *Oligophyllum* sp.
cf. *Allotropiophyllum* sp.
Genus and species undetermined

Of these 28 species, 19 are well enough represented to be assigned to named species, and 14 of these are new. Thus, only five forms are included which represent previously described species from other formations. Several additional species and genera are known in the formation but have not been illustrated because of inadequate material or because of uncertainty as to their stratigraphic occurrence.

Procedures. — The bulk of the coral collection upon which the present study has been based was made during the summer of 1959 by T. W. Amsden, J. M. Cocke, and the author in a series of collecting trips to outcrops of the Henryhouse and Haragan Formations. An intensive stratigraphic search for corals was made at most of Amsden's (1960) measured-section localities in both formations. Additional specimens were collected over a period of several years by the author, aided by graduate students in biostratigraphy at The University of Oklahoma. C. L. Rowett and R. W. Hedlund were particularly helpful. Most of the thin sections were made by J. M. Cocke, D. E. Duggan, and K. L. Lowe, and the photography was done by W. H. Bellis and P. J. Cannon. The University of Oklahoma collection contains about 200 rugose-coral specimens from the Brownsport Formation of Tennessee collected by A. Allen Graffham; these were also utilized in the present study.

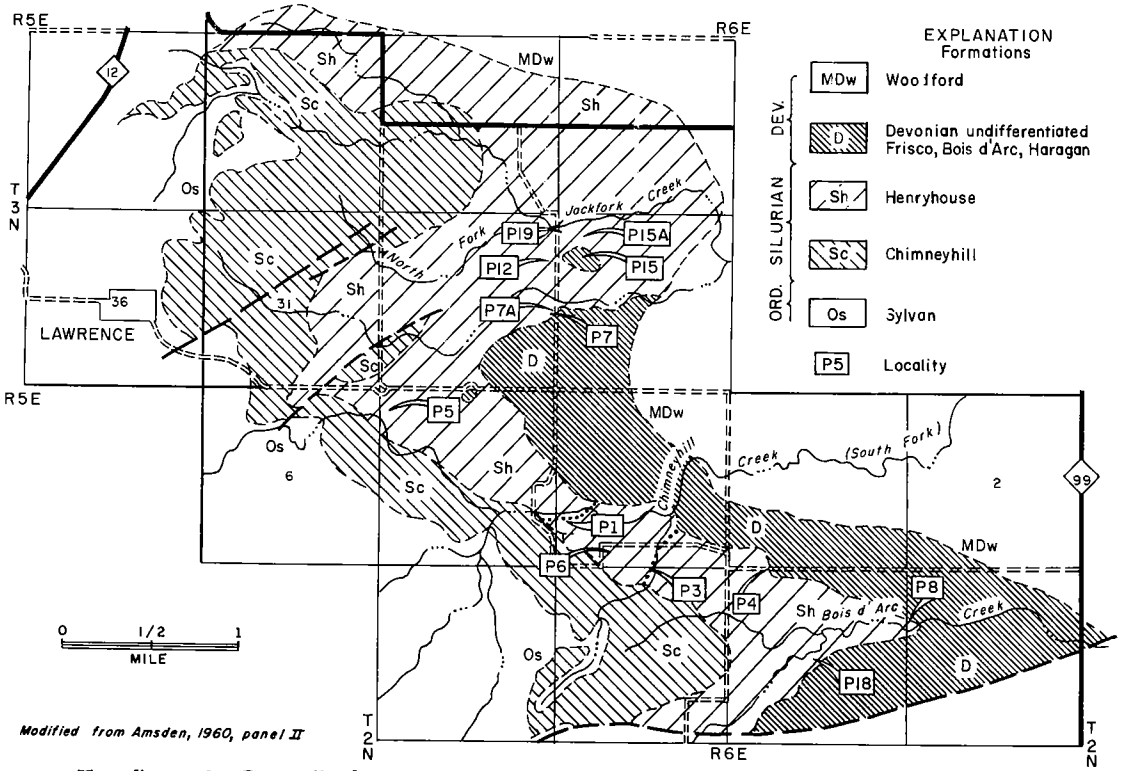
Specimens to which University of Oklahoma catalog numbers have been assigned are designated by the prefix OU. Where reference is made to specimens in other collections, the following notations are used: USNM for U. S. National Museum; YPM for Peabody Museum at Yale University; and WM for Walker Museum at the University of Chicago.

All measurements of diameter, septal count, and height, recorded for each coral species, are listed in appendix II.

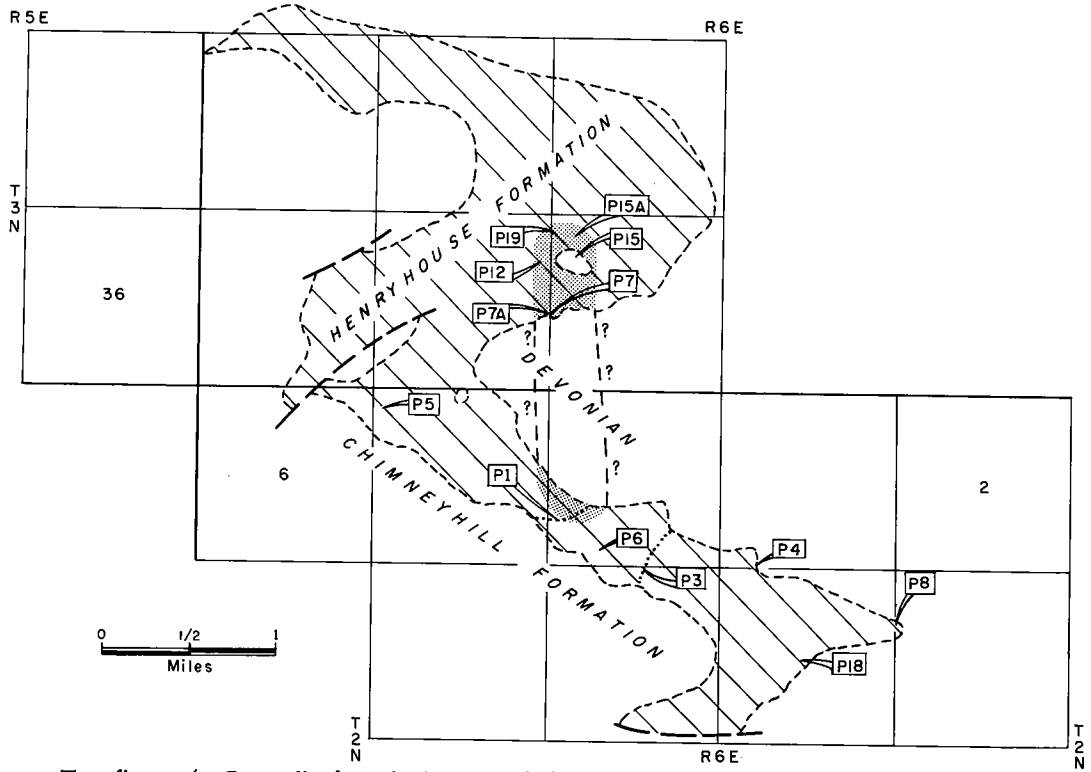
Stratigraphic and geographic distribution. — Rugose corals are strikingly restricted in distribution in the Henryhouse Formation, and in most exposures they are uncommon. Only two genera, *Duncanella* and *Syringaxon,* both small in size, are widely distributed stratigraphically and geographically. These two genera occur in small numbers at many of the localities indicated on text-figure 2 and are locally common. Throughout the area are scattered occurrences of other genera. However, in one area of the Lawrence uplift (text-figs. 3, 4), a wide variety of coral species is common to abundant, and it is therefore the Lawrence uplift which has provided the bulk of material upon which this study was based.

The Lawrence uplift is the most northerly exposure of Hunton rocks in the Arbuckle Mountains region. In this area the Henryhouse Formation is 200 to nearly 250 feet thick and is exposed in a gentle syncline in which dips rarely exceed 5 degrees (text-fig. 3). Three occurrences of corals are of particular interest in the Lawrence uplift region.

(1) Locality P6 is a large glade exposing a section from about 15 to 25 feet above the base



Text-figure 3. Generalized geologic map of the Hunton Group on the Lawrence uplift, Pontotoc County (compare with shaded area on text-fig. 2). Numbers refer to fossil localities.



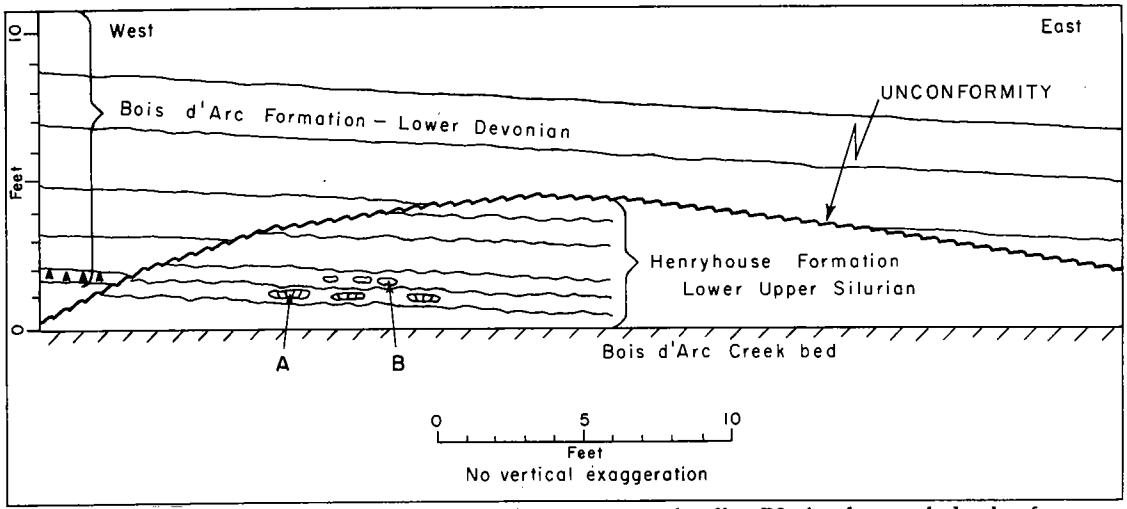
Text-figure 4. Generalized geologic map of the Henryhouse Formation on the Lawrence uplift, Pontotoc County. Shaded area represents the upper coral beds, a local area of coral abundance in the upper 40 feet of the formation.

of the Henryhouse Formation (text-fig. 3). It is the only locality known where corals are common in the lower part of the formation. Of the seven rugose-coral genera represented here, two, *Enterolasma* and *Ditoecholasma,* have not been found at other localities in the formation and one, *Saucrophyllum,* is common here and rare higher in the formation. All coral species which occur at this locality are small.

(2) Upper coral beds: The shaded area in text-figure 4 represents an area in the upper 40 feet of the Henryhouse Formation which includes the following rich coral localities: P7A, P12, P19, and P15A (secs. 32, 33, T. 3 N., R. 6 E.) and locality P1-S,T (secs. 4, 5, T. 2 N., R. 6 E., bluff on north side of Chimneyhill Creek). Possibly these two areas of local coral abundance represent a single unit as indicated on text-figure 4 by dashed lines across the intervening area covered by Devonian strata. If this is true, an elongate area covering at least 0.5 square mile contains rugose corals in marked variety and vast numbers. Many large solitary species occur in this region. No colonial rugose corals have been found here and the abundant occurrence is unrelated to any known biohermal development. However, it does coincide with a particular abundance of other fossils, and the typical marlstone of the Henryhouse Formation is locally replaced in this region by impure fossiliferous calcarenite. Other common fossils are tabulate corals, bryozoans, crinoids, and brachiopods. *Halysites* has been found locally at locality P1-S,T (one of two localities known, the other being P8). Sixteen solitary rugose-coral genera are known from this local area, and many species are large.

(3) Locality P8, in the bank of Bois d'Arc Creek, exposes the upper 5 feet of the Henryhouse Formation. At this locality the Henryhouse Formation is highly fossiliferous and includes some beds of impure calcarenite. At this locality the only colonial rugose coral found in the Henryhouse Formation, *Entelophyllum* cf. *E. angulare* (Amsden), was collected in place about 3 feet below the top of the formation. At point A on text-figure 5, and laterally from it, colonies nearly one foot in diameter occur in a growing position and are associated with fragments of *Halysites.* No major biohermal structures are developed. Locality P8 is also of interest as being the best locality known in the Arbuckle Mountains region where clearly developed local physical evidence can be seen for an unconformity between the Henryhouse and overlying Haragan and Bois d'Arc Formations (text-fig. 5). Compare text-figure 5 with a photograph of the same exposure illustrated by Amsden (1957, pl. IIB).

Most rugose-coral species are too restricted in their occurrence in the Henryhouse Formation to make possible any conclusions about their stratigraphic ranges within the formation. No consistent zonal restriction of corals is evident within the formation. For example, several of the species which have been found only in the upper 40 feet of the formation in the Lawrence uplift area have been found in the lower middle



Text-figure 5. Diagrammatic sketch of the outcrop at locality P8, in the north bank of Bois d'Arc Creek, showing the unconformable contact between the Henryhouse and Bois d'Arc Formations. A is a layer which contains colonies of the rugose coral *Entelophyllum* cf. *E. angulare* in a growing position. B is a bed 0.5 foot above A which contains broken, redeposited fragments of *E.* cf. *E. angulare.* Fragments of *Halysites* occur in both layers.

part of the formation in the western Arbuckle Mountains area on Henryhouse Creek (locality Ca1), at a horizon 80 feet above the base and 110 feet below the top of the formation. These include *Tryplasma* cf. *T. radiculum, Spongophylloides cockei, Capnophyllum hedlundi, Amsdenoides acutiannulatus,* and *Cystiphyllum? henryhousense.* The presence of *Enterolasma* and *Ditoecholasma* at locality P6 in the lower part of the formation is considered to have no stratigraphic significance as these genera are uncommon at this locality and unknown elsewhere.

Age and correlation.—Specific correlation of the Henryhouse corals with other faunas is difficult at this time because a high percentage of the species in the fauna is new. Based upon the limited evidence available, the rugose-coral fauna suggests either a Wenlockian or early Ludlovian age for the Henryhouse Formation. This tentative conclusion is thus in general agreement with the early Ludlovian (early Late Silurian) correlation for the formation indicated by the graptolite and brachiopod faunas.

England and Sweden: *Spongophylloides cockei,* new species, is closely similar to *S. pusillus* Butler from the Wenlock Limestone (Middle Silurian) of England. *Rhizophyllum applanatum,* new species, is closely similar to and may be conspecific with *R. gotlandicum* (Roemer) from the Hemse and Eke Groups (lower Ludlovian) of Gotland, Sweden. *Cystiphyllum? henryhousense,* new species, is closely similar to an undescribed species also from the Hemse and Eke Groups of Gotland.

Brownsport Formation, Tennessee: In North America the rugose-coral fauna of the Henryhouse Formation is most closely similar to that of the Brownsport Formation of western Tennessee, and Amsden (1951, p. 70; and personal communication) stated that the brachiopod faunas in the two formations are closely similar, with 25 genera and 17 species in common. Of the 19 rugose-coral species in the Henryhouse Formation which are well enough represented to warrant being given specific names, 8 have been recorded from the Brownsport Formation. These are:

Amsdenoides acutiannulatus (Amsden)
Enterolasma waynense (Safford)
Cystiphyllum? henryhousense, new species
Phaulactis? lanx, new species
Entelophyllum angulare (Amsden)
Syringaxon acuminatum (Simpson)
Syringaxon adaense, new species
Duncanella pontotocensis, new species

Distinctive genera in the Henryhouse Formation not as yet reported from the Brownsport Formation are *Spongophylloides, Oliveria,* and *Saucrophyllum.*

It is interesting to note that rugose-coral distribution in the Brownsport Formation is, as in the Henryhouse Formation, highly irregular, with most specimens occurring in scattered areas of local abundance, presumably related to places of favorable environment. Corals are most common in the Brownsport Formation in the upper 40 to 50 feet, but most of the species are known from lower horizons (Amsden, 1949, p. 30). *Amsdenoides acutiannulatus* occurs commonly in both the Henryhouse and Brownsport Formations. A coral closely similar to *Enterolasma waynense* is found only at locality P6 in the lower part of the Henryhouse Formation. In the Brownsport Formation this species is common and widely distributed geographically and stratigraphically. *Cystiphyllum? henryhousense,* one of the more common species in the Henryhouse Formation on the Lawrence uplift, is not represented in Amsden's extensive collection of corals from the Brownsport Formation, but it is common in that formation at Graffham's locality 2, a previously unreported locality (appendix II). It seems probable that with further collecting from both formations the percentage of overlap of the two faunas will increase.

Moccasin Springs Formation (Bainbridge Group), Missouri: I have examined Ball and Grove's (1940) small collection of rugose corals from the Bainbridge Group which apparently came from what is now termed the Moccasin Springs Formation (Lowenstam, 1949) and have compared this collection with that of the Henryhouse Formation. Unfortunately many of the specimens are poorly preserved, and only six or seven specimens in the entire collection of a few dozen specimens are sectioned. The following rugose corals can be tentatively recognized in this collection, although they cannot be properly evaluated without additional sectioning and collecting:

Ditoecholasma fanninganum (Safford); called *D. saffordi* Ball and Grove
Enterolasma waynense (Safford)
Saucrophyllum petaloide (Ball and Grove); the holotype has not been sectioned, but this species is possibly the same as *S. arbucklense* in the Henryhouse Formation
Bordenia savagei Ball and Grove; this coral has not been sectioned, it is poorly preserved, and its classification is uncertain

Two of the three species in this collection which can be identified are closely similar to species in the Henryhouse Formation and two of the three occur in the Brownsport Formation.

Ross (1962, p. 64) described a well-preserved monograptid graptolite fauna from the Moccasin Springs Formation in southeastern Missouri and southern Illinois which compares closely with graptolite faunas in the lower Ludlow of Great Britain and with those described by Decker (1935) from the Henryhouse Formation in Oklahoma. Upon the basis of other fossil groups, Boucot (1958, p. 1029) suggested a late Wenlockian or early Ludlovian age for the Bainbridge Limestone (undifferentiated).

Louisville Limestone, Kentucky and Indiana: The rugose-coral fauna of the Henryhouse Formation and that of the Louisville Limestone in Kentucky and Indiana have little similarity. Of the 15 rugose-coral genera listed by Stumm (1965, p. 10) as occurring in the Louisville Limestone, only six occur in my collections from the Henryhouse Formation. *Amsdenoides acutiannulatus* (Amsden) possibly also occurs in the Louisville Limestone among specimens identified by various authors as *Cyathophyllum shumardi* (Edwards and Haime). *Rhizophyllum oklahomense,* new species, is similar in external shape and size to *R. corniculum* (Lyon) and could be a junior synonym of that species.

Comparison of Henryhouse and Haragan rugose-coral faunas. — A preliminary study has been made of the rugose-coral fauna of the Haragan Formation, which immediately overlies the Henryhouse Formation at most localities in the Arbuckle Mountains region. The Haragan fauna is small compared to that of the Henryhouse. Thus far five genera and seven species have been observed in the Haragan fauna, and none of the species appears to be the same as any found in the underlying Henryhouse Formation. Only three species are common in the Haragan and these are representatives of *Syringaxon, Duncanella,* and *Enterolasma.* The species of *Syringaxon* and *Enterolasma* are closely similar to species from the Helderbergian strata (Lower Devonian) in New York. A subsequent report will describe and illustrate the Haragan coral fauna, and that study will contain a detailed comparison of the Henryhouse and Haragan coral faunas.

CORAL DESCRIPTIONS
ORDER RUGOSA

Family GONIOPHYLLIDAE Dybowski, 1873

Genus *Rhizophyllum* Lindström, 1866

Type species. — *Calceola gotlandica* Roemer, 1856, p. 798; Silurian, Gotland, Sweden.

Diagnosis. — Corallites are calceoloid with a semicircular transverse section. The flat surface is developed apparently on the counter side of the corallite. An operculum of one plate covers the calice and is attached along the margin of the flat wall. Septa are clearly developed only on the flat side of the corallite, where they are normally acanthine and short. Individual septa cannot commonly be differentiated on the thin curved wall. The interior contains arched, nonthickened dissepiments and tabulae, which are not arranged in regular series.

Discussion. — The genus *Rhizophyllum* is similar to the closely related genus *Calceola* in external appearance but the latter genus has a structureless interior filled with sclerenchyme so that no dissepiments or tabulae can be differentiated. No confirmed occurrence of *Calceola* has been reported from North America, although most species of *Rhizophyllum* have been incorrectly referred to that genus. The genus *Calceola* is apparently restricted to the Middle Devonian in other parts of the world.

In a recent paper, Oliver (1964, p. 149) summarized the reported occurrences in North America of the genus *Rhizophyllum*. He pointed out that *Rhizophyllum* ranges in age from Middle Silurian (Wenlockian) to lower Middle Devonian (Eifelian). The genus is most common upon a world-wide basis in rocks of Late Silurian and Early Devonian age.

Specimens of *Rhizophyllum* are fairly common in the Brownsport Formation in Tennessee. The two species which have been described (as *Calceola*) are: *R. tennesseense* (Roemer), 1854, and *R. americanum* (Safford), 1860. Neither species was figured or adequately described in the original studies nor have the type specimens since been sectioned or redescribed. Amsden (1949, p. 111) reported the occurrence of only one species of *Rhizophyllum* in the Brownsport Formation and described it as *R. tennesseense* (Roemer).

Five species of *Rhizophyllum* have been described (as *Calceola*) from the Louisville Formation of Kentucky and southern Indiana by Lyon (1879), Hall (1882), and Davis (1887). Bassler (1915, p. 157) grouped all five into the two species *R. attenuatum* (Lyon) and *R. corniculum* (Lyon). Stumm (1965, p. 52) followed the same procedure. None of the type specimens for the five species involved has been sectioned.

Sparsely occurring, unnamed species of *Rhizophyllum* from Middle or Upper Silurian rocks of Nevada, California, southeastern Alaska, and Maine were discussed by Oliver (1964, p. 149).

Rhizophyllum has not previously been reported from the Henryhouse Formation of Oklahoma.

Rhizophyllum applanatum, new species

Pl. 1, figs. 1-4; pl. 2, figs. 1-4

Description. — The 16 solitary specimens upon which this description is based are calceoloid with one side, presumably the counter, strongly flattened. They display great variation in size and shape. Most specimens, including the holotype, are trochoid in cardinal view (pl. 1, fig. 1b). Two specimens (pl. 2, figs. 1b, 3c) develop a more cylindrical shape in adult stages and are not considered to be typical. The holotype (pl. 1, fig. 1) has a maximum height of 39 mm and a maximum width of 25.3 mm. The longest specimen (pl. 2, fig. 1) is 67 mm high and has a maximum width of 22.5 mm. Most specimens are straight, but a few show bends either in the plane of the flat surface (pl. 2, fig. 2a) or perpendicular to it (pl. 1, fig. 2a) and some specimens are irregularly twisted. The exterior is marked by fine, regular growth lines superimposed on larger, irregularly spaced constrictions (pl. 1, figs. 1b-d). No longitudinal ridges can be seen on the curved surface, but faint interseptal ridges are distinctly developed and even in appearance on the flat surface (pl. 2, fig. 3c). The calice is moderately deep to deep, with the maximum depth observed being 10.5 mm (pl. 1, fig. 2b). The calice has an upright shape in relation to the direction of growth and is not consistently tilted toward either side. The character of the operculum is unknown. This species is characterized by irregularly spaced, large radiciform processes located on the angular margin of the flattened surface and pro-

jected outward perpendicular to that surface. These processes commonly occur throughout the full length of the specimen. They are small and closely spaced in the lower 5 to 10 mm but become widely and irregularly spaced higher on the specimen where the spine bases are more than 1 mm in diameter (pl. 2, figs. 3c, 4a). This species was apparently attached throughout growth.

In transverse section a row of short septa, not clearly differentiated into major and minor septa, can be seen along the flat wall. They are commonly about 1.5 mm long in transverse section and are distinctly acanthine. The trabeculae which form the septal spines are irregularly tilted upward toward the axis and commonly do not touch vertically. Therefore the septal spines appear irregular and discontinuous in transverse section since more than one trabecula is intersected (pl. 1, fig. 1k; pl. 2, fig. 4d). It is estimated that about 40 septa are on the flat wall in the late stages of the holotype (pl. 1, fig. 1g). On the exterior of an exceptionally well-preserved silicified specimen (pl. 2, fig. 3c) 22 septal grooves are on each side of a central vertical ridge. This ridge coincides on the interior with a centrally placed elongate septum, presumably the counter, which is about twice as long as the other septa (3 to 3.5 mm) and is continuous vertically. It is spindle-shaped in cross section, but its structure is not well preserved in detail in the specimens available for study. The rounded wall is thin in late growth stages and appears to be composed primarily of lamellar tissue with a few widely spaced septa imbedded in the wall. In earlier growth stages this wall is thicker and may show closely spaced septa (pl. 1, fig. 2c).

In longitudinal section the dissepiments are steeply inclined on both the cardinal and counter sides of the corallite and are gradational with tabulae which are more gently inclined toward the axis. The resulting pattern is one of axial depression, with the deepest part of the depression either in a central position or slightly nearer the cardinal side (pl. 2, fig. 1d). This pattern is reflected in the shape of the base of the calice as shown in plate 2, figure 3b. Both the incomplete tabulae and the dissepiments are distinctly arched upward. The dissepimentarium is about one-half the radius in width.

Discussion.—*Rhizophyllum applanatum,* new species, is characterized by the large size and the elongate shape, the well-developed radiciform processes, and the differentiation of numerous closely spaced dissepiments and tabulae.

R. oklahomense, new species, which also occurs in the Henryhouse Formation, is much smaller, has much flatter transverse elements which are not so clearly differentiated into tabulae and dissepiments, and has proportionally a much larger counter septum.

R. applanatum is clearly not conspecific with *R. tennesseense* (Roemer) from the Brownsport Formation of Tennessee. I base this statement upon an examination of nearly 30 specimens of that species in the Amsden collection (YPM) which were collected from 10 different localities in the Brownsport Formation (Amsden, 1949, p. 112). All of these specimens are closely similar in external shape and character, and no other species of *Rhizophyllum* appears to occur in Amsden's collection from the Brownsport Formation. *R. tennesseense* has a distinctly arched shape, with the lower portion commonly hooked toward the cardinal side (Amsden, 1949, pl. 29, figs. 4, 5). The rim of the calice and growth lines are tilted steeply downward toward the cardinal side, resulting in a tilted shallow calice. The species has a thick wall and the internal characters, as observed in three sectioned specimens in Amsden's Brownsport collection, are highly variable.

R. applanatum is closely similar to *R. gotlandicum* (Roemer), from Silurian rocks in Gotland, Sweden. Illustrations of that species by Lindström (1883, pl. 3, figs. 4-6) poorly show the internal characters. His external illustrations compare closely with specimens in two collections which I have examined. In the University of Oklahoma collection are four well-preserved specimens collected recently by T. W. Amsden from the Eke Group in Gotland. Two of these have been sectioned. The University of Queensland collection contains about a dozen specimens of the species, also from the Eke Group in Gotland, six of which have been sectioned. *R. applanatum* is closely similar in external ornamentation to these specimens and to Lindström's figures. Both species have spine bases extending along the margins of the flat surface. Internally the two species are similar in the character of the tabulae and dissepiments. *R. gotlandicum* differs in having a less well-developed counter septum which ranges from being as short as the adjacent septa on the flat counter side of the coral to being about twice as long. Also, in *R. gotlandicum* short septa are developed along the curved wall, whereas in *R. applanatum* they are absent or sparsely developed. Undoubtedly the two species are closely related, and a study of more specimens than

are now available might show that the differences here listed are insignificant.

R. gotlandicum occurs in Gotland only in the Hemse and Eke Groups of early and possibly middle Ludlovian age (Hede, 1921, p. 88; Regnéll and Hede, 1960, p. 81).

Material and occurrence. — Sixteen specimens from the Henryhouse Formation are in the University of Oklahoma and U. S. National Museum collections. All specimens which are located stratigraphically and geographically came from two general localities in the upper coral beds on the Lawrence uplift (text-fig. 4). These are localities P7A and P1-S,T (equal approximately to USNM loc. 1).

Figured specimens. — Holotype OU 5411; paratypes OU 5412, 5413, 5414 and USNM 145270, 145271, 145272, 145273.

Rhizophyllum oklahomense, new species

Pl. 3, figs. 1-4

Description. — The corallites here described are small calceoloid, and variable in shape. Two specimens show a tendency to a sinuous shape resulting from irregular changes in direction of curvature. Maximum heights of two complete specimens are 20 and 22.5 mm and maximum widths are 9.3 and 11.7 mm. The exterior is marked by fine transverse growth lines superimposed upon larger, irregularly spaced constrictions (pl. 3, fig. 1b). No longitudinal ridges or grooves can be seen on either the flat or the curved surface. The calice is not distinctly tilted away from the direction of growth. The two best preserved specimens show large, widely spaced radiciform processes at the margins of the flat counter surface developed throughout growth.

In transverse section the counter septum is large for the comparative size of the corallite, being up to 2.5 mm (pl. 3, figs. 1f,h). It is spindle-shaped and composed of fibers radiating outward and upward from the median plane. The septa adjacent to the counter septum along the flat surface are irregular in development and are acanthine. In ephebic transverse sections of the holotype (pl. 3, figs. 1f,g) these septa number 11 to 12 on each side of the counter septum. On the curved wall individual septa can be seen in the holotype and number about 24 or 25 along the total curved margin (pl. 3, fig. 1g). In other specimens septa are not clearly detectable in the curved wall.

In longitudinal section transverse elements are clearly differentiated into dissepiments and tabulae only adjacent to the flat wall laterally from the counter septum (compare pl. 3, fig. 1c with 1d). The dissepiments and tabulae are inclined downward toward the axis and are arched upward. The tabulae are widely spaced in the axial region.

Discussion. — *Rhizophyllum oklahomense,* new species, is characterized by the small size, well-developed radiciform processes, large counter septum, and wide spacing of gently inclined tabulae. One atypical specimen in the collection has an oval, noncalceoloid cross section in the lower half of the corallite where it lacks an elongate counter septum.

R. applanatum, new species, which also occurs in the Henryhouse Formation, is much larger and has more numerous and much more steeply inclined tabulae and dissepiments.

R. oklahomense is similar in external shape and size to *R. corniculum* (Lyon), from the Louisville Formation of Kentucky, as described and figured by Stumm (1965, p. 52). It may prove to be a junior synonym of that species but the internal characters of *R. corniculum* are unknown. *R. attenuatum* (Lyon), also from the Louisville Formation, is a compound species which has long, slender corallites that form a dendroid to phaceloid corallum (Stumm, 1965, p. 52).

R. oklahomense is similar in size to specimens referred by Hill (1940, pl. 11, figs. 5-8) to *R. interpunctatum* (de Koninck), from late Wenlockian strata in New South Wales, Australia. *R. oklahomense* differs from that species in having fewer and much less steeply inclined tabulae and possibly in being more cylindrical.

Material and occurrence. — Five specimens are in the University of Oklahoma collection from locality P1-S,T. These specimens are from the upper coral beds on the Lawrence uplift (text-fig. 4).

Figured specimens. — Holotype OU 5415; paratype OU 5416; specimens OU 5417, 5418.

Family PTENOPHYLLIDAE Wedekind, 1923

Genus *Spongophylloides* Meyer, 1881

Type species. — *Spongophylloides schumanni* Meyer, 1881, p. 109, = *Cystiphyllum grayi* Edwards and Haime, 1851, p. 465; Silurian, Wenlockian, Worcestershire, England.

Diagnosis. — Solitary, trochoid, or ceratoid

corals with septa which nearly reach the axis. The septa have zigzag carinae and are flanged parallel to their upper edges. Small lonsdaleoid dissepiments disrupt the peripheral ends of the septa to a variable extent. The dissepimental zone may be partly displaced by a peripheral stereozone or partly obscured by the deposition of secondary sclerenchyme.

Discussion. — *Spongophylloides* shows considerable variation in the development of small lonsdaleoid dissepiments. In *S. grayi,* the type species for the genus, from the Wenlock Limestone of England, the zone is wide and disrupts all septa (Butler, 1934, pl. 18, fig. 1). In *S. pusillus* Butler, also from the Wenlock Limestone, the septa are more continuous and the dissepimental zone is partly displaced by a peripheral septal stereozone. In *S. cockei,* new species, here described from the Henryhouse Formation, the development of the dissepiments shows marked variation from one specimen to another. In a few specimens of this species, the extreme example being that shown in plate 5, figure 1, almost no dissepiments are developed and such specimens appear most similar to species of the genus *Cymatelasma,* described by Hill and Butler (1936) from Silurian rocks of England. The genus *Cymatelasma* differs from *Spongophylloides* only in lacking dissepiments, and its recognition as a distinct genus is based upon this single difference. Several species fall clearly into one or the other category; *S. cockei* would appear to show a continuous gradation between the two generic types.

A comparison of the stratigraphic distribution of the described species of the two genera in England shows the first recorded occurrence of *Cymatelasma* to be in strata of early Wenlockian age, whereas the first recorded occurrence of *Spongophylloides* is in strata of late Wenlockian age. *Cymatelasma* is possibly the more primitive of the two genera and may have given rise to *Spongophylloides* by the development of dissepiments. It is doubtful if the single specimen described by Hill and Butler (1936, pl. 16, fig. 1) as *Cymatelasma multiseptatum,* from the upper Llandovery, belongs to this genus. If that is the case, then the type species, *Cymatelasma corniculum* (pl. 16, figs. 2-8), which occurs in the Woolhope Limestone (lower Wenlock) is the earliest recorded species of the genus. *C. carinatum* occurs stratigraphically higher, in the Wenlock Limestone (upper Wenlock), which also contains *Spongophylloides pusillus.* This species is closely similar to *C. carinatum* except for the sporadic occurrence of small lonsdaleoid dissepiments. Further collecting in the Wenlock Limestone may show that the two represent a single variable species with a range of variation similar to that found in *S. cockei.* The Wenlock Limestone also contains *S. grayi* (Edwards and Haime).

I cannot agree with Wang (1950, p. 216) that *Cymatelasma* is a junior synonym of the genus *Pycnactis* which is characterized by thick, contiguous major septa that are pinnately arranged.

Several species from the Middle and Upper Silurian strata of Gotland, referred by Wedekind (1927) to *Actinocystis,* belong to the genus *Spongophylloides,* but none of these is closely similar to *S. cockei* from the Henryhouse Formation.

Spongophylloides cockei, new species

Pl. 4, figs. 1, 2; pl. 5, figs. 1-4; pl. 6, figs. 2-5

Description. — The solitary corallites here described are trochoid to ceratoid and are gently curved. The species is small with heights of complete specimens ranging from 17 to 29 mm and maximum diameters from 10 to 15 mm. The epitheca has distinct, irregularly spaced, but even, transverse restrictions marking minor stages of rejuvenescence. No septal grooves or other vertical markings are present. Radiciform processes are lacking.

Major septa number about 24 at a diameter of 4.8 mm (septal ratio, 5.0) and increase to an observed maximum of 30 at a diameter of 12.8 mm (septal ratio, 2.4). The number of septa increases regularly as the diameter increases (text-fig. 6), and the septal ratio increases evenly throughout growth (text-fig. 7). In adult stages the number of major septa is typically 26 to 28. The major septa differ in length with about half extending almost to the axis. They are distinctly crooked and differ in thickness (pl. 6, fig. 3a). The crooked appearance in transverse section results from the fact that the septa have well-developed zigzag carinae (pl. 4, fig. 1i). The well-developed flanges are parallel to the upper edge of the septa and occur almost at a right angle to the axis of curvature of the corallite (pl. 4, fig. 1f). As a result, the septa have a highly irregular appearance in transverse section (pl. 4, fig. 1d).

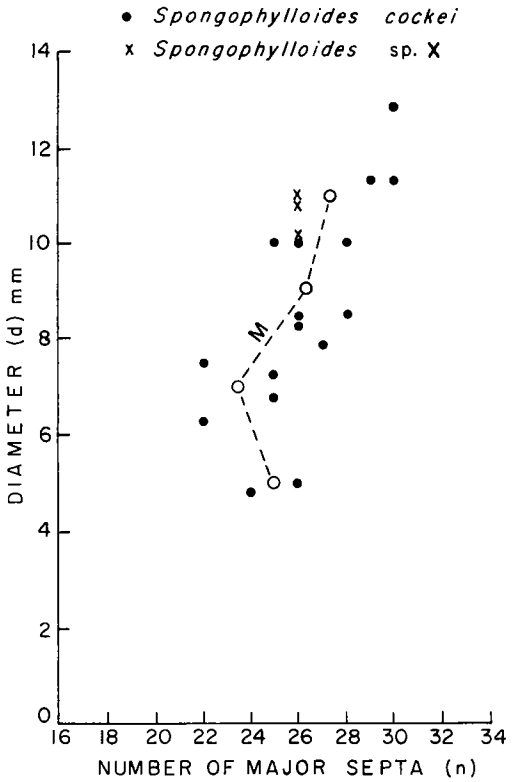
The septa show a distinct bilateral symmetry along the plane of curvature. What is apparently the cardinal septum is on the concave side of the corallite and is oriented downward in the transverse sections illustrated on plates 4-6. The assumption that this is the cardinal septum appears

to be supported by a study of the obscure quadrate arrangement of the septa in early stages (pl. 4, fig. 1e). The cardinal septum is commonly as long as adjacent major septa and no cardinal fossula is developed. Alar septa cannot be differentiated. What is apparently the counter septum is commonly elongate (pl. 6, fig. 3a). In adult stages minor septa are also carniate and extend for 1 to 3 mm axially past the edge of the peripheral stereozone.

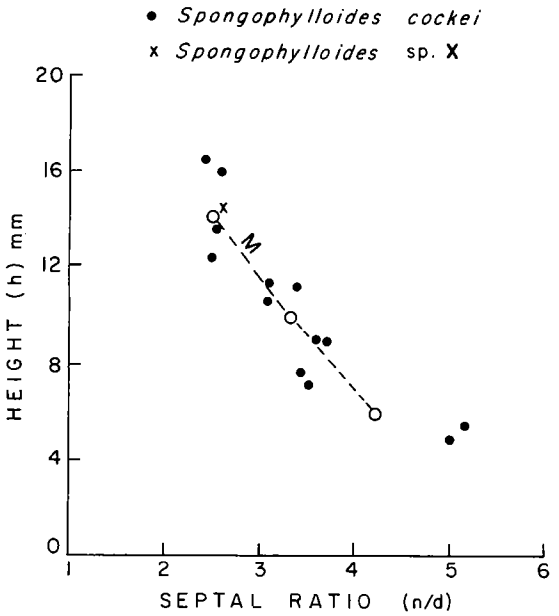
Tabulae, where observable, are thin, incomplete, and sag in the axial region (pl. 5, fig. 4). Some specimens apparently have no tabulae developed in the adult stages of the corallite (pl. 4, figs. 1f,h). A prominent peripheral stereozone is two-fifths to one-third of the radius in width in late growth stages. In some specimens it is thicker on the outside than on the inside of the curvature of the corallite, but this is not a consistent character. The peripheral stereozone is formed partly by a peripheral thickening of the major and minor septa and partly by the irregular development of many small, cystose lonsdaleoid dissepiments. Such dissepiments are developed only in the ephebic stages. All specimens have a peripheral septal stereozone in early growth stages (see discussion under *Ontogeny).* Continuous gradation occurs between specimens which have a peripheral zone composed predominantly of dissepiments which disrupt both major and minor septa (pl. 6, fig. 3) and specimens which have a peripheral septal stereozone and few dissepiments (pl. 5, figs. 1c, 2b).

Ontogeny. — The character of the early stages of growth is unknown in most sectioned specimens of *Spongophylloides cockei* because of secondary silicification. In a few specimens it can be seen that in the neanic stage, at a diameter of about 5 mm, 5 to 6 mm above the proximal end, the major septa are long and are so strongly dilated that they almost fill the entire lumen. At this stage a peripheral stereozone is formed by the thickening of the septa; it is about one-fourth to one-third the radius in width and it may be widest on the counter side of the specimen (pl. 4, fig. 1e). Minor septa are short and imbedded in the peripheral stereozone. Dissepiments are absent or extremely uncommon.

At a diameter of about 6.5 to 7.5 mm, 7 to 9 mm above the apex, the septa in the axial region become thinner and the distinct peripheral stereozone is formed predominantly by the thickening



Text-figure 6. Relation of number of septa to diameter in *Spongophylloides cockei,* based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 2 mm).



Text-figure 7. Relation of height to septal ratio (n/d) in *Spongophylloides cockei,* based upon specimens from all localities. Circles indicate mean values (M) for n/d computed by classes (class intervals, 2 mm).

of the septa. Minor septa are restricted mainly to the stereozone. Dissepiments are uncommon.

Higher in the corallite, in the ephebic stages, the peripheral stereozone is partly and irregularly replaced by a dissepimentarium composed partly of small lonsdaleoid dissepiments, and the minor septa are longer.

Discussion. — *Spongophylloides cockei,* new species, is closely similar to *S. pusillus* Butler, from the Wenlock Limestone of England. The two are similar in size, number, character, and arrangement of the septa, in the irregular development of the tabulae, and in the irregular occurrence of dissepiments in the peripheral stereozone. The English species differs in having distinct external septal grooves, the cardinal septum located on the outside of the curvature of the corallite, and less marked development of flanges on the zigzag septa.

S. cockei may be closely related to an unnamed species of *Spongophylloides* briefly described by Oliver (1962, p. 28) from the Silurian Sayabec Formation of Quebec. That species is similar in size, in number of septa, and in having a peripheral stereozone in which dissepiments are irregularly developed.

Two specimens figured in this paper as *Spongophylloides* sp. X, which occur with specimens of *S. cockei* in the upper part of the Henryhouse Formation, may represent extreme variants of that species. They differ from typical specimens of *S. cockei* in having a better developed dissepimentarium which is not partly replaced by a peripheral septal stereozone and also in having straighter, thinner septa which apparently reflect the occurrence of less well-developed septal flanges.

Material and occurrence. — Thirty-nine specimens from the Henryhouse Formation are in the University of Oklahoma collection. All specimens are from the upper coral beds on the Lawrence uplift (text-fig. 4). They occur commonly at localities P7A and P15A and uncommonly at P19 and P1 (bed Q).

Figured specimens. — Holotype OU 5419; paratypes OU 5420, 5421, 5422, 5423, 5424, 5427, 5429; specimens OU 5426, 5428.

Spongophylloides sp. X

Pl. 6, figs. 1, 6

Discussion. — Two specimens from the Henryhouse Formation are similar to *S. cockei,* with which they occur, in size, number of septa, and the occurrence in early growth stages of a peripheral septal stereozone. They differ from that species in ephebic stages in having a better developed dissepimental zone with no partial development of a peripheral septal stereozone and in having septa which are thinner and straighter, reflecting the development of narrower septal flanges than are found in typical specimens of *S. cockei.* These specimens may represent extreme variants of *S. cockei.*

Material and occurrence. — One specimen from P7A and one from USNM locality 4, near upper part of P3.

Figured specimens. — OU 5425 and USNM 145274.

Family STREPTELASMATIDAE Nicholson, 1889

Subfamily STREPTELASMATINAE Nicholson, 1889

Genus *Amsdenoides,* new genus

Type species. — *Ditoecholasma acutiannulatum* Amsden, 1949, p. 102; Silurian, Brownsport Formation, Tennessee.

Diagnosis. — Solitary, cylindrical coral with major septa which reach or nearly reach the axis but which form no axial structure. Location of primary septa is obscured in ephebic stages by the development of an irregular radial symmetry. The septa are not carinate, but tubercles may be developed locally on the sides of the septa. Tabulae are arched axially and dissepiments are absent.

Discussion. — It is possible that *Ditoecholasma acutiannulatum* Amsden, the type species, here designated, of the new genus *Amsdenoides,* is a junior synonym of a coral described by Edwards and Haime as *Cyathophyllum shumardi* (1851, p. 370, pl. 7, fig. 3). Both species were based upon specimens from Perry County, Tennessee. Edwards and Haime's figured specimen, presumed to be in the École des Mines, Paris, has not been sectioned. The difficulty lies in the fact that their specimen could equally well prove to be a senior synonym of the coral described by Amsden (1949, p. 108, pl. 28, figs. 1-8) as *Cyathophyllum cliftonense,* also from the Brownsport Formation and also occurring in Perry County, Tennessee. This species, which externally resembles *Amsdenoides acutiannulatus* and which occurs with it in the Brownsport Formation, represents a distinctly different genus which has flat tabulae and a well-developed zone of dissepiments.

Amsdenoides acutiannulatus (Amsden), 1949, new combination

Pl. 7, figs. 1-5; pl. 8, figs. 1, 2; pl. 9, fig. 1; pl. 10, fig. 1; pl. 11, figs. 1-4; pl. 12, figs. 1-7

?*Cyathophyllum shumardi* Edwards and Haime, 1851, p. 370, pl. 7, fig. 3.

Ditoecholasma acutiannulatum Amsden, 1949, p. 102, pl. 25, figs. 8-10.

Amplexus shumardi (Edwards and Haime); Amsden, 1949, p. 107.

?*Strombodes shumardi* (Edwards and Haime); Stumm, 1965, pl. 22, figs. 1-6; not pl. 22, figs. 7, 8.

Description. — The corals described here have a distinctive external shape. The corallite is cylindrical in the adult stages after an early trochoid or ceratoid development. The surface is marked by prominent stages of rejuvenescence which are irregularly spaced. At each horizontal line of greatest expansion the epitheca continues outward in a prominent collar (pl. 9, fig. lb; pl. 12, fig. 3a) which is broken off in most specimens. In addition, there are distinct, sharp longitudinal grooves which are more prominent than the fine, evenly spaced growth lines (pl. 12, fig. 6a). One large fragmentary specimen from the Brownsport Formation has a maximum diameter of 23 mm (pl. 7, fig. 2a), and several fragmentary specimens from the Henryhouse Formation have maximum diameters of about 18 mm (pl. 9, fig. 1a), not including the rejuvenescent collars which extend outward from the continuous wall. Maximum diameters of the complete specimens in the collection are less. One specimen from the Brownsport has a maximum height of 56 mm and a maximum diameter of about 14 mm (pl. 8, fig. 1a). One from the Henryhouse has a maximum height of 45 mm and a maximum diameter of 11 mm (pl. 11, fig. 1a). The rate of increase in diameter with growth shows marked variation. Most specimens develop a cylindrical stage of growth 6 to 8 mm above the apex (pl. 12, figs. 1a, 2a, 3a, 4a). In contrast, some specimens show a comparatively rapid rate of expansion in diameter and have not become cylindrical 12 to 15 mm above the apex (pl. 11, fig. 3a). The marked variability of diameter with increasing height is illustrated in text-figure 8.

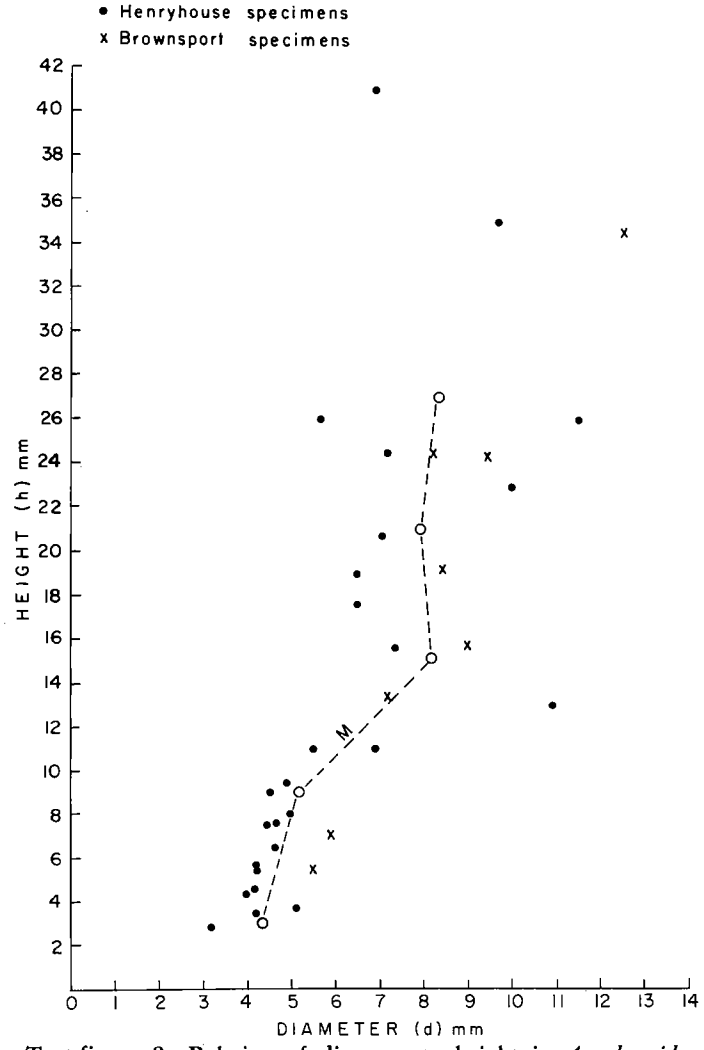
Major septa number about 14 at a diameter of 3.2 mm (septal ratio, 4.4) and increase to an observed maximum of 33 at a diameter of 16.6 mm (septal ratio, 2.0). However, the septal ratio does not decrease uniformly throughout the cylindrical ephebic stages of growth because of variations caused by rejuvenescence (text-fig. 9). Relation of number of septa to diameter is shown in text-figure 10. Major septa typically number 26 to 30 in adult stages, but these do not increase regularly in number with increasing height (text-fig. 11). In the adult stages the major septa display an irregular radial symmetry which obscures the location of primary septa in many specimens. Most specimens have an obscure bilateral symmetry about the cardinal-counter plane in early growth stages (pl. 11, fig. 2e), and an obscure bilateral symmetry persists into the ephebic stages of some specimens (pl. 12, fig. 1b). No cardinal fossula is developed. Major septa reach or nearly reach the axis but do not form an axial structure. A significant relationship exists between rejuvenescence and the extension of the septal ends to the axis. The septa tend to reach and coalesce at the axis only at intervals of restricted diameter, between stages of rejuvenescence (pl. 9, fig. 1e; pl. 10, fig 1e), and to withdraw from the axial region at rejuvenescent stages of maximum diameter (pl. 9, figs. 1b,f; pl. 10, figs. 1d,f). This does not mean that the septa shorten but that they maintain a fairly constant length as the specimen becomes alternately expanded, restricted, and expanded with growth (compare successive transverse sections with corresponding longitudinal sections in pls. 9 and 10). The major septa also tend to be thinner during expanded periods of rejuvenescence than during the narrower intervening stages (compare pl. 9, figs. 1i and 1h). In contrast, the wall appears to be thicker at stages of maximum diameter. Minor septa are short throughout growth and uncommonly exceed 1 mm in length.

Tabulae are mostly complete, widely spaced, and arched axially. Spacing of the tabulae is irregular but tends to be wider at intervals of rejunvenescence than in between (pl. 11, fig. 4). Dissepiments are absent.

Microstructure. — The septa are thin axially and the minute structure cannot be readily detected. Peripherally the septa and the epitheca have a lamellar structure (pl. 9, fig. 1i; pl. 10, fig. 1h). In addition, most individuals have tubercles developed locally on the sides of the septa (pl. 8, fig. 1c; pl. 10, fig. 1c; pl. 11, fig. 1d). Where present in adult growth stages these tubercles tend to be fairly evenly spaced but are not regularly arranged, although in a few specimens they occur in imperfect rows (pl. 10, fig. 1b). They are rounded, kidney-shaped, or irregular in outline and are up to 0.5 mm in greatest diameter. Figure 5 on plate 7 shows them on a weathered specimen. In transverse section these tubercles give the same appearance as would be given by

irregularly distributed, unpaired carinae (pl. 9, fig. 1c). In immature growth stages these tubercles appear to be irregularly distributed. Some transverse sections show none, others show many, and some show scattered tubercles on some septa and none on others in the same section. The cylindrical stages of larger specimens commonly show a striking relationship between rejuvenescence and the development of tubercles (compare pl. 8, figs. 1a-i; pl. 9, figs. 1a-i; pl. 10, figs. 1a-h). Tubercles are present mainly in the restricted intervals between stages of rejuvenescence and are absent at expanded stages of rejuvenescence.

Discussion. — *Amsdenoides acutiannulatus* is characterized by a cylindrical shape with marked stages of rejuvenescence, by long radially arranged septa, by widely spaced tabulae which are arched axially, and by the absence of dissepiments. Perhaps its most striking feature is the marked difference in structure with successive stages of rejuvenescence. At expanded stages of rejuvenescence the wall is thick, the septa are thin, the tabulae are widely spaced, and the septa are withdrawn from the axial region. At restricted intervals between stages of rejuvenescence the septa are thickened, irregularly distributed tubercles are commonly present on the sides of the septa, the septal ends coalesce irregularly in the axial region, and tabulae are more closely spaced. The preceding description is based upon specimens from both the Brownsport and Henryhouse Formations. There appears to be no significant difference be-



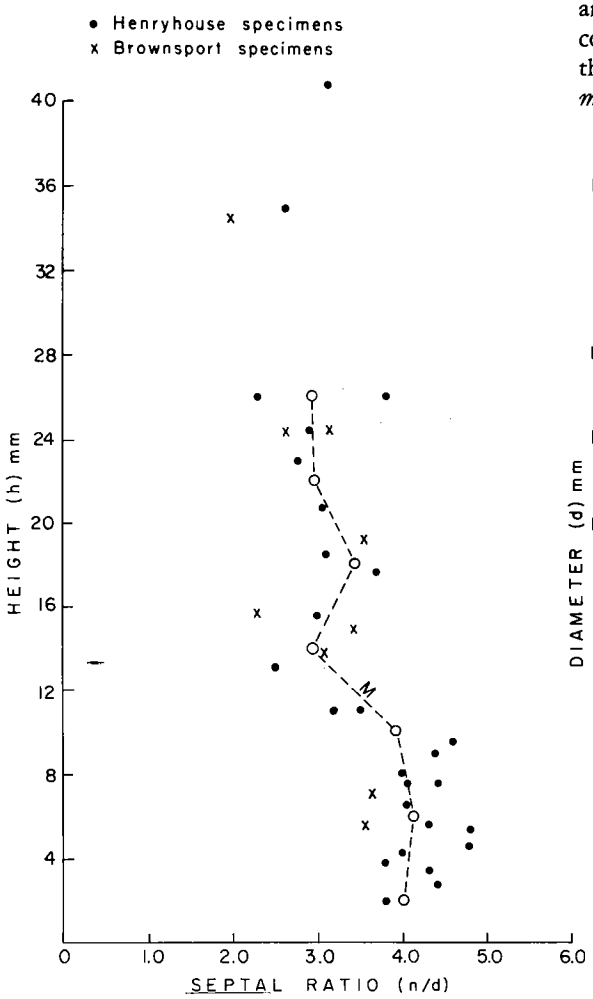
Text-figure 8. Relation of diameter to height in *Amsdenoides acutiannulatus*. Circles indicate mean values (M) computed by classes (class intervals, 6 mm) for all specimens from both the Henryhouse and Brownsport Formations.

tween the two groups of specimens (text-figs. 8-11).

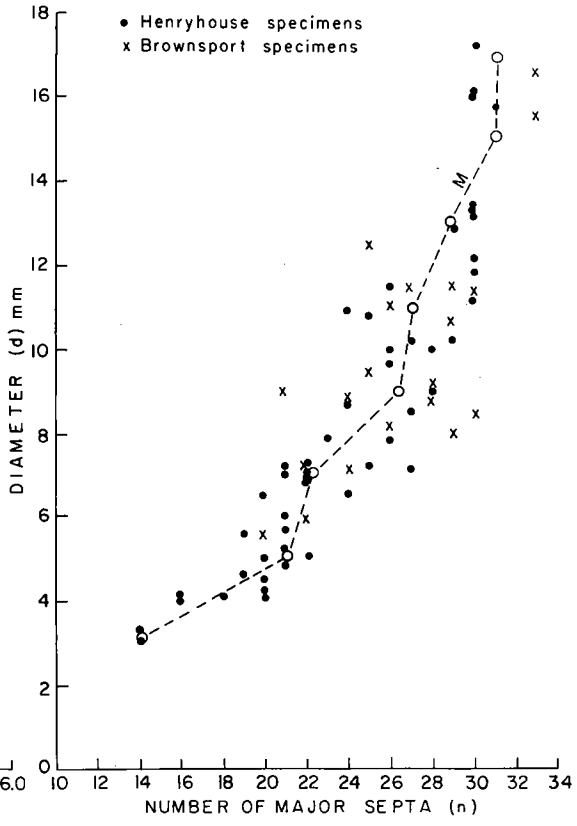
Amsden (1949, p. 102) based his species *Ditoecholasma acutiannulatum* upon two specimens from the Brownsport Formation of Tennessee. Only the holotype has been sectioned, and the one transverse and one longitudinal sections of the holotype have been rephotographed and are here refigured (pl. 7, figs. 1b,c). Amsden's original photograph of the exterior is also reproduced (pl. 7, fig. 1a) to show that the specimen was complete and that it had an attachment structure. Amsden incorrectly placed this species in the genus *Ditoecholasma* because of a misinterpretation of the longitudinal section. What appears to be an axial structure is in fact the intersection of the irregular axial edges of major septa (pl. 7, fig. 1c). The holotype of this species is an immature specimen of the species described but not figured by Amsden (1949, p. 107) as *Amplexus shumardi* (Edwards and Haime). Amsden's Brownsport collection (YPM) contains about 70 specimens of this species. The University of Oklahoma collection has about 25 specimens from the Brownsport Formation collected by Allen Graffham from a previously unrecorded locality in Perry County, Tennessee. A number of these specimens has been sectioned and photographs of several are reproduced on plates 7 and 8.

Material and occurrence.—*Amsdenoides acutiannulatus* occurs commonly in the Brownsport Formation in western Tennessee. The species also apparently occurs commonly in the Louisville Formation of northern Kentucky and southern Indiana. It is presumed to be represented among the corals which various authors have described from the Louisville Formation as *Cyathophyllum shumardi* Edwards and Haime.

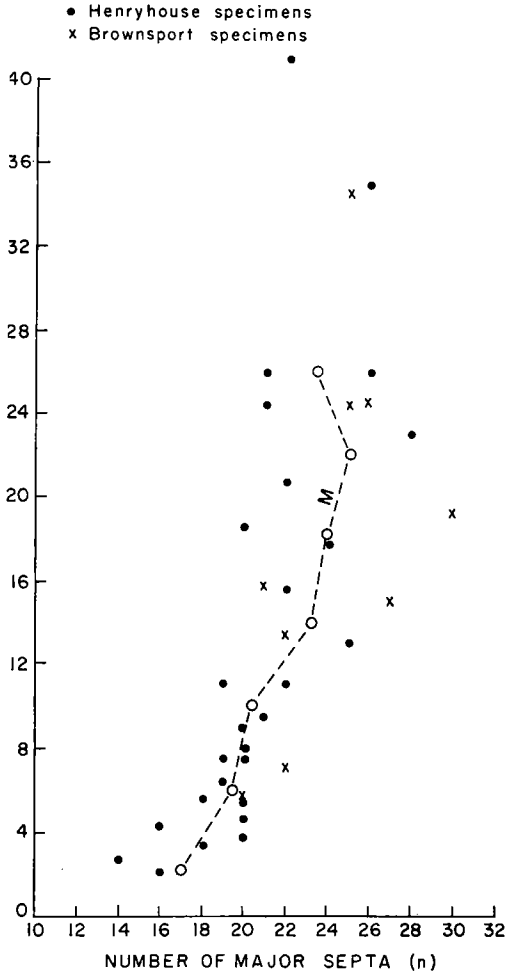
A. acutiannulatus is one of the more common



Text-figure 9. Relation of height to septal ratio (n/d) in *Amsdenoides acutiannulatus*. Circles indicate mean values (M) computed by classes (class intervals, 4 mm) for all specimens from both the Henryhouse and Brownsport Formations.



Text-figure 10. Relation of number of septa to diameter in *Amsdenoides acutiannulatus*. Circles indicate mean values (M) computed by classes (class intervals, 2 mm) for all specimens from both the Henryhouse and Brownsport Formations.



Text-figure 11. Relation of number of septa to height in *Amsdenoides acutiannulatus*. Circles indicate mean values (M) computed by classes (class intervals, 4 mm) for all specimens from both the Henryhouse and Brownsport Formations.

species in the upper coral beds of the Henryhouse Formation on the Lawrence uplift (text-fig. 4). From this local area more than 200 specimens are in the University of Oklahoma collection, and more than 50 specimens are in the U. S. National Museum collection. The species occurs abundantly at localities P7A and P1-S,T and commonly at localities P19 and P15A. It occurs uncommonly in the middle part of the Henryhouse Formation in the western Arbuckle Mountains region on Henryhouse Creek at USNM locality 5 (loc. Ca1); and uncommonly in the lower Henryhouse at locality P5.

Figured specimens. — From the Brownsport Formation: holotype YPM 17665; specimens OU 5430, 5431, 5432, 5433, 5434. From the Henryhouse Formation: specimens OU 5435, 5436, 5437, 5438, 5439, 5440, 5441, 5442, 5443, 5444, 5445; USNM 145275, 145276.

Genus *Enterolasma* Simpson, 1900

Type species. — *Streptelasma strictum* Hall, 1874; Lower Devonian, Helderbergian, New York.

Diagnosis. — Solitary, small, trochoid or ceratoid corals with major septa which extend to the axis and which have irregular carinae or tubercles on the sides. The axial edges of the major septa are lobed and form an irregular, open-mesh axial structure having the appearance of twisted rods. Tabulae are complete or incomplete and dissepiments are absent.

Enterolasma cf. *E. waynense* (Safford), 1869

Pl. 30, figs. 1-3; pl. 31, figs. 4, 5

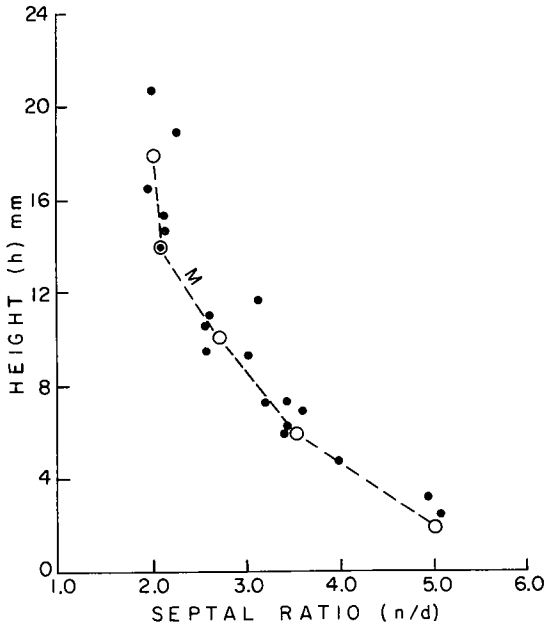
Petraia waynensis Safford, 1869, p. 320, pl. 5(H), figs. 2a-h.

Enterolasma waynense (Safford); Simpson, 1900, p. 204, text-figs. 13-15.

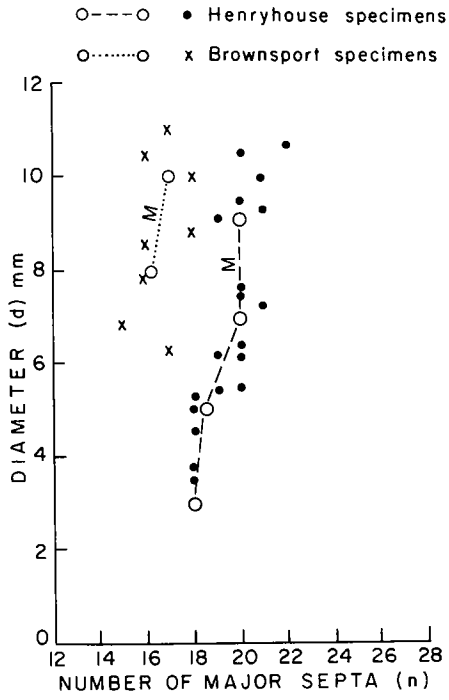
Enterolasma waynense (Safford); Amsden, 1949, p. 103, pl. 25, figs. 11-16.

Description (Henryhouse specimens). — The corals described here are small to medium and are trochoid to ceratoid. The largest specimen in the collection is 42 mm in height and has a maximum diameter of 17 mm. Surface features are poorly preserved but pronounced transverse markings appear to be absent. All specimens show a large attachment area up to 10 mm in greatest width.

Major septa number 18 at a diameter as small as 3.5 mm (septal ratio, 5.1) and increase to an observed maximum of 22 at a diameter of 10.7 mm (septal ratio, 2.1). The relation of septal ratio to height is shown in text-figure 12. Major septa typically number 20 in adult stages. Primary septa cannot be differentiated with certainty and the major septa, which have a radial symmetry, extend to the axial region. In some specimens the major septa are longer in the counter than in the cardinal quadrants, resulting in a slight shift of the axial region toward the cardinal side of the corallite. The septa are highly uneven in thickness as a result of the development of tubercles on the sides of the septa which are arranged in rows that slope slightly downward toward the axis and that form discontinuous carinae. The axial ends of the major septa are lobed and form an open-framework axial structure (pl. 30, fig. 3b) composed of irregularly twisted rods. Minor septa are also tuberculate and are about one-fifth as long as the major septa. Most minor septa are straight but



Text-figure 12. Relation of height to septal ratio (n/d) in *Enterolasma* cf. *E. waynense,* based upon specimens from locality P6. Circles indicate mean values (M) for n/d computed by classes (class intervals, 4 mm).



Text-figure 13. Comparison of the relation of number of septa to diameter in specimens of *Enterolasma* cf. *E. waynense* from the Henryhouse Formation and *E. waynense* from the Brownsport Formation. Circles indicate mean values (M) computed by classes (class intervals, 2 mm).

a few bend slightly toward an adjacent major septum.

Tabulae are thin and widely spaced, some complete and some incomplete. They sag in the axial region but are flat or slightly arched near the periphery (pl. 31, fig. 4). Dissepiments are absent.

Discussion.—I have been unable to locate Safford's (1869, p. 320) type specimens of the species *E. waynense,* from the Brownsport Formation of western Tennessee, which have apparently never been sectioned. However, this common Brownsport species has also been described by Simpson (1900, p. 204) and by Amsden (1949, p. 103). I have examined Amsden's collection (YPM) which includes three sectioned specimens. The specimens here described from the Henryhouse Formation are closely similar in character to those from the Brownsport except for having a distinctly greater number of septa for the same diameter (text-fig. 13).

Material and occurrence.—This species is exceedingly common in the Brownsport Formation of western Tennessee, where it occurs throughout the formation. Amsden collected specimens from 36 different localities (Amsden, 1949, p. 104). The species is uncommon in the Henryhouse Formation, and the University of Oklahoma collection contains only 12 specimens, all from the basal 15 feet of the formation at locality P6.

Figured specimens.—OU 5529, 5530, 5531, 5532.

Family CYSTIPHYLLIDAE Milne-Edwards and Haime, 1850

Genus *Cystiphyllum* Lonsdale, 1839

Type species.—*Cystiphyllum siluriense* Lonsdale, 1839, p. 691; Wenlock Limestone, Middle Silurian, England.

Diagnosis.—Solitary corals in which tabulae and dissepiments are typically globose and not clearly differentiated into two distinct zones. The septa are discontinuous and are represented by trabeculae developed as rows of spines only on upper surfaces of successive dissepiments and tabulae. Minor septa may be long but generally cannot be differentiated from the major septa.

Discussion.—*Cystiphyllum? henryhousense,* new species, from the Henryhouse Formation, is not typical of *Cystiphyllum* and probably represents a different genus. In *C.? henryhousense* the tabulae are flat, and the tabularium is clearly differentiated

from the dissepimentarium. In what have been considered typical species of *Cystiphyllum* the incomplete tabulae are gradational with the dissepiments and are inclined downward axially.

In the University of Queensland collection of Silurian corals from Gotland are several specimens closely similar to *C.? henryhousense,* with flat axial tabulae, from the Hemse and Eke Groups (early and possibly middle Ludlovian in age). Wedekind (1927, pl. 19, fig. 6) figured one specimen of this type, from the Hemse Group, as *Microplasma* sp.

Many small fragmentary specimens from the Henryhouse Formation appear upon first examination to represent a species of *Microplasma,* but these are interpreted here as broken offsets (pl. 15, figs. 1a, 4a; pl. 16, fig. 6a) of *C.? henryhousense,* which occurs at the same localities. The specimens are closely similar in character to known buds of that species (compare pl. 15, figs. 2 and 4). This evidence raises a doubt as to the character and status of the genus *Microplasma.* Dybowski's original illustrations of *M. gotlandicum,* the type species, from the Silurian rocks of Gotland (1874, pl. 5, fig. 5), shows a cylindrical fragment which is possibly an offset from a larger coral. Some of the cystiphyllid corals in the University of Queensland collection from the Hemse Group in Gotland show flat tabulae in the protocorallite and budding similar to that found in *C.? henryhousense.* The buds in these Gotland specimens are somewhat similar to Dybowski's illustrations of *M. gotlandicum* (1874, pl. 5, figs. 5c,d). Possibly a restudy of Dybowski's type specimens of *M. gotlandicum,* in conjunction with a comprehensive study of cystiphyllid corals in Gotland, would show either that *Microplasma* is a junior synonym of *Cystiphyllum* or that it is a valid genus in which the protocorallite has flat tabulae and inclined dissepiments as developed in *C.? henryhousense.* In the latter instance *C.? henryhousense* would be referred to the genus *Microplasma.*

C.? henryhousense may be closely related to the recently described genus *Dentilasma* Ivanovsky (1962, p. 128), for which he designated as the type a new species, *D. honorabile,* from the Lower Silurian (upper Llandoverian), of the Mogokta River and Gorbiyachin River areas of the Siberian platform. *Dentilasma* has a clearly differentiated tabularium, composed mostly of flat tabulae, not unlike that found in *C.? henryhousense.* It also has short septal spines. Ivanovsky illustrated sections of only two specimens of the type species and only two specimens of a second species, *D. contemptum* from the same horizon and locality and gave no indication of the degree of variability to be found in these species. Ivanovsky included the genus *Dentilasma* in the family Ketophyllidae and did not compare it with cystiphyllid corals. The coral would appear to me to belong to the family Cystiphyllidae.

The genus *Cystilasma* (not to be confused with the Mississippian coral genus *Cystelasma* Miller) is closely similar to *Dentilasma* and was described by Zaprudskaya and Ivanovsky (1962, p. 51) also from the Lower Silurian (upper Llandoverian) of the Gorbiyachin River area of the Siberian platform. This genus, which the authors include in the family Cystiphyllidae, appears to be identical in structure to *Dentilasma* except in lacking vestiges of septal spines in adult stages. Zaprudskaya and Ivanovsky illustrated sections of only the holotype of the type species, *C. sibiricum,* and only the holotype of a second species, *C. porfirievi,* from the same horizon and region, and they gave no indication of the degree of variability to be found in these species. It appears likely that *Dentilasma* and *Cystilasma* represent a single genus belonging to the family Cystiphyllidae, but the limited descriptions and illustrations of the two genera are inadequate for evaluation. Both names were proposed in 1962, and I have been unable to determine the priority of publication of the two papers involved.

No satisfactory basis for generic separation of the highly variable Silurian cystiphyllid corals has been proposed. No meaningful comparison can be made at this time among what are presumed to be typical species of *Cystilasma,* the new Siberian species assigned to *Dentilasma* and *Cystilasma, C.? henryhousense* from the Henryhouse Formation, and various species assigned to the genus *Microplasma.* The Silurian sequence in Gotland, where abundant, well-preserved cystiphyllid corals can be collected at various horizons, appears to offer the best possibility for an evaluation of this variable group.

Cystiphyllum? henryhousense, new species

Pl. 13, figs. 1-3; pl. 14, figs. 1-4; pl. 15, figs. 1-7; pl. 16, figs. 1-9.

Description.— The corals here described are variable in size but tend to be cylindrical in adult stages. They are solitary but many specimens show peripheral increase (see section on *Peripheral increase).* Most larger specimens show rejuvenescence with the development of distinct horizontal ridges which are variable in spacing and magni-

tude. Superimposed on them are faint transverse growth lines and wavy longitudinal grooves (pl. 15, fig. 5a). Several large fragmentary specimens are more than 60 mm long, the longest being 67 mm. Maximum lengths for complete specimens would probably exceed 80 mm. The greatest diameter recorded is 24 mm (pl. 13, fig. 2a) but most large specimens are no greater than 20 mm in maximum diameter. Only a few smaller specimens in the collection have earliest growth stages preserved, and all of these show a broad attachment surface (pl. 16, fig. 3a). No radiciform processes have been observed.

The wall is uncommonly thin in adult stages for a coral of the size described (pl. 13, fig. 1f). The septa are represented only by short, separated holacanthine trabeculae developed locally on the upper surfaces of successive dissepiments and tabulae. Few exceed 0.5 mm in length in transverse section of the corallite, and the septa are short even in early neanic growth stages (pl. 16, figs. 3e,f). Minor septa cannot be differentiated from major septa. No accurate count can be made of septa in any available ephebic section partly because of imperfect preservation and partly because septa are locally absent or irregularly spaced (pl. 13, fig. 3c). In immature stages of two specimens, at diameters of 10.5 and 12.0 mm, the total number of septa is 60 to 62 in each case. Primary septa cannot be detected internally but have been found in a few smaller specimens from the external pattern of septal grooves in early growth stages (pl. 15, fig. 1a).

Longitudinal sections in the ephebic stages of all larger specimens show a distinct development of a tabularium in which the tabulae are large, incomplete, globose, and horizontal or arched upward. This pattern is reflected in the development of a flat floor in the calice (pl. 14, figs. 1b, 3b). Dissepiments are found in the adult stages of all larger specimens and are inclined steeply downward toward the axis. They are irregular in number and spacing. A relationship exists between the development of dissepiments and the spacing of stages of rejuvenescence. Two specimens (pl. 14, figs. 2, 3) have more closely spaced rejuvenescent stages than have other specimens in the collection. Both specimens have a wider dissepimentarium with dissepiments much more numerous and more closely spaced than in specimens with widely spaced stages of rejuvenescence (pl. 14, figs. 1a,b). Dissepiments are absent or irregularly developed in earlier growth stages (pl. 13, fig. 3d; pl. 15, fig. 6a). In these cases tabulae extend to the epitheca (pl. 16, fig. 4a).

Peripheral increase. — A number of specimens in the collection show peripheral increase. Offsets originate in two ways. In one, they arise from the dissepimentarium at the margin of the calice (pl. 14, figs. 4a-c). In a second, apparently less common, they arise in the calice from the wall itself (pl. 15, figs. 2a-c). In both cases the offsets which have been observed have flat or arched tabulae and lack dissepiments. In these respects they resemble early growth stages of protocorallites of this species. Many small specimens in the Henryhouse collection, which appear on first examination to be a different coral but which are closely similar in character to observable buds, are interpreted here as broken offsets of *C.? henryhousense* (pl. 15, figs. 1a, 4a; pl. 16, fig. 6a). In all specimens where increase has been noted, further growth of the protocorallite is stopped. Peripheral increase has been noted in immature as well as mature specimens (pl. 15, fig. 2).

Discussion. — *Cystiphyllum? henryhousense* is not similar to a coral from the Brownsport Formation of Tennessee described as *Cystiphyllum lineatum?* Davis by Amsden (1949, pl. 29, figs. 6-11). *C. lineatum?* is a broadly flaring coral with undifferentiated, globose dissepiments and tabulae.

A coral described by Grabau (1930, p. 227) as *Omphyma glomerata,* from upper Silurian strata in the Kweichow Province of China, is similar to *C.? henryhousense* in character of the flat tabulae and in having short septal spines. This coral buds profusely and, as in *C.? henryhousense,* the protocorallite stops growth when budding occurs, and the offsets are invariably small compared to the protocorallite.

Undescribed specimens from the Hemse and Eke Groups (early and possibly middle Ludlovian in age), of Gotland, Sweden, are closely similar to *C.? henryhousense,* but a detailed comparison cannot be made until the Gotland corals are fully described.

Material and occurrence. — *Cystiphyllum? henryhousense* is a common species in the upper coral beds of the Henryhouse Formation on the Lawrence uplift (text-fig. 4). From this local area more than 70 specimens are in the University of Oklahoma collection, and about the same number are in the U. S. National Museum collection. The species occurs commonly at localities P7A, P1-S,T, P19, and P15A. It occurs uncommonly in beds Q and R at locality P1 and from the upper part of the section at locality P3. It also occurs uncommonly in the middle part of the Henryhouse Formation in the western Arbuckle Mountains

region on Henryhouse Creek at USNM locality 5 (near loc. Ca1). This species has not previously been reported from the Brownsport Formation in western Tennessee, where it occurs locally (Graffham loc. 2).

Figured specimens. — Holotype OU 5446; paratypes OU 5447, 5448, 5449, 5450, 5451, 5452, 5453, 5454, 5455, 5456, 5457, 5458, 5459, 5461, 5462, 5463, 5464, and USNM 145277; specimen OU 5460.

Family ARACHNOPHYLLIDAE Dybowski, 1873

Genus *Entelophyllum* Wedekind, 1927

Type species. — *Madreporites articulatus* Wahlenberg, 1821; Silurian, Gotland, Sweden.

Diagnosis. — Dendroid or phaceloid corals with long, radially arranged septa which may be withdrawn slightly from the axis. The septa may be carinate. Small globose dissepiments form a peripheral zone, and tabulae are flat or arched slightly in the axial region.

Entelophyllum cf. *E. angulare* (Amsden), 1949, new combination

Pl. 21, figs. 2-5; pl. 22, figs. 1-4; text-fig. 14

Cyathophyllum angulare Amsden, 1949, p. 109, pl. 28, figs. 9-15.

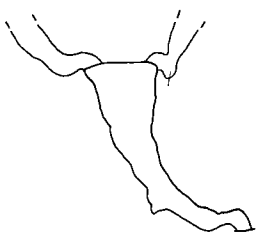
Description (Henryhouse specimens). — The corallum is dendroid and of unknown maximum size. The largest fragment of a colony in the collection is 10 to 12 cm in height and about 25 cm in maximum diameter. The corallites are not closely packed in the corallum (pl. 22, figs. 4a,b), and they tend to flare outward giving a low and wide corallum. Individual corallites are ceratoid to cylindrical, but some show an expanded, trumpet-shaped calice (pl. 22, fig. 2). Individual coralites are typically 2 to 3 cm long, and no corallite longer than 3.5 cm has been observed. Corallites are typically 5.5 to 7 mm in diameter, but a few trumpet-shaped calices have been observed with diameters greater than 10 mm. Peripheral offsets occur 2 to 6 at a time and typically bend abruptly laterally from the calice rim of the protocorallite, and some sag at the margin of the calice (text-fig. 14). No further growth of a protocorallite occurs after budding. New offsets originate from the dissepimental zone, and septal grooves on one side of an offset are commonly continuous with those on the protocorallite. Individual corallites have a surface marked by irregularly spaced small restrictions and by faint, shallow septal grooves (pl. 22, figs. 2, 3). Occasional, widely spaced connecting processes are developed.

Major septa typically number 20 in the few Oklahoma corallites which have been sectioned. The major septa are about two-thirds to three-fourths the radius in length. They have a well-developed radial symmetry and the primary septa cannot be distinguished. Minor septa range from one-fifth to two-thirds the length of the major septa. Both major and minor septa uncommonly become discontinuous locally in the dissepimental zone.

Several rows of small globose dissepiments form a distinct peripheral zone. The dissepimentarium ranges from about one-half the radius in width in cylindrical portions of the corallite to as much as two-thirds the radius where the corallite becomes flared at the base of some calices. Tabulae are flat and closely spaced in the axial region. They number about 12 or 13 in a distance of 5 mm.

Discussion. — Amsden (1949, p. 109) described *Entelophyllum angulare* as a solitary coral, and he based his description upon nearly 100 isolated, silicified specimens, of which only two have been sectioned. However, a comparison of these specimens with the Henryhouse specimens, described above, strongly indicates that Amsden's specimens represent a colonial coral. Most of his specimens show broken buds in their calices, some show irregular connecting processes, and all have broken bases, many of which are laterally deflected. In addition, several slabs in the Amsden collection, from the type locality for the species, show one to three offsets in contact with protocorallites, and these have a lateral deflection similar to the pattern of peripheral increase described above for the Henryhouse specimens.

The Brownsport corallites agree closely with the description given above for corallites from the



Text-figure 14. Outline in side view of a single corallite and two peripheral offsets in the colonial coral *Entelophyllum* cf. *E. angulare* (x1). Note the abrupt lateral tilt or sag of the new offsets.

Henryhouse Formation. Brownsport corallites are slightly larger on the average than those in the Henryhouse, averaging about 7 to 8 mm in diameter as compared to about 6 to 6.5 in the Henryhouse corallites. Internally the characters also agree closely except that the two sectioned Brownsport specimens each have 22 major septa and Henryhouse corallites typically have 20. Illustrations of the Brownsport sections (Amsden, 1949, pl. 28, figs. 13-15) suggest that the septa, dissepiments, and tabulae are thicker than those in the Henryhouse specimens, but this impression results from the fact that the Brownsport sections are exceptionally thick.

Material and occurrence. — *Entelophyllum angulare* is a rare species in the Brownsport Formation of western Tennessee, where it occurs commonly at one locality and uncommonly at six others (Amsden, 1949, p. 110). This species has been found only at locality P8 (text-fig. 3) in the Henryhouse Formation, where it was collected in place 3 feet below the top of the formation in the north bank of Bois d'Arc Creek. Text-figure 5 shows the stratigraphic location of the species at this locality. At point A, and within 3 feet laterally from it in the same stratum, fragments of three coralla were collected that were in a growing position. Closely associated with these coralla were fragments of *Halysites*. At point B, 0.5 foot higher stratigraphically, and in the next overlying stratum of marlstone, were collected numerous, partly broken fragments of coralla and individual broken corallites deposited parallel to the bedding. Locality P8 is one of two sites where *Halysites* has been found in the Henryhouse Formation, the other being in the top 10 feet (bed T) of the formation at locality P1.

Figured specimens. — OU 5492, 5493, 5494, 5495, 5496, 5497.

Entelophyllum sp. A

Pl. 18, fig. 3

Description. — The single specimen described here is a cylindrical fragment 23 mm in maximum height which is possibly a part of a colonial coral-lum. The specimen has a maximum diameter at the calice of 14 mm. The surface is marked by shallow, smooth septal grooves and fine, transverse growth lines. Growth of the protocorallite is terminated by the development of five offsets of equal size and spacing, each of which turns away from the axial region (pl. 18, figs. 3a,b). Each offset is approximately 6 mm in diameter at the base.

Major septa number 26 at a diameter of 12 mm and again higher in the corallite at a diameter of 13.4 mm. The septa are long and thin and are four-fifths the radius in length, leaving a small open axial region. Minor septa are about one-half the length of the major septa.

Entelophyllum sp. A has two distinct series of tabulae. The tabulae in the axial region are flat, and those forming a narrow periaxial series slope gently away from the axial region. Dissepiments are small and globose and form a zone one-half the radius in width. Offsets originate from the dissepimental zone and from the narrow periaxial zone of tabulae (pl. 18, figs. 3c,d), with the periaxial zone of tabulae becoming the axial zone of tabulae in the offset.

Discussion. — The single specimen here described has internal characters typical of the genus *Entelophyllum,* including two zones of tabulae. It is apparently a fragment of a colonial coral. The nature of peripheral increase is similar to that found in the type species of *Entelophyllum, E. articulatum* (Wahlenberg), as described by Smith and Tremberth (1929, p. 371).

Material and occurrence. — The single specimen in the collection is from locality P7A in the upper coral beds on the Lawrence uplift (text-fig. 4).

Figured specimen. — OU 5470.

Genus *Micula* Sytova, 1952

Type species. — *Micula antiqua* Sytova, 1952; Upper Silurian, Urals, Russia.

Diagnosis. — "Solitary corals of cylindroconical form. Septa of the first order long, have thickening of the periphery. Septa of the second order more than one-half as long as septa of the first order. Tabulae convex, sometimes complicated by supplementary plates. Dissepiments small and archlike. Calice deep, goblet-shaped with a boss in the center" (Sytova, 1952, p. 133).*

Discussion. — Tentatively included in the genus *Micula* is a large solitary coral, *Micula? catilla,* new species, with internal characters typical of the faciculate genus *Entelophyllum.* The type species of *Micula* differs from the coral here described and from *Entelophyllum* in having somewhat thickened septa in the dissepimental zone. Both genera are characterized by small globose dissepiments and are considered to be closely related.

* I am indebted to Professor Dorothy Hill for a translation from the original Russian text.

Micula? catilla, new species

Pl. 17, figs. 1-3; pl. 18, figs. 4-6

Description. — The corals described here are solitary and trochoid and are medium in size. The largest complete specimen has a maximum height of more than 50 mm and a maximum diameter of about 30 mm. Curvature is variable in relation to the location of primary septa. One specimen (pl. 17, fig. 1a) changes direction of curvature so that the cardinal septum is on the convex side in the lower third of the specimen and is on the concave side of curvature in the upper two-thirds of the corallite. In other specimens the location of the cardinal septum is unrelated to curvature. The surface is marked by low, rounded, irregularly spaced, transverse ridges and fine growth lines. Longitudinal markings are not prominent; where preserved, they consist of flat longitudinal ridges and shallow septal grooves. An attachment surface of variable size and shape is present in most complete specimens.

Major septa number about 23 at a diameter of 7.3 mm (septal ratio, 3.1) and increase to an observed maximum of 34 at a diameter of 27.3 mm (septal ratio, 1.2). Major septa typically number 30 to 34 in adult stages and are three-fourths to four-fifths the radius in length, leaving an open axial region. Primary septa are obscured by the radial symmetry, but the cardinal septum can be detected in most specimens by the pattern of contratingent minor septa (pl. 17, fig. 1e). Minor septa are long and typically three-fifths to two-thirds the length of the major septa in adult stages. Most are adnate and bend away from the long cardinal septum. No fossula is developed. The epitheca is uncommonly thin and the septa are all thin and noncarinate. Their microstructure cannot be determined because of poor preservation.

Micula? catilla has two distinct zones of tabulae. Those in the open axial region are flat and evenly spaced (pl. 17, fig. 1b). Adjacent to the axial region is a narrow zone of less regularly spaced tabulae which are inclined steeply away from the axis. The dissepimental zone, typically about one-half the radius in width, is composed of small globose dissepiments (pl. 17, fig. 2b). Several specimens show peripheral increase (pl. 17, fig. 3b). The offsets originate from the dissepimentarium.

Material and occurrence. — This species occurs uncommonly in the upper coral beds on the Lawrence uplift (text-fig. 4), from which 12 specimens from localities P1-S,T and P7A are in the University of Oklahoma collection.

Figured specimens. — Holotype OU 5465; paratypes OU 5466, 5467, 5471, 5472, 5473.

Genus *Capnophyllum,* new genus

Type species. — *Capnophyllum hedlundi,* new species.

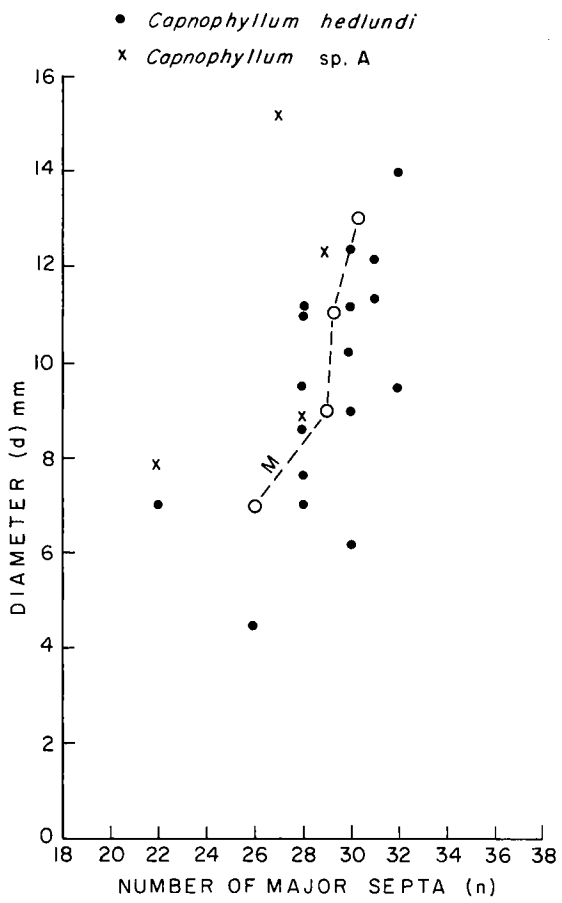
Diagnosis. — Solitary corals with an aulos formed by the union of the axial ends of the long, thin major septa, which are typically carinate. Tabulae are commonly of two series, with those in the axial region being flat. Dissepiments are small and globose.

Capnophyllum hedlundi, new species

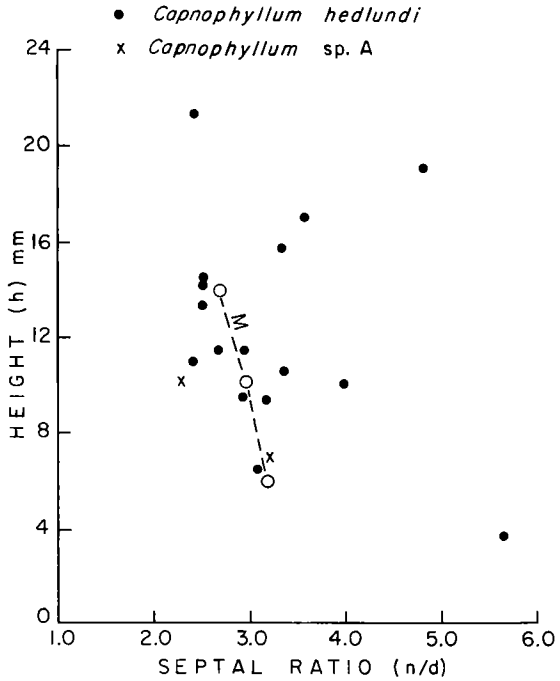
Pl. 19, figs. 1-4; pl. 20, figs. 1-6

Description. — The corals described here are solitary and small. Some specimens show peripheral increase. The largest complete specimen, the holotype, is 25 mm in maximum height and 14 mm in maximum diameter. Most specimens are almost straight. Curvature, where present, is variable in relation to the location of the cardinal septum, having been observed on both the concave and the convex sides of curvature. Specimens range from trochoid to ceratoid. Some broken specimens, interpreted as broken offsets, are cylindrical. All specimens show rejuvenescence and some specimens become sharply restricted in later growth stages (pl. 20, figs. 2, 5). All complete specimens show an attachment surface or structure which is variable in size and character depending upon the surface to which the specimen was attached.

Major septa typically number 28 to 32 in adult stages. The maximum number observed is 32 at a diameter of 14 mm (septal ratio, 2.3), but marked variation in number of septa in relation to diameter occurs as a result of rejuvenescence (text-fig. 15). The same factor also causes marked variation in septal ratio in relation to height (text-fig. 16). Major septa are long but do not reach the axis. They have a well-developed radial symmetry which obscures the location of primary septa. No cardinal fossula is developed. In most specimens the axial ends of the septa unite at the margin of a zone of flat tabulae, thus forming an irregularly shaped aulos enclosing a distinctive, narrow, open axial tabularium. This inner wall becomes discontinuous or disappears in late growth stages of some specimens. Minor septa are long and are typically two-thirds to three-fourths the length of the major septa. They are not contratingent. The epitheca is thin. In most specimens



Text-figure 15. Relation of number of septa to diameter in *Capnophyllum hedlundi,* based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 2 mm).



Text-figure 16. Relation of height to septal ratio (n/d) in *Capnophyllum hedlundi,* based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 4 mm).

both major and minor septa have well-developed yardarm carinae. Carinae are sparse in some sections, particularly in late growth stages (pl. 20, fig. 5c). Some specimens have a few discontinuous septa in the peripheral part of the dissepimentarium, but this character is not consistent.

In longitudinal section all specimens show a narrow, axial auloslike structure containing flat, evenly spaced tabulae (pl. 19, fig. 1b). In some specimens the dissepimentarium extends axially to this wall. In such cases the dissepimentarium is as much as three-fourths the radius in width, but the dissepiments near the axial region are less globose and more steeply inclined than are the distinctly globose dissepiments nearer the periphery. In some specimens the more steeply inclined periaxial dissepiments, near the auloslike wall, are irregularly replaced by a narrow zone of irregular tabulae which are flat and gently inclined downward away from the axis.

Discussion. — The three specimens referred in this paper to *Capnophyllum* sp. A (pl. 20, fig. 7; pl. 21, fig. 1) may represent variants of *C. hedlundi.* Those specimens differ from *C. hedlundi* in having distinctly shorter minor septa and a much narrower zone of dissepiments.

Material and occurrence. — *Capnophyllum hedlundi* is one of the more abundant species in the upper coral beds of the Henryhouse Formation on the Lawrence uplift (text-fig. 4). More than 125 specimens in the University of Oklahoma collection and nearly 100 specimens in the U. S. National Museum collection come from that area. This species occurs abundantly at localities P1-S,T and P7A and commonly at localities P15A and P19. It occurs uncommonly in the upper Henryhouse Formation at locality P18 and in the middle part of the formation in the western Arbuckle Mountains region on Henryhouse Creek at USNM locality 5 (near loc. Ca1).

Figured specimens. — Holotype OU 5474; paratypes OU 5475, 5476, 5477, 5480, 5481, USNM 145278; specimens OU 5478, 5479, USNM 145279.

Capnophyllum sp. A

Pl. 20, fig. 7; pl. 21, fig. 1

Discussion. — The three specimens included here possibly represent extreme variants of *C. hedlundi,* with which they occur. They are similar to that species in having an auloslike structure inclosing flat-lying tabulae at the axial ends of the septa. They differ from that species primarily in having distinctly shorter minor septa, a much narrower zone of dissepiments, and less well developed carinae (compare pl. 20, figs. 7d and 6c). They do not show marked rejuvenescence, as in *C. hedlundi,* and the tabulae outside the aulos form a fairly regular series (pl. 21, fig. 1b).

Material and occurrence. — The three specimens included here all come from locality P1-S,T.

Figured specimens. — OU 5482, 5483.

Family HALLIIDAE Chapman, 1893

Genus *Phaulactis* Ryder, 1926

Type species. — *Phaulactis cyathophylloides* Ryder, 1926; Silurian, Slite Group, Gotland, Sweden.

Diagnosis. — Solitary corals with long septa but no distinct axial structure. In the earlier formed parts of the corallite the septa are typically thickened, but in adult stages the dilation decreases and is restricted to the tabularium or is absent. Tabulae are domed, flat or sagging, and complete or incomplete. The dissepimentarium is wide and is composed of small globose dissepiments.

Phaulactis? lanx, new species

Pl. 18, figs. 1, 2

?*Cyathophyllum pegramense* (Foerste); Amsden, 1949, p. 110, pl. 34, figs. 11, 12; not *Heliophyllum pegramensis* (sic) Foerste, 1909, p. 100, pl. 3, figs. 58A,B.

Description. — The two specimens described here are trochoid and straight, and the type specimen is 33 mm high and has a maximum diameter of 22 mm. The position of the cardinal septum is not related to external growth form. Stages of rejuvenescence are marked but irregular. The axial part of the calice has a distinct cup-shaped depression corresponding to the tabularium which is slightly less than one-half the diameter in width and of approximately equal depth. The margin of the calice is broad and flat. The type specimen has a well-developed attachment structure, 4 mm wide and 7 mm long, at one side of the proximal end of the corallite. It is composed of short, stout talons, and its position is unrelated to the plane of the cardinal septum.

Major septa in the type specimen number 33 at a diameter of 8 mm and increase to 34, in the ephebic stage, at a diameter of 18.8 mm. The major septa are long and reach the axial region but do not form an axial structure. They are thin in the dissepimentarium but are slightly thickened and rhopaloid in the tabularium. Minor septa are two-thirds as long as the major septa and are contratingent. Their length corresponds to the width of the dissepimentarium.

Dissepiments differ in size and shape. Some are small and globular and others are elongate and flat (pl. 18, fig. 1c). This dissepimental zone is one-half to two-thirds the radius in width. Tabulae are arched axially and are incomplete.

Discussion. — Typical species of *Phaulactis* show the greatest degree of thickening of the septa in the earlier growth stages. In *P.? lanx* the septa show only slight thickening at any growth stage.

The coral from the Brownsport Formation in Tennessee figured by Amsden (1949, pl. 34, figs. 11, 12) as *Cyathophyllum pegramense* (Foerste) possibly belongs to *P.? lanx.* The species described here is not that described by Foerste (1909, p. 100, pl. 3, figs. 58A,B) as *Heliophyllum pegramensis,* also from the Brownsport Formation. I have sectioned the better of Foerste's two figured specimens (1909, pl. 3, fig. 58A; USNM 86989), and that species has a well-developed axial vortex. It is possibly related to the genus *Ptychophyllum.*

Material and occurrence. — *Phaulactis? lanx* is represented in the University of Oklahoma collection by two specimens, both from locality P7A. The species possibly occurs in the Brownsport Formation of Tennessee. Amsden's (1949) coral collection (YPM) contains numerous unsectioned specimens labelled *Cyathophyllum pegramense,* some of which possibly belong here.

Figured specimens. — Holotype OU 5468; paratype OU 5469.

Family TRYPLASMATIDAE Etheridge, 1907

Genus *Tryplasma* Lonsdale, 1845

Type species. — *Tryplasma aequabile* Lonsdale, 1845; Silurian, Kakva River, Ural Mountains, Russia.

Diagnosis. — Solitary, dendroid or phaceloid corals which commonly show marked rejuvenescence. Septa are represented by a vertical series

of trabeculae bound together by sclerenchyme but free at their inner ends. Septa may be continued toward the axis as small spines only on the upper surfaces of tabulae. Dissepiments are absent and tabulae are horizontal or inversely conical.

Tryplasma cf. *T. radiculum* (Rominger), 1876

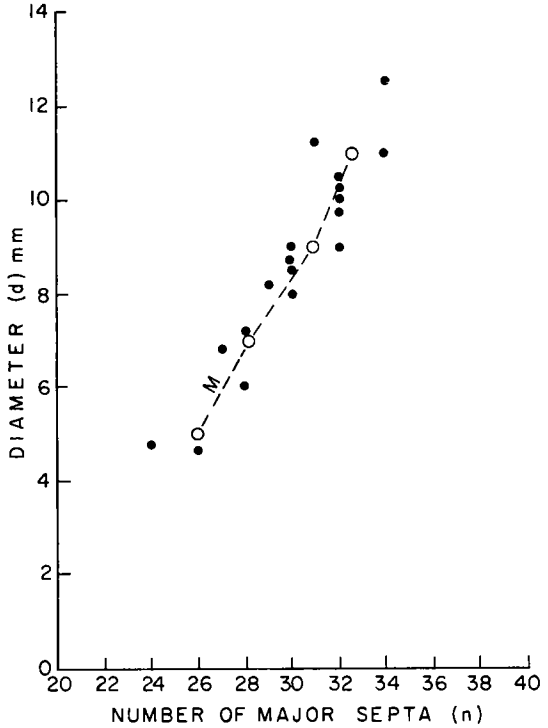
Pl. 23, figs. 1-3; pl. 24, figs. 1-6; pl. 25, figs. 1-6

?*Tryplasma radicula* (sic) (Rominger); Stumm, 1952, pl. 125, figs. 1-9.

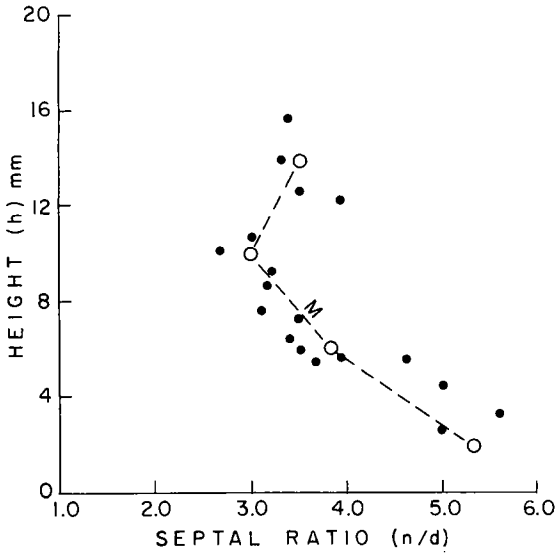
Description (Henryhouse specimens).—The corals described here are small and trochoid to ceratoid, with some becoming cylindrical in adult stages. The largest complete specimen in the collection is about 26 mm high with a maximum diameter of about 12.5 mm. Corallites range from almost straight to distinctly curved, and all show marked and irregularly spaced transverse ridges resulting from rejuvenescence. Many specimens show a small attachment surface or structure a few millimeters across, but only a few have small radiciform processes. In specimens which have developed a cylindrical growth stage the calice has steep sides and a flat bottom formed by the highest tabula (pl. 23, figs. 1f, 3b; pl. 24, fig. 5b). At this stage only a slight difference in length and size can be noted between major and minor septa in the calice. Immature specimens, which are short and trochoid, have narrower and more conical calices, and the minor septa are distinctly shorter and smaller than are the major septa (pl. 25, figs. 1b,c). The epitheca is marked by faint interseptal ridges.

Major septa number about 24 at a diameter of 4.8 (septal ratio, 5.0) and increase to an observed maximum of 34 at a diameter of 12.5 mm (septal ratio, 2.7). A close relationship exists between diameter and number of septa (text-fig. 17), but considerable variation occurs in the relationship of height to septal ratio (text-fig. 18). Major septa typically number 28 to 32 in ephebic stages. The major septa range from about one-fifth to two-thirds the radius in lentgh, and minor septa are about two-thirds as long as the major septa in early ephebic stages but increase to about four-fifths their length in later ephebic growth stages. Each septum is composed of a vertically arranged series of trabeculae, which are tilted upward toward the axis. Both monacanthine and rhabdacanthine trabeculae appear to be present. Some specimens show septal spines on the upper surfaces of tabulae in the axial region (pl. 23, fig. 2b). Primary septa cannot be detected.

Tabulae are horizontal and many are complete. They are irregularly spaced, with as few as 3 and



Text-figure 17. Relation of number of septa to diameter in *Tryplasma* cf. *T. radiculum*, based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 2 mm).



Text-figure 18. Relation of height to septal ratio (n/d) in *Tryplasma* cf. *T. radiculum*, based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 4 mm).

as many as 6 in a space of 5 mm having been observed. Dissepiments are absent.

Discussion.—*Tryplasma radiculum* is a highly variable species and its diagnostic characters are not well known. Rominger's type specimens (1876, p. 109, pl. 39, fig. 3) are from several different formations and regions and show marked variation in shape. More than one species may be included among these specimens. Stumm (1952, p. 842, pl. 125, figs. 1-6) refigured several of Rominger's specimens but apparently did not section them. The specimens described here from the Henryhouse Formation, and which are compared tentatively with *T. radiculum,* show marked variation in shape, size, and septal development. They appear to be similar in most respects to the Rominger specimens but are possibly more cylindrical, and none develops a large attachment structure such as is found in the lectotype (Stumm, 1952, pl. 125, fig. 2).

Specimens of *Tryplasma* figured on plate 25 (figs. 1-6) are interpreted as immature specimens of *T.* cf. *T. radiculum* which did not develop a cylindrical stage. These immature specimens show a depressed conical floor at the base of the calice in contrast to the flat floor found in the ephebic cylindrical stage of a mature specimen.

The Henryhouse specimens clearly do not belong to *Tryplasma brownsportense* (Amsden). They have been compared with the type collection for that species (YPM) from the Brownsport Formation of Tennessee (Amsden, 1949, p. 106). That species differs by being distinctly larger (maximum height up to 40 mm and diameter up to 20 mm) and by having distinctly longer major septa and concave tabulae.

Material and occurrence.—Stumm (1952, p. 842) stated that *Tryplasma radiculum* occurs in the "Middle Silurian (Manistique dolomite); northern Michigan. Middle Silurian (Hopkinton dolomite); vicinity of Masonville, Iowa." The specimens from the Henryhouse Formation, here referred tentatively to this species, come mainly from the upper coral beds on the Lawrence uplift (text-fig. 4). The species is represented by about 60 specimens in the University of Oklahoma collection and by about the same number in the U. S. National Museum collection. The form occurs commonly at localities P7A and P1-S,T and uncommonly at localities P15A and P19. The species also occurs uncommonly in the western Arbuckle Mountains region in the middle part of the formation, on Henryhouse Creek, at USNM locality 5 (near loc. Ca1).

Figured specimens.—OU 5484, 5485, 5486, 5487, 5488, 5489, 5490, 5491, 5498, 5499, 5500, 5501, 5502; USNM 145280, 145281.

Genus *Zelophyllum* Wedekind, 1927

Type species.—*Zelophyllum intermedium* Wedekind, 1927, p. 35; Middle Silurian, Gotland.

Zelophyllum? sp.

PL. 34, fig. 7

Description.—A single specimen is small, ceratoid, and about 16 mm in maximum height. The maximum diameter is 5.5 mm. External features are unknown. Internally there are 32 short septa which may represent alternating major and minor septa. They are about 0.5 mm long and are not acanthine but are continuous vertically. The microstructure is poorly preserved, but each septum is apparently composed of a single vertical row of short, closely packed, small trabeculae tilted upward toward the axis. Tabulae are flat, complete, and widely spaced, numbering 4 or 5 within 5 mm vertically. Dissepiments are absent.

Material and occurrence.—A single specimen from locality P7A in the upper part of the Henryhouse Formation on the Lawrence uplift.

Figured specimen.—OU 5551.

Family ACERVULARIIDAE Lecompte, 1952

Genus *Oliveria,* new genus

Type species.—*Oliveria planotabulata,* new species.

Diagnosis.—Solitary corals with dilated, noncarinate septa. An auloslike subperipheral septal stereozone is formed by the dilatation of major and minor septa near their axial ends. Tabulae are flat. A single vertical series of flat or sagging dissepiments occurs in the peripheral region.

Discussion.—The family position of *Oliveria* is uncertain. This genus differs from described genera in the family Acervulariidae in being solitary and in having noncarinate septa. In internal character it is similar to the phaceloid genus *Diplophyllum* in having a peripheral zone of flat dissepiments, an inner wall formed by dilatation of the septa, and an axial series of horizontal tabulae. It is similar to this genus and to *Acervularia* in the distinctive multitrabecular septal structure.

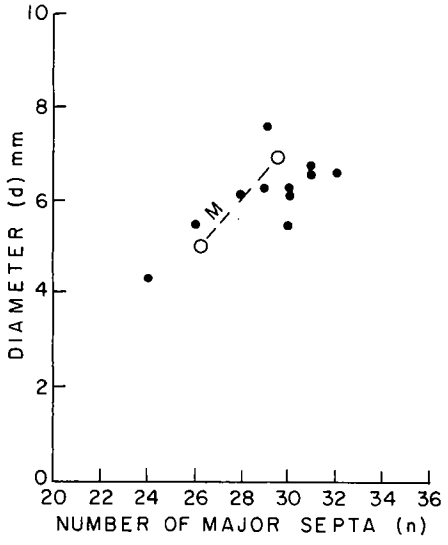
The Devonian genera *Thamnophyllum* and *Macgeea* (subfamily Phacelophyllinae, family Phillipsastraeidae) are similar to *Oliveria* in having a multitrabecular, fanlike septal structure, but in those genera the trabeculate thickening of the septa in vertical growth is closely related to the development of horseshoe-shaped dissepiments.

Oliveria planotabulata, new species

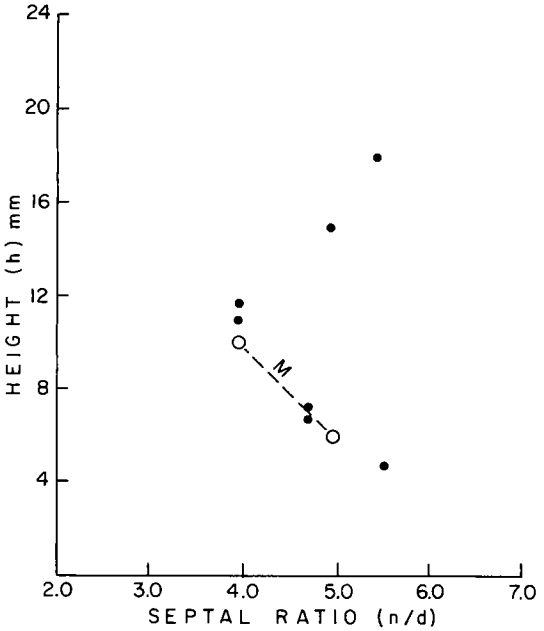
Pl. 25, figs. 7-9; pl. 26, figs. 1-5

Description. — The corals described here are small and solitary. They tend to be cylindrical except for an early trochoid stage. The coral shows marked stages of rejuvenescence which causes considerable variation in diameter. The maximum diameter observed is about 9 mm and most specimens range from 6 to 7.5 mm in diameter in ephebic stages. The longest specimen is incomplete but was possibly 30 mm long when complete. Most complete specimens in the collection are 15 to 20 mm long. Many of the specimens were abraded before deposition and lack the thin wall. Such specimens have the peripheral septal edges exposed at the surface, giving what falsely appears to be a strongly ribbed coral (pl. 26, figs. 2a, 3a). Specimens that show little abrasion (pl. 25, figs. 7, 8) have an almost smooth surface but show faint, shallow septal grooves and broad, flat interseptal ridges in addition to the marked transverse ridges resulting from rejuvenescence. Complete specimens show a blunt early stage beginning in a small irregular attachment surface. Some specimens have several short radiciform processes preserved.

Major septa number about 24 at a diameter of 4.3 mm (septal ratio, 5.6) and increase to an observed maximum of 32 at a diameter of 6.6 mm (septal ratio, 4.8). However, as a result of marked rejuvenescence considerable variation occurs in number of septa in relation to diameter and in septal ratio in relation to height (text-figs. 19, 20). Adult stages typically show 28 to 30 major septa. Major septa extend to the epitheca and are dilated but do not extend into the axial region. They are about 1.5 mm long in most specimens and are one-third to one-half the radius in length. The septa are multitrabecular and are rhabdoplaty (Kato, 1963, p. 593). They are continuous vertically except at their axial ends (pl. 26, fig. 1g). The dispersed trabeculae grow primarily upward but turn inward near the axial region. Minor septa do not extend to the periphery, yet their peripheral ends do not rest on a dissepiment. The minor septa have a microstructure similar to that of the major septa except that the dispersed trabeculae in some septa grow somewhat outward toward the periphery as well as upward and inward at their axial ends (pl. 26, fig. 1c). Their structure in vertical section is that of an upward-radiating fan of needlelike trabeculae. Together



Text-figure 19. Relation of number of septa to diameter in *Oliveria planotabulata,* based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 2 mm).



Text-figure 20. Relation of height to septal ratio (n/d) in *Oliveria planotabulata,* based upon specimens from all Henryhouse localities. Circles indicate mean values (M) computed by classes (class intervals, 4 mm).

the closely spaced and dilated major and minor septa form an inner wall or subperipheral septal stereozone.

In the axial region is a regular series of generally horizontal tabulae which number about 7 to 8 per 5 mm. In the peripheral region, separated from the tabularium by the inner wall, a series of slightly sagging to horizontal dissepiments occurs between the major septa (pl. 26, fig. 1h). Toward the axis these plates rest on the peripheral edges of minor septa. They are thin and somewhat irregularly spaced. They number about 10 to 12 in 2.5 mm and are thus much more closely spaced than are the axial tabulae.

Material and occurrence. — *Oliveria planotabulata* occurs uncommonly in the upper coral beds on the Lawrence uplift (text-fig. 4). About 30 specimens are in the University of Oklahoma and U. S. National Museum collections from localities P7A, P15A, P19, and P1-S,T.

Figured specimens. — Holotype OU 5505; paratypes OU 5503, 5504, 5506, 5507, 5508, USNM 145282, 145283.

Family LACCOPHYLLIDAE Grabau, 1928

Genus *Syringaxon* Lindström, 1882

Type species. — *Cyathaxonia siluriensis* McCoy, 1850; Lindström, 1882, p. 20; Silurian, upper Ludlow, England.

Diagnosis. — Small, solitary corallites with the axial ends of the major septa rhopaloid and laterally contiguous, forming an aulos. Minor septa are free or contratingent. The aular tabulae are horizontal, and the outer tabulae are horizontal or slope upward axially. Dissepiments are absent.

Discussion. — The diagnosis here given for the genus *Syringaxon* is not based upon the type species of the genus, *S. siluriense* (McCoy), and must therefore be considered conjectural and tentative. McCoy (1851, p. 36, pl. 1c, figs. 11, 11a) based his description of the species upon a single specimen from the Bannisdale Slates, Underbarrow, Kendale, County of Westmorland, in northern England. No topotype specimens are known to exist. I have examined the type specimen, A5468, in the Sedgwick Museum, Cambridge University, England. It has not been sectioned. It lacks both the calice and earliest tip. The incomplete specimen is 7.7 mm in maximum height and 4.5 mm in greatest diameter. On the broken upper surface, approximately at the base of the calice, there appear to be 18 major septa. The axial region is occupied by what may be interpreted as an aulos or a solid structure but is probably an aulos. Butler (1935, p. 116) based his redescription of *S. siluriense* primarily upon specimens from the Wenlock and lower Ludlow in England, none of which is necessarily conspecific with McCoy's figured specimen from the upper Ludlow.

Syringaxon adaense, new species

Pl. 28, fig. 7; pl. 29, fig. 7

Description. — The corallites here described are small, solitary, and trochoid. A typical specimen is no more than 14 to 16 mm in height. The cardinal septum is on the inside of curvature, and the calice is exceptionally deep for the size of the specimen. The surface shows well-developed septal grooves and faint transverse markings.

Major septa number 18 to 20 in ephebic stages and are straight and thickened. The location of primary septa cannot be readily determined. The contiguous axial ends of the major septa are thickened to form a large aulos with a diameter more than one-fourth that of the corallite in some specimens. The aulos is large and well developed even in late neanic and early ephebic growth stages. Minor septa are short, not contratingent, and are thickened like the major septa to form a peripheral stereozone one-fourth to one-third the radius in width.

Tabulae are horizontal and widely spaced in the aulos and are steeply inclined upward axially outside the aulos.

Material and occurrence. — *Syringaxon* and *Duncanella* are the only two genera which are widely distributed geographically and stratigraphically in the Henryhouse Formation. *Syringaxon* in the Henryhouse has not as yet been adequately studied and the formation may contain additional species. Small specimens which appear externally to belong to *Syringaxon* occur uncommonly at the following localities: P1-S,T, P1 (beds P, M), P12, P19, P7A, Ca1 (bed S), Ca2 (bed K), M1 (bed F), P4, M15 (bed E), M10 (bed G), C2 (bed D), M1 (bed B), P3 (bed R), M18 (bed I).

Undescribed specimens of *Syringaxon,* similar to *S. adaense,* occur in the Brownsport Formation at Graffham's locality 3.

Figured specimens. — Holotype OU 5521; paratype OU 5528.

Syringaxon acuminatum? (Simpson), 1900

Laccophyllum acuminatum Simpson, 1900, p. 212, figs. 7, 8, 9.

Discussion. — Simpson's figured specimens of *Syringaxon accuminatum* come from the Brownsport Formation of Tennessee, but this species is apparently uncommon in that formation because no specimens of it are in Amsden's (1949) large Brownsport coral collection.

Simpson's figures (1900, p. 212, figs. 8, 9) were based upon two thin sections (N. Y. State Museum) which I have examined. Unfigured specimens from the upper part of the Henryhouse Formation on the Lawrence uplift apparently belong to this species but have not as yet been adequately studied.

Family DITOECHOLASMATIDAE, new family

Typical genus. — *Ditoecholasma* Simpson, 1900.

Range. — The known range is Upper Silurian.

Diagnosis. — Solitary corallites with long contratingent minor septa which form septal pairs with adjacent major septa. The tabulae in these closed interseptal loculi (position I) are typically at a different inclination from those between the septal pairs (position II) and thus form two different cycles of peripheral tabulae. The cardinal and counter septa may bifurcate at their peripheral edges as they grow upward, and an axial structure is commonly developed. Third-order septa may be added in position I only.

Discussion. — Included in Ditoecholasmatidae, new family, are the two genera *Ditoecholasma* and *Saucrophyllum.* They have long contratingent minor septa, each of which forms a distinct septal pair with the adjacent major septum. The closed isosceles triangle so formed is here called position I for convenience of discussion. In ephebic stages in some specimens one or two third-order septa are added in the interseptal loculus (position I) of some or all of the septal pairs. These new septa, if they are long, tend to be contratingent with the adjacent major or minor septum. They are not marked on the exterior by separate septal grooves. Third-order septa are not added in the open area between septal pairs, herein referred to as position II.

The septal pattern here described is at variance with the typical arrangement in rugose corals and has some similarities with that found in the Carboniferous order Heterocorallia. A further study is being made of all known species of the genus *Ditoecholasma,* particularly of the type species *D. fanninganum* (Safford), in order to determine the detailed pattern of septal insertion in early growth stages. This study will be presented in a forthcoming paper. Third-order septa are uncommon in rugose corals and those described here differ from those found in Permian genera such as *Iranophyllum* (Douglas, 1936), in which the tertiary septa are developed between each major and minor septum.

In *Ditoecholasma* and to a less extent in *Saucrophyllum* the cardinal and counter septa, and less commonly the two long minor septa which flank the counter septum, may each bifurcate at their peripheral edges as they grow upward. Each such septal pair is marked externally by a single septal groove. No new septa have been observed to be added in these particular interseptal loculi. This peripheral septal bifurcation is somewhat similar to that found in some Mesozoic and Cenozoic scleractinian corals (Wells, 1956, p. 341).

The species studied show a difference in the angle of inclination of the tabulae in positions I and II, but this difference is more marked in some species than in others. Those in the closed interseptal loculi, position I, tend to slope downward axially and were developed at a distinctly earlier time than were adjacent plates in position II which tend to slope upward axially. New tabulae were added high in the corallite in position I at the same time new tabulae were added at a much lower elevation above the proximal end of the corallite in position II. This conclusion is supported by the fact that in both immature and mature corallites open spaces from the base of the calice extend much farther downward in position II than in position I (pl. 27, fig. 1c).

The development of two distinctly different series of peripheral tabulae, in corals such as *S. arbucklense,* has been misinterpreted in the literature primarily because of the misleading appearance in longitudinal section when the section cuts across a septum and intersects loculi of the two positions (pl. 27, fig. 2b; Amsden, 1949, pl. 25, fig. 5).

Ditoecholasma and *Saucrophyllum* have different types of axial structures, but they are placed in the same family because of the close similarity of their septal and tabular arrangements. These corals are mostly closely related in the arrange-

ment of the septa to the genus *Petraia* (family Petraiidae). No third-order septa have been reported in that genus and it has few or no tabulae (Schindewolf, 1931, p. 633).

Genus *Ditoecholasma* Simpson, 1900

Type species. — *Petraia fanningana* Safford, 1869; Upper Silurian, Brownsport Formation, Tennessee.

Diagnosis. — Ditoecholasmatidae with the axial edges of the septa lobed and forming an irregular, open axial structure with the appearance of twisted rods.

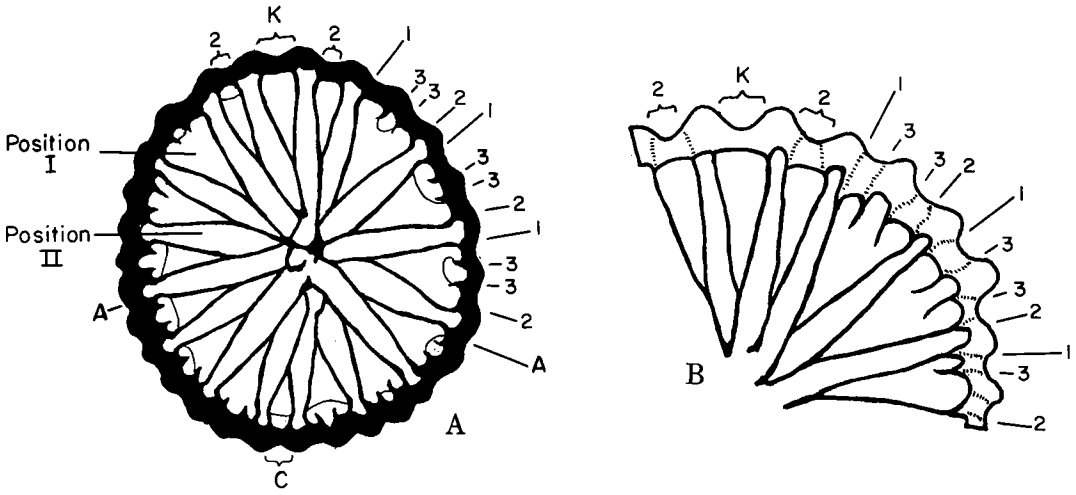
Discussion. — I have been unable to locate Safford's figured specimens of *Petraia fanningana* (1869, p. 320), from the Brownsport Formation of western Tennessee, which Simpson (1900, p. 200) designated as the type species for the genus. Safford's specimens apparently have never been sectioned. However, this common Brownsport species has been described and figured by Amsden (1949, p. 102, pl. 25, figs. 1-7). I have examined Amsden's collection (YPM) which includes three sectioned specimens and specimens from 19 localities from throughout the formation and have compared these specimens with two new species of *Ditoecholasma* here described from the Henryhouse Formation of Oklahoma.

Ditoecholasma lawrencense, new species

Pl. 32, figs. 1-4; text-fig. 21

Description. — The corals described here are small, solitary, and trochoid. The largest specimen in the collection is about 16 mm long and has a maximum diameter of about 9 mm. The exterior is marked by prominent, sharp interseptal ridges and septal grooves and by faint transverse growth lines. An attachment area may be developed but without radiciform processes.

Major septa number 12 to 14 in adult stages. Minor septa are four-fifths the length of the major septa and are contratingent. The two septa merge evenly in the ephebic stages and one radial plate extends on to the axis (text-fig. 21). At an early stage the cardinal and counter septa bifurcate at their peripheral edges forming septal pairs (pl. 32, fig. 2e), and the two minor septa adjacent to the counter septum may bifurcate peripherally in the ephebic stage (pl. 32, figs. 1e, 2a). These pairs are represented externally by a single groove for each pair. In most specimens two third-order septa are added in some of the interseptal loculi of position I (pl. 32, figs. 2b, 2c, 4b), and these tend to be contratingent with the adjacent major and minor septa composing the major pair. These new septa are not represented by separate septal grooves on the exterior. No new septa are added in position II and none is added in the loculi



Text-figure 21. *Ditoecholasma lawrencense,* new species, locality P6.

(1 = major septa; 2 = minor septa; 3 = third-order septa added in position I only)

A. Paratype OU 5539; early ephebic stage taken from a transverse thin section, x9. A late ephebic transverse section of the same specimen is shown on plate 32, figure 4a.

B. Holotype OU 5537; part of counter quadrant, late ephebic stage, x15; taken from thin section shown on plate 32, figures 2a and 2b. Tabulae are omitted.

formed by the peripheral splitting of septa. The axial structure is more open than in other species of the genus and is composed of twisted ropelike rods extending from the lobed axial edges of major septa.

Tabulae in position I are horizontal to slightly inclined downward toward the axis (pl. 32, fig. 2f and fig. 1c, left side) and they number about 10 in a vertical distance of 5 mm. Tabulae of this type also occur in the loculi formed by the bifurcated cardinal and counter septa and by the minor septa flanking the counter septum (pl. 32, figs. 1e, 1g). Tabulae in position II are arched steeply at the periphery and more gently near the axial region (pl. 32, fig. 1c, right side) and number about 5 or 6 in a vertical distance of 5 mm. Dissepiments are absent.

Discussion. — Minor septa are apparently added in sequence with the major septa in *Ditoecholasma lawrencense.* Earliest growth stages have not been studied, but a study of the well-developed septal grooves on specimen OU 5536 (pl. 32, fig. 1b) before sectioning showed no new septa added adjacent to the cardinal septum above the basal attachment area, but a major and a minor septum, each represented by a new groove, were added adjacent to each alar septum at a height of about 3.5 mm above the base. This insertion of new septa can be seen in figure 1f on plate 32. No additional major or minor septa are inserted in the specimen. Further increase in diameter of the corallite results from bifurcation of the cardinal and counter septa and a widening of the septal grooves accompanied in some specimens by the insertion of third-order septa.

D. lawrencense differs from both *D. rowetti,* also from the Henryhouse Formation, and *D. fanninganum,* from the Brownsport Formation of Tennessee, in size, shape, and external ornamentation. This species is short, trochoid, and has pronounced longitudinal grooves and ridges. *D. fanninganum* is more elongate and has less well-developed septal grooves. *D. fanninganum* has a greater number of septa for the same diameter than has either *D. lawrencense* or *D. rowetti* (text-fig. 22). The differences among the three species in the relation of height to septal ratio are well shown in text-figure 23.

Material and occurrence. — *D. lawrencense* is an uncommon species in the Henryhouse Formation and is represented by only six specimens in the University of Oklahoma collection, all from locality P6.

Figured specimens. — Holotype OU 5537; paratypes OU 5536, 5538, 5539.

Ditoecholasma rowetti, new species

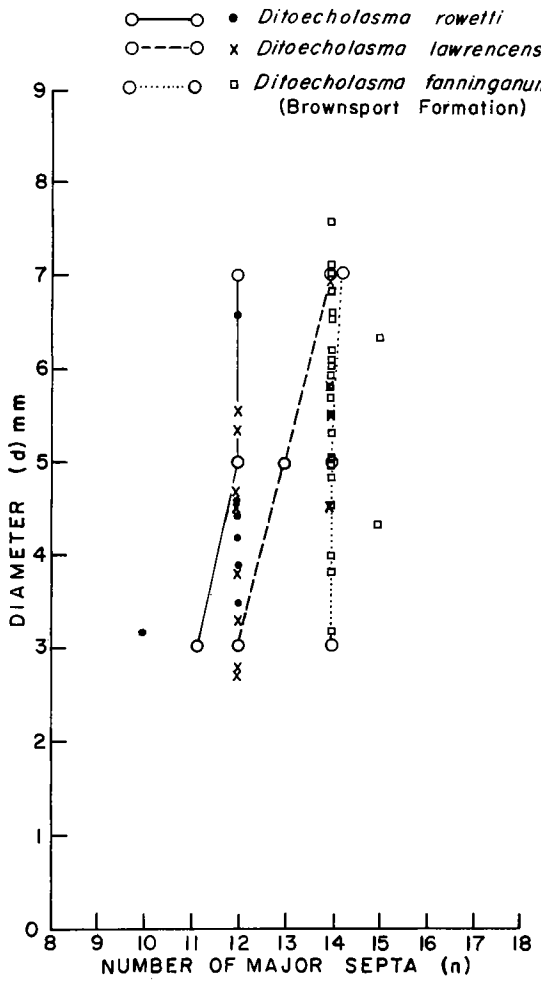
Pl. 31, figs. 1-3

Description. — This species has a small, solitary, cylindrical corallite which has a maximum observed height of slightly more than 30 mm and a maximum observed diameter of 6.6 mm. The surface is marked by fine growth lines which are tilted at about 30 degrees from the horizontal, and the rim of the calice has a corresponding tilt (pl. 31, fig. 3b). Longitudinal ribbing is absent or exceptionally faint. What appears to be scattered, large spine bases is present on two specimens, both with poorly preserved surfaces (pl. 31, figs. 1a, 2a). An attachment surface is developed but without radiciform processes.

Major septa number 12 in all adult stages preserved, but the number of specimens studied is small. In adult stages minor septa are about four-fifths the length of major septa and are contratingent. The two septa merge evenly and a single septum extends to the axis. At an early stage the cardinal and counter septa bifurcate as they grow upward, forming septal pairs inclosing interseptal loculi which are not so wide at the periphery as are adjacent loculi formed by a major septum and a minor septum. One or two third-order septa are commonly added to the latter type of interseptal loculi (position I) but not in the former (pl. 31, figs. 1d, 2c). This development of third-order septa is not a consistent feature. No third-order septa are added in the spaces between interseptal loculi (position II). The axial structure is typical for the genus. It is an open, spongy structure about one-fifth the diameter in width formed by swollen, twisted, ropelike axial lobes of major septa.

Tabulae in position I are closely spaced and are horizontal or inclined downward toward the axis at an angle of 10 to 21 degrees. Most are complete and extend across the interseptal loculus. They number about 10 within a vertical distance of 5 mm. Tabulae of position I also occur in the split loculi of the cardinal and counter septa. Tabulae in position II are arched upward toward the axis at an angle of about 45 degrees and number about 5 in a vertical distance of 5 mm (pl. 31, figs. 1b, 3d). Dissepiments are absent.

Discussion. — *Ditoecholasma rowetti* differs from *D. fanninganum,* from the Brownsport Formation of Tennessee, and from *D. lawrencense,* from the Henryhouse Formation, in being markedly slender and elongate, in having an almost smooth epitheca, in having a smaller number of septa (text-fig. 22), and in having more steeply inclined tabulae in position II. The differences



Text-figure 22. Relation of number of septa to diameter in *Ditoecholasma rowetti* and *D. lawrencense*, both from the Henryhouse Formation, and *D. fanninganum* from the Brownsport Formation.

among *D. rowetti, D. lawrencense,* and *D. fanninganum* in the relation of height to septal ratio are well shown in text-fig. 23.

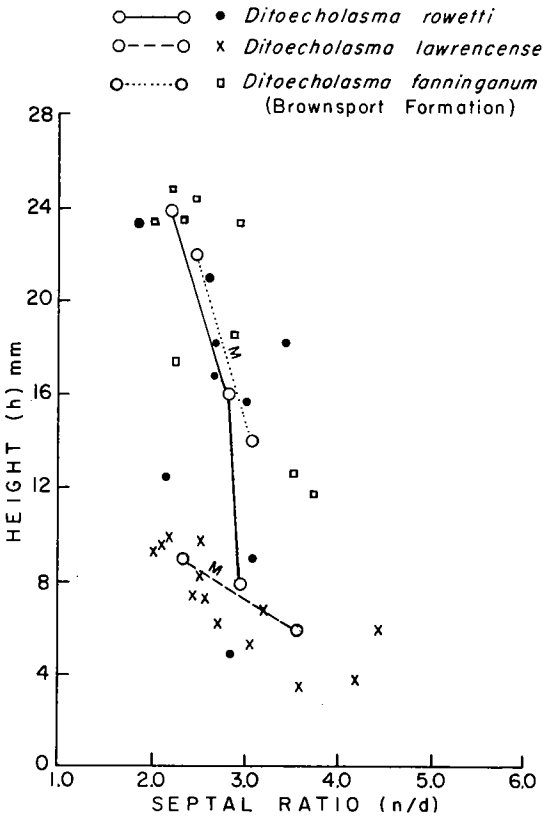
Material and occurrence. — This species is uncommon in the Henryhouse Formation and is represented in the University of Oklahoma collection by seven specimens, all from locality P6.

Figured specimens. — Holotype OU 5533; paratypes OU 5534, 5535.

Genus *Saucrophyllum* Philip, 1962

Type species. — *Saucrophyllum pocillum* Philip, 1962, p. 172; Upper Silurian, Boola Beds, Victoria, Australia.

Diagnosis. — Ditoecholasmatidae with the axial ends of the major septa commonly united to form an aulos.



Text-figure 23. Relation of height to septal ratio (n/d) in *Ditoecholasma rowetti* and *D. lawrencense*, based upon specimens from locality P6 only. Circles indicate mean values (M) computed by classes (class intervals, 6 and 4 mm).

Discussion. — Philip (1962, p. 172) erected *Saucrophyllum* as a subgenus of the genus *Syringaxon* primarily upon the basis of the occurrence of what he considered to be dissepiments in the spaces between the contratingent major and minor septa. I believe that the use of the term "dissepiment" is incorrect for these plates which are horizontal or slope downward axially and form a single series. I regard these plates as tabulae because most of them span the entire closed loculi and are not restricted to a peripheral zone (pl. 27, fig. 1b). I base this interpretation upon a study of the Henryhouse specimens and upon an examination of Philip's figured type specimens of *S. pocillum* from Australia. Philip figured two specimens. The holotype, University of Melbourne T1190-1, consists of two longitudinal sections, and a paratype, T1192-8, consists of seven transverse sections. I am indebted to Alan Pedder for providing me with photographs of sections of two unfigured paratypes (University of Melbourne T1200, T1505) which support the conclusions here drawn.

Saucrophyllum is considered to be a separate genus from *Syringaxon* because the two forms exhibit major differences. *Syringaxon* is presumed to include forms with a single series of peripheral tabulae which are inclined upward axially, thickened major and minor septa, and free or contratingent minor septa which are shorter than those in *Saucrophyllum.* Also, in *Syringaxon,* the minor septa are apparently inserted in a delayed cycle in the early ephebic stage (Butler, 1935, p. 121). In *Saucrophyllum* minor septa are apparently added in series with the major septa, but this point has not been adequately confirmed by a study of early growth stages.

Saucrophyllum is closely similar to the genus *Ditoecholasma* in the character of the septa and tabulae, and each may have peripherally split cardinal and counter septa. They have different types of axial structures.

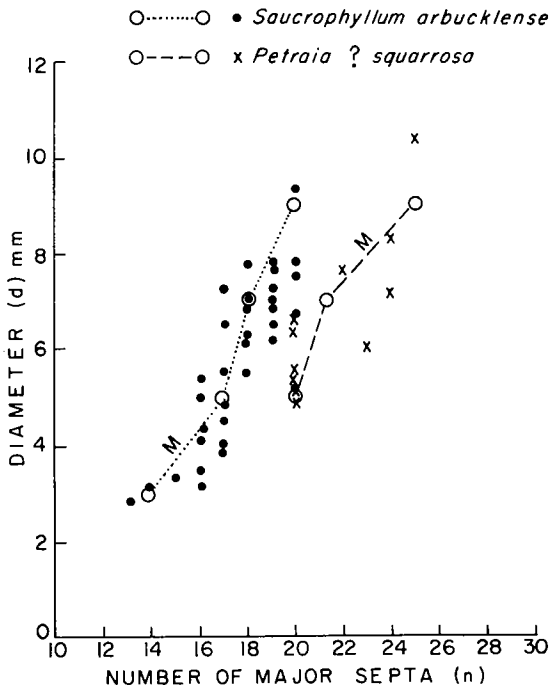
Saucrophyllum arbucklense, new species

Pl. 27, figs. 1-6; pl. 28, figs. 1-6

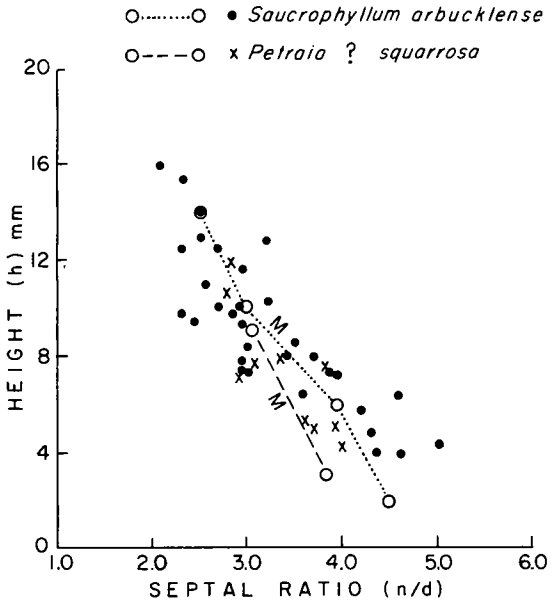
Description. — The corallites here described are small, solitary, and trochoid. The largest complete specimen in the collection is about 24 mm high and has a maximum diameter of 11.5 mm. The tion to curvature, but the location is basically consistent. The cardinal septum is on the side of attachment regardless of the direction of later curvature (compare pl. 27, figs. 1a and 3b). All specimens show a well-developed attachment surface which extends as high as 9 mm up the cardinal side of the corallite. The surface shows sharp, even septal grooves and interseptal ridges. Transverse markings are obscure.

Major septa typically number 18 to 20 in ephebic stages with the maximum observed being 20. The number of septa increases regularly as the diameter and height increase (text-figs. 24, 25). Minor septa are long and contratingent and are typically two-thirds to three-fourths the length of the major septa. Each merges so evenly with the adjacent major septum that the two cannot be differentiated in character in late ephebic stages, and the two form an isosceles triangle. The axial ends of the septa are rhopaloid and typically join axially to form an aulos of variable size and shape. In a few specimens an aulos is absent and the septal ends join axially to form a solid structure (pl. 27, fig. 5b). In no specimen has the aulos been observed to be greater than 1 mm wide or about one-sixth the diameter of the corallite. More typically the width of the aulos is no more than one-eighth the diameter.

In the ephebic stage the cardinal and counter septa commonly bifurcate at their peripheral mar-



Text-figure 24. Relation of number of septa to diameter in *Saucrophyllum arbucklense* and in *Petraia? squarrosa.* Circles indicate mean values (M) computed by classes (class intervals, 2 mm).



Text-figure 25. Relation of height to septal ratio (n/d) in *Saucrophyllum arbucklense* and in *Petraia? squarrosa.* Circles indicate mean values (M) computed by classes (class intervals, 4 and 6 mm).

gins as they grow upward. The resulting loculi may carry tabulae corresponding to those in position I (see *Discussion* under Family Ditoecholasmatidae). Less commonly the minor septa adjacent to the counter septum bifurcate in a like manner (pl. 27, fig. 3d). In a few specimens isolated third-order septa are present in position I only (pl. 27, fig. 2e).

Tabulae are flat and widely spaced in the aulos. Peripheral tabulae in the interseptal loculi between major septa and their adjacent minor septa (position I) are evenly spaced, mostly complete, and inclined downward toward the axis at an angle of 20 to 30 degrees from the horizontal (pl. 27, figs. 1b, 2b). Tabulae in the alternating locations (position II) are inclined upward axially at various angles from the horizontal and are widely spaced. The latter may be developed only in the lower part of the corallite leaving trenches open to the calice which are filled with matrix. Dissepiments are absent.

Material and occurrence. — *Saucrophyllum arbucklense* is the most common species at locality P6, in the lower 15 feet of the Henryhouse Formation on the Lawrence uplift. More than 200 specimens of this species are in the University of Oklahoma collection. The species occurs uncommonly at another locality (P5) in the lower part of the Henryhouse, and in the upper part of the formation at P1-S,T.

Figured specimens. — Holotype OU 5510; paratypes OU 5509, 5511, 5512, 5513, 5514, 5515, 5516, 5517, 5520; specimens OU 5518, 5519.

Family PETRAIIDAE de Koninck, 1872

Genus *Petraia* Münster, 1839

Type species. — *Petraia radiata* Münster, 1839, p. 42; Silurian, middle Ludlow, Bavaria.

Diagnosis. — Small, solitary corals with thin septa which either meet axially or form a poorly developed aulos. Minor septa are long and contratingent and are added in series with the major septa. Tabulae are few or absent. Dissepiments are lacking.

Petraia? squarrosa, new species
Pl. 29, figs. 1-6

Description. — The corals described here are small, solitary, and trochoid. They reach a maximum height of about 15 mm, and some specimens are oval in cross section with the greatest dimension along the cardinal-counter plane. All specimens show a large attachment structure formed by the early part of the corallite itself plus a major extension of the epitheca in the form of a large talon which completes the attachment structure (pl. 29, fig. 3a). The surface is marked by flat interseptal ridges and narrow, shallow septal grooves. The rim of the calice tends to flare slightly in late stages. The cardinal septum is on the side of earliest attachment, which is commonly, but not invariably, on the concave side of the corallite.

Major septa number about 20 at a diameter of 5.0 mm (septal ratio, 4.0) and increase to an observed maximum of 24 at a diameter of 8.4 mm (septal ratio, 2.9). Adult stages typically show 20 to 22 major septa (text-fig. 24). The relation of height to septal ratio is shown in text-figure 25. The major septa are long and commonly join in the axial region. A discontinuous aulos may be developed in some growth stages (pl. 29, fig. 5). Minor septa are long and contratingent. An exceptionally long minor septum occurs on each side of the counter septum and is contratingent with it.

Tabulae are possibly absent in this species, although one unfigured specimen which possibly belongs here shows a few tabulae in the interseptal loculi formed by contratingent major and minor septa (position I). Tabulae are apparently absent in the alternate spaces between septal pairs (position II), and matrix from the calice extends downward into the early part of the corallite in these spaces. Earliest growth stages have not been studied. The calice is exceptionally deep, being one-half to two-thirds the height of the specimen in depth. Dissepiments are absent.

Discussion. — The species described here is not typical of the genus *Petraia* as described by Schindewolf (1931) in having a poorly developed aulos in some specimens. The species may be more closely related to the genus *Saucrophyllum,* but most of the few specimens available for study show no indication of tabulae.

Material and occurrence. — *Petraia? squarrosa* occurs uncommonly in the upper coral beds on the Lawrence uplift (text-fig. 4) at localities P7A and P1-S,T. Ten specimens are in the University of Oklahoma collection.

Figured specimens. — Holotype OU 5526; paratypes OU 5522, 5523, 5524, 5525, 5527.

Family METRIOPHYLLIDAE Hill, 1939

Genus *Duncanella* Nicholson, 1874

Type species. — *Duncanella borealis* Nicholson, 1874, p. 334; Upper Silurian, Waldron Formation, Indiana.

Diagnosis. — Small, solitary, ceratoid to cylindrical corals with septa which unite axially. Major septa may be flanged. Tabulae are widely spaced. Dissepiments are absent.

Discussion. — The characters of *Duncanella borealis,* the type species, are not well known and the location of the type specimens is uncertain. Dorothy Hill has informed me that what are possibly Nicholson's original specimens (1874, p. 334) are in the Nicholson Collection at Aberdeen University, Scotland. In 1960 she examined these specimens but did not compare them with Nicholson's published figures. She recorded that in cabinet II, drawer 13, are five specimens labelled *Duncanella borealis* Nicholson, Niagaran Group, Middle Silurian, Indiana. They are numbered 310 and one has a transverse polished surface and another a longitudinal polished surface. These are possibly the specimens from which Nicholson's drawings were made. In cabinet II, drawer 14, are five uncut specimens, also from Indiana, with the number 449. However, William A. Oliver, Jr., has informed me that an unsectioned specimen from the James Collection, now in the Chicago Museum of Natural History, is labelled as being the holotype for this species. It is apparently not one of the specimens illustrated. A further study of both collections is needed.

I have examined a number of undescribed sectioned specimens in the U. S. National Museum collection (42919) from the Waldron Formation at Waldron, Indiana, collected by C. E. Beecher in 1899. These specimens apparently belong to *D. borealis.* Most of the specimens in this collection are not well preserved and are much recrystallized. In the ephebic stages these specimens show 16 to 18 major septa (text-fig. 26) which are straight and join at the axis. In most specimens the septa are thickened and appear in transverse section to be either flanged or tuberculate. No good longitudinal sections are available.

Duncanella pontotocensis, new species

Pl. 33, figs. 1-5; pl. 34, fig. 8

Description. — Small, solitary, turbinate corals which reach a maximum observed height of about 15 mm and a maximum diameter of 5 to 6 mm. Most specimens are about 10 mm high. They are marked externally by well-developed, rounded interseptal ridges and shallow septal grooves. Transverse markings are faint except for minor restrictions resulting from rejuvenescence (pl. 33, fig. 1a). Many specimens have a low cone at the apical end 1 to 2 mm in diameter which lacks an epitheca and exposes up to a dozen major septa (pl. 33, fig. 1a, base; see *Discussion).*

Major septa number 14 to 16 in ephebic stages (text-fig. 26) and join at the axis except at the base of the calice where they may withdraw slightly, forming an auloslike pit. The septa are flanged parallel to their upper surfaces, and in transverse section they have an irregular, wavy appearance resulting from the low-angle intersection of the flanges. Minor septa differ in length, being as much as two-thirds the length of the major septa in some specimens (pl. 33, fig. 2b). The longer minor septa tend to bend toward the adjacent major septum.

Tabulae are widely spaced and slope downward toward the axis (pl. 33, figs. 1c, 5). They are irregularly spaced and number about 3 to 6 in a vertical distance of 5 mm. Dissepiments are absent.

Discussion. — *Duncanella pontotocensis* is one of the more widely occurring species in the Henryhouse Formation. It shows marked variability in character, and it is possible that more than one species is represented among the many specimens which have not been sectioned.

D. pontotocensis differs from *D. borealis* in having fewer septa at a comparative diameter (text-fig. 26), in having septa which are much more distinctly flanged, and apparently in having longer minor septa. However, the number of sectioned specimens of both species which have been compared is too small for adequate evaluation.

The origin and significance of the apical exposure of septa in many specimens are not clear. Nicholson (1874, p. 333) described the same feature in *D. borealis.* Abrasion appears to be the most likely answer, but the feature can be seen in some specimens where the surface features are otherwise exceptionally well preserved (pl. 33, fig. 1a). Possibly the epitheca was thinner in the early stages of these species, or possibly these corals secreted one composed of some organic material which would be readily removed. Further study is needed in order to evaluate this feature

which occurs as well on specimens of *Duncanella* in the Haragan Formation of Oklahoma.

Material and occurrence.—*Duncanella* is a widely occurring genus in the Henryhouse Formation but too few specimens have been sectioned to conclude that all belong to a single species. *Duncanella* occurs commonly at localities P1 (beds R, Q), P4 (bed A), P3 (beds S, T, V), M2 (bed E), M18 (bed I), Ca1 (beds M, O, Q), and Ca2 (beds G, K).

Undescribed specimens of *Duncanella,* similar to *D. pontotocensis,* occur in the Brownsport Formation at Graffham's locality 1.

Figured specimens.—Holotype OU 5540; paratypes OU 5541, 5542, 5543, 5544, 5545.

Family POLYCOELIIDAE Roemer, 1883

Genus *Pseudocryptophyllum* Easton, 1944

Type species.—*Pseudocryptophyllum cavum* Easton, 1944; Mississippian, Chouteau Formation, Missouri.

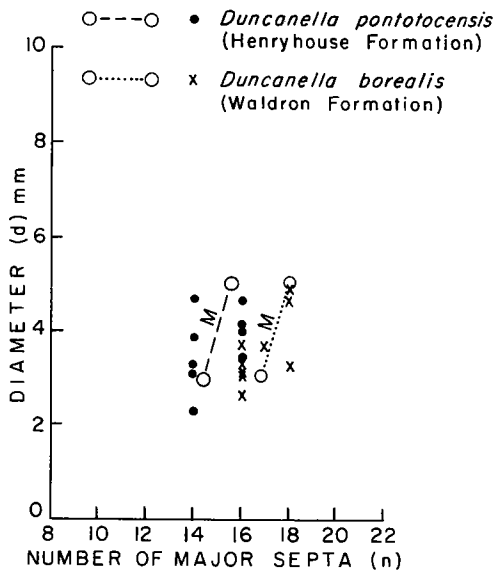
Cf. *Pseudocryptophyllum* sp. A

Pl. 34, figs. 1-4

Description.—Seven small trochoid specimens are 12 to 15 mm high and have rounded interseptal ridges and shallow septal grooves. Internally, six protosepta are prominent and extend to the axis (pl. 34, fig. 1b). Other septa are restricted to the peripheral wall. In one specimen (pl. 34, fig. 2) a study of the external septal grooves shows new septa added adjacent to the cardinal and alar septa, but these are confined to the wall on the interior. The total number of septal grooves at the height of 4.4 mm above the base is 24. One specimen (pl. 34, fig. 4) shows only four extended septa. No tabulae or dissepiments are apparently developed, but early growth stages have not been studied.

Discussion.—The specimens here described do not compare closely to any known Silurian coral. They are similar in the prominence of the primary septa to the Carboniferous and Permian genus *Pseudocryptophyllum,* and they are tentatively compared with that genus until their features are better known. They have a particular resemblance in transverse section to the Permian species *P. primitivum* (Soshkina) from Russia (Hill, 1956, p. 263).

The Devonian genus *Oligophyllum* also shows prominent protosepta, but in that genus the counter septum is short and the counter-lateral septa are thickened (Počta, 1902, p. 192).



Text-figure 26. Relation of number of septa to diameter in *Duncanella pontotocensis* (Henryhouse Formation) and *D. borealis* (Waldron Formation). Circles indicate mean values (M) computed by classes (class intervals, 2 mm).

Material and occurrence.—Seven specimens are in the University of Oklahoma collection from the Henryhouse Formation, four from locality P6 and one each from localities M10 (bed G), P7A, and P1-S,T.

Figured specimens.—OU 5546, 5547, 5548, 5549.

Genus *Anisophyllum* Edwards and Haime, 1850

Type species.—*Anisophyllum agassizi* Edwards and Haime, 1850, p. lxvi; Upper Silurian, Brownsport Formation, Tennessee.

Anisophyllum? sp.

Pl. 34, fig. 5

Description.—A single specimen is 13.5 mm in maximum height and 11.0 mm in maximum diameter at the rim of the calice. It is externally marked by rounded interseptal ridges and shallow septal grooves. The counter side of the specimen is missing, and figures 5a and 5b on plate 34 show two different views toward the cardinal septum inside the deep calice. The cardinal septum is marked externally by the addition of new septal grooves adjacent to it. Seven major septa are in each quadrant between the cardinal and each alar septum. Internally these septa are represented by rounded ridges. The alar and cardinal septa extend

to the axial region below a height of 3 mm but are withdrawn at a greater height. At a height of about 3 mm the cardinal septum extends to the axial region, where it is slightly rhopaloid and is free of its axial end. The character of the counter septum is unknown, but it did not extend to the axial region. Tabulae and dissepiments are absent.

Discussion. — The specimen described here differs from *Anisophyllum agassizi,* from the Brownsport Formation of Tennessee, in having much thinner cardinal and alar septa which extend to the axial region only in the early part of the coral.

Material and distribution. — A single specimen from USNM locality 1, near P1-S,T.

Figured specimen. — USNM 145284.

Genus *Oligophyllum* Počta, 1902

Type species. — *Oligophyllum quinqueseptatum* Počta, 1902; Middle Devonian, Bohemia.

Cf. *Oligophyllum* sp.
Pl. 34, fig. 10

Description. — A single specimen is large and incomplete. The early portion is missing but the remaining fragment is about 40 mm high and has a maximum diameter at the calice of 28 mm. The original height could have exceeded 50 mm. The single section illustrated (pl. 34, fig. 10) was taken about 37 mm below the rim of the calice. The shape is trochoid to ceratoid, and the exterior is marked by rounded interseptal ridges and shallow septal grooves. The depth of the calice is exceptional, being apparently about 30 mm. An attachment area 10 mm wide extended up the side of the specimen possibly for 20 mm.

The number of septa cannot be determined with certainty but it appears to be about 22 to 24 at a diameter of 9.5 mm (pl. 34, fig. 10). All septa are much thickened and of variable length. Four symmetrically arranged septa, presumably the cardinal, counter, and two alar, are longer than the others. They are much thickened and some are rhopaloid. Tabulae cannot be detected in the single transverse section and dissepiments are absent.

Discussion. — The specimen described here does not compare closely to any described genus. It is here compared tentatively to the Devonian genus *Oligophyllum,* which has thickened septa but a different arrangement of the protosepta, until additional material is available for study.

Material and occurrence. — A single specimen from locality Ca1 (bed S), in the upper part of the Henryhouse Formation in the western Arbuckle Mountains region.

Figured specimen. — OU 5553.

Family HAPSIPHYLLIDAE Grabau, 1928

Genus *Allotropiophyllum* Grabau, 1928

Type species. — *Allotropiophyllum sinense* Grabau, 1928, p. 130; Lower Permian, China.

Cf. *Allotropiophyllum* sp.
Pl. 34, fig. 9

Description. — A single small, trochoid specimen has a maximum height of 17.3 mm and a maximum diameter of 1.1 mm. The specimen is slightly curved and the cardinal septum is on the inside of the slightly curved specimen. The calice is exceptionally deep. The exterior is marked by faint longitudinal ridges and grooves. A small attachment surface is preserved at the base of the specimen on the concave side of the corallite.

At a height of 5.0 mm above the proximal end are 18 long major septa. Those in the counter quadrants fuse at their axial ends to form a narrow crescentic area on the counter (convex) side of the specimen. Each septum in the cardinal quadrants bends slightly away from the long cardinal septum which extends to the axial region. At a height of 6.1 mm above the proximal end the cardinal septum and other septa in the cardinal quadrants shorten to about two-thirds their earlier length (pl. 34, fig. 9). Minor septa are absent. Tabulae are widely spaced and dissepiments are absent.

Discussion. — Lower Paleozoic zaphrentoid corals are not common and are not well known. The coral described here is tentatively compared with the Carboniferous and Permian genus *Allotropiophyllum* until further material is available for study.

Material and distribution. — A single specimen from locality P6 in the lower part of the Henryhouse Formation.

Figured specimen. — OU 5552.

Incertae Sedis

Genus and Species Undetermined
Pl. 34, fig. 6

Description. — A single small trochoid specimen here described has a maximum height of 16.7

mm and a maximum diameter of 7 mm. The surface is marked by fine septal grooves and by two or three widely spaced, minor transverse restrictions. The early portion of the specimen is slightly curved at a right angle to the later tilt of the calice (pl. 34, fig. 6a). The calice is shallow, being only about 2 mm deep.

Major septa number 16 at a diameter of 3.3 mm and at a height of 3.4 mm above the base (pl. 34, fig. 6e). At this stage the major septa are long and join axially in several pinnate bundles, but no axial structure is present. Minor septa are absent. Location of the primary septa is uncertain. At a height of 5.2 mm, at a diameter of 4.0 mm (pl. 34, figs. 6d, 6f), are 17 major septa withdrawn slightly from the axis. The major septa continue to become shorter in higher growth stages, and at a height of 10.0 mm, at a diameter of 6.5 mm (pl. 34, fig. 6c), the septa are exceptionally short and are represented only by ridges on the inside of the thin epitheca. Tabulae are horizontal, widely spaced, and complete. Dissepiments are absent.

Discussion. — The coral here described does not compare closely with any known genus but the material is insufficient for adequate description.

Material and occurrence. — A single specimen from locality P6 in the lower part of the Henryhouse Formation.

Figured specimen. — OU 5550.

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HENRYHOUSE RUGOSE CORALS

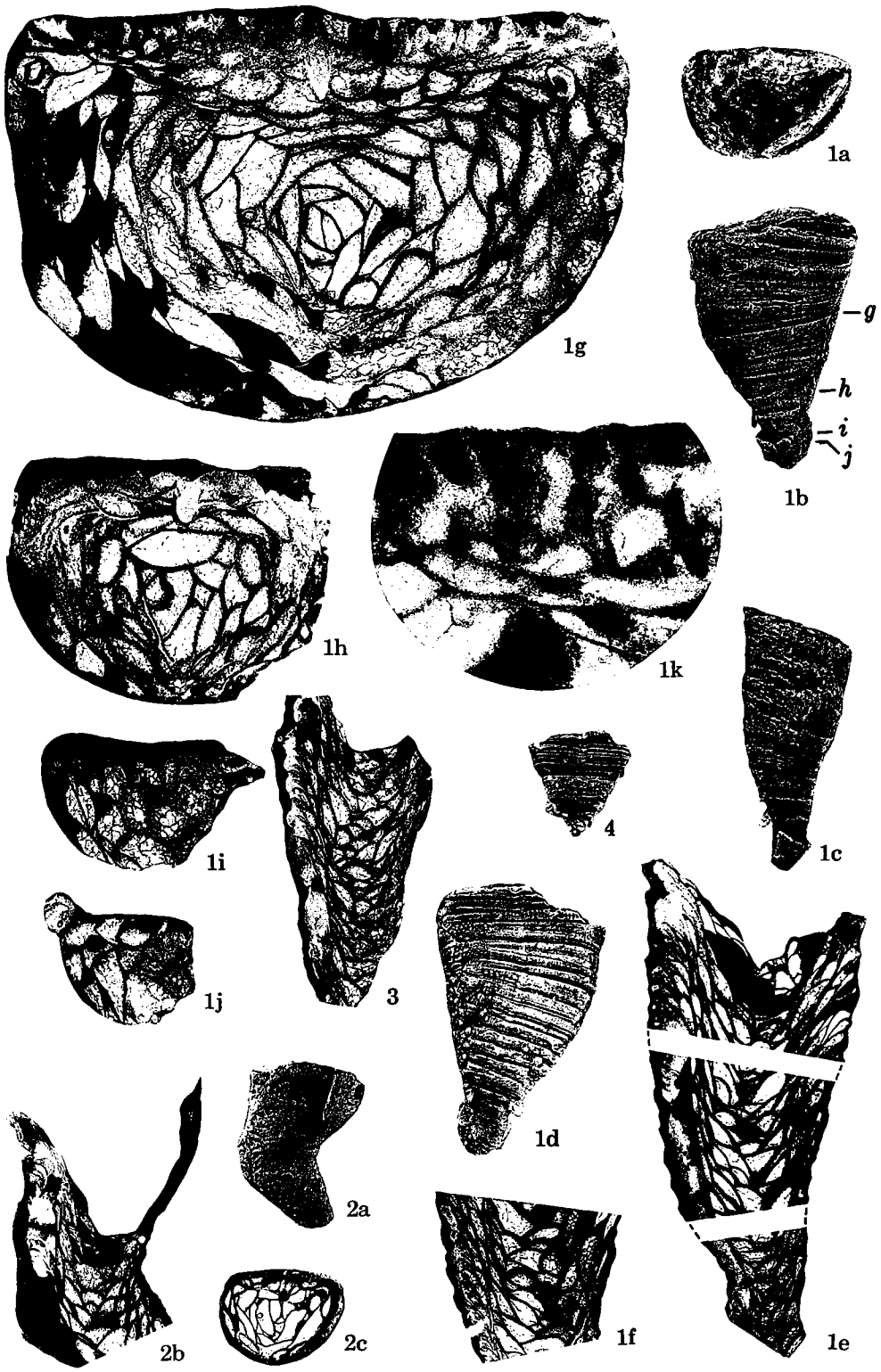
PLATES 1-34

Species	Plate(s)
Cf. *Allotropiophyllum* sp.	34
Amsdenoides acutiannulatus	7-12
Anisophyllum? sp.	34
Capnophyllum hedlundi	19, 20
Capnophyllum sp. A	20, 21
Cystiphyllum? henryhousense	13-16
Ditoecholasma lawrencense	32
Ditoecholasma rowetti	31
Duncanella pontotocensis	33, 34
Entelophyllum cf. *E. angulare*	21, 22
Entelophyllum sp. A	18
Enterolasma cf. *E. waynense*	30, 31
Micula? catilla	17, 18
Cf. *Oligophyllum* sp.	34
Oliveria planotabulata	25, 26
Petraia? squarrosa	29
Phaulactis? lanx	18
Cf. *Pseudocryptophyllum* sp. A	34
Rhizophyllum applanatum	1, 2
Rhizophyllum oklahomense	3
Rhizophyllum cf. *R. oklahomense*	3
Saucrophyllum arbucklense	27, 28
Spongophylloides cockei	4-6
Spongophylloides sp. X	6
Syringaxon adaense	28, 29
Tryplasma cf. *T. radiculum*	23-25
Undetermined genus and species	34
Zelophyllum? sp.	34

Plate 1

Page

1. *Rhizophyllum applanatum,* new species, holotype OU 5411, locality P7A. 13
   - a. Exterior view of calice, partly filled with matrix, x1.
   - b-d. Cardinal, side, and counter views, x1; note irregularly spaced bases of large radiciform processes along vertical margin of flat counter surface.
   - e. Longitudinal section bisecting counter septum, which is to the left, x2; counter septum is mostly silicified.
   - f. Longitudinal section offset from counter septum, x2; counter side of specimen is to the left.
   - g-i. Transverse sections through ephebic stages, x4.
   - j. Neanic transverse section, x4; note hollow radiciform process at left.
   - k. Enlargement of counter margin shown in figure g to show acanthine septal spines, x14.
2. *Rhizophyllum applanatum,* new species, paratype USNM 145270, USNM locality 1, near locality P1-S,T. 13
   - a. Exterior side view, x1; counter at left.
   - b. Longitudinal section bisecting partly silicified counter septum at left, x2; note deep, erect calice.
   - c. Early ephebic transverse section, x2; note closely spaced septa on curved wall.
3. *Rhizophyllum applanatum,* new species, paratype OU 5412, locality P7A. Longitudinal section bisecting counter septum at left, x2. 13
4. *Rhizophyllum applanatum,* new species, paratype OU 5413, locality P1-S,T. Exterior counter view of immature specimen, x1. 13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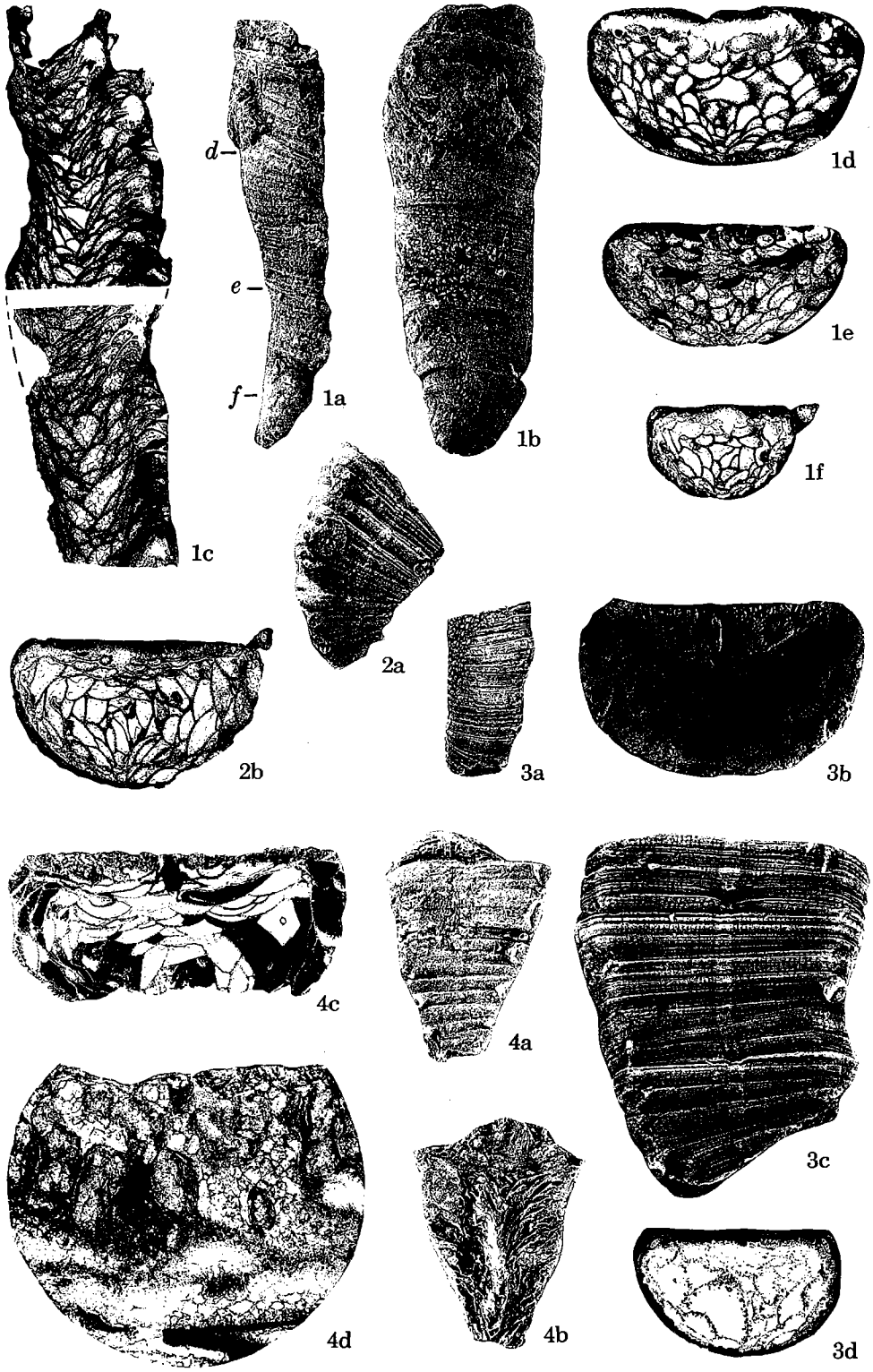
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Plate 2

Page

1. *Rhizophyllum applanatum,* new species, paratype USNM 145271, USNM locality 1, near locality P1-S,T. 13
   a, b. Exterior side and cardinal views of cast, x1.
   c. Longitudinal section bisecting counter septum, which is to the right, x1; partly silicified.
   d-f. Transverse sections through ephebic stages, x2; partly silicified.
2. *Rhizophyllum applanatum,* new species, paratype USNM 145272, USNM locality 1, near locality P1-S,T. 13
   a. Exterior view of tilted specimen showing row of spines along angular margin of flat counter surface, which is to the right, x1; note marked curvature of specimen.
   b. Ephebic transverse section, x2; specimen partly silicified; note hollow radiciform process at right.
3. *Rhizophyllum applanatum,* new species, paratype OU 5414, locality 5 miles south of Ada, Oklahoma, on Lawrence uplift. 13
   a. Exterior side view, x1; counter at right.
   b. Exterior view of calice, x2.
   c. Exterior counter view, x2; note marginal bases of radiciform processes.
   d. Ephebic transverse section, x2; specimen mostly silicified.
4. *Rhizophyllum applanatum,* new species, paratype USNM 145273, USNM locality 1, near locality P1-S,T. 13
   a. Exterior counter view, x1; note large, widely spaced bases of radiciform processes along margins of flat surface.
   b. Weathered exterior view of rounded cardinal surface, x1.
   c. Ephebic transverse section, x2.
   d. Enlargement of flat wall in figure c, x14.

Plate 3

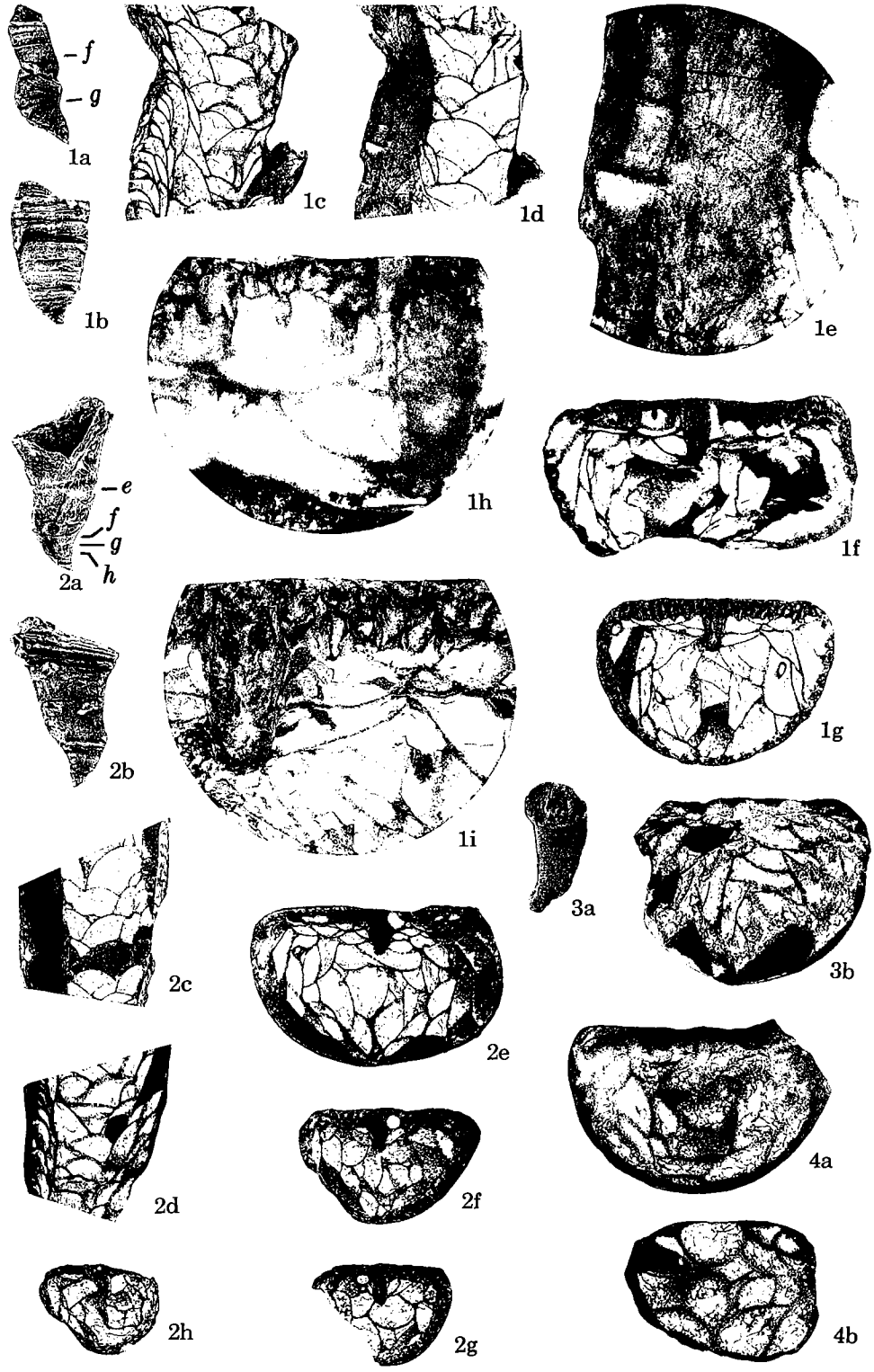
Page

1. *Rhizophyllum oklahomense,* new species, holotype OU 5415, locality P1-S,T. 15
   - a. Exterior side view, x1; counter side at left.
   - b. Exterior counter view, x1; note large spines along margins of flat surface.
   - c. Longitudinal section offset from counter septum, x4; counter side is to the left.
   - d. Longitudinal section bisecting counter septum, which is on the left, x4.
   - e. Enlargement of figure d to show character of counter septum, x14.
   - f, g. Ephebic transverse sections, x4.
   - h, i. Enlargements of figures f and g to show character of septa on flat counter surface, x14.

2. *Rhizophyllum oklahomense,* new species, paratype OU 5416, locality P1-S,T. 15
   - a, b. Exterior cardinal and counter views, x1.
   - c. Longitudinal section bisecting counter septum, which is on the left, x4.
   - d. Longitudinal section offset from counter septum, x4; counter side is to the left.
   - e-g. Ephebic transverse sections, x4.
   - h. Neanic transverse section, x4.

3. *Rhizophyllum oklahomense,* new species, specimen OU 5417, locality P1-S,T. 15
   - a. Exterior side view, x1; counter side to the right.
   - b. Ephebic transverse section, x4.

4. *Rhizophyllum* cf. *R. oklahomense,* new species, specimen OU 5418, locality P1-S,T. 15
   - a. Ephebic transverse section, x4.
   - b. Neanic transverse section, x4; note oval shape of section and lack of development of an elongate counter septum.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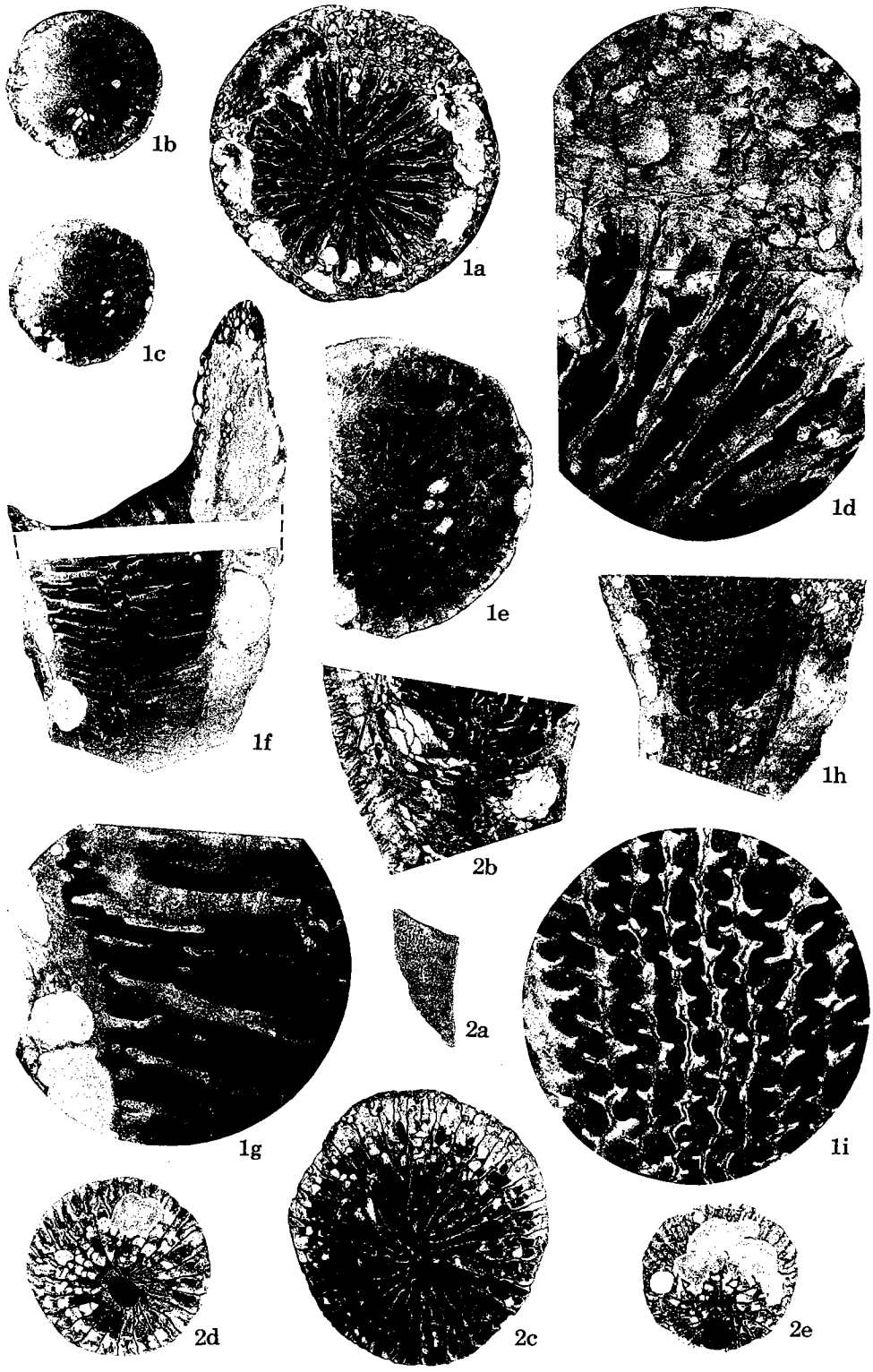
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Plate 4

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1. *Spongophylloides cockei,* new species, holotype OU 5419, locality P7A. 16
   - a. Ephebic transverse section, x4.
   - b, c. Neanic transverse sections, x4; silicified on the left.
   - d. Enlargement of figure a, x14.
   - e. Enlargement of figure c, x8; note peripheral septal stereozone and two isolated dissepiments at right.
   - f. Longitudinal section along cardinal-counter plane, x4; cardinal side is to the left.
   - g. Enlargement of figure f, x14; note horizontal septal flanges.
   - h. Longitudinal section parallel to but offset from cardinal-counter plane, x4; compare with figure g.
   - i. Enlargement of figure h, x14; note zigzag carinae.
2. *Spongophylloides cockei,* new species, paratype OU 5420, locality P7A. 16
   - a. Exterior side view, x1; cardinal side is to the right; surface features obliterated.
   - b. Longitudinal section along cardinal-counter plane, x4; cardinal side is to the left.
   - c-e. Ephebic transverse sections, x4; part of peripheral stereozone is missing as a result of abrasion.

Plate 5

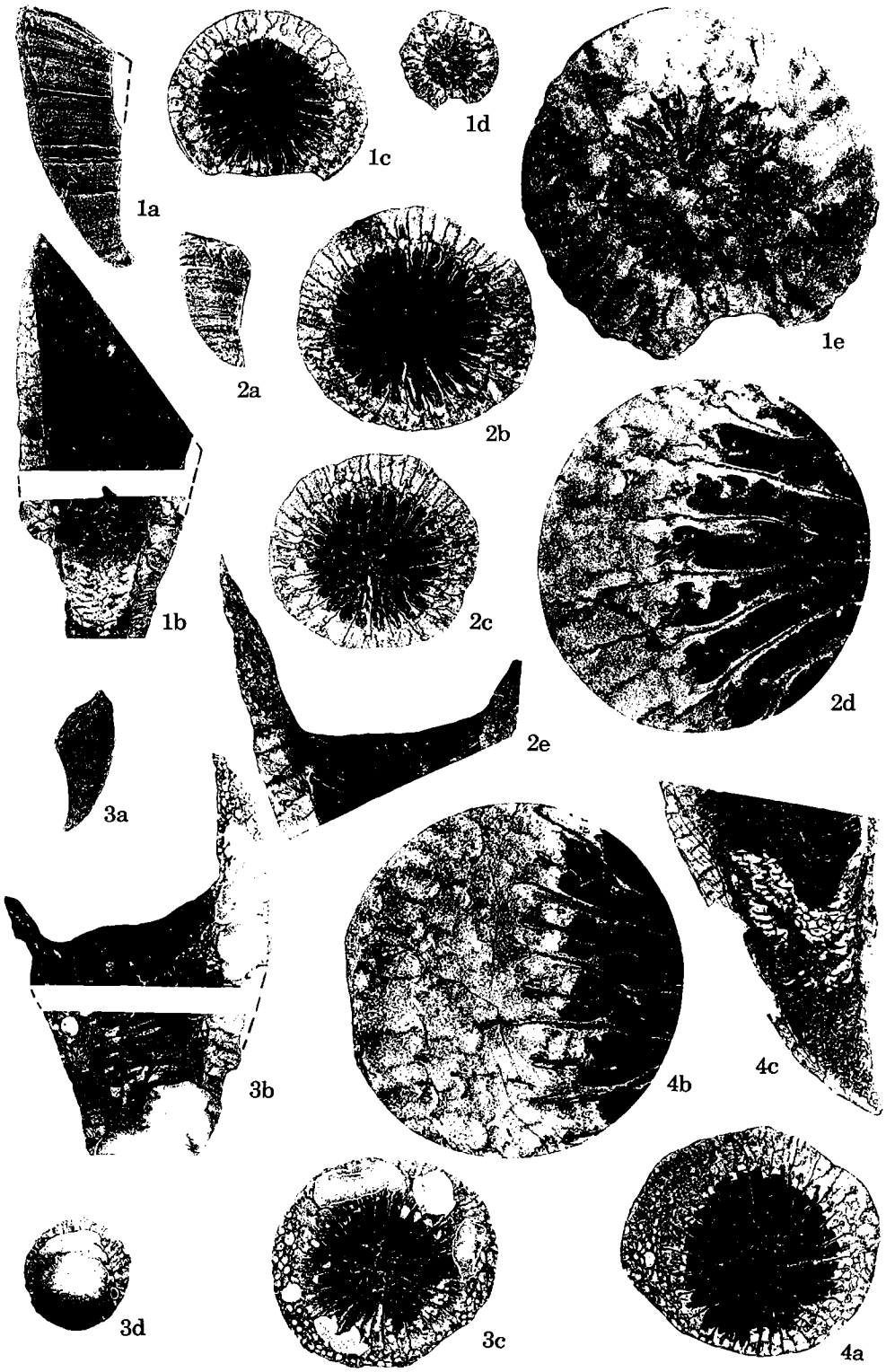
Page

1. *Spongophylloides cockei,* new species, paratype OU 5421, locality P19. 16
   a. Exterior side view, x2; cardinal side to the right.
   b. Longitudinal section along cardinal-counter plane, x4.
   c. Ephebic transverse section, x4; note sparse dissepiments at right of section.
   d. Neanic transverse section, x4.
   e. Enlargement of figure d, x14; note wide peripheral septal stereozone and absence of dissepiments.

2. *Spongophylloides cockei,* new species, paratype OU 5422, locality P7A. 16
   a. Exterior side view, x1; cardinal side to the right; note well-preserved surface ornamentation.
   b, c. Ephebic transverse sections, x4; note uncommon dissepiments in peripheral septal stereozone.
   d. Enlargement of figure c, x14.
   e. Longitudinal section through calice, x4; cardinal side to the right.

3. *Spongophylloides cockei,* new species, paratype OU 5423, locality P15A. 16
   a. Exterior side view, x1; surface ornamentation poorly preserved.
   b. Longitudinal section, x4; cardinal side to the left; partly silicified.
   c. Ephebic transverse section, x4; partly silicified.
   d. Neanic transverse section, x4; partly silicified but shows lack of dissepiments in peripheral septal stereozone.

4. *Spongophylloides cockei,* new species, paratype OU 5424, locality P7A. 16
   a. Ephebic transverse section, x4.
   b. Enlargement of section a, x14.
   c. Longitudinal section, x4; cardinal side to the right.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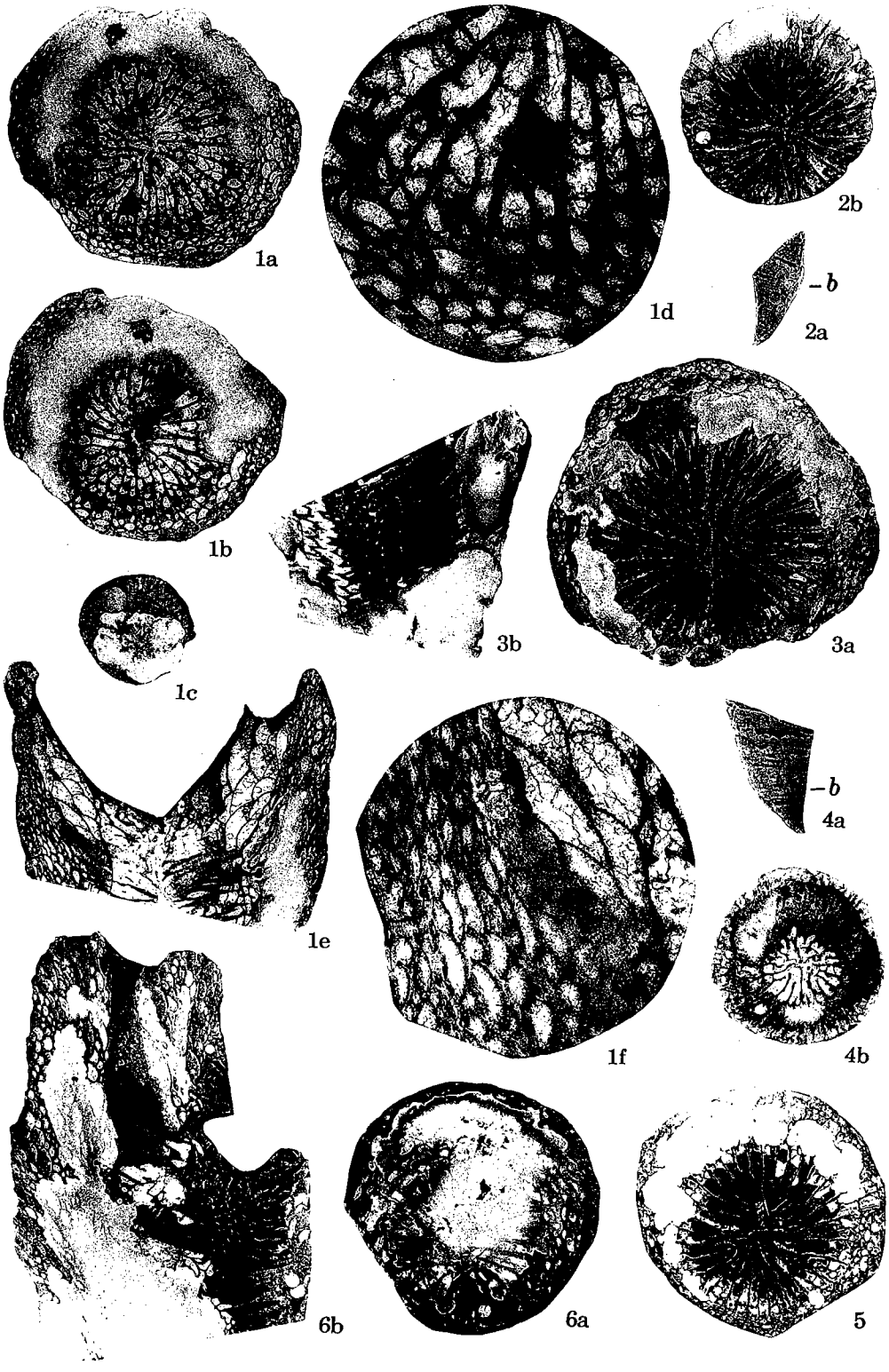
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Plate 6

Page

1. *Spongophylloides* sp. X, specimen OU 5425, locality P7A. 18
   a, b. Ephebic transverse sections, x4.
   c. Neanic transverse section, x4; partly silicified but shows development at this stage of peripheral septal stereozone and absence of dissepiments.
   d. Enlargement of figure a, x14.
   e. Longitudinal section through calice, x4.
   f. Enlargement of figure e, x14.

2. *Spongophylloides cockei,* new species, specimen OU 5426, locality P15A. 16
   a. Exterior side view, x1; cardinal side to the left; surface ornamentation obliterated.
   b. Ephebic transverse section, x4; part of peripheral stereozone missing.

3. *Spongophylloides cockei,* new species, paratype OU 5427, locality P7A. 16
   a. Late ephebic transverse section, x4; partly silicified; part of peripheral stereozone missing.
   b. Longitudinal section, x4; cardinal side to the left.

4. *Spongophylloides cockei,* new species, specimen OU 5428, locality P7A. 16
   a. Exterior side view, x1; cardinal side to the right.
   b. Early ephebic transverse section, x4; note uncommonly wide peripheral stereozone.

5. *Spongophylloides cockei,* new species, paratype OU 5429, locality P7A. Ephebic transverse section, x4; partly silicified. 16

6. *Spongophylloides* sp. X, specimen USNM 145274, USNM locality 4, near upper part of locality P3. 18
   a. Ephebic transverse section, x4; partly silicified.
   b. Longitudinal section, x4; calice crushed.

Plate 7

(All specimens are from the Brownsport Formation, Tennessee)

Page

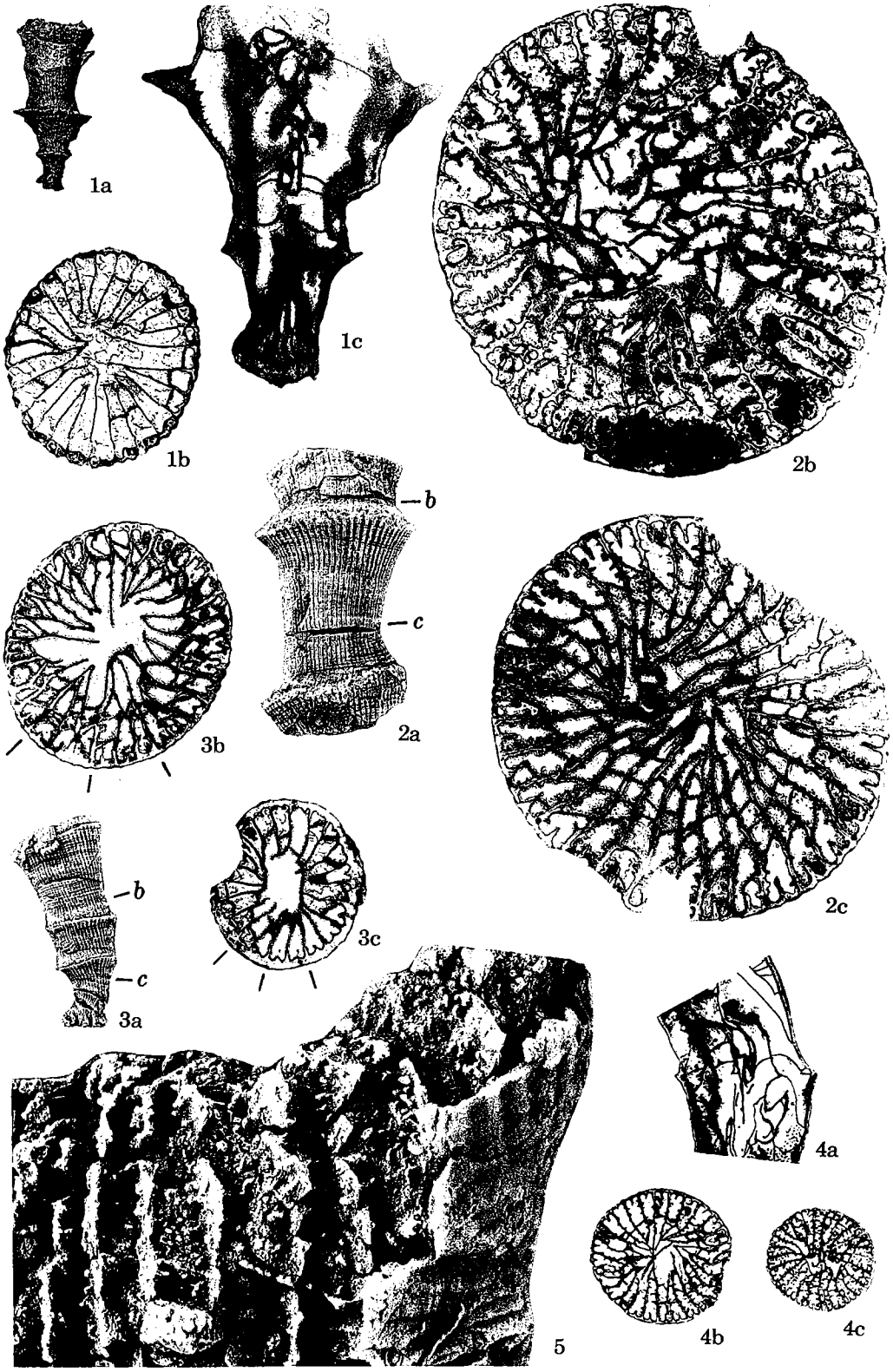
1. *Amsdenoides acutiannulatus* (Amsden), holotype YPM 17665; locality 11(36) (Amsden, 1949). 19
   a. Exterior side view, x1; note attachment structure (from Amsden, 1949, pl. 15, fig. 9).
   b. Ephebic transverse section, x4; orientation uncertain. New photograph of section figured by Amsden (1949, pl. 15, fig. 10).
   c. Longitudinal section, x4. New photograph of section figured by Amsden (1949, pl. 15, fig. 8).

2. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5430, Graffham locality 2. 19
   a. Exterior side view, x1; fragment of an exceptionally large specimen.
   b, c. Ephebic transverse section, x4; orientation in relation to primary septa unknown; bottom of each photograph is at front of exterior side view in figure a.

3. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5431, Graffham locality 2. 19
   a. Exterior side view, x1; cardinal side to the right.
   b, c. Ephebic transverse sections, x4.

4. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5432, Graffham locality 2. 19
   a. Longitudinal section, x2; cardinal side to the right.
   b, c. Ephebic transverse sections, x2.

5. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5433, Graffham locality 2. 19
   Weathered, exposed septa on highest part of specimen figured in plate 8, figure 1a, reverse side, x8; note tubercles on sides of septa.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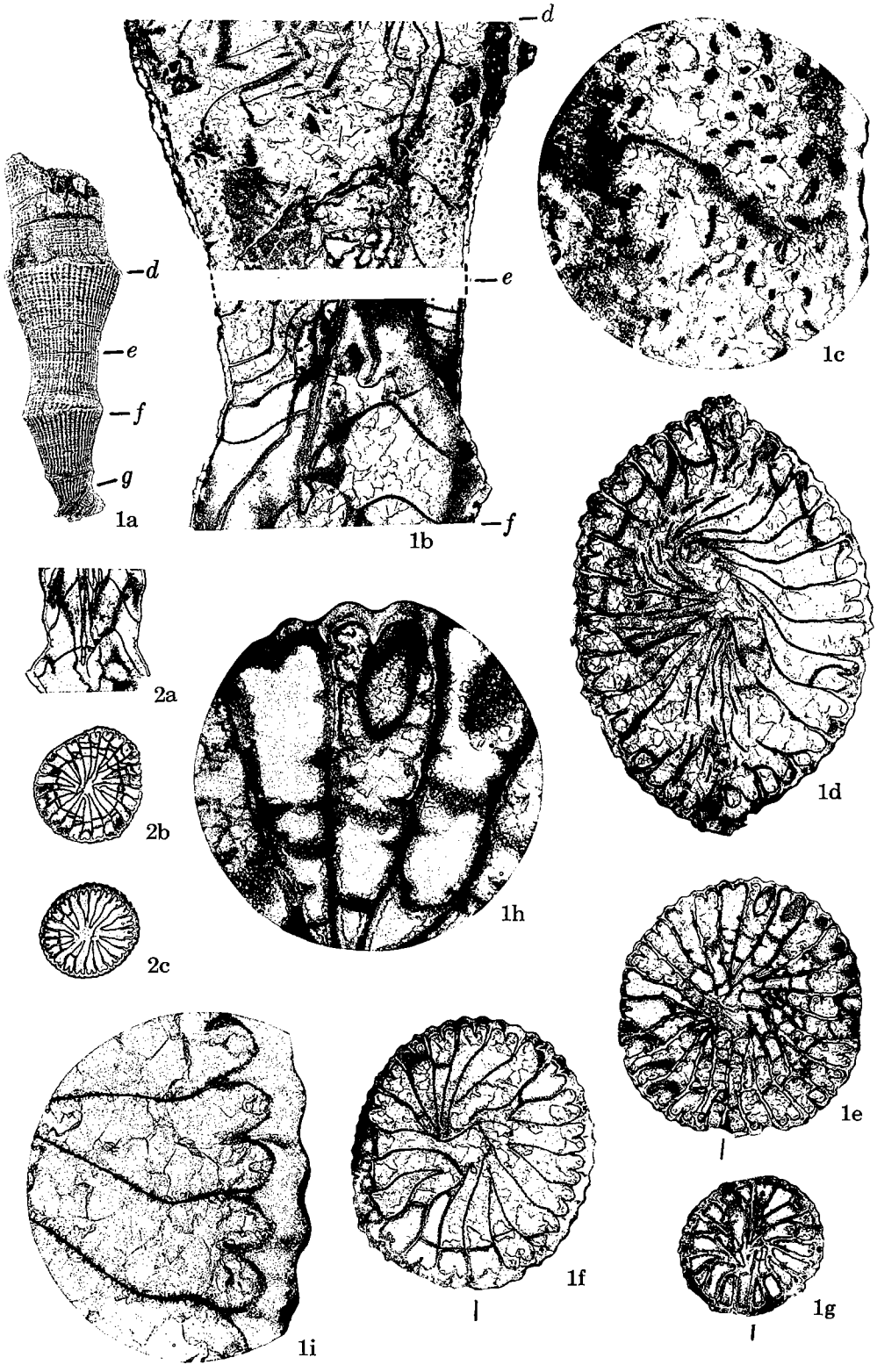
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Plate 8

(All specimens are from the Brownsport Formation, Tennessee)

Page

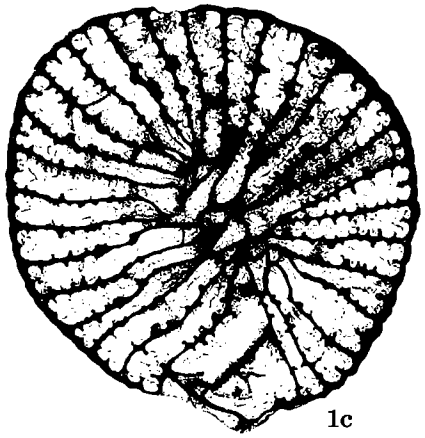
1. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5433, Graffham locality 2. 19
   Same specimen as shown in figure 5, plate 7.
   a. Exterior side view, x1; cardinal side to the left.
   b. Longitudinal section, x4.
   c. Enlargement of figure b, x14; note septal tubercles.
   d-f. Ephebic transverse sections, x4.
   g. Neanic transverse section, x4.
   h. Enlargement of figure e, x14; note tubercles on sides of septa.
   i. Enlargement of figure f, x14; note absence of septal tubercles and thin septa.

2. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5434, Graffham locality 2. 19
   a. Longitudinal section, x2; note widely spaced, arched, complete tabulae.
   b, c. Ephebic transverse sections, x2.

Plate 9

Page

1. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5435, locality P1-S,T. Orientation of specimen in relation to location of primary septa is unknown. All transverse sections are oriented with bottom of photograph in each case corresponding to the front of the exterior side view (fig. a). 19
   - a. Exterior side view, x1; fragment of a large specimen. Compare with plate 7, figure 2.
   - b. Longitudinal section, x2; note intersection of rejuvenescent collars located at horizontal lines of maximum diameter.
   - c-g. Ephebic transverse sections, x4; note presence and absence of septal tubercles in relation to rejuvenescence as shown in figure b.
   - h. Enlargement of figure e, x14; note septal tubercles, thick septa, and comparatively thin epitheca.
   - i. Enlargement of figure f, x14; note absence of septal tubercles, thin septa, and comparatively thick epitheca.



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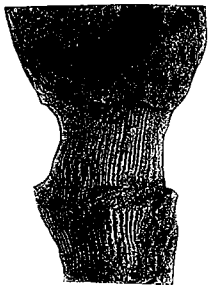

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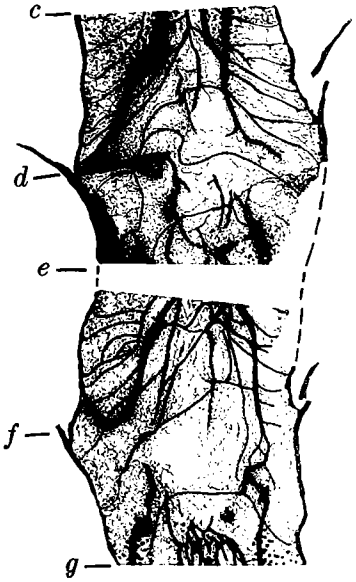

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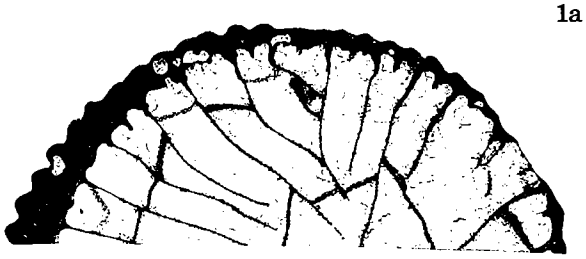

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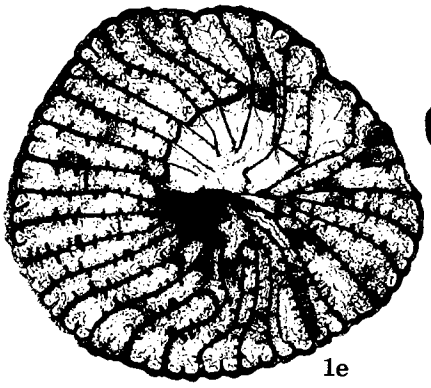

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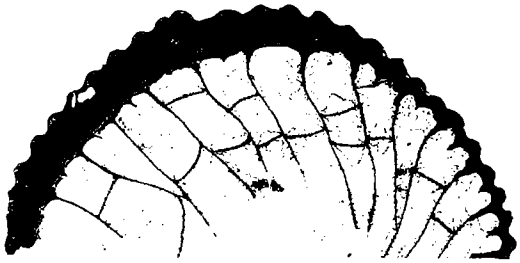

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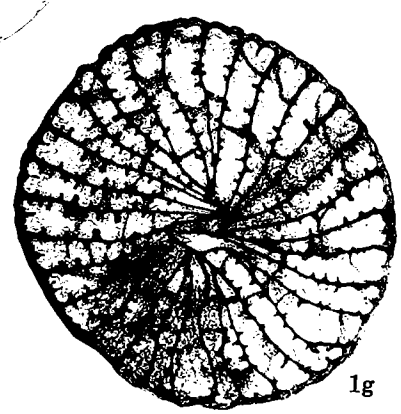

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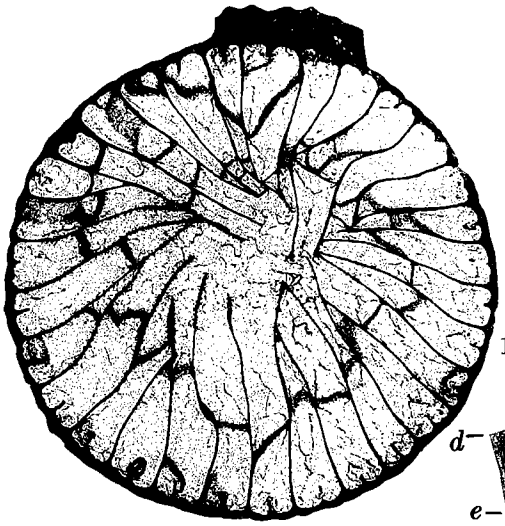

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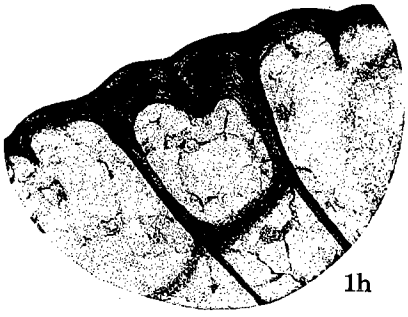

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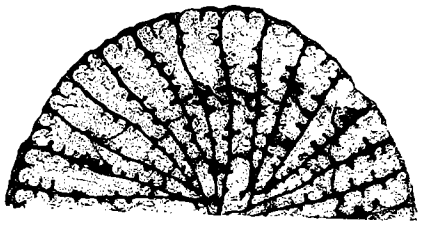

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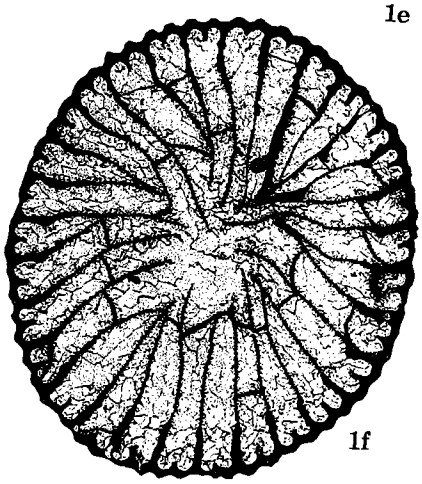

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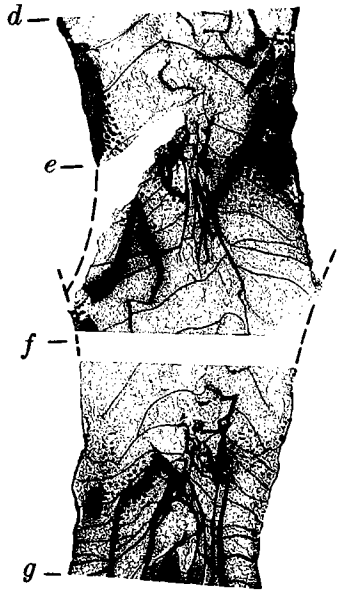

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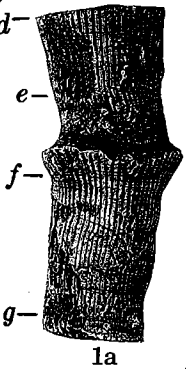

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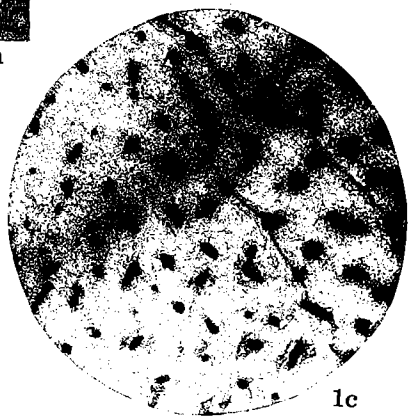

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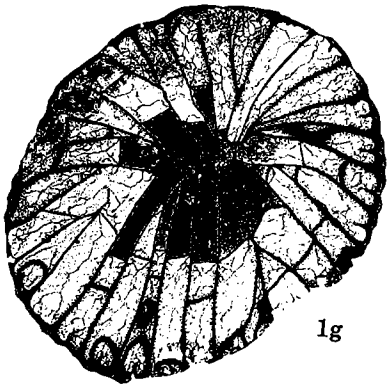

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Plate 10

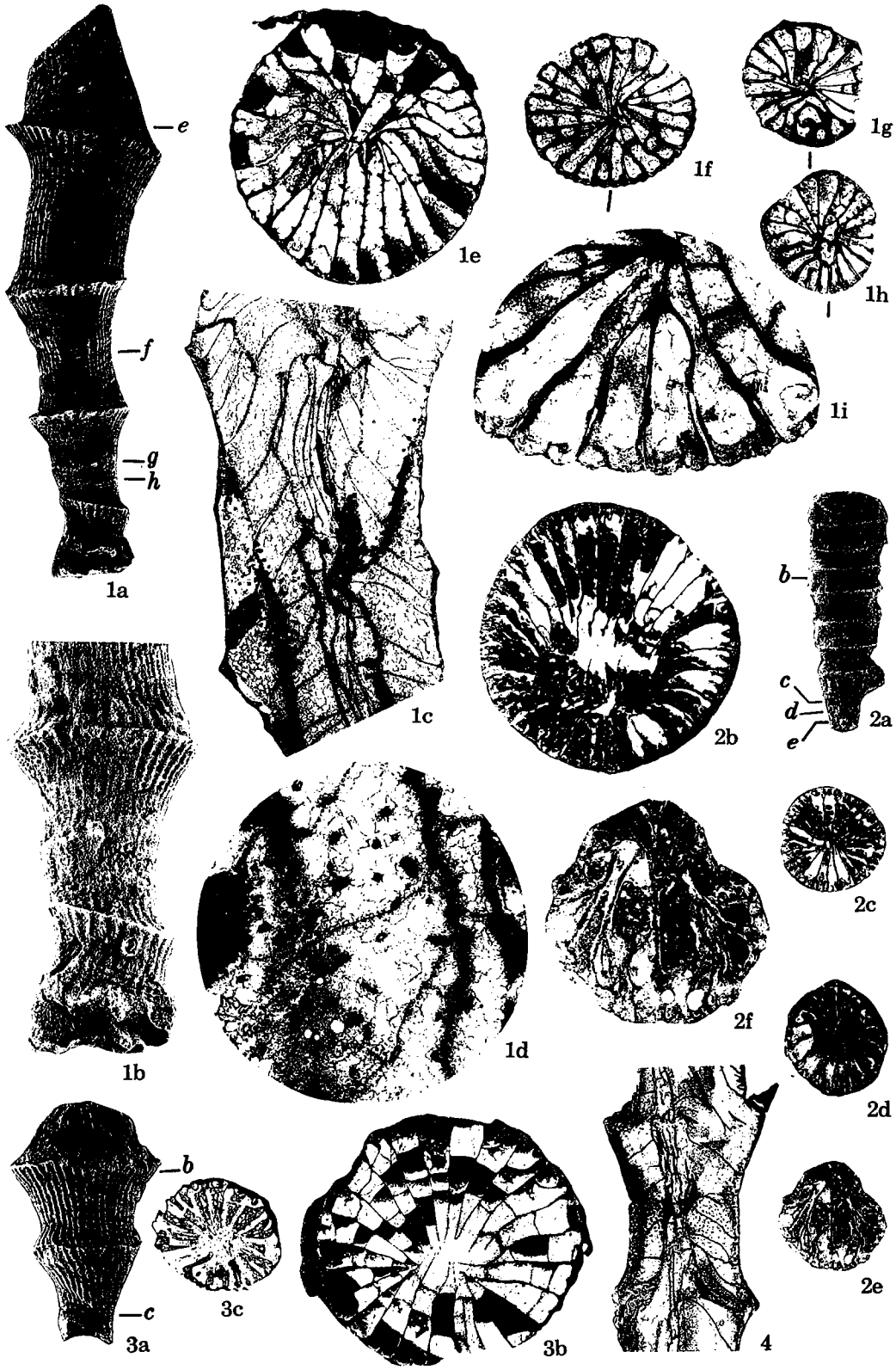
Page

1. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5442, locality P1-S,T. Orientation of specimen in relation to location of primary septa is uncertain, but the septum at the bottom of each transverse photograph is believed to be the cardinal. All transverse sections are oriented with the bottom of photograph corresponding to the left side of the exterior side view (fig. a). 19
   - a. Exterior side view, x1; fragment of a large specimen. Compare with plate 7, figure 2a.
   - b. Longitudinal section, x2.
   - c. Enlargement of figure b, x14; note lamellar microstructure.
   - d-g. Ephebic transverse sections, x4; note presence and absence of septal tubercles in relation to rejuvenescence as shown in figure b.
   - h. Enlargement of figure d, x14; note intersection of septal tubercles.

Plate 11

Page

1. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5436, locality P7A. 19
   - a. Exterior side view, x2; upper half of specimen curves away from plane of photograph; cardinal side is to the right.
   - b. Enlargement of lower part of figure a to show detail of large attachment area, x4; surface ornamentation is not well preserved.
   - c. Longitudinal section in alar plane, x4.
   - d. Enlargement of figure c, x14; note intersection of septal tubercles.
   - e, f. Ephebic transverse sections, x4.
   - g, h. Neanic transverse sections, x4.
   - i. Enlargement of figure f, x14; note lamellar microstructure.
2. *Amsdenoides acutiannulatus* (Amsden), specimen USNM 145275, USNM locality 6, near locality P1. 19
   - a. Exterior side view of imperfect cast, x1; surface ornamentation is poorly preserved and early portion is broken.
   - b. Ephebic transverse section, x4.
   - c-e. Neanic transverse sections, x4.
   - f. Enlargement of figure e, x8; note marked bilateral arrangement of septa.
3. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5437, locality P7A. 19
   - a. Exterior side view, x2; note trochoid shape and well-preserved attachment structure.
   - b. Ephebic transverse section, x4.
   - c. Neanic transverse section, x4; section silicified.
4. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5438, locality P19. Longitudinal section, x2; note restriction of septal tubercles to interval between stages of rejuvenescence. 19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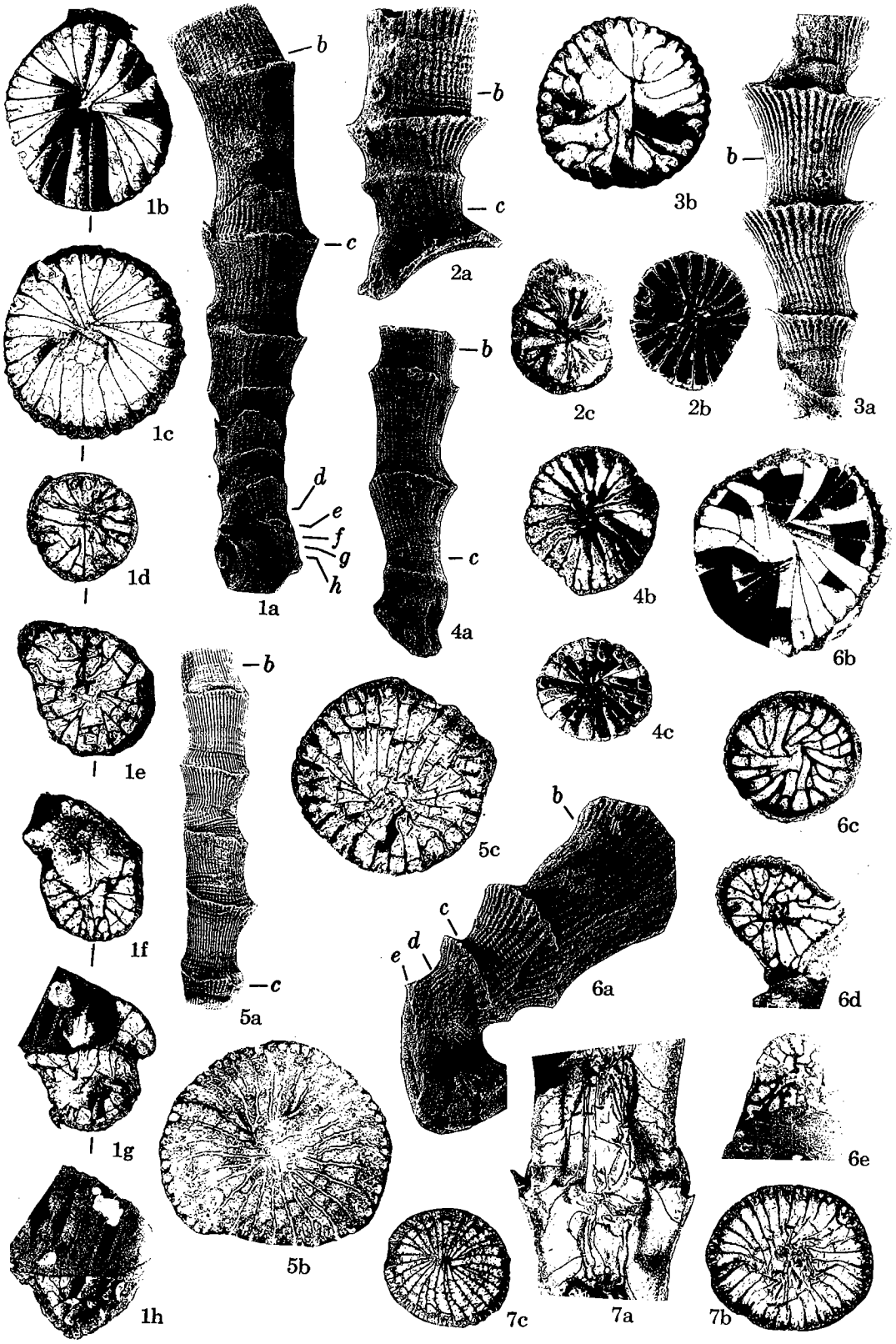
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Plate 12

Page

1. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5439, locality P7A. 19
   - a. Exterior side view, x2; note attachment to crinoid stem. Specimen does not curve in a consistent plane and cardinal septum is unrelated to curvature. The location of the cardinal septum was determined from the pattern of external septal grooves in early stages and is marked on the interior of this specimen by an imperfect bilateral symmetry.
   - b, c. Ephebic transverse sections, x4.
   - d-h. Neanic transverse sections, x4. Most sections partly encounter the attachment structure and crinoid stem.

2. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5440, locality P7A. 19
   - a. Exterior side view, x2; immature specimen with a large attachment structure.
   - b. Early ephebic transverse section, x4.
   - c. Neanic transverse section, x4.

3. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5441, locality P15A. 19
   - a. Exterior side view, x2; note well-preserved rejuvenescent collars, surface ornamentation, and attachment structure.
   - b. Ephebic transverse section, x4.

4. *Amsdenoides acutiannulatus* (Amsden), specimen USNM 145276, USNM locality 1, near locality P1-S,T. 19
   - a. Exterior side view, x2; immature cylindrical specimen.
   - b, c. Ephebic transverse sections, x4.

5. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5443, locality P7A. 19
   - a. Exterior side view, x1; incomplete cylindrical specimen.
   - b, c. Ephebic transverse sections, x4; partly silicified.

6. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5444, locality P1-S,T. 19
   - a. Exterior side view of specimen attached to crinoid stem, x2; earliest portion is missing.
   - b, c. Ephebic transverse sections, x4.
   - d, e. Neanic transverse sections, x4. The sections partly encounter a crinoid stem and a bryozoan colony to which coral is attached.

7. *Amsdenoides acutiannulatus* (Amsden), specimen OU 5445, locality P19. 19
   - a. Longitudinal section, x2.
   - b, c. Ephebic transverse sections, x2.

Plate 13

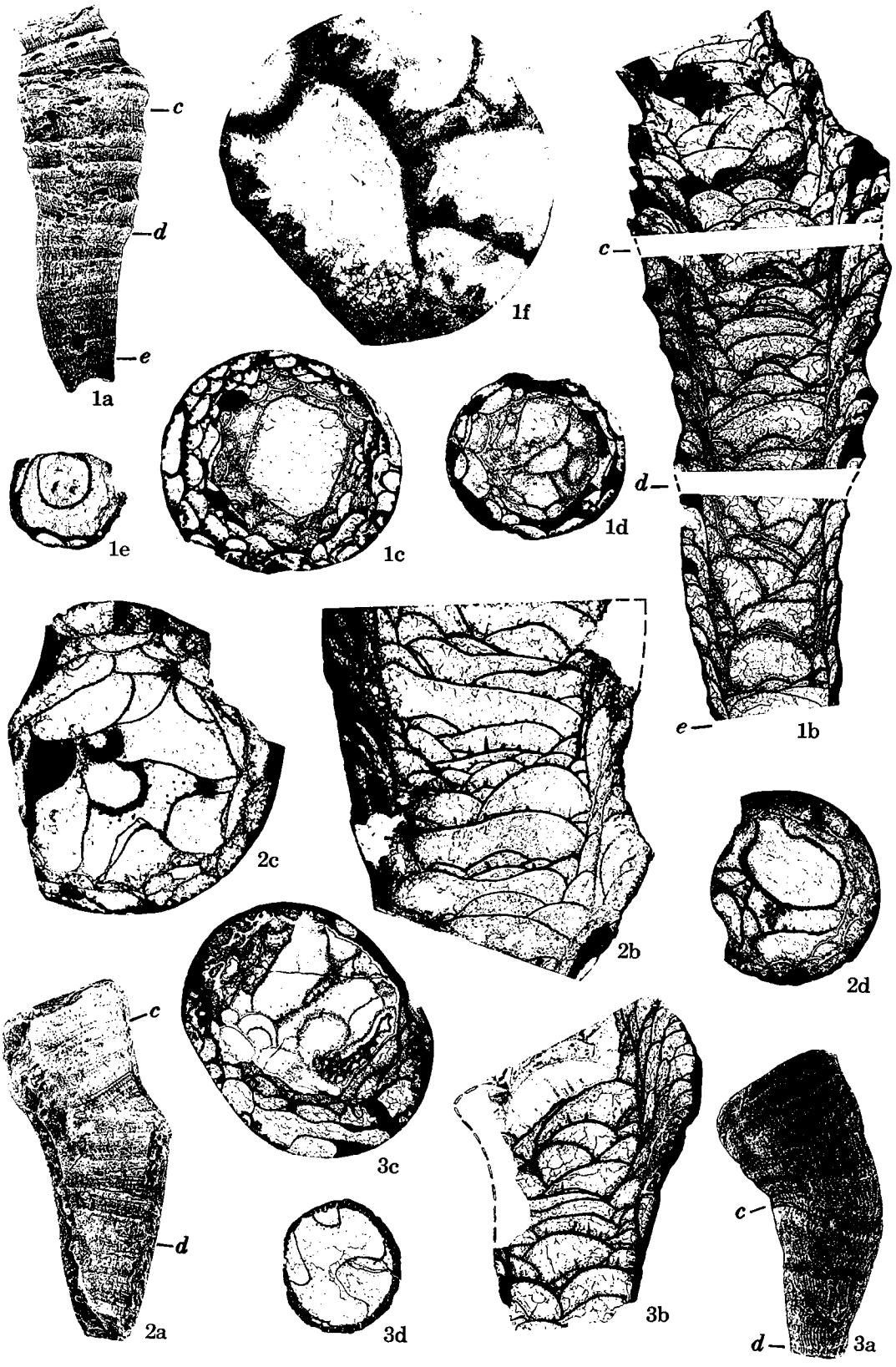
(Orientation of specimens with reference to primary septa is unknown. All transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Cystiphyllum? henryhousense,* new species, holotype OU 5446, locality P7A. 24
   - a. Exterior side view, x1.
   - b. Longitudinal section, x2.
   - c, d. Ephebic transverse sections, x2.
   - e. Neanic transverse section, x2.
   - f. Enlargement of figure c, x14; note thin epitheca at lower left and acanthine septa.

2. *Cystiphyllum? henryhousense,* new species, paratype OU 5447, locality P1-S,T. 24
   - a. Exterior side view, x1; fragment of an exceptionally large specimen.
   - b. Longitudinal section, x2.
   - c, d. Early and late ephebic stages, x2.

3. *Cystiphyllum? henryhousense,* new species, paratype USNM 145277, USNM locality 7, west of P1? 24
   - a. Exterior side view of an imperfect cast, x1.
   - b. Longitudinal section, x2; note absence of dissepiments in earliest stage.
   - c. Ephebic transverse section, x2.
   - d. Neanic transverse section, x2; note absence of dissepiments. See plate 16, figure 8, for an enlargement of this figure to show septal structure.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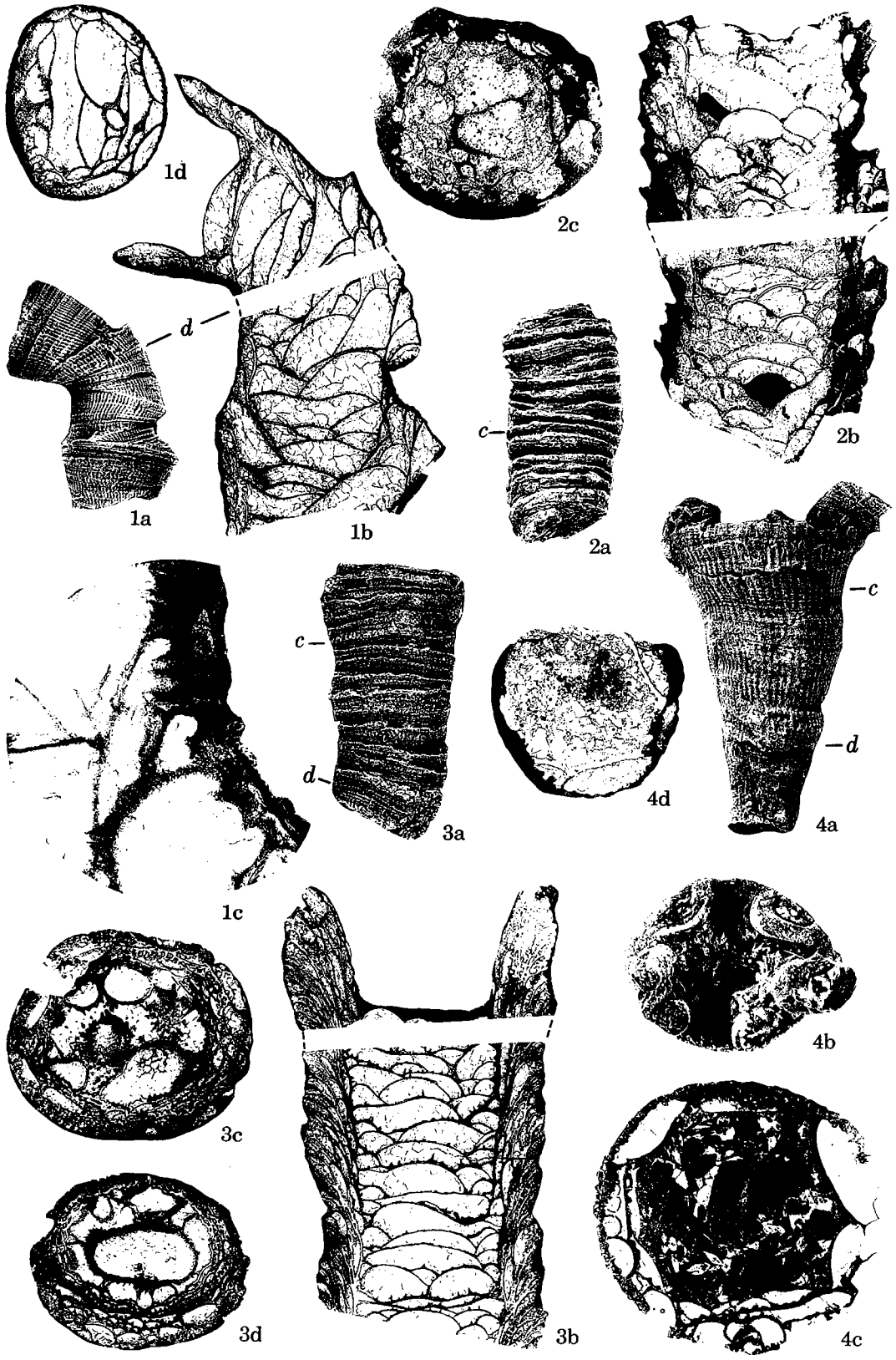
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Plate 14

(Orientation of specimens with reference to primary septa is unknown. All transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Cystiphyllum? henryhousense,* new species, paratype OU 5448, locality P1-S,T. 24
   - a. Exterior side view, x1; note widely spaced ridges of rejuvenescence and well-preserved external features of epitheca.
   - b. Longitudinal section, x2; note lack of development of a distinct dissepimental zone.
   - c. Enlargement of figure b, x14; note short holocanthine trabeculae imbedded in lamellar sclerenchyme.
   - d. Ephebic transverse section, x2.
2. *Cystiphyllum? henryhousense,* new species, paratype OU 5449, locality P19. 24
   - a. Exterior side view, x1; note marked rejuvenescence.
   - b. Longitudinal section, x2. See plate 16, figure 7, for enlargement of this figure showing septal structure.
   - c. Ephebic transverse section, x2; mostly silicified.
3. *Cystiphyllum? henryhousense,* new species, paratype OU 5450, locality P1-S,T. 24
   - a. Exterior side view, x1; note marked rejuvenescence.
   - b. Longitudinal section, x2; note closely spaced dissepiments.
   - c, d. Ephebic transverse sections, x2; note closely spaced dissepiments.
4. *Cystiphyllum? henryhousense,* new species, paratype OU 5451, locality P15A. 24
   - a. Exterior side view of a complete specimen, x2; lower end is an attachment surface partly covered by a bryozoan colony.
   - b. View of calice to show peripheral increase, x2.
   - c. Transverse section through calice near base of offsets, x4. See plate 16, figure 9, for enlargement to show septal structure.
   - d. Neanic transverse section, x4; mostly silicified.

Plate 15

(Orientation of specimens with reference to primary septa is unknown, with the exception of figure 1. Transverse sections, except those of figure 1, are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Cystiphyllum? henryhousense,* new species, paratype OU 5452, locality P7A. 24
   a. Exterior side view, x1. Cardinal septum is located on inside of curve as determined by arrangement of external septal grooves. Earliest stage cylindrical and broken; specimen is possibly a broken offset.
   b. Longitudinal section, x4; note absence of dissepiments in early stage and on inside of curvature in higher growth stages.
   c. Ephebic transverse section, x2; partly silicified.
   d. Neanic transverse section, x2.

2. *Cystiphyllum? henryhousense,* new species, paratype OU 5453, locality P15A. 24
   a. Exterior side view of an immature specimen, x1; note peripheral increase; two of three offsets are shown.
   b. Longitudinal section, x2; note that the two offsets originate high in wall of calice, higher than those illustrated in figure d.
   c. Transverse section through two offsets, x2.
   d. Transverse section through calice below base of offsets, x2.
   e. Neanic transverse section, x2.
   f. Enlargement of figure b, x14; note short holocanthine trabeculae imbedded in lamellar sclerenchyme.

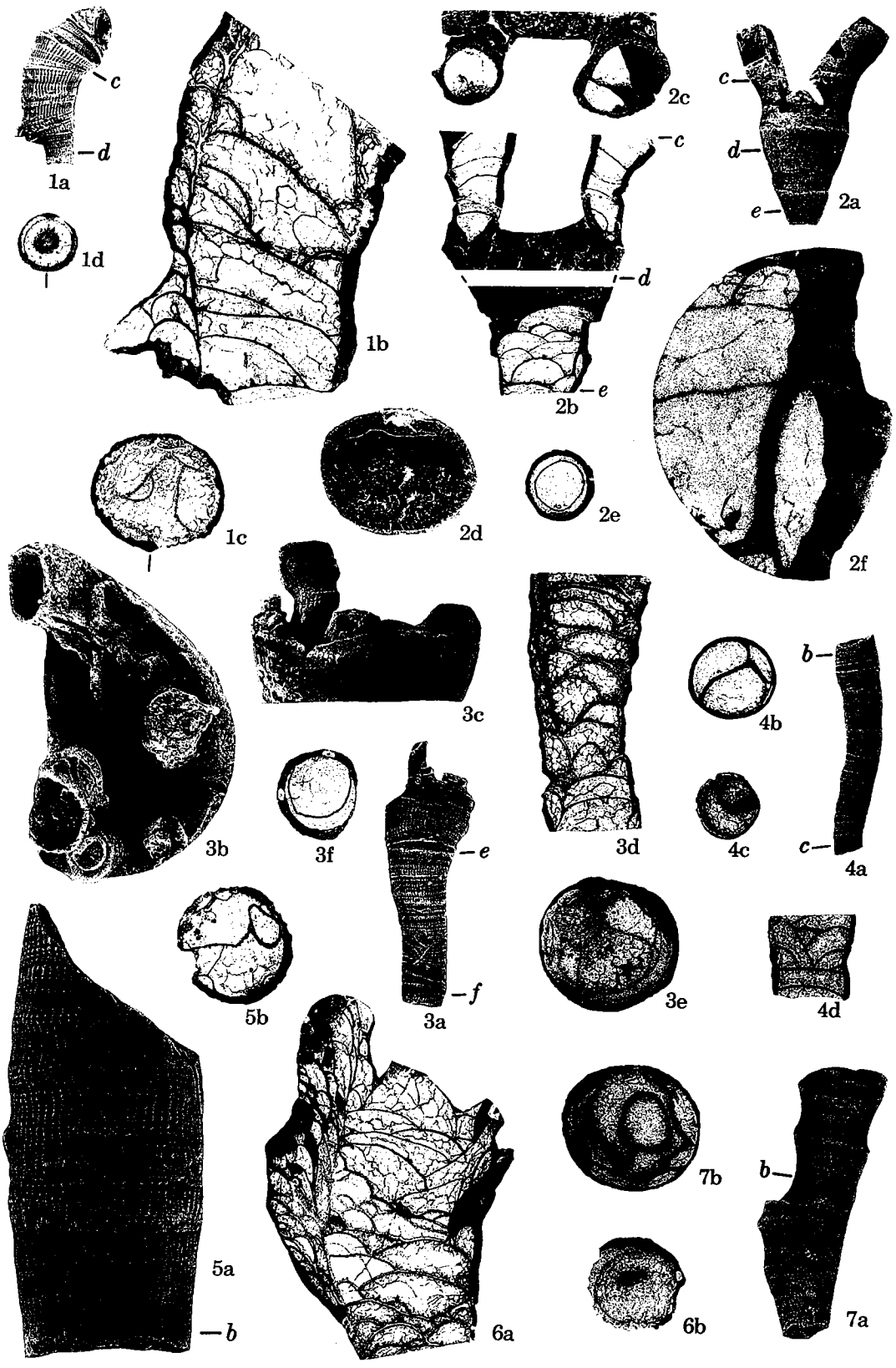
3. *Cystiphyllum? henryhousense,* new species, paratype OU 5454, locality P19. 24
   a. Exterior side view, x1.
   b. Exterior view of partly crushed calice showing peripheral offsets, x3.
   c. Exterior side view of calice taken at a different angle from that of figure a, x2.
   d. Longitudinal section, x2; note sparse and irregular development of dissepiments.
   e. Ephebic transverse section, x2; mostly silicified.
   f. Neanic transverse section, x2; note absence of dissepiments.

4. *Cystiphyllum? henryhousense,* new species, paratype OU 5455, locality P7A. 24
   a. Exterior side view, x1; believed to be a broken offset.
   b, c. Transverse sections, x2.
   d. Longitudinal section of upper part of specimen, x2.

5. *Cystiphyllum? henryhousense,* new species, paratype OU 5456, locality P1-S,T. 24
   a. Exterior side view showing nature of external ornamentation in a specimen which does not develop rejuvenescence, x3.
   b. Transverse section, x2.

6. *Cystiphyllum? henryhousense,* new species, paratype OU 5457, locality P1-S,T. 24
   a. Longitudinal section, x2; note absence of dissepiments in earliest growth stage.
   b. Neanic transverse section, x2; note absence of dissepiments.

7. *Cystiphyllum? henryhousense,* new species, paratype OU 5458, locality P1-S,T. 24
   a. Exterior side view, x1.
   b. Ephebic transverse section, x2.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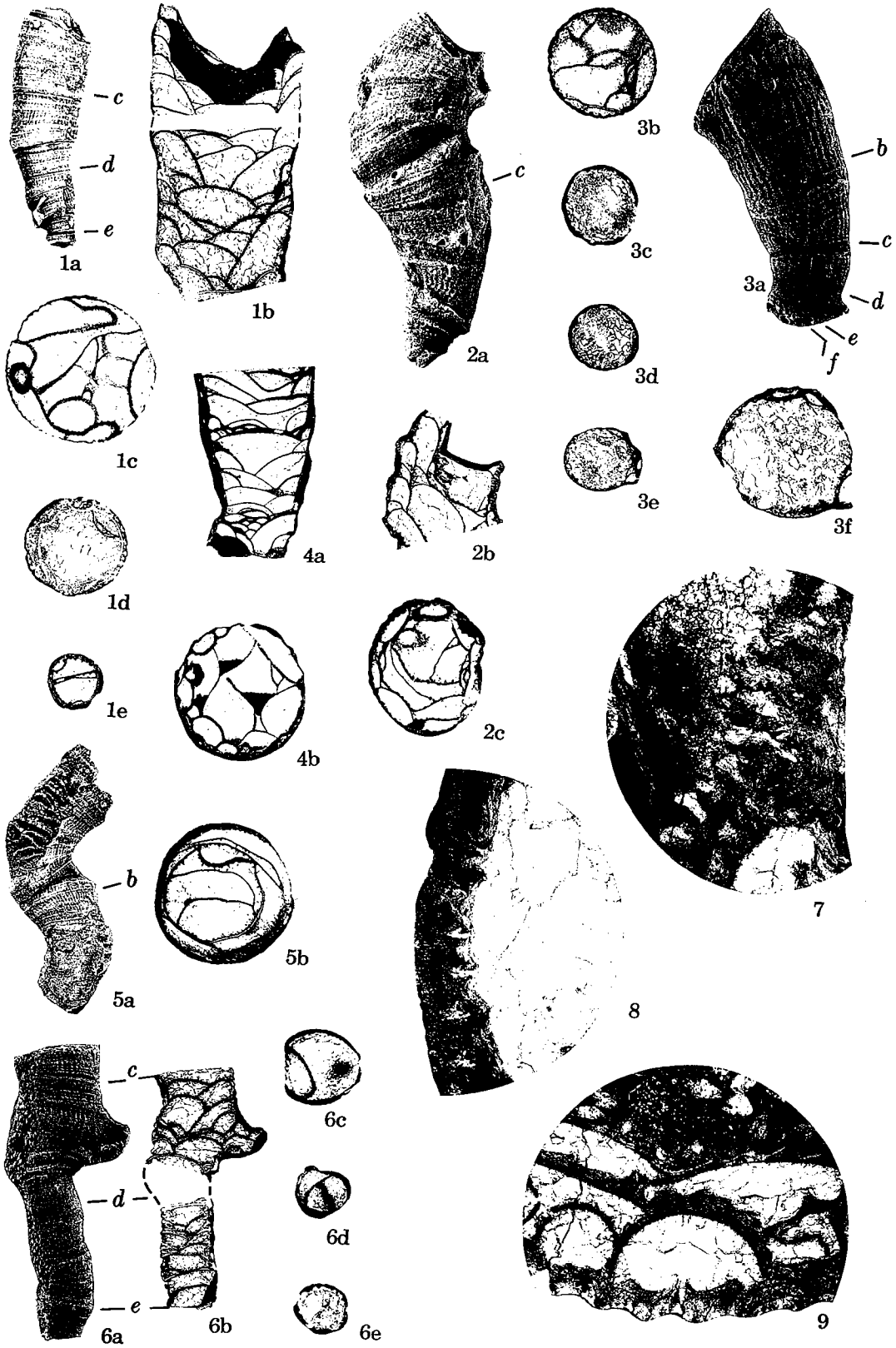
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Plate 16

(Orientation of specimens with reference to primary septa is unknown. All transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Cystiphyllum? henryhousense,* new species, paratype OU 5459, locality P7A. 24
   - a. Exterior side view, x1; earliest portion is cylindrical with an attachment structure developed higher, at a point of abrupt expansion.
   - b. Longitudinal section, x2.
   - c, d. Transverse sections, x2.
   - e. Neanic transverse section, x2.
2. *Cystiphyllum? henryhousense,* new species, specimen OU 5460, locality P7A. 24
   - a. Exterior side view of imperfect cast, x2; note attachment surface, at right of photograph, extends full length of specimen. Specimen changes direction of curvature several times; lowest 8 mm of specimen curves away from plane of photograph.
   - b. Longitudinal section, x2; attachment surface to the right.
   - c. Ephebic transverse section, x2; irregular right side of figure indicates location of wide attachment surface.
3. *Cystiphyllum? henryhousense,* new species, paratype OU 5461, locality P7A. 24
   - a. Exterior side view of an immature specimen, x2; note broad attachment surface at base.
   - b. Early ephebic? transverse section, x2.
   - c-e. Neanic transverse sections, x2, silicified. Figure e intersects attachment surface at right.
   - f. Lowest neanic transverse section, x4; intersects attachment surface at right and top of figure marked by isolated dissepimentlike plates; septa are extremely short or absent.
4. *Cystiphyllum? henryhousense,* new species, paratype OU 5462, locality P1-S,T. 24
   - a. Longitudinal section, x2; basal angular surface is an attachment surface.
   - b. Ephebic transverse section, x2.
5. *Cystiphyllum? henryhousense,* new species, paratype OU 5463, locality P7A. 24
   - a. Exterior side view of a fragmentary specimen, x1; direction of curvature is not constant.
   - b. Ephebic transverse section, x2.
6. *Cystiphyllum? henryhousense,* new species, paratype OU 5464, locality P1-S,T. 24
   - a. Exterior side view, x2; lower stage is cylindrical and broken at base; higher, a broad attachment structure is developed at a point of abrupt increase in diameter. This specimen is believed to be a broken offset.
   - b. Longitudinal section, x2.
   - c-e. Transverse sections, x2.
7. *Cystiphyllum? henryhousense,* new species, paratype OU 5449, locality P19. Enlargement of figure 2b on plate 14 to show longitudinal structure of acanthine septa, x14. 24
8. *Cystiphyllum? henryhousense,* new species, paratype USNM 145277, USNM locality 7, west of P1? Enlargement of figure 3d on plate 13 to show holocanthine trabeculae imbedded in lamellar sclerenchyme, x14. 24
9. *Cystiphyllum? henryhousense,* new species, paratype OU 5451, locality P15A. Enlargement of figure 4c on plate 14, x14. 24

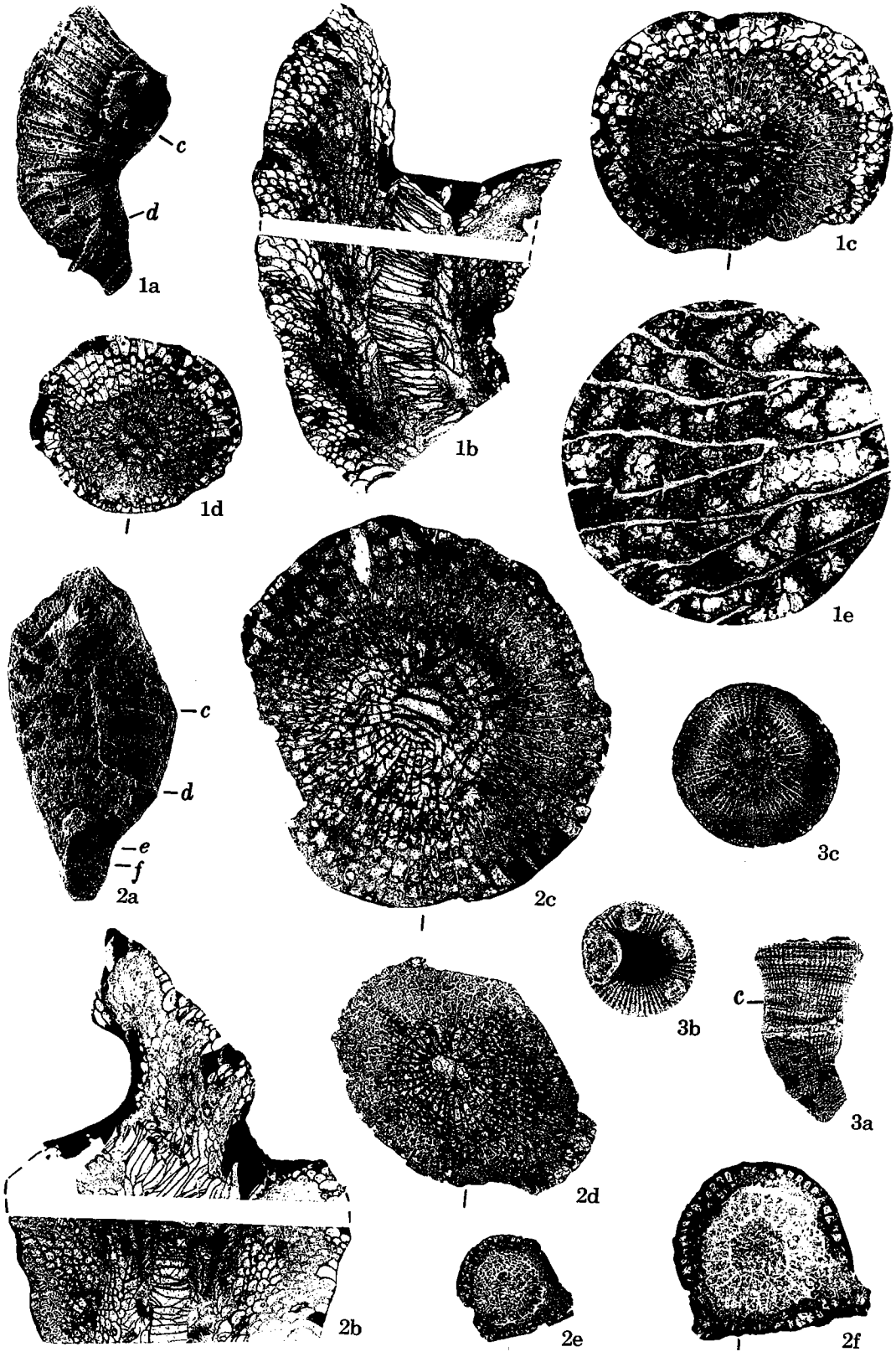
Plate 17

Page

1. *Micula? catilla,* new species, holotype OU 5465, locality P1-S,T. 28
   a. Exterior side view, x1; note change in curvature of specimen. Cardinal septum is at right side of photograph, thus it is on convex side of early portion and on concave side of upper two-thirds of specimen.
   b. Longitudinal section, x2.
   c, d. Ephebic transverse sections, x2.
   e. Enlargement of figure c to show long contratingent minor septa, x14.

2. *Micula? catilla,* new species, paratype OU 5466, locality P1-S,T. 28
   a. Exterior side view, x1; specimen partly silicified and surface partly abraded. View is toward the cardinal septum, which is unrelated to curvature in location. A broad attachment area extends up side of specimen for 21 mm but is not in the plane of the tilted calice in the upper third of the specimen.
   b. Longitudinal section, x2. Upper part of photograph shows tilted calice.
   c, d. Ephebic transverse sections, x2. Pattern of septa in figure c results from slight oblique cut to section.
   e. Neanic transverse section, x2; attachment surface is intersected in lower right of photograph.
   f. Neanic transverse section, x4; attachment surface is intersected in lower right of photograph.

3. *Micula? catilla,* new species, specimen OU 5467, locality P1-S,T. 28
   a. Exterior side view, x1.
   b. Exterior view of calice showing peripheral increase, x1.
   c. Ephebic transverse section, x2; silicification gives the false suggestion of carinae.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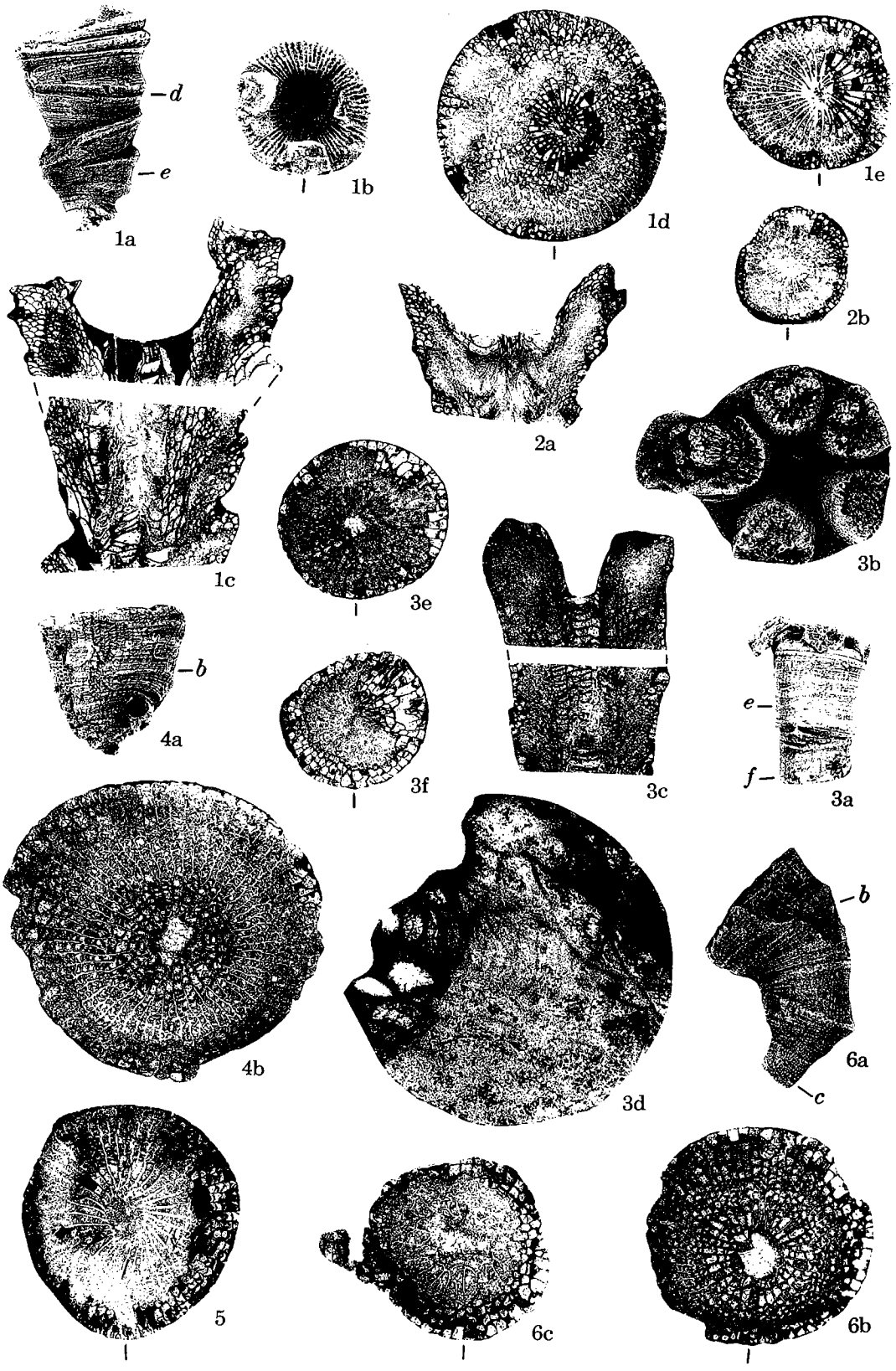
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Plate 18

Page

1. *Phaulactis? lanx,* new species, holotype OU 5468, locality P7A. 30
   a. Exterior side view, x1; note attachment surface and irregular rejuvenescence. Photograph is of counter side of specimen which shows no curvature.
   b. View of calice, x1; cardinal septum is at bottom of photograph; note peripheral increase.
   c. Longitudinal section, x2. Section is parallel to plane of side view shown in figure a. At right side of calice section cuts through offset seen at left side of figure b.
   d, e. Ephebic transverse sections, x2.

2. *Phaulactis? lanx,* new species, paratype OU 5469, locality P7A. 30
   a. Longitudinal section, x2.
   b. Ephebic transverse section, x2; mostly silicified.

3. *Entelophyllum* sp. A, specimen OU 5470, locality P7A. 27
   a. Exterior side view of a cylindrical fragment showing peripheral increase, x1.
   b. View of calice showing large peripheral offsets, x2.
   c. Longitudinal section, x2; specimen mostly silicified. Left side of calice, at top of photograph, cuts through offset which is in upper right part of figure b (for enlargement see figure d).
   d. Enlargement of upper left part of figure c to show formation of an offset from the dissepimentarium and from the periaxial zone of tabulae, x14.
   e, f. Ephebic transverse sections, x2; axial regions silicified.

4. *Micula? catilla,* new species, specimen OU 5471, locality P1-S,T. 28
   a. Exterior side view, x1; specimen mostly silicified; note large attachment area which extends for 13 mm up side of specimen at the lower right of figure.
   b. Ephebic transverse section, x2.5; specimen mostly silicified.

5. *Micula? catilla,* new species, specimen OU 5472, locality P7A. Ephebic transverse section, x2; specimen mostly silicified. 28

6. *Micula? catilla,* new species, specimen OU 5473, locality P1-S,T. 28
   a. Exterior side view, x1; cardinal septum is at right on the concave side of curvature.
   b. Ephebic transverse section, x2.
   c. Neanic transverse section, x4; specimen mostly silicified; extension at right is part of an attachment structure.

Plate 19

Page

1. *Capnophyllum hedlundi,* new species, holotype OU 5474, locality P1-S,T. 28
   - a. Exterior side view of an imperfect cast, x1; note attachment to crinoid stem. Cardinal septum, at right side of photograph, and both alar septa were located by pattern of external septal grooves.
   - b. Longitudinal section, x4.
   - c. Enlargement of figure b, x14; note globose dissepiments and inclined carinae.
   - d, e. Ephebic transverse section, x4; location of cardinal and alar septa determined from pattern of external septal grooves.
   - f. Neanic transverse section, x6; specimen distorted in shape near attachment surface.
   - g. Enlargement of figure d, x14; note well-developed carinae.

2. *Capnophyllum hedlundi,* new species, paratype OU 5475, locality P1-S,T. 28
   - a. Exterior side view, x1; a single large talon forms attachment structure with early portion of specimen.
   - b. View of calice, partly filled by a single tilted offset, x2; note carinate septa.
   - c, d. Ephebic transverse sections, x3; location of primary septa unknown. Bottom of each photograph corresponds to front of exterior side view, figure a.
   - e. Longitudinal section through calice and offset, x3.

3. *Capnophyllum hedlundi,* new species, paratype OU 5476, locality P15A. 28
   - a. Exterior side view, x2; note development of offsets.
   - b. Ephebic transverse section, x4; location of primary septa unknown. Bottom of photograph is at front of exterior side view, figure a.

4. *Capnophyllum hedlundi,* new species, paratype OU 5477, locality P7A. 28
   - a. Exterior side view of an imperfect cast, x1. Cardinal septum is at right of photograph, on convex side of curvature. Note large attachment surface at lower left which extends for 10 mm up side of specimen.
   - b. View of tilted calice to show rejuvenescence, x2.
   - c. Ephebic transverse section, x3.

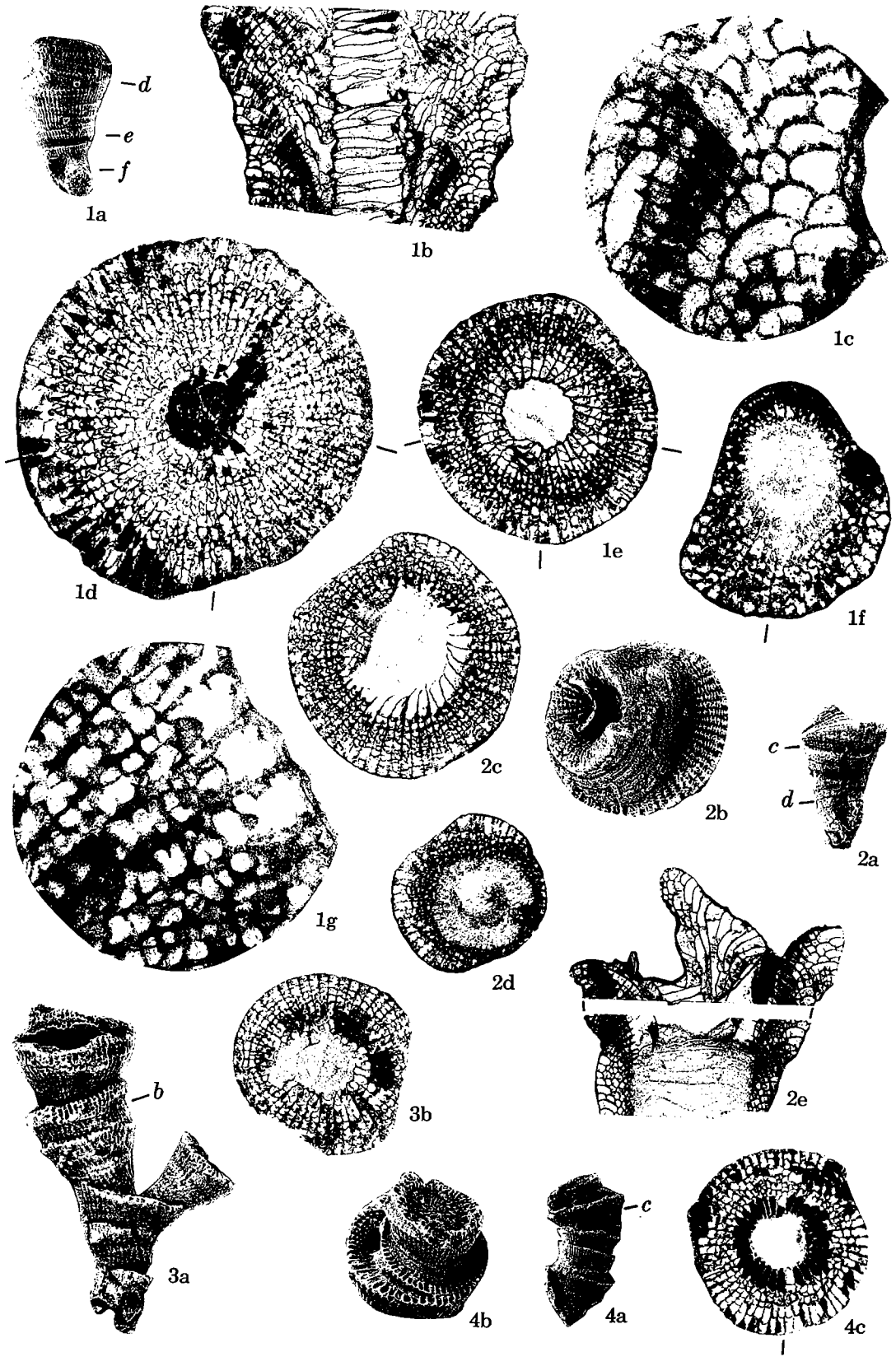
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Plate 20

(Except where indicated, transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Capnophyllum hedlundi,* new species, specimen OU 5478, locality P1-S,T. 28
   a. Exterior side view, x1; nature of broken base suggests that this specimen is a broken offset.
   b. Longitudinal section, x3; note marked rejuvenescence.
   c, d. Transverse sections, x3; note locally discontinuous septa and poor development of carinae in figure c.

2. *Capnophyllum hedlundi,* new species, paratype USNM 145278, USNM locality 2, near locality P1. 28
   a. Exterior side view, x2; surface poorly preserved but specimen complete.
   b. Top view showing marked restriction of specimen and the development of small offsets, x2.
   c. Ephebic transverse section, x4.

3. *Capnophyllum hedlundi,* new species, specimen OU 5479, locality P7A. 28
   a. Exterior side view, x2; specimen complete but surface poorly preserved; note attachment structure and marked rejuvenescence.
   b. Top view, x2; compare with figure a.

4. *Capnophyllum hedlundi,* new species, specimen USNM 145279, USNM locality 2, near locality P1. 28
   a. Exterior side view, x2; note attachment surface.
   b. Oblique view to show calice, x2.

5. *Capnophyllum hedlundi,* new species, paratype OU 5480, locality P1-S,T. 28
   a. Exterior side view, x1; surface poorly preserved but specimen complete; note marked restriction in late stage.
   b. Longitudinal section, x3.
   c, d. Ephebic transverse sections, x3; note that the smaller section, figure c, is from higher in the corallite and lacks carinae.

6. *Capnophyllum hedlundi,* new species, paratype OU 5481, locality P1-S,T. 28
   a. Exterior side view of cast, x1; cardinal septum is to the right. This specimen is an offset and part of the calice rim of the protocorallite is preserved at the base of the specimen.
   b. Ephebic transverse section, x3; cardinal and alar septa, as marked, located by pattern of external septal grooves.
   c. Enlargement of figure b, x14.

7. *Capnophyllum* sp. A, specimen OU 5482, locality P1-S,T. 30
   a. Exterior side view, x2; cardinal septum and one alar septum located from study of septal grooves; cardinal septum is to the left, on inside of curvature; base of specimen broken.
   b. View of calice, x2.
   c. Ephebic transverse section, x4; note short minor septa and narrow dissepimental zone.
   d. Enlargement of figure c, x14.
   e. Longitudinal section, x4.

Plate 21

(Sections here figured are mostly silicified and all were photographed by reflected light except those in figures 1a and 1c. All figures are x6 unless otherwise indicated.)

Page

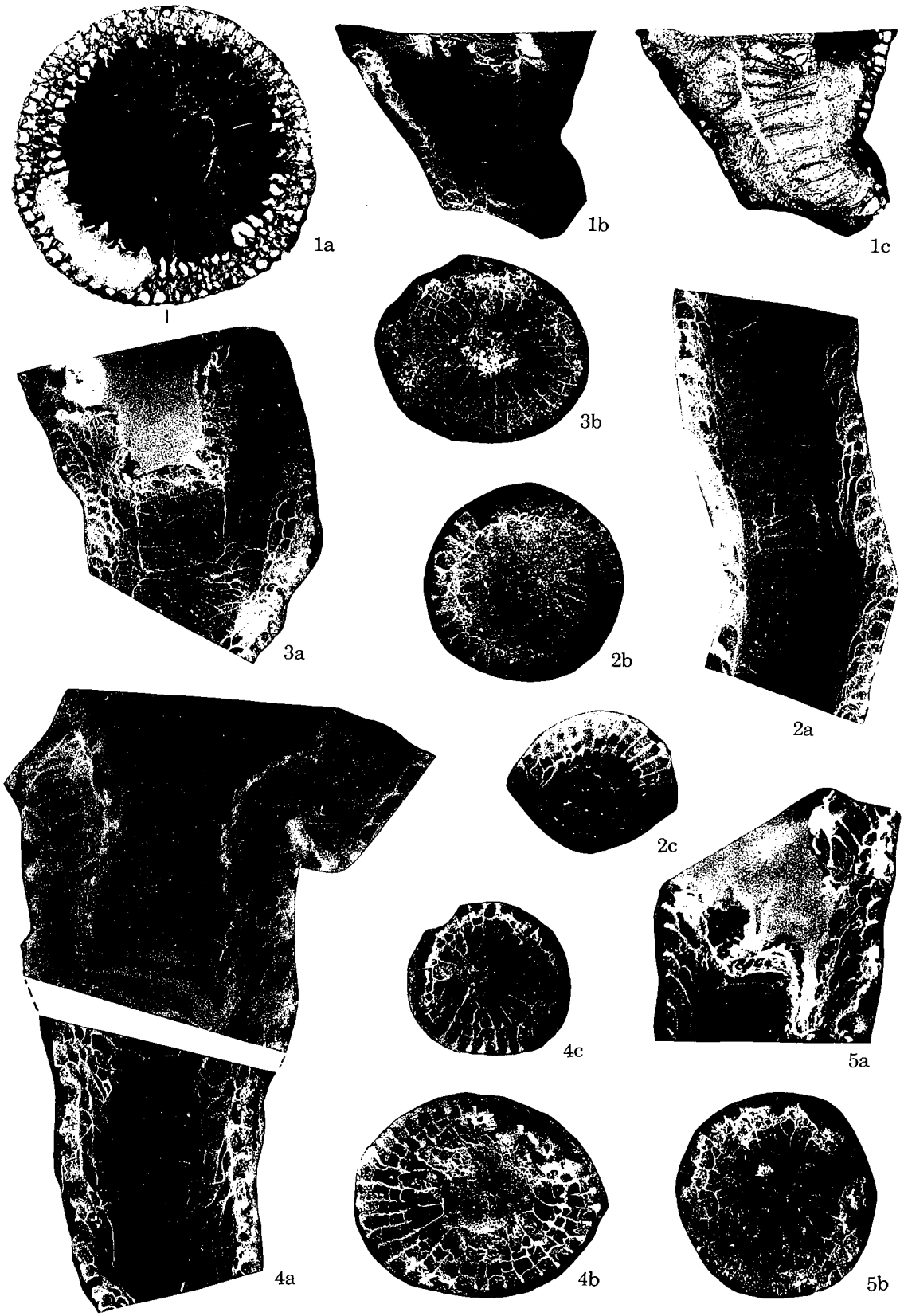
1. *Capnophyllum* sp. A, specimen OU 5483, locality P1-S,T. 30
   a. Transverse section through base of calice, x4.
   b, c. Longitudinal section photographed by both reflected and transmitted light, x4; note narrow dissepimental zone and two distinct zones of tabulae.

2. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5492C-1, locality P8. Sections of a single corallite from the large corallum figured on plate 22, figures 4a,b. Collected at point A, shown on text-figure 5. 26
   a. Longitudinal section.
   b, c. Transverse sections.

3. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5493, locality P8. This broken corallite could be from the same corallum as those of figures 4 and 5. All were found at point B, shown on text-figure 5. 26
   a. Longitudinal section through calice cut between peripheral offsets.
   b. Transverse section.

4. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5494, locality P8. 26
   a. Longitudinal section through calice intersecting two peripheral offsets.
   b, c. Transverse sections.

5. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5495, locality P8. 26
   a. Longitudinal section through calice intersecting one offset at upper right.
   b. Transverse section.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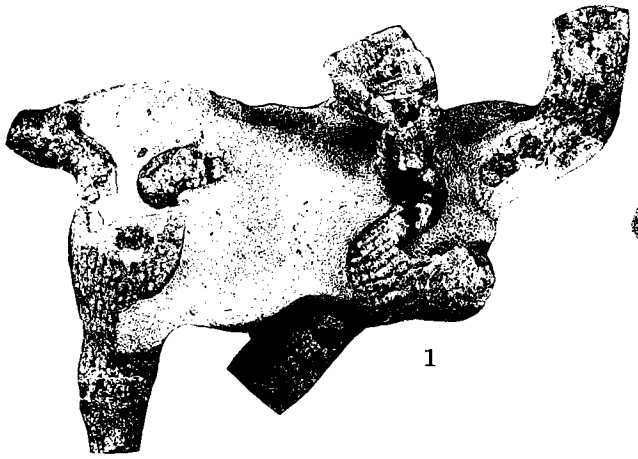

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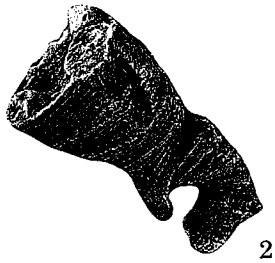

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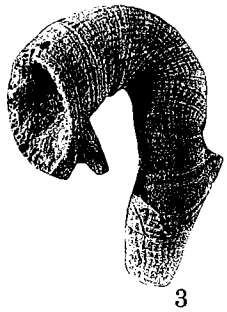

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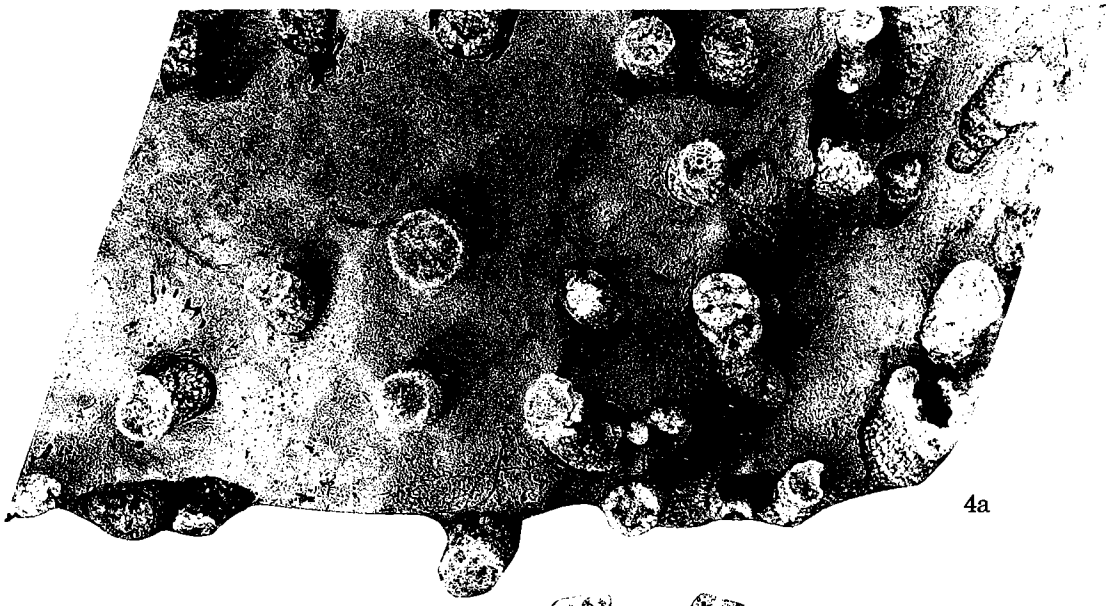

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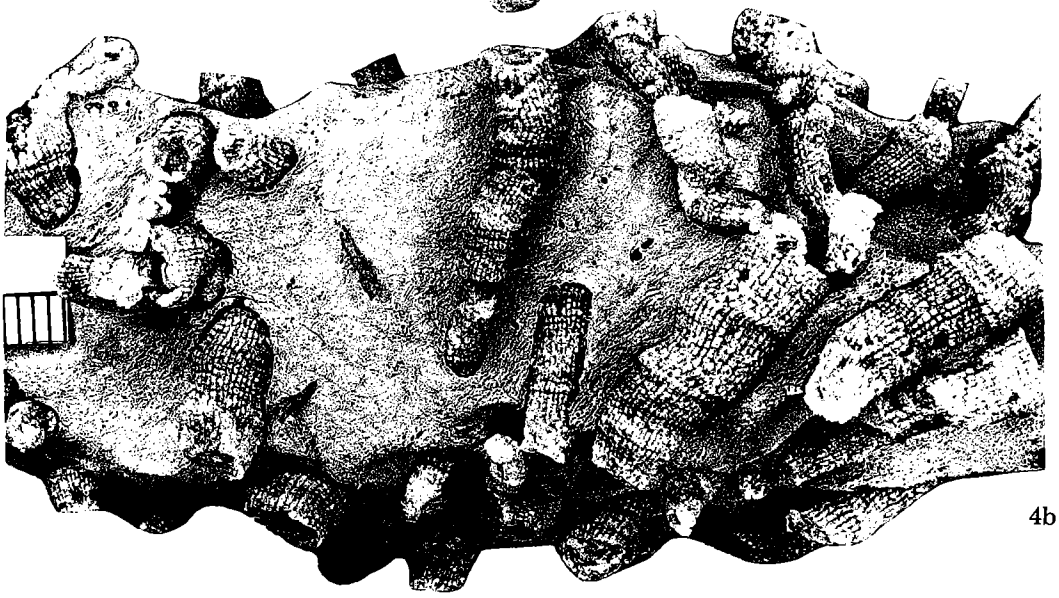


4b

Plate 22

(All figures x2)

Page

1. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5492B, locality P8. Two mainly silicified corallites partly etched from marlstone, showing characteristic peripheral increase in which offsets sag outwardly from the calice rim of the protocorallite. From corallum shown in figures 4a,b. 26

2. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5496, locality P8. Trumpet-shaped offset showing broken bases of additional offsets at calice margin. Note well-preserved surface features of epitheca. Specimen not etched. Broken corallite collected at point B, shown on text-figure 5. 26

3. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5497, locality P8. Curved offset showing well-preserved surface features of epitheca. Specimen not etched. Broken corallite collected at point B, shown on text-figure 5. 26

4. *Entelophyllum* cf. *E. angulare* (Amsden), specimen OU 5492C, locality P8. Limited view of partly etched surface of a corallum at least 25 cm in diameter and 10 to 12 cm in height. Corallum collected at point A, shown on text-figure 5. 26
   a. Top view of partly etched corallum.
   b. Side view of partly etched corallum; corallites match those illustrated at bottom edge of photograph in figure a. Note characteristic peripheral increase in specimen at right side of figure, showing characteristic outward sag of offets. Surface detail of corallites has been destroyed by etching.

Plate 23

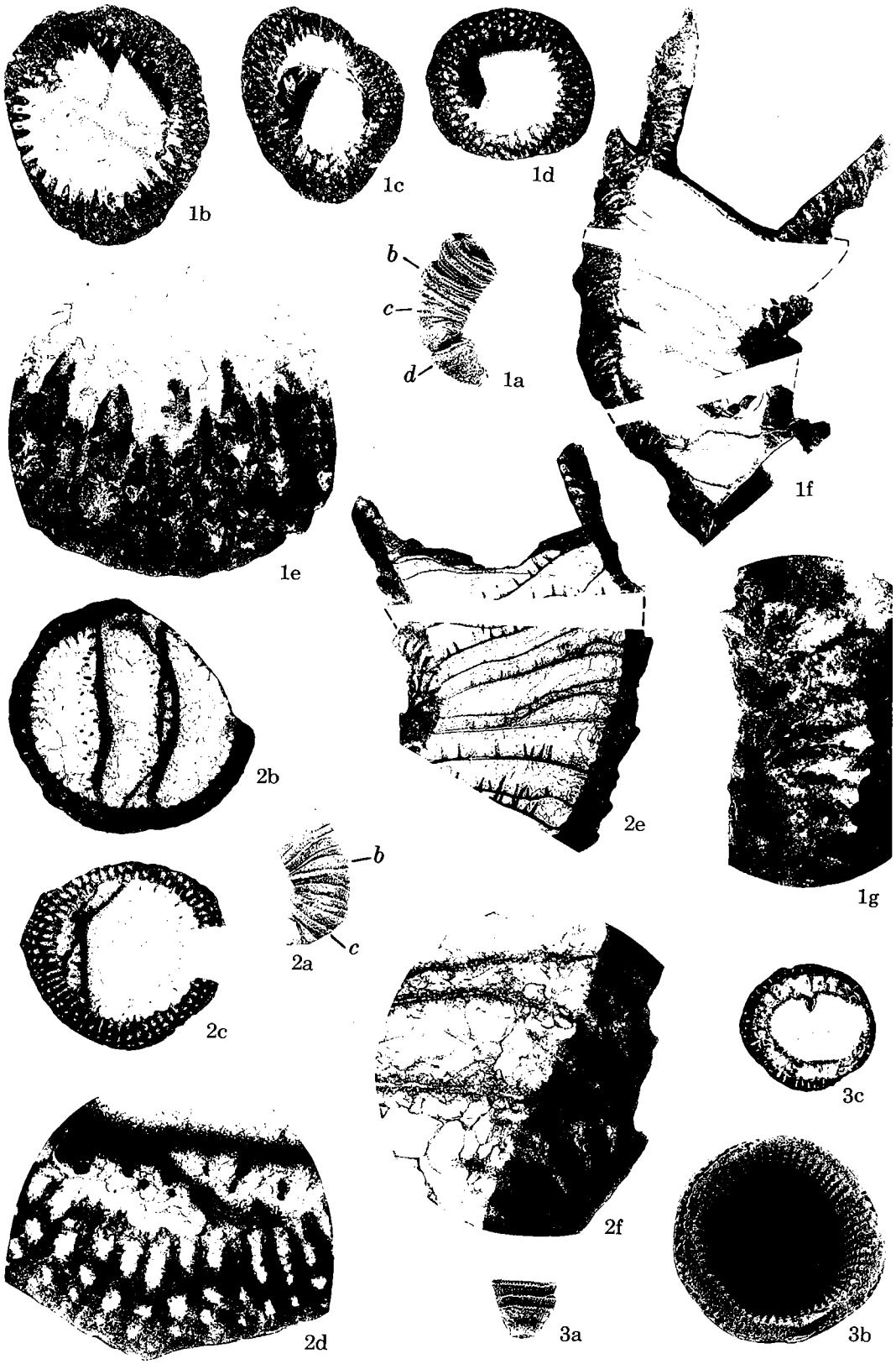
(Orientation of specimens with reference to primary septa is unknown. Unless otherwise indicated, transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5484, locality P1-S,T. 31
   - a. Exterior side view, x1; complete specimen with small attachment surface 2 mm long on inside of curvature.
   - b-d. Ephebic transverse sections, x4. Bottom of each photograph corresponds to inside of curvature of specimen, at right of figure a. Sections b and c are slightly oblique.
   - e. Enlargement of figure b to show septal structure, x14.
   - f. Longitudinal section, x4.
   - g. Enlargement of left side of calice in figure f to show septal structure, x14; epitheca is at left, calice at right.

2. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5485, locality P1-S,T. 31
   - a. Exterior side view, x1; specimen complete.
   - b, c. Ephebic transverse sections, x4. Section b is slightly oblique.
   - d. Enlargement of figure c to show septal structure, x14.
   - e. Longitudinal section, x4.
   - f. Enlargement of figure e to show septal structure, x14; note vertical series of trabeculae.

3. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5486, locality P15A. 31
   - a. Exterior side view, x1; base broken; specimen straight.
   - b. View of calice, x3; calice has almost vertical sides and a flat bottom; 7 mm deep.
   - c. Transverse section, x4.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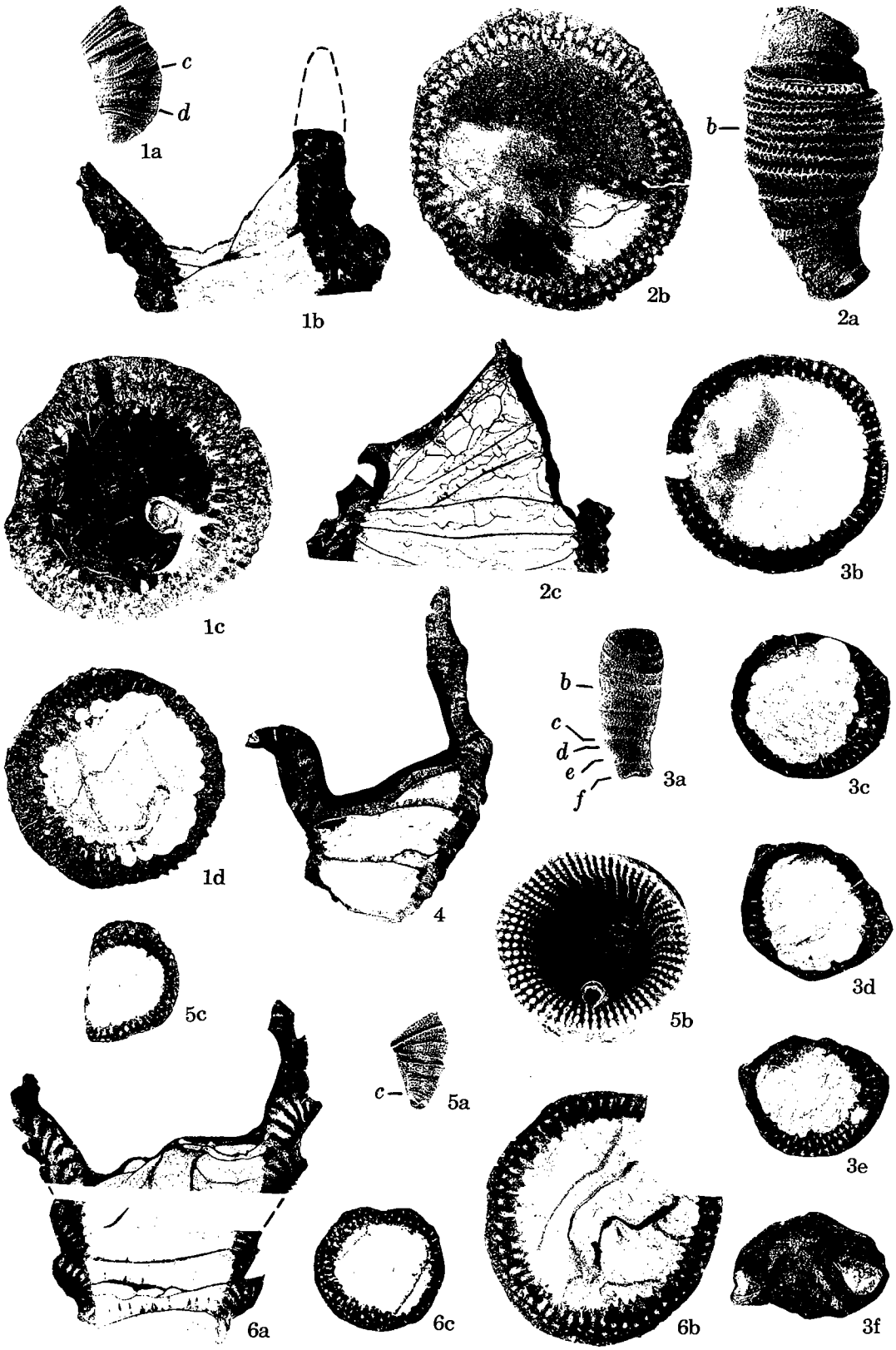
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Plate 24

(Location of primary septa is unknown. Transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

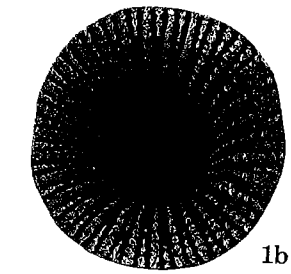
1. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5487, locality P7A. 31
   a. Exterior side view, x1; specimen complete.
   b. Longitudinal section through calice, x4.
   c, d. Ephebic transverse sections, x4.
2. *Tryplasma* cf. *T. radiculum* (Rominger), specimen USNM 145280, USNM locality 1, near locality P1-S,T. 31
   a. Exterior side view, x2; base is broken; final growth stage is restricted and is tilted away from view.
   b. Ephebic transverse section, x4.
   c. Longitudinal section through highest growth stage, x4.
3. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5488, locality P15A. 31
   a. Exterior side view, x1; specimen complete; base is an attachment surface 5 mm long.
   b-e. Ephebic transverse sections, x4; axial region silicified in all sections.
   f. Early neanic transverse section, at right, and part of basal attachment wall, x14; no septa can be detected but specimen is recrystallized.
4. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5489, locality P7A. Longitudinal section, x2; early stages missing. 31
5. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5490, locality P1-S,T. 31
   a. Exterior side view, x1; base broken.
   b. View of calice, x3; calice has almost vertical sides and flat bottom; 6 mm deep. Small circular feature is a foreign object.
   c. Early ephebic transverse section, x4.
6. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5491, locality P1-S,T. 31
   a. Longitudinal section, x4.
   b, c. Ephebic transverse section, x4.

Plate 25

(All specimens of *Tryplasma* cf. *T. radiculum* illustrated on this plate (figs. 1-6) are interpreted as immature specimens which did not develop the cylindrical stage characteristic of specimens illustrated on plates 23 and 24.)

Page

1. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5498, locality P7A. Figures b-d are oriented with the bottom of each photograph at inside of curvature, at right of exterior side view, figure a. 31
   a. Exterior side view, x1; specimen complete; no attachment structure.
   b. View of calice, x3; note narrow funnel shape of calice at this growth stage and marked difference in size of major and minor septa; calice is 7.5 mm deep.
   c. Ephebic transverse section through middle part of calice, x4; note narrow, short minor septa.
   d. Late neanic transverse section which intersects a slightly arched tabulum, x6; note minor septa are short and obscure.
   e. Enlargement of figure c to show septal structure, x14; note close spacing of major and minor septa.
2. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5499, locality P7A. 31
   a. Longitudinal section, x4.
   b. Ephebic transverse section, x4.
3. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5500, locality P1-S,T. 31
   a. Exterior side view of an immature specimen, x3; note well-preserved surface ornamentation and attachment surface which is 4.5 mm long.
   b. View of calice, x3. Bottom of photograph is at inside of curvature in figure a.
4. *Tryplasma* cf. *T. radiculum* (Rominger), specimen USNM 145281, USNM locality 8, near locality P19. 31
   a. Longitudinal section, x4; middle part of section silicified.
   b. Enlargement of figure a to show septal structure, x14; epithecal wall is to the right.
5. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5501, locality P7A. Enlargement of an oblique section through wall of a calice of an immature specimen, x14, similar to that shown in figure 1b, intersecting trabeculae at a right angle. Note comparatively small size of trabeculae making up minor septa. 31
6. *Tryplasma* cf. *T. radiculum* (Rominger), specimen OU 5502, locality P7A. Longitudinal section of an immature specimen of about the same size as that shown in figure 1, x4. 31
7. *Oliveria planotabulata,* new species, paratype USNM 145282, USNM locality 8, near locality P19. Exterior side view of a relatively unabraded immature specimen, x2. 33
8. *Oliveria planotabulata,* new species, paratype OU 5503, locality P19. Exterior side view showing well-preserved surface ornamentation, x2. 33
9. *Oliveria planotabulata,* new species, paratype OU 5504, locality P15A. 33
   a. Ephebic transverse section, x6.
   b. Longitudinal section, x6.
   c. Enlargement of figure b showing tabularium to the left, multitrabecular septal stereozone, and outer zone of thin, sagging dissepiments to the right, x14.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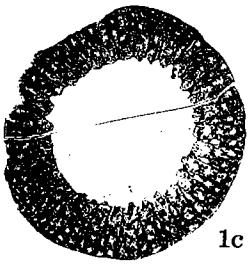
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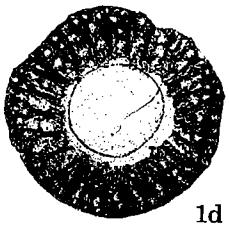
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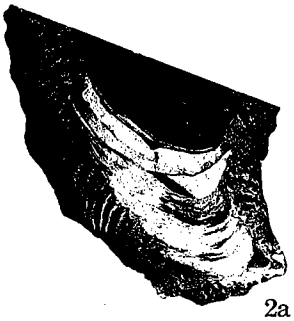
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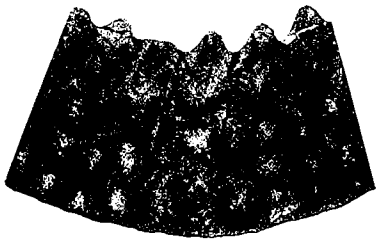
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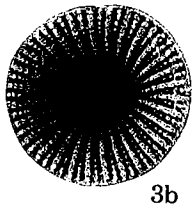
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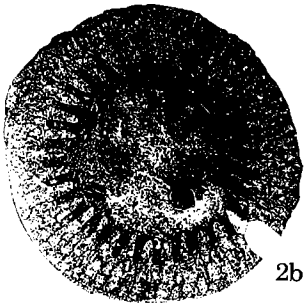
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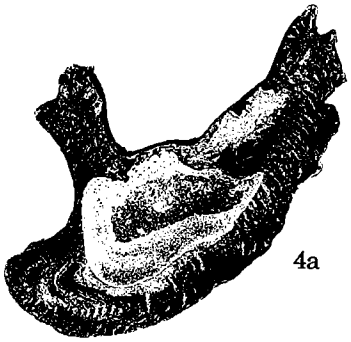
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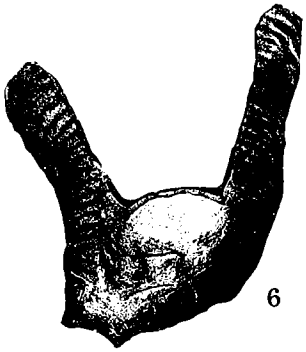
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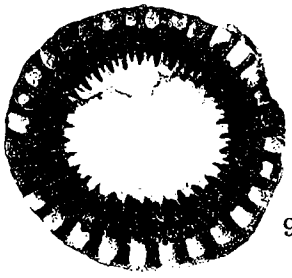
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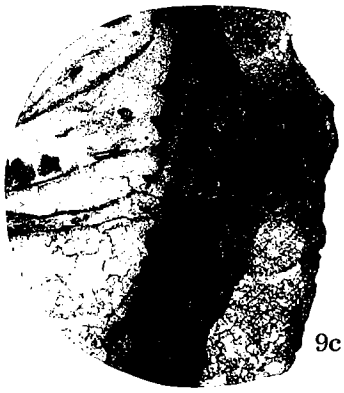
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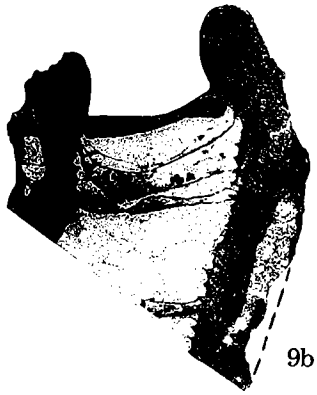
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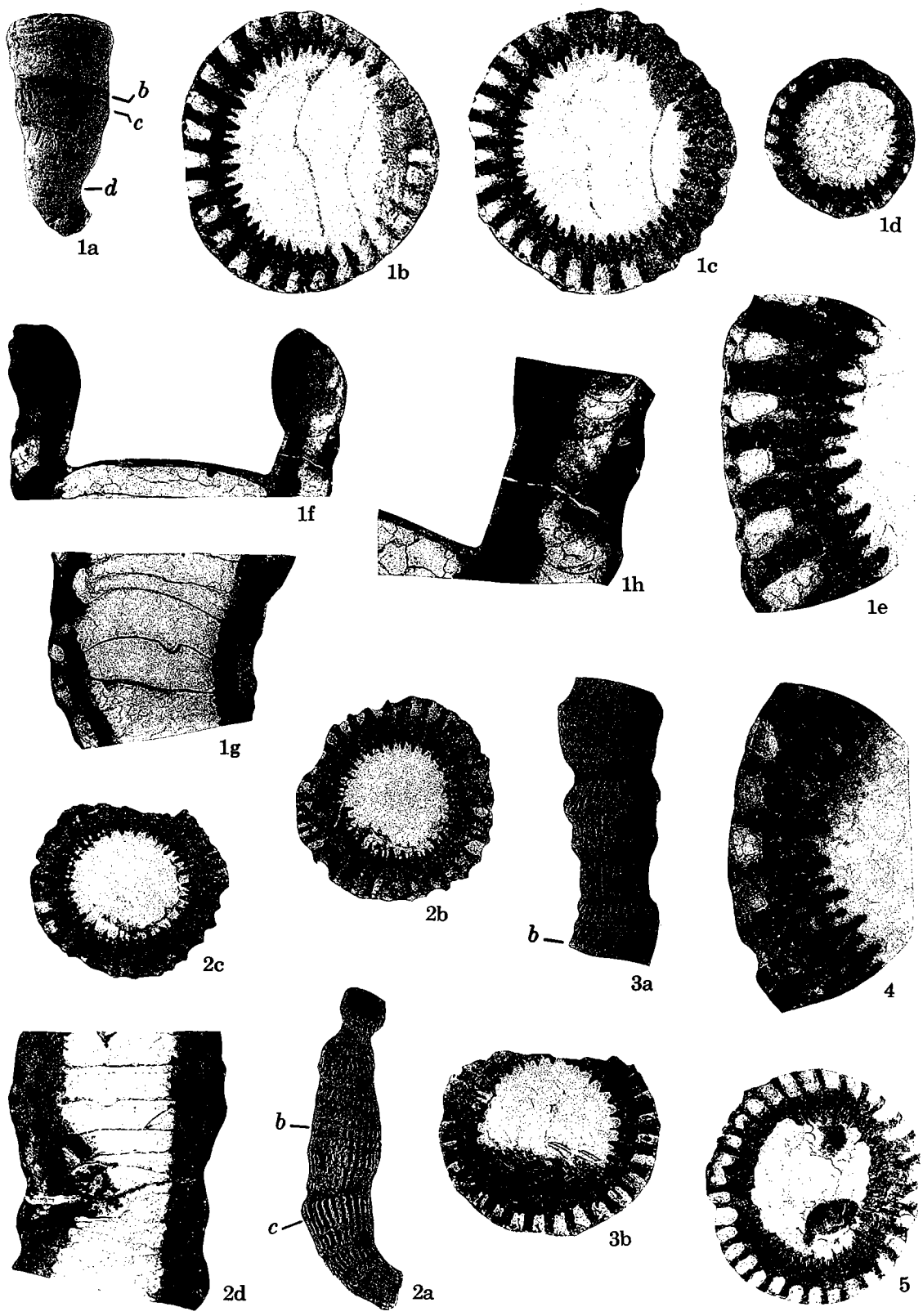
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Plate 26

(Orientation of specimens with reference to primary septa is unknown. Transverse sections are oriented with bottom of each photograph corresponding to front of exterior side view for each specimen.)

Page

1. *Oliveria planotabulata,* new species, holotype OU 5505, locality P15A. 33
   - a. Exterior side view, x2; specimen mostly unabraded; transverse cut made before photograph was taken.
   - b-d. Ephebic transverse sections, x6. Sections b and c are slightly oblique.
   - e. Enlargement of figure c to show thin epitheca and multitrabecular septa, x14.
   - f. Longitudinal section through calice, x6; section is perpendicular to the view shown in figure a.
   - g. Longitudinal section, x6; section is perpendicular to the view shown in figure a.
   - h. Enlargement of figure f to show sagging dissepiments; epitheca to the right, x14.
2. *Oliveria planotabulata,* new species, paratype OU 5506, locality P7A. 33
   - a. Exterior side view, x2; surface abraded before deposition, removing thin epitheca and exposing the major septa.
   - b, c. Ephebic transverse sections, x6; epitheca mostly missing.
   - d. Longitudinal section, x6; note structure of multitrabecular septa; epitheca and dissepimental zone are mostly missing.
3. *Oliveria planotabulata,* new species, paratype USNM 145283, USNM locality 1, near locality P1-S,T. 33
   - a. Exterior side view of a fragment of a large specimen, x2; partly abraded.
   - b, c. Ephebic transverse section, x6; epitheca mostly missing.
4. *Oliveria plantobulata,* new species, paratype OU 5507, locality P19. Enlargement of an ephebic transverse section to show septal structure, x14. 33
5. *Oliveria planotabulata,* new species, paratype OU 5508, locality P7A. Ephebic transverse section, x6; epitheca mostly missing. 33

Plate 27

Page

1. *Saucrophyllum arbucklense,* new species, paratype OU 5509, locality P6. 39
   a. Exterior side view, x3; note attachment to crinoid stem and well-developed longitudinal ridges; cardinal septum is to the right.
   b. Longitudinal section, x6; cardinal side is to the left.
   c. Ephebic transverse section, x6.
   d. Late neanic transverse section, x6.
   e. Enlargement of figure c, x14; note split counter septum.

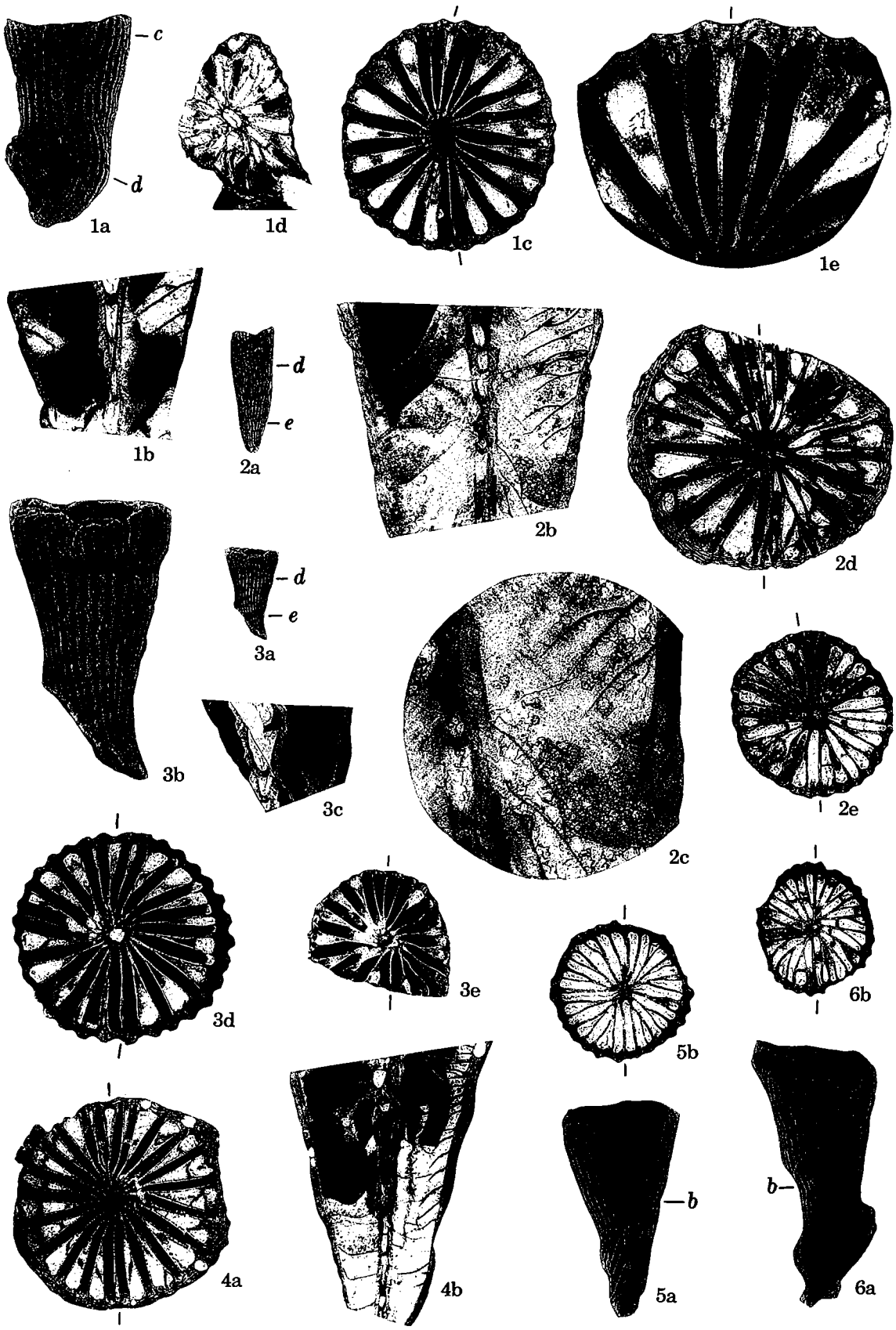
2. *Saucrophyllum arbucklense,* new species, holotype OU 5510, locality P6. 39
   a. Exterior side view, x1; earliest portion broken; cardinal side is to the left.
   b. Longitudinal section, x6; cardinal side is to the left.
   c. Enlargement of figure b, x14; note two sets of tabulae.
   d, e. Ephebic transverse sections, x6.

3. *Saucrophyllum arbucklense,* new species, paratype OU 5511, locality P6. 39
   a, b. Exterior side view, x1 and x3; cardinal side is to the left.
   c. Longitudinal section, x6; left part of section broken.
   d. Ephebic transverse section, x6.
   e. Late neanic transverse section, x6; flat side at bottom of figure is attachment surface.

4. *Saucrophyllum arbucklense,* new species, paratype OU 5512, locality P6. 39
   a. Ephebic transverse section, x4; note split cardinal, counter, and counter-lateral septa.
   b. Longitudinal section, x4; section does not intersect aulos in middle part of figure.

5. *Saucrophyllum arbucklense,* new species, paratype OU 5513, locality P6. 39
   a. Exterior side view, x3; specimen curved at right angle to plane of photograph and in plane of alar septum which can be seen in figure. Specimen is attached to a bryozoan frond.
   b. Early ephebic transverse section, x6.

6. *Saucrophyllum arbucklense,* new species, paratype OU 5514, locality P6. 39
   a. Exterior side view, x3; early portion of specimen attached to a bryozoan colony and is not curved in a consistent plane.
   b. Early ephebic transverse section, x6.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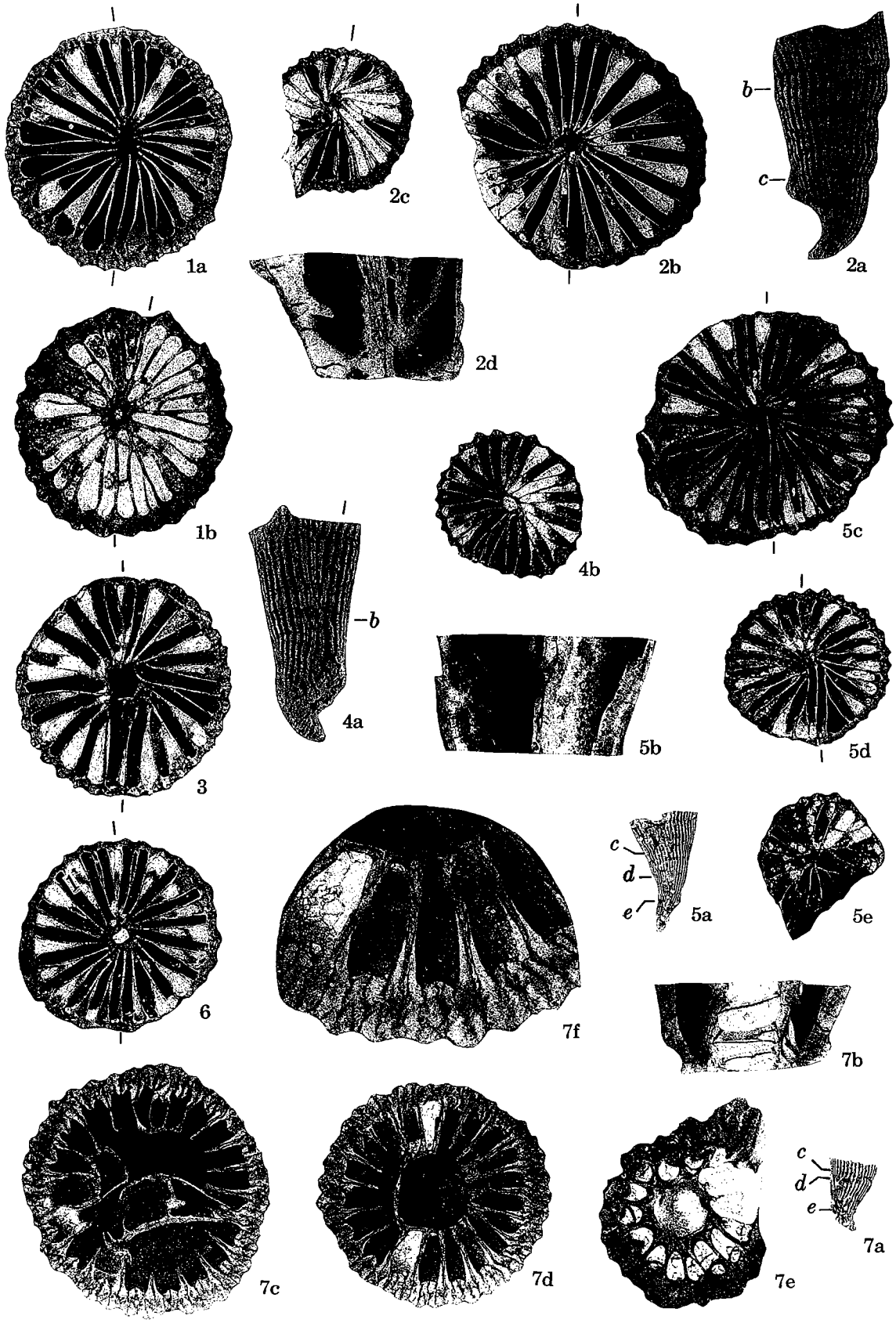
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Plate 28

Page

1. *Saucrophyllum arbucklense,* new species, paratype OU 5515, locality P6. 39
   a, b. Ephebic transverse sections, x6.

2. *Saucrophyllum arbucklense,* new species, paratype OU 5516, locality P6. 39
   a. Exterior side view, x3; cardinal septum to the left; note alar septal groove in middle of photograph.
   b, c. Early and late ephebic transverse sections, x6.
   d. Longitudinal section, x6; section does not intersect center of aulos.

3. *Saucrophyllum arbucklense,* new species, paratype OU 5517, locality P6. Ephebic transverse section, x6; note split cardinal and counter septa. 39

4. *Saucrophyllum arbucklense,* new species, specimen OU 5518, locality P1-S,T. 39
   a. Exterior side view, x3; cardinal septum is offset from right side of photograph.
   b. Early ephebic transverse section, x6.

5. *Saucrophyllum arbucklense,* new species, specimen OU 5519, locality P1-S,T. 39
   a. Exterior view of cardinal side looking into cardinal septum, x1; specimen curved in alar plane.
   b. Longitudinal section, x6; section slightly offset from axis.
   c. Late ephebic transverse section, x6; note extra septa at right of figure.
   d. Early ephebic transverse section, x6.
   e. Late neanic stage, x8.

6. *Saucrophyllum arbucklense,* new species, paratype OU 5520, locality P6. Ephebic transverse section, x6. 39

7. *Syringaxon adaense,* new species, holotype OU 5521, locality P6. 34
   a. Exterior side view, x1; pitted area at lower left is part of large attachment area.
   b. Longitudinal section, x6.
   c. Transverse section through calice, x6.
   d. Ephebic transverse section, x6.
   e. Early ephebic transverse section, x6. Irregular surface at top of figure is attachment surface.
   f. Enlargement of figure d to show septal structure, x14.

Plate 29

Page

1. *Petraia? squarrosa,* new species, paratype OU 5522, locality P1-S,T. 40
   a. Exterior side view, x2; cardinal septum, to the right, is marked at top; note attachment around crinoid stem.
   b. Transverse section through calice, x6.
   c. Ephebic transverse section at base of deep calice, x6.
   d. Longitudinal section of lower part of corallite intersecting crinoid stem and attachment structure, x4; compare with figure a.

2. *Petraia? squarrosa,* new species, paratype OU 5523, locality P1-S,T. 40
   a. Exterior side view, x2; calice missing; note attachment to crinoid stem.
   b. Ephebic transverse section, x4.

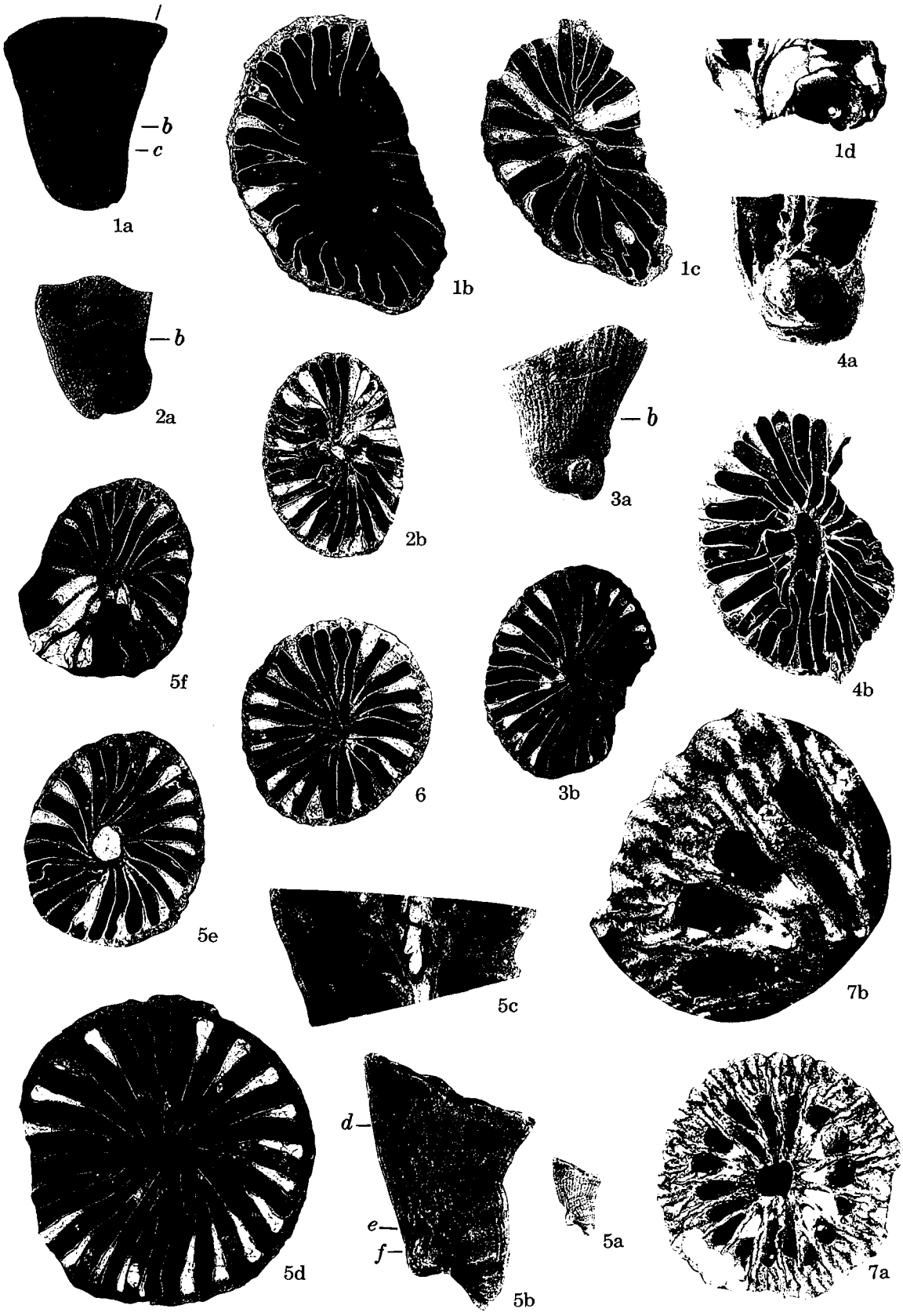
3. *Petraia? squarrosa,* new species, paratype OU 5524, locality P1-S,T. 40
   a. Exterior side view, x2; note attachment to crinoid stem.
   b. Ephebic transverse section, x4.

4. *Petraia? squarrosa,* new species, paratype OU 5525, locality P7A. 40
   a. Longitudinal section, x4; note attachment to crinoid stem and apparent absence of tabulae.
   b. Ephebic transverse section, x6.

5. *Petraia? squarrosa,* new species, holotype OU 5526, locality P1-S,T. 40
   a, b. Exterior side view, x1 and x3; note large attachment structure and change in direction of curvature from early to later growth stage.
   c. Longitudinal section, x6; note occurrence of widely spaced tabulae in irregularly developed aulos.
   d-f. Ephebic transverse sections, x6; note development of aulos in figure e but not in lower and higher sections.

6. *Petraia? squarrosa,* new species, paratype OU 5527, locality P7A. Ephebic transverse section, x6; note lack of development of an aulos. 40

7. *Syringaxon adaense,* new species, paratype OU 5528, locality P6. 34
   a. Ephebic transverse section, x6.
   b. Enlargement of figure a to show septal structure, x14.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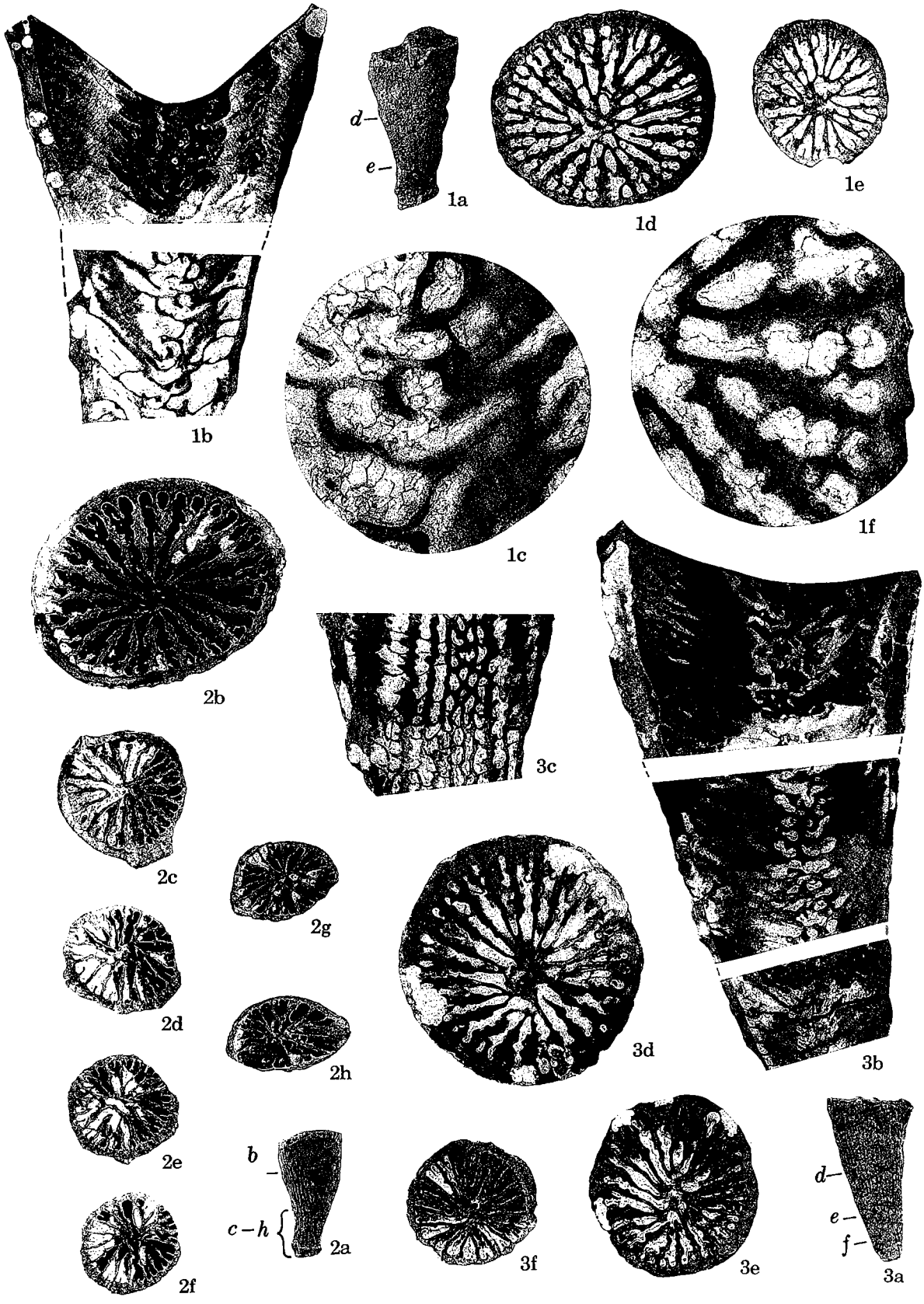
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Plate 30

Page

1. *Enterolasma* cf. *E. waynense* (Safford), specimen OU 5529, locality P6. 22
   a. Exterior side view, x1; surface covered by bryozoan colony; base is an attachment surface.
   b. Longitudinal section, x4.
   c. Enlargement of figure b to show axial structure, x14.
   d, e. Ephebic transverse sections, x4.
   f. Enlargement of figure d to show microstructure, x14.

2. *Enterolasma* cf. *E. waynense* (Safford), specimen OU 5530, locality P6. 22
   a. Exterior side view of a cast, x1; base is an attachment surface; surface is poorly preserved. Longitudinal section of this specimen is illustrated on plate 31, figure 4.
   b. Late ephebic transverse section, x4.
   c-h. Early ephebic and late neanic transverse sections, x4.

3. *Enterolasma* cf. *E. waynense* (Safford), specimen OU 5531, locality P6. 22
   a. Exterior side view, x1; base broken; surface poorly preserved.
   b. Longitudinal section, x4.
   c. Longitudinal section offset from axial region to show thickened tuberculate septa and thin tabulae, x4.
   d-f. Ephebic transverse sections, x4.

Plate 31

Page

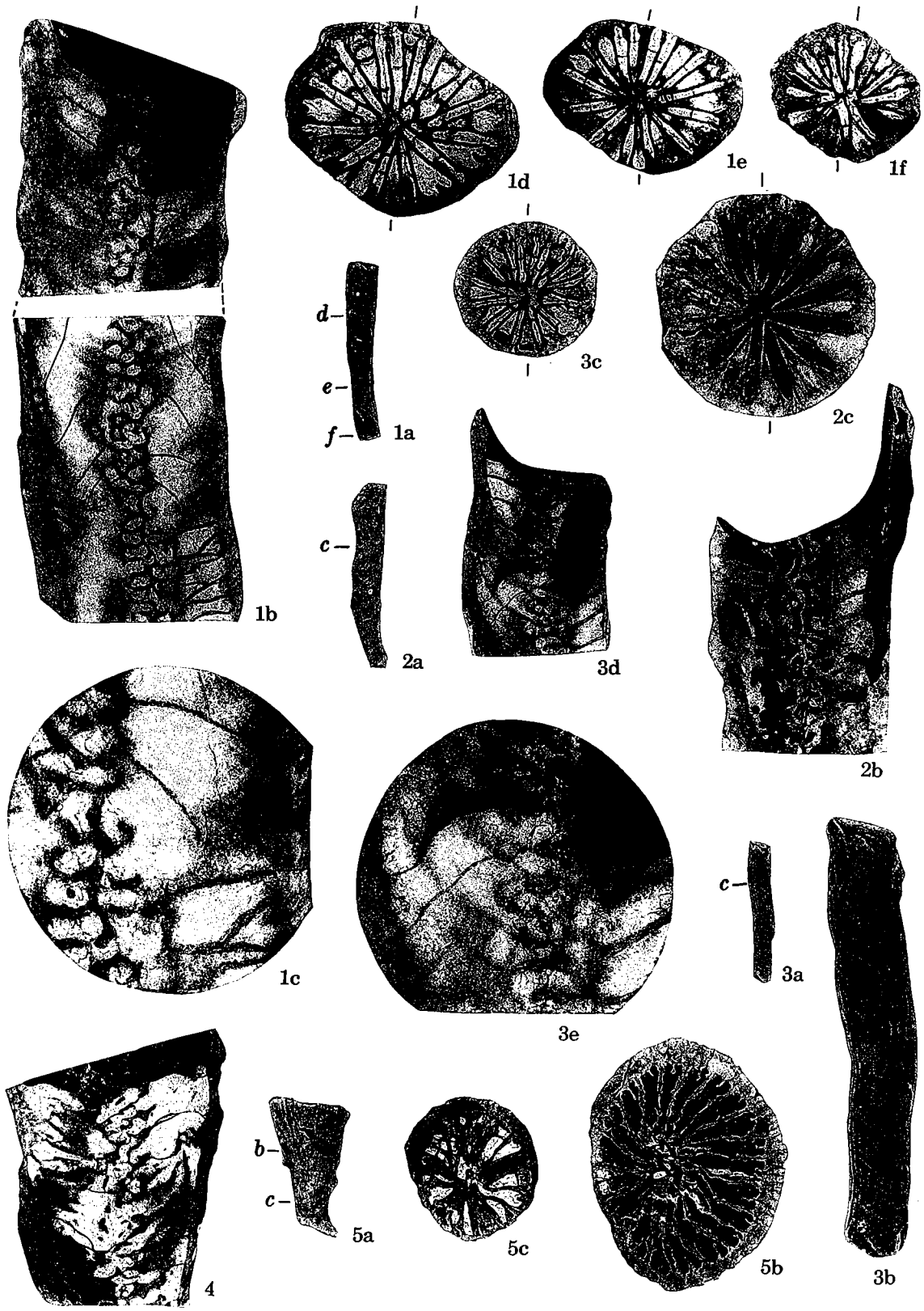
1. *Ditoecholasma rowetti,* new species, holotype OU 5533, locality P6. 37
   a. Exterior side view, x1; note fine, slanting transverse growth lines and what appears to be scattered spine bases; base of specimen broken; cardinal septum is offset about 15 degrees from right side of figure.
   b. Longitudinal section, x6; note flat position-I tabulae at lower right and widely spaced tabulae of position II, which are tilted upward axially.
   c. Enlargement of figure b to show the two types of tabulae and nature of axial structure, x14.
   d-f. Ephebic transverse sections, x6; note split cardinal and counter septa in the interseptal loculi.

2. *Ditoecholasma rowetti,* new species, paratype OU 5534, locality P6. 37
   a. Exterior side view, x1; surface poorly preserved; base broken. View is toward the cardinal side; cardinal septum at right angle to slight curvature.
   b. Longitudinal section of upper part of specimen through calice, x6.
   c. Ephebic transverse section, x8. Note extra septa at lower right in interseptal loculus.

3. *Ditoecholasma rowetti,* new species, paratype OU 5535, locality P6. 37
   a, b. Exterior side view, x1 and x3; base is an attachment surface; note fine, slanting growth lines; cardinal septum is at right of figure.
   c. Ephebic transverse section, x6.
   d. Longitudinal section through upper part of specimen, x6.
   e. Enlargement of figure d to show tabulae of position I at lower right and tabulae of position II at left, which are inclined upward axially, x14.

4. *Enterolasma* cf. *E. waynense* (Safford), specimen OU 5530, locality P6. Longitudinal section of specimen shown on plate 30, figure 2, x4. 22

5. *Enterolasma* cf. *E. waynense* (Safford), specimen 5532, locality P6. 22
   a. Exterior side view, x1; surface poorly preserved; note wide attachment area.
   b. Late ephebic transverse section through base of calice, x4.
   c. Late neanic transverse section, x4.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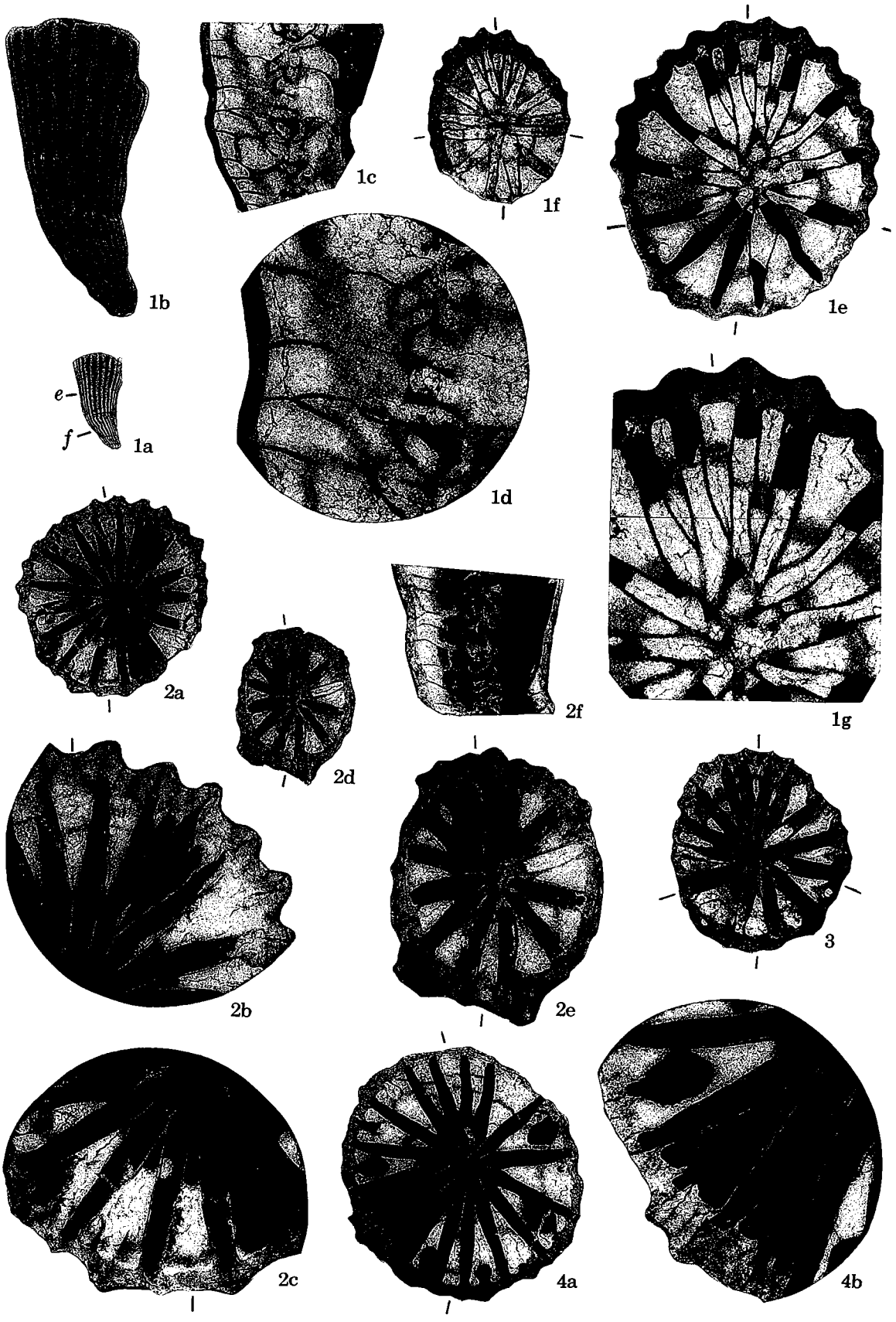
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Plate 32

Page

1. *Ditoecholasma lawrencense,* new species, paratype OU 5536, locality P6. 36
   a, b. Exterior view of counter side, x1 and x3; specimen curved in alar plane; base is an attachment surface.
   c. Longitudinal section, x6. Nearly horizontal position-I tabulae are shown at left, and position-II tabulae, which rise upward toward the axis, can be seen at right.
   d. Enlargement of figure c, x14.
   e, f. Ephebic transverse sections, x8; note split cardinal and counter septa, each represented externally by only one septal groove.
   g. Enlargement of figure e, x14.

2. *Ditoecholasma lawrencense,* new species, holotype OU 5537, locality P6. 36
   a. Late ephebic transverse section, x6.
   b, c. Enlargements of figure a to show split cardinal and counter septa and to show two extra septa in several of the interseptal loculi, x14.
   d, e. Late neanic transverse section, x8 and x14.
   f. Longitudinal section, x6; note flat tabulae at right of position I.

3. *Ditoecholasma lawrencense,* new species, paratype OU 5538, locality P6. Ephebic transverse section, x6. 36

4. *Ditoecholasma lawrencense,* new species, paratype OU 5539, locality P6. 36
   a. Late ephebic transverse section, x6; note split cardinal and counter septa and the presence of tabulae in these intervening interseptal loculi corresponding to position-I tabulae. An unphotographed lower section is illustrated in text-figure 21.
   b. Enlargement of figure a to show two extra septa in interseptal loculi and not between septal pairs, x14.

Plate 33

Page

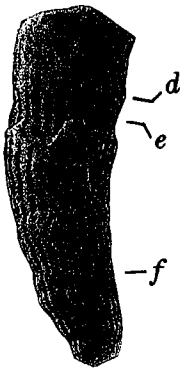
1. *Duncanella pontotocensis,* new species, holotype OU 5540, locality P6. 41
   a. Exterior side view, x3; note exposed septa at base of specimen.
   b. Longitudinal section, x6.
   c. Enlargement of figure b, x14.
   d, e. Late ephebic transverse sections, x6.
   f. Early ephebic transverse section, x8.
   g. Enlargement of figure e, x14.

2. *Duncanella pontotocensis,* new species, paratype OU 5541, locality P6. 41
   a. Late ephebic transverse section, x8; note withdrawal of septa forming aulos-like pit at base of calice.
   b. Enlargement of figure a, x14.
   c, d. Early ephebic transverse section, x8 and x14.
   e. Longitudinal section, x6.

3. *Duncanella pontotocensis,* new species, paratype OU 5542, locality P6. 41
   a. Late ephebic transverse section, x8; note withdrawal of septa to form pit at base of calice.
   b, c. Ephebic transverse section, x8 and x14.
   d. Early ephebic transverse section, x8.
   e. Longitudinal section, x6.

4. *Duncanella pontotocensis,* new species, paratype OU 5543, locality P6. 41
   a. Late ephebic transverse section, x8; note pit in axial region at base of calice.
   b. Longitudinal section offset from axial region to show flanged septa, x6.

5. *Duncanella pontotocensis,* new species, paratype OU 5544, locality P6. Longitudinal section, x6. 41



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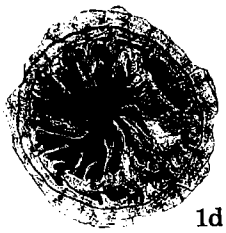
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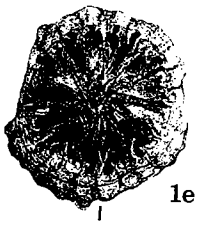
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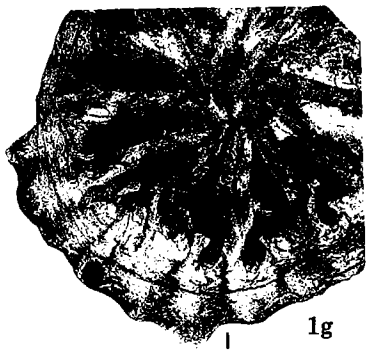
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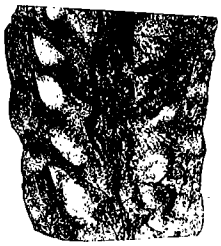
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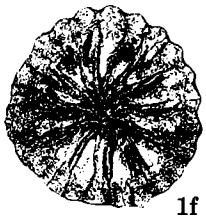
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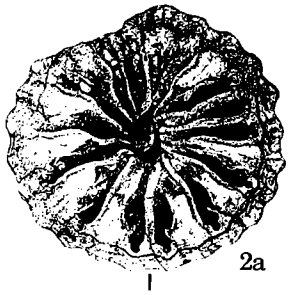
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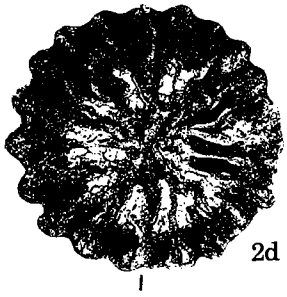
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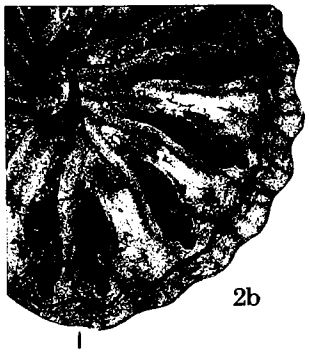
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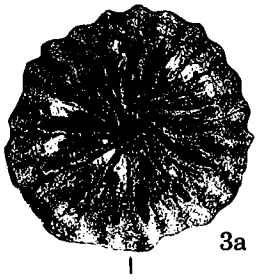
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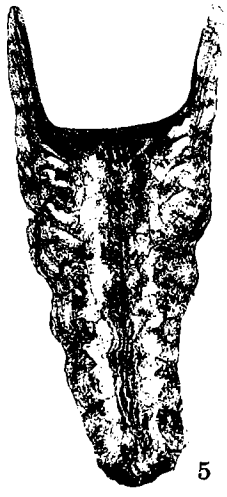
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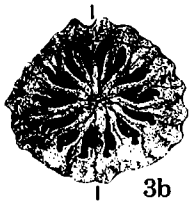
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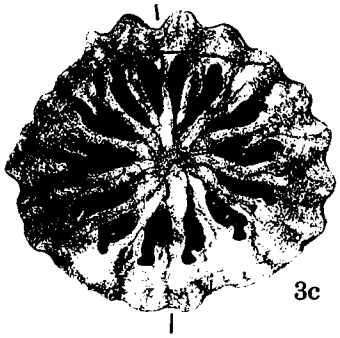
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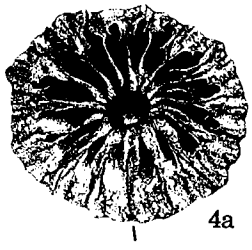
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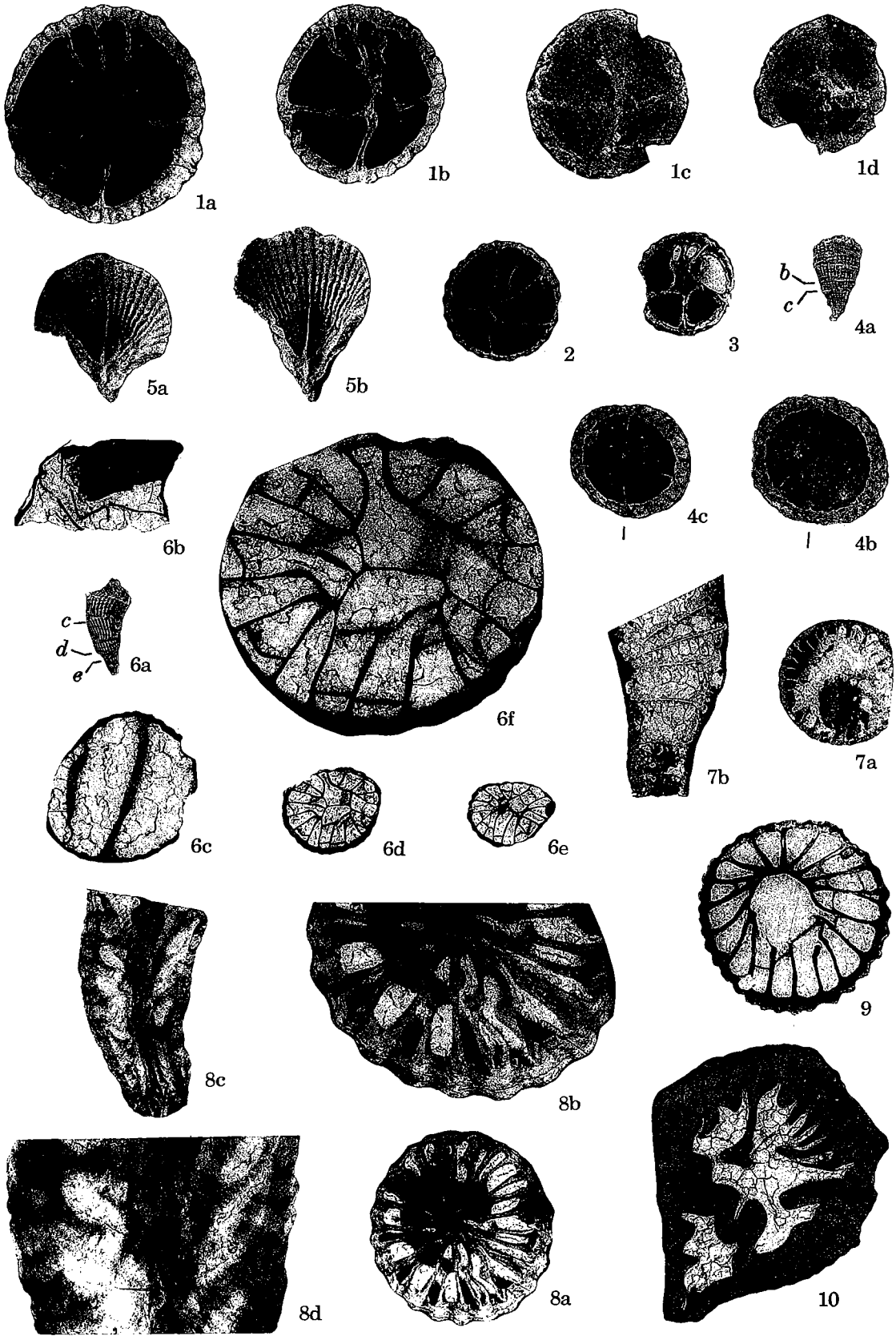
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5a
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2
3
b
c
4a
6b
6f
4c
4b
c
d
e
6a
7b
7a
6c
6d
6e
9
8c
8b
8d
8a
10

Plate 34

APPENDIX I

LOCALITY LIST

Oklahoma Geological Survey Localities

The Henryhouse coral localities shown on text-figures 2 and 3 and listed in the text coincide with measured stratigraphic sections or localities of Amsden (1960, p. 178-286), with the exception of P1-S,T, P7A, P15A, P18, and P19. Individual beds referred to in the text are designated by letters as recorded by Amsden.

C2 About 1 mile northeast of Bromide, SW¼ NW¼ sec. 33, T. 1 S., R. 8 E., Coal County.

Ca1 Henryhouse Creek, SE¼ sec. 30, T. 2 S., R. 1 E., Carter County.

Ca2 About 100 feet west of Tulip Creek, NW¼ SE¼ sec. 25, T. 2 S., R. 1 E., Carter County.

M1 Southeast end of Vines dome, about 1 mile north of Dougherty, NW¼ NW¼ sec. 2, T. 2 S., R. 2 E., Murray County.

M2 About 1,000 feet southeast of White Mound, SE¼ NE¼ sec. 20, T. 2 S., R. 3 E., Murray County.

M10 Buckhorn Ranch, about 4 miles northeast of Dougherty, SW¼ SE¼ sec. 33, T. 1 S., R. 3 E., Murray County.

M14 About 100 yards west of State Highway 18, NE¼ SE¼ sec. 2, T. 2 S., R. 3 E., Murray County.

M15 About 0.25 mile north of Camp Classen, SE¼ SW¼ sec. 13, T. 1 S., R 1 E., Murray County.

M18 West side of Spring Creek, SW¼ SE¼ sec. 17, T. 2 S., R. 1 W., Murray County.

P1 Chimneyhill Creek, on the Lawrence uplift, SW¼ sec. 4 and SE¼ sec. 5, T. 2 N., R. 6 E., Pontotoc County.

P1-S,T 10 to 40 feet below top of Henryhouse Formation, for 0.5 mile along bluff, on north side Chimneyhill Creek, NW¼ SW¼ sec. 4, T. 2 N., R. 6 E., Pontotoc County. This interval coincides with Amsden's units S and T in measured section P1 but extends laterally along the bluff from where the section was measured. USNM locality 1 is near this site.

P3 In small northeastward-trending stream valley south of Cedar Hill, SE¼ sec. 4 and NE¼ sec. 9, T. 2 N., R. 6 E., Pontotoc County.

P4 Small quarry on south side of road, SW¼ SW¼ sec. 3, T. 2 N., R. 6 E., Pontotoc County.

P5 Glade about 1.5 miles southeast of Lawrence, NW¼ NW¼ sec. 5, T. 2 N., R. 6 E., Pontotoc County.

P6 Glade just south of road, SE¼ SW¼ sec. 4, T. 2 N., R. 6 E., Pontotoc County. Glade exposes sequence 15 to 25 feet above base of Henryhouse Formation.

P7 Small roadside outcrop, NE¼ SE¼ sec. 32, T. 3 N., R. 6 E., Pontotoc County. Exposes sequence 10 to 20 feet below top of Henryhouse Formation.

P7A Upper 25 feet of Henryhouse Formation; glade west of road 100 to 300 feet west of P7; NE¼ NE¼ SE¼ sec. 32, T. 3 N., R. 6 E., Pontotoc County.

P8 North bank of Bois d'Arc Creek, SW¼ NW¼ sec. 11, T. 2 N., R. 6 E., Pontotoc County. Exposes upper 5 feet of Henryhouse Formation.

P12 Small hilltop glade on west side of section-line road, SE¼ NE¼ sec. 32, T. 3 N., R. 6 E., Pontotoc County.

P15A Upper 20 feet of Henryhouse Formation, 200 feet north of P15; NW¼ NW¼ sec. 33, T. 3 N., R. 6 E., Pontotoc County.

P18 Yellow Bluff, bluff on south side of Bois d'Arc Creek, NE¼ NE¼ SW¼ sec. 10, T. 2 N., R. 6 E., Pontotoc County.

P19 Upper 40 feet of Henryhouse Formation, glade along east side of road, 900 feet south of northwest corner of section, NW¼ NW¼ NW¼ sec. 33, T. 3 N., R. 6 E., Pontotoc County.

U. S. National Museum Localities

1 USNM locality 472c. Henryhouse Formation (upper coral bed), bluff north of Chimneyhill Creek; NW½ SW¼ sec. 4, T. 2 N., R. 6 E., Pontotoc County (near P1-S,T). Collectors: A. R. Loeblich and W. E. Ham, May 1947.

2 Henryhouse Formation, bluff north of Chimneyhill Creek, Pontotoc County (near P1). Collector: unknown.

3 USNM locality 472b. Henryhouse Formation (upper part), SW¼ NW¼ NW¼ sec. 33, T. 3 N., R. 6 E., Pontotoc County (near P19). Collectors: A. R. Loeblich and W. E. Ham, May 1947.

4 Henryhouse Formation, Cedar Hill and bluffs on north bank of South Fork of Jackfork Creek; S½ sec. 4, T. 2 N., R. 6 E., Pontotoc County (near upper part of section P3). Collector: G. A. Cooper, August 1941.

5 USNM locality 477a. Henryhouse Formation, upper part of bed 7 in a measured section by W. E. Ham, about 80 feet above base and 110 feet below top of formation. On Henryhouse Creek, 3 miles east of Woodford; SW¼ SE¼ sec. 30, T. 2 S., R. 1 E., Carter County (near Ca1). Collectors: A. R. Loeblich and W. E. Ham, May 1947.

6 Henryhouse Formation; NW¼ SW¼ sec. 4, T. 2 N., R. 6 E., Pontotoc County (near P1). Collector: A. R. Loeblich.

7 Henryhouse Formation; NW¼ sec. 4, T. 2 N., R. 6 E., Pontotoc County (west of P1?). Collector: unknown.

Localities of A. Allen Graffham in Brownsport Formation in Western Tennessee

1 Brownsport Formation, glade 1.5 miles due west of Amsden's locality 39 (1949, p. 40), which is located as follows: "Perryville quadrangle; east side of road leading from Perryville to Decaturville, 1.2 miles south of Perryville."

2 Brownsport Formation, glade about 1.25 miles northeast of Amsden's locality 18 (1949, p. 38), which is located as given below for locality 3.

3 Brownsport Formation, Amsden's locality 18 (1949, p. 38), which is located as follows: "Perryville quadrangle: Blue Mound Glade, 0.2 mile north of road leading from Cedar Grove Church to Mt. Carmel Church, 0.8 mile northeast of Cedar Grove Church."

APPENDIX II

TABULATION OF DATA

All measurements of diameter (d), septal count (n), height (h), and septal ratio (n/d) are recorded for each species where septa can be counted. All specimens with OU (University of Oklahoma) catalog numbers are illustrated in plates 1-34. Other specimen designations are the author's reference numbers or refer to other collections.

Oklahoma Geological Survey localities (indicated by the prefix P) and those of Graffham are given in appendix I. Amsden locality numbers are recorded as given in Amsden (1949). The localities of a number of Amsden's unfigured specimens of *Ditoecholasma fanninganum* are recorded according to the Peabody Museum (YPM) locality-acquisition number. The locality of the U. S. National Museum specimens of *Duncanella borealis* from the Waldron Formation is also given by locality-acquisition number. Simpson's specimens (1900) of *Enterolasma waynense* are from an unknown locality in the Brownsport Formation.

Spongophylloides cockei

Locality	Number	d	n	h	n/d
P7A	OU 5419	11.3	29	13.5	2.6
		5.0	26±	5.5	5.2
		4.8	24±	5.0	5.0
	OU 5427	12.8	30	16.5	2.4
	OU 5424	10.0	25	12.4	2.5
	OU 5420	....	28	15.5	....
		6.7	25	9.0	3.7
	OU 5422	8.5	28	9.0	3.3
		7.9	25	7.8	3.2
	OU 5428	6.3	22±	7.1	3.5
	OU 5429	10.0	28	....	2.8
	P7A-63	8.5	26	10.7	3.1
	P7A-58	7.5	22	....	2.9
	P7A-57	11.4+	30	16.3	....
P15A	OU 5426	....	28	10.8	....
	OU 5423	8.3	26	11.2	3.1
		4.1	....	5.2	....
P1 (bed Q)	S-16	10.0	26	16.0	2.6
P19	OU 5421	7.3	25	11.2	3.4
		3.8	....	5.0	....

Spongophylloides sp. X

Locality	Number	d	n	h	n/d
P7A	OU 5425	11.0	26	....	2.4
		10.7	26	....	2.4
Near P3	USNM 145274	10.0	26	14.5	2.6

Amsdenoides acutiannulatus

(Henryhouse Formation)

Locality	Number	d	n	h	n/d
P7A	OU 5437	10.8	25	13.0	2.3
		5.2	20	3.8	3.8
	OU 5443	9.0	28	----	3.1
		7.9	26	----	3.3
	OU 5440	4.8	21	9.5	4.4
		4.2	20	5.4	4.8
	OU 5439	6.8	22	41.0	3.2
		7.2	21	24.5	2.9
		4.6	19	7.6	4.1
		4.6	19	6.5	4.1
		4.2	18	5.6	4.3
		4.0	16	4.3	4.0
		3.2	14	2.9	4.4
	OU 5436	9.7	26	35.0	2.7
		6.5	24	17.8	3.7
		5.0	20	8.0	4.0
		4.5	20	7.5	4.4
	S-21	8.7	24	----	2.8
		6.0	21	----	3.5
	S-94	7.3	22	15.6	3.0
	S-90	7.2	25	----	3.5
	S-179	6.5	20	18.5	3.1
		5.5	19	11.0	3.5
	P7A-5	10.0	26	----	2.6
		9.7	26	----	2.7
		10.9	24	----	2.2
	P7A-31	11.5	26	26.0	2.3
		6.9	22	11.0	3.2
	P7A-6	8.5	27	----	3.2
		10.2	27	----	2.6
		7.8	27	----	3.5
P1-S,T	OU 5435	13.4	30	----	2.2
		17.3	30	----	1.7
		13.2	30	----	2.3
		16.1	30	----	1.9
		12.2	30	----	2.5
	OU 5442	15.8	31	----	2.0
		13.4	30	----	2.2
		11.2	30	----	2.7
	OU 5444	7.9	23	----	2.9
		5.7	21	----	3.7
		3.1	14	----	4.5
Near P1	USNM 145275	10.0	28	23.0+	2.8
		4.2	20	4.6+	4.8
		4.2	18	3.3+	4.3
		4.2	16	2.0+	3.8
	USNM 145276	5.6	21	26.0	3.8
		4.5	20	9.0	4.4
	S-127	9.7	26	----	2.7
		5.0	22	----	4.4
	S-148	16.0	30	----	1.9

Locality	Number	d	n	h	n/d
P15A	OU 5441	7.0	22	20.8	3.1
	S-125	7.0	21	....	3.0
P19	OU 5445	12.9	29	....	2.2
		10.2	29	....	2.8
	Wp-5	11.8	30	....	2.5
		10.2	29	....	2.8

Amsdenoides acutiannulatus
(Brownsport Formation)

Locality	Number	d	n	h	n/d
Amsden 11(36)	YPM 17665	8.0	27	15.0±	3.4
Graffham 1	OU 5433	12.5	25	34.6	2.0
		9.4	25	24.3	2.7
		9.0	21	15.8	2.3
		5.5	20	5.5	3.6
	OU 5432	11.0	26	....	2.4
		8.7	24	....	2.8
	OU 5434	8.2	26	24.5	3.2
		7.2	22	13.4	3.1
	OU 5430	16.6	33	....	2.0
		15.5	33	....	2.1
	OU 5431	8.4	30	19.1	3.6
		5.9	22	7.0	3.7
	B2-13	11.4	30	....	2.6
	B2-4	11.5	29	....	2.5
		9.0	28	....	3.1
	B2-12	11.4	30	....	2.6
	B2-18	8.8	28	....	3.2
		7.1	24	....	3.4
	B2-14	10.7	29	....	2.7
		11.5	27	....	2.3

Enterolasma cf. *E. waynense*
(Henryhouse Formation)

Locality	Number	d	n	h	n/d
P6	OU 5530	9.1	19	20.7	2.1
		6.2	19	9.2	3.1
		5.3	18	7.3	3.4
		5.0	18	6.5	3.6
		4.5	18	4.8	4.0
		3.7	18	3.3	4.9
		3.5	18	2.5	5.1
	OU 5529	10.0	21	15.4	2.1
		6.2	20	7.3	3.2
		5.5	19	6.3	3.5
	OU 5531	10.7	22	....	2.1
		7.3	21	....	2.9
		5.5	20	....	3.6
	OU 5532	9.5±	20	14.0	2.1
		5.3	18	6.0	3.4

Locality	Number	d	n	h	n/d
	S-150	10.5±	20	16.6	1.9
	P6-56	9.3	21	19.0±	2.3
		6.4	20	11.8	3.1
	P6-58	7.5	20	11.0	2.7
	P6-29	9.5	20	14.7	2.1
	P6-59	7.6	20	10.8	2.6
	P6-6	7.5	20	9.5	2.7

Enterolasma waynense
(Brownsport Formation)

Locality	Number	d	n	h	n/d
Amsden 4(14)	YPM 17673	11.0	17	....	1.5
Amsden 22(15)	YPM 17672	10.5±	16	....	1.5
	YPM 17671	10.0±	18	....	1.8
		6.3	17	....	2.7
Graffham 1	B1-8	8.5	16	11.1	1.9
	B1-6	8.8	18	11.2	2.0
Simpson (1900)	Fig. 14	6.8±	15	....	2.2
	Fig. 15	7.9±	16	....	2.0

Entelophyllum cf. *E. angulare*

Locality	Number	d	n	h	n/d
P8	OU 5492C-1	5.5	20	....	3.6
	OU 5494	5.5-6.8	20	....	3.6-2.9
		4.5	18	....	4.0
	OU 5495	5.8	20	....	3.4
	OU 5493	5.2-5.8	20	....	3.8-3.4

Micula? catilla

Locality	Number	d	n	h	n/d
P1-S,T	OU 5465	24.7	34	27.0	1.4
		16.7	30	13.7	1.8
	OU 5466	27.3	34	27.9	1.2
		21.0±	33	17.3	1.6
		7.8	27	8.8	3.5
		7.3	26	6.5	3.6
	OU 5473	18.3	32	....	1.7
		7.3	23	....	3.1
	OU 5467	12.8	31	....	2.4
	OU 5471	20.0±	30	25.5±	1.5
P7A	OU 5472	17.8	30	15.5	1.7

Phaulactis? lanx

Locality	Number	d	n	h	n/d
P7A	OU 5468	18.8	34	21.9	1.8
		13.0±	33	8.0	2.5

Capnophyllum hedlundi

Locality	Number	d	n	h	n/d
P1-S,T	OU 5474	14.0	32	21.2	2.3
		9.5	32	10.5	3.4
		4.5±	26	3.7	5.8
	OU 5475	12.2	31	15.5	2.5
		8.6	28	9.2	3.3
	OU 5480	6.2	30	19.0	4.8
		10.3	30	9.5	2.9
	OU 5481	11.4	31	11.5†	2.7
	USNM 145278	11.2	30	11.5	2.7
	USNM 145279	12.4	30*	11.0±	2.4
	S-63	7.0±	22	6.5	3.1
P15A	OU 5476	7.6	28	17.0	3.7
	S-43	7.0	28	10.8	4.0
P7A	OU 5477	9.0	30	15.8	3.3
	P7A-10	11.2	28	15.4	2.5
		11.0	28	13.4	2.5
		9.5	28	11.5	2.9

Capnophyllum sp. A

Locality	Number	d	n	h	n/d
P1-S,T	OU 5482	15.2*	27	....	1.8
		7.8	22	....	2.8
	OU 5483	12.3	29	10.0	2.3
	S-77	8.7	28	7.0±	3.2

Tryplasma cf. *T. radiculum*

Locality	Number	d	n	h	n/d
P7A	OU 5487	10.5±	32	10.7	3.0
		10.0	32	9.1	3.2
		10.3	32	7.7	3.1
		8.5	30	6.0	3.5
	OU 5498	11.2*	31	10.1	2.8
		9.0	31	6.4	3.4
		4.6	26	3.4	5.7
	OU 5499	9.8	32	8.9	3.3
	P7A-8	9.0	31	....	3.4
P1-S,T	OU 5484	8.7±	30	15.8	3.4
		7.1±	28	12.2	3.9
		6.8	27	5.7	4.0
	OU 5485	9.0	32±	12.8	3.5
		8.0	30	5.5	3.7
	OU 5490	10.3*	32	....	3.1
	OU 5491	12.5*	34	....	2.7
		10.2	32	....	3.1
	USNM 145280	11.0	34	....	3.1
	OU 5500	8.2	29	7.2	3.5
P15A	OU 5488	9.0	30±	14.0	3.3
		6.0	28±	5.6	4.7
		5.0	26±	4.5	5.2
		4.8	24±	2.8	5.0

* Calice.
† Offset.

Oliveria planotabulata

Locality	Number	d	n	h	n/d
P15A	OU 5505	7.6	29	11.7	3.8
		7.6	29	11.0	3.8
		4.3	24	4.7	5.6
	OU 5504	6.3	30	6.7	4.8
P19	OU 5503	6.1	28	----	4.6
	OU 5507	6.6±	32	----	4.8
	S-142	6.8±	31	----	4.6
P7A	OU 5506	5.5±	30	18.0+	5.5
		6.1±	30	15.0+	4.9
		5.5±	26	7.2+	4.7
	OU 5508	6.7±	31	----	4.6
P1-S,T	USNM 145283	6.3	29	----	4.6

Ditoecholasma rowetti

Locality	Number	d	n	h	n/d
P6	OU 5533	6.6	12	23.5+	1.8
		5.5	12	12.5+	2.2
		4.2	12	5.0	2.9
	OU 5534	4.6	12	21.0+	2.6
		4.4	12	18.3+	2.7
		4.4	12	16.9+	2.7
	OU 5535	3.9	12	15.7+	3.1
	P6-19	3.2	10?	9.0	3.1
	P6-15	3.5	12	18.2	3.4

Ditoecholasma lawrencense

Locality	Number	d	n	h	n/d
P6	OU 5536	5.5	12	9.5	2.2
		3.3	12	3.6	3.6
	OU 5537	5.5	14	9.6	2.5
		2.8	12	3.9	4.3
	OU 5538	5.3	12	9.7	2.3
		4.7	12	8.3	2.5
		3.8	12	7.0	3.2
		2.7	12	5.0	4.4
	OU 5539	6.9	14	9.2	2.0
		5.8	14	7.7	2.4
		5.3	14	6.3	2.7
		4.5	14	5.3	3.1
	P6-2	4.5	12	7.2	2.7

Ditoecholasma fanninganum
(Brownsport Formation)

Locality	Number	d	n	h	n/d
Amsden 4(14)	YPM 17662	7.0	14	17.5±	2.0
Amsden 4(6)	YPM 17664	4.9	14	----	2.9
		3.8	14	----	3.7
	YPM 17661	6.5	14	----	2.0
YPM 5486 91-1	----	6.1	14	----	2.3
		5.7	14	----	2.5

Locality	Number	d	n	h	n/d
YPM 5486 129	....	6.5	14	....	2.2
YPM 5486 116-1	....	4.5	14	....	3.1
YPM 5486 116-2	....	5.9	14	....	2.4
YPM 5486 123-1	....	5.5	14	....	2.5
YPM 5486 123-3	....	7.0	14	23.5	2.0
YPM 5486 118-1	....	6.8	14	....	2.1
		5.8	14	....	2.4
Graffham 1	B1-3	6.3	15	....	2.4
		4.3	15	....	3.5
	B1-4	4.8	14	23.4	2.9
		3.8	14	11.8	3.7
	B1-5	5.3	14	....	2.6
		3.2	14	....	4.4
	B1-9	6.0	14	....	2.3
		7.6	14	....	1.8
	B1-10	7.1	14	....	2.0
		6.6	14	....	2.1
	B1-11	6.5	14	24.8	2.2
		6.2	14	23.7	2.3
	B1-13	5.5	14	....	2.5
	B1-14	5.0	14	18.5	2.8
	B1-15	6.0	14	....	2.3
		3.8	14	....	3.7
	B1-16	5.8	13	....	2.4
	B1-17	5.8	14	24.5	2.4
		4.0	14	12.7	3.5
	B1-18	5.5	14	....	2.5
		3.8	14	....	3.7

Saucrophyllum arbucklense

Locality	Number	d	n	h	n/d
P6	OU 5510	7.8	18	15.3±	2.3
		4.5	16	8.0±	3.6
	OU 5516	7.0	19	10.8	2.7
		3.9	17	4.9	4.4
	OU 5509	6.1	18	10.0	2.9
		3.4	15	4.0	4.4
	OU 5511	6.2	18	8.2	2.9
		3.2	16	4.4	5.0
	OU 5517	6.4	18	9.8	2.8
	OU 5512	9.4	20	16.0±	2.1
	OU 5515	6.5	19	....	2.9
		3.1	14	....	4.5
	OU 5513	4.4	16	6.5	3.6
	OU 5520	5.5	18	12.8	3.3
	OU 5514	3.5	16	6.4	4.6
	P6-8	6.5	17	....	2.6
	P6-11	5.5	17	7.3	3.1
		4.0	17	5.8	4.2
	P6-12	6.2	18	7.3	2.9
	P6-23	5.4	16	7.9	3.0

Locality	Number	d	n	h	n/d
	P6-13	7.8	20	13.0	2.6
		7.5	20	11.0	2.7
		6.7	20	9.4	3.0
		5.2	20	7.4	3.8
	P6-47	6.1	18	11.7	2.9
	P6-50	5.0	17	8.0	3.4
	P6-36	7.8	18	9.8	2.3
	P6-41	7.3	18	9.5	2.5
	P6-55	5.0	16	10.1	3.2
	P6-63	7.3	17	12.5	2.3
P1-S,T	OU 5519	6.9	19	12.5	2.8
		4.8	17	8.5	3.5
		2.8	13	4.0	4.6
	OU 5518	4.1	16	7.2	3.9
P5	P5-1	7.7	19	....	2.5

Petraia? squarrosa

Locality	Number	d	n	h	n/d
P1-S,T	OU 5526	8.4	24	10.5	2.9
		5.1	20	5.0	3.9
		5.0	20	4.2	4.0
	OU 5522	5.5	20	5.2±	3.6
	OU 5523	6.4	20	7.6	3.1
	OU 5524	7.2	24	7.8	3.3
	S-185	7.6	22	11.8	2.9
P7A	OU 5525	6.0	23	7.6	3.8
	OU 5527	6.7	20	7.2	3.0
		5.4	20	5.0	3.7

Duncanella pontotocensis

Locality	Number	d	n	h	n/d
P6	OU 5540	4.6	14	10.3	3.0
		3.3	14	3.2	4.2
	OU 5542	4.2	16	6.7	3.8
		3.1	14	3.0	4.5
		2.4	14	1.5±	5.8
	OU 5541	4.6	16	7.6	3.5
		3.5	16	1.7	4.6
	OU 5543	4.0	16	5.2	4.0
	OU 5545	3.9	14	6.8	3.6

Duncanella borealis
(Waldron Formation, Indiana)

Locality	Number	d	n	h	n/d
USNM 42919	A-1b	4.6	18	....	3.9
	A-1a	3.6	16	....	4.4
	A-2	3.2	16	....	5.0
	B-1b	3.3	18	....	5.5
	B-5a	3.2	16	....	5.0
	B-6a	4.8	18	....	3.8
	B-6b	3.7	17	....	4.6
	B-7a	3.5	16	....	4.6
	B-7b	2.7	16	....	5.9

INDEX

(Boldface number indicates main reference)