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Studies of Pennsylvanian Corals in Oklahoma

PART I. — TABULATE CORALS OF THE WAPANUCKA FORMATION

CHARLES L. ROWETT

PART II. — NEW SPECIES OF *Dibunophyllum* FROM THE DEWEY FORMATION

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STUDIES OF PENNSYLVANIAN CORALS IN OKLAHOMA

ABSTRACT

Part I.—Tabulate Corals of the Wapanucka Formation. Tabulate corals from the Lower Pennsylvanian (Morrow Series) Wapanucka Formation of southern Oklahoma include four genera and ten species: *Striatopora* cf. *S. religiosa, Acaciapora subcylindrica, Michelinia referta, M. scopulosa, M. spissata, M. tenuicula, M. latebrosa, M.* cf. *M. meekana, Cladochonus fragilis,* and *C. texasensis.* The distribution of these fossils in the Wapanucka Formation appears to have been independent of marked environmental or stratigraphic control.

Part II.—New Species of Dibunophyllum *from the Dewey Formation. Dibunophyllum brucei,* new species, occurs in the lower thin limestones and calcareous shales and *Dibunophyllum oklahomense,* new species, in the upper thin limestones and calcareous shales of the Dewey Formation, Missourian Series, northeastern Oklahoma.

Earliest stages of both species show the counter and cardinal septa insert as a single crossbar. Counter-lateral septa enter before alar septa.

PART I.—TABULATE CORALS OF THE WAPANUCKA FORMATION

CHARLES L. ROWETT*

INTRODUCTION

The objective of this study is to describe and record the distribution of fossil tabulate corals from the Lower Pennsylvanian Wapanucka Formation in southern Oklahoma. A recently published study by Rowett and Sutherland (1964) included descriptions of the rugose corals from the Wapanucka Formation, as well as detailed description of the age relations, distribution, biostratigraphy, and history of deposition during Morrow time in southern Oklahoma. For this reason a brief summary of the distribution and stratigraphic relationships of the Wapanucka will suffice here.

Surface exposures of the Wapanucka Formation occur in two general areas in southern and southeastern Oklahoma: (1) along the northeastern and eastern flanks of the Arbuckle Mountains (Pontotoc, Coal, and Johnston Counties) and (2) in the frontal belt of the Ouachita Mountains (Atoka, Pittsburg, and Latimer Counties). Outcrops in both areas occur principally as continuous strike ridges.

In the Arbuckle Mountains region the Wapanucka Formation is underlain by the Springer Formation. The depositional relationships between these two units are at present unclear. Field studies of the basal deposits of the overlying Atoka Formation (Rowett, 1963a) indicate that in the northeastern Arbuckle Mountains area the Atoka is a transgressive sequence which has a basal limestone conglomerate composed of fragments from the locally eroded subjacent Wapanucka.

Rapid lateral changes in lithofacies are characteristic of the Wapanucka Formation in the Arbuckle Mountains. Bioclastic limestones, oölitic limestones, and calcareous shales typify these deposits, and local and regional intraformational unconformities are present.

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Lateral shifts and vertical changes in a number of distinct depositional environments can be inferred from the stratigraphic and paleontological evidence. These paleoenvironments are characteristic of an epeiric shelf setting and include sublittoral, lagoonal, neritic, oölitic bank, and shelf lithotopes (Rowett, 1963b).

In the frontal belt of the Ouachita Mountains the stratigraphy and depositional history of the Wapanucka Formation are far less clear. The lower part of the Wapanucka in this region consists of dark, interbedded, spiculiferous shales and spiculites. The contact with the subjacent "Pennsylvanian Caney" shales is problematical. Limited evidence based upon a study of rugose corals suggests that the upper limestones in the Ouachitas are equivalent in age to the middle part of the formation in the Arbuckle area. The zone of *Koninckophyllum,* for example, is present in the Arbuckle Mountains area and has also been found in the upper part of the Wapanucka Formation in the Ouachita Mountains.

Oölitic limestones, bioclastic limestones, and calcareous shales are less in evidence in the Ouachita Mountains region than to the west in the Arbuckles. Nevertheless plentiful evidence indicates that the Wapanucka represents a carbonate shelf environment in the Ouachita region, although the shelf apparently was considerably broader and perhaps extended much farther offshore here than it did to the east and northeast.

The Atoka Formation overlies the Wapanucka in the Ouachita region, but depositional contacts are obscured by severe folding and faulting. The basal part of the Atoka Formation may also be a transgressive sequence in this region, but physical evidence is lacking. Cline (1960) has described spiculite zones in the lower part of the Atoka Formation in the eastern Ouachita Mountains of Oklahoma that may be equivalent to similar zones in the upper part of the Wapanucka Formation to the west.

Earlier studies in which the stratigraphy of the Wapanucka Formation is discussed include the original definition by Taff (1901), a comprehensive study by Wallis (1915), and subsequent studies by Hollingsworth (1933), Miser (1934), Harlton (1938), Kuhleman (1948), Barker (1950), Elias (1956), Cline and Shelburne (1959), and Rowett (1959).

PALEONTOLOGY

The Wapanucka Formation is moderately to highly fossiliferous throughout. A total of 80 genera and 129 species of fossil invertebrates was listed by Rowett (1962), and this number probably does not represent the total preserved fauna.

The rugose corals from the Wapanucka Formation described by Rowett and Sutherland (1964) include the following species:

Empodesma cf. *E. imulum* Moore and Jeffords
Stereocorypha cf. *S. spissata* Moore and Jeffords
Amplexocarinia corrugata (Mather)
Lophophyllidium idonium Moore and Jeffords
L. minutum Jeffords
L. ignotum Moore and Jeffords
L. cf. *L. angustifolium* Moore and Jeffords
L. sp. A
L. sp. B
Leonardophyllum morrowense Rowett and Sutherland
Amplexizaphrentis cf. *A. tumida* (Moore and Jeffords)
A. aff. *A. crassiseptata* (Moore and Jeffords)
A. sp. A
A. sp. B
Barytichisma callosum Moore and Jeffords
Koninckophyllum simplex (Moore and Jeffords)
K. oklahomense Rowett and Sutherland
K. nitellus (Moore and Jeffords)
Dibunophyllum sp. A

Tabulate corals from the Wapanucka Formation described in this report are listed below; locality information is given in the appendix, and full descriptions of stratigraphic sections are recorded in Rowett and Sutherland (1964).

Family Favositidae Dana
Striatopora cf. *S. religiosa* Moore and Jeffords
Acaciapora subcylindrica (Mather)

Michelinia referta Moore and Jeffords
M. scopulosa Moore and Jeffords
M. spissata Moore and Jeffords
M. tenuicula Moore and Jeffords
M. latebrosa Moore and Jeffords
M.? cf. *M. meekana* Girty

Family Auloporidae Milne-Edwards and Haime
Cladochonus fragilis Mather
C. texasensis Moore and Jeffords

Descriptions of tabulate corals in the text are based upon a total of 207 specimens, many of which were thin sectioned or cut and polished for study of internal characters. Although the majority of species have not previously been described from the Wapanucka Formation, these corals have been adequately illustrated elsewhere (notably by Moore and Jeffords, 1945). The illustrations of species in plates I and II are primarily to record the observed variation of Wapanucka specimens from previously described and illustrated specimens.

Because of confusion regarding some species, a complete review of the history and present taxonomic status of each species is given. Distribution of each species in the Wapanucka Formation and elsewhere in the Midcontinent region is included with the descriptions.

Measurements of internal morphological features were made using a binocular microscope with a calibrated ocular. External measurements were made with a micrometer caliper. These measurements for species of *Michelinia* are recorded in table 1. Form ratios are computed as the ratio of the average corallite height to diameter (h/d). The ratios of complete to incomplete tabulae and convex upward to horizontal or sagging tabulae were based upon counts of 100 tabulae made from thin sections. The value for the rate of appearance of new corallites was calculated according to the formula shown below:

$$\text{Rate} = \frac{(\text{total number of peripheral corallites}) - \text{basal corallites})}{(\text{height of corallum in millimeters})}$$

Terminology is that proposed by Moore, Hill, and Wells (1956).

SYSTEMATIC DESCRIPTIONS

Family FAVOSITIDAE Dana, 1846

Subfamily PACHYPORINAE Gerth, 1921

Genus *Striatopora* Hall, 1851

Generic diagnosis. — "Ramose: walls thickened distally only; septa 12, with numerous trabeculae" (Hill and Stumm, 1956, p. 464).

Type species. — *Striatopora flexuosa* Hall.

Discussion. — It is generally agreed that *Striatopora* is distinct from allied genera, such as *Favosites* and *Michelinia,* and can be distinguished from these genera by the presence of a thickened peripheral region and sparse mural pores. *Striatopora* differs from *Thamnopora* Steininger (1831) in having less internal thickening, more closely spaced tabulae, and smaller mural pores. The type species of *Thamnopora (T. madreporacea* = *Alveolites cervicornis* Blainville, 1830) has uniformly thick walls and corallites which attain a maximum diameter of slightly more than 1 millimeter.

Study of *Pachypora* Lindström (1873) has shown this genus to be a junior synonym of *Thamnopora.* This view is followed by Lang, Smith, and Thomas (1940, p. 92), Wells (1944, p. 259), Moore and Jeffords (1945, p. 175), and Hill and Stumm (1956, p. 464).

The genera discussed above may represent a series marked by progressive thickening of the corallite walls. This sequence, according to Wells (1944, p. 259), is as follows: *Favosites, Thamnopora, Striatopora, Trachypora.* Although these genera are recognized by Hill and Stumm (1956), the close similarity of *Thamnopora* and *Striatopora* continues to be a taxonomic problem.

Striatopora cf. *S. religiosa* Moore and Jeffords, 1945

Plate I, figure 1

Striatopora religiosa Moore and Jeffords, 1945, p. 180, text-figs. 186, 187, 198-201.

Description. — One fragment of a corallum from the Wapanucka Formation is tentatively assigned to this species. The specimen is a part of a ramose corallum which is oval in cross section. The fragment has a length of approximately 35 mm and an average width of 30 mm.

Calices are polygonal and variable in diameter; the maximum diameter recorded is 6 mm, but the average is only 3 mm. Low septal ridges and intervening grooves are preserved in some corallites and have widths of approximately 0.5 mm.

The internal structures are poorly preserved but show a distinct differentiation of the immature and mature regions. The mature region is characterized by slightly thicker corallite walls and secondary deposits of stereoplasm up to several millimeters in thickness. Mural pores are large (0.5 mm) but uncommon. Tabulae are complete and incomplete and variable in attitude. They are more numerous in the peripheral parts of the corallum (3 to 4 per 5 mm). In the mature region, as many as 5 to 6 occur per 5 mm along the corallites.

Discussion. — Longitudinal ridges and grooves have not been described in any species of *Striatopora* known to the writer except in *S. religiosa.* This species was described from the Marble Falls Formation of Texas by Moore and Jeffords, who stated (1945, p. 180): ". . . longitudinal low ridges and intervening grooves . . . are spaced two in 1 mm on the average . . ." The present specimen corresponds closely to this species in other aspects and differs from *S. religiosa* only in the smaller size of some calices.

This species was described as *Pachypora carbonaria* by Mather (1915, p. 94), as *P. oklahomensis* by Snider (1915, p. 72), and as *P. caneyana* by Morgan (1924, p. 175). *P. carbonaria* and *P. oklahomensis* apparently are synonymous and are referred by Moore and Jeffords (1945) to *Striatopora oklahomensis* (Snider). To this synonymy the writer adds *P. caneyana* Morgan.

Striatopora religiosa can be distinguished from *S. oklahomensis* by the presence of septal grooves and ridges, larger corallites, and a less thickened peripheral region. This species does not require detailed comparison with *S. immota* Moore and Jeffords (1945), in which the calices range in diameter from less than 1 mm to only 1.6 mm.

Range and distribution. — *Striatopora religiosa* Moore and Jeffords (1945) was described from the upper Marble Falls Limestone (Morrow Series), San Saba County, Texas. *Striatopora oklahomensis* (Snider) was described by Moore and Jeffords (1945) from the Brentwood Limestone (Morrow Series) of northwestern Arkansas, and from Morrowan strata in northeasten Oklahoma.

Pachypora caneyana Morgan (1924) was described from one locality reported as being near the top of the Caney Shale by Morgan (1924, p. 176). This locality (Morgan's no. 170) is now mapped as the Union Valley Formation (Morrow Series). *Pachypora oklahomensis* Snider (1915) was reported from the "Mayes" Formation (Morrow Series). *Pachypora carbonaria* Mather (1915) was described from the Brentwood Limestone (Morrow Series) near Brentwood, Arkansas, and from the Morrow Formation near Fort Gibson and Chouteau, Oklahoma.

Material and occurrence. — One fragmentary specimen from locality 27, unit A.

Genus *Acaciapora* Moore and Jeffords, 1945

Generic diagnosis. — "Like *Thamnopora* but with squamulae" (Hill and Stumm, 1956, p. 464).

Type species. — *Michelinia subcylindrica* Mather, 1915.

Discussion. — The genus *Acaciapora* was defined by Moore and Jeffords (1945, p. 181) to include small ramose coralla which are distinguished primarily by the presence of squamulae (i. e., incomplete tabulae which are free at one end and which do not extend completely across the corallites). This feature separates *Acaciapora* from other tabulate genera, including *Thamnopora* Steininger (1831), *Michelinia* de Koninck (1841), *Striatopora* Hall (1851), *Cladochonus* Hall (1851) and *"Pachypora"* (= *Striatopora* in part) Lindström (1873).

Described species of *Acaciapora* are separated principally upon the basis of surface features such as the spacing and degree of overlap of calices. The type species, *Michelinia subcylindrica,* was stated by Mather (1915, p. 97) to have a "wrinkled, concentrically striated epitheca which does not extend far upon the sides of the colony in any of the specimens at hand . . ." Specimens described by Moore and Jeffords (1945) as *Acaciapora subcylindrica* (Mather) and *A. venusta,* however, lack of epitheca. An epitheca is not present in the specimens from the Wapanucka Formation.

The outer surfaces of species of *Acaciapora* and *Michelinia* are superficially similar, particularly when comparison is made with small species of *Michelinia,* such as *M. tenuicula.* However, all species of *Michelinia* have subcircular or polygonal, nonoverlapping calices which are flush with the curved plane of the surface of the corallum. In *Acaciapora,* calices are obliquely oriented with respect to this surface because of their raised lower rims, and are round. Internally, the squamulae distinguish this genus from *Michelinia* and all other tabulate genera.

Acaciapora subcylindrica (Mather), 1915

Plate I, figure 4

Michelinia subcylindrica Mather, 1915, p. 97, pl. 1, fig. 18.
Acaciapora subcylindrica Moore and Jeffords, 1945, p. 182, pl. 14, figs. 7-9, text-figs. 190-192, 202.

Description. — Material consists of eight incomplete specimens, including a branching portion of a corallum. The largest fragment is 14 mm long, and the maximum diameter of any fragment is 6.4 mm. The basal attachment surface is present on several specimens, but an epitheca is absent, or is not preserved.

Closely spaced subcircular calices occur on the outer surfaces of the coralla. The lower rims of the calices are elevated slightly, so that a given calice appears to be overlapped distally by the lower rim of the adjacent corallite calice. Calices are from 3 to 4 mm deep and have a maximum diameter of about 1.5 mm; most are less than 1 mm across. Well-preserved calices show from 14 to 16 indistinct septal ridges and have slightly denticulate rims. Interspaces between apertures are narrow.

Longitudinal sections show evenly expanding corallites which curve gently upward and outward toward the surface of the corallum. Numerous incomplete tabulae with free ends, or squamulae, occur at irregular intervals along the corallites. A maximum of 2 or 3 of these plates occurs in a vertical distance of 1 mm. Some thin sections intersect the free ends of squamulae, which thus appear to "float" in the open axial area. Thickening of inner walls is limited to areas of branching. Corallite walls are 0.5 mm or less in thickness and are perforated by widely spaced, large (0.15 to 0.5 mm) mural pores. Mural pores also can be observed in the walls of weathered calices on the outer surfaces of the coralla.

Discussion. — Although internal differences between the two species are but slight, *Acaciapora subcylindrica* can be distinguished externally from *A. venusta* by its closely spaced calices and its broader growth form. Septal grooves are reported not to be present in *A. venusta.*

Range and Distribution. — *Michelinia subcylindrica* Mather (1915) was described from the Morrow Formation, near Fort Gibson, Oklahoma. Moore and Jeffords' specimens, described as *Acaciapora subcylindrica* (Mather) were collected from the Bloyd(?) Formation (Morrow Series) at Greenleaf Lake near Braggs, Oklahoma, and near Keough quarry, north of Fort Gibson, Oklahoma. *Acaciapora* has not previously been reported from the Wapanucka Formation.

Material and occurrence. — *Acaciapora* is commonly associated with small bryozoan fragments in the Wapanucka Formation and probably is more common than the available material indicates. The eight specimens described above were collected at locality 4, unit A.

Subfamily MICHELINIINAE Waagen and Wentzel, 1886

Genus *Michelinia* de Konink, 1841

Generic diagnosis. — "Like *Pleurodictyum* but with numerous, incomplete, convex tabulae; may be thin-walled" (Hill and Stumm, 1956, p. 466).

TABLE 1. — MORPHOLOGICAL CHARACTERS IN SPECIES OF *Michelinia*

(measurements in millimeters)

	referta		*scopulosa*		*spissata*		*tenuicula*		*latebrosa*		cf. *meekana*	
	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG
Height of corallum	21.0	15.0	35.1	25.0	39.0	30.0	30.0	20.0	63.0	47.0	110.0	85.0
Diameter of corallum	64.0	61.0	41.0	27.0	35.6	27.0	26.1	17.0	56.0	48.0	70.0	57.0
Length of corallites	16.0	12.0	24.0	15.0	26.0	15.0	24.0	14.0	55.0	30.0	----	----
Diameter of corallites (ephebic)	8.0	5.0	3.0	2.5	4.9	3.0	2.2	1.8	5.2	3.5	6.5	3.0
Thickness of corallite walls (ephebic stage)	1.0	0.5	0.8	0.5	0.8	0.7	0.7	0.3	0.7	0.5	1.1	0.5
Width of tabulae	0.5	0.3	0.4	0.3	0.4	0.3	0.3	0.2	0.4	0.3	0.4	0.3
Diameter of mural pores	0.3	0.2	0.3	0.2	0.5	0.2	0.2	0.1	0.2	0.1	0.3	0.2
Number of tabulae per corallite	9	6	31	20	19	12	15	10	54	35	----	----
Number of tabulae per 5 mm	4	3	10	7	4	3	8	6	4	3	7	5
Form ratio (height/diameter)	0.4	----	1.2	----	1.5	----	1.3	----	0.7	----	1.6	----
Ratio of complete tabulae to incomplete tabulae (ephebic)	0.30	----	0.16	----	0.23	----	0.26	----	0.3	----	----	----
Ratio of convex-upward to horizontal or sagging tabulae (ephebic stage)	0.1	----	0.6	----	0.3	----	0.3	----	0.3	----	----	----
Rate of appearance of new corallites per 1 mm height	0.5	----	0.7	----	0.7	----	1.3	----	0.7	----	----	----

Type species. — *Calamopora tenuisepta* Phillips, 1836 (= *Michelinia tenuisepta* de Koninck, 1841; subsequent designation by Milne-Edwards and Haime, 1850).

Discussion. — The genus *Michelinia* includes tabulate coralla of rather varied external form composed of closely packed polygonal corallites. A holotheca may be continuous, discontinuous, or absent. Corallite walls are thin (less than 1 mm) and bear large mural pores which perforate the walls or, less commonly, lie in the plane of the walls. Tabulae are numerous, complete and incomplete, and in general are convex upward. Septal ridges are rudimentary or absent. Measurements are given in table 1, page 14.

Michelinia differs from *Pleurodictyum* Goldfuss (1829), which has as its type species *P. problematicum,* in having much thinner corallite walls, smaller mural pores, and incomplete tabulae. *Michelinia* is distinguished from *Striatopora* Hall (1851) (type species, *S. flexuosa*) primarily by the absence of a thickened peripheral region.

Michelinia is the most common tabulate coral in the Wapanucka Formation. Representatives of this genus are referred to five species, *M. scopulosa, M. spissata, M. referta, M. latebrosa,* and *M. tenuicula.* Two specimens are tentatively referred to *M. meekana.*

Michelinia referta Moore and Jeffords, 1945

Plate I, figure 5

Michelinia referta Moore and Jeffords, 1945, p. 174, text-figs. 171, 172, 182.

Description. — Two poorly preserved coralla assigned to this species are wider than high. One corallum has a tabular or encrusting form of growth. The larger specimen has a maximum height of about 21 mm and a maximum diameter of 57 mm. The smaller corallum is 64 mm across in one direction but does not exceed 10 mm in height. There is no holotheca.

Individual corallites are large, polygonal, and thin walled. Calices with diameters of 6 mm are common, and a few are as much as 8 mm across. The depth of the calices is normally less than one-half the diameter, but this is due in part to weathering. Septal ridges are absent.

Longitudinal thin sections show numerous, thin, closely spaced tabulae, with as many as 8 or 10 occurring per 10 mm along the corallites. Tabulae are gently convex upward and typically are complete. Corallite walls are less than 0.5 mm wide and bear small, widely spaced mural pores in the peripheral portions of the coralla. The maximum recorded diameter of the mural pores is 0.3 mm, but most are less than 0.2 mm.

Discussion. — These coralla correspond closely in internal morphology to *Michelinia referta* Moore and Jeffords (1945). The growth form of *M. referta,* however, was described by Moore and Jeffords (1945, p. 174) as being massive, ovoid, and higher than wide.

Michelinia referta is distinguished from *M. scopulosa, M. tenuicula, M. spissata,* and *M. latebrosa* by its larger corallites, thin corallite walls, and closely spaced tabulae. *Michelinia referta* differs from *M. exilimura,* described by Mather (1915, p. 96, pl. 2, figs. 2, 2a) from beds of Morrowan age near Chouteau, Oklahoma, in having larger corallites and more closely spaced tabulae.

Michelinia harkeri, described by Nelson (1962, p. 957) from the upper Pennsylvanian(?) of the Yukon Territory, is also characterized by larger individual corallites. However, both the maximum and average corallite diameters recorded by Nelson are several millimeters in excess of these values for *M. referta. M. harkeri* also differs from the Wapanucka species in having widely spaced, almost vesicular tabulae (Nelson, 1962, p. 956, text-fig. 2e).

Range and distribution. — *Michelinia referta* was described by Moore and Jeffords (1945, p. 174, text-figs. 171, 172, 182) from beds thought to belong to the Marble Falls Limestone (Morrow Series) in San Saba County, Texas.

Material and occurrence. — Two coralla, from locality 8, unit B.

Michelinia scopulosa Moore and Jeffords, 1945

Plate I, figures 7a-d

Michelinia eugeneae White, 1884 [part], p. 119, pl. 23, figs. 14-16.
Michelinia eugeneae Mather, 1915, p. 96, pl. 1, figs. 17, 17a; pl. 2, fig. 1.

Michelinia eugeneae Morgan, 1924, pl. 35, figs. 1, 1a.
Michelinia scopulosa Moore and Jeffords, 1945, p. 169, pl. 14, figs. 10, 11; text-figs. 174-178, 183, 184.

Description. — Examples of *Michelinia scopulosa* are common in the Wapanucka Formation. The coralla are varied in shape, but most are subhemispherical. The maximum diameter recorded is about 40 mm but most specimens are less than 30 mm across. A few specimens have a strongly wrinkled holotheca at the base of the corallum, but in most examples the holotheca is rudimentary or absent.

Individual corallites are small, polygonal, and thin walled. Most calices are 3 mm or less in diameter and between 2.5 mm and 3.5 mm in depth. Septal ridges are present in well-preserved calices, but are low, closely spaced, and almost imperceptible.

Longitudinal sections show thin complete and incomplete tabulae, most of which are gently convex upward. As many as 10 tabulae occur per 5 mm in the immature portions of corallites. Corallite walls range in thickness from 0.4 to 0.5 mm. At points where walls bifurcate to form new corallites they approach 1 mm in width. Mural pores are most common in the mature portions of the coralla and are as much as 0.3 mm in diameter.

Discussion. — Coralla of this type were described and illustrated by White (1884, p. 119, pl. 23, figs. 14-16) as *Michelinia eugeneae.* The exteriors of White's specimens, however, indicate that more than one species was represented in his collections. No illustrations of internal structures were given by White, and *M. eugeneae* therefore must be regarded as an unrecognizable species until the type material is restudied. Specimens described and figured by Mather (1915, p. 96, pl. 1, figs. 17, 17a; pl. 2, fig. 1) as *M. eugeneae* are here referred to *M. scopulosa* as are specimens illustrated by Morgan (1924, pl. 35, fig. 1, 1a).

External forms of *M. tenuicula* Moore and Jeffords (1945) and *M. scopulosa* are somewhat similar. *M. scopulosa* can be distinguished from *M. tenuicula,* however, by the greater diameter attained by many of its corallites, thicker corallite walls, more crowded tabulae, and more numerous mural pores.

Coralla described as *M. spissata* Moore and Jeffords (1945) are associated with *M. scopulosa* at many localities in the Wapanucka Formation. *M. scopulosa* is distinguished from this species by its smaller size, lesser diameters of individual corallites, thinner, more numerous tabulae, and smaller, more widely spaced mural pores. Transverse thin sections of this species (pl. I, figs. 7c,d) also show the coralites to have a more distinctly circular outline than have those of *M. spissata.*

Two additional species of *Michelinia* which occur in the Wapanucka Formation are *M. referta* and *M. latebrosa,* both of which also were described by Moore and Jeffords (1945). These species are much larger, both in the size of the coralla and in the diameters of individual corallites, and do not require detailed comparison with *M. scopulosa.*

Range and distribution. — The original description of *Michelinia eugeneae* by White (1884) includes one specimen (pl. 23, fig. 14) which may be a representative of this species. White's material was collected from several horizons in the Pennsylvanian of Indiana and Illinois. Specimens assigned by Mather (1915) to *M. eugeneae* were from the Brentwood and Kessler Limestones (Morrow Series) in Arkansas and Oklahoma. Specimens illustrated by Morgan (1924) and listed as *M. eugeneae* were collected from the Wapanucka Formation at a locality which corresponds to locality 4 of this report. The description of *M. scopulosa* by Moore and Jeffords (1945) was based on specimens from the Bloyd(?) Formation (Morrow Series) at Greenleaf Lake, near Braggs, Oklahoma, and near Keough quarry, north of Fort Gibson, Oklahoma.

Material and occurrence. — Fifty-four specimens, from the following localities: 3, units A, F; 4, unit A; 7, units A, B; 8, unit B; 9, unit B; 17, unit A; 21, unit F; 22; and 26, unit A.

Michelinia spissata Moore and Jeffords, 1945

Plate I, figures 6a-f; plate II, figures 3a,b

Michelinia meekana Snider, 1915, pl. 3, figs. 9, 10.
Michelinia spissata Moore and Jeffords, 1945, p. 169, text-figs. 170, 180.

Description. — Coralla from the Wapanucka Formation assigned to *Michelinia spissata* show a greater range of variation than indicated by previous descriptions. Specimens range from small conical forms with a well-developed and prominent holotheca to large globose or subhemispherical colonies in which the holotheca is rudimentary or absent. The largest corallum is approximately 40 mm high and the maximum diameter recorded is 35 mm. Most coralla average about 30 mm in height and from 25 mm to 30 mm in diameter. The holotheca of many specimens is well developed. In some elongate specimens as much as four-fifths of the total height is covered by a strongly rugose holotheca; in subhemispherical coralla, the holotheca commonly covers only the basal portion.

Individual corallites have an average diameter of approximately 4 mm, but many are 5 mm across. Calices are deep, polygonal, and are separated by thick walls. In well-preserved calices closely spaced rudimentary septal grooves are visible.

Longitudinal thin sections of this species show numerous thick complete and, less commonly, incomplete tabulae which are subhorizontal to steeply inclined and spaced at from 2 to 3 tabulae per 5 mm along the corallites. In the immature growth stages tabulae commonly are more closely spaced. Corallite walls range from 1.3 mm in thickness in the immature parts of corallites to about 0.8 mm in mature portions. Mural pores up to 0.5 mm in diameter are numerous throughout the coralla, and are most numerous in the thickened walls adjacent to points of origin of new corallites.

Discussion. — The description of this species by Moore and Jeffords (1945) apparently was based upon only a few specimens. Their illustrations (text-figs. 170, 180) are all of the holotype, and the presence of a holotheca is not noted. The prominent holotheca present in many of the coralla here described is considered to be significant only insofar as it further defines this species.

Michelinia spissata is distinguished by the abrupt thickening of the corallite walls, polygonal corallites, thick evenly spaced tabulae, and numerous large mural pores. The prominent holotheca observed

in many of the Wapanucka specimens is also considered to be characteristic of the species.

Range and distribution. — A specimen of *Michelinia* stated to have been collected from the Boggy Formation (Des Moines Series) was illustrated by Morgan (1924, pl. xxxv, fig. 1b). This corallum is listed by Morgan (1924, erroneously under the description of plate xxxiii) as *Michelenia* [sic] *eugeneae* White. This specimen has a well-developed holotheca and may belong to *M. spissata.* The type specimen (UK 720) of *M. spissata* Moore and Jeffords was collected from the Brentwood Limestone (Morrow Series) at "Acorn Cut," northwest of Brentwood, Arkansas.

Material and occurrence. — This description of *M. spissata* is based upon 86 specimens, from the following localities: 7, unit A; 16, unit B; 18, unit U; 24, unit F; 25, unit A; and 26, unit A.

Michelinia tenuicula Moore and Jeffords, 1945

Plate II, figures 1a-f

Michelinia eugeneae White, 1884 [part], p. 119, pl. 23.
Michelinia tenuicula Moore and Jeffords, 1945, p. 172, text-figs. 167-169, 181.

Description. — This small species is common in the Wapanucka Formation. The largest corallum is approximately 25 mm across. The maximum height recorded is 30 mm. The development of the holotheca is variable, but no specimen has a continuous holotheca.

Individual corallites are small, polygonal, and are separated by thin walls. Most corallites are 2 mm or less in diameter, but a few exceed this value by 0.1 or 0.2 mm. Septal ridges are not present.

Longitudinal sections show numerous closely spaced, complete and incomplete, tabulae which are gently convex upward. Tabulae in the immature portions of the corallites are crowded, with as many as 12 to 14 occurring per 5 mm. Spacing is somewhat greater in the mature region (6-8 per 5 mm). Corallite walls are 0.5 mm or less thick, except where they bifurcate to form new corallites, where they may be 1 mm thick. Mural pores are up to 0.2 mm in diameter and are evenly distributed throughout the coralla.

Discussion. — Coralla assigned to *M. tenuicula* from the Wapanucka Formation are small and are composed of corallites decidedly smaller than those of *M. scopulosa.* In addition, the present species has thinner, less numerous tabulae and fewer mural pores than has *M. scopulosa.*

M. tenuicula does not require detailed comparison with larger forms of *Michelinia.*

Range and distribution. — White's type material for *Michelinia eugeneae* was reported to have been collected from Pennsylvanian strata in Indiana and Illinois. As noted, one of his specimens (White, 1884, pl. 23, no. 15) is thought to represent the present species. Coralla described by Moore and Jeffords (1945, p. 172) as *M. tenuicula* were collected from the Bloyd(?) Formation (Morrow Series) at the Greenleaf reservoir, near Braggs, Oklahoma, and near Keough quarry, north of Fort Gibson, Oklahoma.

Material and occurrence. — Twenty-eight coralla, from the following localities: 3, unit D; 4, unit A; 7, unit A; 17, unit A; 26, unit A.

Michelinia latebrosa Moore and Jeffords, 1945

Plate II, figures 4a-d

Michelinia exilimura Mather, 1915, p. 96, pl. 2, figs. 2, 2a.
Michelinia? [sic] *exilimura* Morgan, 1924, pl. 35, fig. 2.
Michelinia latebrosa Moore and Jeffords, 1945, p. 172, text-figs. 173, 179.

Description. — Three coralla from the Wapanucka Formation are referred to this species. The specimens are subhemispherical to subcylindrical in form. The largest corallum has an unequal "dumbbell" shape, with an over-all length of 102 mm and a maximum diameter of 56 mm. The growth form is clearly anomalous and apparently the coral was toppled over at an early stage of growth. Subsequent growth obscured the original attachment area. A second corallum is subhemispherical and has a height of 63 mm and a maximum diameter of 44 mm. The third corallum is subhemispherical in form and is wider than high, measuring 45 mm and 29 mm, respectively. All specimens lack a holotheca.

Corallites are large, with an average diameter of 3.5 mm. A

maximum diameter of 5.2 mm is attained by some corallites. Polygonal calices are separated by well-developed walls and are slightly deeper than wide. Septal ridges are present in well-preserved calices and are about 0.3 mm wide.

Longitudinal sections show corallite walls to be uniform in thickness with little deviation from an average of 0.5 mm. Tabulae are both complete and incomplete, and are evenly spaced along the corallites (2 to 4 tabulae per 5 mm). Mural pores are small, up to 0.15 mm in diameter, and are common only in the peripheral (mature) portions of the coralla.

Discussion. — The specimens of *Michelinia latebrosa* from the Wapanucka Formation differ from those described by Moore and Jeffords only in that the diameters of some of the corallites exceed the stated maximum by as much as 1 mm. *M. latebrosa* is similar to *M. referta* Moore and Jeffords (1945), but is readily distinguishable by its smaller corallites, thinner corallite walls, and stouter, more widely spaced tabulae.

Corals described by Nelson (1962, p. 957) from western Canada as *Pleurodictyum meekanum* (Girty)? correspond in general to these specimens, but lack both the mural pores and rudimentary septal ridges that are present in Girty's material and the Wapanucka specimens.

Range and distribution. — *Michelinia latebrosa* was described by Moore and Jeffords (1945, p. 174) from the Jolliff and Otterville Limestones (Morrow Series) near Ardmore, Oklahoma; from two specimens "presumably from the middle Marble Falls limestone (Bendian) . . . southwest of Mason, Texas" (p. 175); and from two specimens from the Brentwood Limestone (Morrow Series) near Woolsey, Arkansas.

Material and occurrence. — Three coralla, from the following localities: 4, unit A; 7, unit A; 24, unit F.

Michelinia? cf. *M. meekana* Girty, 1910

Plate II, figure 2

Michelinia meekana Girty, 1910, p. 189.
Pleurodictyum meekanum Easton, 1943, p. 136.
Pleurodictyum? cf. *P. meekanum* Easton, 1945, p. 527, text-figs. 9, 10.

Description. — Two fragmentary coralla from the Wapanucka Formation resemble this species. The largest fragment is tabular and appears to represent a stage of growth broadened by branching; it is about 70 mm in width and 110 mm in length. The corallum is approximately oval in cross section. A smaller specimen is subspherical and has a maximum diameter of about 45 mm.

Calices average about 3 mm in diameter. The maximum diameter recorded is 6.5 mm, but calices of this size are few. Many calices are as much as 4 mm deep, but this may be in part due to the destruction of the uppermost tabulae. Unweathered calices bear numerous narrow ridges and grooves, with an average of 9 or 10 ridges per 3 mm around the calicular opening. Both ridges and grooves extend to the base of the calyx. As many as 40 ridges occur in some calices, but precise counts are not possible.

The internal structure of the larger fragment is poorly preserved and sections show little more than a thickened peripheral region up to 6 mm wide. The immature region is fragmentary. In the smaller specimen, the peripheral thickened zone has a maximum width of 3 mm. The average thickness of corallite walls is 0.5 mm and the maximum about 1.0 mm. Mural pores are up to 0.3 mm in diameter and occur only in the peripheral portion of the coralla. Tabulae are both complete and incomplete, variable in attitude, and spaced at from 2 to 7 per 5 mm in the mature growth stages.

Discussion. — To the writer's knowledge, the only described coral which approaches these specimens in morphology is *Michelinia meekana* Girty; Girty stated (1910, p. 189):

> The rudimentary septa consist of fine ridges, more distinct in some specimens than in others, and are very numerous. They are so fine and obscure that no satisfactory count can be made.

Other aspects of Girty's description agree in general with the Wapanucka specimens, but no illustrations of his material were given. Coralla were subsequently described as *M. meekana* by Snider (1915), but his illustrations (pl. III, figs. 9-11) indicate that at least two species were present in his collections. Upon the basis of Girty's original description, Snider's specimens appear to represent

examples of *Michelinia spissata* Moore and Jeffords (pl. III, figs. 9, 10) and *Striatopora* sp. (pl. III, fig. 11).

Range and distribution. — Girty's specimens were described from the lower part of the Fayetteville Shale (Mississippian) of Arkansas (Fayetteville quadrangle). No specific locality is given.

Material and occurrence. — Fragments of two coralla, from locality 27, unit B.

Family AULOPORIDAE Milne-Edwards and Haime, 1851

Genus *Cladochonus* McCoy, 1847

Generic diagnosis. — "Proximal corallites in reptant ring from which free branches arise; individual corallites trumpet- or pipe-shaped, in contact only at points of origin, each giving rise to another by lateral increase through wall of expanded calice; each with a thick peripheral stereozone of laminar or reticulate sclerenchyme. Septal spines and tabulae lacking in the narrow lumen, but septal rings may appear in the calices . . ." (Hill and Stumm, 1956, p. 472).

Type species. — *Cladochonus tenuicollis* McCoy, 1847 (subsequent designation by Milne-Edwards and Haime, 1850).

Discussion. — *Cladochonus* includes diminutive ramose coralla in which small trumpet-shaped corallites alternately branch in opposite directions. Lateral increase through corallite walls produces new individuals. Calices are wide and are obliquely oriented with respect to the midline of the branch. Horizontal elements such as tabulae are absent.

Study of this genus by Hill and Smyth (1938) demonstrated that the basal portion of the corallum consists of a ring of corallites, commonly encircling some foreign object, which gives rise to branches. Prior to their study, the distal portions of these coralla were assigned to *Cladochonus,* and the proximal ringlike portions were referred by Nicholson and Etheridge (1879) to a separate genus, *Monilopora. Monilopora* is now regarded as a junior synonym of *Cladochonus.*

Girty (1925, p. 23) designated *C. crassus* (McCoy) = *Jania crassa* McCoy, 1844, as the type species of *Cladochonus.* This assignment is invalid, as an earlier designation of *C. tenuicollis* McCoy as the type was established by Milne-Edwards and Haime (1850, p. lxxvi) and has priority. Girty, however, correctly recognized the synonymy of *Monilopora* and *Cladochonus.*

Hill and Stumm (1956, p. 472) followed Nicholson (1879) and others in regarding the genus *Pyrgia* Milne-Edwards and Haime (1851) as a junior synonym of *Cladochonus.* Examination of the illustrations of the type species, *P. michelini,* indicates that the type material consisted of disarticulated corallites from one or more *Cladochonus* colonies.

The alternating growth pattern of calices in *Cladochonus* serves to distinguish these corals from most other tabulate genera. *Aulopora* Goldfuss (1829) is similar in the form of individual corallites, but differs from *Cladochonus* in having a netlike growth pattern, in which the lower sides of corallites are adhered to an attachment surface. The calices in *Aulopora* all open in the same direction, away from the attachment surface.

Cladochonus fragilis Mather, 1915

Plate I, figure 2

Cladochonus fragilis Mather, 1915, p. 98, pl. 1, figs. 3-5.
Cladochonus fragilis Morgan, 1924, p. 190, pl. 31, fig. 3.
Cladochonus fragilis Moore and Jeffords, 1945, p. 186, pl. 14, figs. 1-3.

Description. — This species is represented in the Wapanucka Formation by slender trumpet- or funnel-shaped corallites which alternately branch in opposite directions. The outer surfaces of corallites are smooth except for almost imperceptible low growth lines near the rims of calices. The largest fragment consists of 3 corallites and has a total length of 12 mm. Most corallites are from 3.0 mm to 3.5 mm long, but a few are almost 5 mm long. Maximum diameter occurs at the calice and averages about 2 mm; the largest calice present has a diameter of 2.8 mm.

Well-preserved calices are denticulate at their rims, and contain faint septal grooves and interseptal ridges, with as many as four pairs

of ridges and grooves per 1 mm. The average width of the ridges approximates 0.12 mm. Most calices are approximately 2 mm deep and contain a narrow trenchlike depression in the calicular floor. These elongate pits are laterally constricted by swelling of the inner wall of the calices and are parallel to the direction of growth. Those measured have lengths of about 1.2 mm and are 0.4 mm or less wide.

Growth of the coralla is by lateral increase. New corallites arise between 0.5 and 1.5 mm from the rims of the calices of their antecedents. Connecting pores between individuals are not present, but the outer lamellae of the theca is absent at the point of gemmation and septal ridges are exposed. Tabulae are absent.

Discussion. — The specimens described above agree closely to *Cladochonus fragilis* Mather (1915, p. 98, pl. I, figs. 3-5).

Cladochonus texasensis, which also occurs in the Wapanucka Formation, was described by Moore and Jeffords (1945, p. 187, pl. 14, fig. 4, text-figs. 206a,b) from the Marble Falls Formation of Texas. This species, however, is a larger form and is marked externally by a reticulate pattern. *C. fragilis* also differs from *C. texasensis* in having a different form of growth, in which only a single new corallite arises from the antecedent individual.

C. fragilis does not require detailed comparison to *C. bennetti* Beede (1898, p. 17; 1900, p. 24, pl. III, fig. 1) or to *C. americanus* Weller (1909, p. 275, pl. 10, fig. 30).

Range and distribution. — *Cladochonus fragilis* Mather (1915) was first described from the Morrow Formation (Morrow Series) near Fort Gibson, Oklahoma. Subsequently, a single specimen of *C. fragilis* from the Wapanucka Formation was illustrated by Morgan (1924, pl. xxxi, fig. 3), from a locality which corresponds to locality 4 in this study. This species was recorded by Moore and Jeffords (1945, p. 186) from the Bloyd(?) Formation (Morrow Series) near Fort Gibson and near Braggs, Oklahoma, and from the basal Marble Falls Limestone (Morrow Series) in San Saba County, Texas.

Material and occurrence. — Twenty-three specimens, from locality 4, unit A.

Cladochonus texasensis Moore and Jeffords, 1945

Plate I, figure 3

Cladochonus texasensis Moore and Jeffords, 1945, p. 187, pl. 14, fig. 4, text-figs. 206a,b.

Description. — One fragment of *Cladochonus* from the Wapanucka Formation is referred to *C. texasensis.* The specimen includes parts of three corallites, and has an over-all length of 14.8 mm. The maximum diameter of the fragment (7.4 mm) includes the diameters of two subparallel corallites and the basal portion of a third. Calices open in opposite directions and have subcircular rims which are approximately parallel to the direction of growth. Septal grooves and interseptal ridges are present, but are low and indistinct. Each pair of ridges and grooves has a width of 0.8 mm to 1.0 mm.

Individual corallites, all of which are incomplete, appear to have originally been 9 or 10 mm long. Diameter is about 3.0 mm in the immature region and 4.5 mm at the calice. Corallite walls are thick, 1.5 mm in the immature parts and 0.5 mm at the rim of the calice.

Gemmation is by lateral increase, which typically occurs 2 to 3 mm from the distal ends of the corallites. Two new corallites arise from a single antecedent individual. Fine lines of growth and indistinct longitudinal ridges on the exterior surface correspond to the positions of septa.

Discussion. — This specimen agrees in essential details to coralla described by Moore and Jeffords (1945) as *Cladochonus texasensis.* Diagnostic features include the bifurcating pattern of growth, width of septal ridges and interseptal grooves, and presence of an external reticulate pattern. The Wapanucka specimen is somewhat smaller than Moore and Jeffords' illustrated types (1945, pl. 14, fig. 14, text-figs. 206a,b), but is fragmentary.

Cladochonus texasensis differs from *C. fragilis* Mather (1915) in its larger size, ribbed exterior, and pattern of growth. This species

is larger than *C. americanus* Weller (1909), and also differs from that species in growth form and external markings. *C. texasensis* is distinguished from *C. bennetti* Beede (1898) by the lack of a strongly wrinkled epitheca and by its larger calices.

Range and distribution. — *Cladochonus texasensis* was described by Moore and Jeffords (1945, p. 187) from the upper part of the Marble Falls Formation (Morrow Series) of San Saba County, Texas. This species has not previously been reported from the Wapanucka Formation.

Material and occurrence. — One specimen, from locality 3, unit F.

PLATES I, II

WAPANUCKA TABULATE CORALS

Plate I

(All photographs and drawings are x1 unless otherwise noted)

Plate I

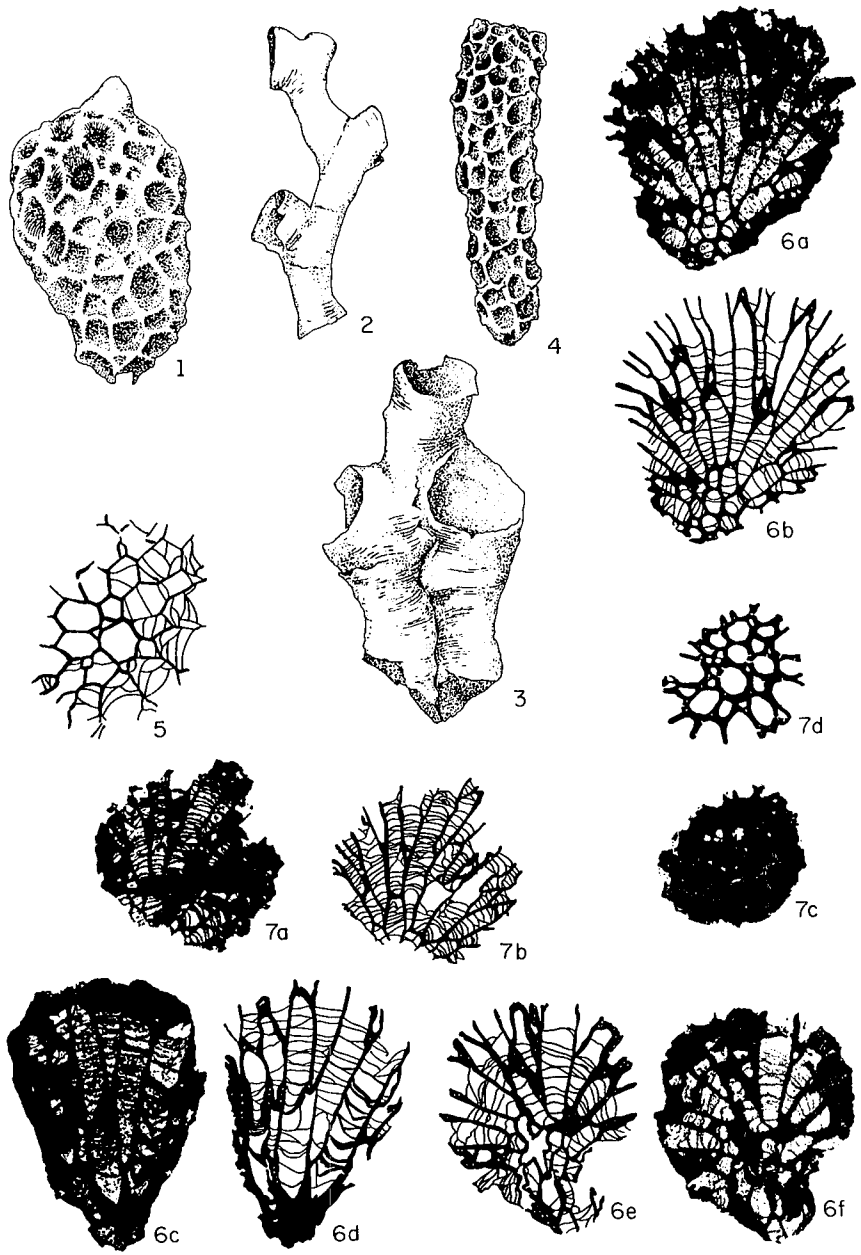
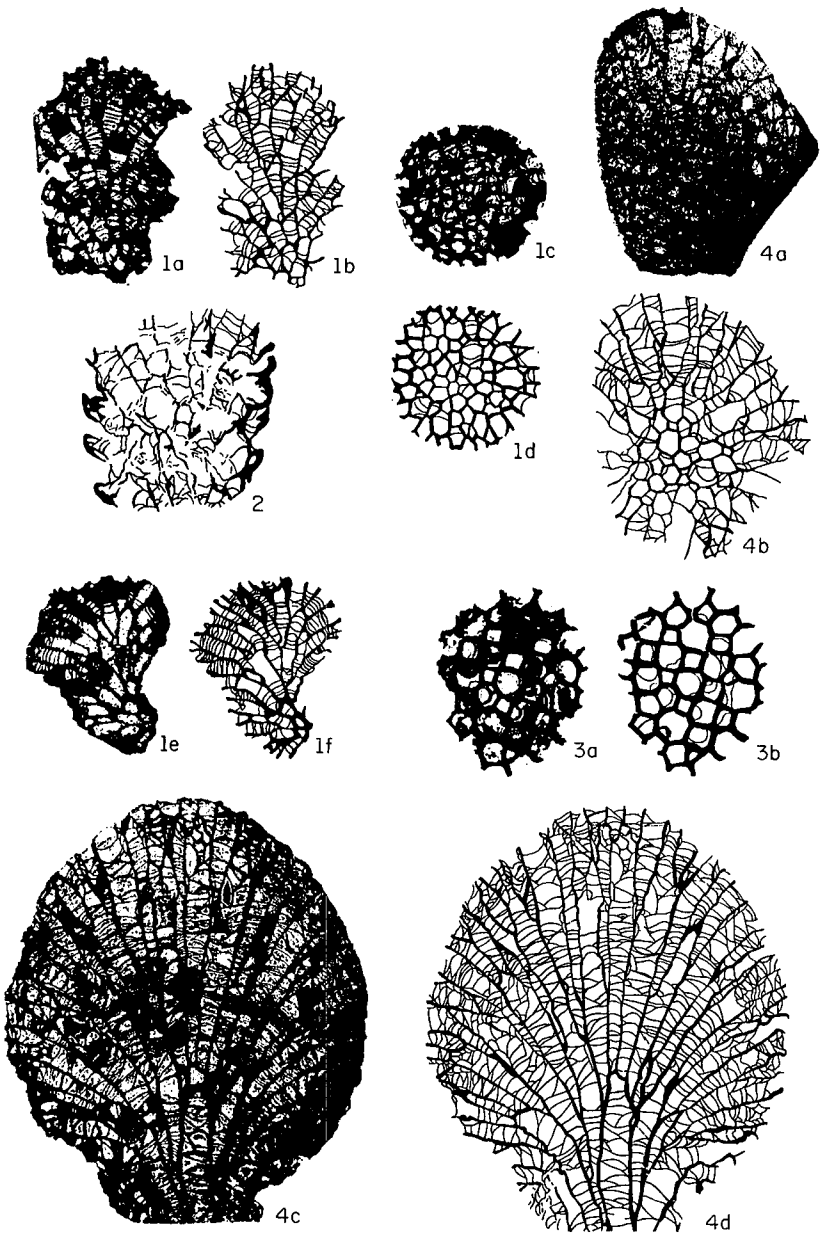


Plate II

(All photographs and drawings are x1)

	Page
1. *Michelinia tenuicula* Moore and Jeffords, 1945	20
a,b. Specimen OU 5729, locality 3 (unit D); longitudinal thin section.	
c,d. Specimen OU 5730, locality 7 (unit A); transverse thin section.	
e,f. Specimen OU 5731, locality 4 (unit A); longitudinal thin section.	
2. *Michelinia*? cf. *M. meekana* Girty, 1910	22
Specimen OU 5732, locality 27 (unit B); longitudinal thin section.	
3. *Michelinia spissata* Moore and Jeffords, 1945	18
a,b. Specimen OU 5733, locality 26 (unit A); transverse thin section.	
4. *Michelinia latebrosa* Moore and Jeffords, 1945	21
a,b. Specimen OU 5734, locality 4 (unit A); oblique thin section.	
c,d. Specimen OU 5735, locality 4 (unit A); longitudinal thin section.	

Plate II



PART II. — NEW SPECIES OF *DIBUNOPHYLLUM* FROM THE DEWEY FORMATION

J. M. COCKE*

INTRODUCTION

Externally smooth, column-bearing corals are abundant in many Pennsylvanian limestones and calcareous shales of the Midcontinent region, and commonly are accompanied by prolific caniniid and lophophyllidiid faunas. Early stratigraphers and paleontologists (Meek and Worthen, 1875; White, 1884; Keyes, 1894; Beede 1900) assigned most of these forms to *Axophyllum* Milne-Edwards and Haime, 1850, generally to *A. rude* White and St. John, 1867. Girty (1915) described two probable dibunophyllids as *A. cylindricum,* new species, and *Axophyllum?* sp. D; other forms discussed by Girty in the same paper seemingly belong to *Koninckocarinia* Dobrolyubova, 1937. The writer's investigation of corals from Kansas and Oklahoma indicates that most of these specimens can be assigned to *Dibunophyllum* Thomson and Nicholson, 1876, but *Koninckocarinia?, Heritschiella* Moore and Jeffords, 1941, *Bothrophyllum* Trautschold, 1879, and at least one undescribed genus are also abundant locally.

Dibunophyllid corals from this region have not been studied exhaustively; however, several species have been described. Newell (1935) described *Dibunophyllum valeriae* from the Eudora Shale of Kansas. Two Morrowan forms from northeastern Oklahoma were tentatively placed in the genus by Moore and Jeffords (1945).

Jeffords (1948a) noted the presence of *Dibunophyllum* in many Pennsylvanian and Permian units of Kansas; however, no species was named. He described *D. exigum* from the Dover Limestone of Kansas and *D. moorei* from the Oologah Formation of Oklahoma (Jeffords, 1948b). More recently, Duncan (1962, p. 66) illustrated a single corallite of *D. exigum* from the Stotler Formation, Virgilian of Kansas. A specimen from the Wapanucka Formation

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of Oklahoma was placed in *Dibunophyllum* (Rowett and Sutherland, 1964).

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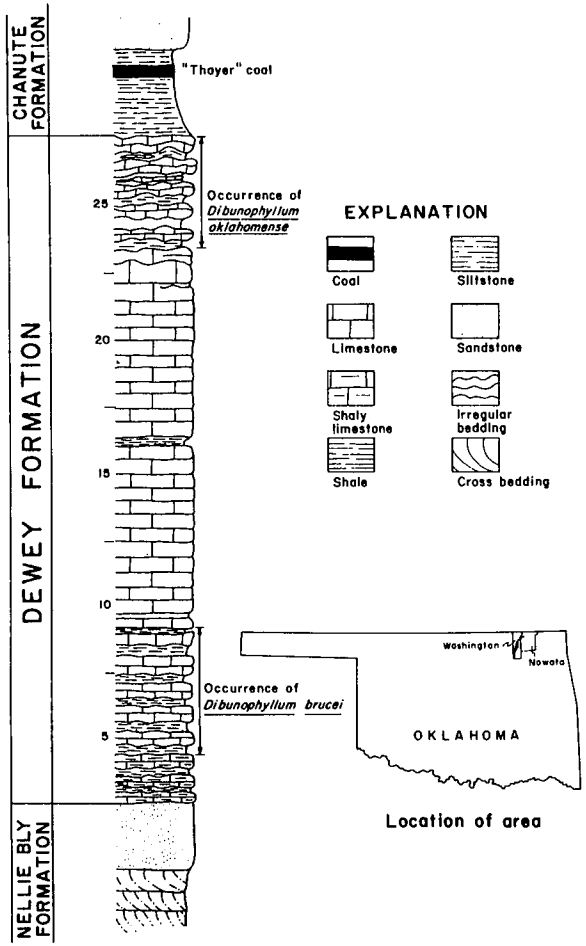


Text-figure 1. Stratigraphic section of the Dewey Formation in Washington and Nowata Counties, Oklahoma.

STRATIGRAPHY

Alternating algal limestones and calcareous shales compose the Dewey Formation (Missourian) in Washington and Nowata Counties, Oklahoma (text-fig. 1). The limestones and shales of the lower 3 to 9 feet are thin and wavy bedded. The upper part of the formation consists of two parts: (1) a lower massive limestone as much as 12 feet thick and (2) 6 to 8 feet of thin beds of knobby limestones interbedded with gray to green shales. Near the type locality at Dewey, Oklahoma, the Dewey is 24 to 30 feet thick and is underlain by cross-bedded micaceous siltstones of the Nellie Bly Formation. The upper massive limestones of the Dewey are overlain by 8 feet of green shales and poorly bedded "cobbly" limestones. The Dewey Formation is overlain by nonmarine sandstone, shale, and coal of the Chanute Formation. Northward, in Nowata County, the lower Dewey reaches a thickness of 4.5 feet, and is overlain by a limestone conglomerate. In the southwestern part of Washington County, shales and nodular marls of the Chanute Formation overlie 9 feet of typical thin beds of limestones and calcareous shales of the lower part of the Dewey Formation.

Dibunophyllum brucei, new species, has been collected only from the lower thin limestone and shale beds of the Dewey Formation at all localities in which these beds are exposed, although the species is most abundant in the Bartlesville-Dewey area of Washington County. At every place, it was accompanied by abundant caniiids, *Lophamplexus, Michelinia,* and by smaller numbers of *Koninckocarinia?* and *Syringopora.* Only the caniniids can be collected in all beds of the formation; *Dibunophyllum oklahomense,* new species, *Koninckocarinia?* sp., and *Syringopora* sp. are present in the upper cobbly limestone and green shale sequence.

Dibunophyllum oklahomense, new species, is found in the cobbly limestone and green shale beds of the upper part of the Dewey Formation at localities 9 and 19. The specimens are found with a coral fauna that is similar to that of the limestone and shale beds in the lower part of the formation.

LOCALITIES

The measured sections described below are regularly spaced along the outcrop belt in Washington County, Oklahoma, except for locality 15, which is in the northwestern part of Nowata County, Oklahoma.

1. SE¼ SE¼ SE¼ sec. 17, T. 26 N., R. 13 E. Roadcut on west side of U. S. Highways 60 and 75, extending approximately 150 yards north of junction. *Dibunophyllum brucei,* new species, occurs in lower 6.5 feet of thin limestones and shales with *Koninckocarinia*? sp., *Pseudozaphrentoides* spp., *Lophamplexus ulius, Michelinia* sp., and *Syringopora* sp. Total thickness of Dewey: 10.0-11.5 feet.

5. SE¼ sec. 22, T. 27 N., R. 13 E. South wall of abandoned quarry of Dewey Portland Cement Company, 150 yards east of bridge on north-south road across the quarry. *Dibunophyllum brucei,* new species, *Pseudozaphrentoides* spp., *Koninckocarinia*? sp., *Lophamplexus ulius, Michelinia* sp., and *Syringopora* sp. occur in lower 1.5 feet with a prolific brachiopod and bryozoan fauna. This is the best collecting locality in the Dewey Formation. Total thickness: 24 feet.

9. SW¼ SW¼ sec. 1, T. 25 N., R. 12 E. Located 0.3 mile west and 0.2 mile north of Caney River bridge, in an abandoned quarry. *Dibunophyllum oklahomense,* new species, occurs in upper 6 feet with *Pseudozaphrentoides* spp., *Koninckocarinia*? sp., and *Syringopora* sp. Total thickness of Dewey: 16 feet; lower thin-bedded limestones and shales covered.

10. SW¼ SW¼ SW¼ sec. 33, T. 26 N., R. 13 E. Roadcut on west side of U. S. Highway 75, 3 miles north of Caney River bridge. Corals include *Dibunophyllum brucei,* new species, *Pseudozaphrentoides* spp., *Koninckocarinia*? sp., *Lophamplexus ulius,* and *Michelinia* sp. These corals occur in lower 6 feet with large numbers of brachiopods and bryozoans. Total thickness of Dewey: 12.5 feet.

11. NW¼ NE¼ NW¼ sec. 25, T. 23 N., R. 12 E. Top of hill on north side of east-west road. *Dibunophyllum brucei,* new species, and *Koninckocarinia*? represented by a few weathered specimens. Nellie Bly and Chanute Formations are well developed. Southernmost exposure of Dewey Formation studied by the writer. Total thickness of Dewey: 9 feet.

13. NE¼ SW¼ sec. 30, T. 24 N., R. 12 E. Approximately 2.5 miles west of Ramona, Oklahoma, 250 yards southwest of hilltop on east-west road, west bank of small stream. A few specimens of *Dibunophyllum brucei,* new species, *Pseudozapherntoides* spp., and *Koninckocarinia*? sp. were collected. Total Dewey: 8.5 feet.

15. SW¼ SW¼ NW¼ sec. 13, T. 28 N., R. 14 E. Approximately 2.5 miles east of railroad crossing at Wann, Oklahoma. Underlying Nellie Bly covered. *Dibunophyllum brucei,* new species, *Pseudozaphrentoides* spp., *Koninckocarinia*? sp., and *Syringopora* sp. are found in 4.5 feet of interbedded limestone and shale. The overlying limestone conglomerate, 4.0 feet thick, is tentatively assigned to the Chanute Formation.

19. SE¼ SE¼ sec. 6, T. 27 N., R. 14 E. In abandoned quarry approximately 0.3 mile north of winding, generally east-west road. *Dibunophyllum brucei,* new species, occurs abundantly in the lower 8 feet with *Pseudozaphrentoides* spp., *Koninckocarinia*?, *Lophamplexus ulius, Michelinia* sp., and *Syringopora* sp. *Dibunophyllum oklahomense,* new species, is scarce in the upper 6.0 feet, occurring with *Pseudozaphrentoides* spp. and *Michelinia* sp. Chanute and Nellie Bly Formations are well developed. Total thickness of Dewey: 25 feet.

METHODS OF STUDY

Longitudinal and transverse thin sections and peels were used to analyze the late neanic and ephebic stages. The apical regions of several specimens were studied through use of closely spaced peels. The specimens, with apices oriented vertically, were imbedded in a block of dental plaster, glued to a steel plate, and the desired amount was removed with a Pultra Microlathe, Model 1770. The specimen was then etched in dilute hydrochloric acid for a few seconds and a dry cellulose acetate peel was made. Peels in the brephic stage were spaced 0.03 to 0.05 mm apart. Most individuals studied were more or less curved in the early parts and required several reorientations during grinding. Photographs were made by placing the peels in an enlarger and printing directly. After the structures were outlined with India ink, the emulsion was removed with a commercial photographic bleach. The epithecae of a few specimens of *Dibunophyllum brucei,* new species, and *D. oklahomense,* new species, were removed to facilitate study of septal insertion in the ephebic stage.

SYSTEMATIC PALEONTOLOGY

All figured specimens are in the paleontology collection of The University of Oklahoma. The terminology of this report agrees with rugose coral definitions given by Moore, Hill, and Wells (1956).

PHYLUM COELENTERATA

CLASS ANTHOZOA

Order RUGOSA Milne-Edwards and Haime, 1850

Suborder STREPTELASMATINA Wedekind, 1927

Family AULOPHYLLIDAE Dybowski, 1873

Subfamily AULOPHYLLINAE Dybowski, 1873

Genus *Dibunophyllum* Thomson and Nicholson, 1876

Type species. — *Dibunophyllum muirheadi* Thomson and Nicholson (1876a, p. 462).

Diagnosis. — Solitary rugose corals with a cobweblike axial structure and well-developed dissepimentarium in the ephebic stage compose the genus. Minor septa are degenerate, commonly not extending through inner limit of the dissepimentarium. The major septa are long and somewhat crooked; within the dissepimentarium they are thin. The cardinal septa may be somewhat shorter than other major septa and lie in small inconspicuous fossulae. If present, alar pseudofossulae are obscure. An inner wall, formed by stereoplasmic thickening of innermost dissepiments, separates the dissepimentarium from the outermost tabulae. The tabulae are incomplete and anastomosing; they are horizontal on the outer periphery of the tabularium but are more steeply inclined within the axial region. The axial structure consists of a median plate and four to eight irregularly spaced, radiating lamellae on either side. The corallites are solitary, conical in early stages but tend to become cylindrical. The epitheca is thin and shows no evidence of longitudinal ribbing. (Diagnosis modified from Hill, 1938, p. 65.)

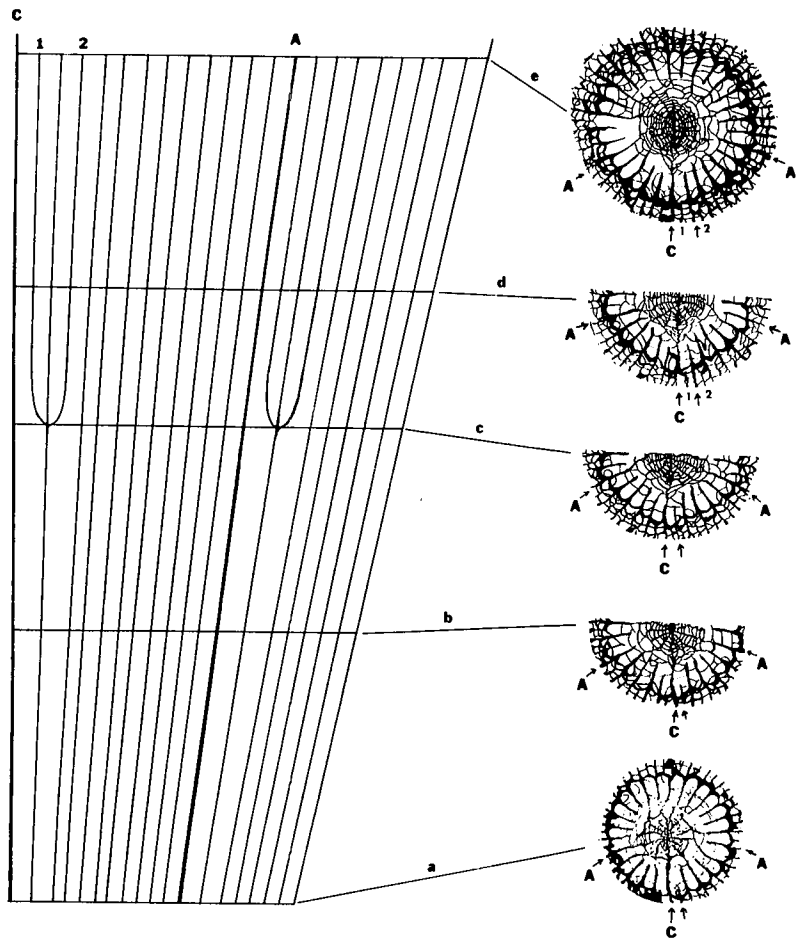
Remarks. — According to Hill (1956, p. 286) corals which have been assigned to six other genera should be included in *Dibunophyllum;* the names *Rhodophyllum, Asipidophyllum,* and *Cymatiophyllum* have priority, but Hill proposed the retention of *Dibunophyllum* because of widespread usage. That procedure is followed here.

Dibunophyllum brucei, new species

Text-figure 2; plate III, figures 1a-c, 2a-g

External characteristics. — The adult specimens are solitary, small to moderately large, ranging in length from 10 to 40 mm and in diameter from 7 to 10 mm. The calice is moderately deep with prominent axial boss commonly elongate in the plane of curvature. Major and minor septa are visible in well-preserved specimens. The epitheca is marked by thin, closely spaced annulations and large rugae. Rejuvenescence is rare. A small subtriangular attachment area lies on the convex, cardinal side of the corallite.

Ephebic stage. — The major septa are approximately equal to two-thirds of the radius, well developed and lanceolate in the tabularium, attenuate and crooked in the dissepimentarium. The average septal formula is K7A4C4A7K, with 22 to 29 major septa present. The cardinal septum lies in an obscure fossula; the counter septum is invariably connected to the median plate of the axial structure. Minor septa, approximately one-fourth as long as major septa, are thin and sinuous and may extend a short distance into the tabularium. The dissepimentarium consists of four to six rows of irregular and herringbone dissepiments. A distinct inner wall is formed by thick deposits on the innermost dissepiments and the axial ends of the minor septa. However, at the base of the calice in mature specimens, the wall may be obscure or missing. The tabularium consists of widely separated, outwardly convex plates and is equal to one-third of the diameter. The axial structure is typically dibunophylloid with three distinct parts: (1) a well-defined median lamella, which is the axial continuation of the counter septum but is commonly connected to the cardinal septum, (2) three to nine irregularly spaced radiating lamellae, which may be joined to major septa, and (3) numerous outwardly convex tabellae between the radiating lamellae.



Text-figure 2. Schematic sketch of etched exterior of a typical specimen of *Dibunophyllum brucei,* new species, and transverse sections of paratype OU 4973, from locality 19, Washington County, Oklahoma. Transverse sections are oriented with cardinal septum down. The last-formed septum adjacent to cardinal septum is indicated by an arrow. The septa inserted on each side of the last-formed major septum are indicated by numbers 1 and 2. The cardinal and alar septa are indicated by C and A, respectively.

a. 4.5 mm below insertion of septa 1 and 2. Last-formed septum restricted to dissepimentarium.
b. 2.2 mm below insertion of septa 1 and 2. Last-formed septum elongated into tabularium.
c. Point of insertion of septa 1 and 2 on each side of major septum.
d. 2.2 mm above insertion of septa 1 and 2.
e. 3.5 mm above insertion of septa 1 and 2, near base of calice.

Some specimens with epitheca removed show two septa originating on each side of the last-formed septum on either side of the cardinal septum or the counter side of the alar septa (text-fig. 2). Transverse sections confirm that the newly formed septum on the counter side is a minor septum throughout growth. The septum adjacent to the cardinal septum may become a major septum below the point where the next two septa arise in the manner described above. In a few specimens, the newly formed septum on the cardinal side remains short to the point of insertion of the next septum or septa with the following variations: (1) the last-formed septum adjacent to the cardinal or alar septum may become a major septum above the point where two septa arise as described above, or (2) the newly formed septum may shift its position sharply toward the counter side and a minor septum may arise at the point of flexure; in a short distance, a major septum is inserted from the counter side of the last-formed minor septum.

Neanic stage. — The neanic stage is characterized by the addition of major septa, introduction of minor septa, dissepimentarium, and axial tabellae, and development of a cardinal fossula and a complex axial structure (table 2). Both cardinal and counter septa are commonly attached to the median plate, although the cardinal septum may withdraw or become attenuate in the tabularium at 3 to 4 mm from the apex. In the early neanic stage, the major septa usually attach to the median septum or to an adjoining metaseptum; higher sections show that septa are either free or connected to the radiating lamellae of the axial structure. In early neanic stage, before insertion of minor septa, major septa are introduced on each side of the cardinal septum and the counter side of the alar septum. The former may lean against the cardinal septum but are commonly free; the latter may be free, lean against either the alar septum or the last-formed major septa. Insertion of septa of the late neanic stage is similar to that of the ephebic stage. Minor septa, dissepiments, and an obscure inner wall appear in the counter quadrants at approximately 2 mm above the apex and are between all septa at about 2.5 mm. The inner wall is strongly developed at 3.5 to 4.0 mm above the apex. Isolated tabulae may be present at 0.2 mm from the apex; a well-developed tabularium develops between 2.0 and 2.5 mm. The

early neanic axial structure consists of the counter-cardinal crossbar and fused ends of the counter-lateral septa. The latter may be somewhat thickened at the point of juncture to form a plate perpendicular to the counter-cardinal plane. A few tabellae are present at 1.7 mm from the apex, but between 3.0 and 3.3 mm the lateral plate of the counter-lateral septa disappears and globular tabellae are numerous. A few radiating lamellae are formed at 2.2 mm; they become abundant at 3.0 to 3.5 mm from the tip. In specimens with strongly developed attachment areas, the major septa may be thick and abnormally long.

Brephic stage. — In all specimens in which the apex was completely preserved, the counter-cardinal septum is inserted first as a single crossbar which is perpendicular to the flattened attachment area. The cardinal part of the crossbar invariably occurs on the side of attachment. Next, two counter-lateral septa are inserted perpendicularly or obliquely to the counter-cardinal crossbar septum and join it near the center. A short distance higher, two metasepta enter and may join either the crossbar near its midpoint or lean against the counter-lateral septa. In a few specimens, two metasepta may be inserted on both sides of the cardinal septum before introduction of the alar septa. The alar septa are the last primary septa inserted and may be free or joined axially to the cardinal septum a short distance from the center of the corallite. A few tabulae may be present

TABLE 2. — FIRST APPEARANCE OF STRUCTURES IN *Dibunophyllum brucei*, NEW SPECIES

(measurement of six specimens)

STRUCTURE	DISTANCE FROM APEX (RANGE IN MM)	DIAMETER (RANGE IN MM)
Counter-cardinal septal crossbar	lowest sections	-------
Counter-lateral septa	0.0-0.2	0.4-0.8
Alar septa	0.2-0.5	0.5-1.5
First metasepta	0.2-0.5	0.4-0.8
Minor septa	2.0-2.5	2.5-3.0
Tabulae	0.0-0.2	0.4-0.8
Well-developed tabularium	2.0-2.5	2.5-3.0
Inner wall	2.0-2.5	2.5-3.0
Dissepimentarium	2.0-2.5	2.5-3.0
Tabellae	1.7-2.0	2.0-2.5

in earliest sections. On completion of the brephic stage, 0.2 to 0.5 mm from the apex, the septal formula is either K2ACA2K or K2A1C1A2K.

Longitudinal section. — The dissepimentarium consists of steeply inclined, inwardly convex plates, with an average of twelve present within a vertical distance of 5 mm, and is bounded by a prominent inner wall. The tabulae are incomplete and are inclined at low angles in the outer tabularium but steepen and abut against the more steeply inclined axial tabellae. A thin, sinuous line marks the changing position of the median plate of the axial structure.

Discussion. — *Dibunophyllum brucei*, new species, differs from *D. moorei* Jeffords, 1948, in a number of characteristics. Externally, *D. brucei* is more conical and has a less conspicuous attachment area; internally, it has a wider inner wall but fewer septa and dissepiments. Examination by the writer of the brephic stage of a single topotype of *D. moorei* confirms the separation of the two species. *Dibunophyllum exigum* Jeffords, 1948, from the Dover Limestone, differs from *D. brucei* in having a more loosely packed columella and a less conspicuous inner wall. *Dibunophyllum valeriae* Newell, 1935, from the Eudora Shale, has fewer septa and a median lamella that is less prominently developed. *Dibunophyllum brucei* differs from *D. oklahomense* by being of larger size, having a more conical shape, and having a triangular attachment area. Also, *D. brucei* has a more complex columella, a more distinct inner wall, and a greater number of septa in the ephebic stage (see discussion of *D. oklahomense).*

The septal insertion pattern in the brephic stage of aulophyllid corals has not been studied extensively. Carruthers (1906, p. 358-362) outlined three stages of septal insertion for several species of rugose corals: (1) a single axial septum stretches across the corallite in earliest section, (2) two alar septa are added on each side of the axial septum and lean against it, and (3) after the alar septa develop, two septa (counter-laterals) are inserted on the counter end in a similar manner as the alar septa were inserted. Carruthers placed *Dibunophyllum* sp. in the third category, but did not illustrate the form studied. Smith (1913, p. 64) noted the presence but did not discuss the sequence of the six primary septa in *Aulophyllum.*

Hill (1938, p. 32-35) discussed two plans of septal insertion in the brephic stage. Those corals of the zaphrentid group, including *Dibunophyllum, Aulophyllum, Clisiophyllum,* and *Koninckophyllum,* are characterized by the insertion of alar septa before the counter-lateral septa. In the cyathaxonid group, the cardinal and counter septa first appear as an axial septum, then two counter-laterals arise close to and leaning against the cardinal end of the counter-cardinal septum. The insertion pattern of *Dibunophyllum brucei* is similar to that of the cyathaxonids in the appearance of counter-lateral before the alar septa, but differs in at least two important aspects. First, a pair of metasepta is introduced on the cardinal side of and leans against each counter-lateral septum before the appearance of the alar septa. Secondly, the alar septa tend to be free and to be inserted after the first pair of metasepta of the counter quadrants and in some specimens may be preceded by a pair of metasepta introduced adjacent to the cardinal septum.

Coope (1956, p. 234-238) discussed septal insertion in the ephebic stage of Lower Carboniferous clisiophyllids from the Carboniferous of Britain. In all the species studied, *Dibunophyllum bipartitum* (McCoy), 1849, *Koninckophyllum magnificum* Thomson and Nicholson, 1876, *Corwenia* sp., *Aulophyllum fungites* (Fleming), 1828, and *Clisiophyllum* sp., a septum is added on either side of a newly formed metaseptum. The septum on the counter side is a minor septum throughout growth; the one on the cardinal side remains short for some distance but becomes elongate and forms a major septum. The last septum inserted adjacent to the cardinal or alar septum is a minor septum. Coope noted two variations of septal elongation. In *Dibunophyllum, Koninckophyllum,* and *Corwenia,* a major septum forms by coalescence of a minor septum and a septal bud which originates on the innermost dissepiments. In *Clisiophyllum* and *Aulophyllum,* the minor septum on the cardinal side, after remaining short through several millimeters, grows axially quite rapidly to become a major septum. In a later paper Coope (1957, p. 465-468) described the septal insertion pattern in the adult stages of *Palaeosmilia murchisoni* Milne-Edwards and Haime, 1848, a noncolumnate species with a wide dissepimentarium and long minor septa. New septa originate as septal crests, become elon-

gate axially and peripherally, and attain the length of minor septa. The length of the septum on the counter side remains constant, but after a period of arrested growth, the septum on the cardinal side lengthens axially to become a major septum. Some septa in *Dibunophyllum brucei* insert in a manner like that of *Clisiophyllum* and *Aulophyllum;* however, other patterns are present. In the British form, as in the form here described, the dissepimentaria are narrow and the minor septa extend to their inner limits.

Material studied. — Approximately 100 thin sections and peels were studied. Apices of six specimens, paratypes OU 4975, OU 5778, OU 5779, OU 5780, and OU 5781 and holotype OU 4974, were studied for septal insertion pattern. Several exteriors were etched. Six specimens, paratypes OU 5782 to OU 5787, were studied for calice and attachment area variation. All types and an additional 200 specimens are in the paleontology collections of The University of Oklahoma.

Dibunophyllum oklahomense, new species

Plate III, figures 3a-n

External characteristics. — The corals are small to moderately large with lengths of 8 to 35 mm and diameters of 5 to 8 mm. They are conical throughout growth and are gently curved. The calice is moderately deep with a thin axial boss which is most commonly elongate in the plane of curvature. Both major and minor septa are visible in well-preserved calices. The epitheca is crossed by numerous small annulations. No rejuvenated forms have been collected. The attachment area consists of thick, irregular epithecal deposits on the convex side of the corallite.

Ephebic stage. — The major septa are approximately equal to two-thirds the radius, thick and lanceolate in the tabularium, but are somewhat attenuate in the dissepimentarium. The average septal formula is K7A4C4A7K. The type specimen has 29 major septa at the base of the calice. The cardinal septum may be shortened; the counter septum is attached to the median plate of the axial structure. All major septa are crooked and attenuate in the dissepimentarium, but are thickened and lanceolate in the tabularium. Minor septa are

thin in the dissepimentarium and may extend a short distance into the tabularium. The dissepimentarium is composed of one to five rows of dissepiments bounded axially by thin, discontinuous stereoplasmic deposits on the innermost dissepiments and axial ends of minor septa. The tabularium consists of widely separated peripherally convex plates and is equal to slightly more than one-third of the diameter.

The axial structure is weakly dibunophylloid. At the base of the calice in adult specimens, neither the median plate nor radiating lamellae are clearly defined. The outwardly convex tabellae are spaced between irregular, radiating lamellae. Sections of earlier stages show a more typically dibunophylloid axial structure.

Examination of etched exteriors of the species indicates that the addition of major septa is similar to that of *Dibunophyllum brucei,* new species.

Neanic stage. — Addition of minor septa, dissepiments, and axial tabellae, and the increase in number of major septa and tabulae characterize the neanic stage. The cardinal and counter septa are attached to the median plate but both may thin in the tabularium. Early in the neanic stage, the major septa may be connected directly to the median plate or to adjoining metasepta; later sections have major septa that may be free or connected to the radiating lamellae of the axial structure. Sections below the point where minor septa are inserted show that major septa are inserted on each side of the cardinal septum and on the counter sides of the alar septa. Those inserted adjacent to the cardinal septum may be free or may lean against the cardinal septum. The septa inserted near the alar septa may be free, or may lean against the alar septa or adjacent metasepta. Insertion of major septa in the late neanic stage is similar to that of the ephebic stage. Minor septa appear in the counter quadrant at 2.0 mm and are located between all major septa at 2.5 mm from the apex. The inner wall is developed at 4.0 mm from the apex but is not strongly developed. A few tabulae may be present at 1.5 mm; the tabularium becomes well developed between 2.0 and 3.0 mm from the tip. The counter-cardinal crossbar may be centrally thickened at the point of juncture with the counter-lateral and first two metasepta. Tabellae originate at 1.5 mm and are numerous at

3.0 mm from the apex. Radiating lamellae may be present at 2.0 mm from the tip but are not strongly developed.

Brephic stage. — Only a single specimen sufficiently well preserved for study of the brephic stage was collected. The earliest stages show a counter-cardinal crossbar and two counter-lateral septa which join the crossbar near the center. A short distance above, two metasepta are introduced on the cardinal side and lean against the counter-lateral septa. The alar septa are inserted last and may be preceded by a pair of metasepta adjacent to the cardinal septum. The septal formula is K2ACA2K at the completion of the brephic stage. No tabulae or dissepiments are present.

Longitudinal section. — The dissepimentarium is composed of steeply inclined, axially convex dissepiments and is bounded by an obscure inner wall. The tabularium consists of incomplete tabulae that are flat in outer parts, but that are inclined and merge with the tabellae at the outer limits of the columella. The columella is composed of steeply inclined, outwardly convex plates that lean against other tabellae or the median plate. The center of the axial structure is marked by the thin sinuous outline of the median plate.

Discussion. — *Dibunophyllum oklahomense,* new species, can be separated from *D. moorei* Jeffords, 1948, *D. valeriae,* 1935, and *D. brucei* by its smaller size, inconspicuous inner wall, and weakly dibunophylloid columella in the ephebic stage. *Dibunophyllum exigum* Jeffords, 1948, is similar to the form described herein but differs in having smaller dissepiments, a less strongly developed axial structure in the early ephebic stage and smaller dissepiments. The insertion pattern in *D. oklahomense* of the primary septa is similar to that of *D. brucei*; however, only a single apex was examined. Etched exteriors indicate that major septa arise from minor septa in the same manner as in *D. brucei.*

Material studied. — Eleven transverse and five longitudinal sections from five specimens were studied. The apical part of the holotype was studied to determine insertion of primary septa. Holotype OU 4976 and five paratypes, OU 5788 to OU 5792, are in the paleontology collection, The University of Oklahoma.

PLATE III

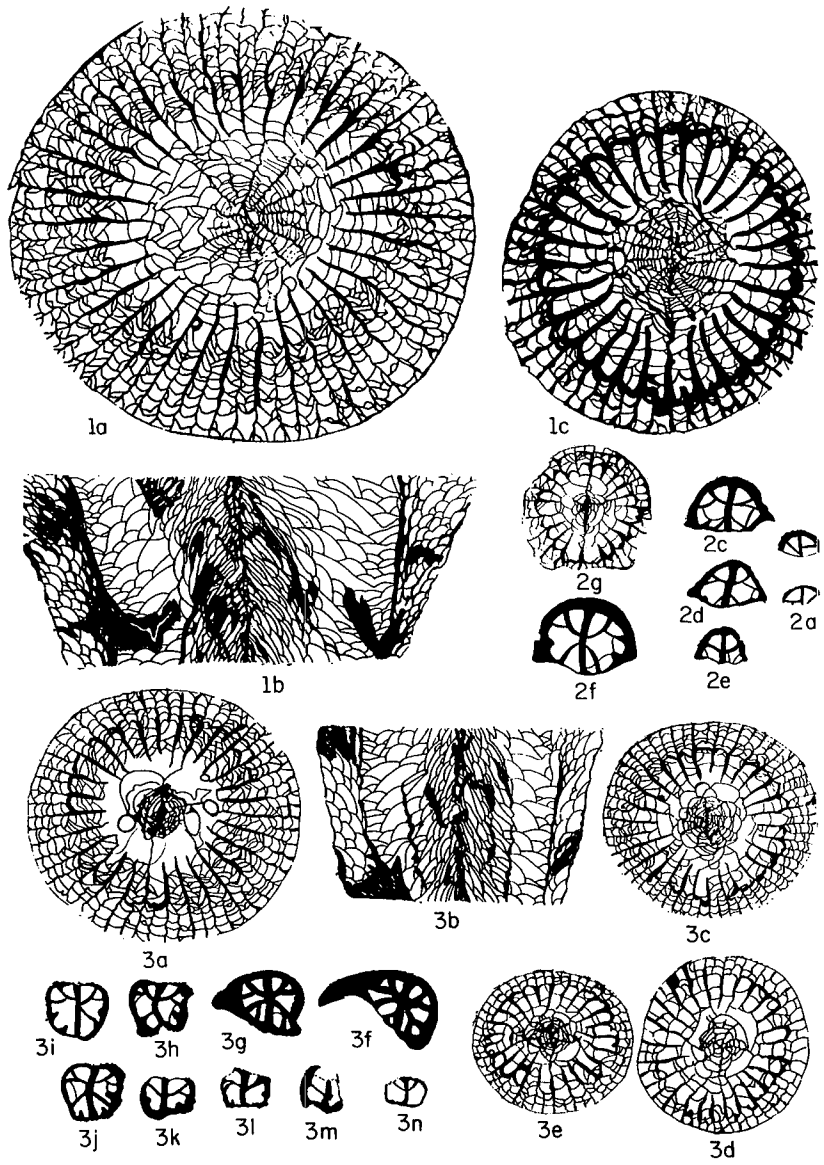
NEW SPECIES OF *DIBUNOPHYLLUM*

Plate III

Page

1. *Dibunophyllum brucei,* new species, holotype OU 4974, x3, ephebic stage, locality 19. — 42
   a. Transverse section at base of calice, 32 mm from apex.
   b. Longitudinal section, alar plane between sections shown in figures a and c.
   c. Transverse section, 36 mm from apex.
2. Transverse sections of *Dibunophyllum brucei,* new species, paratype OU 4975, x10, locality 19. — 42
   a. Lowest section of slightly weathered form.
   b. 0.05 mm from apex.
   c. 0.30 mm from apex.
   d. 0.60 mm from apex.
   e. 1.0 mm from apex.
   f. 1.2 mm from apex.
   g. 4.8 mm from apex.
3. Transverse sections (figs. a, c-n) and longitudinal section (fig. b) of *Dibunophyllum oklahomense,* new species, holotype OU 4976, locality 19. — 48
   a. Base of calice, 22.0 mm from apex, x3.
   b. Longitudinal section, alar plane between sections shown in figures a and c, x3.
   c. 13 mm from apex, x3.
   d. 8 mm from apex, x3.
   e. 6 mm from apex, x3.
   f. Top of attachment area, 1.15 mm from apex, x10.
   g. 0.9 mm from apex, x10.
   h. 0.6 mm from apex, x10.
   i. 0.8 mm from apex, x10.
   j. 0.35 mm from apex, x10.
   k. 0.25 mm from apex, x10.
   l. 0.15 mm from apex, x10.
   m. 0.05 mm from apex, x10.
   n. Lowest section of slightly weathered specimen, x10.

Plate III



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APPENDIX TO PART I

Tabulate-Coral Localities in the Wapanucka Formation

The localities listed below are those of Rowett and Sutherland (1964) and the reader is referred to that publication for more detailed descriptions and for information regarding the occurrence of rugose corals.

LOCALITY 3 — NE¼ NW¼ SE¼ sec. 8, T. 1 N., R. 7 E., Pontotoc County. Tabulate corals occur in a basal calcareous shale (unit A), an intermediate bioclastic limestone (unit D, 111.5 feet above base), and in an upper bioclastic arenaceous limestone (unit F, 171.0 feet above base).

Coral species: *Michelinia scopulosa* (units A, F); *M. tenuicula* (unit D); *Cladochonus texasensis* (unit F).

LOCALITY 4 — NE¼ SE¼ SE¼ sec. 8, T. 1 N., R. 7 E., Pontotoc County. Lower part of formation. Tabulate corals occur only in the basal calcareous shale (unit A).

Coral species: *Acaciapora subcylindrica, Michelinia scopulosa, M. latebrosa, M. tenuicula, Cladochonus fragilis.*

LOCALITY 7 — NE¼ NE¼ sec. 33, T. 3 N., R. 7 E., Pontotoc County. Undetermined part of formation. Tabulate corals occur in the basal interbedded shale and limestone (unit A) and in an overlying calcareous shale (unit B, 4.0 feet above base of exposures).

Coral species: *Michelinia scopulosa* (units A, B); *M. spissata* (unit A); *M. tenuicula* (unit A); *M. latebrosa* (unit A).

LOCALITY 8 — NE¼ SE¼ SW¼ sec. 34, T. 3 N., R. 7 E., Pontotoc County. Undetermined part of formation. Tabulate corals occur only in upper interbedded limestones and shales at this locality (unit B, 16.5 feet above base of section).

Coral species: *Michelinia referta; M. scopulosa.*

LOCALITY 9 — SW¼ NE¼ sec. 18, T. 1 S., R 9 E., Coal County. Tabulate corals are restricted to a limestone (unit B) approximately 50 feet above the base of the section.

Coral species: *Michelinia scopulosa.*

LOCALITY 16 — NE¼ NW¼ sec. 22, T. 2 S., R. 8 E., Johnston County. Tabulate corals occur only in a thin bioclastic limestone (unit B) 5.5 feet above the base of the section.

Coral species: *Michelinia spissata.*

LOCALITY 17 — NE¼ NE¼ sec. 30, T 1 N., R. 8 E., Coal County. Upper part of formation. Tabulate corals were found only in a lower crystalline limestone (unit A) at the base of the section.

Coral species: *Michelinia scopulosa*; *M. tenuicula.*

LOCALITY 18 — NE¼ sec. 31, T. 2 N., R. 13 E., Atoka County. Tabulate corals were found only in the uppermost limestone (unit U), approximately 293 feet above the base of the section.

Coral species: *Michelinia spissata.*

LOCALITY 21 — NW¼ sec. 18, T. 4 N., R. 17 E., Pittsburg County. Tabulate corals occur only in a glauconitic limestone (unit F) approximately 113 feet above the base of the section.

Coral species: *Michelinia scopulosa.*

LOCALITY 22 — Center west line, SW¼ SE¼ sec. 10, T. 4 N., R. 17 E., Pittsburg County. No section was measured at this locality.

Coral species: *Michelinia scopulosa.*

LOCALITY 24 — Center west line, sec. 24, T. 2 S., R. 8 E., Johnston County. Tabulate corals were found only in a coarse-crystalline crinoidal limestone (unit F, 70 feet above base of section).

Coral species: *Michelinia spissata*; *M. latebrosa.*

LOCALITY 25 — SW¼ SW¼ NE¼ sec. 19, T. 1 N., R. 8 E., Coal County. Tabulate corals were found only in the basal fossiliferous limestone and shale (unit A).

Coral species: *Michelinia spissata.*

LOCALITY 26 — SE¼ NW¼ SE¼ sec. 6, T. 1 S., R. 9 E., Coal County. Upper part of formation. Tabulate corals at this locality occur in the only unit exposed, a thick interbedded oölitic limestone and shale (unit A).

Coral species: *Michelinia scopulosa; M. spissata; M. tenuicula.*

LOCALITY 27 — NE¼ NE¼ sec. 30, T. 1 N., R. 8 E., Coal County. Tabulate corals occur in the interbedded shale and limestone (unit A) at the base of this section and in the immediately overlying shaly limestone (unit B, 65 feet above base of section).

Coral species: *Michelinia?* cf. *M. meekana* (unit B); *Striatopora* cf. *S. religiosa* (unit A).