CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

BULLETIN 42

BRYOZOA (MAINLY TREPOSTOMATA) FROM THE OTTAWA FORMATION (MIDDLE ORDOVICIAN) OF THE OTTAWA-ST. LAWRENCE LOWLAND

By

Madeleine A. Fritz

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
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PREFACE

In 1925 Dr. Alice E. Wilson commenced the study of the stratigraphy of the Palæozoic formations of the Ottawa-St. Lawrence Lowland, publishing her general findings in 1946 (Memoir 241, Geol. Surv., Canada). Many fossils were collected and the results of later studies were published in the following bulletins of the Geological Survey of Canada by Dr. Wilson: Bulletins Nos. 4, 8, 9, 11, 17, and 28, on Echinodermata, Brachiopoda, Trilobita, miscellaneous smaller groups, Gastropoda, and Pelecypoda, respectively.

A study of the Bryozoa was undertaken by Dr. Fritz of the University of Toronto and this bulletin by her is a part of the series.

George Hanson,
Director, Geological Survey of Canada

OTTAWA, October 29, 1956

Bryozoa (Mainly Trepostomata) from the Ottawa Formation (Middle Ordovician) of the Ottawa-St. Lawrence Lowland

INTRODUCTION

The material that has formed the basis of this study was derived from numerous localities in the Ottawa-St. Lawrence Lowland area. This area in Ordovician time seems to have been a well defined basin along the margin of the Appalachian geosyncline. The basin extends from the Precambrian Shield on the north to the Adirondacks in the south. It is limited on the west by the Frontenac axis, which passes from the Precambrian Shield to the west side of the Adirondack Mountains. On the east, it is limited by the Beauharnois anticline, which passes south from St. Jerome, Quebec, to the eastern edge of the Adirondacks.

OTTAWA FORMATION

The Ottawa formation, which gets its name from its development in the Ottawa Valley, is a relatively new stratigraphic term. This term was established by Dr. Alice E. Wilson (1938)[1] for a Middle Ordovician formation laid down in Black River-Trenton time, and its use is restricted to that part of the Lowland basin lying north of the Canada-United States boundary. This formation occupies an area of over 400 square miles in the central part of the Ottawa-St. Lawrence basin, and consists of approximately 700 feet of limestone with a minimum of shale and small amounts of sandstone towards the base. In the vicinity of the city of Ottawa three lithological phases are more or less definable. A lower phase consists of shale, some sandstone, impure limestone, and dolomite, a middle of pure, thick-bedded, crystalline limestone, and an upper of some shale and thin impure limestone giving place to thicker beds of a purer, more crystalline variety with shaly partings. Despite this possible threefold lithological sequence, these phases merge both vertically and laterally throughout the general area and much repetition of lithologic type occurs.

CONTACTS AND SUBDIVISIONS

No complete section of the Ottawa formation has been observed. The thickness noted above was determined from wells at Ottawa and Mont-

[1]Dates in parentheses are those of references cited in the Bibliography at the end of this report.

real. The lower contact is disconformable with the St. Martin, Rockcliffe, or Oxford formations. Northwest along the Ottawa River it may rest upon the Precambrian. The Eastview formation, lithologically different, lies above but the contact between the two has not been seen. The strata under consideration were formerly divided, on the basis of certain fossils, into two formations which were in turn subdivided into seven members as indicated in the following table.

TABLE I

Table of Stratigraphic Units

	Standard Section	Formation		Thickness Feet	Lithology
ORDOVICIAN	Collingwood	Eastview		20	Blackish limestone with some brownish shale at top
	Trenton	Ottawa	Cobourg Sherman Fall Hull Rockland	700	Chiefly limestone and dolomite with some sandstone and shale
	Black River		Leray Lowville Pamelia		
	Chazy	St. Martin		150	Limestone
		Rockcliffe		20	Grey, green shale; grey sandstone
	Beekmantown	Oxford		225	Grey limestone; blue-grey dolomite
		March		30	Grey calcareous sandstone; sandy blue-grey dolomite
Ordovician or Cambrian		Nepean		280	Coarse- to fine-grained, cream to yellow sandstone.

In addition to the faunal evidence the above members were originally based upon unreliable physical evidence obtained from isolated surface outcrops, including what now appear to be minor and frequently repeated differences in lithology. According to Wilson these palæontologically defined 'formations and members' do not correspond to the three roughly defined lithologic units, although from the base of the Pamelia to middle Lowville possibly represents the lower phase; from middle Lowville to the top of the Hull, the middle phase; and Sherman Fall and Cobourg, the upper phase.

With the exception of the Bryozoa, Dr. Wilson has studied in detail and reported upon all major fossil groups represented in the basin. Her conclusions indicate that although a few fossil types have a limited range within the formation, many of them range through a

number of so-called 'members'. The Bryozoa certainly corroborate this opinion. Upon the palæontological evidence, therefore, and in view of the apparent uniformity of the lithological sequence, there is much justification for assuming that the basin was one of continuous sedimentation during Middle Ordovician time, giving rise to a major formational unit in which 'faunal associations', rather than 'members', can be recognized.

PRESENT WORK

Bryozoa are among the most prolific fossil groups in the Middle Ordovician of North America, and the Ottawa limestone proves to be no exception. Up to now little attention has been given to the occurrence of this stratigraphically important phylum in the Ottawa formation. Only brief descriptions of a few isolated species have hitherto appeared. The chief contributions have been made by Nicholson (1881), Foord (1883), Ulrich (1889), and Wilson (1921).

The present study is based upon specimens contained in the extensive collections of the Geological Survey of Canada that have been acquired over a period of 60 years or more by various Survey officers. The most valuable material was found in the systematic collections made more recently by A. E. Wilson and G. Winston Sinclair. Several hundred thin sections have been prepared from this material in an effort to identify every possible species. As, however, it would be impractical to section every fragment in the collections, it follows that the list of species herein recorded, represents only a fraction of the complete fauna.

This investigation deals mainly with the Trepostomata which is by far the most abundant and stratigraphically important order of Bryozoa represented. A few Cyclostomata and Cryptostomata that were included in the collections have been identified (*see* Table II), and the new forms have been described in detail.

I am greatly indebted to Dr. Thomas E. Bolton for his valued assistance in the final preparation of the manuscript. Without his cooperation in arranging certain data, supervising the preparation of the photomicrographs, and his careful attention to many other important details, publication of the bulletin would have been greatly delayed.

FAUNAL ANALYSES

To date sixty-four forms have been recognized. Of these fifty-two belong to the Trepostomata, thirty of which are new; four belong to the Cyclostomata, three of which are new; and eight belong to the Cryptostomata, only one of which is new.

Table II represents the range of these species through the Ottawa formation, arranged alphabetically in their respective orders. In-

dicated, also, is the assumed thickness of the beds in which the recognized 'faunal associations' occur.

From this table it will be observed that a correlation is evident with the regions of Minnesota and the Baltic. In addition to the presence of hitherto well established species upon which the correlation is primarily based, the general assemblage of new species in the Ottawa formation bears a striking resemblance to still other characteristic species described from each of the above mentioned regions.

Despite the general similarity of the faunas it should be pointed out that the great differentiation of *Prasopora* species, so marked here and in Minnesota, is apparently absent in the Baltic province. Among the unique forms appearing in the present fauna is *Orbipora americana* n. sp. As far as the writer is aware this is the first record of the genus on the North American continent, although it is represented by several species in the Baltic.

A bryozoan fauna ranging in age from Middle to Upper Ordovician has been described by Troedsson (1929) from the Cape Calhoun formation of Northern Greenland which, in generic composition, resembles the Ottawa formation fauna. It includes *Amplexopora, Batostoma, Homotrypa, Monticulipora,* and *Nicholsonella.* Specifically, only *Homotrypa minnesotensis* Ulrich is common to both the Cape Calhoun and Ottawa formations, whereas several species are common to the Cape Calhoun and Middle-Upper Ordovician beds of central United States.

Recently, Loeblich (1942) described a bryozoan assemblage from the Ordovician Bromide formation of Oklahoma that is strikingly similar in general aspect but, as in the Ottawa basin, local speciation occurs. *Batostoma winchelli* Ulrich, *Dekayella praenuntia echinata* Ulrich, and *Rhinidictya mutabilis* (Ulrich) are common to both the Bromide and Ottawa formations. Liberty (1953 MS.), in a detailed investigation of the stratigraphy and palæontology of the Ordovician strata exposed west of the Frontenac axis in the Lake Simcoe district, central Ontario, recorded the presence of six of the species herein described as new, namely, *Dekayia typica, Hallopora dumalis magna, Hemiphragma shermanense, Mesotrypa angularis parvatrypa, Nicholsonella wilsonae,* and *Prasoporina semioculata.* In addition, some twenty species were found common to both central Ontario and the Ottawa basin. It is hoped that a detailed study of the Bryozoa of the entire area west of the Frontenac axis will be undertaken at a later date. Such a study would undoubtedly reveal many other species in common.

TABLE II

Range of Bryozoa

Species	Ottawa formation faunal beds							Minnesota		Baltic		
	75 ft. Pamelia	30 ft. Lowville	30 ft. Leray	35 ft. Rockland	80 ft. Hull	100 ft. Sherman Fall	340 ft. Cobourg	Decorah (chiefly)	Prosser (chiefly)	Jewe	Wassalem	Wesenberg
TREPOSTOMATA												
Amplexopora glengarria n. sp.	....	....	....	....	.....	X	X	.....	.....	....	....	....
A. glengarria shermanensis n. var.	....	....	....	....	.....	X	.....	.....	.....	....	....	....
Anaphragma delicatula n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
Aspidopora vacua n. sp.	....	....	....	....	.....	X	.....	.....	.....	....	....	....
Batostoma gallowayi n. sp.	....	....	....	....	.....	X	.....	.....	.....	....	....	....
B. winchelli (Ulrich)	....	X	X	X	.....	.....	.....	X	.....	X	....	X
B. winchelli spinulosum Ulrich	....	....	....	....	.....	X	.....	X	.....	....	X	....
Constellaria varia Ulrich	....	....	....	....	X	.....	.....	.....	X	X	X	....
Dekayella clavata n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
D. praenuntia alexandria n. var.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
D. praenuntia echinata Ulrich	....	....	....	....	.....	X	XX	X	.....	....	....	....
Dekayia typica n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
Dianulites rocklandensis Wilson	....	....	X	X	.....	.....	.....	.....	.....	....	....	....
Eridotrypa aedilis (Eichwald)	....	....	....	....	X	XX	.....	X	X	....	....	X
?*Eridotrypella ottawaensis* n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
?*E. prima* n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
Hallopora dumalis magna n. var.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
H. lydiana n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
H. multitabulata (Ulrich)	X	....	....	X	X	X	X	X	X	....	X	....
Hemiphragma crassicrenulatum n. sp.	....	....	....	....	.....	.....	XXX	.....	.....	....	....	....
H. ottawaense (Foord)	....	....	....	X	.....	.....	X	.....	.....	....	....	....
H. shermanense n. sp.	....	....	....	....	X(?)	X	.....	.....	.....	....	....	....
H. tenuimurale Ulrich	....	....	....	....	XX	XXX	XX	.....	X	....	X	....
Homotrypa lowvillensis n. sp.	....	X	X	....	.....	.....	.....	.....	.....	....	....	....
H. cf. *minnesotensis* Ulrich	....	....	X	....	.....	.....	.....	.....	.....	....	....	....
H. similis Foord	X	....	....	....	.....	X	X	.....	.....	....	....	....
Homotrypella hospitalis crassa (Ulrich)	....	X	X	....	.....	.....	.....	X	X	....	X	....
H. spicata n. sp.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
Mesotrypa angularis parvatrypa n. var.	....	....	....	....	.....	X	.....	.....	.....	....	....	....
M. obliqua n. sp.	....	....	X	....	.....	.....	.....	.....	.....	....	....	....
M. prolifica Fritz	....	....	....	....	.....	.....	X	.....	.....	....	....	....
M. whiteavesii (Nicholson)	....	....	....	....	X	X	X	.....	.....	....	....	....
Monticulipora arborea Ulrich	....	....	....	....	.....	X	.....	.....	X	....	....	....
M. bullata n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
?*M. cannonensis* Ulrich	....	....	....	....	.....	X	.....	.....	X	....	?X	....
M. loeblichi n. sp.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
Nicholsonella wilsonae n. sp.	....	....	X	X	.....	.....	.....	.....	.....	....	....	....
Orbignyella definita n. sp.	X	X	....	....	.....	.....	.....	.....	.....	....	....	....
Orbipora americana n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
Prasopora cf. *conoidea* Ulrich	....	....	....	....	X	.....	.....	X	.....	....	....	....
P. grandis (Ulrich)	X	....	....	X	.....	.....	.....	X	X	....	....	....
P. hybrida n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
P. insularis Ulrich	....	....	....	....	.....	X	.....	.....	.....	....	....	....
P. mesoporosa n. sp.	....	....	....	....	.....	X	.....	.....	.....	....	....	....
P. prismatica n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
P. similis n. sp.	....	....	....	X	.....	.....	.....	.....	.....	....	....	....
P. simulatrix orientalis Ulrich	X	....	X	....	XX	XX	XX	.....	X	....	....	....
P. sinclairi n. sp.	....	....	....	X	X	.....	.....	.....	.....	....	....	....
Prasoporina oculata (Foord)	....	....	....	....	.....	.....	X	.....	X	....	....	....
P. selwyni (Nicholson)	....	....	....	....	X	XX	.....	.....	X	....	....	....
P. semioculata n. sp.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
Stigmatella ottawaensis n. sp.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
CYCLOSTOMATA												
Ceramopora vesiculosa n. sp.	....	....	....	X	.....	.....	.....	.....	.....	....	....	....
Favositella laxata (Ulrich)	....	....	....	....	.....	.....	X	X	X	....	....	....
F. mammilata n. sp.	....	....	....	....	.....	.....	X	.....	.....	....	....	....
Fistulipora stewarti n. sp.	X	....	....	X	.....	.....	.....	.....	.....	....	....	....
CRYPTOSTOMATA												
Arthroclema pulchellum Billings	....	....	....	....	X	.....	X	.....	.....	....	....	....
Escharopora hogbeni Fritz	....	....	....	....	X	.....	.....	.....	.....	....	....	....
Graptodictya proava (Eichwald)	....	....	....	....	X	.....	.....	X	X	....	X	....
Nematopora various species	....	....	....	....	X	.....	.....	.....	X	....	....	....
Pachydictya acuta (Hall)	....	....	X	X	.....	.....	.....	.....	X	....	....	....
Phyllodictya hybrida n. sp.	....	....	....	....	X	.....	.....	.....	.....	....	....	....
Rhinidictya fidelis (Ulrich)	....	X	X	X	.....	.....	.....	X	.....	....	....	....
R. mutabilis (Ulrich)	....	....	X	....	.....	.....	.....	X	X	....	X	....

LOCALITIES

The following list comprises the localities from which the Bryozoa, treated in this paper, have been obtained.

Vicinity Ottawa

1. Road to Rockcliffe airport from Montreal road, Ottawa, Ontario (Leray-Rockland)
2. Cut on right side of former Ottawa Electric Railway, entering Rockcliffe Park, Ottawa, Ontario (Hull ?)
3. Cliff, National Research building, Sussex Street, Ottawa, Ontario (Cobourg)
4. MacKay Street, New Edinburgh, Ottawa, Ontario (Cobourg)
5. Nepean Point, southwest Sussex Street, Ottawa, Ontario (Cobourg)
6. At shore, Nepean Point, Ottawa, Ontario (Cobourg)
7. Wharf, Sussex Street, Ottawa, Ontario (Cobourg)
8. Dow's Lake (St. Louis dam), Ottawa, Ontario (Cobourg)
9. Cliff at west end of Sparks Street, Ottawa, Ontario (Cobourg)
10. Corner Preston and Balsam Streets, Ottawa, Ontario (Cobourg)
11. Corner Rochester and Lydia Streets, Ottawa, Ontario (Cobourg)
12. Old Limekiln, Rochesterville, Ottawa, Ontario (Cobourg)
13. Excavation, Mines Branch (Ore) building, Booth Street, Ottawa, Ontario (Cobourg)
14. Booth Street, Ottawa, Ontario (Cobourg)
15. Old quarry, Experimental Farm (now Records building), Ottawa, Ontario (Leray-Rockland)
16. Lakeside Park, east side of Dow's Lake, Ottawa, Ontario (Cobourg)
17. Lakeside Park, between Carling Avenue and Dow's Lake, Ottawa, Ontario (Cobourg)
18. Mechanicsville, Ottawa, Ontario (Lowville-Leray)
19. Base line, City View, Ontario (Leray)
20. Excavation on Clarendon Avenue, at sanatorium, Ottawa, Ontario (Pamelia-Lowville)
21. Fifth Avenue, Ottawa, Ontario (Cobourg)
22. Excavation on Ruskin Avenue, west of Holland Avenue, Ottawa, Ontario (Pamelia-Lowville)
23. Corner Young Street and Fairmont Avenue, Ottawa, Ontario (Rockland)
24. Merivale road, 1½ miles south of Carling Avenue, Ottawa, Ontario (Lowville-Leray)
25. Foster's quarry, Merivale road, Ottawa, Ontario (Leray)

Vicinity Hull

26. Axe factory quarry, Hull, Quebec (Hull or Sherman Fall)
27. Axe factory, Brewery Creek, Hull, Quebec (Sherman Fall)
28. Brewery Creek, Hull, Quebec (Hull or Sherman Fall)
29. Large quarry, east side of Brewery Creek, Hull, Quebec (Hull)
30. Brigham Creek, Hull, Quebec (Hull)
31. Cache Bay, west of Hull, Quebec (Hull or Sherman Fall)
32. Small island at foot of Hull Timber Slide, Hull, Quebec (Sherman Fall)
33. Cement Works, Hull, Quebec (Hull)
34. Quarry behind Health of Animals division, Wrightville, Quebec (Hull)
35. Cliff behind former Canada Match Company, Hull, Quebec (Hull or Sherman Fall)
36. Between the Canadian Pacific Railway tracks and the Armouries, Hull, Quebec (Hull)
37. Val Tetreau, Quebec (Leray-Rockland)
38. Railroad-cut at Val Tetreau, Quebec (Sherman Fall)

East and South of Ottawa

39. St. Laurent Blvd., road east of Notre Dame cemetery, Ottawa, Ontario (Cobourg)
40. One-half mile west of Green Creek, east of Ottawa, Ontario (Cobourg)
41. Powder Magazine quarry, north of the Montreal road, Ottawa, Ontario (Hull)
42. Navan road, 4,130 feet north of Blackburn road, Ontario (Cobourg)
43. Mille Roches quarries, Ontario (Leray)
44. Stewart quarry, lowest 10′, Rockland, Ontario (Pamelia-Lowville)
45. Loose blocks, Rockland, Ontario (Rockland)
46. Stewart quarry, Rockland, Ontario (Rockland)
47. East of Clarence Creek, Ontario (Sherman Fall)
48. Plantagenet, Ontario (Hull or Sherman Fall)
49. Castor River, about 1 mile east of Embrun, Ontario (Sherman Fall)
50. Small quarry on first farm south of river at Embrun, Ontario (Hull)
51. Castor River, Embrun, Ontario (Sherman Fall)
52. Small quarry west side of New York Central Railway tracks, about ½ mile south of river at Embrun, Ontario (Lowville)
53. Castor River, Embrun, Ontario (Rockland or Hull)
54. Castor River, Ontario (Leray to Sherman Fall)
55. Osnabruck tp., Ontario (Leray to Sherman Fall)
56. Payne River, 900′ east of Berwick road and south of bridge on road between cons. IV and V, Finch tp., Ontario (Sherman Fall)
57. Quarry 1½ miles west of Finch, Ontario (Sherman Fall)
58. Berwick, Ontario (Sherman Fall)
59. Old quarry south of St. Isidore de Prescott, Ontario (Cobourg)
60. ¾ mile south of Embrun, small cut south of main pit, Ontario (Rockland)
61. Lot 22, con. IV, Kenyon tp., Ontario (Cobourg)
62. Kenyon tp., Ontario (Cobourg)
63. Alexandria, Ontario (Cobourg)
64. Loose at intersection between con. IX and Indian Lands, Roxborough tp., Ontario (Cobourg)
65. Railroad-cut, lots 14 and 15, con. III, Roxborough tp., Ontario (Cobourg)
66. Con. I, Roxborough tp., where stream crosses road, east of Strathmore, Ontario (Sherman Fall)
67. West half lot 22, con. III, Roxborough tp., Ontario (Cobourg)
68. Lot 15, con. II, Roxborough tp., Ontario (Cobourg)
69. Con. IX, Charlottenburgh tp., second road north of Sandfield Mills (Cobourg)
70. McLaughlin farm, near Bonville, Ontario (Cobourg)
71. East half lot 21, con. VIII, Cornwall tp., Ontario (Cobourg)
72. East of Black River station, where Raisin River touches road, Ontario (Sherman Fall)
73. Farm 1 mile southeast of St. Andrew's, con. V, Cornwall tp., Ontario (Sherman Fall)
74. Ridge west of Grant Corner, less than ½ mile back from south road, con. IV, Cornwall tp., Ontario (Leray to Cobourg)
75. One mile east of Bouckhill, Ontario (Leray)
76. National Quarry Company east end Montreal Island, Quebec (Tetreauville) [not in Ottawa limestone]

West of Ottawa

77. Old quarry on right bank of river at Pakenham, Ontario (Leray-Rockland)
78. Eganville, Ontario (Leray)
79. Paquette Rapids, Ottawa River (Leray-Rockland)

South and West of Ottawa[1]

80. Picton, Ontario (Cobourg)
81. Five miles northwest of Picton, Ontario (Cobourg)
82. Two small quarries on either side of highway No. 14, 1 mile east of Chisholm, Ontario (Cobourg)

[1]West of the Frontenac Axis and, therefore, not in Ottawa limestone, strictly speaking.

DESCRIPTION OF SPECIES

Included in this section are detailed descriptions of all new species and varieties together with comments on other species identified. The arrangement is alphabetical. For a more detailed taxonomy the reader is referred to the "Treatise on Invertebrate Paleontology", Part G, Bryozoa, 1953.

Trepostomata

Amplexopora glengarria n. sp.

Plate I, figures 1, 2

External features. Zoarium massive branches up to 20 mm. in diameter; surface smooth.

Tangential section. Zooecia polygonal in outline, an average of six in 2 mm.; walls thin, line of demarcation between zooecia well marked; mesopores absent but a few young zooecia present; well-developed acanthopores occupy the angles of the zooecia for the most part, a few inflecting the apertures.

Vertical section. The most striking feature of these sections is the large number of diaphragms in both the axial and peripheral regions. In the former they are spaced from two to three tube diameters apart; in the latter they are much more crowded, three often occupying the space of one tube diameter; on the whole the diaphragms are straight, but oblique and sometimes curved forms may be observed. The zooecia approach the surface with a very gentle curve; the thin walls of the axial region thicken slightly towards the outer region; a few acanthopores may be seen in the zooecial walls.

Remarks. The manner of growth of *A. glengarria* resembles the Maysville form *A. ampla* U. & B., from Ohio, but the branches are larger; sections, also, resemble that species. A similarity is noted as well, particularly in sections, with *A. columbiana* U. & B. from the Lorraine of Tennessee, and with *A. cylindracea* U. & B. from the Catheys limestone of the Trenton at Nashville, Tennessee. The latter form is nearest the present species as to horizon but the cylindrical manner of growth is different and the diaphragms are less numerous in the axial region.

Occurrence. Sherman Fall beds, localities 27 and 57; Cobourg beds, locality 63.

Type. Holotype, G.S.C. No. 12399, Cobourg beds, Alexandria, Ontario.

Amplexopora glengarria shermanensis n. var.

Plate I, figures 3, 4

Amplexopora glengarria n. sp. was first noted in and described from the Cobourg horizon. The Sherman Fall representatives of the species compare very closely with those from the Cobourg. Sections studied show slightly thicker zooecial walls, more numerous, subangular zooecia, and generally a longer mature region. These features, however, are considered as constituting varietal differences rather than specific characters.

Occurrence. Sherman Fall beds, localities 57 and 72.

Type. Holotype, G.S.C. No. 12400; Sherman Fall beds, east of Black River Station, Ontario.

Anaphragma delicatula n. sp.

Plate II, figures 2, 5

External features. Zoarium ramose with frequent slender, subcylindrical branches, the diameter of which ranges from 2 mm. to 5 mm.; surface smooth.

Tangential section. Zooecia irregularly polygonal, both size and shape varying considerably but averaging six in 2 mm.; no distinct groups of larger or smaller tubes; smaller interstitial tubes occur which suggest young zooecia in various stages of development; walls moderately thin; integrate character well demonstrated; under high magnification line of demarcation appears rod-like, the zooecial wall on either side of the rod very finely laminate; small, seemingly imperforate, acanthopores sparingly developed.

Vertical section. Zooecial walls thin in axial region with considerable crenulation; diaphragms absent in axial region, one or two present in sub-mature zone; mature region very short; zooecial walls in mature region thicken appreciably and are less crenulated; zooecia bend sharply in the short mature region to open almost directly at the surface.

Remarks. This species resembles both the genotype *A. mirabile* U. & B. from rocks of Richmond age in the Mississippi Valley and equivalent strata in Russia, and *A. mirabile cognata* Bassler from the Middle Ordovician (Wassalem and Wesenberg) of the Baltic province. *A. mirabile* is a stouter form, with ill-defined maculae, and perforated acanthopores. *A. mirabile cognata,* smaller than the genotype though larger than the present form, has more crenulated zooecial walls in the axial region than either of the other two species mentioned. *Anaphragma* is known by relatively few species. It is of considerable interest, therefore, to record a further representative from a new locality and from still another horizon within the known stratigraphic range of the genus.

Occurrence. Tetreauville beds, locality 76.

Type. Holotype, G.S.C. No. 12401; Tetreauville beds, National Quarry Co., Montreal Island, Quebec.

Aspidopora vacua n. sp.

Plate II, figures 1, 4

External features. Zoarium a hollow, globular mass, 15 mm. by 10 mm. A small *Zygospira*-like brachiopod occupies a part of the central space, and the colony may have begun its growth around that object. The thickness of the growth is slightly over 1 mm.; surface smooth; apertures in places tend to open obliquely.

Tangential section. Zooecia subangular, thin walled, closely packed, touching on several sides; angular mesopores fill the intervening spaces; average zooecia measure eight in 2 mm. but indistinct groups of larger tubes are present; acanthopores absent.

Vertical section. Zooecia practically devoid of internal structures, an occasional cystiphragm may be present in the initial part where the tubes are recumbent but their presence is doubtful; mesopores, on the other hand, are closely packed with diaphragms.

Remarks. This species closely resembles internally *A. elegantula* Ulrich from the Galena shales of Minnesota. The hollow form of the zoarium, however, and the absence of the peculiar external configuration of that species are features that will serve to distinguish the two forms.

Occurrence. Sherman Fall beds, locality 38.

Type. Holotype, G.S.C. No. 12402, Sherman Fall beds, Val Tetreau, Quebec.

Batostoma gallowayi n. sp.

Plate II, figure 3; Plate III, figure 4

External features. Zoarium a small, sub-spherical mass with diameter approximating 11 mm.; surface covered with low rounded monticules equidistant about 2 mm. and composed of zooecia that do not vary greatly from the ordinary type.

Tangential section. Zooecia small, subangular, somewhat irregularly arranged, with an average of ten in 2 mm.; walls moderately thick, studded with acanthopores of various sizes, many of which indent the walls, thus rendering the zooecial apertures sub-petaloid; mesopores practically non-existent, only a few small tubes appear throughout the section.

Vertical section. Seen from this point of view the species is unique in that at least five mature and immature regions follow in rhythmical succession. It would appear that the colony was built up by means of a series of elevated disc-like units representing separate growth

stages. Each unit starts from an initial set of tubes, followed by a short immature region where the walls are thin and where diaphragms are either absent or widely spaced; mature region follows and may be distinguished by thicker walls and more closely arranged diaphragms, the latter often crowded; zooecia straight throughout their length and open directly to the surface; diaphragms straight for the most part but curved or oblique in places; acanthopores prominent.

Remarks. The shape of the zoarium distinguishes this form from other species of *Batostoma* known to me. In tangential section the species shows some resemblance to *B. winchelli spinulosum* Ulrich from the Middle Ordovician of Minnesota. In vertical section B. *gallowayi* is unique for the genus and if considered alone might be regarded as belonging to a separate genus. Until further material is available for study it seems preferable to include the species in the genus *Batostoma.*

Occurrence. Sherman Fall beds, locality 56.

Type. Holotype, G.S.C. No. 12403, Sherman Fall beds, Payne River, Finch tp., Ontario.

Batostoma winchelli (Ulrich)

Plate IV, figures 1-3

Amplexopora winchelli Ulrich, 14th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 91.

Batostoma winchelli Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 295, Pl. 26, figs. 33-37, Pl. 27, figs. 1-6.

Batostoma winchelli Loeblich, *J. Paleo.*, vol. 16, no. 4, 1942, p. 432, Pl. 64, figs. 8-10.

Examples of this species are not uncommon in the Lowville, Leray, and Rockland. The sections figured were taken from a Rockland specimen and are typical in all respects.

Occurrence. Lowville beds, locality 52; Leray beds, locality 75; Rockland beds, locality 46.

Type. Hypotype, G.S.C. No. 12404, Rockland beds, Stewart quarry, Rockland, Ontario.

Batostoma winchelli spinulosum Ulrich

Plate III, figures 1, 2

Batostoma winchelli var. *spinulosum* Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 295, Pl. 26, fig. 35.

This variety was identified from the Sherman Fall. It may be clearly distinguished from the typical species as will be seen by comparing the above figures with those of *B. winchelli.* This variety is associated with *Mesotrypa angularis parvatrypa.*

Occurrence. Sherman Fall beds, locality 72.

Type. Hypotype, G.S.C. No. 12405, Sherman Fall beds, east of Black River, Ontario.

Constellaria varia Ulrich

Plate V, figures 4, 5

Constellaria varia Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 311, Pl. 21, figs. 1-7.

Only one small fragment of this species has been identified. Fortunately the specimen is well preserved and thin sections leave little doubt as to the accuracy of the determination. The horizon represented is Hull.

Occurrence. Hull beds, locality 50.

Types. Hypotype, G.S.C. No. 12406, Hull beds, quarry south of river at Embrun, Ontario.

Dekayella clavata n. sp.

Plate V, figures 2, 3

External features. Five examples of this species have been identified from a single locality. The specimens which are small and club-like may represent only the basal part of the zoarium. The best of these specimens, selected as the holotype, is 15 mm. long, 5 mm. wide at the distal end, narrowing to 3 mm. at the proximal extremity; the latter may represent the point of attachment; surface with monticules, prominent but widely spaced.

Tangential section. Zooecia subpolygonal, nine in 2 mm., walls moderately thick, heterotrypid character well marked; mesopores very few; a larger set of acanthopores prominent and hollow, often projecting into the zooecia; a smaller set fewer in number, situated usually in the angles of the tubes.

Vertical section. Zooecial walls thin and slightly crenulate in axial region; walls thicken considerably and abruptly in mature region where they appear distinctly bead-like; zooecia bend gradually in mature region and open directly to surface; larger set of acanthopores appear to originate in the sub-mature region; they are coarse, rigid, spike-like structures well developed throughout the entire mature region where they may be seen cutting obliquely across the zooecia; diaphragms practically absent in axial tubes, irregularly developed in mature region, where they are straight or oblique and spaced a tube diameter or less apart.

Remarks. This species may be distinguished by the club-shaped, monticuled zoarium, and by the very prominent acanthopores. In regard to the latter feature it might be compared with *D. praenuntia echinata* but, in other respects, the two species show little specific likeness.

Occurrence. Cobourg beds, locality 61.

Type. Holotype, G.S.C. No. 12407, Cobourg beds, lot 22, con. IV, Kenyon tp., Ontario.

Dekayella praenuntia alexandria n. var.

Plate VI, figures 3, 5

External features. Zoarium ramose, branches cylindrical to flattened, from 5 mm. to 15 mm. in diameter; surface with small monticules, spaced 4 mm. apart measuring from centre to centre, and composed of larger zooecia than the ordinary.

Tangential section. Zooecial apertures faintly angular or rounded; walls stout and minutely spinulose; clear line of demarcation between zooecia well marked; zooecia irregular in size and form, those in the monticules measure six in 2 mm. while an average among the ordinary zooecia is eight in 2 mm.; mesopores rare; two sets of acanthopores present but neither are numerous nor conspicuous, and they only slightly inflect the walls.

Vertical section. Walls thin and often crenulated in axial region; zooecia bend gradually to surface where the walls thicken and assume a beaded appearance; diaphragms sparingly developed in axial part but towards the periphery they are from one to two tube diameters apart; acanthopores are not obvious in these sections.

Remarks. This variety most closely resembles the variety *D. praenuntia simplex* from the Decorah and the Wassalem beds. The most conspicuous difference is the monticuled surface.

Occurrence. Cobourg beds, localities 13, 63.

Type. Holotype, G.S.C. No. 12408, Cobourg beds, Alexandria, Ontario.

Dekayella praenuntia echinata Ulrich

Plate VI, figures 1, 2

Dekayella praenuntia var. *echinata* Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 271, Pl. 23, figs. 32-38.

Dekayella praenuntia var. *echinata* Loeblich, *J. Paleo.*, vol. 16, no. 4, 1942, p. 426, Pl. 63, figs. 12-14.

This variety is not uncommon in collections from the city of Ottawa. One very striking feature is the remarkable development of both sets of acanthopores which inflect the zooecia to a marked degree. These structures are perhaps even more conspicuous than in Ulrich's Minnesota examples. Diaphragms, too, are very numerous in the mature regions and somewhat irregular, forming in places almost a vesicular mass. These features, however, do not seem of sufficient significance to warrant the establishment of a separate variety. It

should be pointed out, however, that the typical variety is usually considered to mark a lower horizon in the Trenton than Cobourg and Sherman Fall.

Occurrence. Sherman Fall beds, localities 38, 47, 48, 49; Cobourg beds, locality 3.

Type. Hypotype, G.S.C. No. 12409, Cobourg beds, cliff National Research building, Ottawa, Ontario.

Dekayia typica n. sp.

Plate VII, figures 1, 2

External features. Zoarium ramose, branches cylindrical, 5 mm. in diameter, monticules present but not conspicuous.

Tangential section. Zooecia polygonal, irregular in size and shape, nine in 2 mm.; walls fairly thick; mesopores very few; hollow acanthopores conspicuous, situated in angles of tubes but not usually inflecting zooecia.

Vertical section. Zooecial walls in axial region thin and crenulated, practically no diaphragms in zooecia in that region; zooecia turn rather abruptly as they approach the mature region and open a little obliquely to surface; walls thicken appreciably and continue crenulate throughout mature region where they appear slightly moniliform; diaphragms a tube diameter apart in sub-mature and early mature region but are seemingly absent later; acanthopores noticeable elements in mature region where they parallel the walls and appear as rigid hollow rods.

Remarks. Examples of the genus *Dekayia* are not common in the Middle Ordovician, it being more characteristic of the Upper Ordovician. The discovery of a typical species in the Cobourg beds is, therefore, of some significance.

Occurrence. Cobourg beds, locality 3.

Type. Holotype, G.S.C. No. 12410, Cobourg beds, cliff National Research building, Ottawa, Ontario.

Dianulites rocklandensis Wilson

Dianulites rocklandensis Wilson, Geol. Surv., Canada, Bull. 33, Geological Series No. 40, 1921, p. 47, Pl. II, figs. 1, 2.

Numerous sections prepared for this study so closely resemble those figured by Wilson that it seemed unnecessary to photograph them, especially since the specimens are so crystallized that the structures are not easily detected. The species is a splendid horizon marker, more numerous in the Rockland beds than the Leray.

Occurrence. Leray beds, localities 18, 19; Rockland beds, localities 46, 77.

Eridotrypa aedilis (Eichwald)

Plate VI, figure 4; Plate VII, figures 4, 5

Cladopora aedilis Eichwald, Bull. Soc. Naturalists Moscow, No. 4, 1855, p. 457.
Eridotrypa aedilis Bassler, Bull. U.S. Nat. Mus., 77, 1911, p. 242, Pl. 4, figs. 5, 5a; figs. 137, 138.
Eridotrypa mutabilis Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 265, Pl. 26, figs. 20-32.

No comments are necessary with regard to this species (syn. *E. mutabilis* Ulrich) as the specimens identified are characteristic in every respect.

Occurrence. Hull beds, locality 30; Sherman Fall beds, localities 26, 27, 35.

Type. Hypotype, G.S.C. No. 12411, Sherman Fall beds, axe factory quarry, Hull, Quebec.

?*Eridotrypella ottawaensis* n. sp.

Plate VII, figure 3; Plate VIII, figure 1

External features. Zoarium discoidal, best preserved specimen 20 mm. in diameter, 8 mm. thick. On the deeply concave under surface of this fossil a fragment of a *Rafinesquina* shell may indicate an incrusting habit for this particular specimen. Two other examples, however, of the species, which appear to be free, are present in the collection. One of the latter exhibits a wrinkled epitheca. A few irregularly disposed, conspicuous monticules occur; these structures appear more as crater-like excrescences than typical monticules, their centres being depressed.

Tangential section. Zooecia polygonal, ordinarily nine in 2 mm.; walls thin, heterotrypid, and minutely granular; mesopores few; well marked hollow acanthopores in angles, some slightly inflect zooecia. Two monticules 4 mm. apart, measuring from centre to centre, appear in one of the type sections. The depressed centres of these monticules appear now to be devoid of structure but there is some indication that they were originally occupied by polygonal plates. The distinct, circular monticular rim shows two cycles of polygonal tubes, the inner of which appears to be smaller than the outer.

Vertical section. Zooecial walls moderately thin, slightly crenulated and periodically thickened; where the section passes through the walls, minute granulation obvious; diaphragms remote on the whole but at intervals several may be observed, spaced apart a distance equivalent to one or two tube diameters; prominent acanthopores, ranging through immature and mature regions, well developed at intervals; hollow and laminated in character, they are usually closely associated with the zooecial walls.

Remarks. When the species was first examined I failed to observe the granular nature of the wall and believed it formed a link between *Cyphotrypa* and *Stigmatella.* The granular wall structure, however, suggests the genus *Eridotrypella.* This species may be distinguished from ?*Eridotrypella prima,* described in this report from the Cobourg, by the discoidal rather than branching zoarium, by the presence of crater-like monticules, and by the detail of internal structure.

Occurrence. Cobourg beds, localities 11, 42, 64.

Type. Holotype, G.S.C. No. 12412, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

?*Eridotrypella prima* n. sp.

Plate VIII, figures 2, 4

External features. Zoarium ramose, cylindrical branches, 7 to 10 mm. in diameter; surface smooth; inconspicuous maculae present composed of zooecia considerably larger than the average.

Tangential section. Zooecia polygonal, mostly pentagonal or hexagonal in outline, eight or nine of the ordinary zooecia in 2 mm.; maculae show much larger zooecia among which young zooecia or mesopores are interspersed; wall structure heterotrypid-amalgamate; transverse rows of granules well defined; apertures lined with a well marked deposit of laminated tissue, the latter rendering the zooecia somewhat infundibuliform; hollow acanthopores of considerable size are developed here and there throughout the sections, usually situated in the angles of the tubes, occasionally slightly inflecting the walls.

Vertical section. Walls thin and crenulated in axial region where diaphragms are remote; zooecia bend slightly towards mature zone and open a little obliquely to the surface; walls irregularly thickened and laminated in mature region; diaphragms congregated in submature and early mature regions, absent in peripheral zone, horizontal for the most part but some oblique, becoming thicker as they approach the outermost part of the tubes; where the section cuts across a wall the finely granulate character of the wall is clearly observed; an occasional acanthopore may be seen which has its origin in the early mature region.

Remarks. One might consider this species as an *Eridotrypa* with heterotrypid wall structure and with transverse rows of granules. As such it fits perfectly in Duncan's genus *Eridotrypella* (1939, p. 210). *Eridotrypella,* however, has no diaphragms in the axial region, whereas ?*E. prima* has a few. It is with some hesitation that this new species is assigned to the genus *Eridotrypella* in view of the fact that to date no representatives of that genus have been reported from strata older than the Devonian.

Occurrence. Cobourg beds, localities 3, 9.

Type. Holotype, G.S.C. No. 12413, Cobourg beds, cliff at west end of Sparks Street, Ottawa, Ontario.

Hallopora dumalis magna n. var.

Plate X, figures 3, 5

This variety agrees very closely in its internal structure with *Hallopora dumalis* Ulrich from the "upper third of the Trenton shales" (Ion member) of Minnesota. It differs, however, in its larger growth, the branches having a diameter of 5 mm. as opposed to 1.5 mm. in the species.

Occurrence. Hull beds, locality 41.

Type. Holotype, G.S.C. No. 12414, Hull beds, Powder Magazine quarry, north of Montreal Road, Ottawa, Ontario.

Hallopora lydiana n. sp.

Plate X, figures 1, 4

External features. Zoarium ramose consisting of cylindrical branches 5 to 10 mm. in diameter, smooth or slightly monticulose.

Tangential section. Zooecia polygonal, hexagonal and pentagonal for the most part, direct and in contact with each other usually on all sides, six to seven in 2 mm. ordinarily, five to six in 2 mm. in the monticules, the latter being spaced 3 mm. apart from centre to centre; black line of demarcation between zooecia very well marked; zooecial walls thick for *Hallopora;* mesopores practically absent in sections taken from the larger specimens, very rare in the smaller examples.

Vertical section. Walls very thin in axial region where diaphragms are regularly developed, one tube diameter apart throughout the whole region; mature region comparatively long; walls distinctly thickened; diaphragms increase in number in mature region where as many as six, or even more, may be counted in a distance equal to the width of a tube; many of the diaphragms horizontal but some cystose, the latter tending to form almost a vesicular tissue in places; mesopores may or may not be present in the submature zone, when present however, they are closely tabulated.

Remarks. This species belongs definitely to that section of the genus which includes *H. multitabulata, H. ampla,* and *H. splendens,* thus reflecting a slightly older fauna than might be expected to occur at the present horizon. Its large zooecia, thick walls, lack of mesopores, and cystose diaphragms are features that peculiarly combine to distinguish it from others in the group.

Occurrence. Cobourg beds, localities 5, 11.

Type. Holotype, G.S.C. No. 12415, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Hallopora multitabulata (Ulrich)

Plate XI, figures 1-4

Monotrypella multitabulata Ulrich, 14th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 100.
Callopora multitabulata Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 280, Pl. 23, figs. 11, 12, 16, 17, 24-26, 30, 31.
Hallopora multitabulata Bassler, Bull. U.S. Nat. Mus., 77, 1911, p. 326, fig. 202.

This species has been identified from among a group of specimens containing in addition the new species *Hallopora lydiana* described above. *H. multitabulata* is characteristic of the Black River and Lower Trenton. The presence of this species in the Cobourg formation is still further evidence of the survival of older forms in the Ottawa basin.

Occurrence. Pamelia-Lowville beds, locality 44; Rockland beds, locality 60; Hull beds, locality 50; Sherman Fall beds, locality 57; Cobourg beds, localities 5, 11.

Type. Hypotypes, G.S.C. No. 12416, Rockland beds, ¾ mile south of Embrun, Ontario; No. 12417, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Hemiphragma crassicrenulatum n. sp.

Plate XII, figures 4, 5

External features. Zoarium consists of small rounded subspherical or subpyriform masses that range in diameter from 7 mm. to 30 mm.; surface smooth but clusters of large zooecia forming maculae occur at intervals of 5 mm.

Tangential section. Zooecia polygonal, direct, thin walled, seemingly in contact, five and one-half to six of the ordinary type in 2 mm., four occupy the same space in the maculae; mesopores few, sometimes wanting; acanthopores absent.

Vertical section. Zooecial walls thin throughout, showing here and there considerable coarse crenulation or waviness; an occasional small beaded tube with straight diaphragms may be present either at the surface or deeper in the section; diaphragms and hemiphragms are sparingly developed within the zooecia, commonly grouped more closely in zones representing colonial growth stages; diaphragms may be straight, oblique, concave, or convex; hemiphragms, likewise, assume various attitudes.

Remarks. This species, which is the commonest form met with in the Cobourg collections, has its closest ally in *H. subsphericum* Bassler (1911, p. 292), from Wesenberg limestone at Wesenberg in Esthonia. Bassler described his species as growing in irregular subspherical masses that may attain a diameter of 5 or 6 cm. In this respect *H. crassicrenulatum* differs materially as the spherical zoaria of this

prolific species are constantly smaller and are not known to exceed 30 mm. in diameter, the larger specimens of which appear to be mature colonies. The zooecia of the present species also are somewhat smaller than *H. subsphericum* and their walls in vertical section display a coarser crenulation. Furthermore, small beaded mesopores with straight diaphragms are occasionally present. The marked similarity of these two species, from two such widely separated areas and from strata that may be homotaxially compared, is of considerable significance. This new species has been identified also in recent Cobourg collections from the Georgian Bay region.

Occurrence. Cobourg beds, localities 12, 14, 16, 17, 39, 40, 65, 67, 69, 70, 71, 80, 81, 82.

Type. Holotype, G.S.C. No. 12418, Cobourg beds, ½ mile west of Green Creek, east of Ottawa, Ontario.

Hemiphragma ottawaense (Foord)

Plate X, figure 2; Plate XII, figures 1-3

Batostoma Ottawaense Foord, Contr. Micro-Palæo. Cambro-Sil., 1883, p. 18, Pl. 2, figs. 1-1f.
Hemiphragma ottawaense Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 300, Pl. 24, figs. 1-4.

Good sections of this species have been obtained from a specimen found in an excavation on Booth Street, Ottawa. They agree in all respects with those of the type collected from the Black River at Paquette Rapids, Ontario. The species has been recorded, however, by the original author from the Upper beds of the Trenton at Ottawa (Foord, 1883, p. 19). Bassler (1911) states that the species is present in the lowest Trenton of Canada. This species, therefore, apparently ranges throughout Black River and Trenton formations.

Occurrence. Leray-Rockland beds, locality 79; Cobourg beds, locality 13.

Type. Hypotypes, G.S.C. No. 12420, Leray-Rockland beds, Paquette Rapids, Ottawa River; G.S.C. No. 12419, Cobourg beds, Ore building excavation, Booth Street, Ottawa, Ontario.

Hemiphragma shermanense n. sp.

Plate XIII, figures 2, 4

External features. Zoarium consisting of smooth, cylindrical, frequently dividing branches, varying in size from 5 to 10 mm.

Tangential section. Zooecia subangular, about six in 2 mm.; walls of medium thickness; well marked acanthopores sparingly developed in the angles of the tubes, sometimes inflecting the walls.

Vertical section. Zooecial walls thin in axial part, some distinctly

crenulated. As the zooecia curve gradually to the surface, where they open directly, the walls thicken appreciably; complete diaphragms very scarce in the axial region but numerous in the mature region, being spaced about half a tube diameter apart; hemiphragms interspersed among the complete diaphragms in the peripheral zone but not numerous; mesopores, or more likely young zooecia, in this zone; complete diaphragms, of about the same frequency as noted in the regular zooecia, characterize these tubes.

Remarks. This species may be compared with *H. tenuimurale* Ulrich from which it differs chiefly in the possession of fewer hemiphragms and more abundant diaphragms, in having thicker zooecial walls in the mature region, and in the presence of acanthopores.

Occurrence. Hull or Sherman Fall beds, locality 35; Sherman Fall beds, locality 27.

Type. Holotype, G.S.C. No. 12421, Hull or Sherman Fall beds, cliff behind Canada Match Company, Hull, Quebec.

Hemiphragma tenuimurale Ulrich

Plate XIII, figures 3, 5

Hemiphragma tenuimurale Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 301, Pl. 24, figs. 20-23.

This species has been identified with certainty at a number of localities, at each of which it is abundantly developed. In the Sherman Fall it constitutes a distinct horizon marker. The only significant difference to be noted is that the branches reach a larger diameter than that given in the original description; 6 to 10 mm. are typical but in the present forms they range from 4 to 15 mm. This species is common in the Lower Trenton of Minnesota and Iowa, and is recorded also from one of the Wassalem beds at Uxnorm, Esthonia.

In the Cobourg beds a form of *H. tenuimurale* occurs which differs slightly from the typical species recorded from the Hull and Sherman Fall. This apparent variety is described as follows:

External features. Zoarium consisting of smooth branches 5 mm. to 10 mm. in diameter; groups of zooecia larger than the ordinary observed.

Tangential section. Ordinary zooecia subpolygonal, six in 2 mm.; mesopores few to rather numerous; walls relatively thick, granular, laminate; true acanthopores appear to be absent.

Vertical section. Zooecial walls in the axial region thin, rather coarsely crenulate; diaphragms remote; zooecia curve gradually to the surface where they open somewhat obliquely; walls thicken appreciably in comparatively long mature region where diaphragms and hemiphragms are abundant; mesopores somewhat beaded.

Occurrence. Hull beds, locality 31; Sherman Fall beds, localities 26, 28, 35, 38, 49, 54; Cobourg beds, localities 5, 8, 11, 63.

Type. Hypotype, G.S.C. No. 12422, Sherman Fall beds, Brewery Creek, Hull, Quebec.

Homotrypa lowvillensis n. sp.

Plate XIII, figure 1; Plate XIV, figure 3

External features. Zoarium consisting of cylindrical branches from 3 to 5 mm. in diameter; surface smooth but with maculae made up of large cells.

Tangential section. Zooecia subangular, seven to eight of the ordinary type in 2 mm., six in the same space in the maculae; walls relatively thick and laminated; acanthopores, if present, obscure; few round cystiphragms present, not extending far beyond the walls.

Vertical section. Zooecia with thin, slightly crenulated walls in axial region; thicker walls in the short mature region, where the zooecia curve gently, opening somewhat obliquely to surface; diaphragms apparently absent in the axial, sparingly developed in the submature region, and continuing to the surface; few well marked 'homotrypid' cystiphragms present in outer part.

Remarks. This species may be distinguished from the associated *H. similis* by its short, mature region, where zooecial walls show lamination; by possessing very few but clearly marked cystiphragms in outer region; and by its poorly developed acanthopores. Several other examples of *Homotrypa* were found in the Leray but the sections could not be specifically identified. They resembled *H. lowvillensis* which is likely a fairly common species at the recorded horizons.

Occurrence. Lowville beds, locality 52; Leray beds, locality 24.

Type. Holotype, G.S.C. No. 12423, Lowville beds, about ½ mile south of river at Embrun, Ontario.

Homotrypa cf. *minnesotensis* Ulrich

Plate XIV, figures 1, 2

Homotrypa minnesotensis Ulrich, 14th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 79.

Homotrypa minnesotensis Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 235, Pl. 19, figs. 1-9.

Sections of a specimen from the Leray beds agree in most of the essentials with this species. The zooecia in the mature region, however, open less obliquely to the surface, their walls appearing to be thicker.

Occurrence. Leray beds, locality 24.

Type. Hypotype, G.S.C. No. 12424, Leray beds, corner Young Street and Fairmont Avenue, Ottawa, Ontario.

Homotrypa similis Foord

Plate XIV, figures 4, 5

Homotrypa similis Foord, Contr. Micro-Palæo. Cambro-Sil., 1883, p. 10, Pl. 2, figs. 2-2d.

This species, described originally from the Lower Trenton of Ottawa city (Foord, 1883, p. 10), has been identified in the present collections at a somewhat higher horizon. The only difference noted in the sections prepared from this material is that the acanthopores appear to be larger and more pronounced than those figured by the author of the species.

Occurrence. Pamelia beds, locality 20; Sherman Fall beds, locality 55; Cobourg beds, localities 3, 11, 14.

Type. Hypotype, G.S.C. No. 12425, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Homotrypella hospitalis crassa (Ulrich)

Plate XV, figures 3, 4

Atactoporella crassa Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 225, Pl. 15, figs. 18-21.

Homotrypella hospitalis crassa Bassler, Bull. U.S. Nat. Mus., 77, 1911, p. 193, figs. 104, 105.

Homotrypella hospitalis (Nicholson) is a common and widespread Upper Ordovician (Richmond) fossil. Ulrich's variety *crassa* is characteristic of the Middle Ordovician of Minnesota and of the Wassalem beds in the Baltic area. Actually the variety differs but slightly from the species. It would appear to have more crowded diaphragms and cystiphragms, and possibly fewer acanthopores but even these characteristics may vary. However, the lower horizon occupied by the variety has seemed in the past sufficient reason to justify its existence. Finding it now well developed in the Lowville-Leray of the Ottawa basin increases its value as an index fossil. It is interesting to note the occurrence in the Black River-Trenton and in the Richmond of two such closely related forms without any definite connecting links in intervening strata. This is another example of faunal similarities of these formations.

Occurrence. Lowville beds, locality 52; Leray beds, locality 18.

Type. Hypotype, G.S.C. No. 12426, Leray beds, Mechanicsville, Ottawa, Ontario.

Homotrypella spicata n. sp.

Plate XV, figures 1, 2

External features. Zoarium a small rounded mass 6 mm. across and 4 mm. thick, appearing to start its growth on a foreign object. Under

strong hand lens, surface appears finely spinulose owing to presence of numerous, strong acanthopores. Neither monticules nor maculae present. Only one specimen observed.

Tangential section. Zooecia small, subpolygonal, and irregular in shape, at least ten in 2 mm.; walls thick; acanthopores prominent, numerous, at time inflecting the walls; cystiphragms seen within the tubes but not numerous owing to fact that they are, for the most part, developed in the immature region; mesopores very few.

Vertical section. Three distinct superimposed growth stages represented; walls thin to begin with, thicken appreciably with age; in the oldest growth stage observed cystiphragms developed to a greater extent than in the later growths; for the most part, they line one side of the zooecia being more common in the immature part; diaphragms present as well but irregularly distributed; in the latest of the colonial growths diaphragms are the most obvious endozooecial structures; acanthopores extremely numerous, appearing as spikes within the walls.

Remarks. This is a unique little form which may be readily distinguished from other species of the genus. It might be compared with *H. hospitalis crassa* (Ulrich), in fact, it could be regarded as somewhat of a miniature of that variety but relatively smaller zooecia, of a more variable character, and many more spike-like acanthopores characterize the present species.

Occurrence. Hull beds, locality 36.

Type. Holotype, G.S.C. No. 12427, Hull beds, between C.P.R. tracks and Armouries, Hull, Quebec.

Mesotrypa angularis parvatrypa n. var.

Plate XVI, figures 1, 2

External features. Zoarium a hat-shaped expansion, i.e., elevated into a central crown and with an expanded rim, diameter at least 50 mm., height at crown from 10 to 15 mm.; surface smooth but with inconspicuous groups of larger cells.

Tangential section. Zooecia polygonal at surface, eight of the ordinary type in 2 mm.; acanthopores prominent, one occupying almost every angle and tending to indent the wall; walls comparatively thin; mesopores at surface practically wanting but not uncommon at depth in the immature zones; maculae of larger zooecia present.

Vertical section. Zooecia vertically disposed except in the earliest growth stage where they are recumbent; walls thin for the most part, thickening only slightly as growth proceeds; diaphragms less than a tube diameter apart in the mature region, straight to oblique, the latter being rather striking; mesopores, which contain closely spaced diaphragms, tend to pinch out in the mature region; the numerous

acanthopores, seen in tangential sections, are likewise conspicuous features of certain vertical sections. The colonies were apparently rejuvenated from time to time, several mature and immature regions being at times obvious.

Remarks. This variety differs from the species *Mesotrypa angularis* Ulrich and Bassler mainly in the smaller size of the zooecia which measure eight in 2 mm. rather than six in 2 mm. The species was recorded by Ulrich and Bassler (1904, p. 23) from the Trenton of Ottawa and Peterborough. In addition to *M. angularis* other species with which the variety in question may be compared are: *M. infida* Ulrich which occurs in the "middle third of the Trenton shales" (Spechts Ferry member) of Minnesota, but its characteristic shape serves to distinguish the variety, and *M. quebecensis* Ami, another Trenton form in which diaphragms are not as well defined.

Occurrence. Sherman Fall beds, localities 55, 72.

Type. Holotype, G.S.C. No. 12428, Sherman Fall beds, east of Black River Station, Ontario.

Mesotrypa obliqua n. sp.

Plate XVI, figures 3, 4; Plate XVII, figure 3

External features. Zoarium discoidal, diameter 20 mm., thickness 4 mm.; surface not observed but sections indicate that maculae are present, though probably not well marked.

Tangential section. Zooecia oval to subangular, seven of the ordinary variety in 2 mm., six in the same space in the macular groups; angular mesopores separate the zooecia for the most part; acanthopores absent.

Vertical section. Most striking feature is the presence of prominent obliquely curved diaphragm-like cystiphragms, which occur in regular sequence, from one to two tubes diameter apart, throughout the length of the zooecia; zooecial walls of uniform thickness; mesopores closely tabulated.

Remarks. There is a definite resemblance to *M. infida* Ulrich but acanthopores are absent in the present species and oblique interzooecial structures are much more characteristic.

Occurrence. Leray beds, locality 43.

Type. Holotype, G.S.C. No. 12429, Leray beds, Milles Roches quarries, Ontario.

Mesotrypa prolifica Fritz

Plate XVII, figures 1, 2; Plate XXX, figure 4

Mesotrypa prolifica Fritz, *in* Parks, Trans. Roy. Soc. Canada, 3rd series, vol. 22, sec. IV, 1928, p. 76, figs. 22, 23, Pl. 1, fig. 28.

This species was described by Fritz (1928, p. 76) from the Lower

Collingwood formation of the Georgian Bay region. Zoaria were collected which ranged from minute discs to large massive forms. It was later recorded by Sproule (1935, pp. 106, 107) as one of the most characteristic fossils from the Cobourg formation on Georgian Bay, on Lake Ontario, and in northern New York. Its present identification from localities east of the Frontenac Axis furnishes added evidence of the widespread distribution of this apparently diagnostic Cobourg bryozoan.

Occurrence. Cobourg beds, localities 10, 11, 80, 81, 82.

Type. Hypotype, G.S.C. No. 12430, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Mesotrypa whiteavesii (Nicholson)

Plate XVIII, figures 2-4

Monticulipora (*Diplotrypa*) *whiteavesii* Nicholson, Palæozoic Tabulate Corals, 1876, p. 316, Pl. 13, figs. 4-4b.
Mesotrypa whiteavesii Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 248, figs. 15g, h.

This species, which Nicholson described (1876, p. 316) as "not uncommon in the Trenton limestone of Peterboro, Ontario", is among the rarer massive forms represented in the collections from the upper beds of the Ottawa formation at Ottawa. A characteristic feature of tangential sections is the presence of large, commonly hollow, acanthopores situated in the angles of zooecia.

In addition to typical *M. whiteavesii* identified from Hull beds an apparent variety also occurs (Plate XVIII, figure 4) which shows an excess of acanthopores when compared with typical representatives of this species.

Occurrence. Hull beds, localities 30, 33; Sherman Fall beds, localities 49, 51; Cobourg beds, localities 6, 11, 13.

Type. Hypotypes, G.S.C. No. 12432, Hull beds, Brigham Creek, Hull, Quebec; G.S.C. No. 12431, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Monticulipora arborea Ulrich

Plate XIX, figures 3, 4

Monticulipora arborea Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 220, Pl. 20, figs. 1-9, 13, 14.

The specimen figured here requires no comment for it is typical of the species in every respect.

Occurrence. Sherman Fall beds, locality 38.

Type. Hypotype, G.S.C. No. 12433, Sherman Fall beds, railroad-cut at Val Tetreau, Quebec.

Monticulipora bullata n. sp.

Plate XVIII, figure 1

External features. Zoarium very thin, discoidal, 22 mm. in diameter; surface with depressed maculae about 2½ mm. apart measuring from centre to centre.

Tangential section. Zooecia irregularly polygonal verging on petaloid; eight to nine ordinary zooecia in 2 mm., seven to eight of the larger zooecia in the same space; mesopores practically absent. The most characteristic internal feature of the species is the large, well defined, granules which stud the walls, giving the latter a very rough, beaded appearance; certain granules inflect the walls rendering the zooecial apertures concerned somewhat irregular, in places even petaloid; these granules do not suggest typical acanthopores, which appear to be absent. Within each zooecial aperture may be seen, in considerable abundance, cross-sections of the cystiphragms which evidently line the tubes. The extreme thinness of the zoarium renders impossible the preparation of vertical sections.

Remarks. Three species of *Monticulipora* have been previously recorded from the Trenton rocks of Ottawa, from which the present form was also collected. These species include *M. westoni* Foord, *M. billingsi* Foord, and *M. parasitica* Ulrich. An examination of the types of *M. westoni* and *M. billingsi* shows that the present form does not belong to either of these species. *M. westoni* is hemispherical in shape, has small zooecia, and possesses structures that appear to be true acanthopores, though granular in character. *M. billingsi* forms a thin layer but the internal organization is such that it could not be confused with the present species. From *M. parasitica* it may be distinguished by its free manner of growth; its distinct granular wall structure; and lack of true acanthopores. Only one example of this new species has been identified up to the present time.

Occurrence. Cobourg beds, locality 6.

Type. Holotype, G.S.C. No. 12434, Cobourg beds, Nepean Point, Ottawa, Ontario.

?*Monticulipora cannonensis* Ulrich

Plate XIX, figures 1, 2

Monticulipora (?) *cannonensis* Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 221, Pl. 20, figs. 10-12.

A specimen which closely resembles this species has been identified. As noted by Ulrich the generic reference is doubtful there being a resemblance also to *Homotrypa.* The peculiar association of this species with *M. arborea* both in Minnesota and the present region is significant for the purpose of correlation.

Occurrence. Sherman Fall beds, locality 51.

Type. Hypotype, G.S.C. No. 12435, Sherman Fall beds, Castor River, Embrun, Ontario.

Monticulipora loeblichi n. sp.

Plate XX, figures 1, 2

External features. Zoarium disc to dome shaped, maximum diameter observed 35 mm. and maximum thickness 20 mm.; surface with well defined monticules 4 mm. apart, centres of which are made up of numerous small angular tubes surrounded by one or more rows of tubes much larger than the ordinary. A few of the zooecia show structures herein referred to as closure plates. They are preserved as chalk-white plates with a peripheral radiating structure and a non-radiate centre. Upon lifting one or two of these plates (incidentally crushing them) an amber coloured corneous 'cup' was found to lie beneath; like the plates, the 'cups' proved to be very fragile.

Tangential section. Zooecia almost exclusively six-sided, seven to eight of the ordinary and about six of the larger type in 2 mm.; walls thin, slightly granulose, and amalgamate with light coloured medial zone and only the trace of a darker zone comprising the cingulum; mesopores practically absent; cystiphragms appear in mouths of the zooecia leaving only a central orifice. In this orifice may be seen, in many instances, the disintegrated remains of the structures referred to above as cover plates and corneous 'cups'; they appear as blackish brown masses, often granular. In two instances, at least, the wall between adjacent zooecia is broken down and the apertures have coalesced. This joint aperture is filled with the same blackish brown material referred to above.

Vertical section. Zooecia flexuous, curving in a serpentine manner throughout their course. Although never thick, the walls thicken and thin at regular intervals in what appear to be successive mature and immature regions. For the most part, the zooecial tubes are lined on either side with closely-set cystiphragms; the space between the cystiphragms may be crossed by remote diaphragms or it may be void of such structures; furthermore, in certain zones diaphragms only are present, and there they are crowded and fairly straight. The void spaces noted above very commonly lodge masses of dark brownish black, granular material ('brown bodies') described in the mouths of the zooecia in tangential sections.

Remarks. This clearly defined species may be readily distinguished by its flexuous zooecial tubes and by the character of the interzooecial deposits. In addition, the six-sided zooecia are unique. The nature of the monticules likewise is diagnostic. No other species known to me should be confused with this form. Certainly the associated species

M. bullata and *M. arborea* bear little resemblance other than generic.

Occurrence. Hull beds, localities 36, 50.

Type. Holotype, G.S.C. No. 12436, Hull beds, quarry south of river at Embrun, Ontario.

Nicholsonella wilsonae n. sp.

Plate XXI, figures 1, 2

External features. Zoarium consisting of cylindrical branches from 10 to 15 mm. in diameter, possibly inosculating; surface not clearly shown but apparently smooth.

Tangential section. Near the surface the zooecia subpolygonal, actually very irregular in outline owing to the presence in the interzooecial space of large, round, centrally perforated acanthopores; acanthopores arranged in a single row and spaced apart a distance not greatly in access of their diameter; furthermore, the acanthopores tend to indent the granular, amalgamate zooecial walls, greatly distorting the apertures and rendering them petaloid in many instances; mesopores few, at the surface, in fact, practically wanting. As mesopores are numerous in most species of *Nicholsonella,* their paucity in the present form is significant.

Vertical section. Zooecia curve very gradually outwards from the axial region; walls, slightly crenulated in places, display well the typical granular structure of the genus; diaphragms present throughout the entire length of the zooecia; in the immature region diaphragms two or three tube diameters apart, in the mature region much closer, often only one tube diameter apart; a few slightly beaded mesopores appear at depth; walls, which are in places distinctly moniliform, thicken appreciably in mature region, but this circumstance may be due to the presence of the numerous, large acanthopores.

Remarks. N. wilsonae may be compared with *N. ottawaensis* Wilson but more particularly with *N. irregularis* Loeblich. From the former, the present species differs in its ramose zoarium; from the latter, in its larger branches, complete diaphragms, and even fewer mesopores.

Occurrence. Leray beds, locality 79; Rockland beds, localities 45, 46.

Type. Holotype, G.S.C. No. 12437, Rockland beds, loose blocks, Stewart quarry, Rockland, Ontario.

Orbignyella definita n. sp.

Plate XXII, figures 3, 4

External features. Zoarium small, rounded, semidiscoidal mass 10

mm. across, 7 mm. thick; maculae indistinct, consisting of zooecia larger than the ordinary.

Tangential section. Zooecia polygonal, eight to nine in 2 mm.; walls of moderate thickness; mesopores absent but a few small tubes present, probably young zooecia; zooecia in maculae number six in 2 mm.; centrally perforated acanthopores large and prominent, located in certain zooecial angles and, for the most part, not inflecting the walls; cystiphragms observed within some of the zooecial apertures.

Vertical section. Walls thin in axial, somewhat thicker in mature region; straight and oblique diaphragms along with a minimum number of irregular shaped, infundibular cystiphragms developed to such an extent that the interzooecial space appears almost vesiculose; favourably cut sections plainly reveal conspicuous acanthopores.

Remarks. Compared with *O. germana* Bassler, which is apparently rare in the Wassalem beds of Esthonia, the following differences may be noted: form of zoarium more flattened, zooecia considerably smaller, interzooecial structures more crowded and irregular to vesiculose. Only one specimen has been identified.

Occurrence. Pamelia or Lowville beds, locality 20.

Type. Holotype, G.S.C. No. 12438, Pamelia or Lowville beds, Clarendon Avenue at sanatorium, Ottawa, Ontario.

Orbipora americana n. sp.

Plate XXI, figure 3; Plate XXII, figure 2

External features. Zoarium a flattened discoidal or cake-shaped mass; the only specimen identified is 27 mm. wide with a maximum height of 13 mm.; upper surface slightly convex, smooth, spiny (owing to prominent acanthopores); maculae practically indistinguishable; lower surface shows zooecial tubes radiating from a central point with no sign of wrinkled epitheca in the present state of preservation.

Tangential section. Zooecia large averaging four in 2 mm.; irregularly polygonal, in close contact, oblique in certain places, thin walled; mesopores absent but young zooecia present; acanthopores, large with central foramen, numerous in parts of the sections, situated in zooecial angles or in the walls, occasionally indenting the apertures.

Vertical section. Walls uniformly thin except where thickened by an acanthopore, mostly straight but here and there wavy; diaphragms practically absent in axial region, one or two to a tube in mature zone; tubes tend to radiate, direct in central part of zoarium, slightly oblique towards peripheral rim; mesopores absent but a few young zooecia present showing normal tabulation.

Remarks. This new species is not closely related to any of the described representatives of the genus. It resembles *O. distincta* in the

form of the zoarium and *O. solida* in vertical section, but in tangential section acanthopores appear to be fewer than in any of the other species.

To my knowledge this is the first time the genus *Orbipora* has been reported from North American strata. Several species, however, are reported from the Ordovician of the Baltic.

Occurrence. Cobourg beds, locality 14.

Type. Holotype, G.S.C. No. 12439, Cobourg beds, Booth Street, Ottawa, Ontario.

Prasopora cf. *conoidea* Ulrich

Plate XXIII, figures 2, 3

Prasopora conoidea Ulrich, 14th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 87. Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 249, Pl. 16, figs. 11-15.

One specimen from the Hull beds of Brigham Creek has been doubtfully referred to the above species. Among the differences noted the 'monticules' do not show the subsolid centres characteristic of *P. conoidea.* It may be that this form is a slight variation from *P. sinclairi* n. sp. from the Rockland beds near the type locality. It will be noted in the description of that species that 'maculae' without subsolid centres occur.

Occurrence. Hull beds, locality 30.

Type. Hypotype, G.S.C. No. 12440, Hull beds, Brigham Creek, Hull, Quebec.

Prasopora grandis (Ulrich)

Plate XXIV, figures 3, 4

Monticulipora grandis Ulrich, 14th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1886, p. 78.
Prasopora grandis Nickles and Bassler, Bull. U.S. Geol. Surv., 173, 1903, p. 371.

This species is named for the large size of the massive zoarium. It is among the rarer species of *Prasopora* and is usually irregularly discoidal. It may, however, form lobate masses measuring 50 mm. or more at base. It is not to be confused with the more prolific *P. simulatrix orientalis* which occurs at the same horizon. This latter species is smaller and tends to form elevated discs.

Occurrence. Pamelia-Lowville beds, locality 44; Rockland beds, localities 45, 46.

Type. Hypotype, G.S.C. No. 12441, Rockland beds, loose blocks Stewart quarry, Rockland, Ontario.

Prasopora hybrida n. sp.

Plate XXIV, figures 1, 2

External features. Zoarium free, discoidal, 10 mm. wide, 1.5 mm. high; surface presumably smooth but with maculae composed of groups of large zooecia.

Tangential section. Zooecia polygonal to rounded depending upon the number of mesopores and the depth of the section. Former condition (i.e. polygonal shape) more typical of surface; no tendency for mesopores to aggregate in maculae; walls of tubes thin, amalgamate with light coloured central band; acanthopores present, prominent and numerous in angles of polygonal zooecia; central or eccentric lumen within zooecial apertures indicative of cystiphragms at surface.

Vertical section. Zooecia fairly straight throughout; cystiphragms, rather large on the whole, line zooecia on one or both sides; diaphragms present as well, crowded or widely spaced; closely tabulated mesopores not uncommon; walls thickened in both axial and mature regions by numerous acanthopores in which a clear central part is bordered by pinnately arranged laminated tissue.

Remarks. This species closely resembles both *P. conoidea* Ulrich and *P. fritzae* Loeblich. From the former it may be distinguished by its more prominent acanthopores and from the latter by its more numerous mesopores. The absence of acanthopores in the associated *P. prismatica* n. sp. will serve to separate that species from the present form. As only one fragmentary zoarium has been found it is unwise to stress the discoidal shape of the zoarium.

Occurrence. Cobourg beds, locality 67.

Type. Holotype, G.S.C. No. 12442, Cobourg beds, west half lot 22, con. III, Roxborough tp., Ontario.

Prasopora insularis Ulrich

Plate XXV, figures 3, 5

P. insularis Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 251, Pl. 16, figs. 18-23.

This species has been identified with certainty from the Sherman Fall at Plantagenet where it is not an uncommon form.

Occurrence. Sherman Fall beds, localities 48 and 57.

Type. Hypotype, G.S.C. No. 12443, Sherman Fall beds, Plantagenet, Ontario.

Prasopora mesoporosa n. sp.

Plate XXV, figures 1, 4

External features. Zoarium small, discoidal, concavo-convex, about 18 mm. in diameter and between 3 and 4 mm. thick; surface smooth

but with groups of larger zooecia than the ordinary, grouped into maculae.

Tangential section. Zooecia almost round and completely separated by a ring of closely packed angular mesopores; ordinary zooecia measure from seven to nine in 2 mm. according to the number of intervening mesopores; zooecia in the maculae larger, about six in 2 mm.; many more mesopores in the maculae; maculae somewhat star-shaped, although this feature not as pronounced as in *P. simulatrix orientalis;* numerous irregular cystiphragms fill much of the endozooecial space, the unoccupied central part appearing prismatic in outline; acanthopores not observed.

Vertical section. Walls thin throughout; cystiphragms line either or both sides of the zooecia, commonly extending half-way across the tubes; diaphragms sparingly developed in the zooecia but very close-set in the abundant mesopores.

Remarks. The closest ally of this species is *Prasopora insularis* Ulrich. Distinguishing features of the present form are: numerous mesopores in maculae, paucity of diaphragms in zooecia, and well developed cystiphragms which extend half-way across the zooecia.

Occurrence. Sherman Fall beds, localities 27, 35.

Type. Holotype, G.S.C. No. 12444, Sherman Fall beds, axe factory quarry, Brewery Creek, Hull, Quebec.

Prasopora prismatica n. sp.

Plate XXVII, figures 2, 3

External features. Zoarium of the only specimen examined, an elevated discoidal mass, 25 mm. wide, 18 mm. high; well pronounced maculae rise slightly above the surface.

Tangential section. Zooecia polygonal, in contact except at angles, where a small triangular space is almost invariably developed; nine of the ordinary zooecia in space of 2 mm., those in maculae nearly twice that size, at least towards the centres of these structures; a clear medial, seemingly structureless, band between the thin amalgamated zooecial walls; mesopores or more probably young zooecia, very few, restricted mainly to the maculae; acanthopores absent; the numerous overlapping cystiphragms fill much of the endozooecial space, the reduced central, unoccupied part distinctly prismatic in outline.

Vertical section. Walls, which are of uniform thickness throughout their length, are slightly crenulate in places; cystiphragms profuse, many of which are small, lining the tubes either on one side or on both; diaphragms commonly numerous, but may be few, straight, as a rule, but much variation is observed in these structures; horizontal diaphragms commonly bridge the gap between two rows of cystiphragms; again oblique or curved diaphragms, together with the

cystiphragms, may form a vesicular mass which fills the interior of the zooecia.

Remarks. This very intricate little form is quite unique among the species of *Prasopora* hitherto recorded from this region. It would seem to have its closest relative in *Prasopora fritzae* Loeblich from the Bromide formation of Oklahoma (1942, p. 426). From that species it differs primarily in the absence of acanthopores.

Occurrence. Cobourg beds, locality 59.

Type. Holotype, G.S.C. No. 12446, Cobourg beds, quarry south of St. Isidore de Prescott, Ontario.

Prasopora similis n. sp.

Plate XXIX, figures 1, 2

External features. Zoarium small, hemispheric mass 20 mm. in diameter and 8 mm. thick at centre; surface smooth but with groups of larger cells forming inconspicuous maculae, the centres of which are subsolid, being composed of smaller cells.

Tangential section. Zooecia subangular, seven to eight of the ordinary type in 2 mm.; mesopores few, so that many of the zooecia are in contact; maculae composed of larger zooecia, five of which occur in a 2 mm. space; centres of maculae made up of small, crowded, angular tubes; cystiphragms within the mouths of the zooecia modify the zooecial opening to an irregular shaped prismatic orifice, for the most part centrally located; acanthopores apparently absent.

Vertical section. Tube walls thin throughout; zooecia lined on both sides by numerous cystiphragms; the central area spanned by numerous diaphragms, the latter, for the most part, horizontal; mesopores closely tabulated.

Remarks. The specific name *similis* is given owing to the resemblance of the species to *P. sinclairi* n. sp. and *P. conoidea* Ulrich. From the former the present species may be distinguished chiefly by its subsolid maculae; from the latter by the absence of acanthopores, by its hemispheric form, and lack of monticulated surface.

Occurrence. Rockland beds, locality 46.

Type. Holotype, G.S.C. No. 12449, Rockland beds, Stewart quarry, Rockland, Ontario.

Prasopora simulatrix orientalis Ulrich

Plate XXVIII, figures 2, 3

Prasopora simulatrix orientalis Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 246, Pl. 16, figs. 1, 2, 6, 7.

This variety, described by Ulrich from the Trenton of Ottawa, Peterborough, and other points in Ontario, has been recognized in

profusion at a number of localities. It appears to be the most prolific representative of the genus *Prasopora* in the rocks under consideration, and most easily spotted externally. It is found in all stages of growth but the fully developed mature zoaria prevail. They tend to become subconical after having passed through the discoidal or hemispheric stage.

Occurrence. Pamelia-Lowville beds, locality 44; Leray beds, localities 74, 78; Hull beds, localities 30, 36; Sherman Fall beds, localities 26, 27, 38, 56, 57, 58, 66, 73; Cobourg beds, localities 4, 5, 7, 8, 21.

Type. Hypotype, G.S.C. No. 12450, Sherman Fall beds, con. I, Roxborough tp., east of Strathmore, Ontario.

Prasopora sinclairi n. sp.

Plate XXIX, figure 3; Plate XXX, figure 3

External features. Zoarium small flat to elevated discs ranging from 10 mm. to 25 mm. in diameter; under surface, concentrically wrinkled, commonly deeply concave; upper surface smooth but with groups of larger cells, which in some specimens constitute fairly prominent maculae; these structures may rise slightly but such a condition is not typical.

Tangential section. Zooecia subangular, almost circular, from five to seven in 2 mm., the larger cells confined for the most part to the maculae; angular mesopores, commonly in pairs or groups of three, variable in size, separate the zooecia; walls moderately thin; acanthopores present in the walls but inconspicuous.

Vertical section. Endozooecial structures numerous. Continuous rows of regular shaped, close-set cystiphragms line either or both sides of the tubes, occasionally they meet to form a funnel-shaped structure; horizontal to oblique diaphragms are likewise present occurring at distances apart of from one-half to two tube diameters; mesopores with numerous diaphragms, a half-tube diameter apart or even less; walls of uniform thickness throughout.

Remarks. This new species finds its closest ally in *Prasopora conoidea* Ulrich from the "upper third of the Trenton shales" (Ion member) of Minnesota. It may be distinguished from that species by the absence of monticules and the presence of maculae which do not show subsolid centres as do the monticules of *P. conoidea;* by the slightly larger size of the average zooecium; and by possessing fewer mesopores.

Occurrence. Rockland beds, locality 45; Hull beds, locality 41.

Type. Holotype, G.S.C. No. 12451, Rockland beds, loose blocks, Stewart quarry, Rockland, Ontario.

Prasoporina oculata (Foord)

Plate XXVI, figures 2, 3

Prasopora oculata Foord, Contr. Micro-Palæo. Cambro-Sil., 1883, p. 11, Pl. 3, figs. 1-1g.

One example of this species, described originally "as somewhat rare in the Trenton of Ottawa City", has been identified from the collections serving as a basis for the present study. In the Hull beds at Brigham Creek, however, a closely related form occurs which is described in this report as a new species *P. semioculata.* A comparison of the two species is included in the description of the Hull species.

Occurrence. Cobourg horizon, locality 11.

Type. Hypotype, G.S.C. No. 12445, Cobourg beds, corner Rochester and Lydia Streets, Ottawa, Ontario.

Prasoporina selwyni (Nicholson)

Plate XXVI, figures 1, 4

Monticulipora (*Prasopora*) *selwynii* Nicholson, Genus Monticulipora, 1881, p. 206, fig. 44.
Prasopora selwyni Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 250, Pl. 16, figs. 16, 17; figs. 15a, b (p. 248).
Prasoporina selwyni Bassler, J. Wash. Acad. Sci., vol. 42, 1952, p. 382.

Nicholson's classic species occurs in the Sherman Fall and is recorded as well from the Hull beds. The sections illustrated here indicate very clearly the main differences between this species and the more prolific associated species *P. simulatrix orientalis* Ulrich. Externally these two species are frequently confused owing to their common massive growth. However, the zoaria of *P. simulatrix orientalis,* especially older colonies, commonly assume a hat-shaped manner of growth, which characteristic is useful, when it occurs, for spot diagnoses.

Occurrence. Hull beds, locality 36; Sherman Fall beds, locality 49.

Type. Hypotype, G.S.C. No. 12447, Sherman Fall beds, Castor River, about 1 mile east of Embrun, Ontario.

Prasoporina semioculata n. sp.

Plate XXVII, figure 1; Plate XXVIII, figure 1

External features. Zoarium an elevated disc, approaching conical form, diameter 38 mm., height at centre 15 mm.; surface with depressed maculae, 3 to 5 mm. apart from centre to centre.

Tangential section. Zooecia thin walled, subangular to round, an average of eight in 2 mm., separated by a minimum number of angular mesopores; irregular shaped cystiphragms conspicuous with-

in the zooecia; acanthopores apparently absent; maculae consist of a ring of large zooecia surrounding relatively small aggregations of small prismatic tubes that form a compact centre.

Vertical section. Zooecia with thin walls, thickening slightly towards maturity; diaphragms and cystiphragms numerous; some tubes contain both, whereas in others only diaphragms or cystiphragms occur; the former straight for the most part; the latter usually cyst-like but some conical; mesopores with closely crowded straight diaphragms.

Remarks. The species resembles *P. oculata* but differs in the following respects: larger zoarium; smaller aggregations of small prismatic tubes in centre of the maculae surrounded by a definite ring of large peripheral zooecia; more crowded diaphragms and cystiphragms in longitudinal sections, with fewer conical forms.

Occurrence. Hull beds, locality 30.

Type. Holotype, G.S.C. No. 12448, Hull beds, Brigham Creek, Hull, Quebec.

Stigmatella ottawaensis n. sp.

Plate XXX, figures 1, 2, 5

External features. Zoarium appears to have formed a large hemispheric mass or lateral expansion. As the specimen is fragmentary, complete measurements cannot be given but the largest fragment on hand is 50 mm. across and 20 mm. thick; surface features not observed.

Tangential section. Zooecia polygonal in outline, seven to eight in 2 mm.; groups of larger tubes, with not more than five in 2 mm., present and spaced apart 5 mm. measuring from centre to centre; near the surface zooecia have slightly thicker walls than at depth; small, angular mesopores present; true acanthopores lacking.

Vertical section. Zooecial walls thin and slightly crenulated in the long axial region, becoming slightly thicker towards periphery; diaphragms remote in axial part, somewhat more numerous in mature zone; bead-like mesopores appear spasmodically throughout the growth of the colony; intermittent thickening of the walls, characteristic of the genus, noted chiefly in the outer region.

Remarks. Stigmatella ottawaensis is related to *S. massalis* Bassler from the Kegel beds of Esthonia. The most significant differences noted are: the more massive character of the zoarium in the present form; the lack of acanthopores; the more conspicuous maculae; and the absence of mesopores in the maculae.

Occurrence. Hull beds, locality 2.

Type. Holotype, G.S.C. No. 12452, Hull beds, Rockcliffe Park, Ottawa, Ontario.

Cyclostomata

Ceramopora vesiculosa n. sp.

Plate III, figure 3; Plate V, figure 1

External features. Zoarium a medium sized, knobby mass, approximately 16 mm. thick and over 20 mm. in diameter; upper surface smooth, lower surface concentrically wrinkled; hood-shaped lunarium present.

Tangential section. Zooecia for the most part circular with a slight tendency to subpolygonal; although variable in size and shape, they average eight in 2 mm.; walls weak, irregularly thick and thin, in places somewhat spongy in appearance; irregularity due to connecting pores; lunarium not readily distinguished; mesopores rare.

Vertical section. Zooecia long and contorted, with walls of very uneven thickness and with numerous connecting pores; an occasional diaphragm crosses the tubes; vesicular appearance of these sections suggestive of *Favositella exserta* Bassler from the Baltic.

Remarks. The species is related to *Ceramopora spongiosa* Bassler from the Wassalem beds of Esthonia. It differs in its larger zooecia; less angular zooecia; and in the vesicular character of the zooecia in vertical sections.

Occurrence. Rockland beds, locality 77.

Type. Holotype, G.S.C. No. 12453, Rockland beds, quarry right bank of river at Pakenham, Ontario.

Favositella laxata (Ulrich)

Plate VIII, figure 3; Plate IX, figure 2

Fistulipora ? laxata Ulrich, Contr. Micro-Palæo. Cambro-Sil., pt. 2, 1889, p. 37, Pl. 8, figs. 2, 2a.
Bythotrypa laxata Ulrich, Geol. Minnesota, 3, pt. 1, 1893, p. 325, Pl. 28, figs. 21-25.
Favositella laxata Bassler, Bull. U.S. Nat. Mus., 77, 1911, p. 101.

One very fine example of this species in the form of a relatively smooth, elevated disc measuring 47 mm. in diameter and 13 mm. maximum height has been identified with certainty from the Cobourg beds. It shows very well all the characteristics displayed by Ulrich's type.

Occurrence. Cobourg beds, locality 13.

Type. Hypotype, G.S.C. No. 12454, Cobourg beds, Booth Street, Ottawa, Ontario.

Favositella mammilata n. sp.

Plate IX, figures 1, 4

External features. Only one example of this species is known. Zoarium discoidal, measuring 20 mm. in diameter, 5 mm. thick at centre, and 1 mm. thick at rim; upper surface marked by about twelve conspicuous monticules approximately 5 mm. apart, measuring from centre to centre; largest monticules in the centre of the zoarium with a diameter of 4 mm., towards the rim monticules diminish in size.

Tangential section. Resembles the associated *F. laxata* but distinguished by the presence of dark patches representing the monticules; character of the tubes in these patches obscure; several sections have been prepared but all show a confused mass in these dense monticular areas.

Vertical section. Agrees in all essentials with *F. laxata.*

Remarks. In addition to the resemblance to *F. laxata* the present species may be compared with *F. discoidalis* Bassler from the Baltic. The latter species has similar zoarial dimensions but lacks monticules; furthermore, the zooecia are larger.

Occurrence. Cobourg beds, locality 6.

Type. Holotype, G.S.C. No. 12455, Cobourg beds, Nepean Point, Ottawa, Ontario.

Fistulipora stewarti n. sp.

Plate IX, figures 3, 5

External features. Zoarium encrusting a small irregularly tapering and slightly curved cup coral. As the endothecal structures are gone, the Bryozoa might appear at first sight to be a hollow branch. Maximum thickness of encrustation 2 mm., average thickness 1 mm.; surface with slightly elevated, substellate maculae from 3.5 mm. to 4 mm. apart from centre to centre.

Tangential section. Zooecia circular to elongate ovate, four to five in 2 mm., those in the immediate vicinity of the maculae largest and most elongate; walls thin; zooecia not in contact but separated by spaces equalling one or two tube diameters; maculae composed of polygonal tubes of varying size, some nearly as large as the smaller zooecia; acanthopore-like structures abundant in walls of the macular tubes, some indent the walls; similar structures likewise present in the regular zooecial interspaces, though not as well marked; these interspaces appear to be covered by a thin membrane, through which a semi-vesiculose tissue may be faintly seen.

Vertical section. No endozooecial structures present; interzooecial spaces made up of a regular type of vesicular tissue resembling rather

large mesopores with fairly close-set diaphragms. The acanthopore-like structures have not been detected in these sections.

Remarks. Only three specimens have been identified from the collections. The species appears to belong to a small primitive group of Bryozoa which includes *Fistulipora primaeva* Bassler and *Fistulipora? bassleri* Loeblich. From the former it may be distinguished by its encrusting manner of growth and less prominent granular acanthopores; from the latter chiefly by the absence of a lunarial pore.

Occurrence. Pamelia-Lowville beds, localities 22 and 44; Rockland beds, locality 46.

Type. Holotype, G.S.C. No. 12456, Pamelia-Lowville beds, lowest 10 feet, Stewart quarry, Rockland, Ontario.

Cryptostomata

Phyllodictya hybrida n. sp.

Plate XXII, figure 1; Plate XXIII, figure 1

External features. Zoarium a broad, bifoliate expansion, the specimen used for this description, which is only a fragment, measuring 25 mm. by 40 mm. with a thickness of about 1 mm.; surface covered by solid, granular maculae, spaced approximately 4 to 5 mm. apart.

Tangential section. Zooecia oval, bordered by a pronounced light coloured, ring-like band; tubes somewhat linear in arrangement, interzooecial space granular; measured longitudinally six zooecia appear in the space of 2 mm.

Vertical section. Zooecia arise from a median septum, at first prostrate, then proceed to surface in a gentle curve; one or two diaphragms present, horizontal to gently convex upward; zooecial interspace dense, longitudinally and transversely marked.

Remarks. This new species displays characteristics of both *P. flabellaris* Bassler and *P. varia* Ulrich. It resembles the former in the large form of the zoarium and in the minute structure of the zooecial interspace. It is like the latter in the small size of the zooecia and in the possession of diaphragms.

Occurrence. Hull beds, locality 50.

Type. Holotype, G.S.C. No. 12457, Hull beds, quarry on first farm south of river at Embrun, Ontario.

SELECTED BIBLIOGRAPHY

Bassler, R. S.
1911: The Early Paleozoic Bryozoa of the Baltic Provinces; *U.S. Nat. Mus. Bull.* 77

1934: Bryozoa; Fossilium Catalogus, *Animalia*, pt. 67.

Duncan, H.
1939: Trepostomatous Bryozoa from the Traverse Group of Michigan; *Contr. Mus. Paleo.*, Univ. Michigan, vol. V, no. 10, pp. 171-270.

Foord, A. H.
1883: On the Monticuliporidae of the Chazy, Black River, and Trenton formations, with descriptions of ten new species; Contributions to the Micro-Paleontology of the Cambro-Silurian Rocks of Canada, pt. I; *Geol. Nat. Hist. Surv., Canada*, pp. 7-22.

Fritz, M. A.
1928: *in* Parks, Faunas and Stratigraphy of the Ordovician Black Shales and Related Rocks in Southern Ontario; *Trans. Roy. Soc. Can.*, 3rd ser., vol. 22, sec. IV, pp. 39-90.

1944: The Hull Bryozoan *Escharopora hogbeni; J. Paleo.*, vol. 18, no. 3, pp. 263-265.

Liberty, B. A.
1953, MS.: Stratigraphy and Palæontology of the Lake Simcoe District, Ontario; unpubl. Ph.D. thesis, Univ. Toronto.

Loeblich, A. R., Jr.
1942: Bryozoa from the Ordovician Bromide Formation, Oklahoma; *J. Paleo.*, vol. 16, no. 4, pp. 413-436.

Nicholson, H. A.
1881: On the Structure and Affinities of the Genus Monticulipora and its Sub-genera; Edinburgh, 240 pp.

Sproule, J. C.
1935: A Study of the Cobourg Formation; Contributions to the Study of the Ordovician of Ontario and Quebec; *Geol. Surv., Canada*, Mem. 202, pp. 93-110.

Troedsson, G. T.
1929: On the Middle and Upper Ordovician Faunas of Northern Greenland. Part II; *Medd. om Grønland*, vol. 72, pt. I, no. 1, pp. 1-197.

Ulrich, E. O.
1889: On some *Polyzoa* (*Bryozoa*) and *Ostracoda* from the Cambro-Silurian rocks of Manitoba; Contributions to the Micro-Paleontology of the Cambro-Silurian Rocks of Canada, pt. II, *Geol. Nat. Hist. Surv., Canada*, pp. 27-57.

1893: On Lower Silurian Bryozoa of Minnesota; *Geol. Minnesota*, vol. 3, pt. I, pp. 96-331.

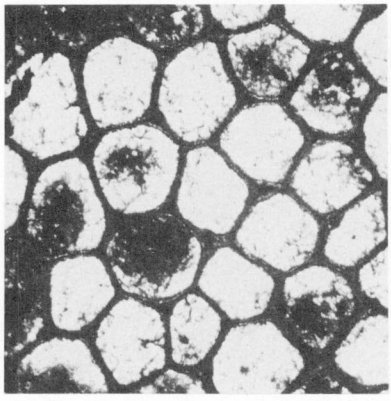
Ulrich, E. O., and Bassler, R. S.
1904: Revision of the Paleozoic Bryozoa, pt. II, Trepostomata; *Smith. Misc.Coll.*, vol. 47, no. 1470, pp. 15-55.

Wilson, A. E.
1921: The Range of Certain Lower Ordovician Faunas of the Ottawa Valley with Descriptions of Some New Species; *Dept. Mines, Canada, Geol. Surv.*, Bull. 33, pp. 19-57.

1938: Legends of Maps 413A-414A, Ottawa Sheets, Carleton and Hull counties, Ontario and Quebec; *Geol. Surv., Canada.*

1946: Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec; *Geol. Surv., Canada*, Mem. 241, pp. 21-26.

PLATES I TO XXX



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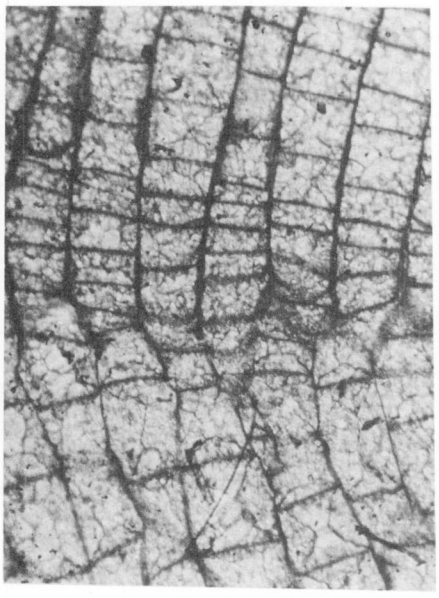

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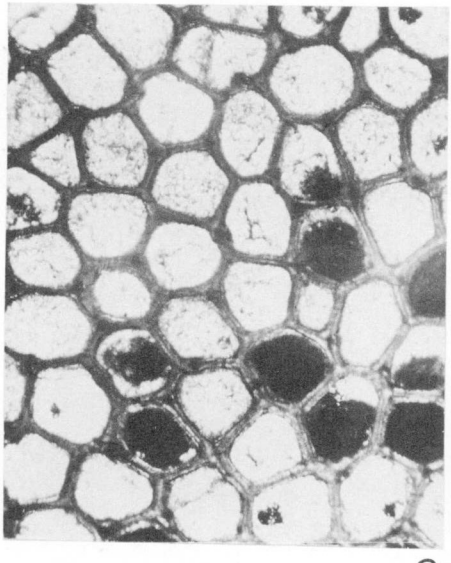

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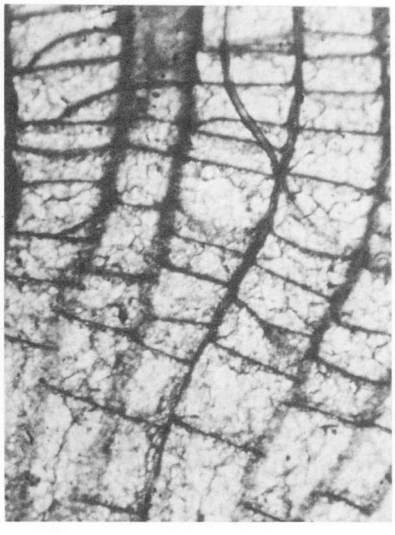

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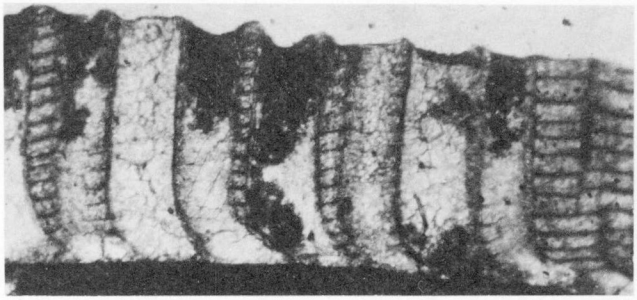
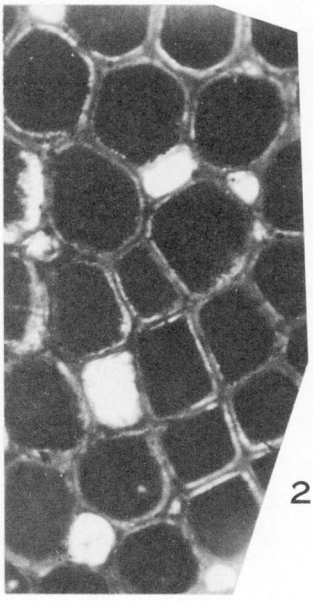
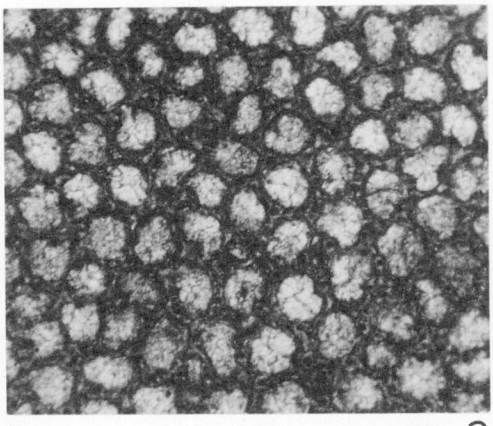
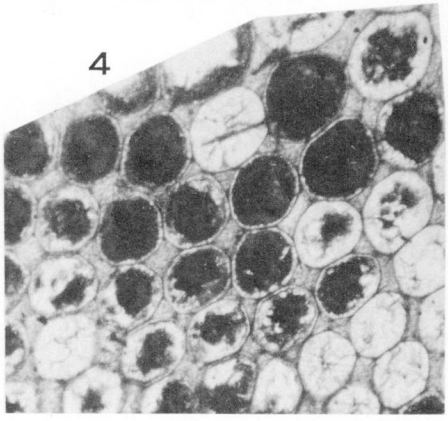
Figures 1, 2. *Amplexopora glengarria* n. sp. (X 25). Tangential and vertical sections; Cobourg beds, Alexandria, Ontario; holotoype, G.S.C. No. 12399. (Page 9.)

Figures 3, 4. *Amplexopora glengarria shermanensis* n. var. (X 25). Tangential and vertical sections; Sherman Fall beds, east of Black River Station, Ontario; holotype, G.S.C. No. 12400. (Page 10.)





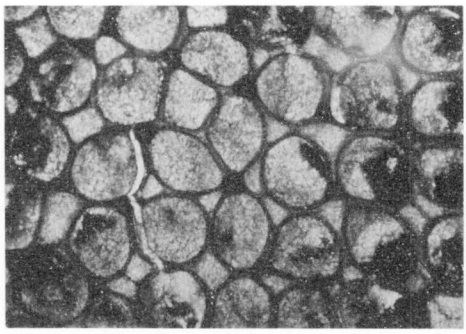




Figures 1, 4. *Aspidopora vacua* n. sp. (X 25). Vertical and tangential sections; Sherman Fall beds, Val Tetreau, Quebec; holotype, G.S.C. No. 12402. (P. 11.)

Figures 2, 5. *Anaphragma delicatula* n. sp. (X 25). Tangential and vertical sections; Tetreauville beds, Montreal Island, Quebec; holotype, G.S.C. No. 12401. (Page 10.)

Figure 3. *Batostoma gallowayi* n. sp. (X 25). Tangential section; Sherman Fall beds, Payne River, Finch tp., Ontario; holotype, G.S.C. No. 12403. (Page 11.)



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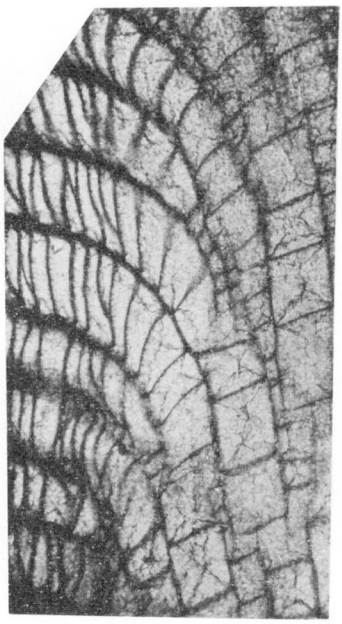

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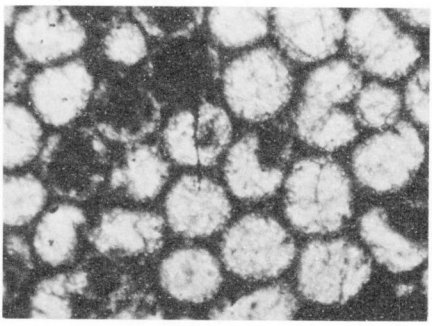

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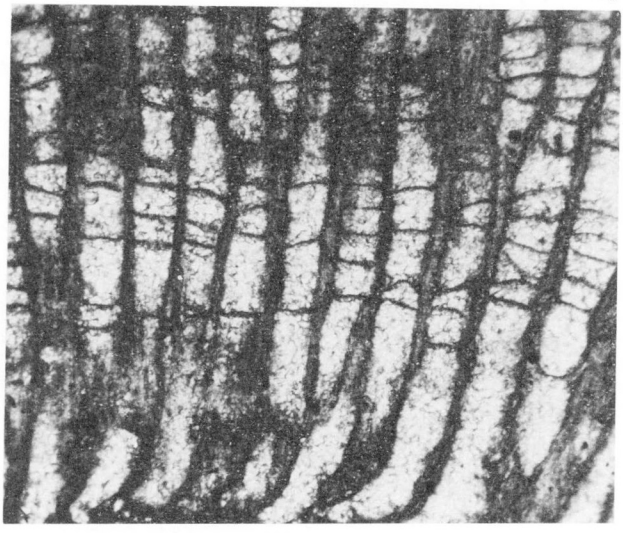
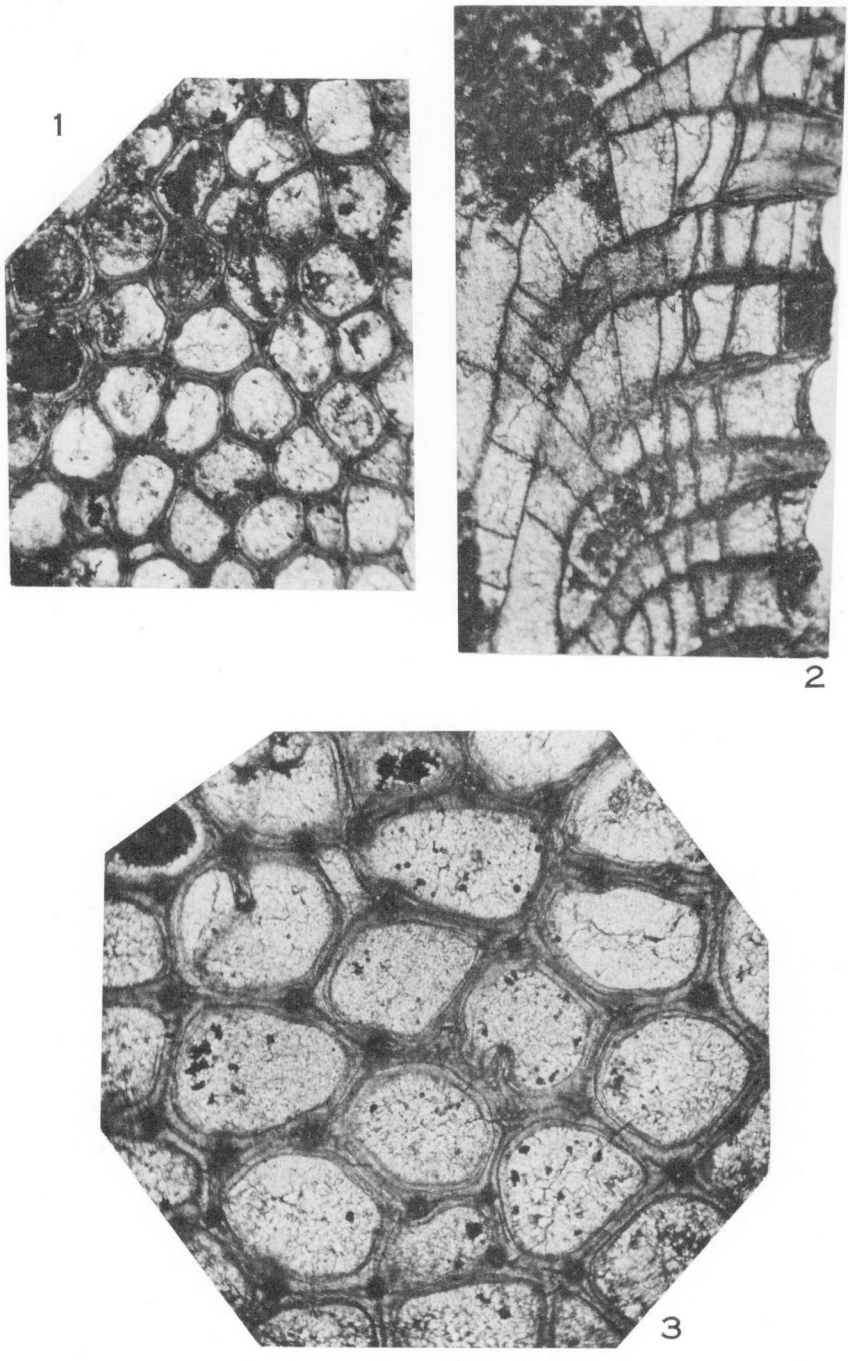


Figures 1, 2. *Batostoma winchelli spinulosum* Ulrich (X 25). Tangential and vertical sections; Sherman Fall beds, east of Black River, Ontario; hypotype, G.S.C. No. 12405. (Page 12.)

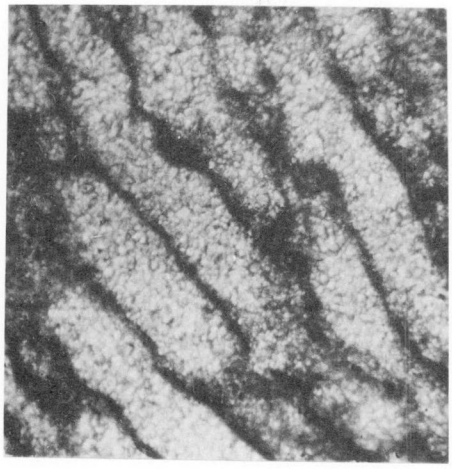
Figure 3. *Ceramopora vesiculosa* n. sp. (X 25). Tangential section; Rockland beds, Pakenham, Ontario; holotype, G.S.C. No. 12453. (Page 38.)

Figure 4. *Batostoma gallowayi* n. sp. (X 25). Vertical section; Sherman Fall beds, Payne River, Finch tp., Ontario; holotype, G.S.C. No. 12403. (Page 11.)



Figures 1, 2. *Batostoma winchelli* (Ulrich) (X 25). Tangential and vertical sections; Rockland beds, Stewart quarry, Rockland, Ontario; hypotype, G.S.C. No. 12404. (Page 12.)

Figure 3. Enlargement (X 45) of figure 1.



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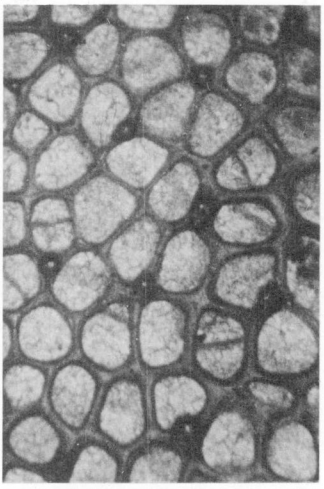

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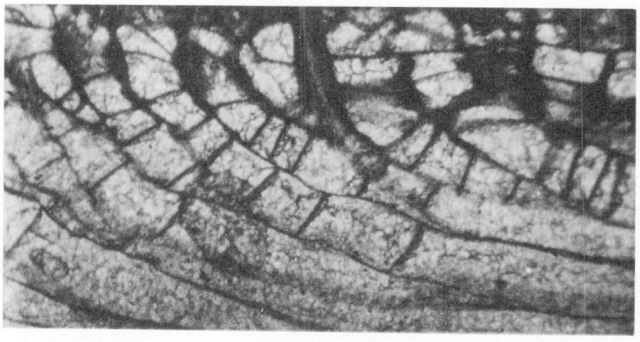

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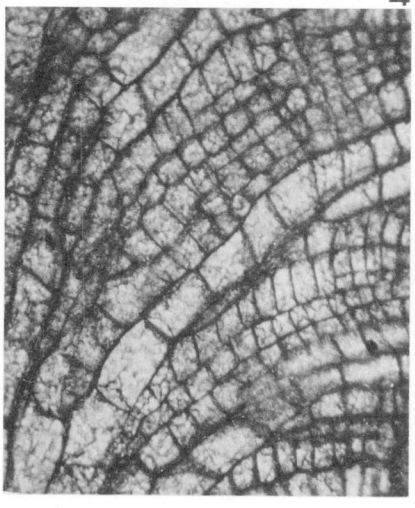

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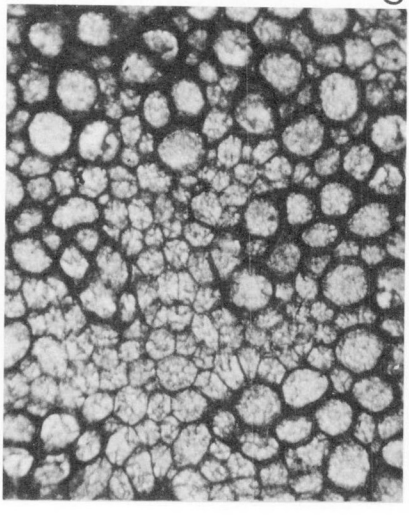

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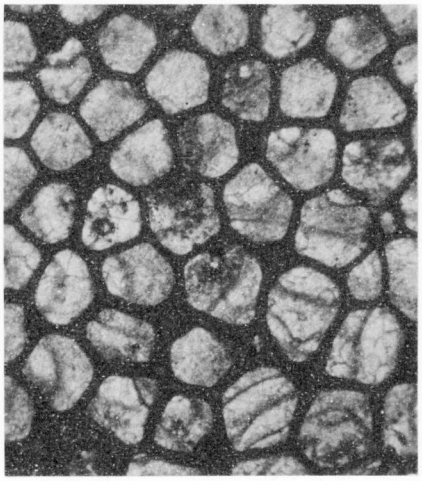
Figure 1. *Ceramopora vesiculosa* n. sp. (X 25). Vertical section; Rockland beds, Pakenham, Ontario; holotype, G.S.C. No. 12453. (Page 38.)

Figures 2, 3. *Dekayella clavata* n. sp. (X 25). Tangential and vertical sections; note large, hollow acanthopores; Cobourg beds, Kenyon tp.; holotype, G.S.C. No. 12407. (Page 13.)

Figures 4, 5. *Constellaria varia* Ulrich (X 25). Vertical and tangential sections; Hull beds, Embrun, Ontario; hypotype, G.S.C. No. 12406. (Page 13.)



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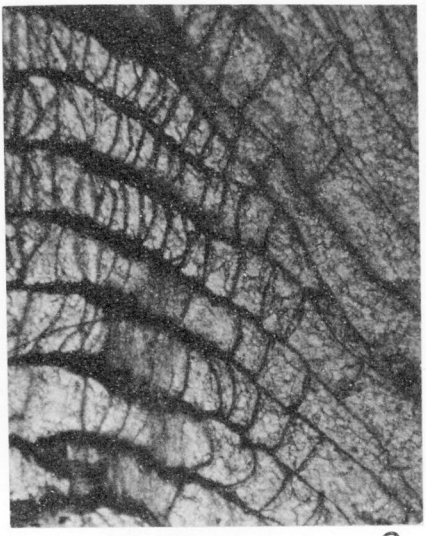

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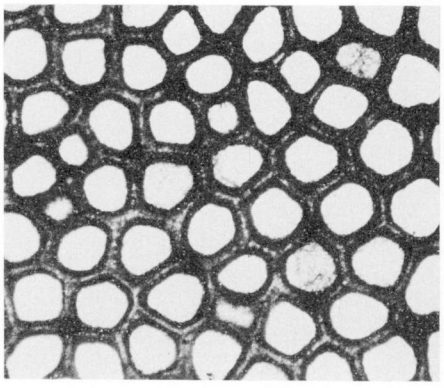

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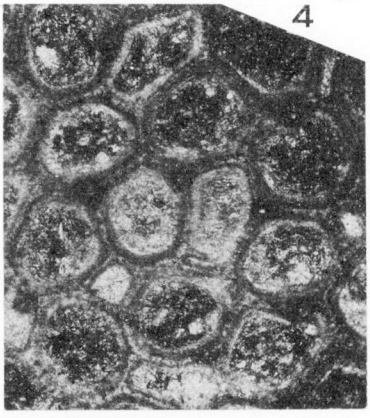

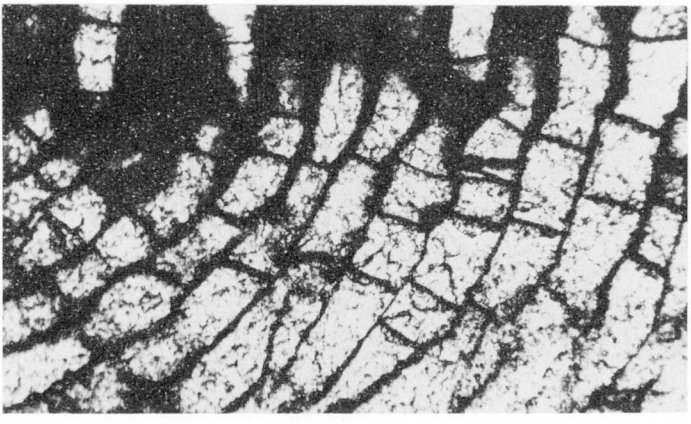

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Figures 1, 2. *Dekayella praenuntia echinata* Ulrich (X 25). Tangential and vertical sections; Cobourg beds, National Research building, Ottawa, Ontario; hypotype, G.S.C. No. 12409. (Page 14.)

Figures 3, 5. *Dekayella praenuntia alexandria* n. var. (X 25). Tangential and vertical sections; Cobourg beds, Alexandria, Ontario; holotype, G.S.C. No. 12408. (Page 14.)

Figure 4. *Eridotrypa aedilis* (Eichwald) (X 45). Tangential section; Sherman Fall beds, axe factory quarry, Hull, Quebec; hypotype, G.S.C. No. 12411. (Page 16.)

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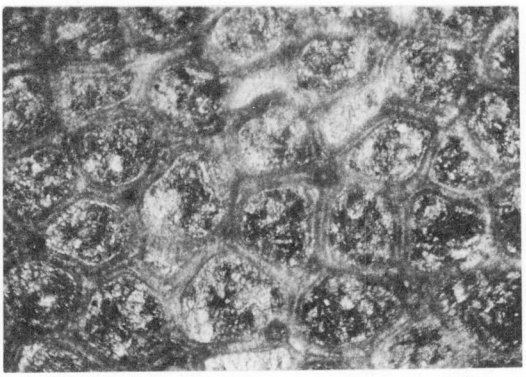

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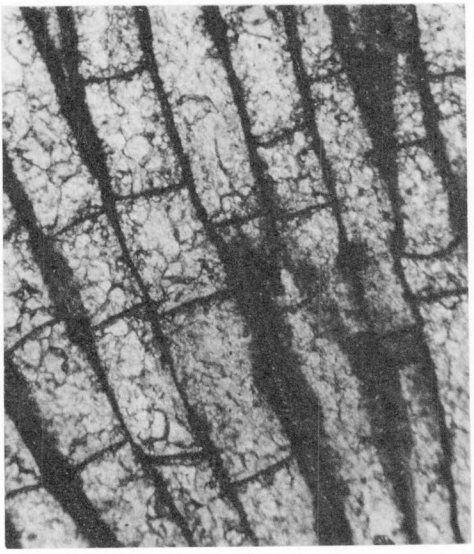

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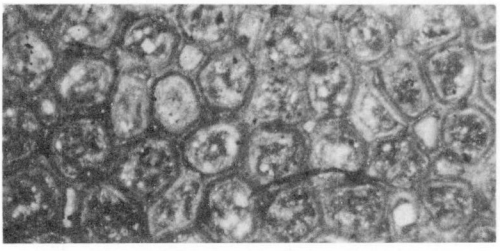

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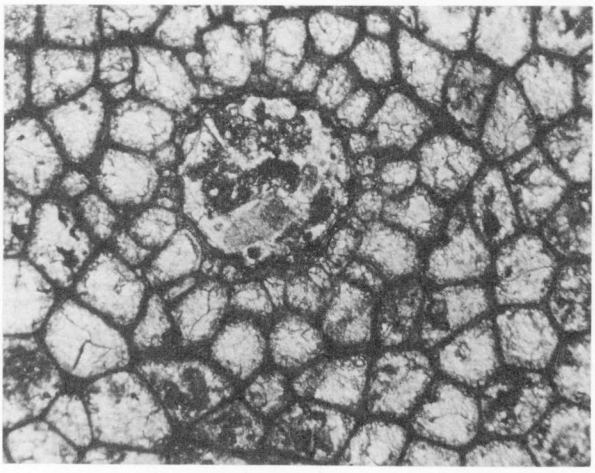
Figures 1, 2. *Dekayia typica* n. sp. Vertical (X 25) and tangential (X 45) sections; Cobourg beds, National Research building, Ottawa, Ontario; holotype, G.S.C. No. 12410. (Page 15.)

Figure 3. ?*Eridotrypella ottawaensis* n. sp. (X 25). Vertical section; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; holotype, G.S.C. No. 12412. (Page 16.)

Figures 4, 5. *Eridotrypa aedilis* (Eichwald) (X 25). Vertical and tangential sections; Sherman Fall beds; axe factory quarry, Hull, Quebec; hypotype, G.S.C. No. 12411. (Page 16.)



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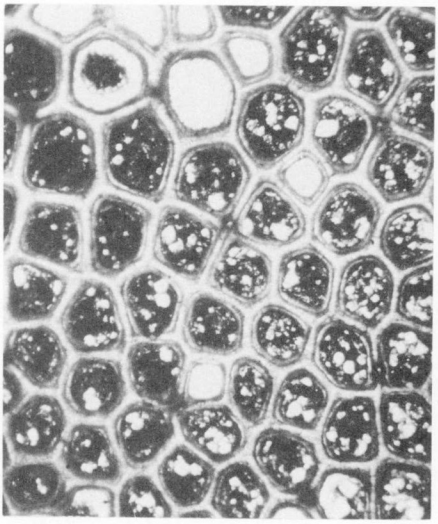

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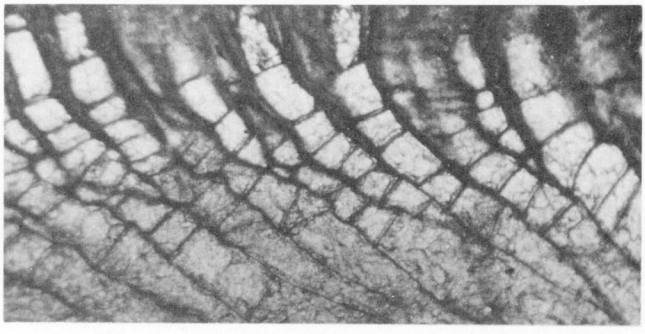

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Figure 1. ?*Eridotrypella ottawaensis* n. sp. (X 25). Tangential section showing monticule and monticular rim with two cycles of tubes; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; holotype, G.S.C. No. 12412. (Page 16.)

Figures 2, 4. ?*Eridotrypella prima* n. sp. (X 25). Tangential and vertical sections; Cobourg beds, west end of Sparks Street, Ottawa, Ontario; holotype, G.S.C. No. 12413. (Page 17.)

Figure 3. *Favositella laxata* (Ulrich) (X 25). Vertical section; Cobourg beds, Booth Street, Ottawa, Ontario; hypotype, G.S.C. No. 12454. (Page 38.)

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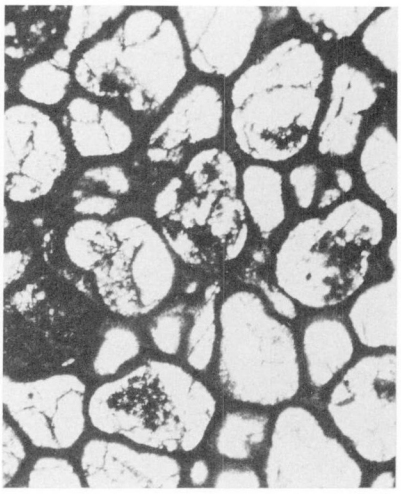

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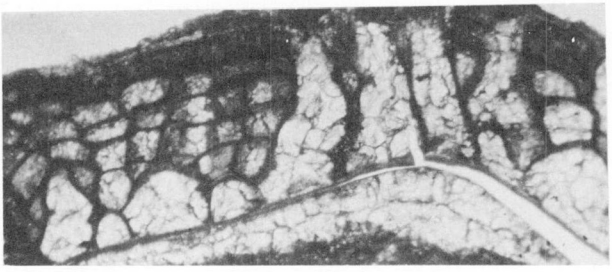

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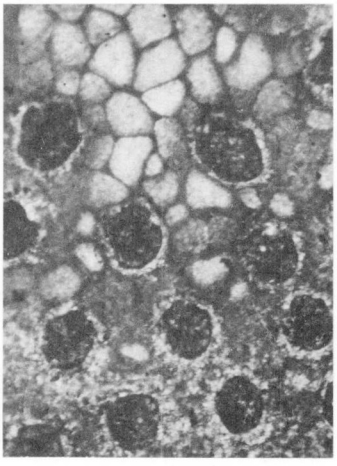

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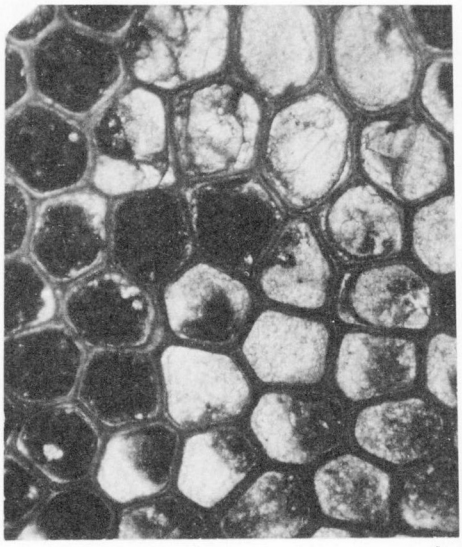
Figures 1, 4. *Favositella mammilata* n. sp. (X 25). Tangential and vertical sections; Cobourg beds, Nepean Point, Ottawa, Ontario; holotype, G.S.C. No. 12455. (Page 39.)

Figure 2. *Favositella laxata* (Ulrich) (X 25). Tangential section; Cobourg beds, Booth Street, Ottawa, Ontario; hypotype, G.S.C. No. 12454. (Page 38.)

Figures 3, 5. *Fistulipora stewarti* n. sp. (X 25). Vertical and tangential sections; Pamelia-Lowville beds, Stewart quarry, Rockland, Ontario; holotype, G.S.C. No. 12456. (Page 39.)



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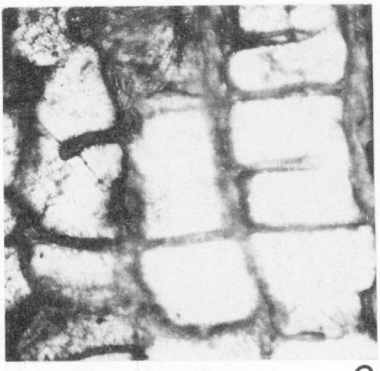

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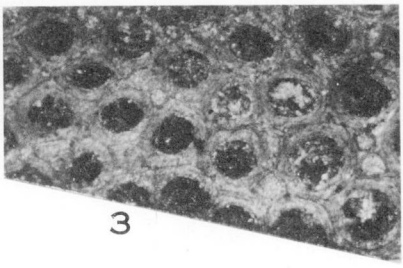

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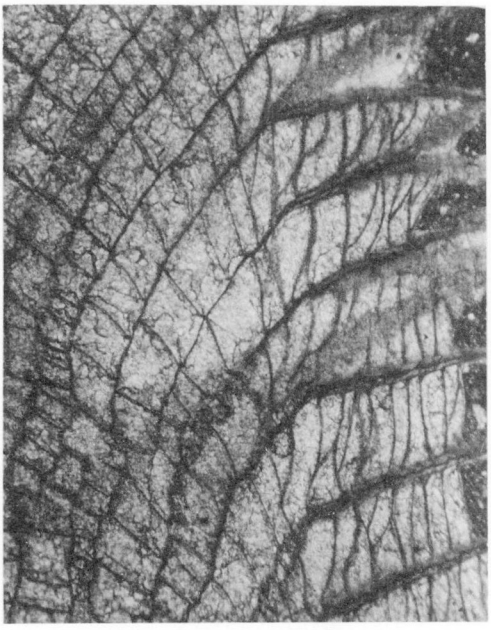

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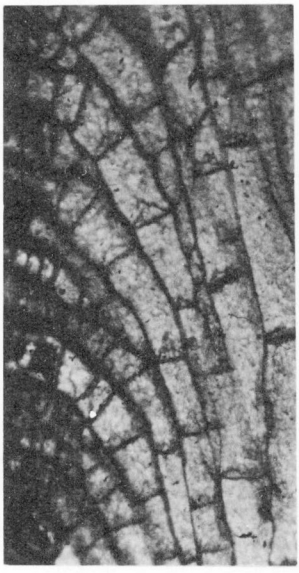
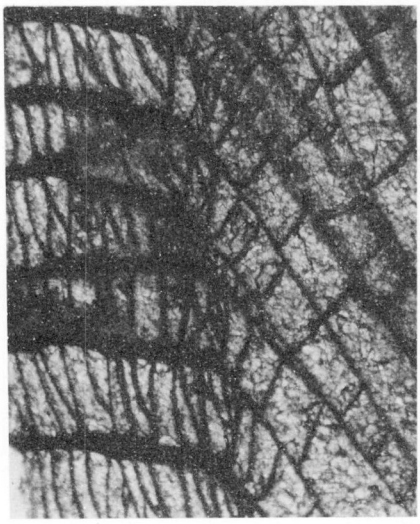


Figures 1, 4. *Hallopora lydiana* n. sp. (X 25). Tangential and vertical sections; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; holotype, G.S.C. No. 12415. (Page 18.)

Figure 2. *Hemiphragma ottawaense* (Foord) (X 45). Vertical section; Cobourg beds, Booth Street, Ottawa, Ontario; hypotype, G.S.C. No. 12419. (Page 20.)

Figures 3, 5. *Hallopora dumalis magna* n. var. (X 25). Tangential and vertical sections; Hull beds, Powder Magazine quarry, Ottawa, Ontario; holotype, G.S.C. No. 12414. (Page 18.)



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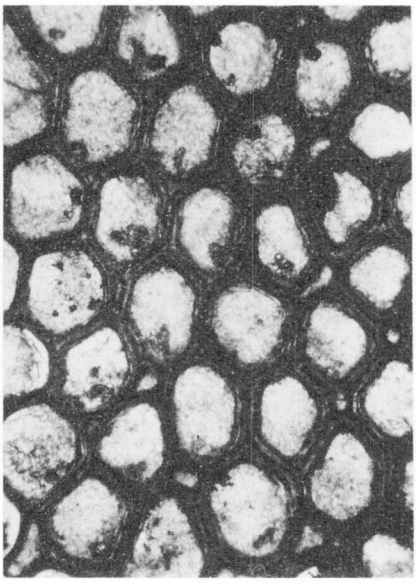

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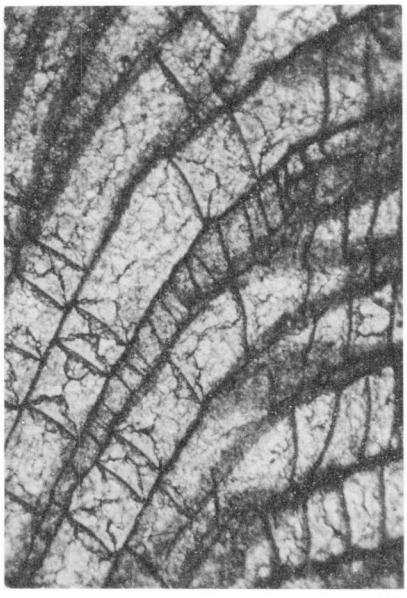

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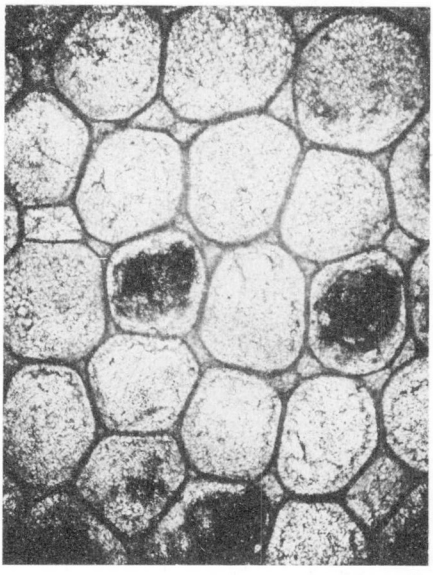

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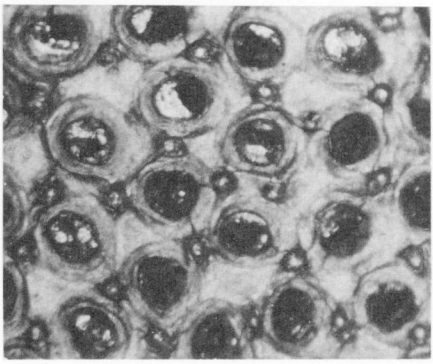
Figures 1, 2. *Hallopora multitabulata* (Ulrich) (X 25). Vertical and tangential sections; Rockland beds, Embrun, Ontario; hypotype, G.S.C. No. 12416. (Page 19.)

Figures 3, 4. *Hallopora multitabulata* (Ulrich). Vertical (X 25) and tangential (X 40) sections; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; hypotype, G.S.C. No. 12417. (Page 19.)



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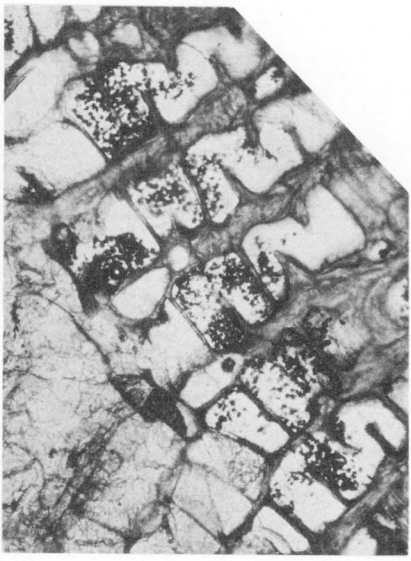

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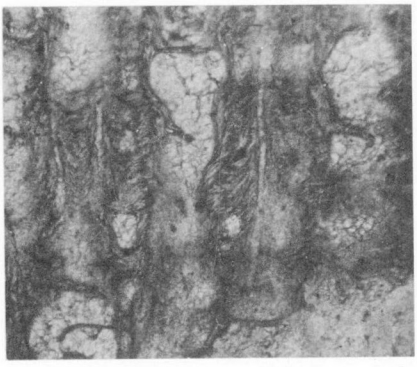

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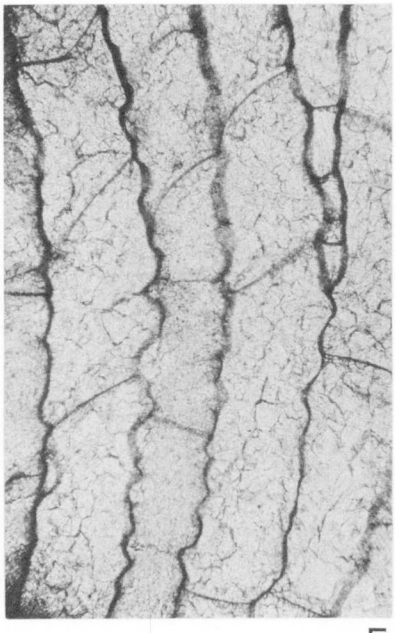

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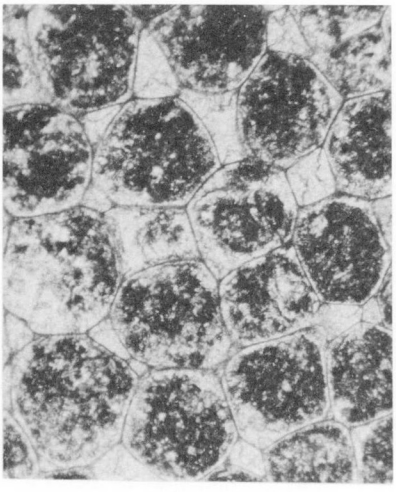

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Figures 1, 2. *Hemiphragma ottawaense* (Foord). Tangential (X 25) and vertical (X 30) sections; Cobourg beds, Booth Street, Ottawa, Ontario; hypotype, G.S.C. No. 12419. (Page 20.)

Figure 3. *Hemiphragma ottawaense* (Foord) (X 25). Vertical section; Leray-Rockland beds, Paquette Rapids, Ottawa River; hypotype, G.S.C. No. 12420. (Page 20.)

Figures 4, 5. *Hemiphragma crassicrenulatum* n. sp. Tangential (X 25) and vertical (X 30) sections; Cobourg beds, west of Green Creek, Ontario; holotype, G.S.C. No. 12418. (Page 19.)

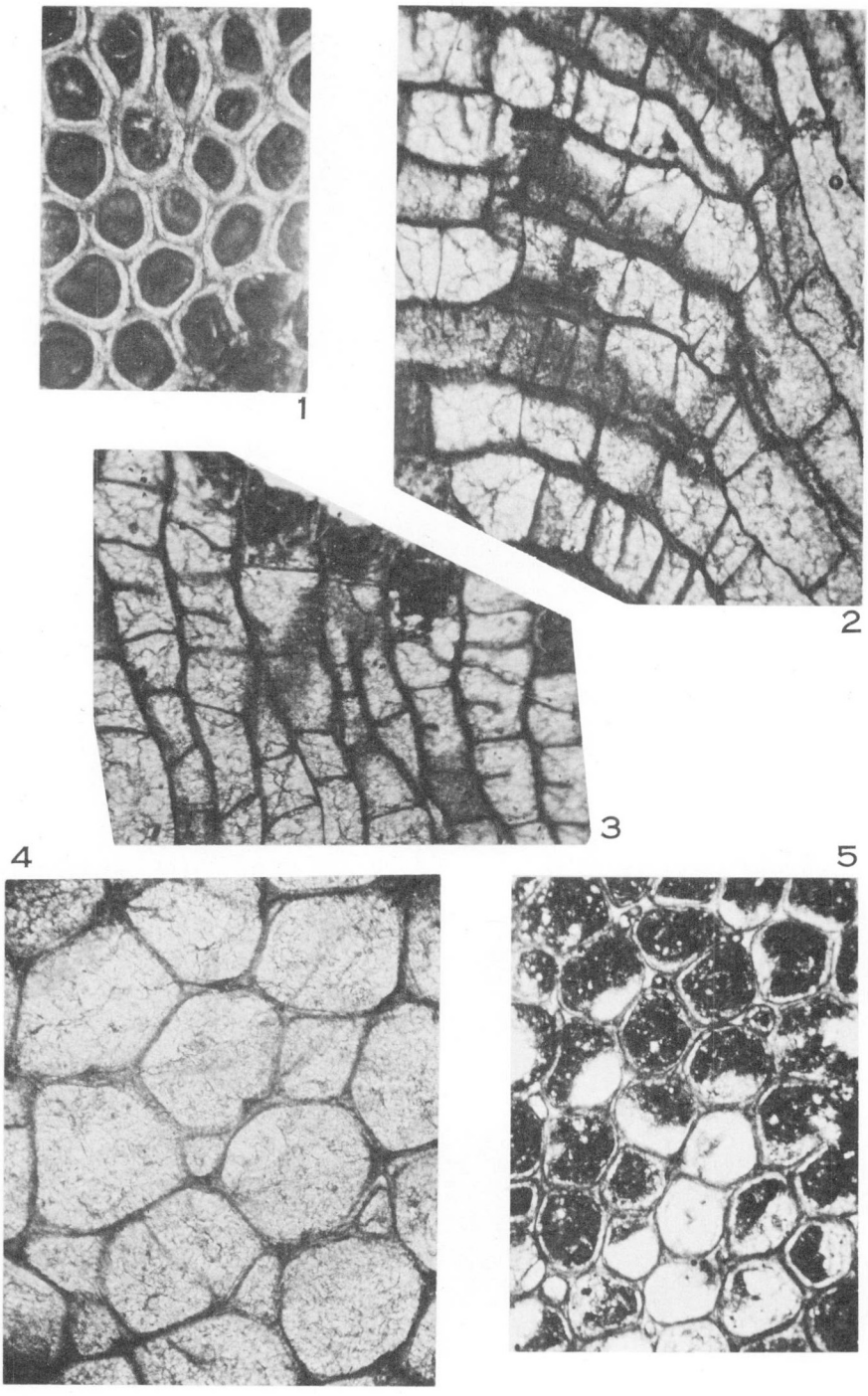
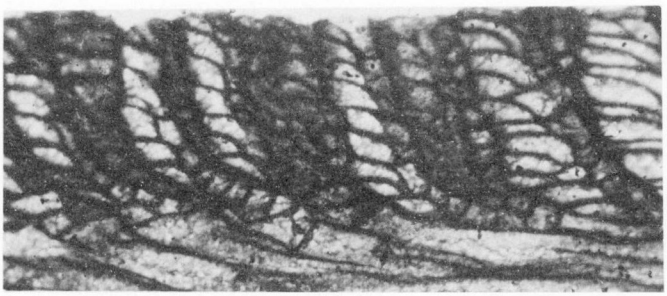


Figure 1. *Homotrypa lowvillensis* n. sp. (X 25). Tangential section; Lowville beds, Embrun, Ontario; holotype, G.S.C. No. 12423. (Page 22.)

Figures 2, 4. *Hemiphragma shermanense* n. sp. Vertical (X 25) and tangential (X 45) sections; Sherman Fall beds, Hull, Quebec; holotype, G.S.C. No. 12421. (Page 20.)

Figures 3, 5. *Hemiphragma tenuimurale* Ulrich (X 25). Vertical and tangential sections; Sherman Fall beds, Brewery Creek, Hull, Quebec; hypotype, G.S.C. No. 12422. (Page 21.)



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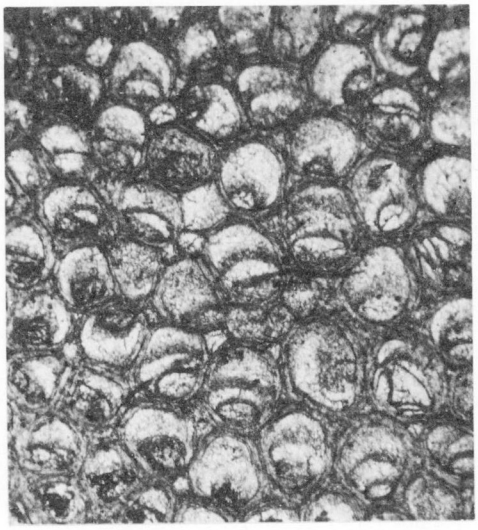

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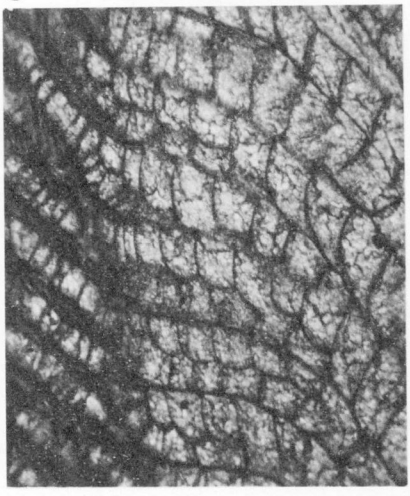
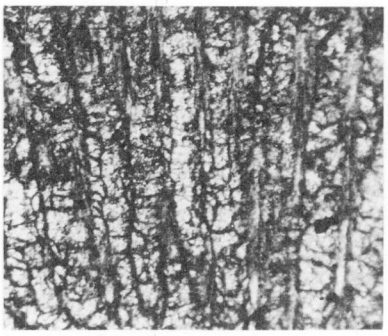


Figures 1, 2. *Homotrypa* cf. *minnesotensis* Ulrich (X 25). Vertical and tangential sections; Leray beds, Young Street and Fairmont Avenue, Ottawa, Ontario; hypotype, G.S.C. No. 12424. (Page 22.)

Figure 3. *Homotrypa lowvillensis* n. sp. (X 25). Vertical section; Lowville beds, Embrun, Ontario; holotype, G.S.C. No. 12423. (Page 22.)

Figures 4, 5. *Homotrypa similis* Foord (X 25). Tangential and vertical sections; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; hypotype, G.S.C. No. 12425. (Page 23.)



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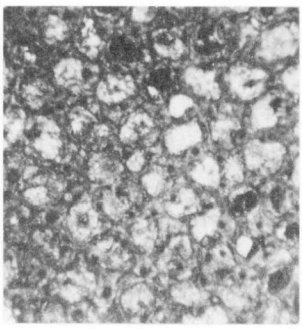

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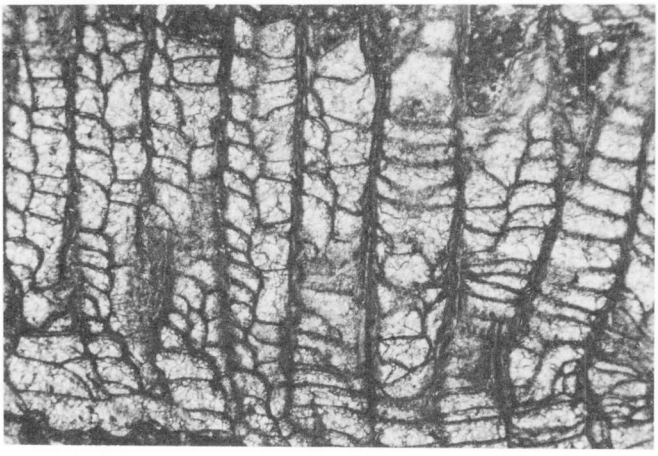

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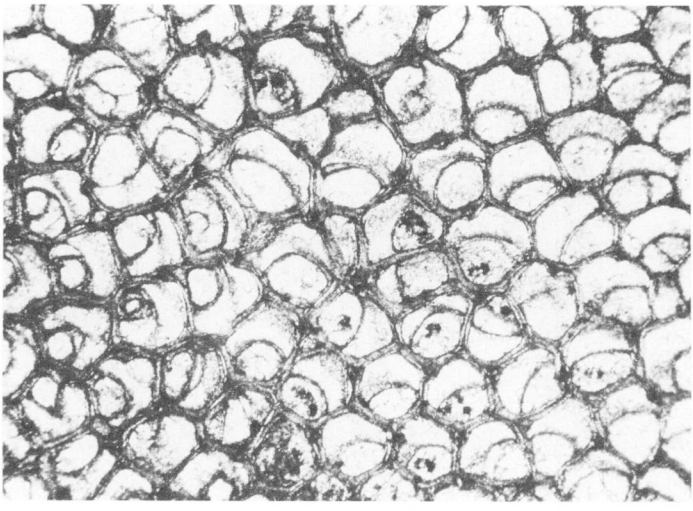

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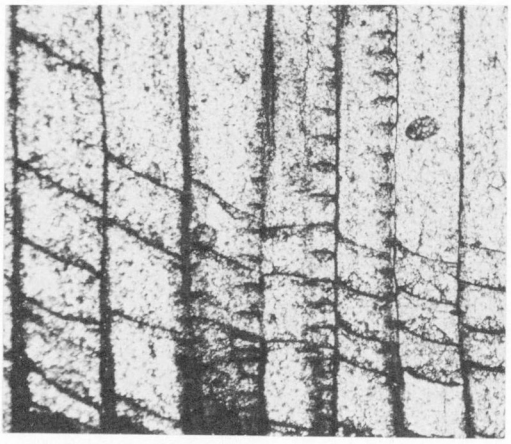
Figures 1, 2. *Homotrypella spicata* n. sp. (X 25). Vertical and tangential sections; Hull beds, Huli, Quebec; holotype, G.S.C. No. 12427. (Page 23.)

Figures 3, 4. *Homotrypella hospitalis crassa* (Ulrich) (X 25). Vertical and tangential sections; Leray beds, Mechanicsville, Ottawa, Ontario; hypotype, G.S.C. No. 12426. (Page 23.)



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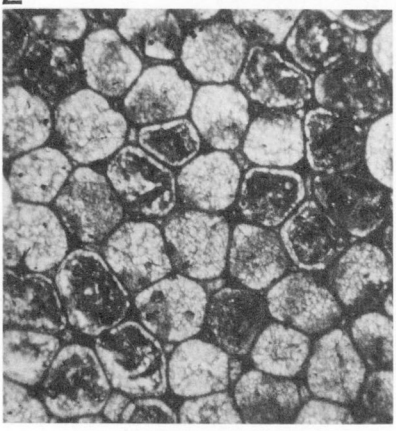

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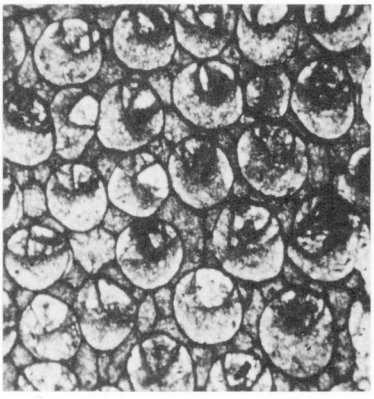

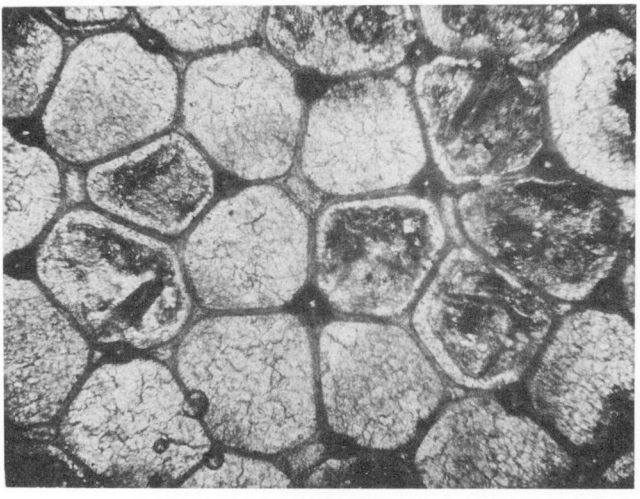

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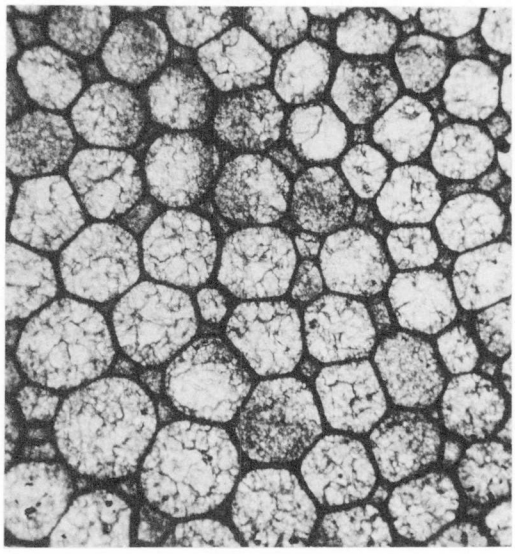
Figures 1, 2. *Mesotrypa angularis parvatrypa* n. var. (X 25). Vertical and tangential sections; Sherman Fall beds, east of Black River Station, Ontario; holotype, G.S.C. No. 12428. (Page 24.)

Figure 3. *Mesotrypa obliqua* n. sp. (X 25). Tangential section; Leray beds, Milles Roches quarries, Ontario; holotype, G.S.C. No. 12429. (Page 25.)

Figure 4. Enlargement (X 50) of figure 2.



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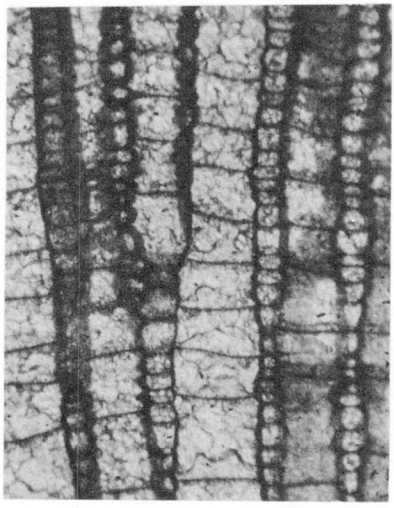

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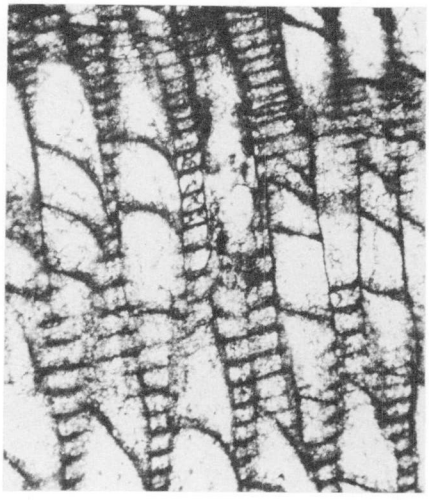

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Figures 1, 2. *Mesotrypa prolifica* Fritz (X 25). Tangential and vertical sections; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; hypotype, G.S.C. No. 12430. (Page 25.)

Figure 3. *Mesotrypa obliqua* n. sp. (X 25). Vertical section; Leray beds, Milles Roches quarries, Ontario; holotype, G.S.C. No. 12429. (Page 25.)

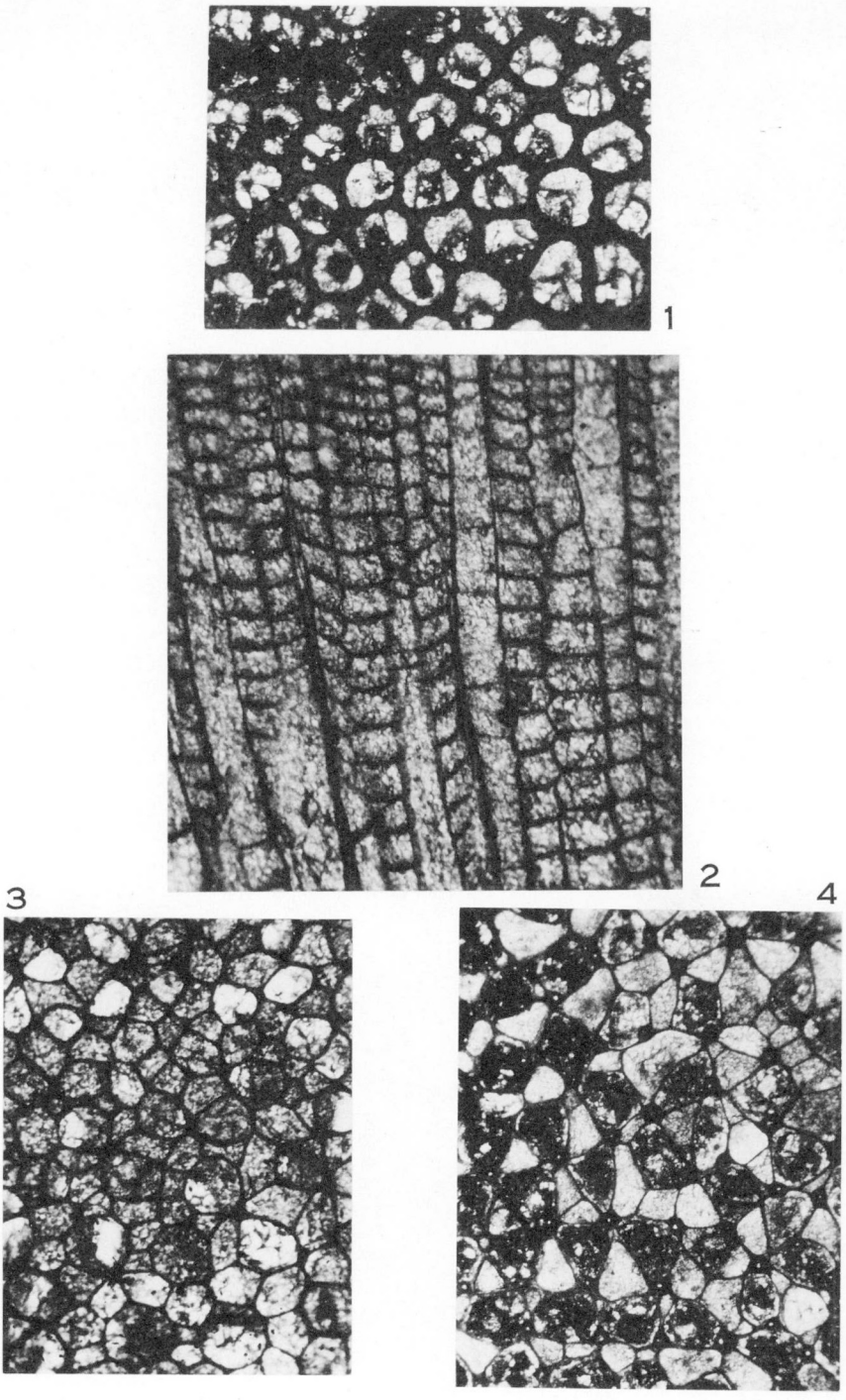
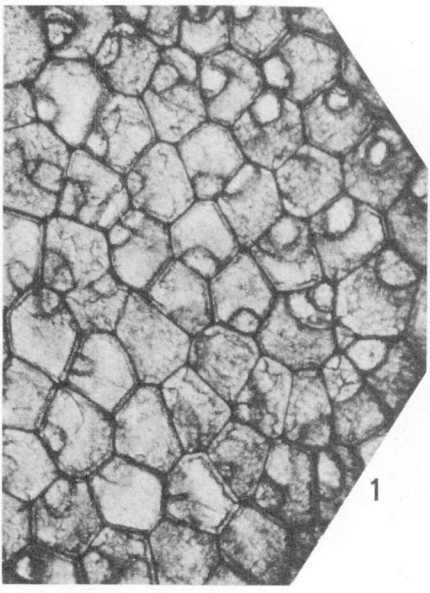


Figure 1. *Monticulipora bullata* n. sp. (X 25). Tangential section; Cobourg beds, Nepean Point, Ottawa, Ontario; holotype, G.S.C. No. 12434. (Page 27.)

Figures 2, 3. *Mesotrypa whiteavesii* (Nicholson) (X 25). Vertical and tangential sections; Cobourg beds, Rochester and Lydia Streets, Ottawa, Ontario; hypotype, G.S.C. No. 12431. (Page 26.)

Figure 4 *Mesotrypa whiteavesii* (Nicholson) (X 25). Tangential section; Hull beds, Brigham Creek, Hull, Quebec; hypotype, G.S.C. No. 12432. (Page 26.)



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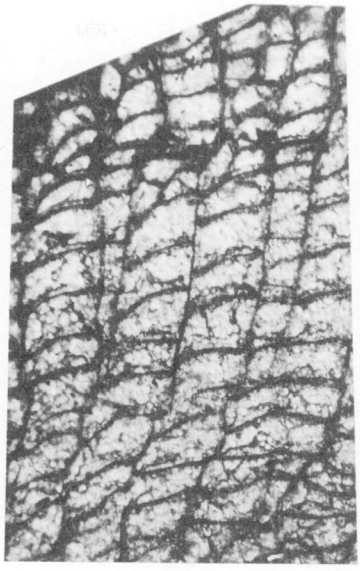

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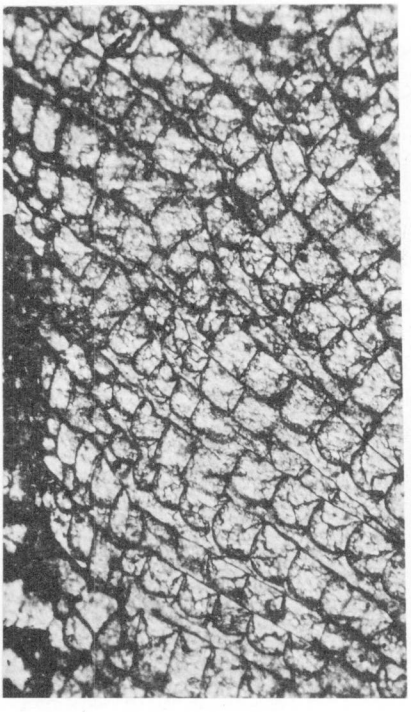

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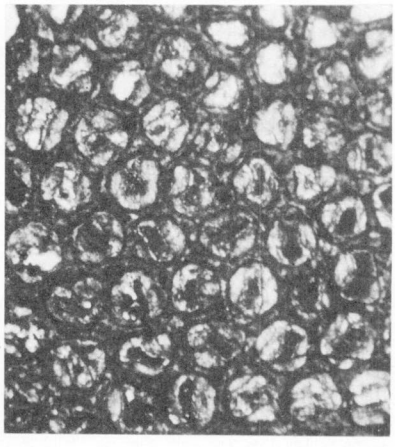

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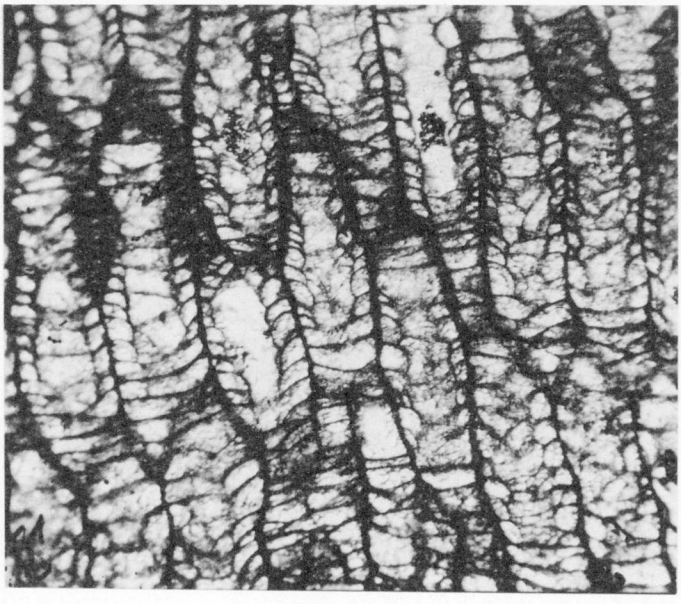
Figures 1, 2. ?*Monticulipora cannonensis* Ulrich. Tangential (X 30) and vertical (X 25) sections; Sherman Fall beds, Embrun, Ontario; hypotype, G.S.C. No. 12435. (Page 27.)

Figures 3, 4. *Monticulipora arborea* Ulrich (X 25). Vertical and tangential sections; Sherman Fall beds, Val Tetreau, Quebec; hypotype, G.S.C. No. 12433. (Page 26.)



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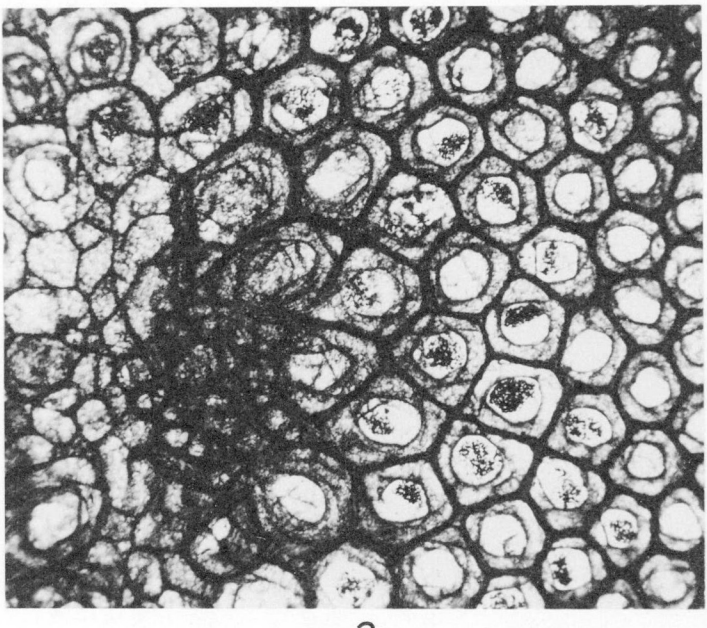

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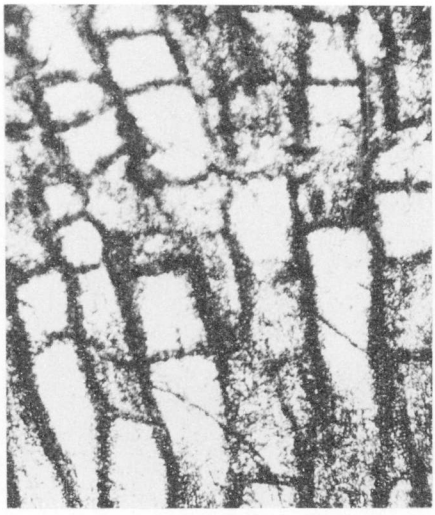
Figures 1, 2. *Monticulipora loeblichi* n. sp. (X 25). Vertical and tangential sections; Hull beds, Embrun, Ontario; holotype, G.S.C. No. 12436. (Page 28.)



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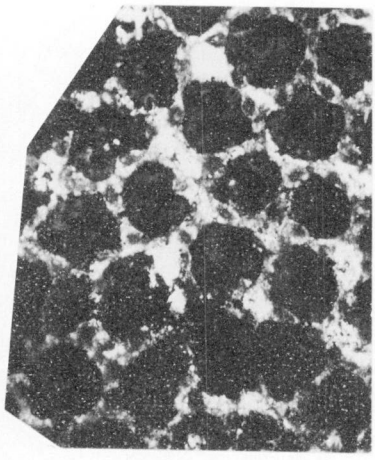

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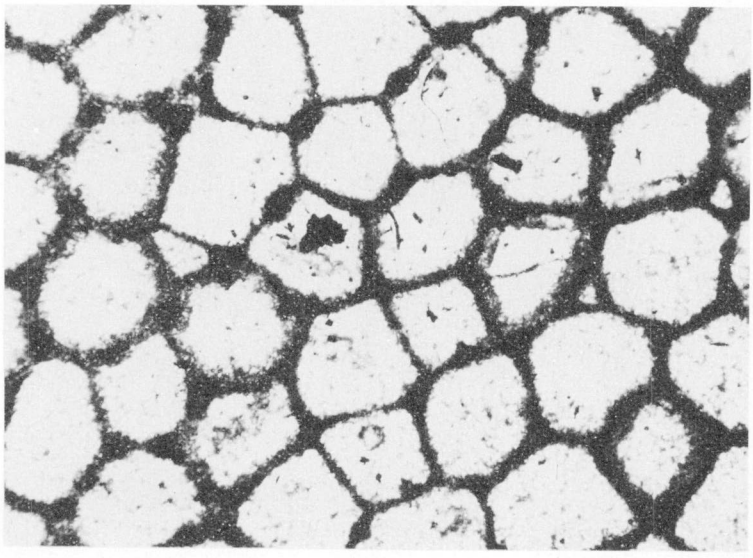
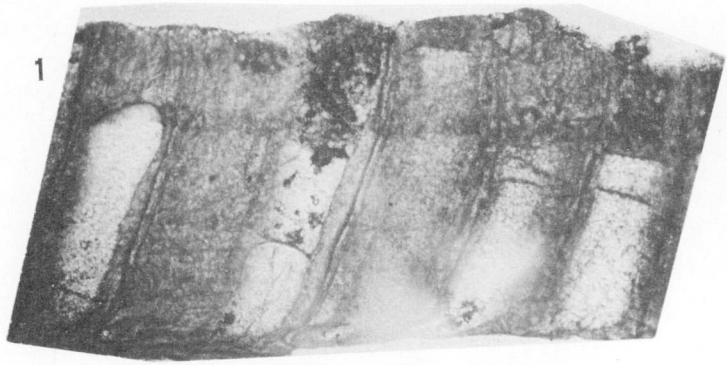
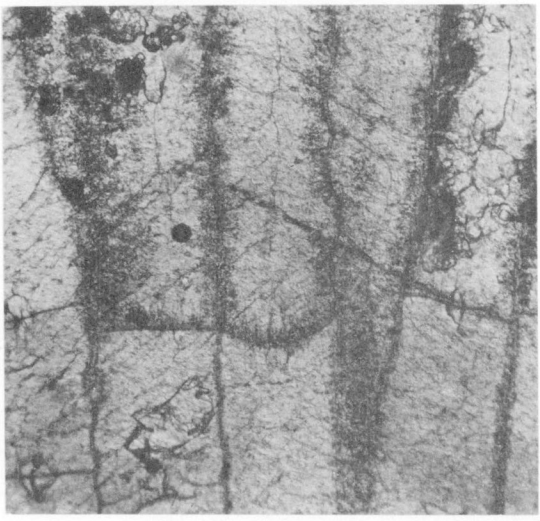


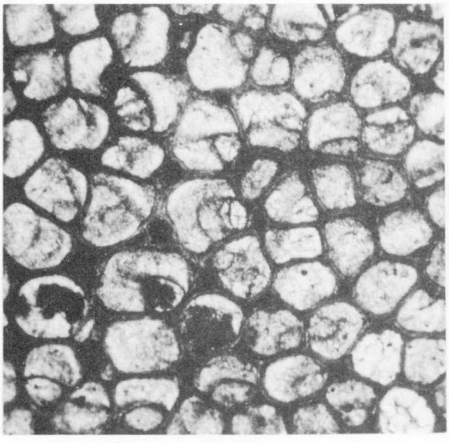
3

Figures 1, 2. *Nicholsonella wilsonae* n. sp. (X 25). Vertical and tangential sections; Rockland beds, Stewart quarry, Rockland, Ontario; holotype, G.S.C. No. 12437. (Page 29.)

Figure 3. *Orbipora americana* n. sp. (X 25). Tangential section; Cobourg beds, Booth Street, Ottawa, Ontario; holotype, G.S.C. No. 12439. (Page 30.)







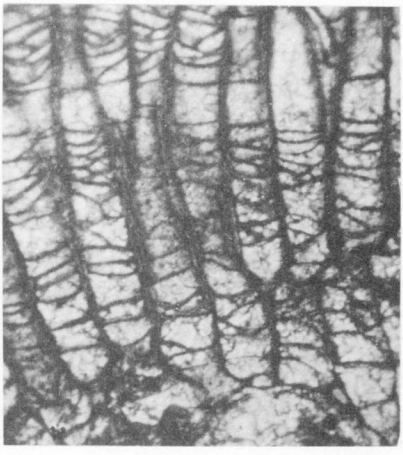


Figure 1. *Phyllodictya hybrida* n. sp. (X 30). Vertical section; Hull beds, Embrun, Ontario; holotype, G.S.C. No. 12457. (Page 40.)

Figure 2. *Orbipora americana* n. sp. (X 25). Vertical section; Cobourg beds, Booth Street, Ottawa, Ontario; holotype, G.S.C. No. 12439. (Page 30.)

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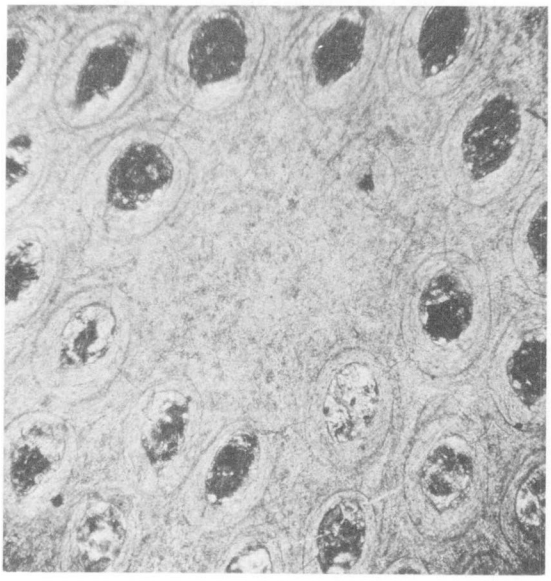

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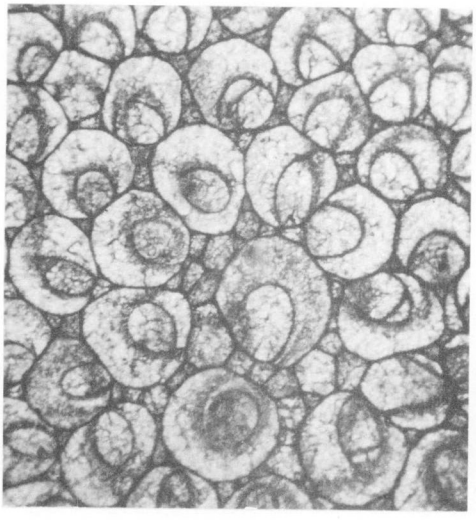

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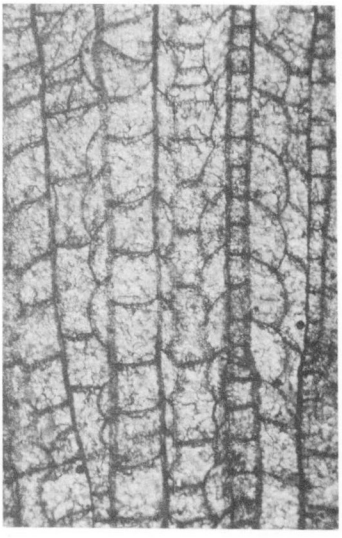

Figure 1. *Phyllodictya hybrida* n. sp. (X 30). Tangential section; Hull beds, Embrun, Ontario; holotype, G.S.C. No. 12457. (Page 40.)

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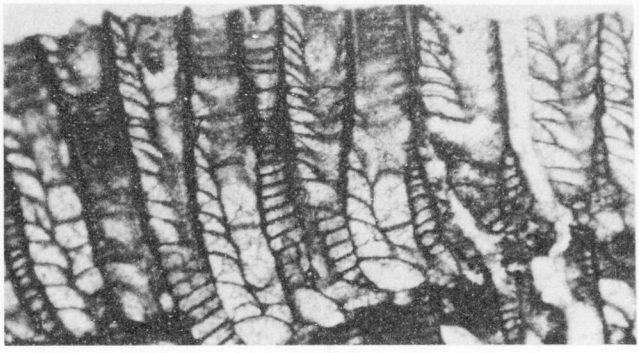

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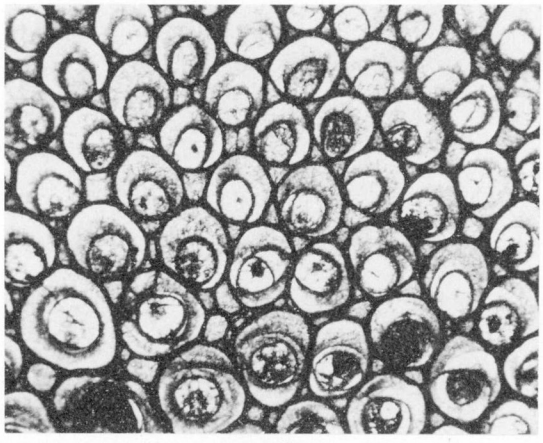

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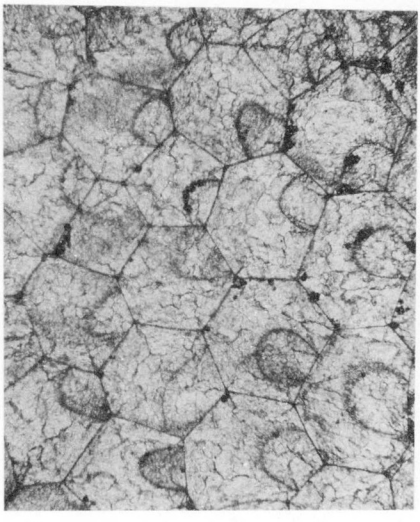

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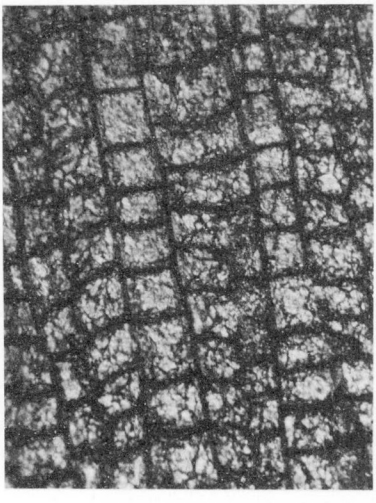

Figures 1, 2. *Prasopora hybrida* n. sp. (X 25). Vertical and tangential sections; Cobourg beds, Roxborough tp., Ontario; holotype, G.S.C. No. 12442. (Page 32.)

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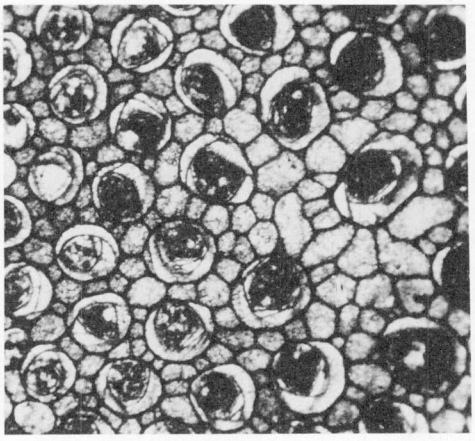

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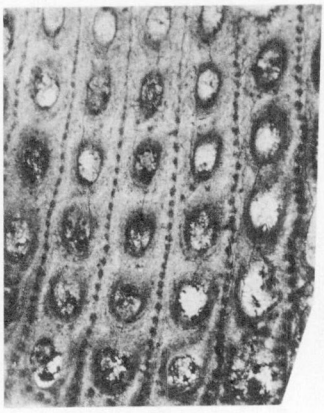

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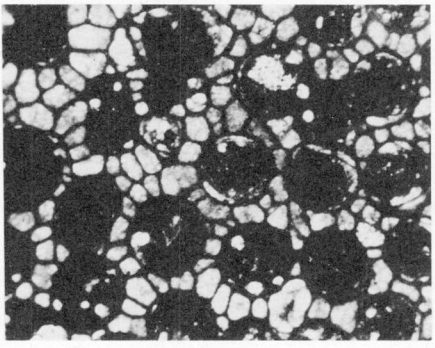

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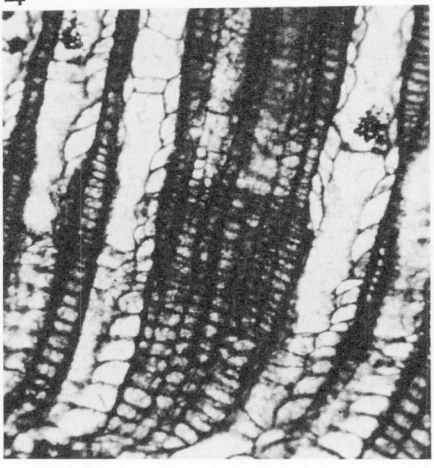

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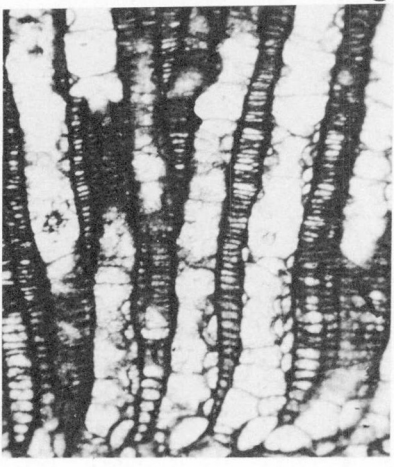

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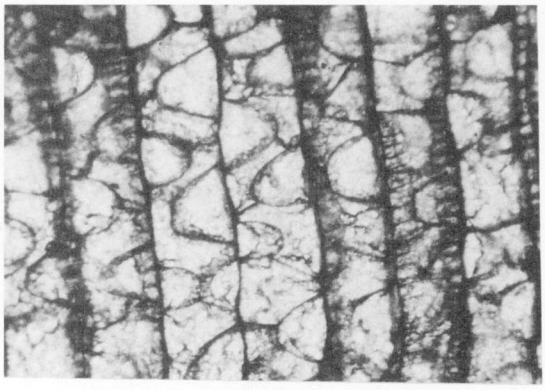

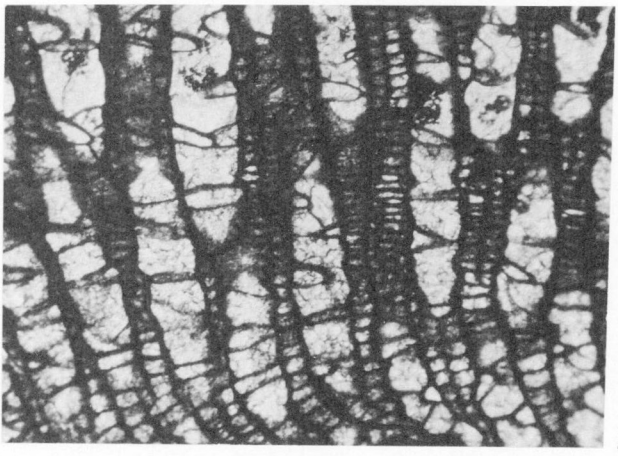

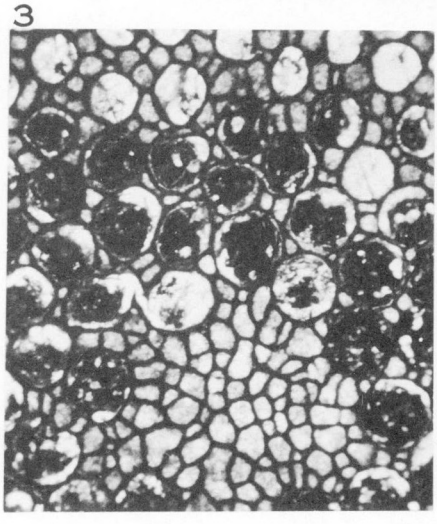

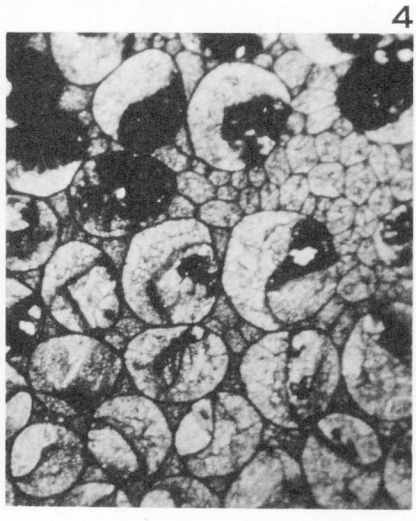

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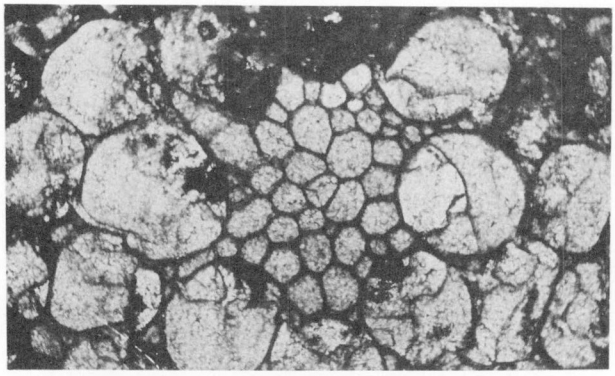

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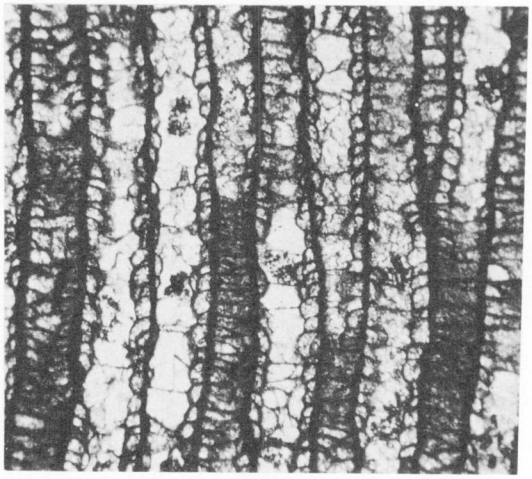

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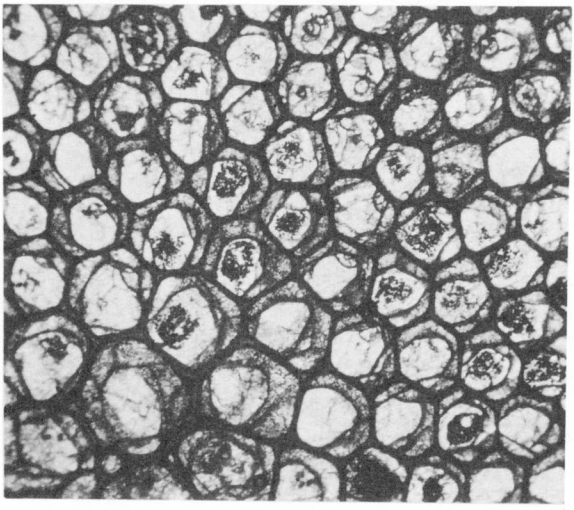

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Figure 1. *Prasoporina semioculata* n. sp. (X 30). Tangential section showing large zooecia surrounding maculae; Hull beds, Brigham Creek, Hull, Quebec; holotype, G.S.C. No. 12448. (Page 36.)

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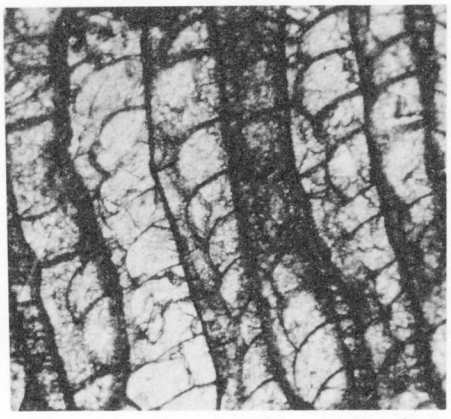

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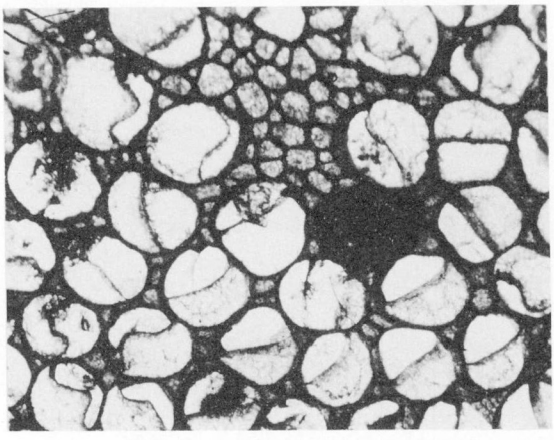

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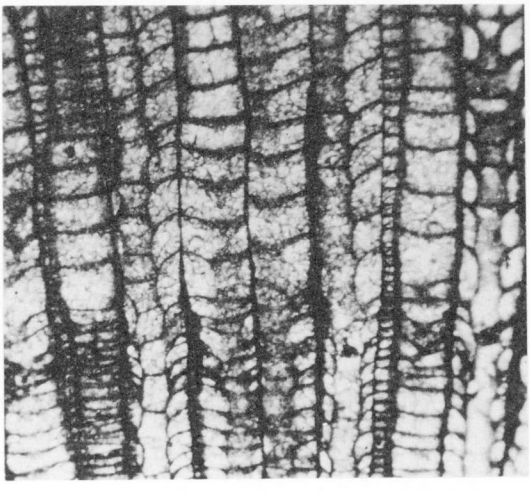

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Figure 1. *Prasoporina semioculata* n. sp. (X 25). Vertical section; Hull beds, Brigham Creek, Hull, Quebec; holotype, G.S.C. No. 12448. (Page 36.)

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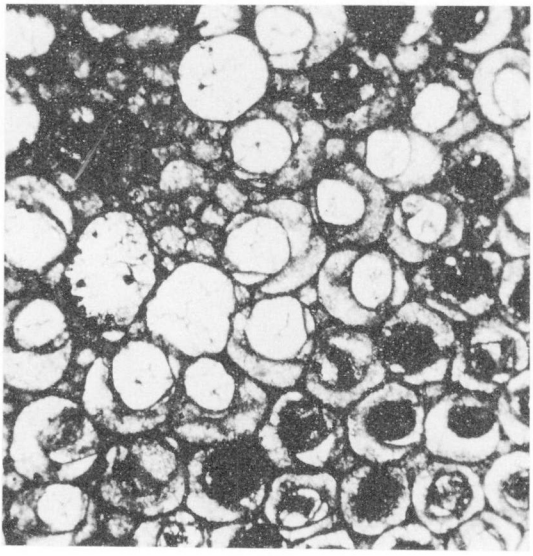

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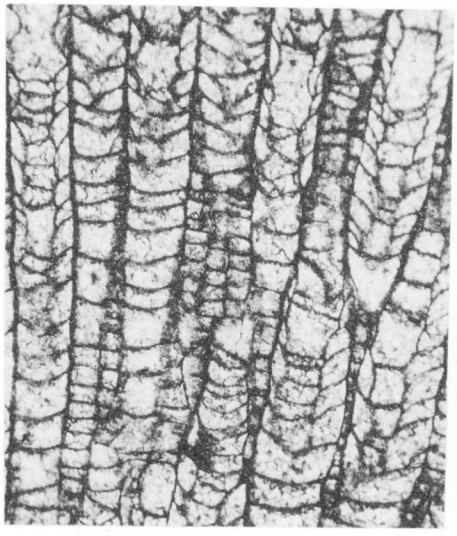

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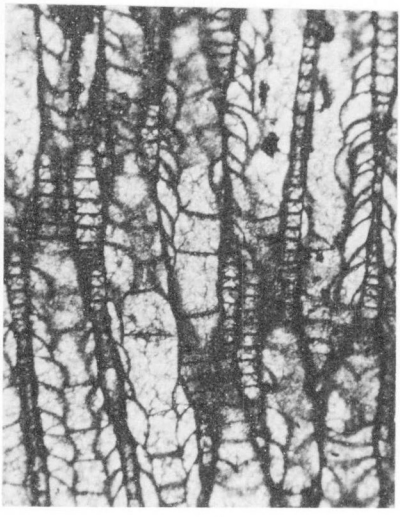

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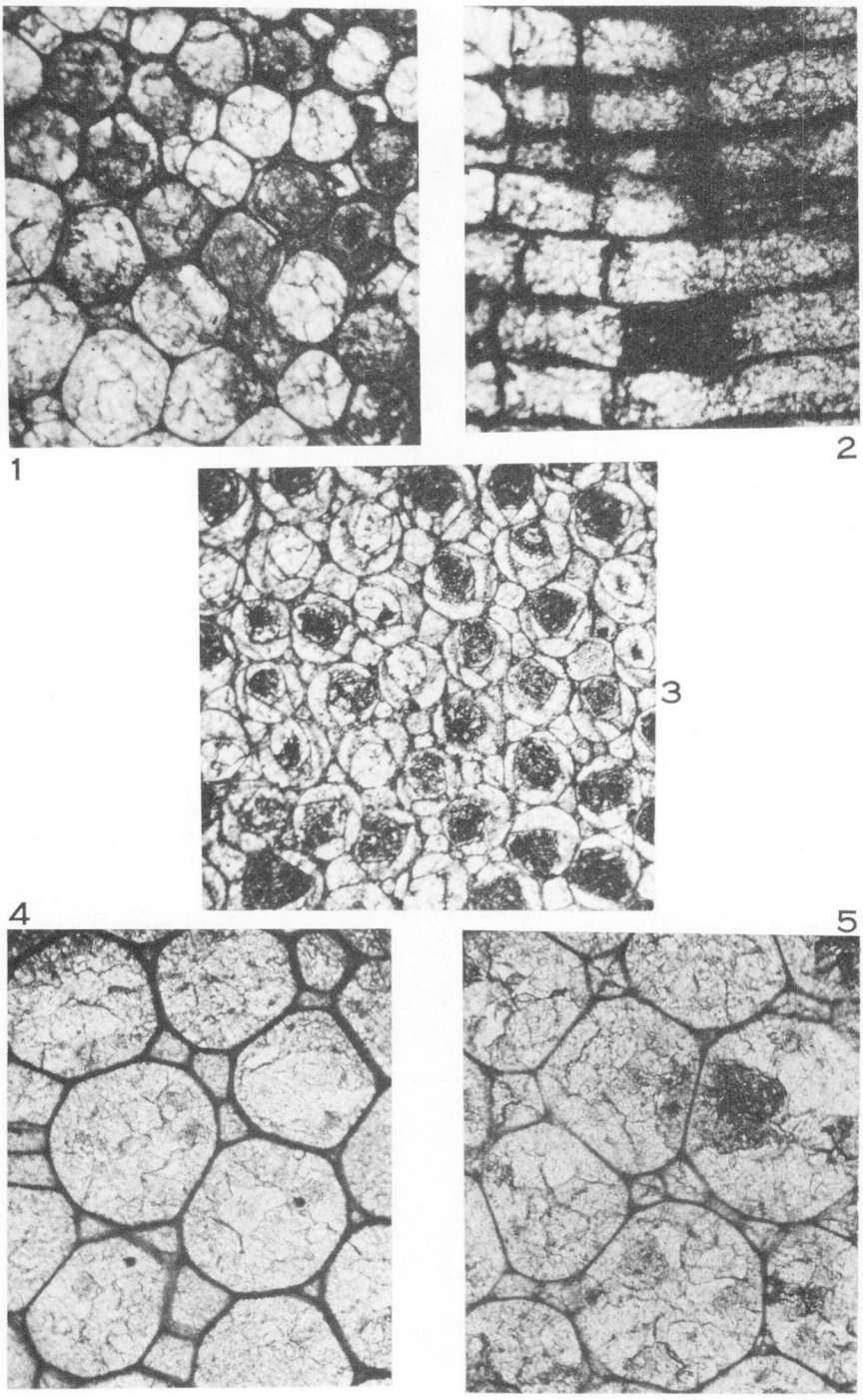

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