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J. M. Cocke

East Tennessee State University

Joan Mussler

East Tennessee State University

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Upper Pennsylvanian Missourian Corals of Iowa

J. M. COCKE¹ and JOAN MUSSLER²

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As in Kansas, where distinct zonation of corals has been recognized, the dissepimental Rugosa *Dibunophyllum*, *Neokoninckophyllum* and *Geyerophyllum* are invariably associated with limestones and thin calcareous shale interbeds within limestone units. In both states, the nondissepimental rugose genera *Lophamplexus* and *Stereostylus* have been collected from both limestones and thick

intervening shale units. The tabulate genera *Syringopora* and *Cladochonus* are restricted to limestones in both areas. Although the vertical distribution of Iowa and Kansas dissepimental corals is similar, Iowa rocks contain fewer and generally smaller corals than correlative Kansas units. Elements of the informal dissepimental coral zones 1, 3 and 4 established by Cocke (1970, 1972) in Kansas are presently known in Iowa.

INDEX DESCRIPTORS: Pennsylvania Corals, Missourian Corals, Fossil Corals.

ACKNOWLEDGMENTS

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Rocks of Pennsylvanian age are exposed in more than half of the states of the United States as well as several other locations in the world. In many areas they are present as alternations of persistent marine limestones and thicker shales and siltstones. The limestones and their associated thin calcareous shale interbeds are richly fossiliferous with a wide range of marine invertebrates present.

In Iowa, Missourian rocks are exposed in an arcuate outcrop band from southern Ringgold and Decatur counties westward to the Council Bluffs area, Pottawattamie County, in western Iowa (Figure 1). The exposed rocks are approximately 200 feet thick, and consist of thin limestone formations separated by thicker shale units (Figure 2). Nondissepimental corals occur in limestones and in the thicker shales. *Syringopora* and *Cladochonus*, as well as the three dissepimental genera, are restricted to normal marine limestones and shale interbeds. Several limestone formations in Iowa have an abundance of supratidal limestones (Heckel, 1968). These supratidal limestones are poorly fossiliferous and no corals have been collected from them.

As Missourian rocks crop out southwestward from Iowa

across Missouri, Kansas and Oklahoma, they become progressively thicker, reaching 450 feet in the Kansas City area and in excess of 700 feet in northeastern Oklahoma. In these states, as in Iowa, the dissepimental corals are restricted to normal marine limestone units or to phylloid algal mound complexes. These complexes are restricted to Kansas and northeastern Oklahoma (Cocke, 1970; Cocke, 1971).

In a series of papers, Jeffords (1942, 1947, 1948) reported rich midcontinent coral faunas. Although he recognized no zonation, he stated that the lophophyllids show a great deal of potential as zone fossils (Jeffords, 1947). In 1970, research by Cocke led him to establish four informal zones of dissepimental corals (Zones 1-4) in Upper Pennsylvanian Missourian rocks of Kansas. Zone 1 contains dissepimental corals from the Kansas Hertha, Swope and Dennis limestone formations and the Block Limestone Member of the Cherryvale Shale Formation in Kansas. The boundaries of Zone 2 correspond to those of the Westerville Limestone Member of the Cherryvale Shale Formation. This zone is recognized only in the Kansas City area. Zone 3 is found within the boundaries of the Cement City Limestone in the Kansas City area. The Iola Limestone, containing an aberrant dissepimental coral fauna at one locality in Kansas, has not been included in the underlying Zone 3 or overlying Zone 4. The most abundant dissepimental coral faunas of Kansas are in the Wyandotte, Plattsburg and Stanton limestone formations which are within Zone 4. Subsequently, Cocke (1972) revised the upper limits of the lowest zone. Other works (Cocke, 1971, Cocke and Haynes, 1973, and Cocke and Molinary, 1973) have led to the recognition of some elements of Kansas zones in the Hogshooter and Wann formations of Oklahoma. Preliminary investigation of Illinois coral faunas indicates that several Kansas zonal elements are there, chiefly those of Zones 3 and 4.

The purpose of this paper is twofold: (1) to discuss briefly the vertical distribution of all known coral genera in Missourian rocks of Iowa; seven genera exist, of which two are the tabulates *Syringopora* and *Cladochonus*; *Lophophyllidium* and *Stereostylus* are nondissepimental Rugosa; *Dibunophyllum*, *Neokoninckophyllum* and *Geyerophyllum* are rugose corals which bear dissepiments; (2) to compare the vertical distribution of the dissepimental corals in Iowa to that of Kansas where zonation of these forms is well known.

¹ J. M. Cocke, Geology Department, East Tennessee State University, Johnson City, Tennessee.

² Joan Mussler, Department of Geology, Bryn Mawr College, Bryn Mawr, Pennsylvania.

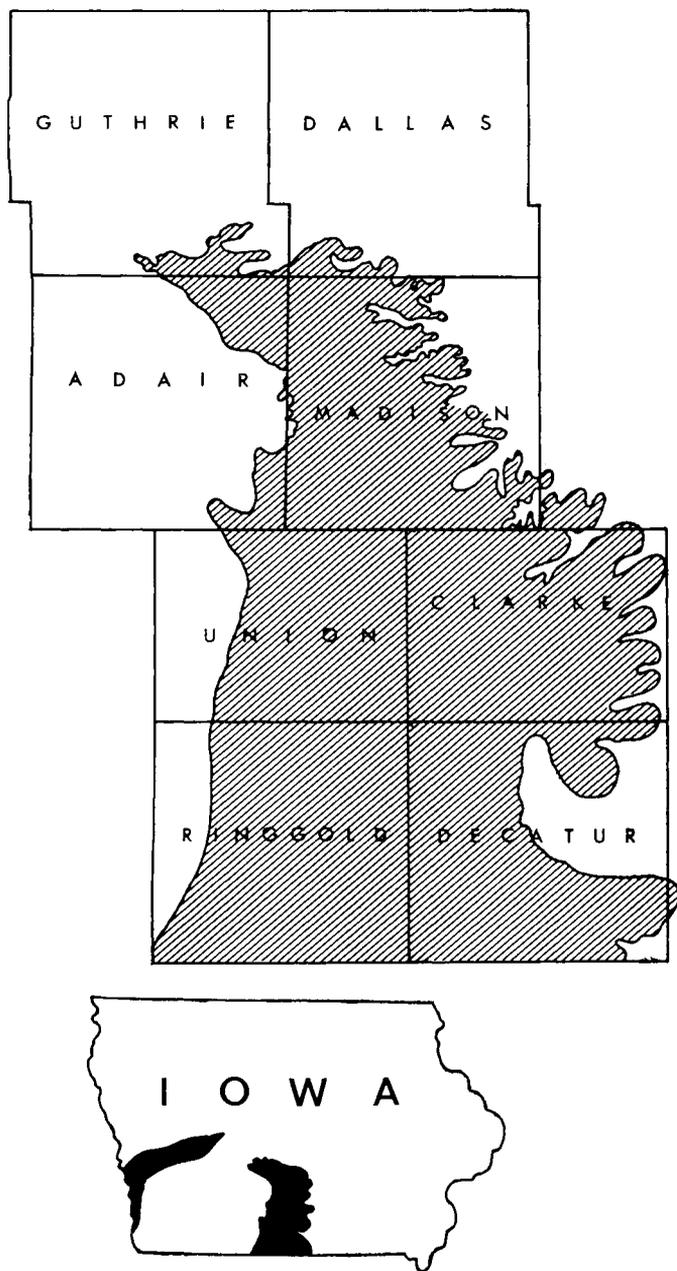


Figure 1. Outcrop map of southwestern Iowa showing units where these were collected. Inset map of Iowa shows study area and the general outcrop pattern farther west.

MATERIALS AND METHODS

For three summers the senior author, aided by his wife, collected Iowa and Missouri coral faunas while he completed a comprehensive study of coral zonation in Missourian rocks of Kansas. After that study was finished, the Iowa specimens were sectioned and further collections were made. The identification of the taxa and the zonation of coral faunas recog-

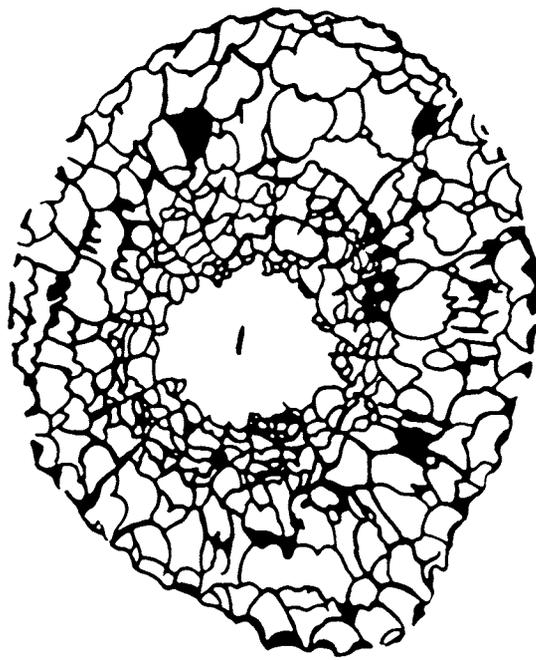
MISSOURIAN SERIES	LANSING GROUP	STANTON FM	
		VILAS SH	
		PLATTSBURG FM	
	KANSAS CITY GROUP	BONNER SPRINGS SH	
		WYANDOTTE FM*	
		LANE SH	
		IOLA FM*	RAYTOWN LS MUNCIE CREEK SH PAOLA LS
		CHANUTE SH	
		DRUM FM	CORBIN CITY LS CEMENT CITY LS
		QUIVIRA SH	
		WESTERVILLE LS	
		CHERRYVALE FM	
		DENNIS FM*	WINTERSET LS STARK SH CANVILLE LS
		GALESBURG FM*	
		SWOPE FM*	BETHANY FALLS LS HUSHPUCKNEY SH MIDDLE CREEK LS
		LADORE SH*	
HERTHA FM*			

Figure 2. Sequence of Upper Pennsylvanian Missourian rocks in southwestern Iowa. Asterisks mark units from which corals have been collected.

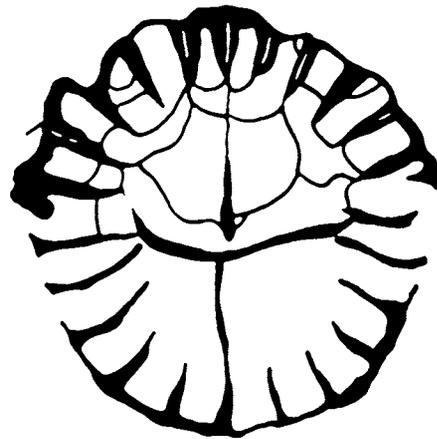
nized in this paper are the result of comparison of Iowa corals to those of Kansas.

STRATIGRAPHIC DISTRIBUTION OF IOWA CORALS

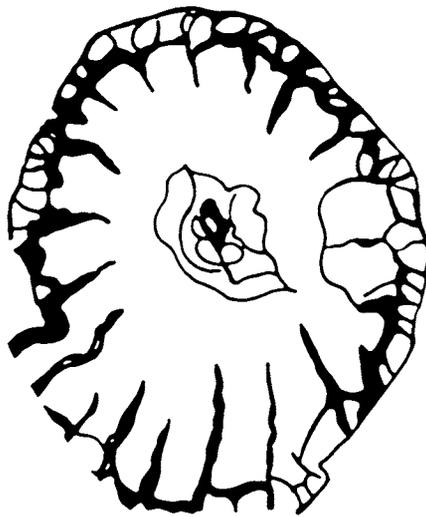
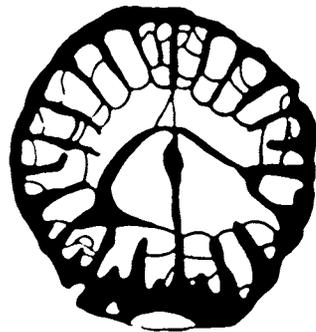
The Hertha Formation (Figure 3) yielded the first dissepimental coral, *Axophyllum rude*, to be described from Pennsylvanian rocks of Iowa (White and St. John, 1867). One hundred and two years later Cocks and Cocks (1969) assigned that species to *Geyerophyllum* Heritsch (1936). No other published descriptions of Iowa Pennsylvanian dissepimental corals are known to exist. Unquestionably, *G. rude* is related to early members of the *Geyerophyllum jewetti*-*G. patulum* lineage of Kansas Zone 4 and seemingly to *G. girtyi* of Zone 3. A single poorly preserved neokoninckophyllid which may be an immature *N. tushanense* has been collected from the Hertha. *Neokoninckophyllum acolumnatum*, which occurs in the Hertha, Swope and Dennis of Kansas Zone 4, is represented by a single Hertha specimen in Iowa. Two



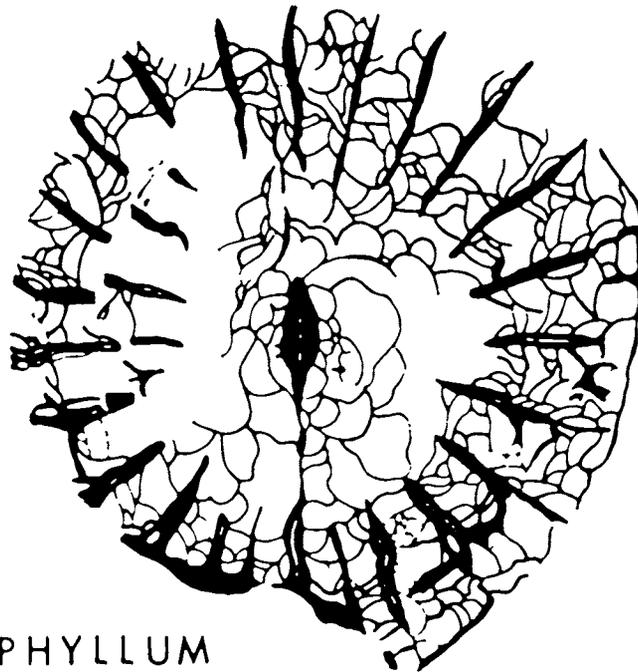
GEYEROPHYLLUM



STEREOSTYLUS



?NEOKONINCKOPHYLLUM

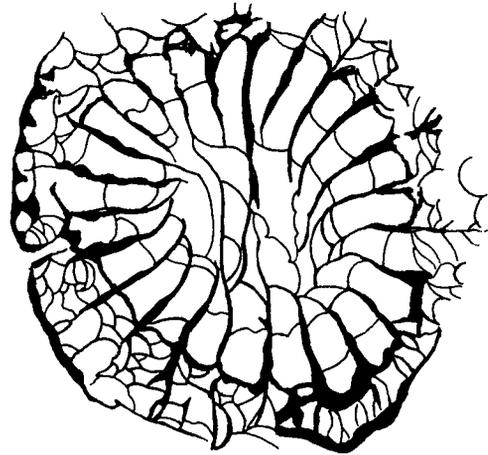


DIBUNOPHYLLUM

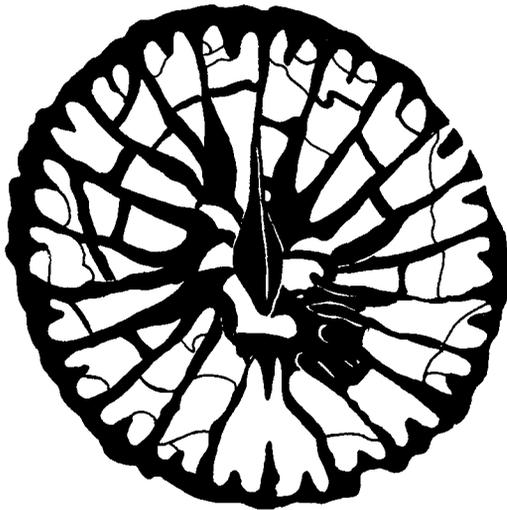
Figure 3. Corals of the Hertha and Swope formations. The geyerophyllid in the upper right is *G. rude* from the Hertha. The *Stereostylus* sp. is from the Swope (upper right) and is unlike any described species of the genus. The neokoninckophyllid and dibunophyllid (lower half of figure) are *N. tushanense* and ?*D. bourbonense* from float boulders of the Swope.



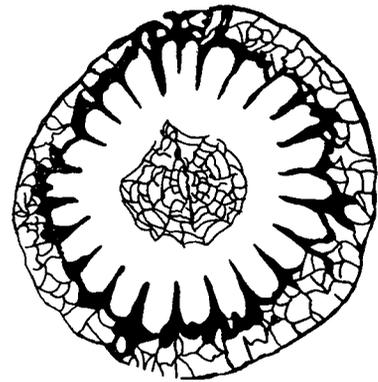
GEEROPHYLLUM



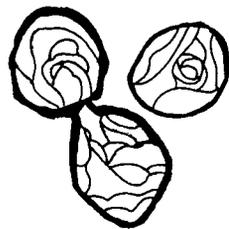
NEOKONINCKOPHYLLUM



STEREOSTYLUS



DIBUNOPHYLLUM



S Y R I N G O P O R A



Figure 4. Corals of the Winterset Limestone of Iowa. Only a questionable *Lophamplexus* is omitted.

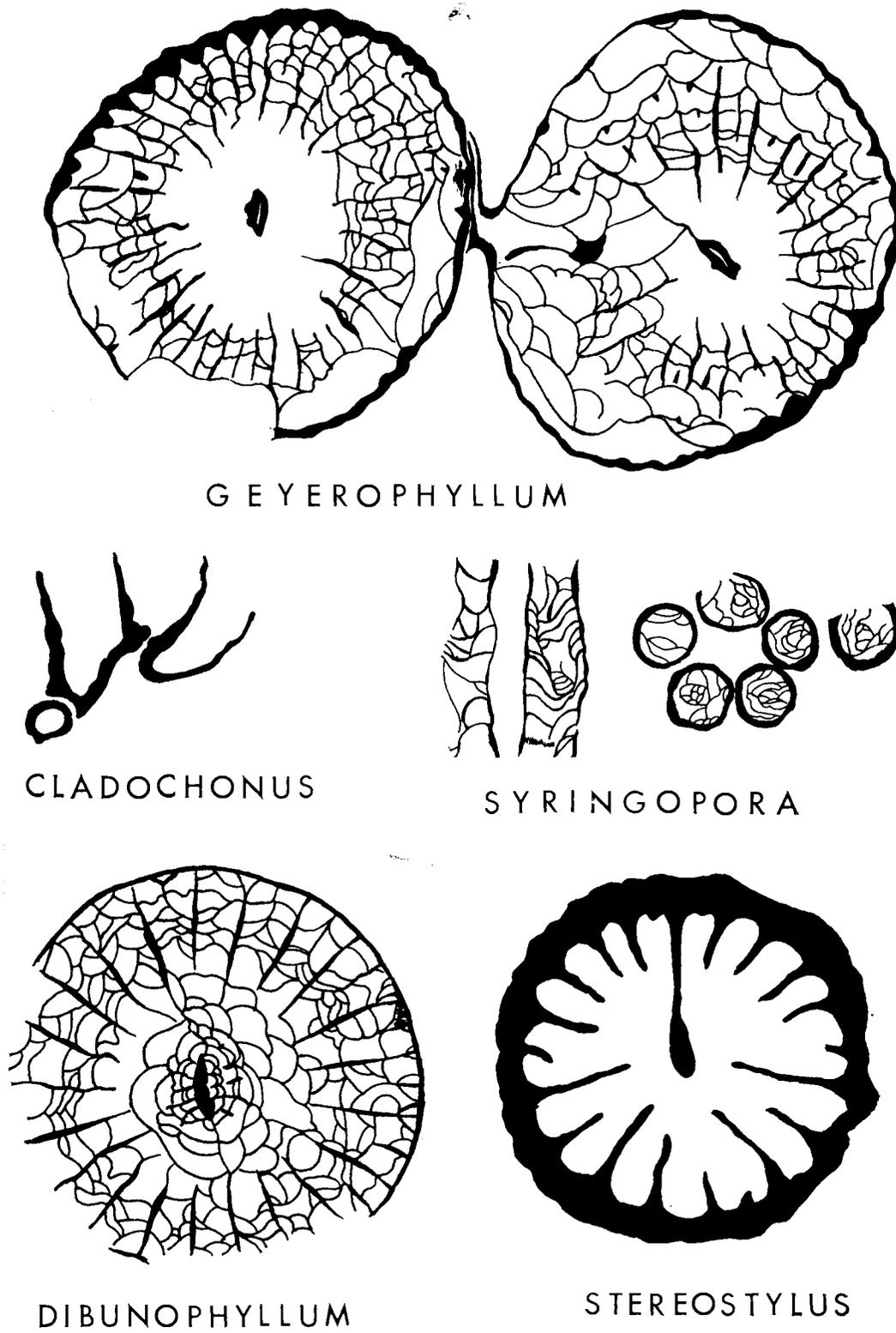


Figure 5. Corals from the Iola Formation of Iowa (see discussion).

dibunophyllids, *D. bourbonense* and *Dibunophyllum* sp. cf. *D. bourbonense*, are in the Hertha of Iowa; both are also present in that unit in Kansas. The Kansas Hertha has eight species of corals, two species of *Dibunophyllum*, four species of *Neokoninckophyllum*, one species of *Caninia* and one species of *Geyerophyllum*. In Iowa the unit has only *G. rude*; several float boulders which are almost certainly from the Bethany Falls Limestone of the Swope Formation contain poorly preserved specimens of *N. tushanense* and ?*D. bourbonense*. Despite extensive collecting, no dissepimental corals have been found in the Swope of Iowa, in contrast to five species present in Kansas: one *Dibunophyllum*, two *Neokoninckophyllum* and two *Geyerophyllum*.

The Winterset coral fauna, the most varied in Iowa, includes the tabulate *Syringopora* and the nondissepimental corals ?*Lophamplexus* and *Stereostylus* (Figure 4). Only a few mature forms of *Lophamplexus* have been collected, making specific assignment impossible. The *Stereostylus* species resembles both *S. phainus* of the Kansas Drum Limestone and *Lophophyllidium elongatum* of the Oklahoma Lost City Limestone. *Neokoninckophyllum tushanense*, which occurs in the Hertha, Swope and Dennis formations of Kansas as well as in the Oklahoma Lost City Limestone and the Upper Carboniferous of China, is very common in the Winterset of Iowa. *Neokoninckophyllum acolumnatum* (see Hertha above) is also present. A Winterset *Dibunophyllum* is somewhat similar to *D. hansonii* and to *D. brucei* from the Oklahoma Lost City and Dewey limestones, respectively. An aberrant unfigured ?dibunophyllid specimen from the Iowa Winterset probably belongs to a new genus. Geyerophyllids are common and may belong to an unnamed species which is abundant in the Oklahoma Dewey Formation. This Oklahoma species seemingly links the *G. jewetti*-*G. patulum* lineage to geyerophyllids of Kansas Zone 4. The Block Limestone is the upper limit of Zone 1 in Kansas; the unit, if present in Iowa, was not examined by us. The Winterset Limestone Formation contains five species of dissepimental corals in Iowa: two neokoninckophyllids, one dibunophyllid, one questionable dibunophyllid and one geyerophyllid. In Kansas the Winterset Member, Dennis Formation, has two neokoninckophyllids, one dibunophyllid and one geyerophyllid.

Locally, the Iola Limestone of Iowa is abundantly fossiliferous with the two tabulates *Syringopora* and *Cladochonus*, the nondissepimental rugose genus *Stereostylus* and two dissepimental genera *Dibunophyllum* and *Geyerophyllum* (Figure 5). This abundance of corals is in sharp contrast to their scarcity in the Kansas Iola, from which one dibunophyllid species has been collected at a single locality. The *Stereostylus* species present resembles *S. lenis* and *S. phainus* from the Kansas Iola and Drum formations respectively. The dissepimental corals show affinities to species from Kansas Zones 3 and 4. *Dibunophyllum clathrum* is abundant in Zone 3 as well as in the Iowa Iola. The *Geyerophyllum* species is similar to *Geyerophyllum broilii* of the Wyandotte and Plattsburg limestones of the lower and middle Kansas Zone 4. A form of *D. clathrum* similar to an aberrant form cited by Cocke (1970) from the Cement City, Kansas, limestone has also been collected in the Iola of Iowa. Five species of tabulates and rugose corals are present in the Iola of Iowa.

A single locality in the Argentine Limestone Member, Wyandotte Formation, in Adair County, Iowa, yielded one fragment of ?*Geyerophyllum broilii*, a common species in Kansas (see discussion above), and several hundred dibuno-

phyllids which are related to the *D. parvum*-*D. dibolium* lineage identified throughout Zone 4 in Kansas (Figure 6). Unfortunately, these dibunophyllids are somewhat aberrant, thus obscuring their relationship to the lineage. Four species of dissepimental corals occur in the Wyandotte of Kansas.

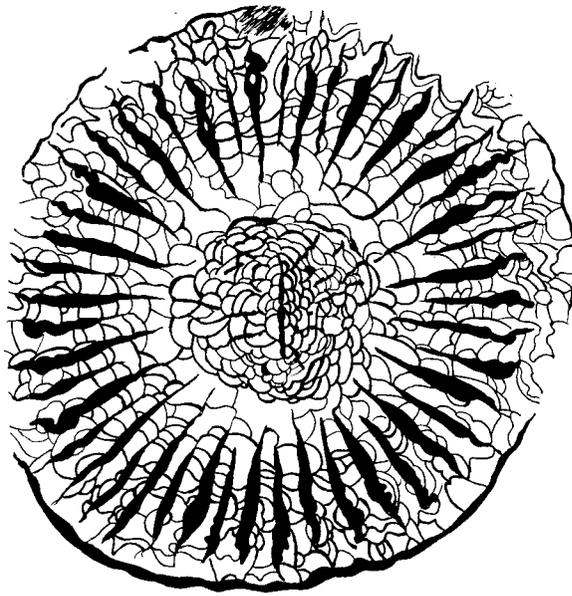
SUMMARY AND CONCLUSIONS

Two fossil assemblages have been recognized in Missourian rocks of Oklahoma and Kansas (Cocke, 1971). Both are recognized in Iowa though neither is as well developed as it is farther south in Kansas and Oklahoma. One assemblage, restricted to thick clastic units between widespread limestones, is dominated by gastropods and pelecypods. It also contains nautiloids, crinoids, chonetids and productid brachiopods, and in Oklahoma and Kansas is commonly accompanied by the nondissepimental rugose corals *Lophophyllidium* or *Stereostylus*. Dissepimental genera are not present in this assemblage. Although *Lophophyllidium* is not positively identified in Iowa, most of the other elements of this assemblage are present. The second assemblage commonly contains some of the following genera: *Caninia*, *Dibunophyllum*, *Neokoninckophyllum* and *Geyerophyllum*. Of these, only *Caninia* has not been collected in Missourian rocks of Iowa. A diverse fauna composes this assemblage: fenestrate and fistuliporid bryozoans; phylloid algae; the tabulates *Michelinia*, *Cladochonus*, *Syringopora* and *Sutherlandia*; the nondissepimental corals *Stereostylus* and *Lophamplexus*; and very numerous brachiopods including *Neospirifer*, *Punctospirifer*, *Composita*, *Crurithyris*, *Reticularia*, *Echinococonchus*, *Echinaria*, *Pulchratia* and *Meekella*. As in Kansas and Oklahoma, this assemblage is present in Iowa Missourian limestones but size of individuals and faunal diversity is considerably less.

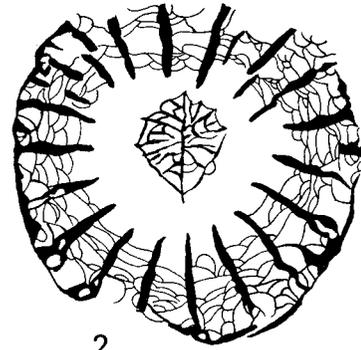
Comparison of the coral genera present in Iowa to those in Kansas and Oklahoma reveals that of the tabulates only *Syringopora* and *Cladochonus* are present in Iowa, whereas in the other states *Michelinia*, *Striatopora* and *Sutherlandia* are locally abundant. Only two genera of nondissepimental corals, *Stereostylus* and *Lophamplexus*, are present in Iowa; two additional genera, *Lophophyllidium* and *Amplexi-Zaphrentis*, are abundant locally farther south; the latter has been collected only in Oklahoma.

Elements (Zones 1, 3 and 4) erected in Kansas on distribution of dissepimental corals have been recognized in Iowa. Corals similar to those of Zone 1 are found in the Hertha, Swope and Winterset limestones of Iowa. The Iowa Winterset has geyerophyllids similar to those of the Oklahoma Dewey Formation and a dibunophyllid species similar to *D. hansonii* from the Oklahoma Lost City Limestone. The Iola Formation of Iowa contains a dibunophyllid, *D. clathrum*, which in Kansas is restricted to Zone 3, and a geyerophyllid, *G. broilii*, which ranges throughout the lower and middle Zone 4 in Kansas. The Argentine Limestone of Iowa contains a fragment of *G. broilii* as well as an aberrant member of the *Dibunophyllum parvum*-*D. dibolium* lineage of Kansas Zone 4. Unfortunately, we have been unable to collect corals from the Stanton of Iowa.

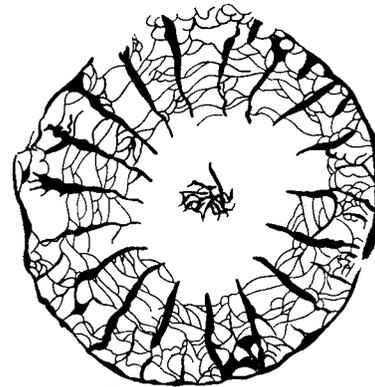
Corals have been collected from Missourian rocks of Oklahoma and Illinois by Cocke. In Oklahoma the Lost City Limestone contains Zone 1 corals; the Dewey Formation has corals related to those of Zones 1 and 4 and the Wann



D. dibolium of Oklahoma



2.

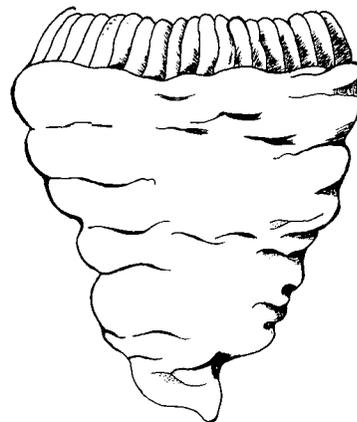


1.

1-2. Iowa Forms



D. parvum of Kansas
& Oklahoma



Typical Exterior

CORALS OF ZONE 4

Figure 6. Corals of the *Dibunophyllum parvum*-*D. dibolium* lineage. Exterior view in lower right is diagrammatic but is characteristic of the entire lineage. Iowa specimens (middle and upper right) show Iowa corals related to the lineage. Note the almost total absence of minor septa in the Iowa specimens.

Formation contains corals of both upper and lower Zone 4. In Illinois, the Shaw Point Limestone has corals of Kansas Zone 3 and the Millersville and Livingston limestones have some elements of Zone 4.

Further study may verify or reject the following rather tentative observations regarding comparison of midcontinent dissepimental corals to corals from other areas:

(1) Zone 1, recognized in the Hertha, Swope and Winterset of Iowa, contains corals similar to those from the Upper Middle Carboniferous of China. The upper part of Zone 1 contains corals similar to those which occur near the boundary of the Moscovian and Kazimovian of Russia.

(2) The Russian Kazimovian corals are similar to lower and middle Missourian corals of Kansas, Oklahoma and Iowa. The Russian Gzelian has faunas similar to those from Upper Missourian and Virgilian rocks of America. The P₂ suite in the Russian Donetz Basin contains dibunophyllids and neokoninckophyllids almost identical to those from the upper part of Kansas Zone 4. Gzelian faunas from the Austrian Carnic Alps are likewise similar to corals from upper Zone 4.

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