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Syringoporoid corals: Guides to the stratigraphy of
upper Paleozoic rocks in the western interior region

by

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This report is preliminary and has not been reviewed for conformity
with U.S. Geological Survey editorial standards and stratigraphic
nomenclature.

1984

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INTRODUCTION

Tabulate corals having the general morphology of Syringopora Goldfuss are among the most common and widespread fossils in carbonate rocks of late Paleozoic age. Although they have received little attention in biostratigraphy, recent taxonomic refinements in the group have created new and useful tools for biostratigraphic analysis.

This report presents the results of a study of 581 occurrences of syringoporoid corals from rocks ranging in age from latest Devonian to Early Permian in the western interior region of the United States (Fig. 1). Most of the specimens studied are from collections made during the past 80 years by various geologists of the U.S. Geological Survey. This is the largest and most comprehensive collection of these fossils ever assembled from the United States. All specimens were independently dated either by conodonts (identified by C. A. Sandberg), foraminifers (identified by R. C. Douglass and B. L. Mamet), or brachiopods (identified by M. Gordon, Jr., T. W. Henry, and J. T. Dutro, Jr.). The occurrences are overwhelmingly in shallow-water shelf carbonate facies, mostly free of terrigenous detritus, except for some quartzose arenaceous limestones in the Pennsylvanian and some deep-water limestones in the Mississippian.

The upper Paleozoic syringoporoid fauna of the western interior region includes eight nominal genera divided into 24 morphogroups, which are tentative taxonomic groupings based on somewhat arbitrary and convenient morphologic criteria (Table 1). These groupings may be species or species groups and need to be tested by statistical studies but, for the time being, they afford new tools useful for biostratigraphic discrimination.

UPPER DEVONIAN

Famennian.--The syringoporoid succession described herein begins in the Upper Devonian (Famennian) rocks of Utah, the oldest strata investigated for this report. Here we find the genus Syringopora, characterized by a fasciculate, bush-like corallum, cylindrical corallites, axial to subaxial visceral cavity, infundibular tabulae, connecting tubuli, and a lamellar wall structure. Septal spines are a variable feature in this genus and all the others that I will discuss. Four morphogroups, A, B, C, and D, are distinguished principally on mean corallite diameter in the Famennian. Plate 1 shows morphogroups A and B, and Plate 2 illustrates morphogroups C and D from rocks of Famennian age. Scale is indicated by lines one cm long adjacent to thin sections on all the plates. Note the gradual increase in corallite diameter in the four groups.

MISSISSIPPIAN

Kinderhookian.--The Kinderhookian Series of the Mississippian is characterized by the same four Syringopora morphogroups, three of which are illustrated on Plate 3. I have not been able to distinguish these Kinderhookian forms from the Famennian ones.

Osagean.--In the Osagean Series of the Mississippian, we again find the four morphogroups of Syringopora that began in the Famennian (Pls. 4 and 5). A new form, Syringopora E (Pl. 5), characterized by close-packed subcerioid

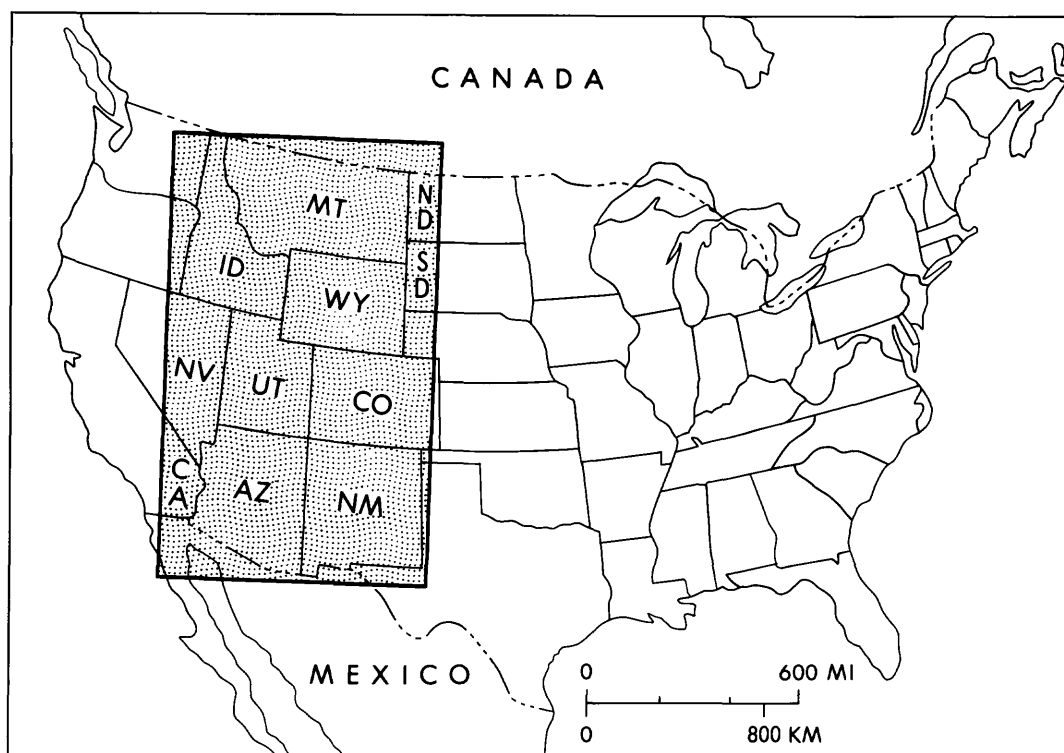


Figure 1.- Map of the USA showing location of western interior region where syringoporoid corals occur in upper Paleozoic rocks.

MORPHOGROUP	NOMINAL NORTH AMERICAN SPECIES AND FORMAE	CORALLUM		CORALLITE		CONNECTIONS		CORALLITE WALL THICKNESS (MM)	VIS-CERAT	TABULAE		SEPTAL SPINES	
		FORM	SHAPE	FORM	SHAPE	MEAN DIAMETER (MM)	MEAN FREQUENCY (PER CM ²)			ARRANGE-MENT	TRACES	ABUND-ANCE	ABUND-LENGTH
<i>Syringopora</i>	<i>Syringopora aculeata</i> Girty,	fasciculate	bush-like	phaceloid and dendroid	cylindrical	1.1-1.8	8-18	absent	axial or subaxial	infundibular	concentric to subconcentric	sparse to abundant	absent to short
	<i>S. harveyi</i> White, <i>S. tubulera</i> Easton	-do-	-do-	-do-	-do-	1.5-2.6	3-14	absent	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora compacta</i> Nelson, <i>S. pennsylvanica</i> Shimer, <i>S. surculata</i> Girty	-do-	-do-	-do-	-do-	2.7-3.3	3-10	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora rudyi</i> Nelson	-do-	-do-	-do-	-do-	3.5+	2-4	-do-	-do-	-do-	-do-	-do-	-do-
<i>Pleurostrophonella</i>	None	-do-	-do-	-do-	-do-	2.0-2.5	16-17	-do-	-do-	-do-	-do-	-do-	-do-
	<i>?Syringopora agglomerata</i> Nelson	massive	hemispherical	phaceloid to subcylindrical	cylindrical to subcylindrical	3.0-4.1	2-4	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora bassoi</i> Nelson	fasciculate	bush-like	phaceloid and dendroid	-do-	2.0-2.5	9-13	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora dingmanae</i> Nelson	-do-	-do-	-do-	-do-	1.5-2.0	7-9	-do-	-do-	-do-	-do-	-do-	-do-
<i>Multithecopora</i>	None	-do-	-do-	-do-	-do-	1.5-2.0	9-23	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora virginica</i> Butts	-do-	-do-	-do-	-do-	2.3-2.5	5-9	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora drummondii</i> Nelson	-do-	-do-	-do-	-do-	1.9-2.6	7-13	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Multithecopora? amdensensis</i> Sando	-do-	-do-	-do-	-do-	1.1-1.2	26-33	-do-	-do-	-do-	-do-	-do-	-do-
<i>Duncanopora</i>	None	-do-	-do-	-do-	-do-	1.6-2.5	6-20	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Multithecopora hypaeae</i> Wilson, <i>M. paucitubulata</i> Moore & Jeffords, <i>?Sinopora minor</i> Rowett	repent	thin sheet (3 cm. max.)	phaceloid and dendroid	cylindrical to subcylindrical	1.3-2.5	16-43	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Duncanopora duncanae</i> Sando	massive	hemispherical to discoidal	phaceloid to subcylindrical	cylindrical to prismatic	1.3-2.5	10-15	-do-	-do-	-do-	-do-	-do-	-do-
	None	repent to fasciculate	thick sheet (5 cm. max.)	phaceloid and dendroid	cylindrical	1.9-2.5	10-15	-do-	-do-	-do-	-do-	-do-	-do-
<i>Neomultithecopora</i>	None	repent	thick sheet (4 cm. max.)	-do-	-do-	1.6	23	-do-	-do-	-do-	-do-	-do-	-do-
	None	fasciculate to submassive	tabular to hemispherical	-do-	cylindrical to subcylindrical	1.9-2.3	14-19	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Syringopora mcccutehonae</i> Wilson	fasciculate	bush-like	-do-	cylindrical	1.6-2.3	9-19	-do-	-do-	-do-	-do-	-do-	-do-
	None	-do-	-do-	-do-	-do-	2.4-2.6	10-15	-do-	-do-	-do-	-do-	-do-	-do-
<i>Neosyringopora</i>	None	-do-	-do-	-do-	-do-	3.0	10	-do-	-do-	-do-	-do-	-do-	-do-
	None	-do-	-do-	-do-	-do-	1.9-2.3	11-13	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Cornwallia tabularia</i> Hoare	massive	tabular to hemispherical	subcylindrical to prismatic	-do-	2.5	23	-do-	-do-	-do-	-do-	-do-	-do-
	None	-do-	-do-	-do-	-do-	2.5-3.0	15-23	-do-	-do-	-do-	-do-	-do-	-do-
<i>Baythium</i>	None	submassive	tabular to hemispherical	-do-	-do-	1.6-2.0	20-35	-do-	-do-	-do-	-do-	-do-	-do-
	<i>Baythium vallium</i> Hoare	to massive	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-

Table 1.- Critical morphologic characters of syringoporoid morphogroups.

corallites, is restricted to Mamet microfossil Zone 7. And we find also the earliest representatives of Pleurosiphonella (Pl. 5), characterized by a lateral visceral cavity, short connecting tubes and mural pores, and a fibrous wall structure. Pleurosiphonella A seems to be a transitional form from Syringopora to later Pleurosiphonella because its corallites have both axial and lateral visceral cavities.

Meramecian.--The four original Syringopora morphogroups continue into the Meramecian Series of the Mississippian. Plate 6 shows lower Meramecian specimens of all but Syringopora D, which is rare.

In the upper Meramecian, we find Syringopora F and G (Pl. 7), which are rare forms that represent the youngest occurrences of the genus in the upper Paleozoic sequence. These forms are distinct from and have no apparent connection to older representatives of Syringopora.

Here also we see Pleurosiphonella A (Pl. 8) from the lower Meramecian and Pleurosiphonella B (Pl. 8), with its strongly excentric visceral cavity, which characterizes middle and upper Meramecian.

The upper Meramecian is also marked by the first appearance of Multithecopora (pl. 9), which has a fasciculate, bush-like corallum, horizontal tabulae, short connecting tubuli, and corallite walls of highly variable thickness and fibrous-amorphous microstructure. The two morphogroups illustrated here are separated readily on corallite diameter.

Chesterian.--The Chesterian Series of the Mississippian marks a significant change in the syringoporoid fauna. Syringopora is not found above the Meramecian, and all the syringoporoids in the Chesterian and younger strata have a fibrous or fibrous-amorphous wall structure.

In the Chesterian, we find a continuation of Pleurosiphonella B, (Pl. 10), but it is very rare. Pleurosiphonella C, (Pl. 10), distinguished by corallites of larger diameter, is the common Chesterian form.

Chesterian strata are also characterized by a continuation of Multithecopora A (Pl. 11). A new form, Duncanopora (Pl. 11), characterized by corallites having the internal morphology of Multithecopora but connected at regular intervals in the corallum by platforms and wall contact, is restricted to the Chesterian.

PENNSYLVANIAN

Morrowan and Atokan.--A profound change in the syringoporoid fauna takes place at the Mississippian-Pennsylvanian boundary. Multithecopora C, characterized by reptant coralla that form thin sheets and have few horizontal tabulae, is the only syringoporoid present in the Morrowan and Atokan Series. This form may have started in the Chesterian, but the evidence is inconclusive. A Morrowan specimen is shown in the upper half of Plate 12. The lower half of the same plate illustrates Multithecopora C from the Atokan, where this form is abundant for the first time.

Desmoinesian.--The Desmoinesian Series of the Pennsylvanian is marked by a flowering of the syringoporoids. In addition to abundant Multithecopora C

(Pl. 13), we have the first appearance of Neomultithecopora, which has a bush-like corallum in which the corallites have both horizontal and infundibular tabulae and a fibrous or fibrous-amorphous wall structure. Neomultithecopora A is shown on Plate 13. Plate 14 show Desmoinesian Neomultithecopora B, a form having smaller corallites and more abundant tabulae, most of which are horizontal, and Neosyringopora A, which represents the first appearance of Neosyringopora, characterized by a bush-like corallum, abundant vesicular tabulae, and fibrous-amorphous wall structure.

Middle Pennsylvanian, undifferentiated.--Neomultithecopora C, a large corallite form, occurs in beds dated only as Middle Pennsylvanian (Pl. 15, upper half).

Upper Pennsylvanian, undifferentiated.--Neomultithecopora C has also been found in strata dated only as Upper Pennsylvanian (Pl. 15, lower half). Plate 16 shows two Neosyringoporas, C and D, from beds dated only as Upper Pennsylvanian. Neosyringopora C has large, closely-packed corallites and many complex vesicular tabulae, whereas Neosyringopora D has vesicular, horizontal, and infundibular tabulae.

Missourian.--Missourian strata are characterized by Multithecopora C (Pl. 17) and Neosyringopora A (Pl. 17), which are a continuation of the Desmoinesian fauna. Although no change in genera occurs at the Middle Pennsylvanian-Upper Pennsylvanian boundary, Neosyringopora C and D appear for the first time.

Virgilian.--In the Virgilian Series of the Pennsylvanian, we have a continuation of Multithecopora C (Pl. 18), and Neomultithecopora A (Pl. 18), which has not been found in the Missourian but whose presence there is inferred. Neosyringopora A (Pl. 19) is another form that continued into the Virgilian from the Missourian. We also find two new submassive to massive forms in the Virgilian: Cornwallatia (Pl. 19), characterized by subcerioid to cerioid corallites having the same internal structure as Neosyringopora, and Bayhaium (Pl. 19), which has subcerioid to cerioid corallites having the same internal structure as Neomultithecopora.

PERMIAN

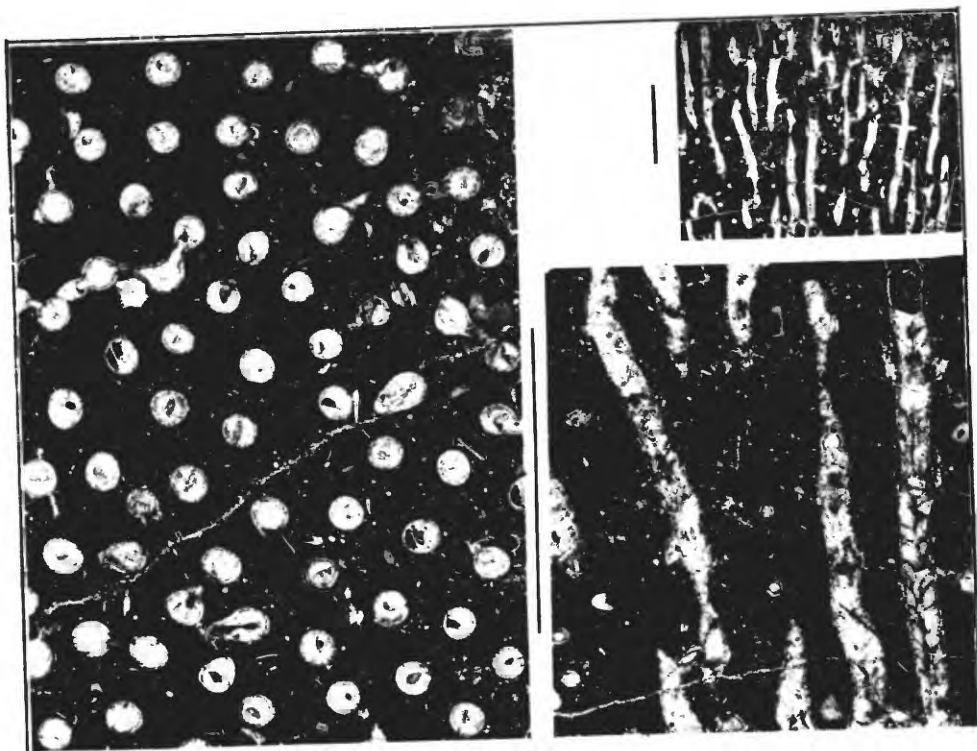
Wolfcampian.--The Wolfcampian Series of the Permian is characterized by a syringoporoid fauna not readily distinguishable from that of the Virgilian. Here we see an old Pennsylvanian standby, Multithecopora C (Pl. 20), which is rare in the Wolfcampian, and Neomultithecopora C (Pl. 20), a form found rarely in the Middle Pennsylvanian, but now common in the Wolfcampian. Plate 21 shows Wolfcampian Neosyringopora A and B, forms previously noted in the Middle and Upper Pennsylvanian.

In Plate 22, we see the same Bayhaium that occurs in the Virgilian and Cornwallatia B, which differs from the Virgilian form in having larger corallites and thinner walls.

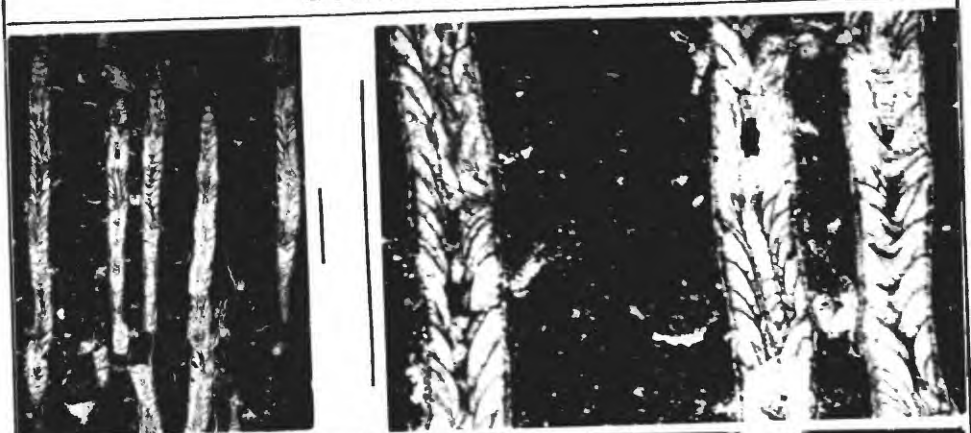
SUMMARY

Figure 2 summarizes the ranges of syringoporoid morphogroups in the upper Paleozoic of the western interior region. The picture is essentially one of a

continuously evolving sequence of closely related animals changing progressively through time. However, there is a good deal of overlapping of ranges and, in fact, some variations or discontinuities in the pattern are useful for biostratigraphy. Thus, we can discern useful discontinuities within the Mississippian between lower and middle Meramecian and at the Meramecian-Chesterian boundary. The Mississippian-Pennsylvanian boundary is well-marked. In the Pennsylvanian, a major change occurs at the Atokan-Desmoinesian boundary and a lesser one at the Missourian-Virgilian boundary. Unfortunately, the Devonian-Mississippian boundary is unmarked and the Pennsylvanian-Permian boundary is poorly marked by changes in the succession of syringoporoid corals.

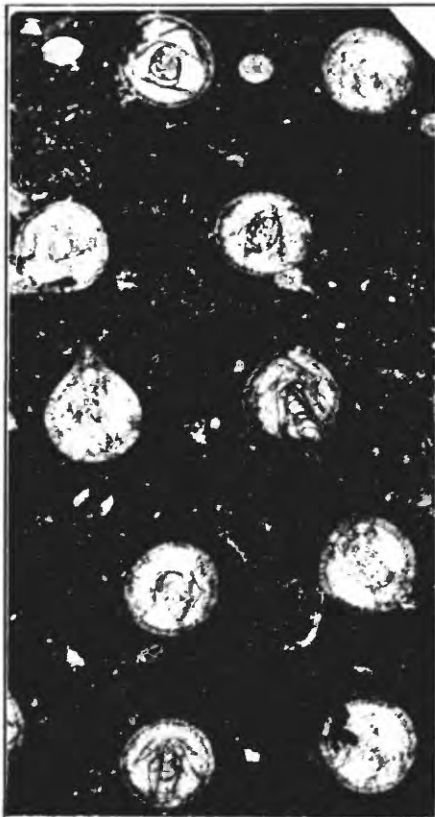


SYRINGOPORA A



SYRINGOPORA B

UPPER DEVONIAN (FAMENNIAN)

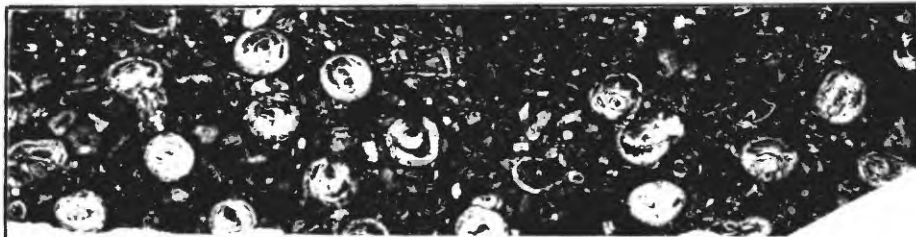


SYRINGOPORA C

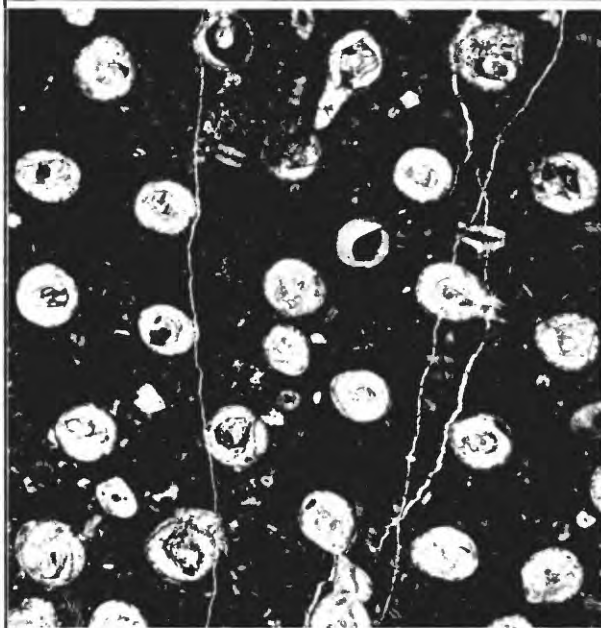


SYRINGOPORA D

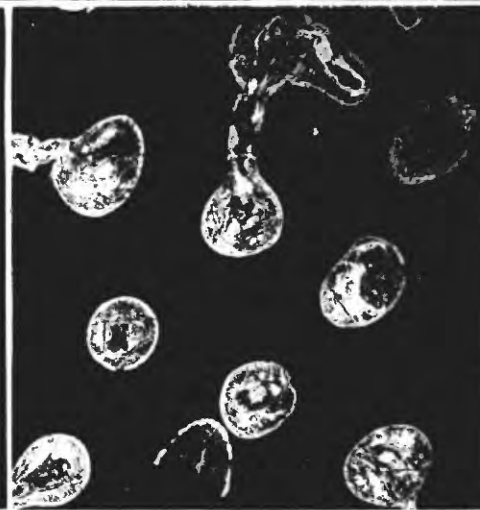
UPPER DEVONIAN (FAMENNIAN)



SYRINGOPORA A

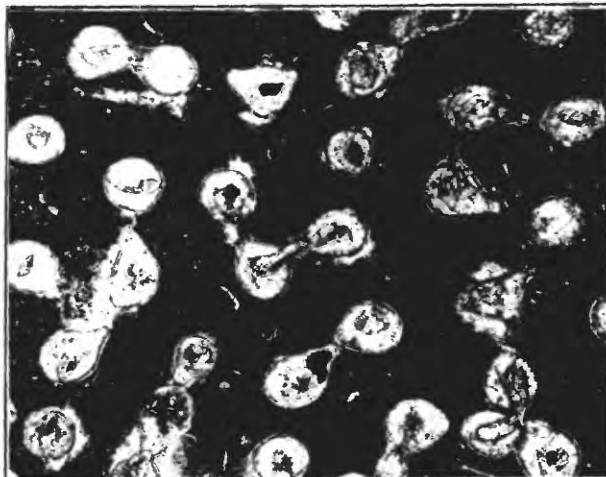


SYRINGOPORA B

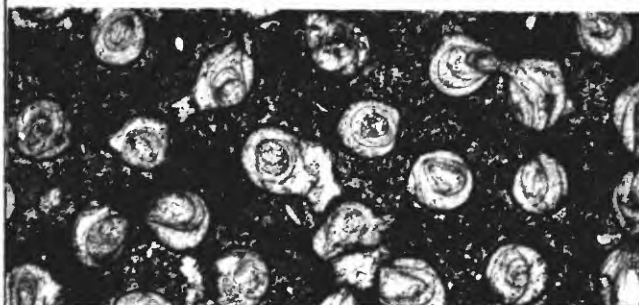


SYRINGOPORA C

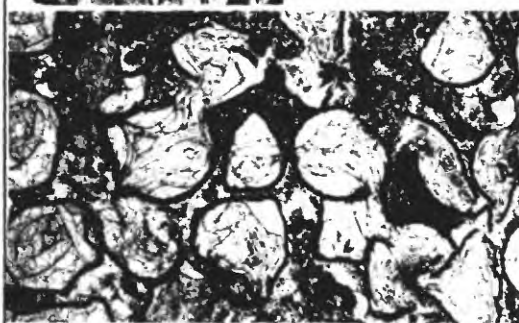
MISSISSIPPIAN (KINDERHOOKIAN)



SYRINGOPORA A



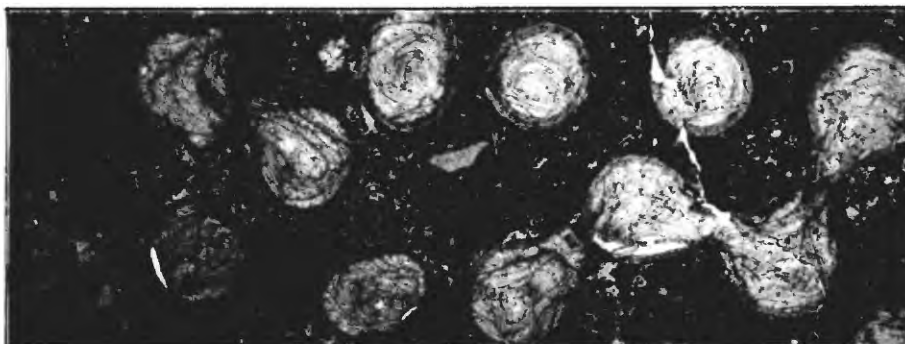
SYRINGOPORA B



SYRINGOPORA C



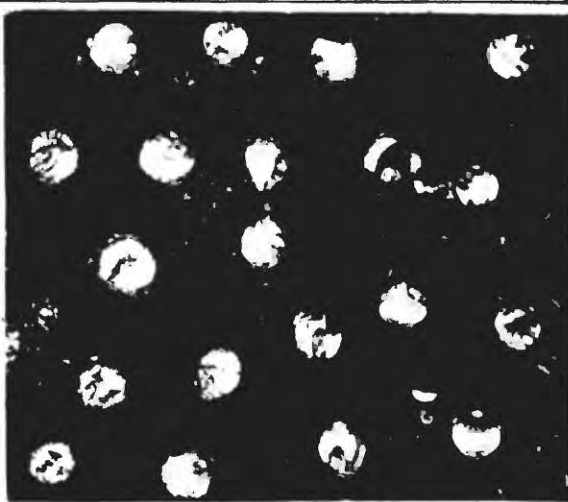
MISSISSIPPIAN (OSAGEAN)



SYRINGOPORA D



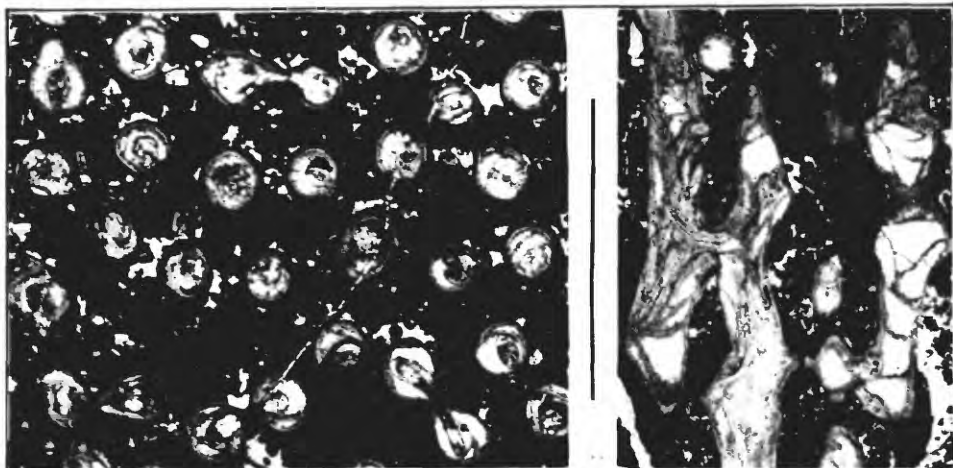
SYRINGOPORA E



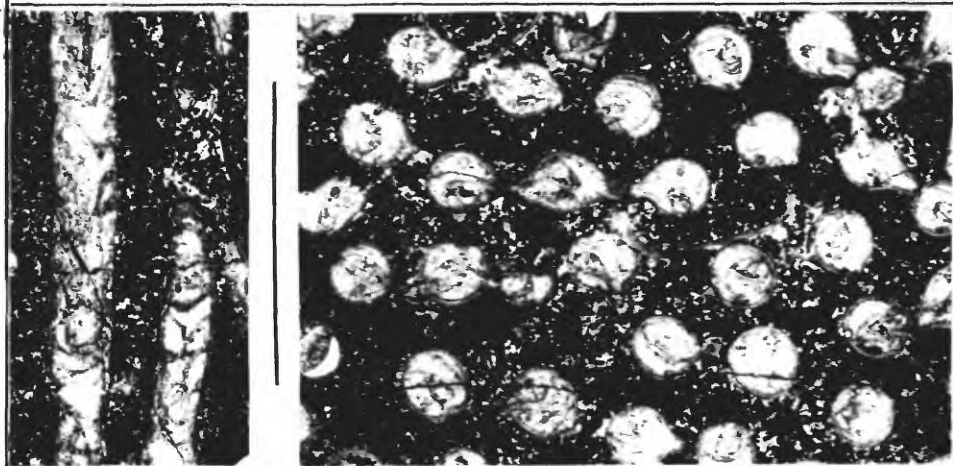
PLEUROSIPHONELLA A

MISSISSIPPIAN (OSAGEAN)

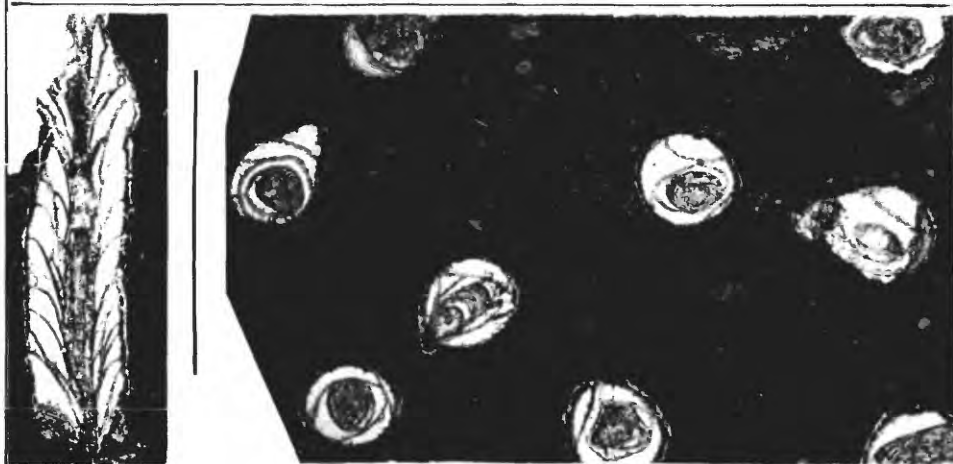
Plate 5



SYRINGOPORA A

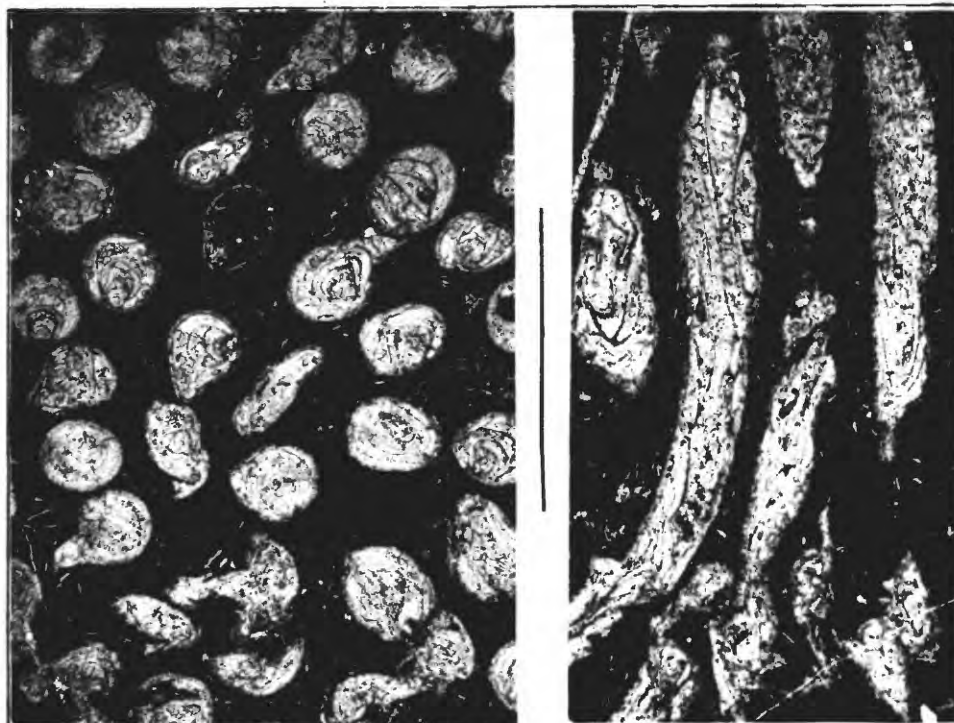


SYRINGOPORA B

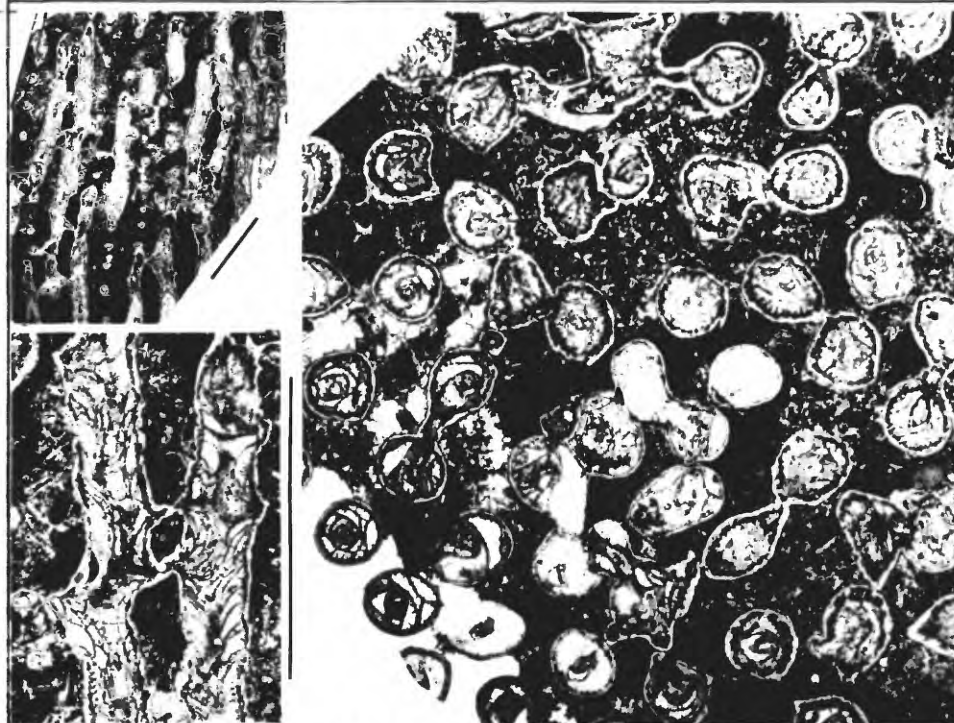


SYRINGOPORA C

MISSISSIPPIAN (MERAMECIAN)

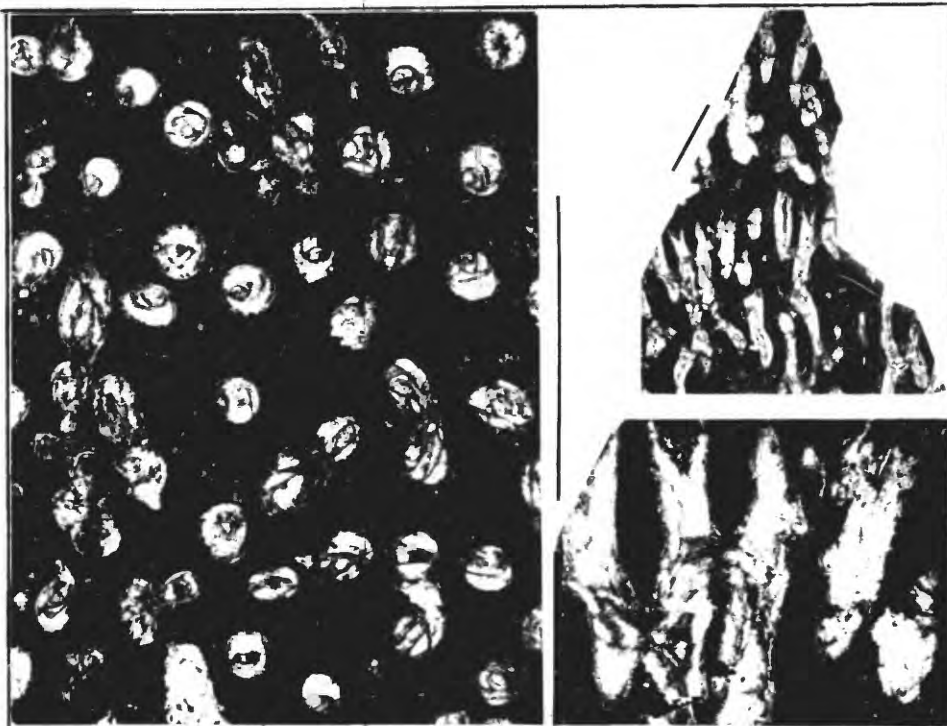


SYRINGOPORA F

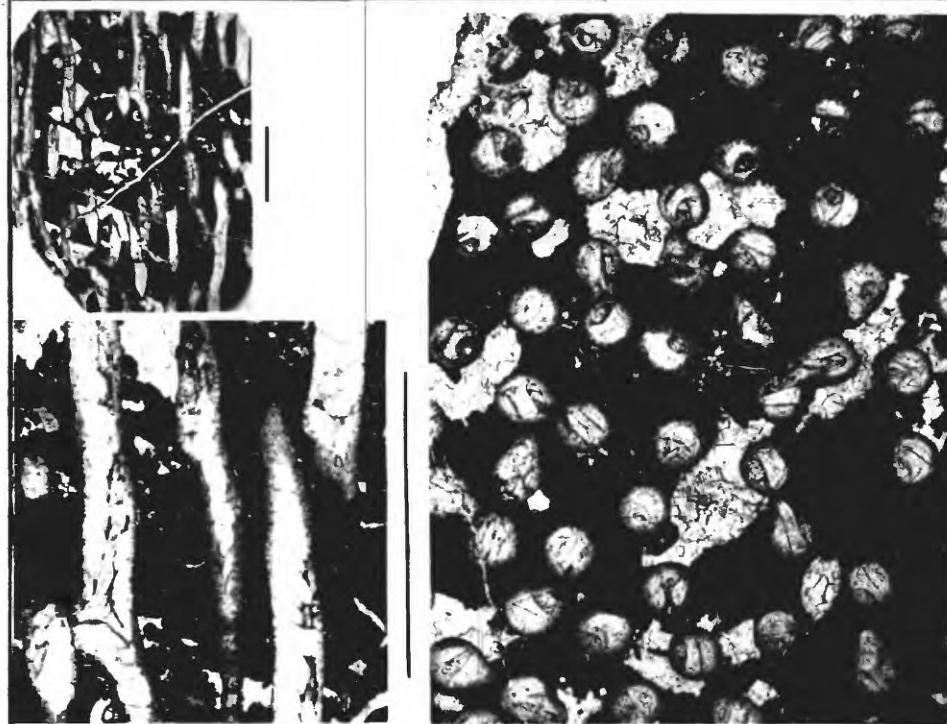


SYRINGOPORA G

MISSISSIPPIAN (MERAMECIAN)

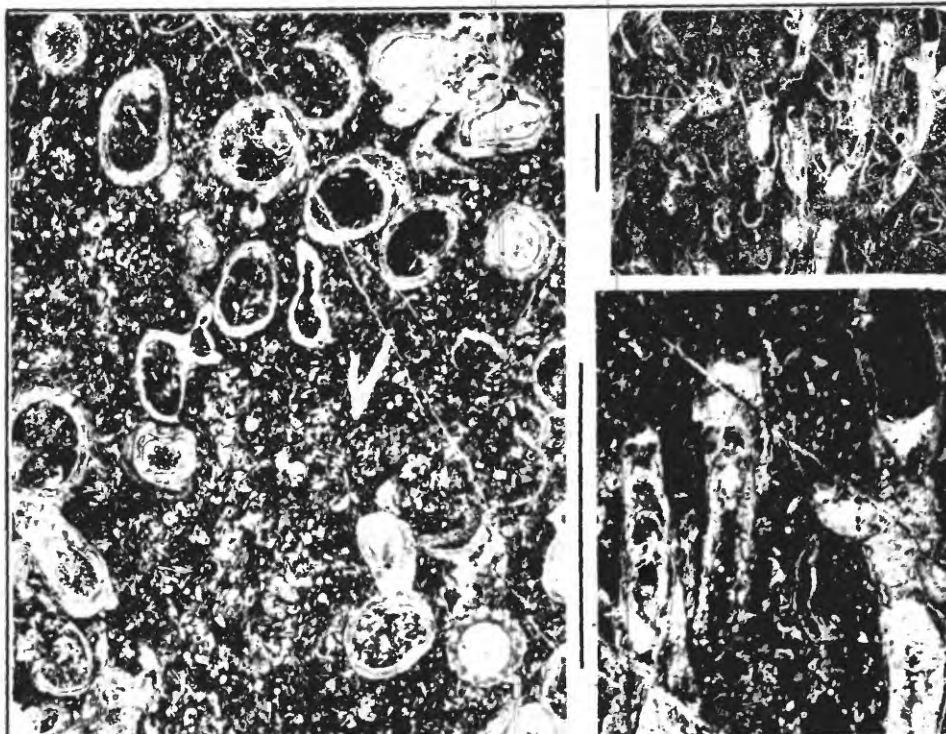


PLEUROSIPHONELLA A

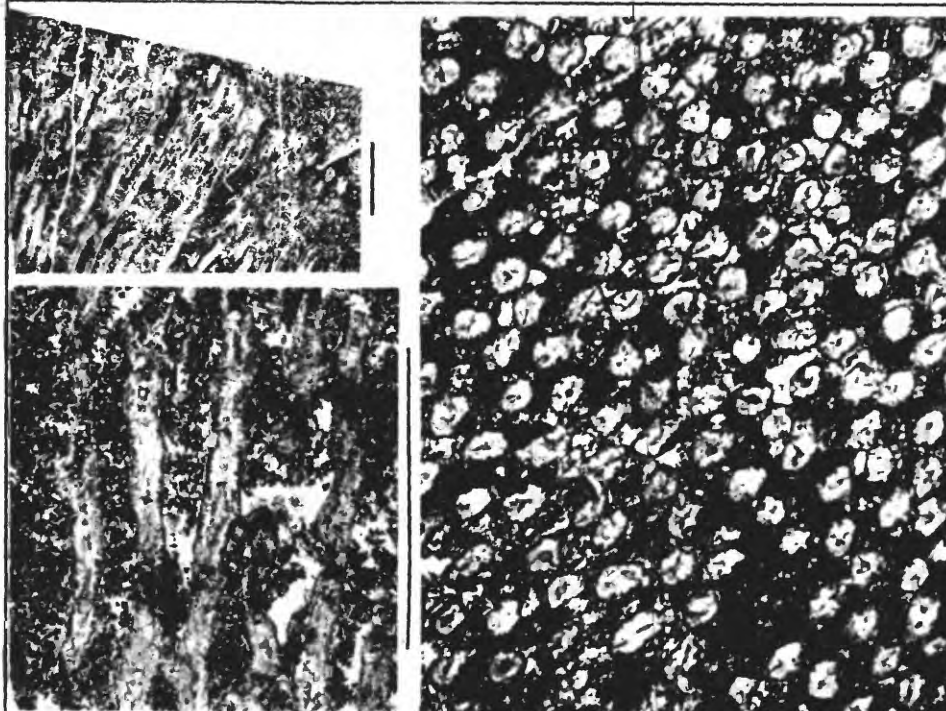


PLEUROSIPHONELLA B

MISSISSIPPIAN (MERAMECIAN)

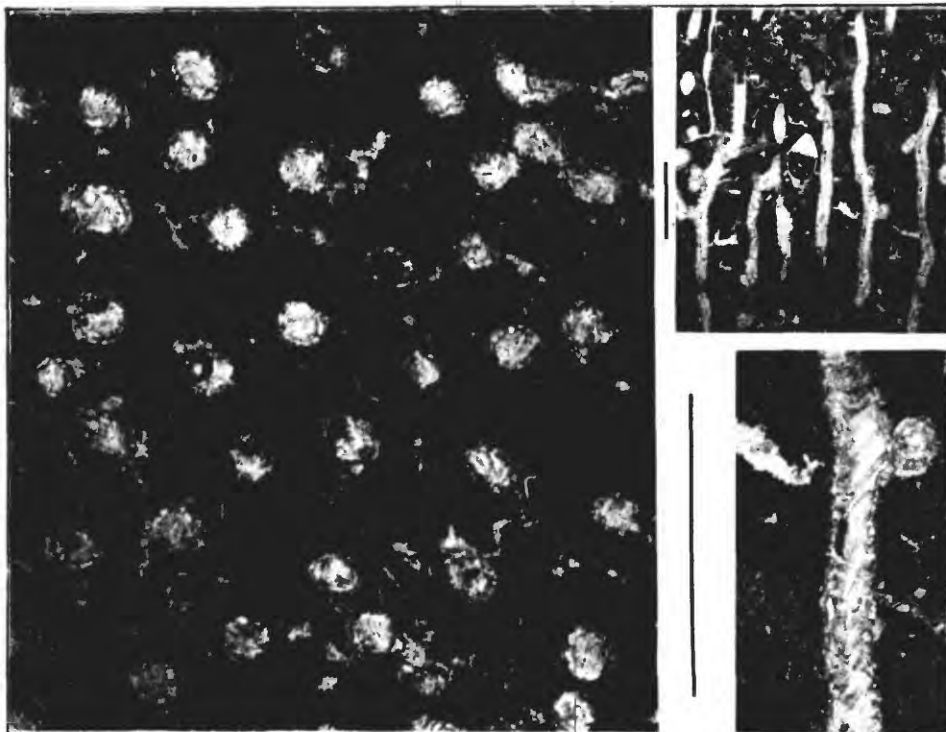


MULTITHECOPORA A

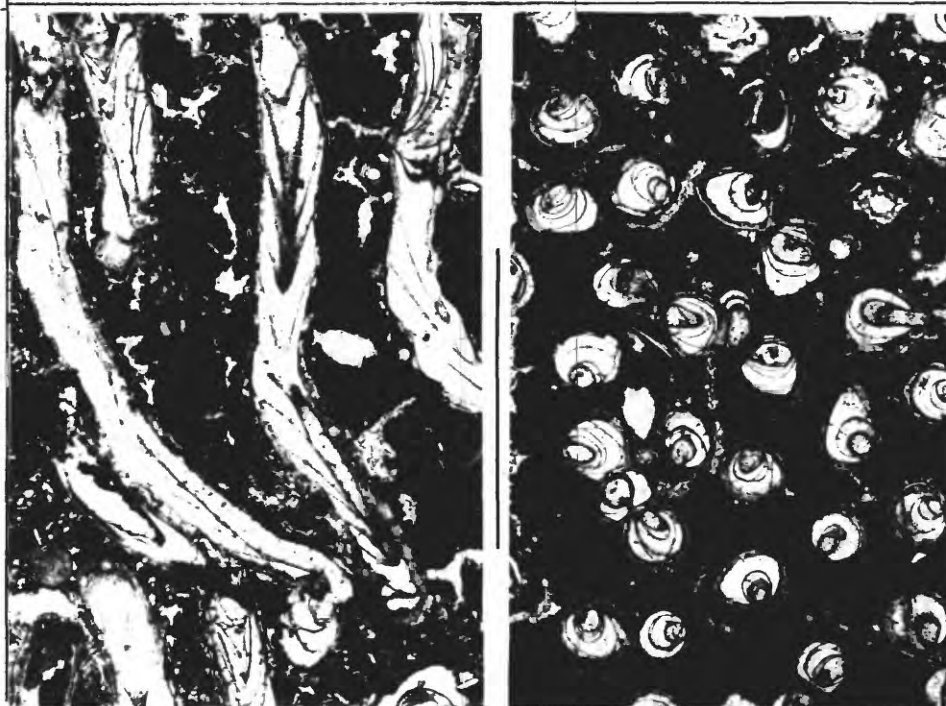


MULTITHECOPORA B

MISSISSIPPIAN (MERAMECIAN)

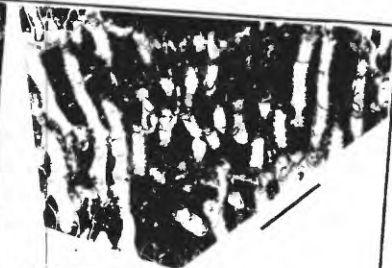
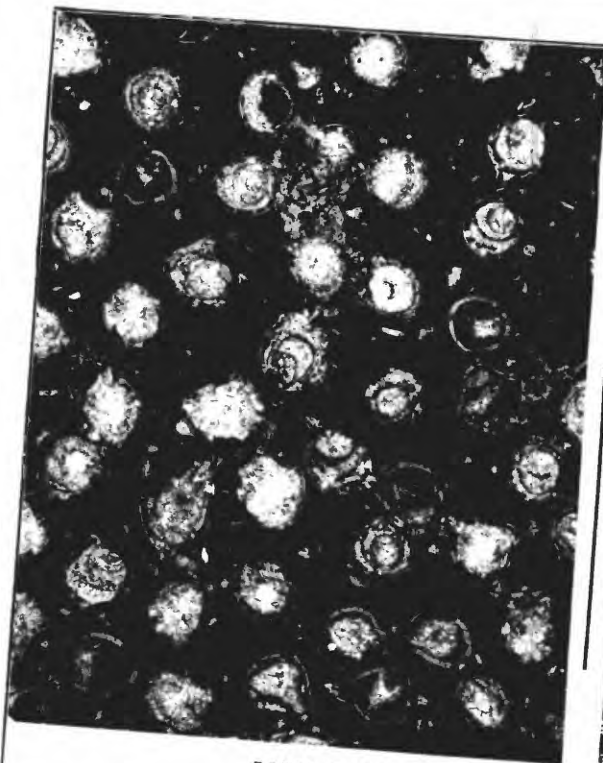


PLEUROSIPHONELLA B

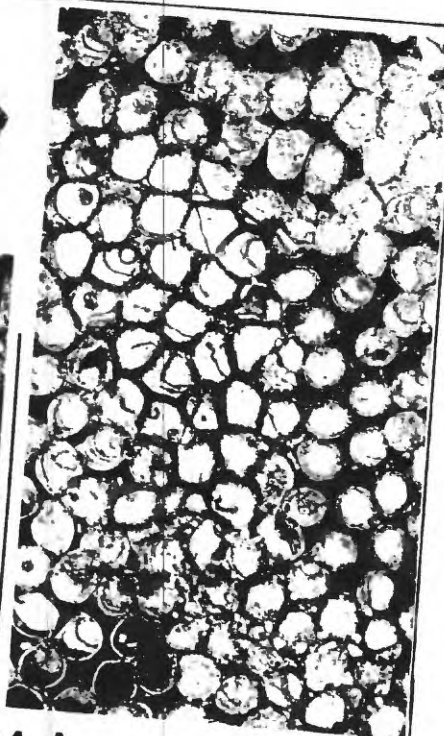
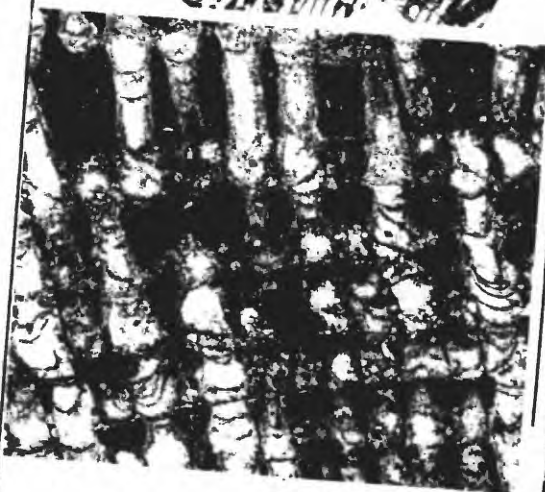


PLEUROSIPHONELLA C

MISSISSIPPIAN (CHESTERIAN)

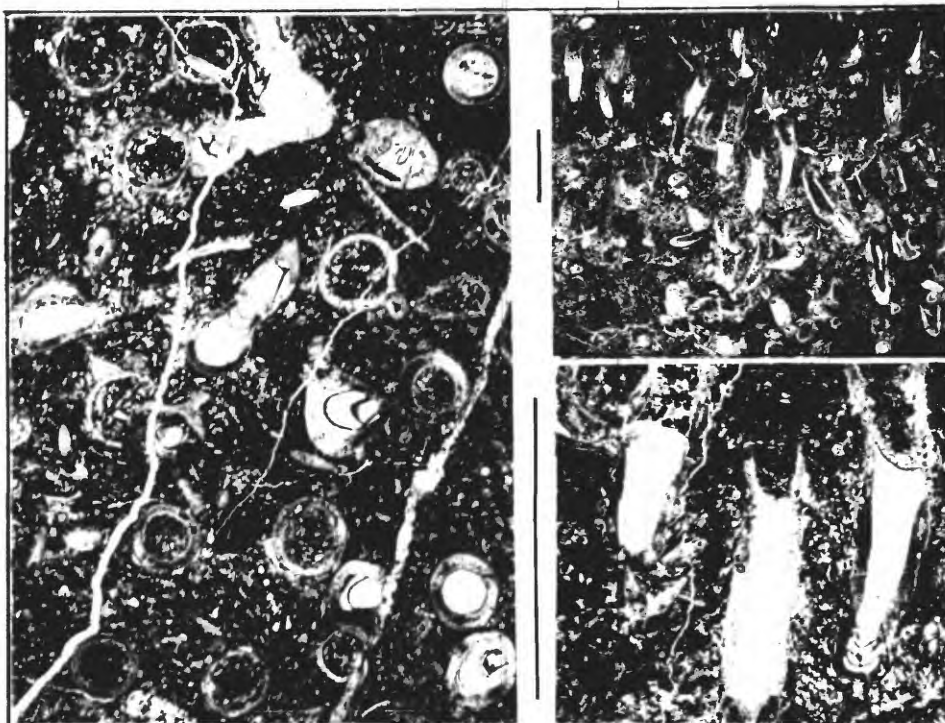


MULTITHECOPORA A

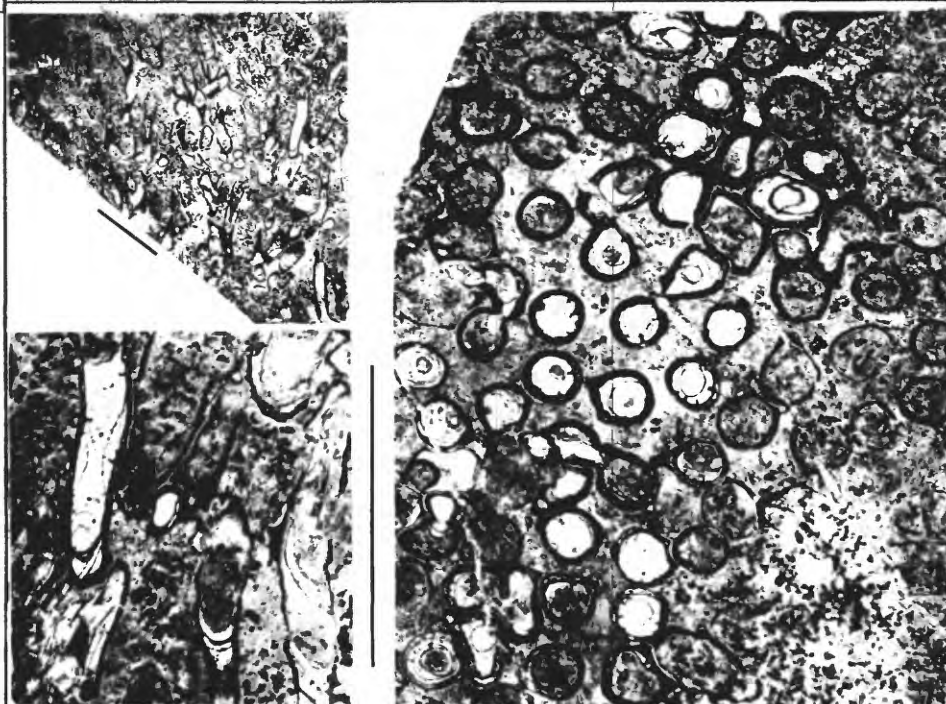


DUNCANOPORA A

MISSISSIPPIAN (CHESTERIAN)

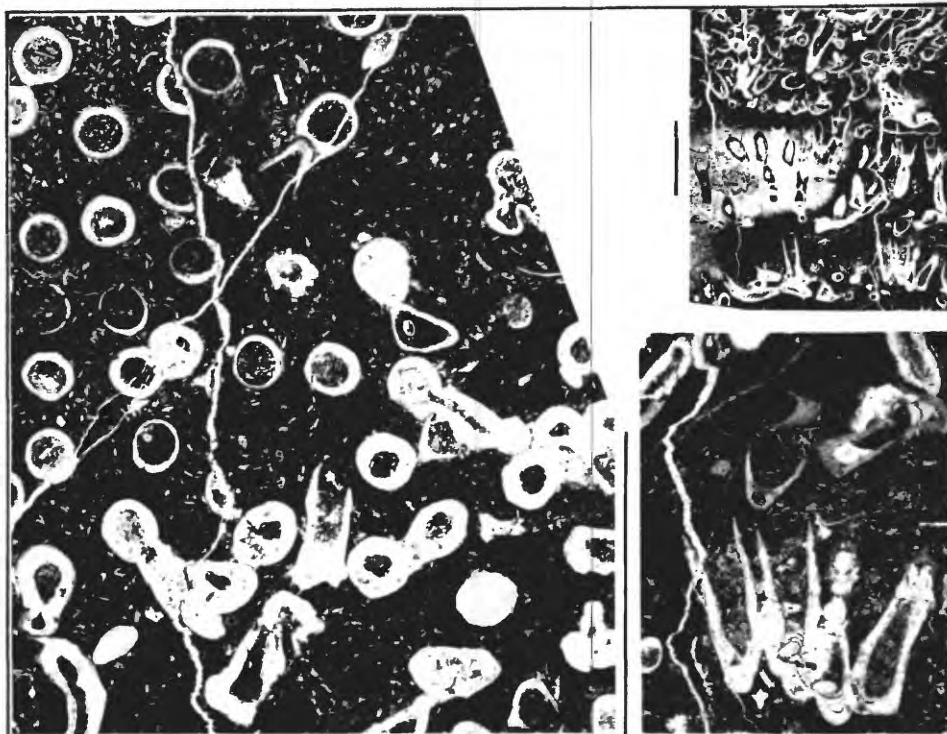


MULTITHECOPORA C

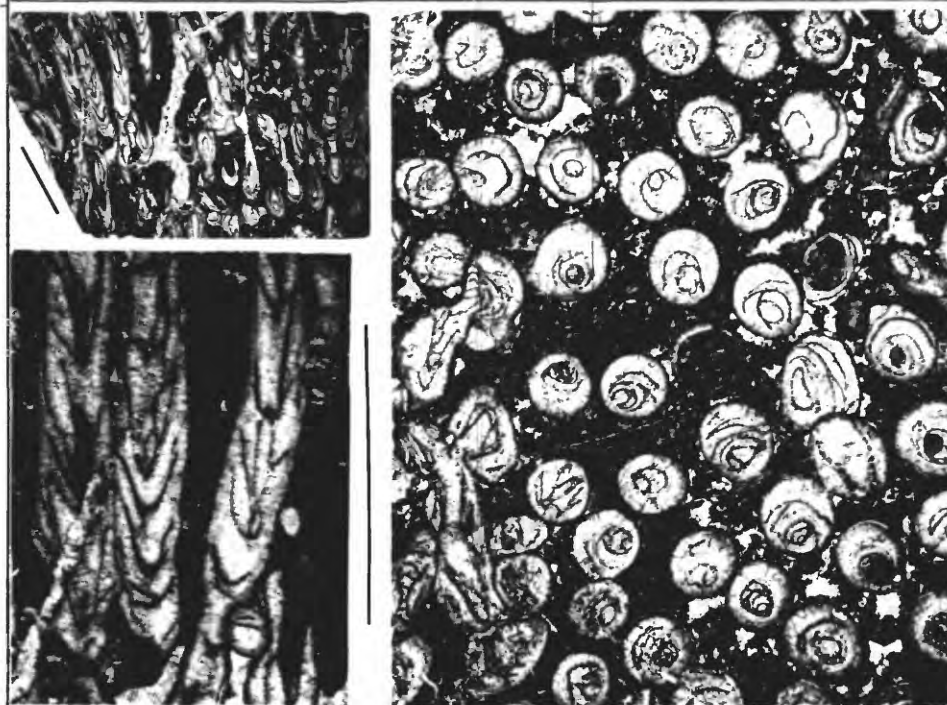


MULTITHECOPORA C

PENNSYLVANIAN (MORROWAN AND ATOKAN)

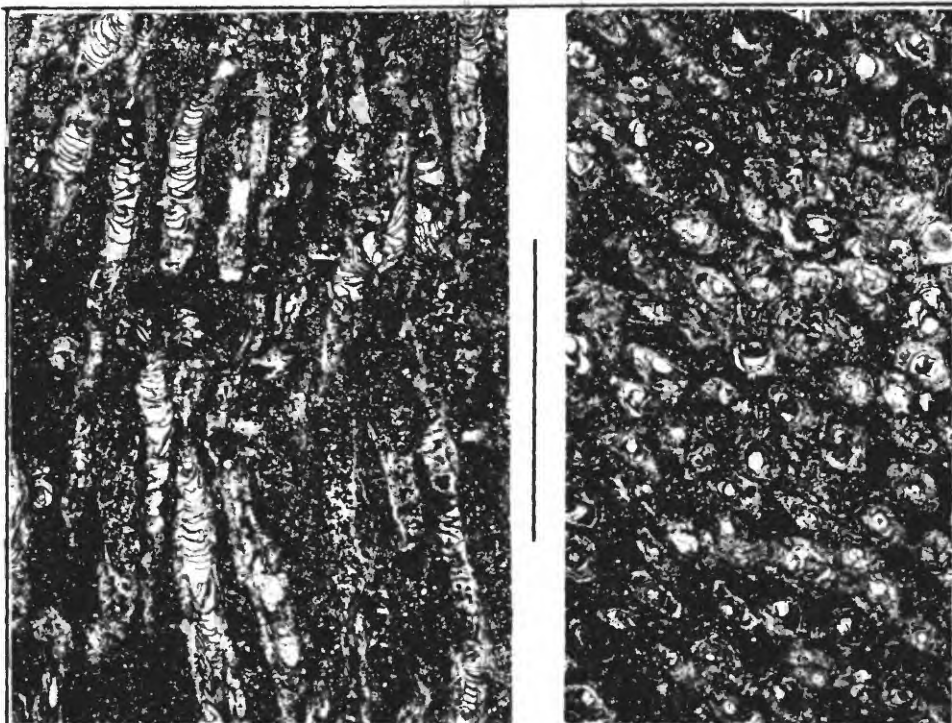


MULTITHECOPORA C

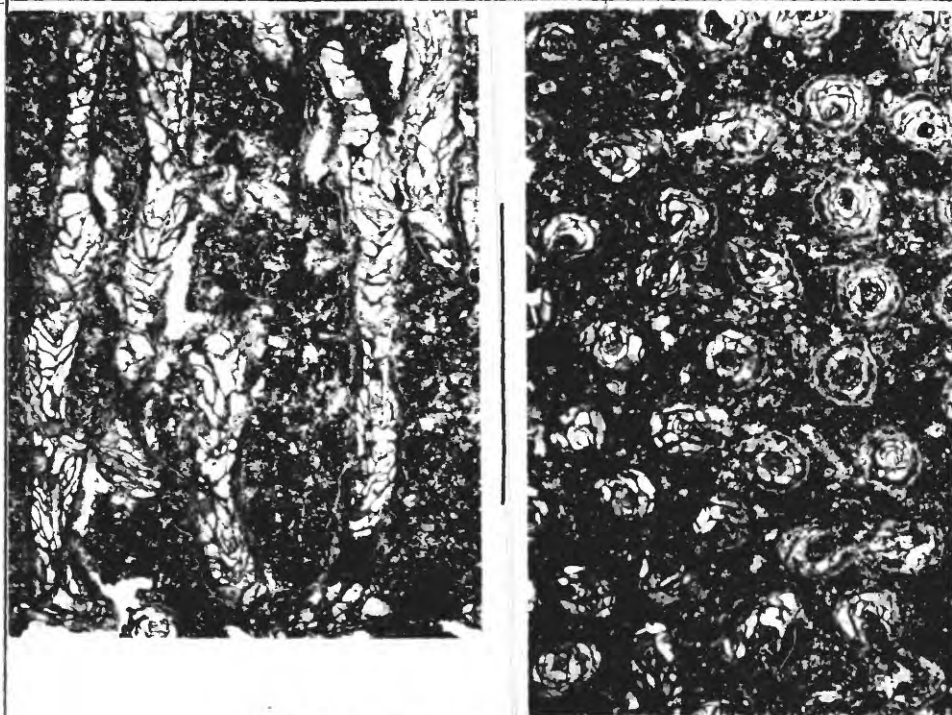


NEOMULTITHECOPORA A

PENNSYLVANIAN (DESMOINESIAN)



NEOMULTITHECOPORA B

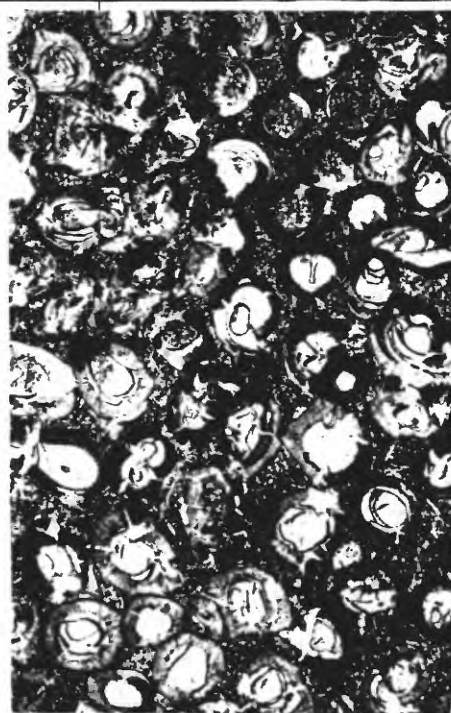
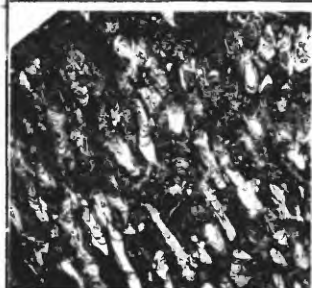


NEOSYRINGOPORA A

PENNSYLVANIAN (DESMOINESIAN)

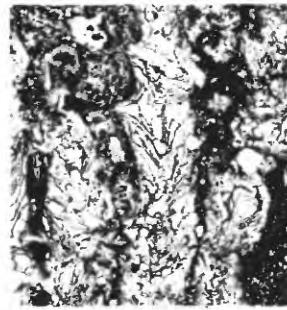
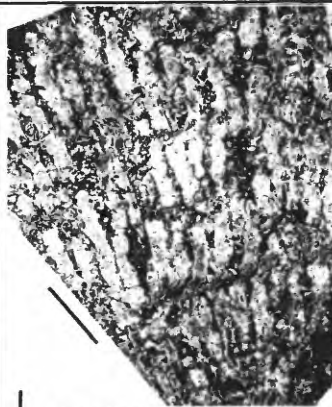


NEOMULTITHECOPORA C

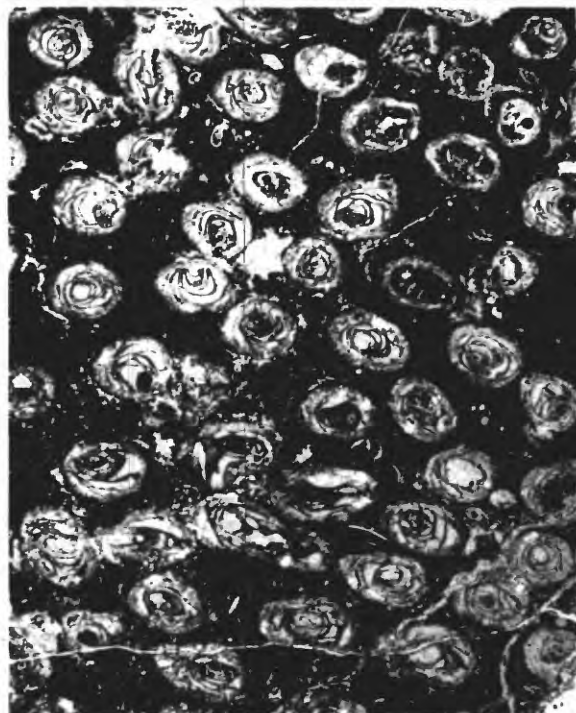


NEOMULTITHECOPORA C

PENNSYLVANIAN (MIDDLE AND UPPER)

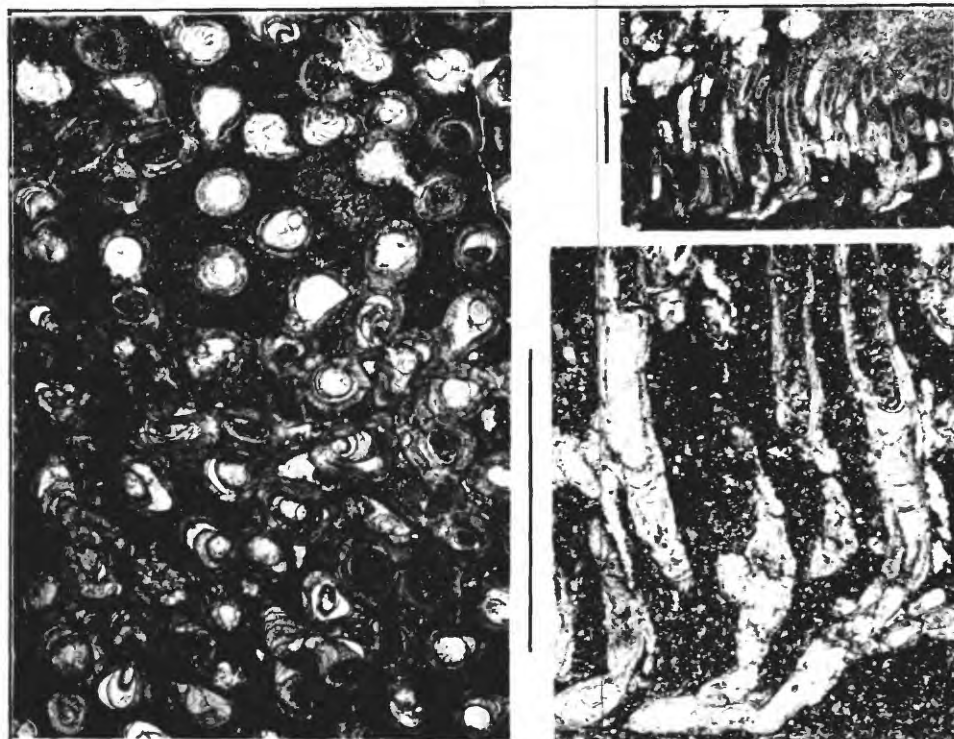


NEOSYRINGOPORA C

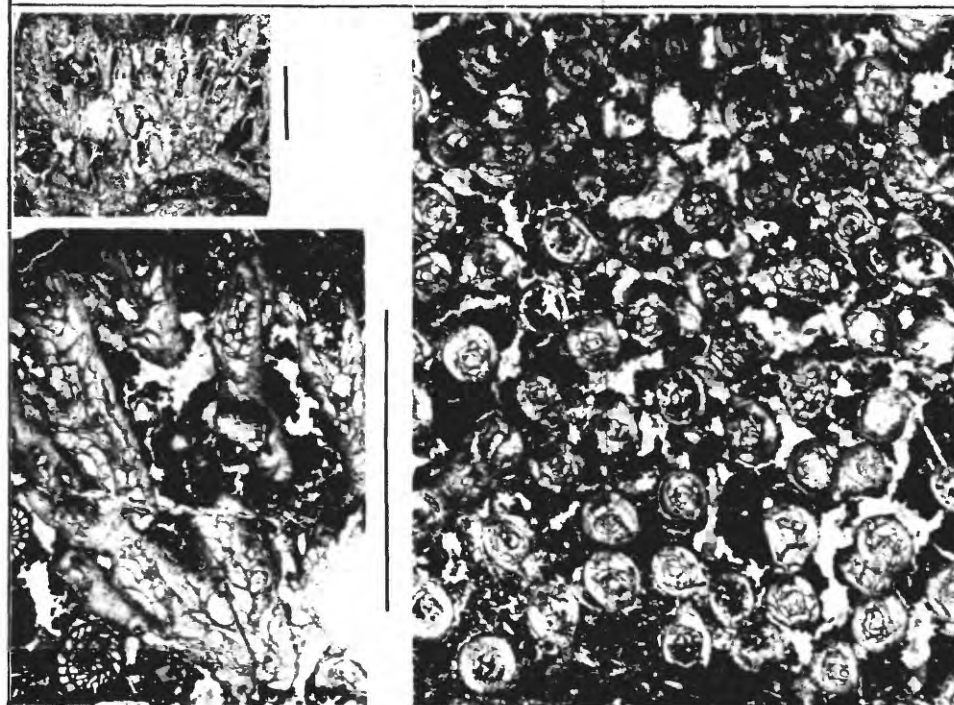


NEOSYRINGOPORA D

PENNSYLVANIAN (UPPER)

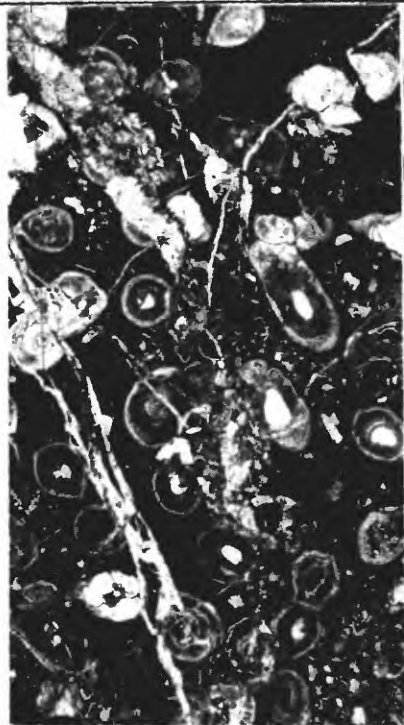
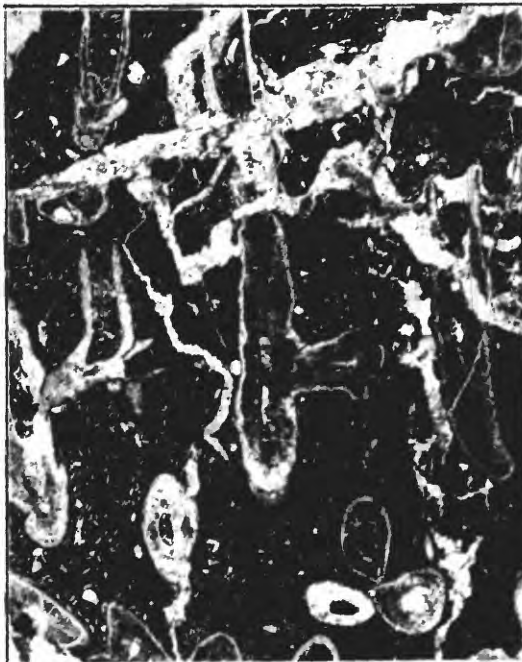


MULTITHECOPORA C

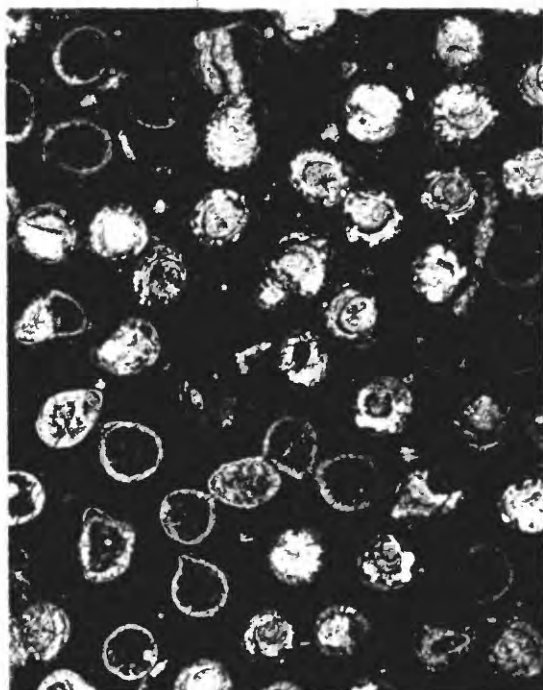


NEOSYRINGOPORA A

PENNSYLVANIAN (MISSOURIAN)

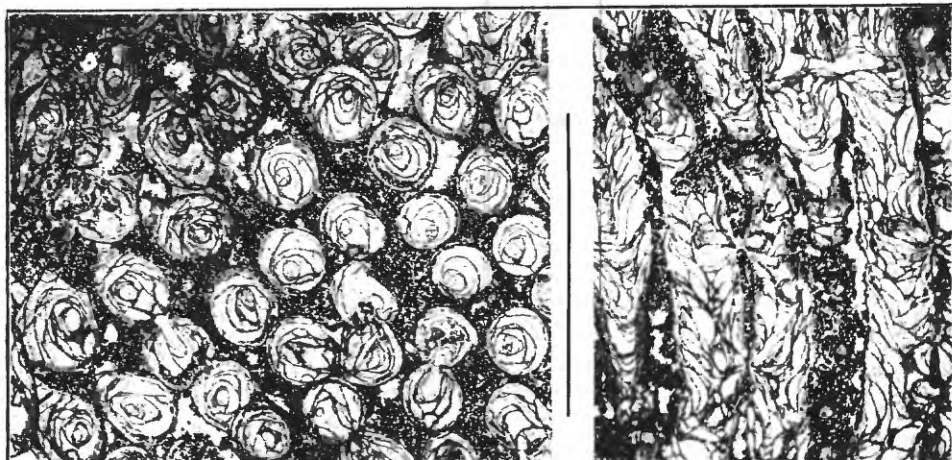


MULTITHECOPORA C

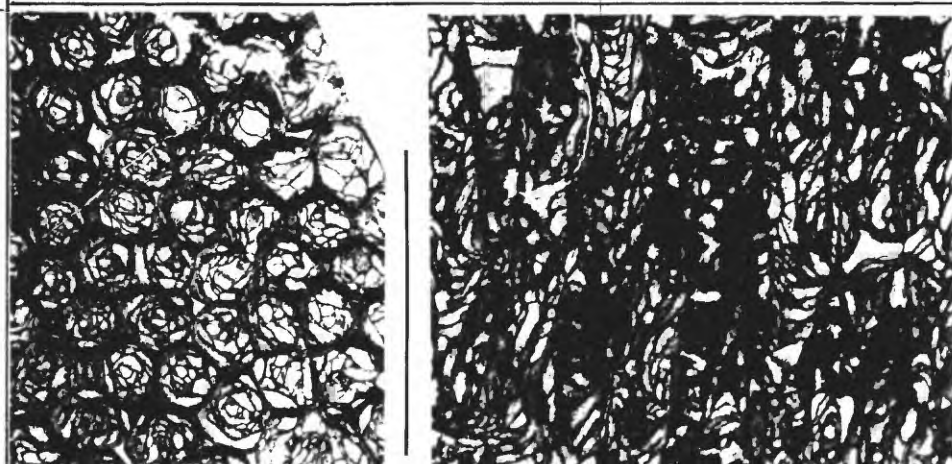


NEOMULTITHECOPORA A

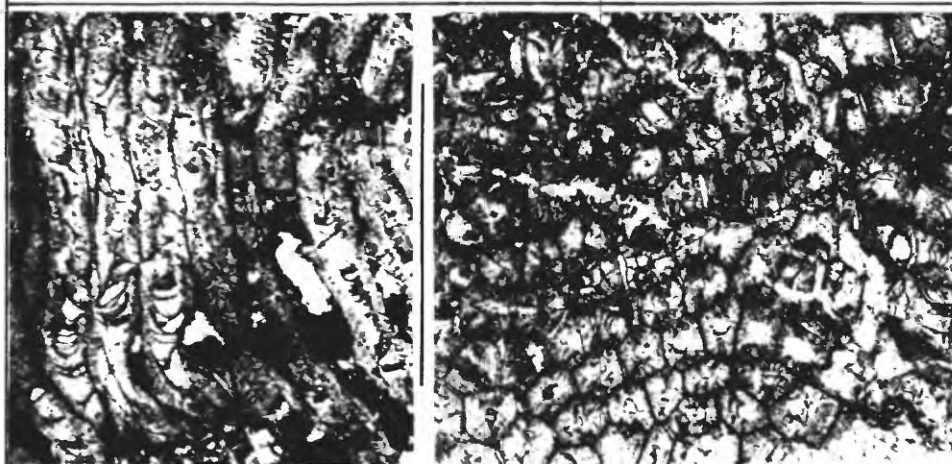
PENNSYLVANIAN (VIRGILIAN)



NEOSYRINGOPORA A



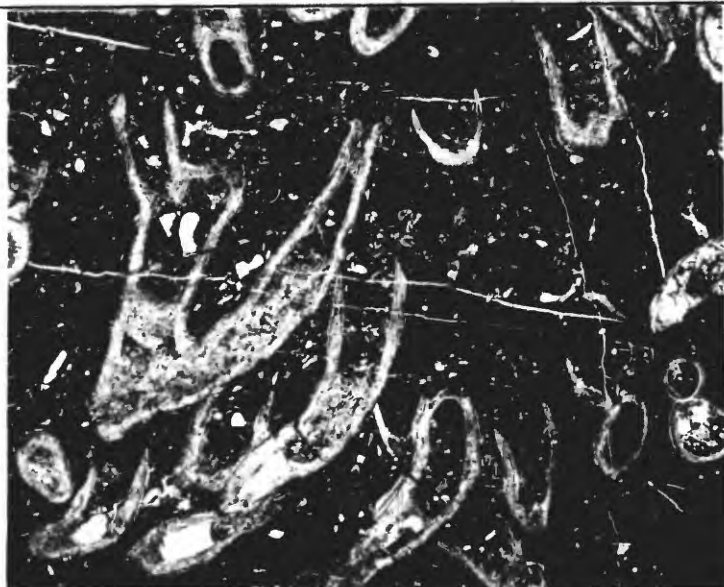
CORNWALLATIA A



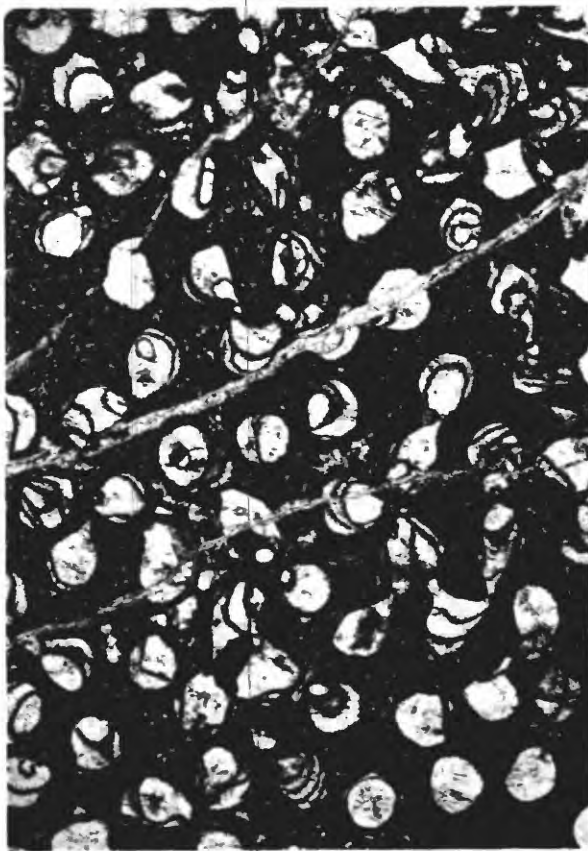
BAYHAIUM A

PENNSYLVANIAN (VIRGILIAN)

Plate 19

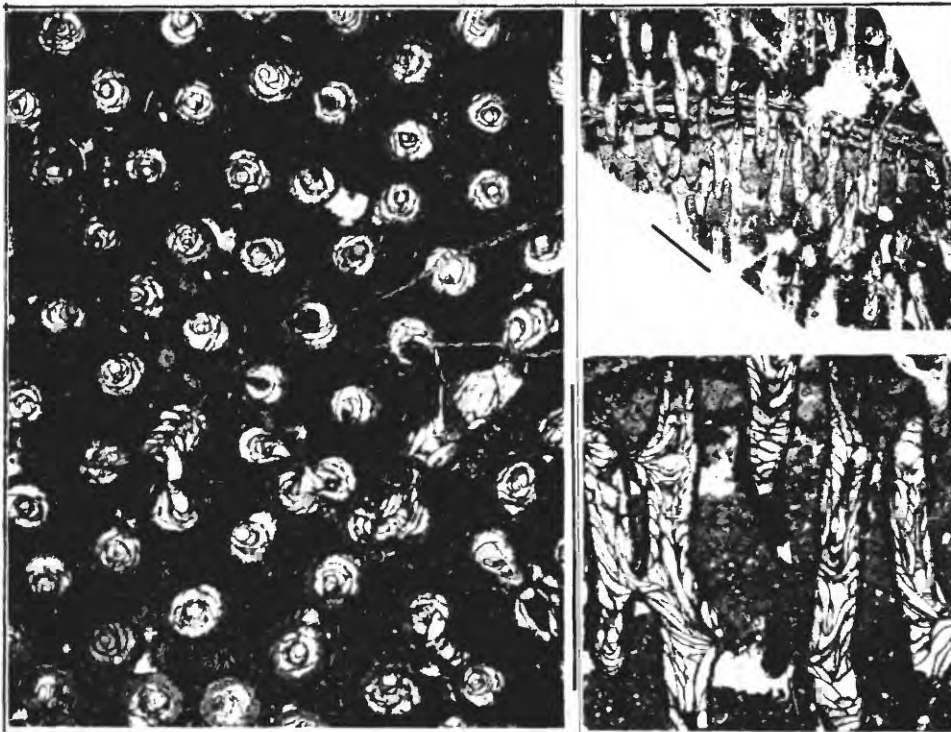


MULTITHECOPORA C

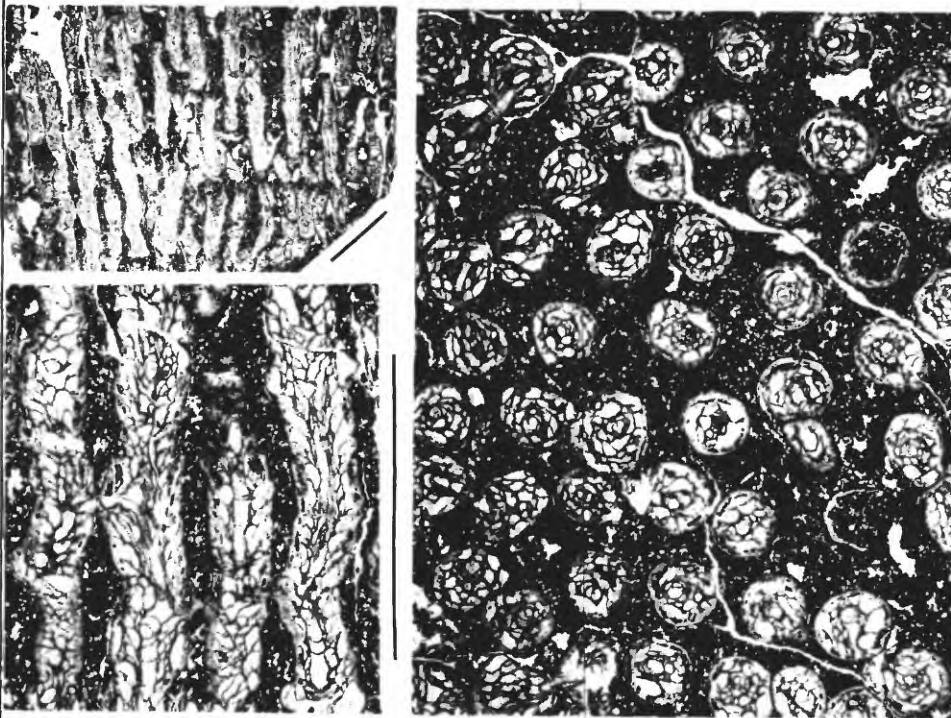


NEOMULTITHECOPORA C

LOWER PERMIAN (WOLFCAMPIAN)

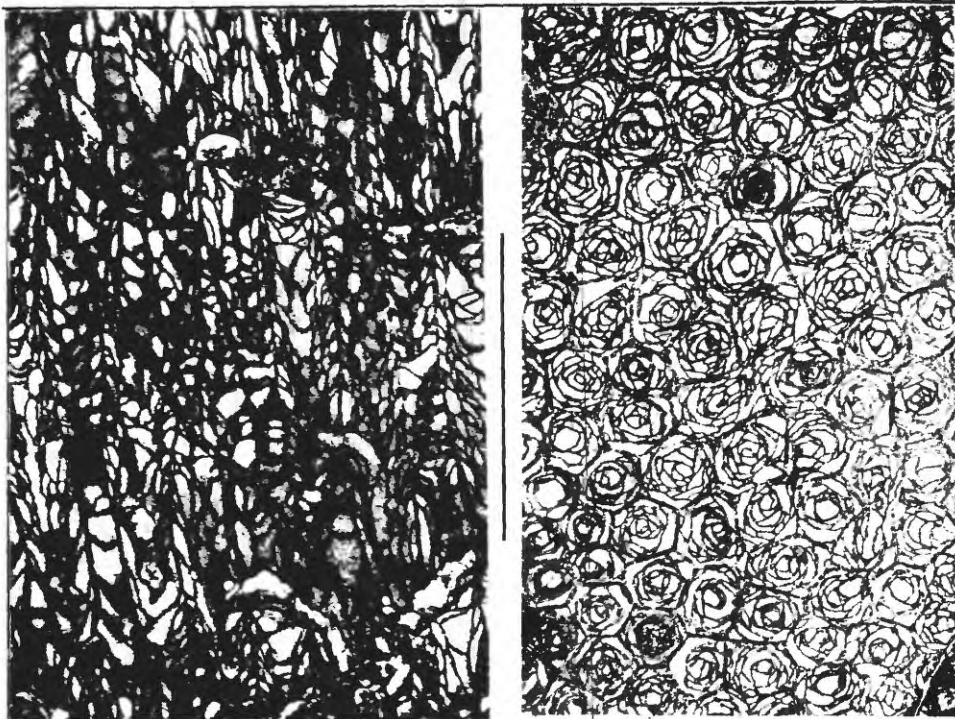


NEOSYRINGOPORA A

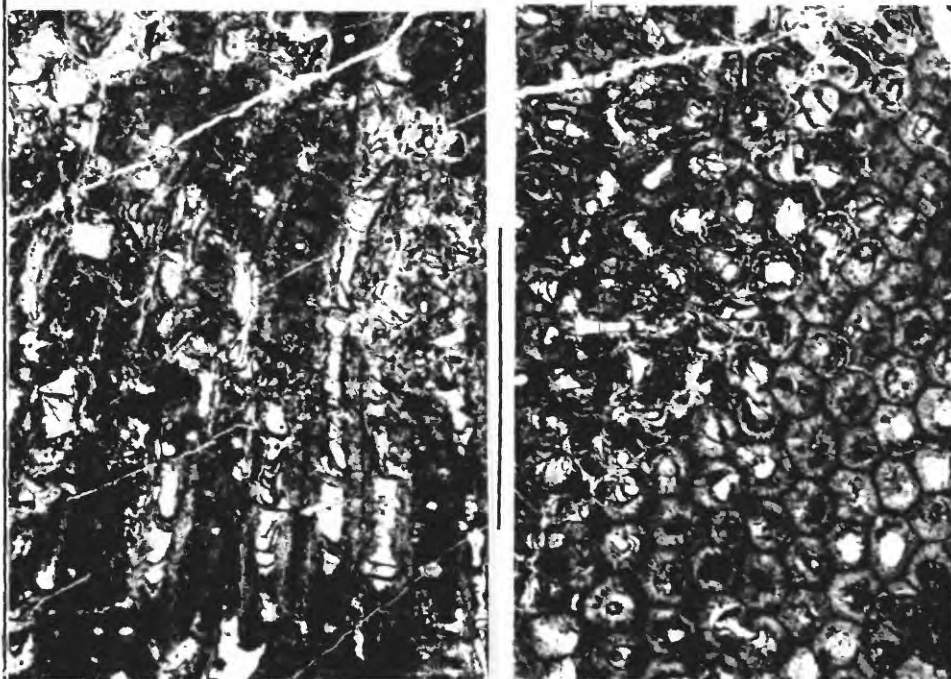


NEOSYRINGOPORA B

LOWER PERMIAN (WOLFCAMPIAN)



CORNWALLATIA B



BAYHAIUM A

LOWER PERMIAN (WOLFCAMPIAN)