STATE GEOLOGICAL SURVEY OF KANSAS, BULLETIN 76
1948 REPORTS OF STUDIES, PART 3, PAGES 29-52, FIGURES 1-3, PLATES 1-4
MAY 15, 1948

THE OCCURRENCE OF CORALS IN LATE PALEOZOIC ROCKS OF KANSAS

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ABSTRACT

This report summarizes information on late Paleozoic corals in Kansas that has become available during somewhat detailed studies of these fossils. Although the systematic investigations are incomplete as yet, preliminary data on the more abundant types of corals in Kansas may be of immediate use in studies of the rock formations in the State and to students of paleontology. The morphology of the corals is considered briefly and major structural characters are illustrated. The genera of corals known to occur in the State are illustrated and characterized, and a key is given for ease in identification of the several distinctive genera.

The stratigraphic occurrence of the corals in Kansas as determined by careful study of the collections made by the Geological Survey is recorded, and mention is made of corals that seem especially useful in the determination and tracing of stratigraphic horizons.

INTRODUCTION

Purpose and scope.—Investigation of fossil corals in the Pennsylvanian and Permian rocks of Kansas during recent years has indicated the occurrence of many varied types. Whereas these systematic studies are only partly completed, the major features of the Kansas coral faunas are evident. It seems desirable, therefore, to review briefly the characters by which principal types of corals may be recognized and to summarize available information on the stratigraphic occurrence of corals in the State. Although no new corals are described here, these data should be of interest and value in Kansas both to those engaged in systematic stratigraphic and paleontological studies and to those who are interested in collecting and studying fossils from a nonprofessional point of view.

In order to make the information more usable to persons not trained in systematic paleontology, many of the more technical details and taxonomic considerations are simplified in the following discussion; these data may be obtained from other more technical reports (Moore and Jeffords, 1941, 1945; Jeffords, 1942, 1947; Lang, Smith, and Thomas, 1940). General information on the principles of scientific nomenclature that must be employed in a study of fossils is contained in numerous textbooks on geology, as those by Moore (1933), Twenhofel and Shrock (1935), and Schuchert and Dunbar (1941). The exposed rock formations of Kansas are described in summary manner by Moore, Frye, and Jewett (1944), and more specific data on the geology of local

areas are available in county reports of the State Geological Survey.

Previous investigations.—Pennsylvanian and Permian corals have been studied by numerous geologists throughout the world, but these corals from Kansas have been described only in several scattered papers by Worthen (1890), Beede (1898, 1900), Newell (1935), Moore and Jeffords (1941), Jeffords (1942, 1947), and Wells (1944). Many Kansas corals, however, have been referred to types previously described from equivalent rocks in other areas. Published data on corals that have been the basis for such identification of Kansas corals include papers by Edwards and Haime (1850, 1851), Owen (1852), McChesney (1860-1865), White and St. John (1867), Meek (1872), White (1884), Miller and Gurley (1893), Rowley (1901), Barbour (1911), Girty (1911, 1915), and Mather (1915). More recently Easton (1944), Moore and Jeffords (1945), and Wells (1944) have discussed the nomenclature of Pennsylvanian corals similar to those found in Kansas.

Methods of study.—Corals from late Paleozoic rocks in Kansas commonly may be separated into generic groups by examination of external features such as the form of the individual or colony and the character of surface markings, and by such internal structures as are visible in the calyx or in weathered and broken specimens. Reliable separation of closely allied types (species) of solitary corals, however, requires knowledge of the internal structures as are revealed only by longitudinal and transverse sections that may be prepared by sawing or by grinding and polishing the specimens. Because of the variation in structural characters and the importance of characters shown by successive growth stages, a series of transverse sections and a longitudinal section are requisite. Some types of colonial corals may be identified on the basis of external form and arrangement of the corallites, but the majority must be sectioned also. After the critical internal structural features have been determined, many of the corals may be identified readily by external characters. Some techniques useful in preparation of sections and in study of the corals are summarized by Jeffords (1942, 1947).

Acknowledgments.—Studies on corals in Kansas have been under the general direction of Dr. R. C. Moore who also made available for study the extensive collections of the State Geological

Survey. Dr. J. M. Jewett has been particularly helpful in furnishing information on the stratigraphic occurrences of corals and in correcting erroneous stratigraphic designations. Many others at the University of Kansas, however, have aided this study by careful search in the field for additional coralline material.

MORPHOLOGY OF KANSAS CORALS

The numerous and varied structural features of corals and the lack of uniformity in usage of terms among authors precludes a comprehensive review of the terms applied to these fossils. Relatively extended glossaries have been compiled by Hill (1935), Sanford (1939), Easton (1944a), and Jeffords (1947). An abbreviated explanation of morphologic terms as applied to corals is given below as an aid to the identification of terms used later in this paper. These structures with identifying labels are shown also on Plate 1.

External Features

Calyx—the more or less deep cuplike depression at the top of a coral skeleton that was occupied by the living animal.

Corallite—the hard parts of a coral individual.

Corallum—the hard parts of a coral colony.

Growth lines—fine irregularities that encircle the exterior of some corals.

Holotheca—the outer wall surrounding some colonies of tabulate corals.

Septal grooves—longitudinal depressions on the exterior of some corals that mark inbending of the outer wall along lines at the edge of the septa.

Theca—the outer wall of rugose corals; it is the *epitheca* of some authors.

Internal Features

Alar septum—each of the two septa that have insertion points for newly formed major septa on the counter side. The alar septa are indicated by the symbol A on diagrams.

Cardinal septum—a septum having insertion points of newly formed major septa adjoining on either side; commonly it is shorter than other major septa. On diagrams the cardinal septum is indicated by the symbol C.

Column—an axial structure of corals that ranges from solid rodlike growths to delicate open meshworks.

Counter septum—the septum opposite the cardinal septum. On diagrams the counter septum is indicated by the symbol K, and it is directed upward in figures of transverse sections.

Dissepiments—small curved plates built one on another so as to form vesicles; their convex surfaces are directed upward and toward the in-

terior of the coral. In transverse sections intercepts of tabulae may be identified erroneously as dissepiments.

Fossula—a depression in the floor of a rugose coral calyx formed by the partial or complete abortion of a septum, commonly the cardinal septum. In transverse sections a fossula may be indicated by an open space extending peripherally between some of the major septa.

Inner wall—a thickened wall-like structure occurring in some corals at the inner edge of a zone of dissepiments; it is applied also to a curved wall formed by intercepts of tabulae.

Lamellae—subvertical plates of the axial region of some rugose corals, generally not confluent with septa; they may be discontinuous longitudinally. Some genera are characterized by a median lamella in the plane of the cardinal and counter septa and by radiating lamellae, which intersect the median lamina at different points.

Laminae—sheet-like structures formed by the juxtaposition of two layers of skeletal material in septa and the column. Lamellae, unlike laminae, comprise distinct wall-like structural units.

Major septa—the relatively long septa of rugose corals that comprise the four first-formed septa and subsequently inserted pairs of main septa appearing in definite order in the rugose corals.

Minor septa—secondarily introduced septa, generally short, that appear nearly simultaneously between major septa.

Pseudofossula—a depression or space between septa on the floor of the calyx of some rugose corals which is formed on the counter side of the alar septa in many corals.

Septa—radial partitions that partly or completely divide the interior of rugose corallites into compartments.

Stereoplasm—organically deposited skeletal matter that may secondarily thicken some coral structures.

CLASSIFICATION AND DESCRIPTION OF KANSAS CORALS[1]

The late Paleozoic corals of Kansas are divisible into two major groups—rugose corals and tabulate corals. The former are characterized by a solitary or colonial mode of life, by the addition of major septa at four points only, and by the conspicuous occurrence of septa. Tabulae are present commonly, but dissepiments may be lacking. Tabulate corals found in Kansas include only colonial forms that comprise groups of loosely connected or closely packed tubes. Septa, or septalike structures, are inconspicuous or lacking, but tabulae commonly are very numerous. Dissepiments do not occur.

[1] References to the genera mentioned in this paper and more detailed discussion of their characters may be found in reports given in the list of references, particularly Lang, Smith, and Thomas (1940), Moore and Jeffords (1941, 1945), Wells (1944), Easton (1944), and Jeffords (1947).

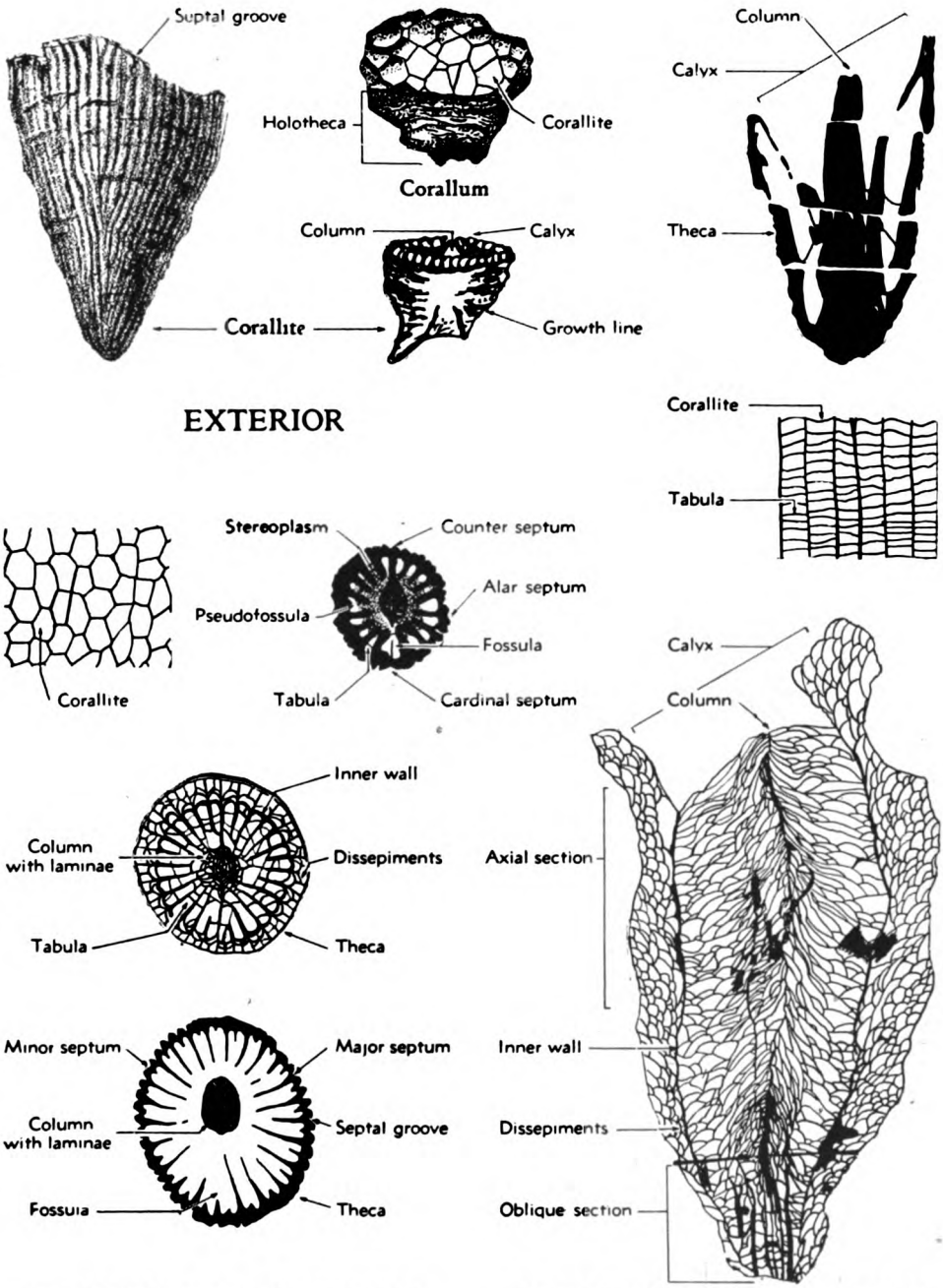


PLATE 1.—Illustrations of some important structural characters in Kansas corals (in part after Miller and Gurley, 1893; and Jeffords, 1942). Approximately X 2.5. On the transverse section second from the bottom on the left read "lamellae" for "laminae."

The rugose corals became extinct at the end of the Paleozoic Era although a different type of coral, the hexacoral, occurs in some younger beds and in the present seas. The tabulate corals range upward into the Mesozoic Era, but no living coral seems to resemble these fossils closely.

Kansas rugose and tabulate corals may be subdivided rather readily into several distinct groups, each of which includes corals that are more or less similar in appearance and in structural characters.

Rugose Corals

LOPHOPHYLLIDID CORALS

These abundantly occurring fossils comprise solitary conical to conico-cylindrical corallites having an axial column developed by a thickening of the counter septum, shortened cardinal septum, tabulae but no dissepiments, and well-defined septal grooves. Most specimens are characterized by a spikelike column that protrudes from the base of the calyx. The genus *Lophophyllidium* (*Lophophyllum* of authors, in part) is recognized by the large axial column that contains radiating laminae, few tabulae, and septa that are not shortened in maturity (Pl. 2). Somewhat similar corals characterized by a relatively smaller and laterally compressed column that lacks radiating laminae, and by a notable reduction in the length of the major septa in maturity are referred to *Stereostylus* (Pl. 2). *Lophamplexus* (Pl. 2) includes corals that are similar to *Stereostylus* in youthful stages but lose the column in the upper part of the corallite. *Malonophyllum,* a lophophyllidid genus based on poorly preserved and inadequately known material has been doubtfully recognized in Kansas for Permian lophophyllidid corals that lack tabulae.

Nearly twenty species of lophophyllidid corals have been described from Pennsylvanian and Permian rocks in Kansas (Moore and Jeffords, 1941; Jeffords, 1942, 1947), but this does not represent accurately the total number of species that may be determined upon careful study and collection. The corals *Lophophyllidium profundum, L. proliferum,* and *L. distortum* do not seem to be represented in Kansas.

CLISIOPHYLLID CORALS

Solitary or more rarely colonial corals having a conical to cylin-

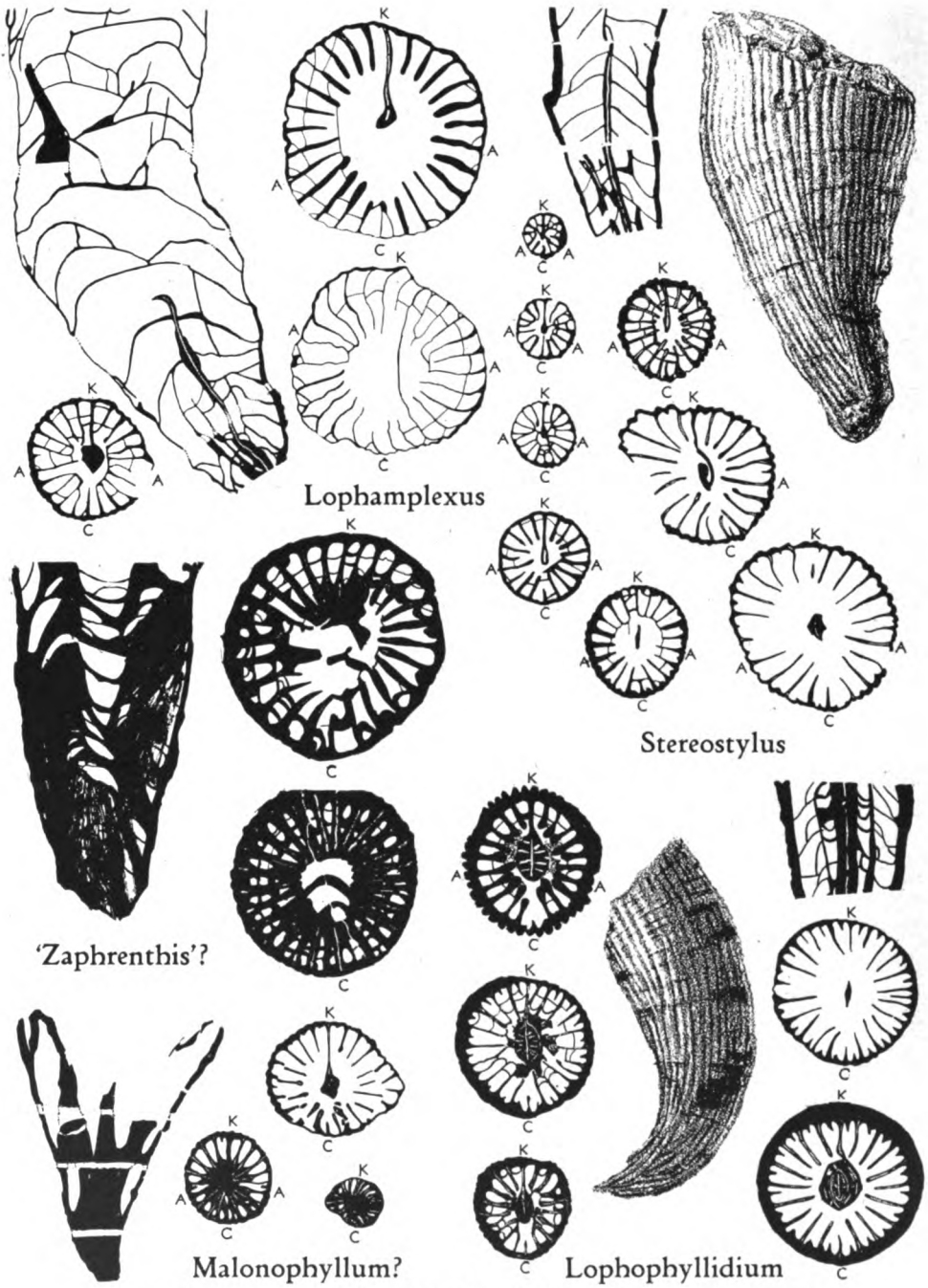


PLATE 2.—Lophophyllidid and "zaphrenthid" coral genera occurring in Kansas (in part after Moore and Jeffords, 1941; and Jeffords, 1942, 1947). X 2.5.

drical form are known as clisiophyllids. The distinctive features include a peripheral dissepimental zone and a column composed of twisted lamellae. In transverse sections the column is not essentially solid as in the lophophyllidid corals, but has an appearance resembling that of a cobweb. These corals resemble the caninid corals in the broad peripheral dissepimental zone, but they are distinguished by the presence of a column.

The genus *Dibunophyllum* (Pl. 3), which seems to include most Kansas corals referred to *Axophyllum* in early reports, comprises subcylindrical corallites covered by fine growth lines and wrinkles but lacking distinct septal grooves. The column is formed by a prominent median lamella, radially diverging lamellae that do not meet at a common point, and steeply inclined extensions of tabulae; these form a distinct cobweb-like pattern in transverse sections. *Heritschia* (Pl. 3) includes compound corals growing in subparallel position but in contact only at points of budding. The internal structures generally resemble those of *Dibunophyllum*, although the lamellae of the column are less evenly disposed as seen in transverse section, and the column is strengthened somewhat by the addition of stereoplasm. Also, the tabulae sag downward between the column and the dissepimental zone, whereas in *Dibunophyllum* they slope upward toward the column.

A single species of each of these genera, *Dibunophyllum valeriae* Newell (1935) and *Heritschia girtyi* Moore and Jeffords (1941), have been described from rocks of Kansas, but many other species of *Dibunophyllum* are known to occur.

CANINID CORALS

Corals assigned to this group comprise solitary corallites and colonies of individuals joined loosely by budding. The theca is thin and the exterior is marked by growth lines and wrinkles; septal grooves are inconspicuous. Dissepiments occur as a peripheral band and tabulae cross the axial region, inasmuch as a column is lacking. These large corals that occur commonly in several Kansas formations are assigned to *Pseudozaphrentoides* (Pl. 3). The generic names *Campophyllum, Caninia, Craterophyllum* Barbour, and *Barbouria* have been applied to corals like those here referred to *Pseudozaphrentoides*. *Campophyllum* is based on inadequately known material, so that its characters are in doubt; *Caninia* seems best restricted to species (chiefly older than Pennsylvanian)

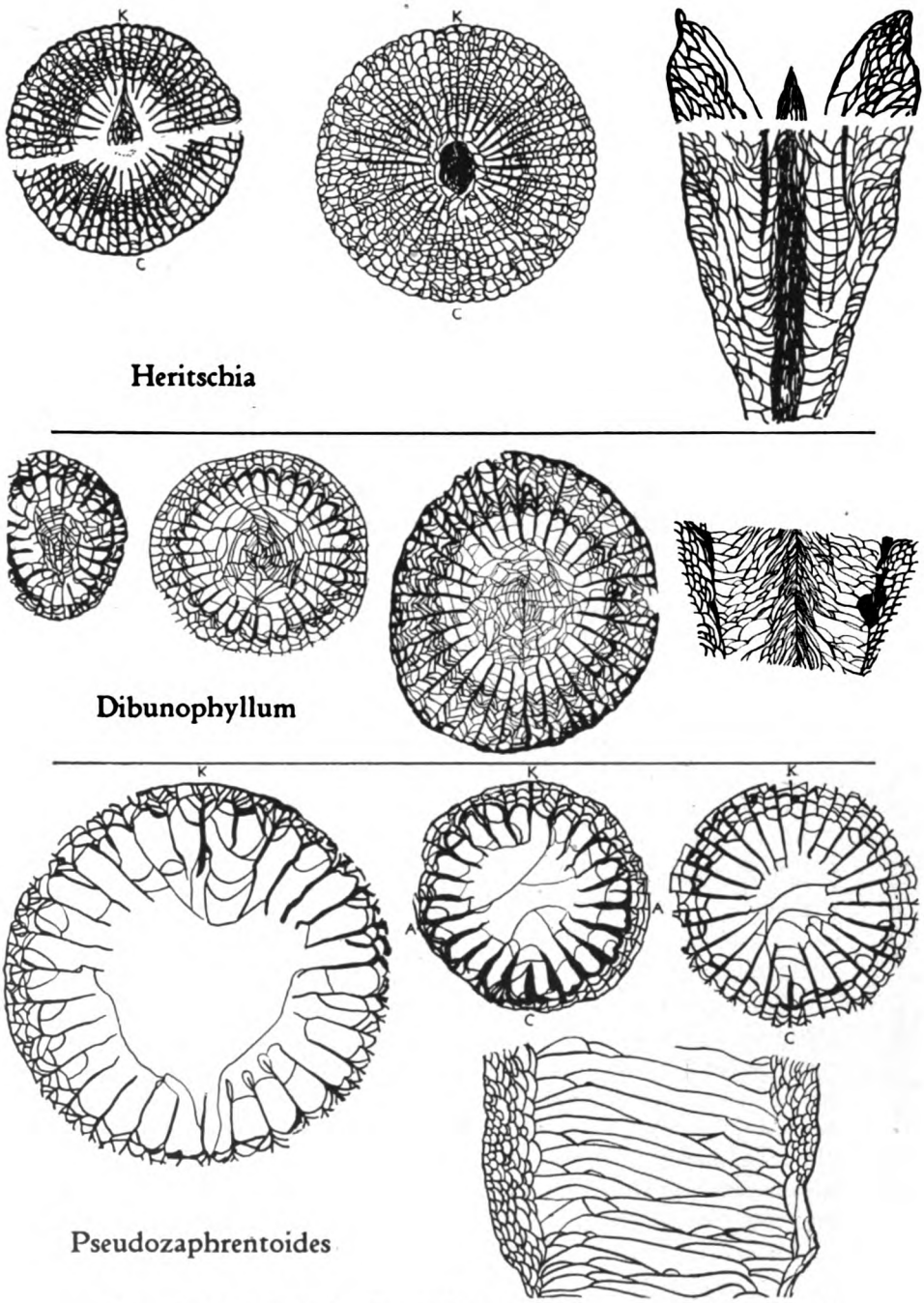


PLATE 3.—Clisiophyllid and caninid coral genera occurring in Kansas (in part after Moore and Jeffords, 1941). X2.5.

having a few dissepiments only; *Barbouria,* which is a new name for the invalid term *Craterophyllum* Barbour, has characters essentially the same as assigned to *Pseudozaphrentoides,* a prior name.

Pseudozaphrentoides torquius (Owen, 1852), *P. verticillatus* (Barbour, 1911), and several undescribed species have been recognized in Kansas.

"ZAPHRENTHID" CORALS

Solitary conical corallites having a distinct cardinal fossula and commonly prominent alar pseudofossulae but lacking a column and dissepiments are termed "zaphrenthids." Generic separation of these so-called zaphrenthid corals is confused by a lack of reliable information on the internal structures of the several genera that have been proposed and also by a notable difference of opinion as to the proper bases for such separation. Accordingly, inasmuch as the generic name *Zaphrenthis* (*Zaphrentis of authors*) has wide although erroneous usage with corals of this type, Kansas "zaphrenthid" corals are referred tentatively to *Zaphrenthis*? (Pl. 2) for convenience in classification.

Zaphrenthis? *wannensis* Newell (1935) and several undescribed species are known in Kansas.

TABULATE CORALS

MASSIVE TABULATE CORALS

These colonial corals include forms having loosely or closely packed tubes that form massive coralla. *Michelinia* (Pl. 4) comprises colonies of closely packed prismatic corallites of moderately large size and bearing a concentrically wrinkled holotheca at the base. Very short septa-like structures occur on the walls of the corallites and numerous complete and incomplete tabulae occur within the corallites. *Chaetetes* (Pl. 4) includes very small closely packed tubes of prismatic corallites that occur as small moundlike masses or as more extensive reefs. Although resembling bryozoans in some features, specimens of *Chaetetes* from Kansas are separated from known Bryozoa by the much larger diameter of the individual tubes. *Michelinia* is separated from *Chaetetes* by the larger diameter of the individual corallites and from *Syringopora* (Pl. 4) by the same feature, as well as by the polygonal cross-section of the corallites. Relatively thick-walled

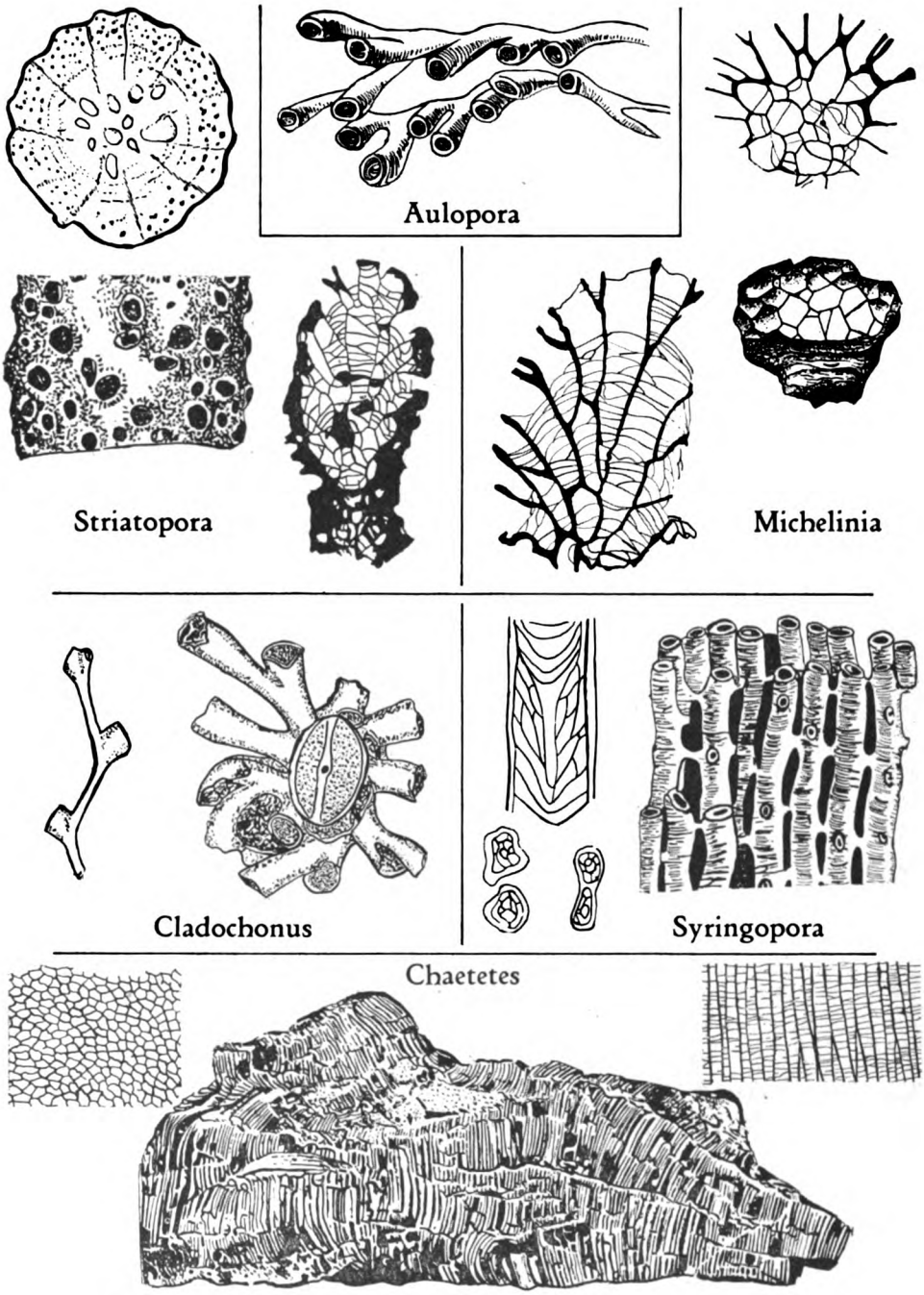


PLATE 4.—Tabulate coral genera occurring in Kansas (in part after Worthen, 1890; Miller and Gurley, 1893; Keyes, 1894; and Mather, 1915. Approximately X 2.5.

cylindrical tubes that are joined together by horizontal connecting processes are assigned to *Syringopora*. Tabulae in these corals commonly are funnel-shaped when seen in longitudinal section.

Massive tabulate corals of Kansas are referred commonly to *Chaetetes milleporaceous, Michelinia eugeneae*, and *Syringopora multattenuata*, but more critical study may result in the recognition of other species that are more useful to stratigraphic paleontology.

BRANCHING TABULATE CORALS

Colonial branching forms, clearly distinct from rugose corals and containing larger individual tubes than in known late Paleozoic bryozoans, are grouped under this heading. The corals from Kansas that are placed tentatively in the genus *Striatopora* (Pl. 4) comprise ramose colonies having a strongly thickened peripheral region and a thin-walled immature region. The coral here assigned to *Striatopora* has been referred also to the genera *Trachypora* and *Pachypora* (more properly *Thamnopora*), and more study may modify the generic placement.

Colonies of small trumpet-like or cylindrical corallites are included in the genera *Aulopora* and *Cladochonus*. The former corals consist of prostrate tubes connected by their entire lower surface to foreign objects; individual tubes expand gradually to the calices which open in a single direction. *Cladochonus* (Pl. 4), on the other hand, comprises colonies of erect oppositely directed corallites that dilate suddenly at short regular intervals into large calices. Only the base is attached and this commonly comprises a ring of corallites encircling a crinoid stem. The corallum, therefore, consists of numerous zigzaz corallites. The Kansas corals described by Beede (1898) as *Aulopora anna, A. prosseri*, and *Cladochonus bennetti* seem to belong to *Aulopora*. Undescribed species of both genera, however, occur in several formations.

KEY TO COMMON GENERA OF CORALS RECOGNIZED IN KANSAS

I. Corallum composed of one or few relatively large corallites.
Septa prominent. ....Rugose corals
A. Corals having an axial column.

1. Dissepiments present, column composed of tabulae and lamellae. ..... Clisiophyllids
   a. Column thickened by stereoplasm, long minor septa, and tabulae that sag between dissepimental zone and column ..... *Heritschia*
   b. Column open and more or less cobweb appearance in transverse section, minor septa short, and tabulae that rise steeply from dissepimental zone to column ..... *Dibunophyllum*
2. Dissepiments lacking, column formed in part by thickening of inner edge of counter septum ..... Lophophyllidids
   a. Column absent or discontinuous in mature stages. *Lophamplexus*
   b. Column continuous in mature stages.
      1. Tabulae consistently lacking. ..... *Malonophyllum*
      2. Tabulae present, although few in some types.
         a. Column large, cylindrical, characterized by radiating laminae and intercepting growth layers. ..... *Lophophyllidium*
         b. Column laterally compressed, containing median lamina but no radiating laminae ..... *Stereostylus*

B. Corals lacking column.
1. Dissepiments present, cylindrical corallites, septal grooves inconspicuous or lacking ..... *Pseudozaphrentoides*
2. Dissepiments lacking, conical corallites, septal grooves commonly present. ..... *Zaphrenthis?*

II. Corallum composed of many relatively small corallites. Septa-like structures inconspicuous, dissepiments lacking ..... Tabulate corals

A. Corallum massive or irregular, corallites loosely or closely packed ..... Massive tabulate corals
1. Corallum composed of parallel cylindrical tubes that are joined by horizontal processes. Tabulae funnel-shaped. ..... *Syringopora*
2. Corallum composed of tightly compressed polygonal corallites.
   a. Diameter of corallites very small, holotheca lacking ..... *Chaetetes*
   b. Diameter of corallites relatively large, holotheca present on base ..... *Michelinia*

B. Corallum branching, corallites loosely or closely packed ..... Branching tabulate corals
1. Corallum cylindrical, ramose; corallites tightly compressed and having walls thickened notably adjacent to surface. ..... *Striatopora*
2. Corallum composed of cuplike or funnel-shaped corallites that are in contact with each other at base only.
   a. Corallites prostrate, expanding gradually, calices nearly all directed in one direction. ..... *Aulopora*

b. Coralites erect, attached at base only, flaring strongly at aperture, and calices directed alternately in opposite directions ..... *Cladochonus*

STRATIGRAPHIC OCCURRENCE OF CORALS IN KANSAS

The occurrence of corals in Pennsylvanian and Permian rocks of Kansas is related closely to conditions under which these rocks were deposited so that many corals occur only in particular types of deposits. *Lophophyllidium* is confined chiefly to shales and calcareous shales within a predominantly shaly section, and the species are associated commonly with a mixed fauna of brachiopods, mollusks, and sponges. *Stereostylus* occurs in formations that range lithologically from shales to pure limestones. Elongate conico-cylindrical forms that are characterized by thin structural elements and minor deposits of stereoplasm are characteristics of the limestones, however, and broadly conical corallites that contain stout structures and much secondary thickening occur in the shales.

Pseudozaphrentoides (*Campophyllum* of authors) and *Syringopora* occur in shallow-water calcareous shales and thin limestones; locally they are found in such numbers as to constitute a reef. *Aulopora* and *Cladochonus* may occur with these two genera also, but *Cladochonus* is more common in shaly beds. *Michelinia, Striatopora,* and "Zaphrenthid" corals are not common in Kansas but they seem to occur largely in shales. *Chaetetes* is distinguished especially by its occurrence as extensive nodular and moundlike reefs immediately above persistent limestones in the Marmaton group.

The stratigraphic occurrence of corals in the late Paleozoic rocks of the State is indicated on Figures 1, 2, and 3. These data represent a careful study of corals from several thousand localities represented in collections of the Kansas Geological Survey and supplementary specimens collected in Kansas.

Although changes in coral faunas resulting from differences in the conditions of deposition over wide areas preclude at this time the definition of coral zones that are applicable throughout the midcontinent area, the stratigraphic occurrence of some corals seems to permit tentative correlation with stratigraphic units within Kansas. The Cherokee shale, belonging to the lower part of the Desmoinesian Series, Middle Pennsylvanian, is char-

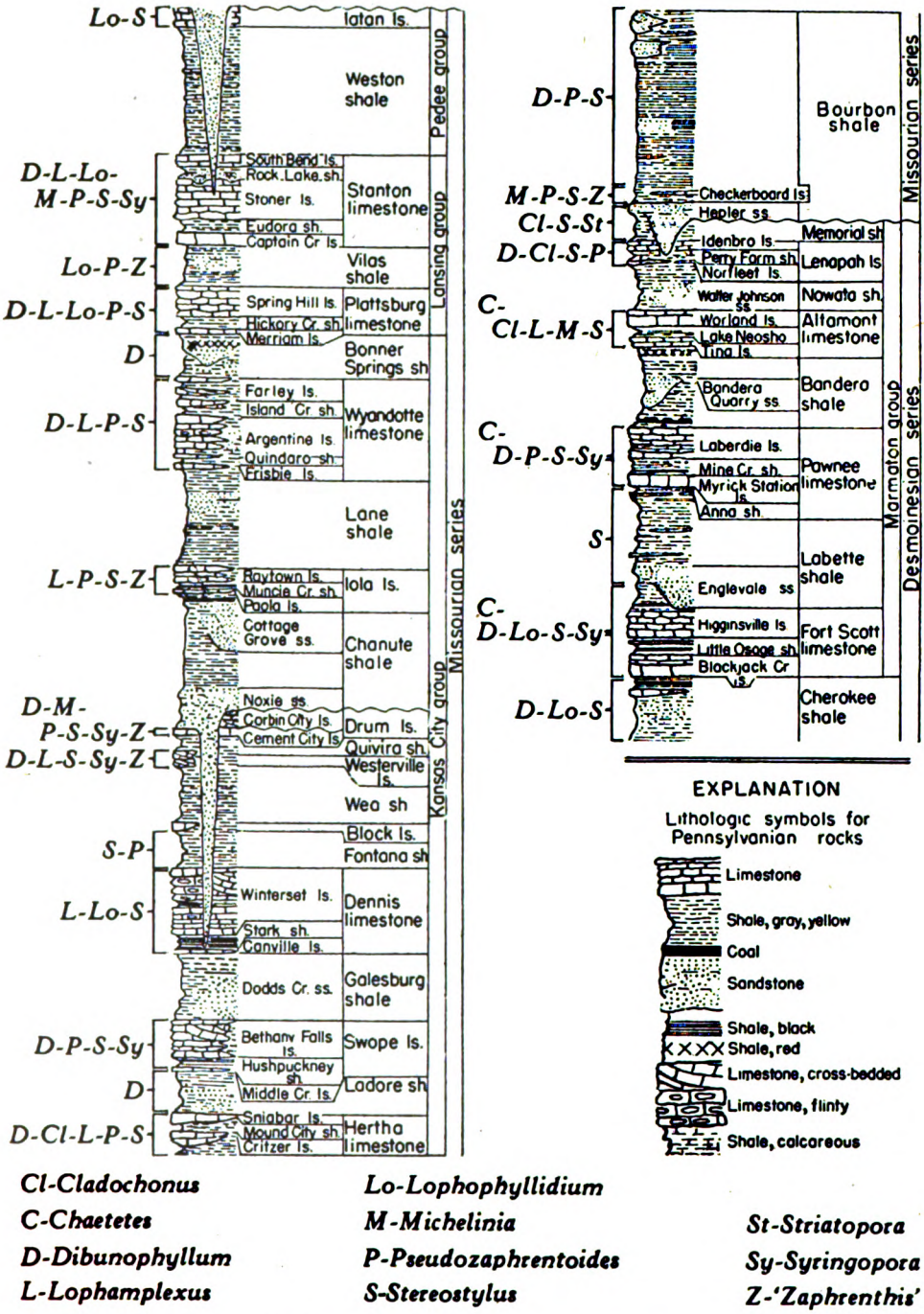


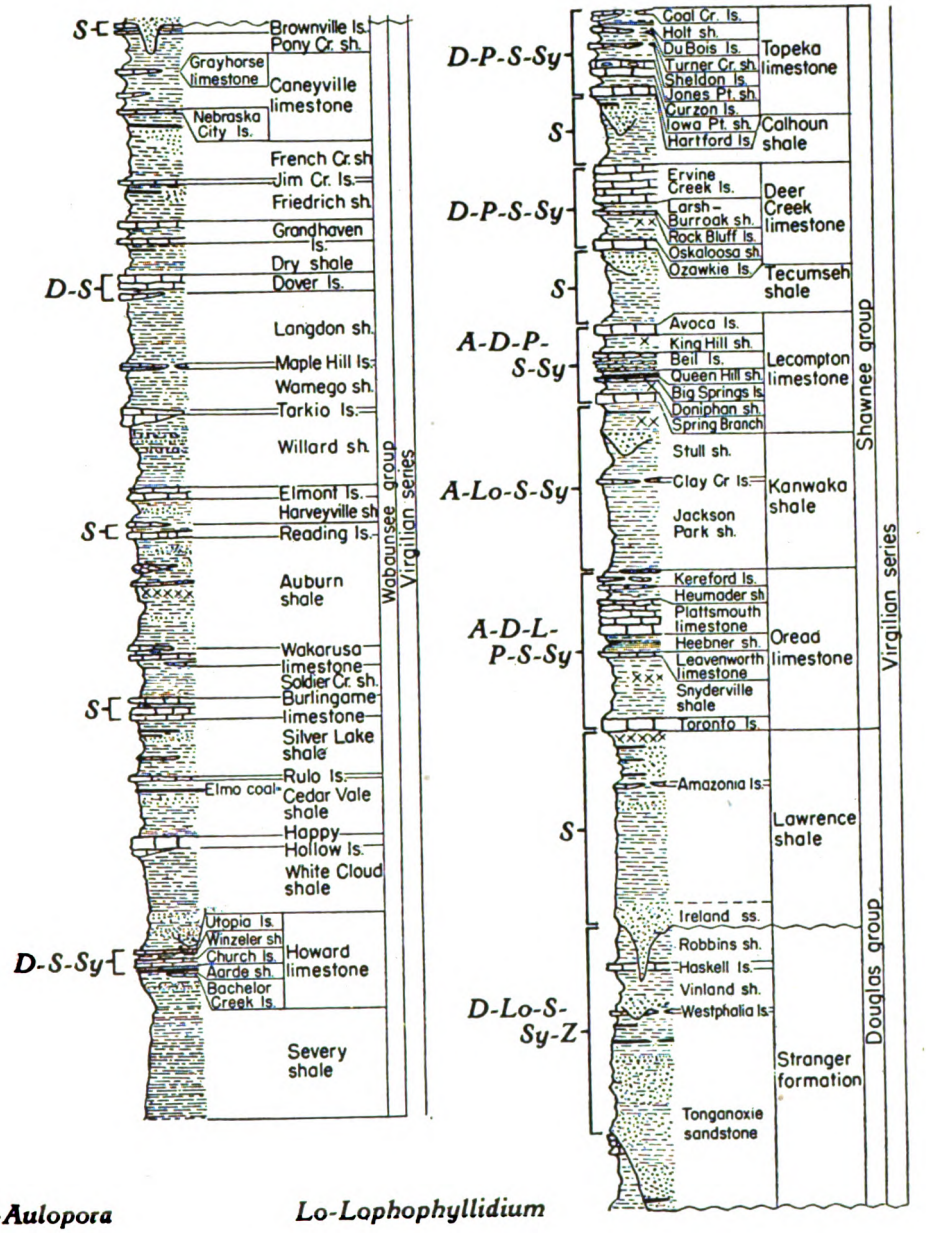
FIG. 1.—Generalized section of Desmoinesian and Missourian rocks in Kansas showing the occurrence of coral genera.

acterized by the occurrence of radicle-bearing corallites like *Stereostylus girtyi* (Jeffords, 1942) and by a smooth elongated and curved conico-cylindrical form, *Lophophyllidium hadrum* Jeffords (1947). The Fort Scott, Pawnee, and Altamont limestones of the Marmaton group (upper Desmoinesian) are separated from the other formations in Kansas by the common occurrence of *Chaetetes*. The peculiar tabulate coral, *Striatopora,* is known in Kansas only from the Memorial shale, although in Oklahoma it occurs in beds equivalent to the Dennis limestone. The Memorial shale also contains a thin bed composed almost entirely of *Cladochonus*.

Whereas the Desmoinesian Series in Kansas is characterized by a predominance of broadly conical species of lophophyllidids, corals of this type in the overlying Missourian Series (Upper Pennsylvanian) are thinner and more cylindrical in form and contain more distinct clear-cut structural elements that lack important deposits of stereoplasm.

The Hertha limestone, belonging in the lower part of the Missourian Series, commonly yields the large cylindrical species of *Lophamplexus, L. westii* (Beede). The Drum limestone at most localities contains a large, easily recognized species, *Stereostylus phainus* Jeffords (1947), and in northern Kansas a large species of *Pseudozaphrentoides* occurs commonly. The Kansas City group is distinguished by the relative abundance of slender species of *Stereostylus* and *Lophamplexus,* such as *S. lenis* and *L. ulius* Jeffords (1947). Several genera common in the overlying formations are rare in these beds. Limestones of the Lansing group are characterized by an elongate species of *Dibunophyllum,* whereas the shales of this and the Pedee group contain abundant specimens of *Lophophyllidium coniforme* Jeffords (1947), a short broadly conical coral. "Zaphrenthid" corals occur also in these shales in southern Kansas.

The Stranger formation (lower Virgilian Series, Upper Pennsylvanian) contain locally a larger and more elongate species of *Lophophyllidium* than is found in the underlying formations. The Shawnee group includes abundant lophophyllidid corals at several horizons and a few types of clisiophyllid corals. The reefs of *Pseudozaphrentoides, Syringopora,* and *Aulopora* in the Kereford limestone member of the Oread and the Beil limestone member of the Lecompton limestone are distinctive features. The



A-Aulopora ***Lo-Lophophyllidium***

D-Dibunophyllum ***P-Pseudozaphrentoides*** ***Sy-Syringopora***

L-Lophamplexus ***S-Stereostylus*** ***Z-'Zaphrenthis'***

FIG. 2—Generalized section of Virgilian rocks in Kansas showing the occurrence of coral genera.

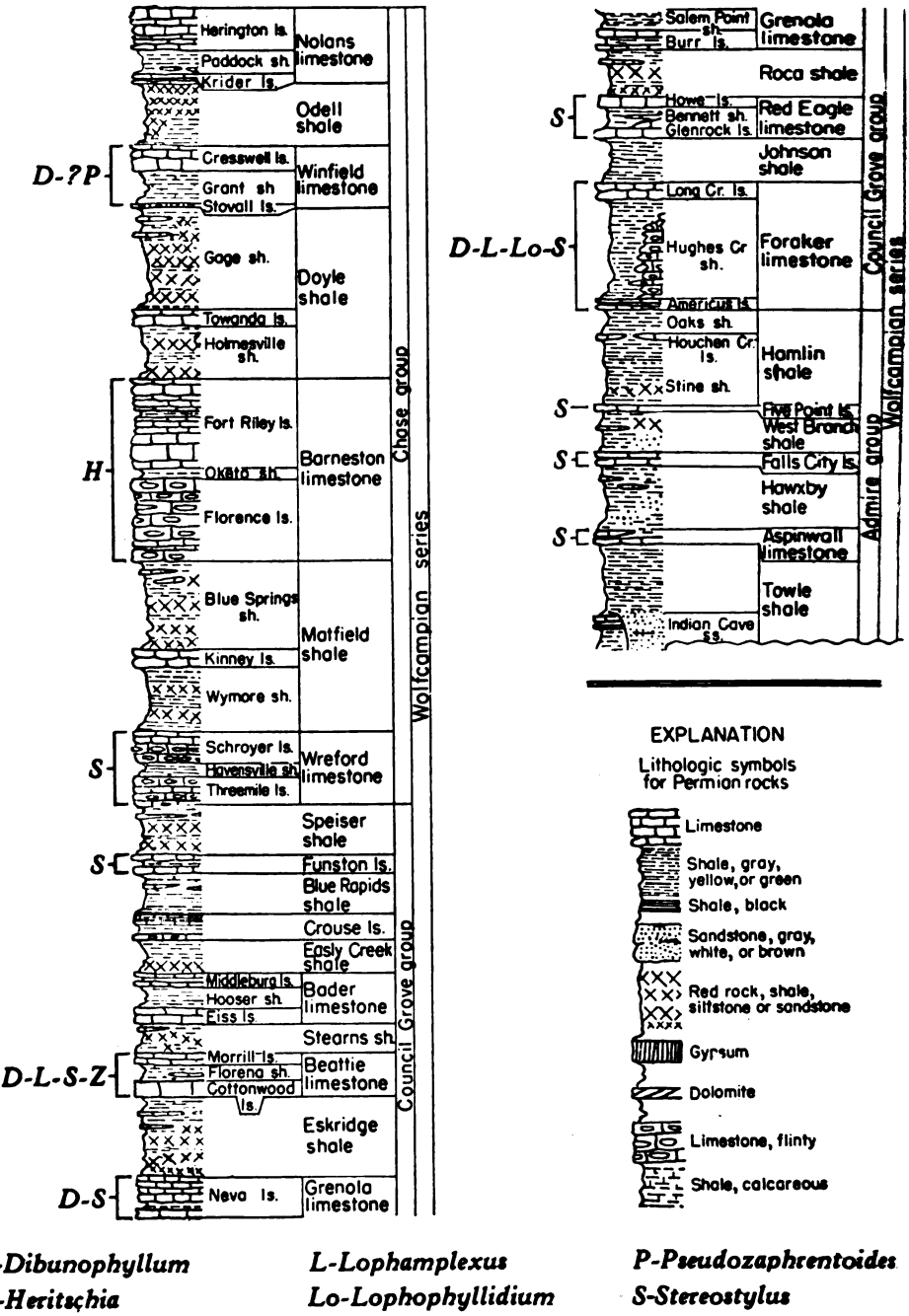


FIG. 3.—Generalized section of Lower Permian rocks in Kansas showing the occurrence of coral genera.

Wabaunsee group (upper part of Virgilian Series) contains relatively fewer corals than older formations; most specimens seem to comprise species of *Stereostylus*. A short conical species of *Dibunophyllum* is characteristic of the Dover limestone, however.

Permian corals in Kansas consist mainly of small species of *Stereostylus* and local occurrences of "zaphrenthid" and clisiophyllid corals. The Neva limestone, however, contains a distinctive species of *Stereostylus* that may be recognized by the wavy nature of the septa as seen in transverse section. The Barneston limestone contains the colonial coral *Heritschia*. The highest

TABLE 1.—*Stratigraphic distribution of coral genera in Late Paleozoic rocks of Kansas*

Genus	Stratigraphic divisions											
	Pennsylvanian									Permian		
	Desmoinesian			Missourian			Virgilian			Wolfcampian		
RUGOSE CORALS												
Dibunophyllum	×	×	—	×	×	×	×	×	×	—	×	×
Heritschia	—	—	—	—	—	—	—	—	—	—	—	×
Lophamplexus	—	—	×	×	×	×	—	×	—	—	×	—
Lophophyllidium	×	×	—	×	×	×	×	×	—	—	×	—
Malonophyllum	—	—	—	—	—	—	—	—	—	—	×	—
Pseudozaphrentoides	—	×	×	×	×	×	—	×	—	—	—	?
Stereostylus	×	×	×	×	×	×	×	×	×	×	×	×
Zaphrenthis?	—	—	×	×	×	×	×	×	—	—	×	—
TABULATE CORALS												
Aulopora	—	—	—	—	—	—	—	×	—	—	—	—
Chaetetes	—	×	×	—	—	—	—	—	—	—	—	—
Cladochonus	—	—	×	×	—	—	—	—	—	—	—	—
Michelinia	—	—	×	×	×	×	—	—	—	—	—	—
Striatopora	—	—	×	—	—	—	—	—	—	—	—	—
Syringopora	—	×	—	×	×	×	×	×	×	—	—	×

known occurrence of corals in the Permian rocks of Kansas is a clisiophyllid coral in the Winfield limestone of the upper part of the Chase group (Wolfcampian Series).

Data on the occurrence of corals are condensed in Tables 1 and 2, to indicate tentative conclusions as to distribution of corals in the rocks of Kansas. It should be evident, however, that the characteristic corals may not be found in every stratigraphic unit within a zone, and certain genera (but not named species) do occur more rarely elsewhere in the section. Moreover, additional study and collection of coral faunas in Kansas doubtless will result in a more rigorous subdivision of these general zones. For example, the Drum, Oread, and Lecompton limestones all contain *Pseudozaphrentoides* in relative abundance; each formation, however, may be distinguished by the consistent differences in the species that occurs in it.

Some genera that have been reported from Kansas, such as *Axophyllum*, *Caninia*, and *Cyathaxonia*, have not been recognized. On the other hand, a few corals, as *Lonsdaleia* and several

TABLE 2.—*Distribution of characteristic coral types in Late Paleozoic rocks of Kansas*

Stratigraphic subdivision	Coral
Permian System	
Wolfcampian Series	
Pennsylvanian System	
Virgilian Series	
Wabaunsee group	
Shawnee group	*Pseudozaphrentoides, Syringopora*
Douglas group	*Lophophyllidium* sp. cf. *L. coniforme*
Missourian Series	
Peedee group, Lansing group	*Lophophyllidium coniforme* (in shales), *Dibunophyllum* sp. (in limestones)
Kansas City group	*Stereostylus lenis, Lophamplexus westii*
Pleasanton group	
Desmoinesian Series	
Marmaton group	*Chaetetes, Striatopora*
Cherokee group	*Lophophyllidium hadrum, Stereostylus girtyi*

clisiophyllids, have been recognized doubtfully from specimens that are inadequate in quantity and in preservation. Doubtless, however, many additional types of corals will be discovered as more attention is given to careful collection and description of corals in Kansas.

REFERENCES

BARBOUR, E. H., *1911*, A new Carboniferous coral, *Craterophyllum verticillatum*: Nebraska Geol. Survey, vol. 4, pt. 3, pp. 38-49, pls. 1-4.

BEEDE, J. W., *1898*, New corals from the Kansas Carboniferous: Kansas Univ. Quart., vol. 7, pp. 17-18, pl. 1.

———, *1900*, Carboniferous invertebrates: Kansas Univ. Geol. Survey, vol. 6, pt. 2, pp. 1-187, pls. 1-22.

EASTON, W. H., *1944*, Revision of *Campophyllum* in North America: Jour. Paleontology, vol. 18, pp. 119-132, pl. 22, text figs. 1-4.

———, *1944a*, Corals from the Chouteau and related formations of the Mississippi valley region: Illinois Geol. Survey, Rept. Inv. 97, pp. 1-93, pls. 1-17.

EDWARDS, H. M., and HAIME, J., *1850*, A monograph of the British fossil corals, PART 1. Introduction: Palaeontologr. Soc., Pub., pp. 1-71, pls. 1-11.

———, *1851*, Monographie des polypiers fossiles des terrains palaeozoiques, precédee d'un tabeau général de la classification des polypes: Paris Mus. Hist. Nat. Arch., tome 5, pp. 1-502, pls. 1-20.

ELIAS, M. K., *1944*, Auloporidae and Hederelloidea: Jour. Paleontology, vol. 18, pp. 529-534.

GIRTY, G. H., *1911*, On some new genera and species of Pennsylvanian fossils from the Wewoka formation of Oklahoma: New York Acad. Sci. Annals, vol. 21, pp. 119-156.

———, *1915*, Invertebrate paleontology [of the Pennsylvanian of Missouri]: Missouri Bureau Geol. and Mines, ser. 2, vol. 13, pp. 263-376, pls. 27-32.

HILL, DOROTHY, *1935*, British terminology for rugose corals: Geol. Mag., vol. 72, pp. 481-519, text figs. 1-21.

JEFFORDS, R. M., *1942*, Lophophyllid corals from the Lower Pennsylvanian rocks of Kansas and Oklahoma: Kansas Geol. Survey, Bull. 41, pt. 5, pp. 185-260, pls. 1-8, text figs. 1-2.

———, *1945*, Pennsylvanian rugose corals from the midcontinent region: Geol. Soc. America Bull., vol. 56, p. 1170.

———, *1947*, Pennsylvanian lophophyllidid corals: Univ. Kansas Paleont. Contrib., Coelenterata, Art. 1, pp. 1-84, pls. 1-28, text figs. 1-9.

KEYES, C. R., *1894*, Paleontology of Missouri: Missouri Geol. Survey, vol. 4, pt. 1, pp. 1-271, pls. 1-32.

LANG, W. D., SMITH, STANLEY, and THOMAS, H. D., *1940*, Index of Paleozoic coral genera: British Mus. Nat. Hist., pp. 1-231, London.

MCCHESNEY, J. H., *1860-1865*, Descriptions of new fossils, from the Paleozoic rocks of the western states: pp. 1-96, pls. 1-9, Chicago [pp. 1-56 (1859) issued Jan. 3, 1860; pp. 57-76, issued May 24, 1860; pp. 77-96, issued Feb. 1861; pls. issued April 1865. Reissued in revised and rearranged form in Chicago Acad. Sci. Trans., pp. 1-57, pls. 1-9, 1867.]

MATHER, K. F., *1915*, The fauna of the Morrow group of Arkansas and Oklahoma: Denison Univ. Bull., Jour. Sci. Labs., vol. 18, pp. 59-284, pls. 1-16.

MEEK, F. B., *1872*, Report on the paleontology of eastern Nebraska: Hayden Final Report, U. S. Geol. Survey Nebraska, U. S. 42 d. Cong., House Ex. Doc. 19, pp. 140-244, pls. 1-11.

MILLER, S. A., and GURLEY, W. F. E., *1893*, Descriptions of some new species of invertebrates from the Paleozoic rocks of Illinois and adjacent states: Ill. State Mus. Nat. Hist., Bull. 3, pp. 1-81, pls.

MOORE, R. C., *1933*, Historical Geology: pp. 1-673, figs. 1-413, McGraw-Hill, New York.

MOORE, R. C., FRYE, J. C., and JEWETT, J. M., *1944*, Tabular description of outcropping rocks in Kansas: Kansas Geol. Survey, Bull. 52, pt. 4, pp. 137-212, figs. 1-9.

MOORE, R. C., and JEFFORDS, R. M., *1941*, New Permian corals from Kansas, Oklahoma, and Texas: Kansas Geol. Survey, Bull. 38, pt. 3, pp. 65-120, pls. 1-8.

———, *1945*, Description of Lower Pennsylvanian corals from Texas and adjacent states: Texas Univ. Pub. 4401, pp. 77-208, pl. 1, text figs. 1-214.

NEWELL, N. D., *1935*, Some mid-Pennsylvanian invertebrates from Kansas and Oklahoma; pt. 2, Stromatoporoidea, Anthozoa, and Gastropoda: Jour. Paleontology, vol. 9, pp. 341-355, pls. 33-36.

OWEN, D. D., *1852*, Report of a geological survey of Wisconsin, Iowa, and Minnesota and incidentally of a portion of Nebraska Territory: pp. 1-638, pls. 1-15, Philadelphia.

ROWLEY, R. R., *1901*, Two new genera and some new species of fossils from the Upper Paleozoic rocks of Missouri: Am. Geologist, vol. 27, pp. 343-355, pl. 28.

SANFORD, W. G., *1939*, A review of the families of tetracorals: Am. Jour. Sci., vol. 237, pp. 295-323, 401-423, text. figs. 1-16.

SCHUCHERT, CHARLES, and DUNBAR, C. O., *1946*, A textbook of geology; Part 2, Historical Geology: pp. 1-544, text figs. 1-343, John Wiley & Sons, New York.

TWENHOFEL, W. H., and SHROCK, R. R., *1935*, Invertebrate paleontology: pp. 1-511, figs. 1-175, McGraw-Hill, New York.

WELLS, J. W., *1944*, New tabulate corals from the Pennsylvanian of Texas: Jour. Paleontology, vol. 18, pp. 259-262, pls. 40-41.

WHITE, C. A., *1884*, The fossils of the Indiana rocks, no. 3: Indiana Dept. Geol. Nat. History, Ann. Rept. 13 (1883), pt. 2, pp. 107-180, pls. 23-39.

WHITE, C. A., and ST. JOHN, O. H., *1867*, Descriptions of new Subcarboniferous and Coal Measures fossils collected upon the geological survey of Iowa; together with a notice of new generic characters observed in two species of brachiopods: Chicago Acad. Sci., Trans., vol. 1, pp. 115-127, pls.

WORTHEN, A. H., *1890*, Description of fossil invertebrates: Illinois Geol. Survey, vol. 8, pt. 2, pp. 71-83, 102-154, pls. 9-11, 18-28.