

Redescription of Type Specimens  
of Species of the Bryozoan Genera  
*Dekayia*, *Homotrypa*, and *Stigmatella*  
from Upper Ordovician Rocks  
Along Workman's Creek, Ontario

Madeleine A. Fritz





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MADELEINE A. FRITZ

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# Redescription of Type Specimens of Species of the Bryozoan Genera *Dekayia*, *Homotrypa*, and *Stigmatella* from Upper Ordovician Rocks Along Workman's Creek, Ontario

## Abstract

Bryozoan species described by the author in 1926 from the Upper Ordovician Georgian Bay (Meaford) Formation are redescribed both qualitatively and quantitatively. These types are housed in the Department of Invertebrate Palaeontology, Royal Ontario Museum.

## Introduction

This publication is devoted to the redescription of bryozoan type specimens from the marine rocks outcropping along Workman's Creek, a small stream that enters Nottawasaga Bay approximately 4 km southeast of the town of Meaford, Grey County, Ontario. On 2 June 1945 Workman's Creek was renamed East Meaford Creek, but in 1976 the original name was restored by the Ontario Geographic Names Board.

The marine strata along Workman's Creek were correlated with those of the Toronto region (Parks, 1925a; Dyer, 1925). The stratigraphic sequence recognized by the author (1926) for the Workman's Creek Section is as follows:

| <i>Formation</i> | <i>Member</i>                              |
|------------------|--|
| Meaford          | Vincent<br>Erindale                        |
| Dundas           | Christie<br>Humber<br>Danforth<br>Rosedale |

Liberty (1969) included this section in the upper part of the Georgian Bay Formation.



## *Materials and Methods*

The primary types of the following species are treated in this paper:

*Dekayia appressa distincta* Fritz, ROM 1308HR, herein *Dekayia distincta* Fritz

*Dekayia granulosa* Fritz, ROM 1309HR

*Dekayia meafordensis* Fritz, ROM 1310HR

*Homotrypa cincinnatiensis meafordensis* Fritz, ROM 12317, herein *Homotrypa meafordensis* Fritz

*Stigmatella sessilis delicatula* Fritz, ROM 1316HR

*Stigmatella intermedia* Fritz, ROM 1276HR

*Stigmatella crenulata meafordensis* Fritz, ROM 1313HR

*Stigmatella peculiaris* Fritz, ROM 12318

*Stigmatella vulgaris ramosa* Fritz, ROM 1317HR

*Stigmatella peculiaris similis* Caley, ROM 1530HR, herein *S. similis*

In addition, two figured specimens of *Stigmatella crenulata* Ulrich and Bassler, USNM 43197 and 43198, were kindly lent by the United States National Museum.

The external features of the zoaria, such as colony shape and surface character, were observed by hand lens, and the internal structures by thin sections. The mensuration of the number of zooecia in 2 mm in the intermonticular or intermacular areas and the measurements in millimetres of the maximum dimension of zooecial apertures in the monticular, macular, and "inter" areas were made with a binocular microscope and a micrometre scale calibrated to 0.01 mm. The number of entire mesopores and the number of entire acanthopores in 1 mm<sup>2</sup> were obtained by using a compound microscope and a reticle calibrated to 1 mm<sup>2</sup>. Statistical computations were made on the IBM360 computer at the University of Toronto Computer Centre. As most of the samples had heterogeneous variances, it was not possible to test differences among means using parametric statistical methods; instead the samples were tested for differences in dispersion using the non-parametric Mann-Whitney U-Test (Siegel, 1956). In the tables, probability ranges associated with the significance tests are designated with asterisks as follows: \*\*\* =  $P \leq 0.001$ ; \*\* =  $P \leq 0.01$ ; \* =  $P \leq 0.05$ ; not significant = ns =  $P > 0.05$ .

## *Systematic Palaeontology*

**Order Trepostomata Ulrich, 1882**

**Family Heterotrypidae Ulrich, 1890**

**Genus *Dekayia* Milne-Edwards and Haime, 1851**

**Type Species**

*Dekayia aspera* Milne-Edwards and Haime, 1851



## *Dekayia distincta* Fritz

Fig. 1A-D

*Dekayia appressa distincta* Fritz, 1926: 98, 99.

### EXTERNAL FEATURES

Type a single round branch, 20 mm long, 6 mm diameter, compressed with growth to 11 mm wide by 4 mm thick. Surface with small conical monticules, 2 to 3 mm apart centre to centre. Zooecia in monticules larger than those in intermonticular areas.

### TANGENTIAL SECTION

Zooecia bluntly polygonal, 9 to 10.5 in 2 mm in intermonticular areas (Table 1); apertures oval, circular, subangular; walls appear amalgamate and concentrically laminated, mural lacunae prominent. Mesopores scarce (Table 1). Acanthopores moderately abundant (Table 1), 0.02 to 0.05 mm diameter, with walls concentrically laminated and central core clear. Diameter of zooecial apertures in monticules 0.17 to 0.25 mm, in intermonticular areas 0.13 to 0.16 mm (Table 1).

### LONGITUDINAL SECTION

Zooecia fanning out gradually, meeting zoarial surface perpendicularly to slightly obliquely. Endozone walls thin, undulating or finely crenulated throughout the several rejuvenations; crenulation coarser in terminal endozone. At base of exozone walls thicken gradually, becoming irregularly thickened as growth proceeds. Usually two diaphragms per zooecium in exozone. Mural lacunae show clearly in certain areas. Acanthopores not observed in endozone, but a few appear in exozone where they are short, relatively stout structures with cone-in-cone walls and clear central axis; some protruding beyond surface as low pointed cones.

### Remarks

*Dekayia distincta* differs from *Dekayia appressa* in being uniformly larger and in having more numerous acanthopores, fewer diaphragms, irregular zooecial walls in exozone, and in lacking closely spaced diaphragms in mesopores of exozone. Quantitative data are not at present available for *D. appressa*. However, in Table 1 *D. distincta* is shown in comparison with *D. granulosa* and *D. meafordensis*.

### Type

Holotype: ROM 1308HR, Dundas Formation, Christie Member, Workman's Creek, Ontario.



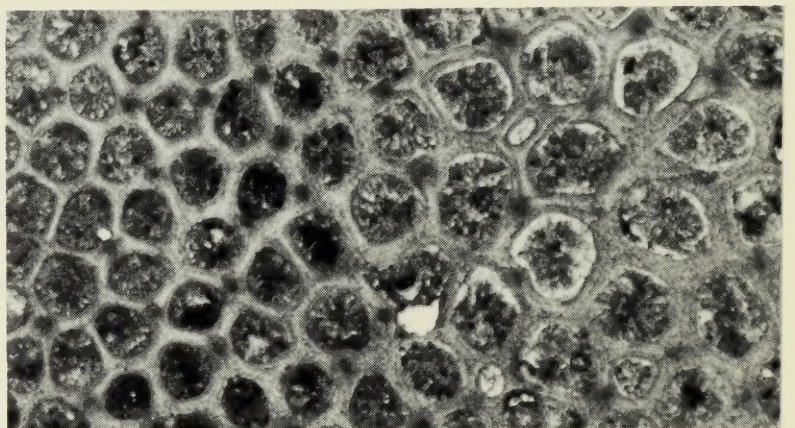
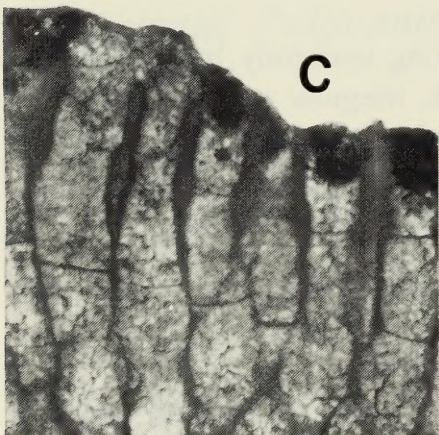
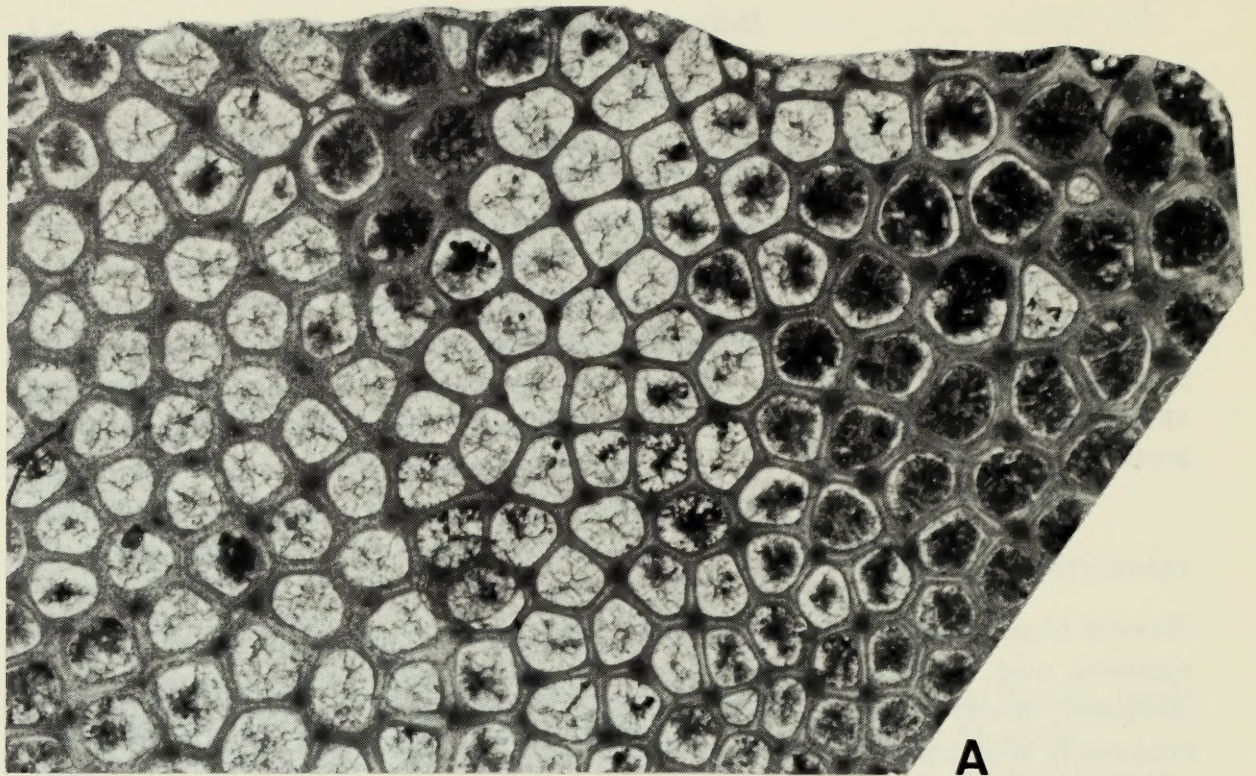


Fig. 1 A-D *Dekayia distincta* Fritz, holotype, ROM 1308HR.  
A, D Tangential section,  $\times 30$   
B, C Longitudinal section,  $\times 30$



## *Dekayia granulosa* Fritz, 1926

Figs. 2A, B; 4F

*Dekayia granulosa* Fritz, 1926: 99.

### EXTERNAL FEATURES

Type a Y-shaped fragment, 25 mm long; zoarium dichotomously branched with average branch diameter 5 mm. Surface smooth, with maculae composed of zooecia larger than those in the intermacular areas.

### TANGENTIAL SECTION

Zooecia subangular with apertures round, oval, or bluntly polygonal, 9 to 12 in 2 mm in intermacular areas (Table 1); walls 0.02 to 0.04 mm wide, amalgamate, concentrically laminate, with clear central band highlighting junction of contiguous zooecia; walls with tiny lacunae. Mesopores rare (Table 1); acanthopores numerous (Table 1), mostly in zooecial angles very slightly inflecting the zooecial void, 0.02 to 0.03 mm in diameter, with walls concentrically laminated and clear central core. Maculae about 3 mm apart centre to centre, composed of larger zooecia surrounding small central cluster of mesopores. Diameter of zooecial apertures in maculae 0.15 to 0.20 mm (Table 1), in intermacular areas 0.13 to 0.16 mm (Table 1).

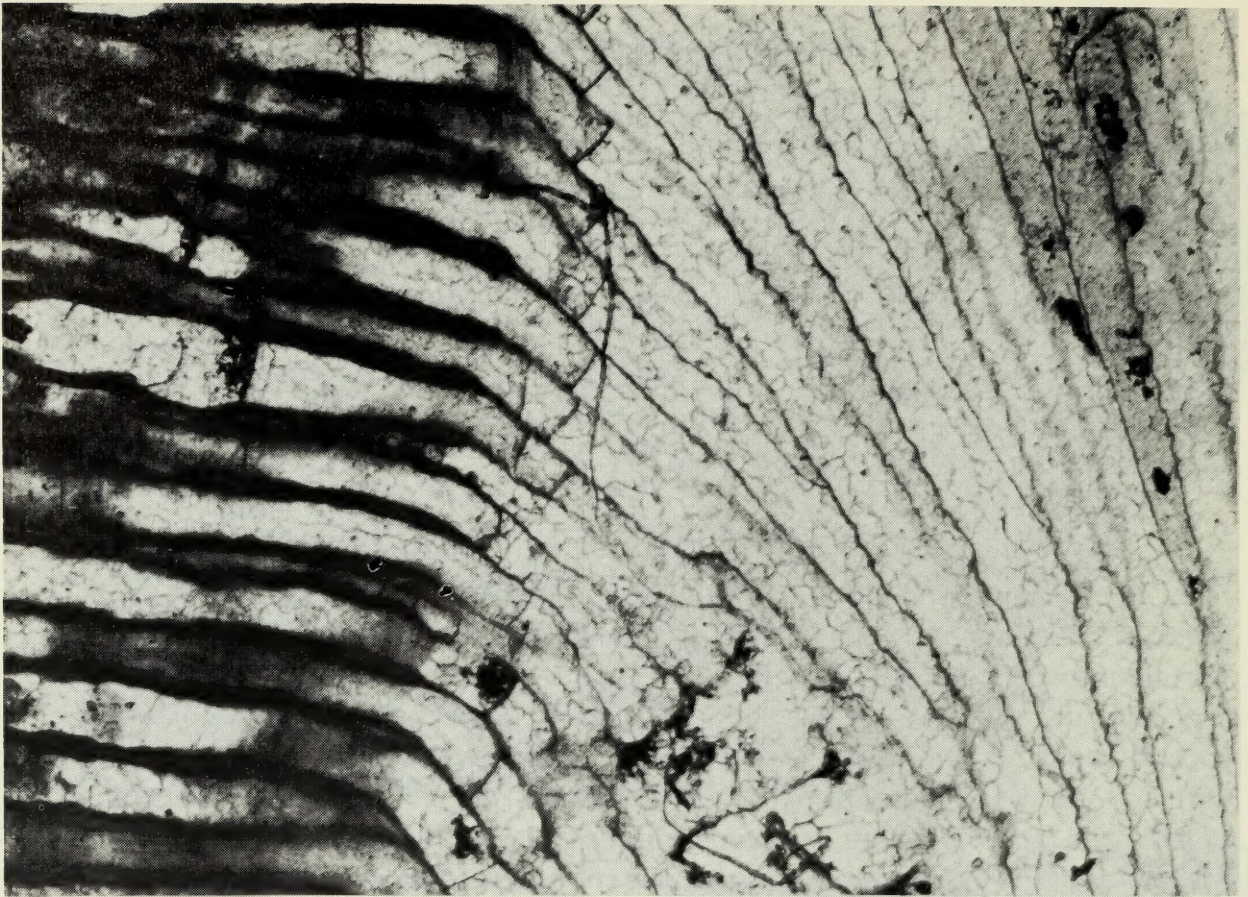
### LONGITUDINAL SECTION

Zooecia bend abruptly to surface from outer endozone. Walls in endozone thin, undulatory to crenulate in successive growth stages, becoming coarsely crenulate prior to zooecial bend where one (rarely two) diaphragms occur; otherwise no diaphragms visible throughout endozone. In exozone, walls gradually thickening, becoming irregular to slightly moniliform. Diaphragms normally one, at zooecial bend, and one in exozone where two rejuvenations are recognized. Acanthopores not distinguishable in endozone, but visible in exozone where they are short and stout with cone-in-cone wall structure and clear central axis; at times merely the laminate walls are preserved; some project beyond the zoarial surface as short spines. Wall lacunae show clearly in certain locales.

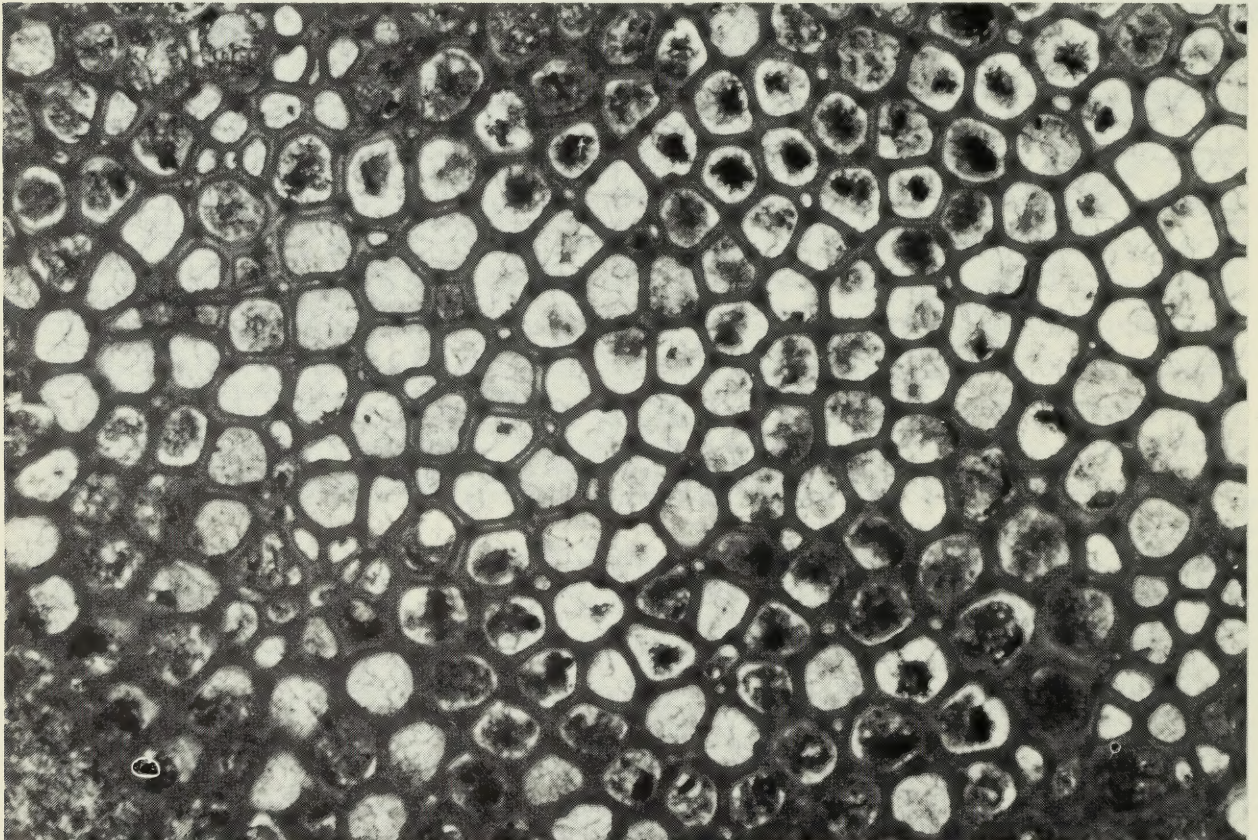
### Remarks

*Dekayia granulosa* might be mistaken for *Dekayia meafordensis* considered qualitatively, but internally the smaller zooecia and more numerous acanthopores help distinguish *D. granulosa*. *D. maculata* (James, 1881) is like *D. granulosa* except that maculae in the latter species are composed of groups of larger zooecia surrounding central clusters of small mesopores. Statistical analysis (Table 1) in which *D. distincta*, *D. granulosa*, and *D. meafordensis* are compared shows their relationship to one another when considered quantitatively.





**A**



**B**

Fig. 2 A-B *Dekayia granulosa* Fritz, holotype, ROM 1309HR.  
A Longitudinal section,  $\times 30$   
B Tangential section,  $\times 30$



## Type

Holotype: ROM 1309HR, Dundas Formation, Christie Member, Workman's Creek, Ontario.

### *Dekayia meafordensis* Fritz, 1926

Fig. 3A-D

*Dekayia meafordensis* Fritz, 1926: 100.

#### EXTERNAL FEATURES

Zoarium ramose, Y-shaped, branching at 45-degree to 90-degree angle, diameter 4 to 7 mm; surface smooth, but with maculae composed of larger zooecia than in the intermacular areas.

#### TANGENTIAL SECTION

Zooecia polygonal, apertures irregular in shape, 8 to 11 in intermacular areas (Table 1), walls 0.01 to 0.03 mm wide, concentrically laminated, apparently amalgamate, with clear central area highlighting contiguous zooecia (Table 1). Mesopores rare (Table 1), acanthopores numerous (Table 1), 0.03 to 0.04 mm diameter, with concentrically laminated walls and clear round centre. Mural lacunae distinct. Diameter of zooecial aperture in maculae 0.18 to 0.22 mm (Table 1), in intermacular areas 0.11 to 0.19 mm (Table 1).

#### LONGITUDINAL SECTION

Zooecial walls thin, undulating to crenulate in successive endozonal growths, and becoming more coarsely crenulate prior to the acute zooecial bend. Throughout endozone, one diaphragm per zooecium at termination of each rejuvenation; occasionally, a beadlike swelling represents a resorbed exozonal wall. Walls in relatively short exozone show two growth stages, each with irregular beaded walls, thicker as growth proceeds, and each growth stage with one diaphragm. Stout acanthopores with cone-in-cone wall structure and bright central axis, protruding beyond surface as appreciable spines. Mesopores very rarely present.

#### Remarks

The emended description of the genus *Dekayia* Boardman and Utgaard, 1966, typified by the species *D. aspera* Milne-Edwards and Haime, leaves little doubt that the Workman's Creek species are close variants of the genus as presently understood. Quantitatively, all three species belong to the group in which mesopores are almost absent; species are based upon shape of zoarium, presence of monticules or maculae, size of zooecia, character of walls, and number and character of acanthopores.

No quantitative data are available for *D. aspera*, but in Table 1 *D. distincta*, *D. granulosa*, and *D. meafordensis* are compared quantitatively and the statistical relationships between the three species are indicated.



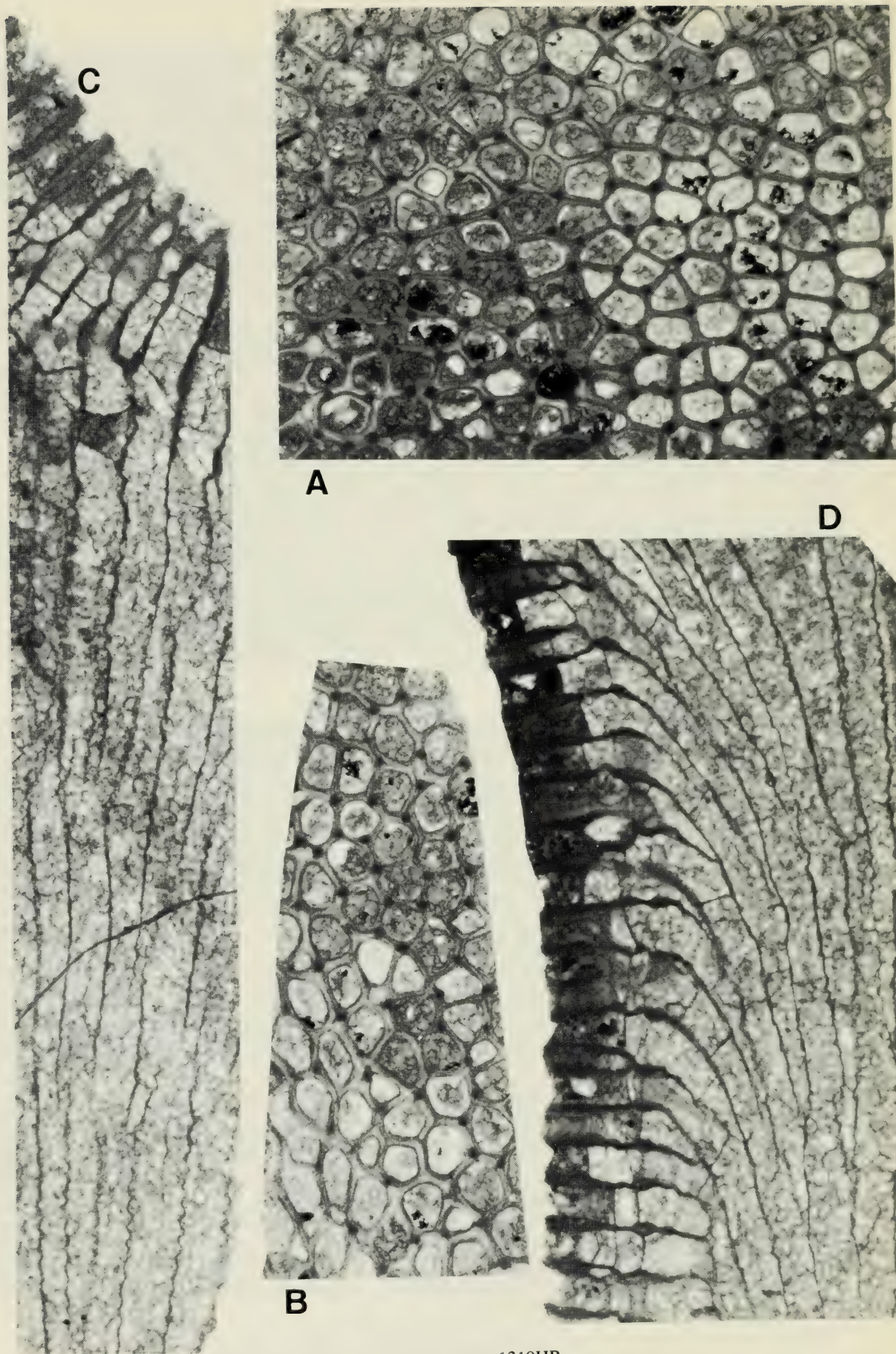


Fig. 3 A-D *Dekayia meafordensis* Fritz, syntype, ROM 1310HR.  
 A, B Tangential section,  $\times 30$   
 C, D Longitudinal section,  $\times 30$



## Type

Syntypes: ROM 1310HR, ROM 1327HR, Dundas Formation, Humber Member, Workman's Creek, Ontario.

## Family Monticuliporidae Nicholson, 1881

### Genus *Homotrypa* Ulrich, 1882

## Type Species

*Homotrypa curvata* Ulrich, 1882.

### *Homotrypa meafordensis* Fritz

Fig. 4A-E

*Homotrypa cincinnatiensis meafordensis* Fritz, 1926: 100.

## EXTERNAL FEATURES

Zoarium ramose, consisting of an initial branch 10 mm in diameter from which arise dichotomously round branches 4 to 5 mm in diameter. Surface with small conical monticules 2 to 3 mm apart centre to centre; zooecia in monticules larger than those in the intermonticular areas.

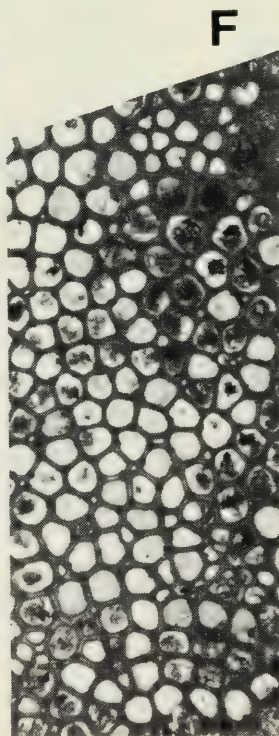
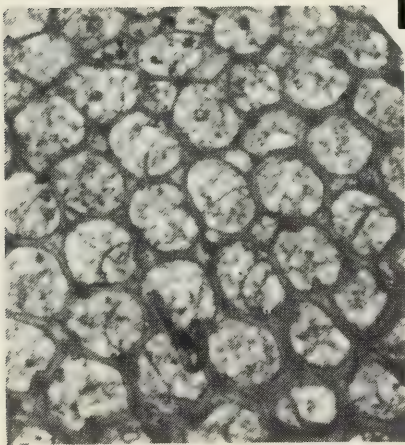
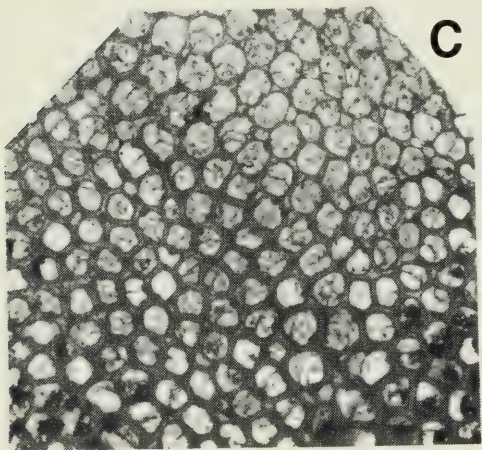
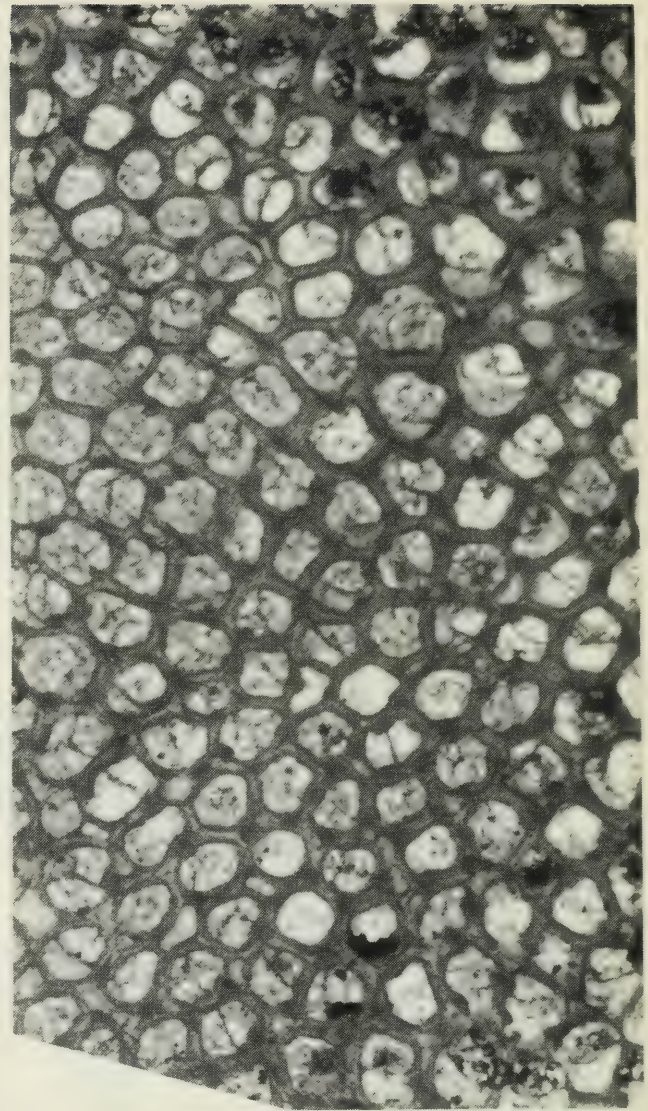
## TANGENTIAL SECTION

Zooecia round, oval, or bluntly polygonal 10 to 12 in 2 mm in intermonticular areas; walls concentrically laminated, 0.03 to 0.07 mm wide near surface, amalgamate with clear median zone (or in places with dark line interpreted as marking fusion of contiguous zooecia). Mesopores few (Table 2); acanthopores numerous (Table 2), at times slightly inflecting zooecial void, with walls concentrically laminated and clear central core. Maximum zooecial aperture in monticular area 0.20 to 0.27 mm (Table 2), in intermonticular area 0.12 to 0.18 mm (Table 2).

## LONGITUDINAL SECTION

In each successive rejuvenation, walls first straight and wavy, followed by short zone of coarsely crenulated walls; at zooecial bend, walls become successively thicker with demarcation line distinct in exozone. Diaphragms straight and widely spaced in endozone; a few hook-shaped cystiphagms, at times overlapping, line distal wall in exozone. Mesopores with close-set diaphragms. Feather-shaped acanthopores, with steep laminae and clear central core, appear within zooecial wall or cutting across a zooecium; some protrude as blunt spines beyond zoarial surface.







## Remarks

On the basis of external features, *Homotrypa meafordensis* was originally considered a variety of *Homotrypa cincinnatiensis* (Bassler, 1903) from the Lorraine Formation of New York State. The present study has shown that a closer phenetic relationship exists between *H. meafordensis* and *H. creditensis* (Dyer, 1925; Fritz, 1977), each from the Upper Ordovician Meaford Formation. The two are alike in zoarium shape and monticuled surface, but when compared quantitatively (Table 2) they differ significantly in the number of mesopores and acanthopores in the intermonticular area, and the diameter of zooecia in the monticule and intermonticular area.

## Type

Holotype: ROM 12317, Meaford Formation, Erindale Member, Workman's Creek, Ontario.

## Family Heterotrypidae Ulrich, 1890

### Genus *Stigmatella* Ulrich and Bassler, 1904

## Type Species

*Stigmatella crenulata* Ulrich and Bassler, 1904.

### *Stigmatella delicatula* Fritz

Fig. 5A-D

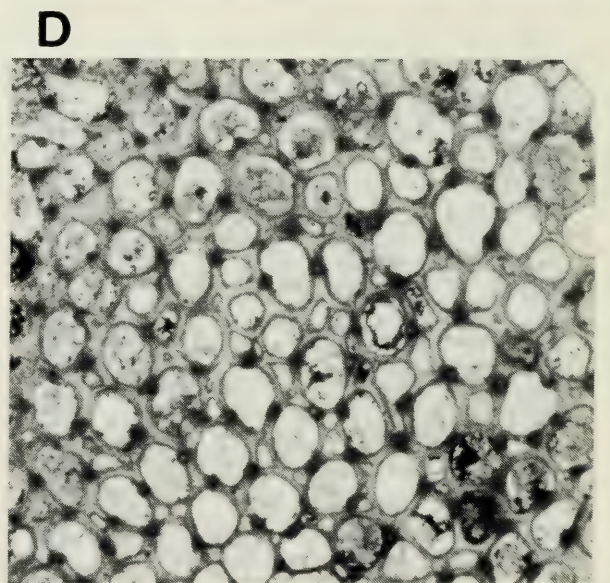
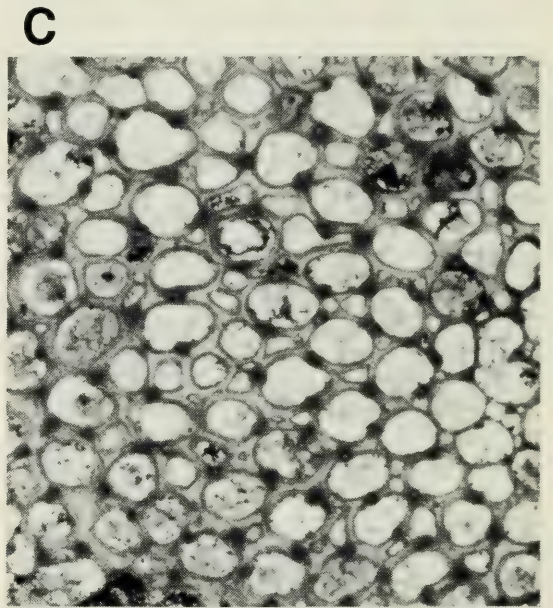
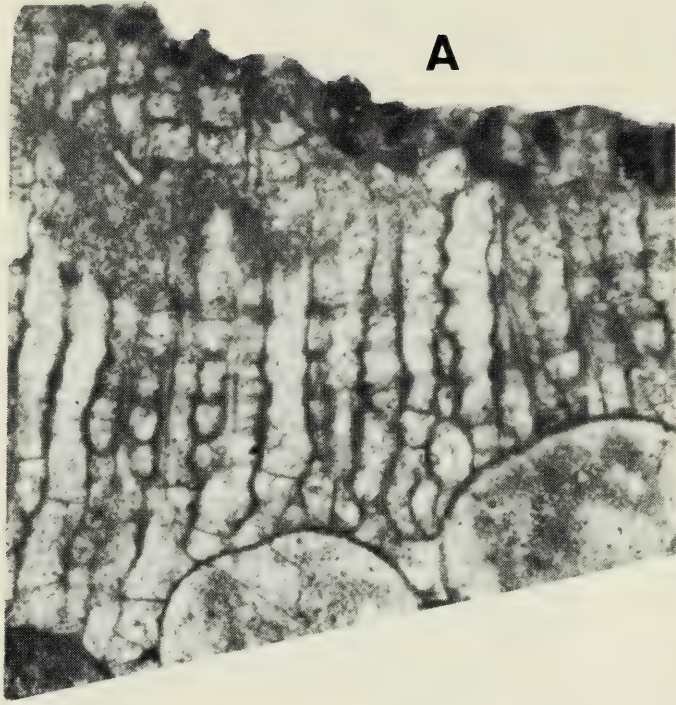
*Stigmatella sessilis delicatula* Fritz, 1926: 103.

## EXTERNAL FEATURES

Zoarium an incrustation 1.5 mm thick (surrounding a pentagonal crinoid stem) from which extend small branches 7 mm long and 4 mm wide. Surface with small monticules spaced 1 mm apart centre to centre.

- Fig. 4 A-E *Homotrypa meafordensis* Fritz, holotype, ROM 12317.  
A, E Longitudinal section,  $\times 30$   
B, D Tangential section,  $\times 30$   
C Tangential section,  $\times 15$   
F *Dekayia granulosa* Fritz, holotype, ROM 1309HR.  
Tangential section,  $\times 15$ .







#### TANGENTIAL SECTION

Zooecia oval to circular, a few slightly petaloid. Zooecia 8 to 12 in 2 mm in intermonticular area (Table 3); zooecial walls concentrically laminated, near surface up to 0.03 mm wide, gradually thinning at depth to 0.01 mm; contiguous zooecia often showing dark line of demarcation. Mesopores few to relatively numerous (Table 3). Acanthopores abundant (Table 3), three to five surrounding each zooecium, in places slightly inflecting zooecial void; diameter 0.01 to 0.05 mm; walls concentrically laminated, centre clear, round. Apertural diameter of zooecia in monticules 0.13 to 0.17 mm (Table 4), in intermonticular areas 0.10 to 0.13 mm (Table 3).

#### LONGITUDINAL SECTION

Zooecia briefly prostrate, then upright in long endozone in which several rejuvenations, separated by about 1 mm, occur; walls in each at first thin and wavy, then crenulated and slightly thicker; two to three diaphragms in each growth stage. Zooecia turn outwards at angles of 45 degrees to 90 degrees; walls thicken gradually and become moniliform in short exozone, 0.05 mm long; wall laminae convex outwards, diverging at an angle of approximately 45 degrees, and passing into diaphragms, which are three to four per zooecium. Mesopores beadlike with at least five diaphragms spaced one tube diameter apart. Acanthopores with cone-in-cone structure and clear central core; protruding beyond surface as sharp spines, unless blunted by denudation.

#### Remarks

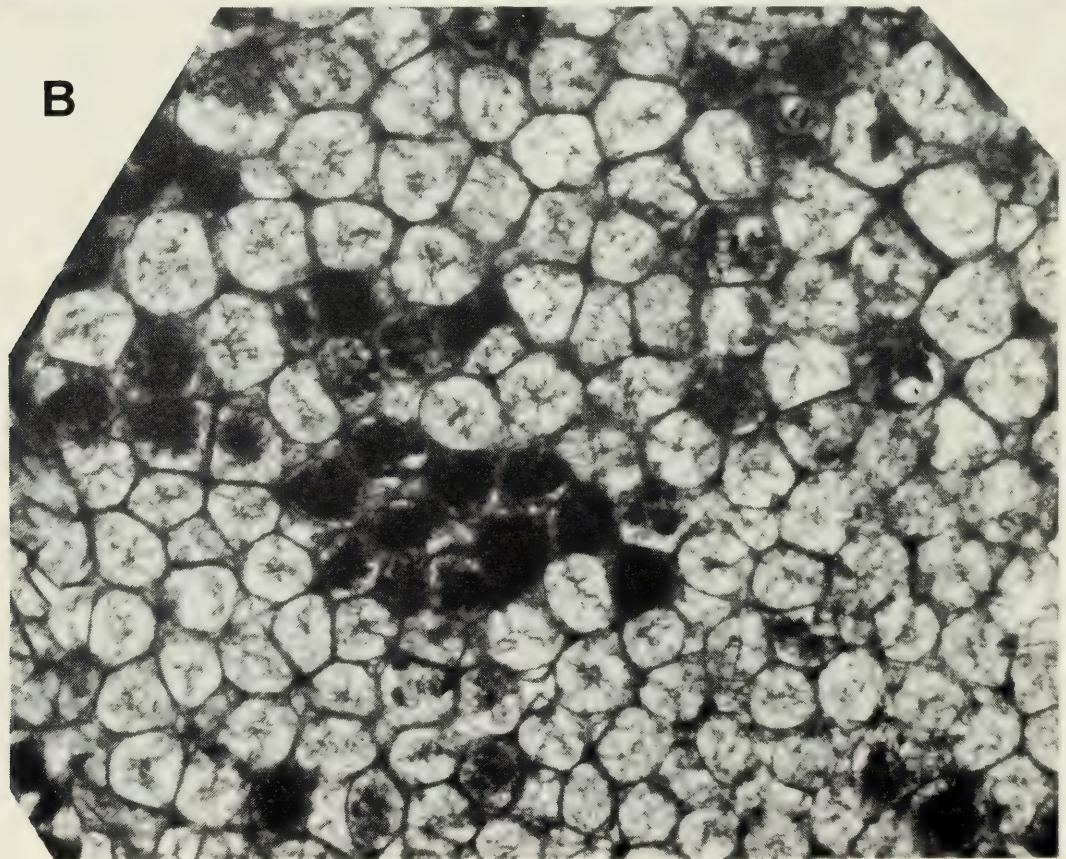
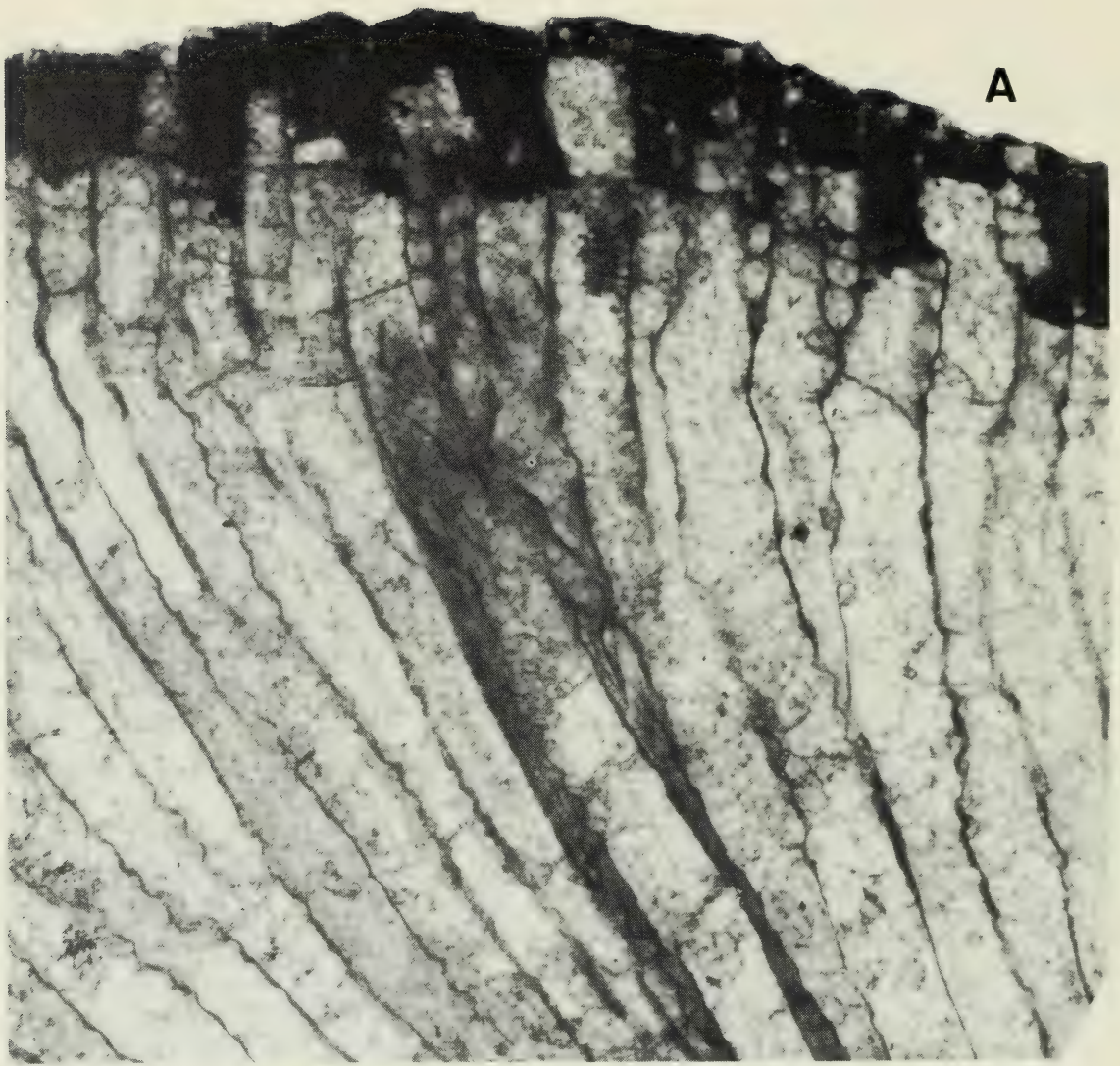
*Stigmatella sessilis* Cumings and Galloway (1913), of which the present species was considered to be a variety (Fritz, 1926), differs from *S. delicatula* in possessing adhesive monticuled discs, 10 zooecia in 2 mm, and petaloid zooecial apertures, and in the absence of mesopores. Furthermore, *S. sessilis* is of Fairmount age and is therefore older. Among the species represented in the fauna under consideration, this taxon is unlike any species known to the author.

#### Type

Holotype: ROM 1316HR, Dundas Formation, Humber Member, Workman's Creek, Ontario.

Fig. 5 A-D *Stigmatella delicatula* Fritz, holotype, ROM 1316HR.  
A Longitudinal section,  $\times 30$   
B Longitudinal section,  $\times 30$   
C Tangential section,  $\times 30$   
D Tangential section,  $\times 30$   
E *Stigmatella meafordensis* Fritz, holotype, ROM 1313HR.  
Longitudinal section,  $\times 60$







## *Stigmatella intermedia* Fritz, 1925

Figs. 6A, B; 10

*Stigmatella intermedia* Fritz, in Parks, 1925b: 36.

*Stigmatella intermedia* Fritz, 1926: 103.

Although this species was mentioned and figured in 1925, it was not formally described until 1926.

### EXTERNAL FEATURES

Zoarium a digitate growth which begins as a thin incrustation, 1 mm thick, on a round crinoid stem (Fritz, in Parks, 1925b: plate IV, fig. 1, misoriented). From the centre of the growth radiate four short, equally spaced, fingerlike projections, 10 to 12 mm in diameter and 5 to 6 mm long; these projections divide and redivide dichotomously diminishing in size and terminating in 16 small rounded processes each approximately 5 mm in diameter. Zoarial surface with small conical monticules spaced 2 to 3 mm apart centre to centre.

### TANGENTIAL SECTION

Zooecia polygonal, 9 to 10.5 in 2 mm in area between monticules (Table 4); walls concentrically laminated, maximum thickness at surface 0.03 mm, thicker in monticules. Mesopores few (Table 4). Acanthopores small, numerous (Table 4), noninflecting, situated in zooecial angles, 0.02 mm in diameter, walls concentrically laminated and clear round centre; maximum diameter of zooecia in monticular areas 0.20 to 0.28 mm (Table 4), in intermonticular areas 0.12 to 0.18 mm (Table 4).

### LONGITUDINAL SECTION

Zooecia bending gradually from outer endozone, through short (0.05 mm long) exozone, to surface, intersecting surface slightly obliquely. Endozone long, consisting of several rejuvenations, each approximately 1 mm long; walls tenuous, straight to wavy to crenulate; diaphragms seldom preserved, recrystallization having taken place. Acanthopores small, in zooecial angles, present in endozone, but structure not clear. Walls thickening gradually from outer endozone, becoming thicker, crenulate, and moniliform. Mesopores few, chainlike, with up to six diaphragms. Acanthopores with laminated walls, terminating beyond surface as low conical spines.

Fig. 6 A-B *Stigmatella intermedia* Fritz, holotype, ROM 1276HR.

A Longitudinal section,  $\times 30$

B Tangential section,  $\times 30$



## Remarks

*Stigmatella intermedia* resembles *S. crenulata* more closely than *S. catenulata*, in that the numerous chainlike mesopores are absent. In order to compare *S. intermedia* with *S. crenulata*, thin sections from Ulrich's figured specimens (USNM 43197, 43198) were borrowed. These sections show that *S. crenulata* has conspicuously inflecting acanthopores resulting in distinctly petaloid zooecia apertures; furthermore, maculae composed of mesopores are present. Besides these morphological differences, *S. crenulata* is younger, being of Meaford (i.e., Waynesville stage) age. Table 4 indicates the statistical differences. The unique manner of growth of the colony, combined with the microstructure, distinguishes *S. intermedia* from other species.

## Type

Holotype: ROM 1276HR, Dundas Formation, Humber Member, Workman's Creek, Ontario.

### *Stigmatella meafordensis* Fritz

Figs. 5E; 7A-B

*Stigmatella crenulata meafordensis* Fritz, 1926: 71.

#### EXTERNAL FEATURES

Specimen a fragment 20 mm × 35 mm from a lobate zoarium. Surface with low monticules; zooecia larger in monticules than between.

#### TANGENTIAL SECTION

Zooecia angular, 8 to 9 in 2 mm in intermonticular area (Table 5). Walls thin, 0.01 to 0.03 mm near surface. Mesopores few (Table 5). Acanthopores with clear round centre and concentrically laminated walls located in practically every zooecial angle, 0.01 to 0.025 mm diameter; maximum apertural diameter in monticules 0.27 to 0.35 mm (Table 5), in intermonticular areas 0.15 to 0.20 mm (Table 5).

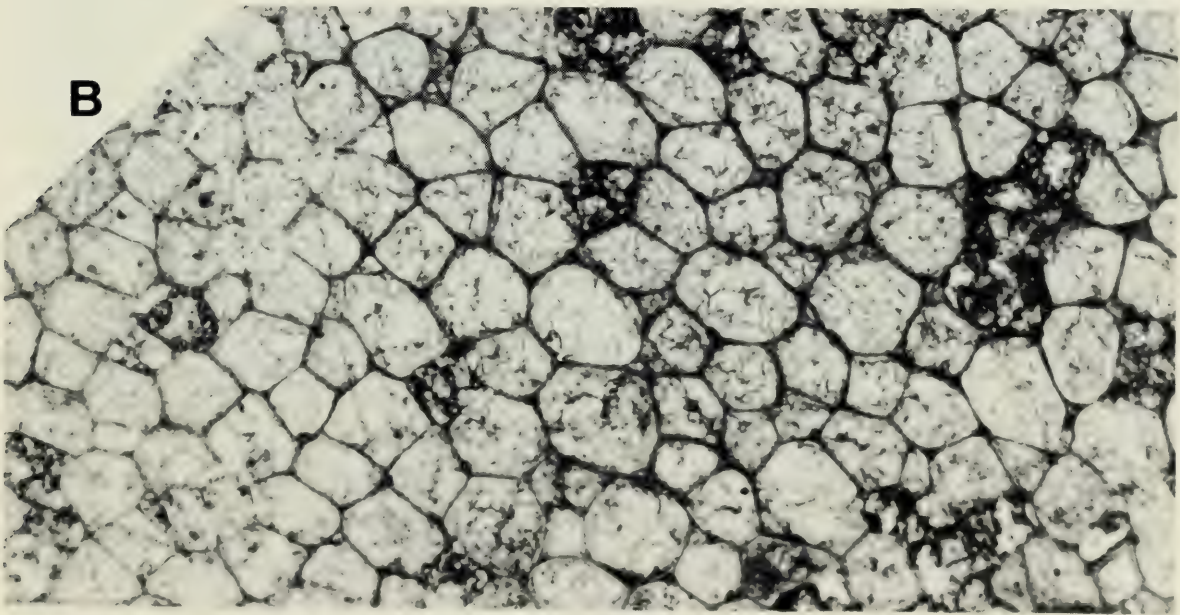
#### LONGITUDINAL SECTION

Zooecia curving broadly to the surface, several rejuvenations each approximately 1 to 1.5 mm long apparent in the long exozone. Walls very thin and straight, becoming finely crenulate; usually two diaphragms per zooecium. Acanthopores randomly situated in the walls, tapering and needlelike with highly inclined laminate walls and clear round centre; extending beyond surface as sharp spines. Zooecial walls in the short exozone (0.05 mm long), greatly thickened and crenulate, but non-moniliform. Mesopores few and beadlike.





A



B

Fig. 7 A-B *Stigmatella meafordensis* Fritz, holotype, ROM 1313HR.  
A Longitudinal section,  $\times 30$   
B Tangential section,  $\times 30$



## Remarks

*Stigmatella meafordensis* appears to be closest to *S. vulgaris* Parks and Dyer (1922). Qualitatively, the most significant difference is the large size of the zooecial aperture in both the monticular and intermonticular areas in the former. Data from the holotype of *S. vulgaris* (Fritz, 1973) and that of the present species are compared statistically in Table 5.

## Type

Holotype: ROM 1313HR, Dundas Formation, Humber Member, Workman's Creek, Ontario.

### *Stigmatella peculiaris* Fritz, 1926

Fig. 8A-B

*Stigmatella peculiaris* Fritz, 1926: 104.

#### EXTERNAL FEATURES

Specimen consisting of one fragmentary branch, 20 mm long, 10 mm wide, showing bases of three small branches (diameter 3–8 mm). Surface with low bun-shaped monticules, approximately 2 mm in diameter at base, 1 mm in height, and spaced about 2.5 mm apart centre to centre; these monticules give surface a significant hummocky appearance.

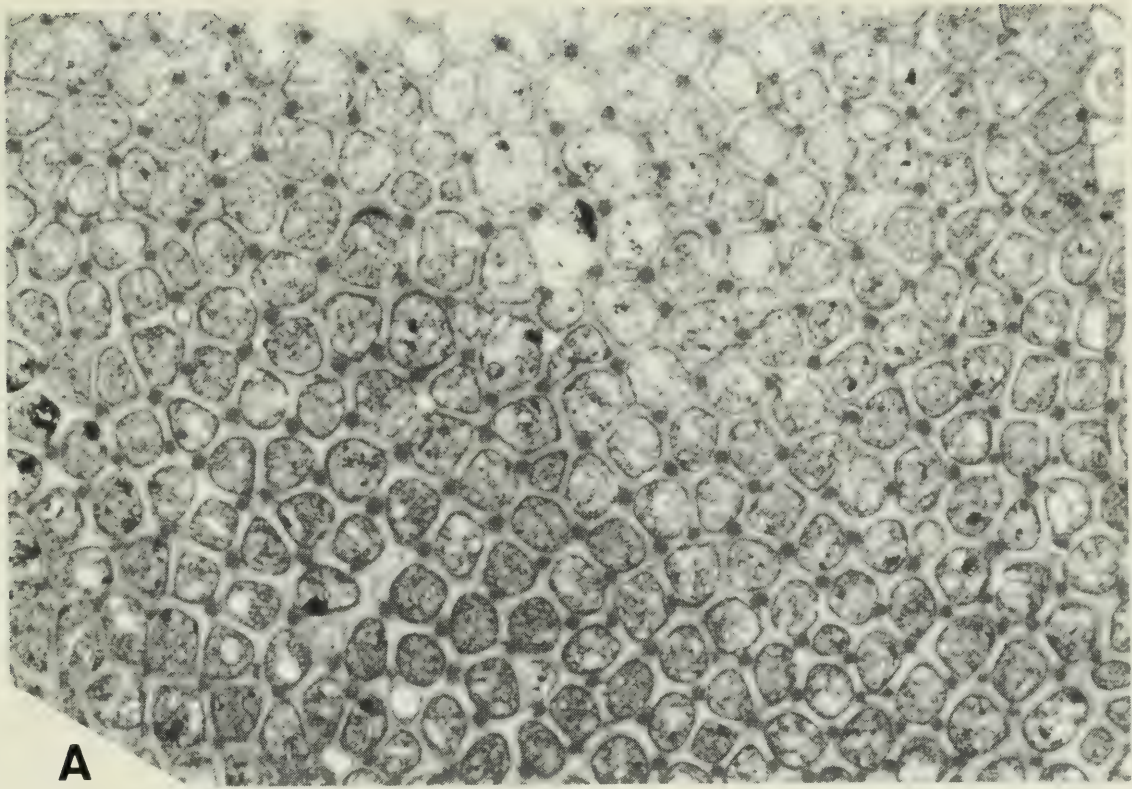
#### TANGENTIAL SECTION

Zooecia polygonal, or irregular size, 9 to 13 in 2 mm in intermonticular areas (Table 6); apertures subangular to oval. Zooecial walls appear amalgamated (likely owing to recrystallization), but in places line of demarcation between walls is clearly defined. Amalgamated walls 0.03 to 0.04 mm wide in intermonticular areas, 0.06 to 0.07 mm wide in monticular areas. Mesopores virtually absent (Table 6). Acanthopores numerous (Table 6). Diameter of zooecial apertures in monticules 0.18 to 0.25 mm, in intermonticular areas 0.14 to 0.17 mm (Table 6).

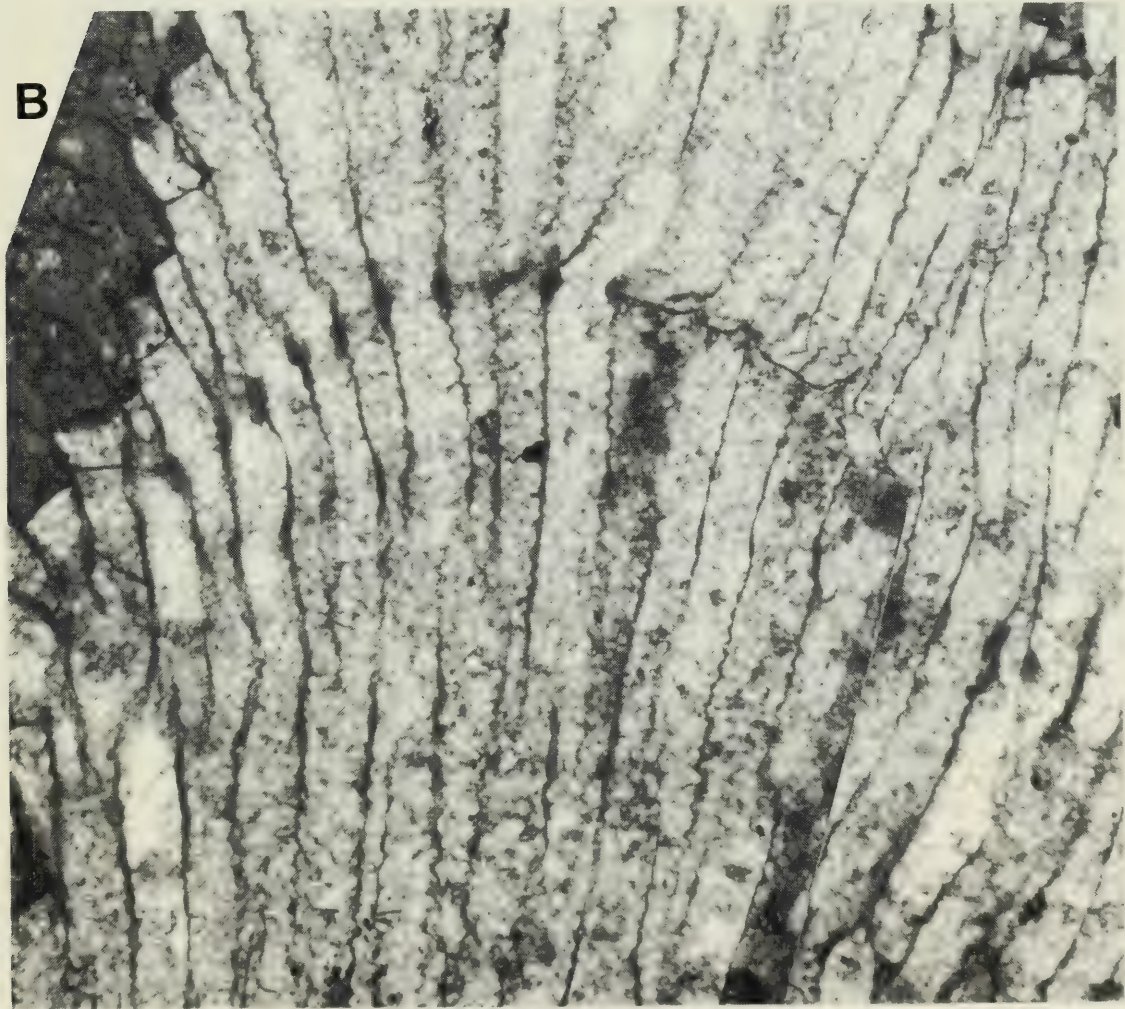
#### LONGITUDINAL SECTION

Endozone long, composed of several stages of colonial growth with zooecial walls at first straight or undulatory, then relatively coarsely crenulated. At regular intervals, monilae (traceable horizontally across section) represent resorbed exozonal stages. Diaphragms rare in endozone growths (each 1 mm in length). Zooecia curving gradually into short exozone (approximately 1 mm long); walls thickening, becoming somewhat moniliform; diaphragms commonly four per zooecium, spaced one tube diameter apart. Mesopores few, slightly chainlike, usually each with four diaphragms. Acanthopores obscured by thickness of the section, but a close examination of the external surface indicates that they extend beyond the surface as blunt projections.





A



B

Fig. 8 A-B *Stigmatella peculiaris* Fritz, holotype, ROM 12318.

A Tangential section,  $\times 30$

B Longitudinal section,  $\times 30$



## Remarks

*Stigmatella similis* Caley (1936; ROM 1530HR), from the Wekwemikongsing Formation of Manitoulin Island resembles *S. peculiaris* in the ramose zoarium with branches 5 to 10 mm in diameter. Zooecia, however, are larger, numbering 8 to 10 in 2 mm, and acanthopores are more numerous. Furthermore, the zoarial surface of Caley's variety is smooth, whereas that of the Meaford species is undulatory owing to the relatively large, closely spaced, bun-shaped monticules. Table 6 shows the quantitative comparison indicating a significant difference between the two.

## Type

Holotype: ROM 12318, Meaford Formation, Vincent Member, Workman's Creek, Ontario.

### *Stigmatella ramosa* Fritz

Fig. 9A, B

*Stigmatella vulgaris ramosa* Fritz, 1926: 105.

#### EXTERNAL FEATURES

Fragment 25 mm long, from a dichotomously branching zoarium; branches flat, maximum width 10 mm, 4 mm thick; surface with maculae, most of which are depressed centrally and comprised of relatively large zooecia often with clusters of irregular-shaped mesopores.

#### TANGENTIAL SECTION

Zooecia angular to subangular, 8 to 10 in 2 mm in intermonticular areas (Table 7); line of demarcation well defined in some walls, otherwise a clear central area represents fused walls of contiguous zooecia 0.01 to 0.15 mm wide, concentrically laminated. Mesopores few in intermacular areas (Table 7), in maculae scattered or in central clusters. Acanthopores relatively few (Table 7), never inflecting zooecial void; each with concentrically laminated walls and clear central core. Diameter of zooecial aperture in maculae 0.22 to 0.26 mm (Table 7), in intermonticular areas 0.15 to 0.20 mm.

#### LONGITUDINAL SECTION

Zooecia proceeding to surface in a gentle curve, intersecting it almost at right angles. Long endozone composed of several colonial rejuvenations (each approximately 1.5 mm long); walls in each successive growth thin at first, then crenulated and slightly thickened. Diaphragms rare and widely spaced. Exozone shallow (0.05 mm in length); exozonal walls thicken materially and become moniliform, with wall laminae diverging at moderate angle from central core and passing into the diaphragms (usually two per zooecium). Mesopores few and slightly beadlike. Short



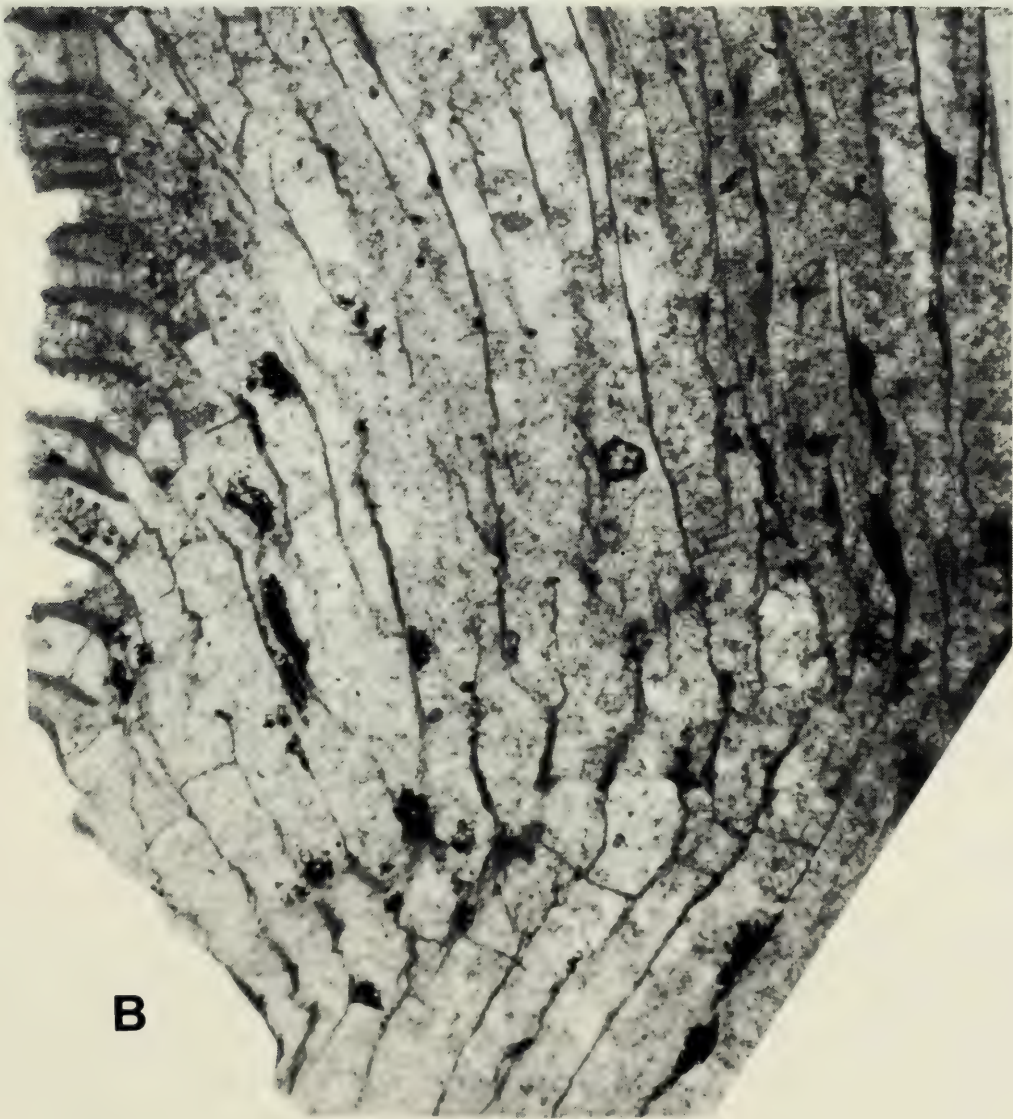
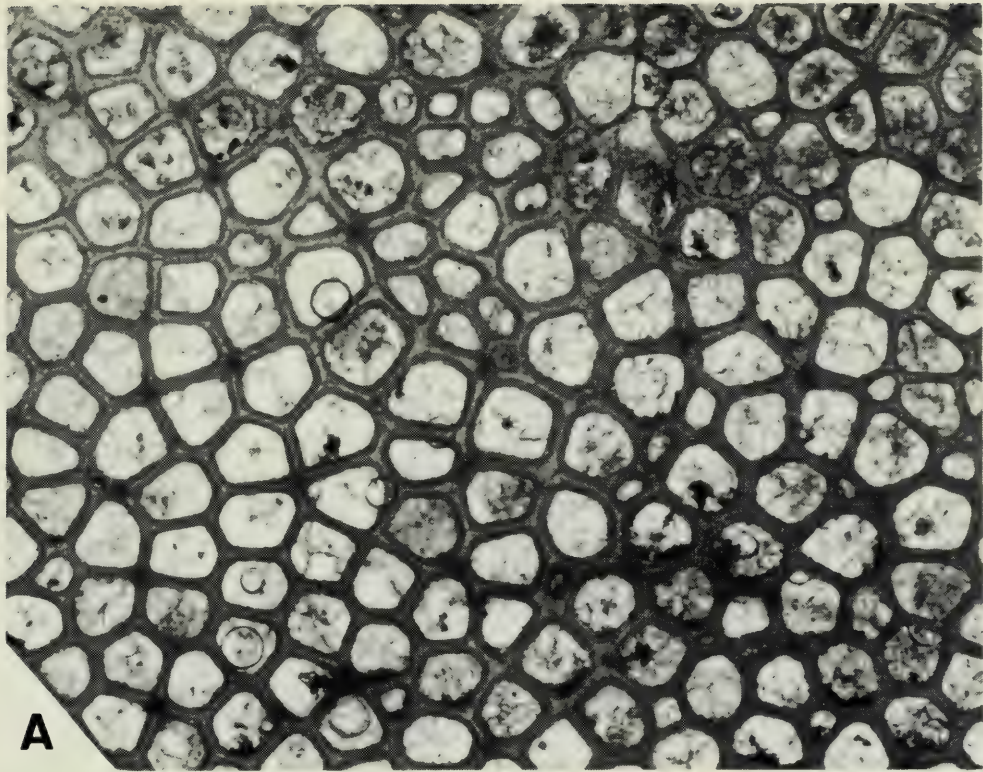


Fig. 9 A-B *Stigmatella ramosa* Fritz, holotype, ROM 1317HR.  
A Tangential section,  $\times 30$   
B Longitudinal section,  $\times 30$





Fig. 10 *Stigmatella intermedia* Fritz, holotype, ROM 1276HR.

acanthopores, with clear central core, may be traced from their origin in zoecial walls to their spiniform termination.

### Remarks

The medium-sized flattened branches with depressed maculae distinguish this species from any other in the Meaford fauna. It is here compared statistically with the type of *Stigmatella vulgaris* (ROM 1091HR), with which species *S. ramosa* was originally described as a subspecies. Table 7 indicates that the two species differ significantly in the number of zoecia in 2 mm in intermonticulate area, number of entire acanthopores in 1 mm<sup>2</sup> in intermonticulate area, and the maximum apertural diameter of zoecia in monticulate areas.



## Type

Holotype: ROM 1317HR, Dundas Formation, Humber Member, Workman's Creek, Ontario.

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**Table 1** Comparison and measurable characters of *Dekayia distincta* (ROM 1308HR), *D. granulosa* (ROM 1309HR), and *D. meafordensis* (ROM 1310HR). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|   | A <i>D. distincta</i> |                             |      | B <i>D. granulosa</i> |                             |      | C <i>D. meafordensis</i> |                             |      | Mann-Whitney<br>U Statistic                  |
|---|-----------------------|-----------------------------|------|-----------------------|-----------------------------|------|--------------------------|-----------------------------|------|--|
|   | n                     | Mean ± S.E.                 | S.D. | n                     | Mean ± S.E.                 | S.D. | n                        | Mean ± S.E.                 | S.D. |  |
| Number of zoecia in 2 mm in<br>intermonticular area                           | 20                    | 9.48 ± 0.13<br>(9-10.5)     | 0.13 | 20                    | 10.48 ± 0.18<br>(9-12)      | 0.79 | 20                       | 9.45 ± 0.22<br>(8-11)       | 1.00 | A&B 65.0 ***<br>A&C 198.0 ns<br>B&C 90.0 **  |
| Number of entire mesopores in 1 mm <sup>2</sup><br>in intermonticular area    | 19                    | 0.47 ± 0.12<br>(0-1)        | 0.51 | 20                    | 0.65 ± 0.02<br>(0-1)        | 0.49 | 20                       | 1.40 ± 0.11<br>(1-2)        | 0.50 | A&B 156.5 ns<br>A&C 54.0 ***<br>B&C 78.0 *** |
| Number of entire acanthopores in<br>1 mm <sup>2</sup> in intermonticular area | 20                    | 10.3 ± 0.23<br>(9-12)       | 1.00 | 21                    | 22.5 ± 0.54<br>(19-27)      | 2.50 | 19                       | 20.9 ± 0.37<br>(18-24)      | 1.6  | A&B 0.0 ***<br>A&C 0.0 ***<br>B&C 123.0 *    |
| Maximum apertural diameter of<br>zoecia in monticules                         | 21                    | 0.20 ± 0.005<br>(0.17-0.25) | 0.23 | 20                    | 0.17 ± 0.005<br>(0.15-0.20) | 0.02 | 20                       | 0.20 ± 0.003<br>(0.18-0.22) | 0.14 | A&B 56.0 ***<br>A&C 187.5 ns<br>B&C 41.5 *** |
| Maximum apertural diameter of<br>zoecia in intermonticular area               | 20                    | 0.15 ± 0.005<br>(0.13-0.16) | 0.21 | 20                    | 0.14 ± 0.003<br>(0.13-0.16) | 0.01 | 20                       | 0.15 ± 0.006<br>(0.11-0.19) | 0.03 | A&B 136.5 ns<br>A&C 198.5 ns<br>B&C 159.0 ns |



**Table 2** Comparison and measurable characters of *Homotrypa creditensis* (ROM 12162) and *H. meafordensis* (ROM 12317). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|  | <i>H. creditensis</i> |                                 |      | <i>H. meafordensis</i> |                                 |      | Mann-Whitney<br>U Statistic |
|--|-----------------------|---------------------------------|------|------------------------|---------------------------------|------|-----------------------------|
|  | n                     | Mean $\pm$ S.E.<br>( )          | S.D. | n                      | Mean $\pm$ S.E.<br>( )          | S.D. |                             |
| Number of zooecia in 2 mm in intermonticular area                          | 20                    | 10.85 $\pm$ 0.15<br>(10-12)     | 0.67 | 20                     | 10.55 $\pm$ 0.15<br>(10-12)     | 0.67 | 147.0 ns                    |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 20                    | 4.05 $\pm$ 0.41<br>(0-7)        | 1.82 | 10                     | 1.50 $\pm$ 0.34<br>(0-3)        | 1.08 | 45.5 **                     |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 21                    | 10.0 $\pm$ 0.08<br>(4-16)       | 3.70 | 20                     | 25.9 $\pm$ 1.30<br>(20-37)      | 5.60 | 0.0 ***                     |
| Maximum apertural diameter of zooecia in monticules                        | 20                    | 0.16 $\pm$ 0.003<br>(0.14-0.20) | 0.01 | 21                     | 0.23 $\pm$ 0.005<br>(0.20-0.27) | 0.02 | 0.1 ***                     |
| Maximum apertural diameter of zooecia in intermonticular area              | 40                    | 0.11 $\pm$ 0.003<br>(0.07-0.15) | 0.02 | 20                     | 0.15 $\pm$ 0.004<br>(0.12-0.18) | 0.02 | 70.0 ***                    |



**Table 3** Measurements of the taxonomic characters of *Stigmatella delicatula* (ROM 1316HR).  
Measurements are given in millimetres. Figures in parentheses denote ranges.

|  | n  | Mean ± S.E.                 | S.D. |
|--|----|-----------------------------|------|
| Number of zoecia in 2 mm in intermonticular area                           | 10 | 10.00 ± 0.42<br>(8-12)      | 1.33 |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 10 | 6.08 ± 0.63<br>(4-10)       | 1.99 |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 10 | 24.0 ± 1.10<br>(20-30)      | 3.50 |
| Maximum apertural diameter of zoecia in monticules                         | 10 | 0.14 ± 0.006<br>(0.13-0.17) | 0.01 |
| Maximum apertural diameter of zoecia in intermonticular area               | 10 | 0.12 ± 0.009<br>(0.10-0.13) | 0.03 |



**Table 4** Comparison and measurable characters of *Stigmatella intermedia* (ROM 1276HR) and *S. crenulata* (USNM 43197, 43198). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|  | <i>S. intermedia</i> |                                 |      | <i>S. crenulata</i> |                                 |      | Mann-Whitney<br>U Statistic |
|--|----------------------|---------------------------------|------|---------------------|---------------------------------|------|-----------------------------|
|  | n                    | Mean $\pm$ S.E.                 | S.D. | n                   | Mean $\pm$ S.E.                 | S.D. |                             |
| Number of zoecia in 2 mm in intermonticular area                           | 10                   | 9.80 $\pm$ 0.18<br>(9-10.5)     | 0.56 | 20                  | 8.25 $\pm$ 0.10<br>(8-9)        | 0.43 | 0.75 ***                    |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 10                   | 2.10 $\pm$ 0.22<br>(1-3)        | 0.70 | 20                  | 1.50 $\pm$ 0.24<br>(0-3)        | 1.07 | 67.5 ns                     |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 10                   | 28.0 $\pm$ 0.76<br>(25-32)      | 2.40 | 20                  | 29.0 $\pm$ 0.80<br>(23-35)      | 3.60 | 94.0 ns                     |
| Maximum apertural diameter of zoecia in monticules                         | 10                   | 0.23 $\pm$ 0.008<br>(0.20-0.28) | 2.50 | 20                  | 0.20 $\pm$ 0.003<br>(0.18-0.23) | 0.02 | 33.0 **                     |
| Maximum apertural diameter of zoecia in intermonticular area               | 10                   | 0.15 $\pm$ 0.007<br>(0.12-0.18) | 0.02 | 20                  | 0.15 $\pm$ 0.003<br>(0.14-0.19) | 0.02 | 86.0 ns                     |



**Table 5** Comparison and measurable characters of *Stigmatella meafordensis* (ROM 1313HR) and *S. vulgaris* (ROM 1091HR). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|  | <i>S. meafordensis</i> |                                 |      | <i>S. vulgaris</i> |                                 |      | Mann-Whitney<br>U Statistic |
|--|------------------------|---------------------------------|------|--------------------|---------------------------------|------|-----------------------------|
|  | n                      | Mean $\pm$ S.E.                 | S.D. | n                  | Mean $\pm$ S.E.                 | S.D. |                             |
| Number of zoecia in 2 mm in intermonticular area                           | 10                     | 8.40 $\pm$ 0.15<br>(8-9)        | 0.49 | 30                 | 7.90 $\pm$ 0.11<br>(7-9)        | 0.59 | 89.0 *                      |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 20                     | 1.60 $\pm$ 0.22<br>(0-3)        | 0.99 | 30                 | 1.60 $\pm$ 0.15<br>(0-3)        | 0.79 | 298.0 ns                    |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 10                     | 20.6 $\pm$ 0.45<br>(18-23)      | 1.40 | 30                 | 22.8 $\pm$ 0.72<br>(19-29)      | 3.20 | 64.5 ns                     |
| Maximum apertural diameter of zoecia in monticules                         | 10                     | 0.31 $\pm$ 0.008<br>(0.27-0.35) | 0.03 | 30                 | 0.26 $\pm$ 0.005<br>(0.22-0.29) | 0.02 | 20.5 ***                    |
| Maximum apertural diameter of zoecia in intermonticular area               | 10                     | 0.17 $\pm$ 0.006<br>(0.15-0.20) | 0.02 | 30                 | 0.16 $\pm$ 0.003<br>(0.14-0.19) | 0.02 | 108.0 ns                    |



**Table 6** Comparison and measurable characters of *Stigmatella peculiaris* (ROM 12318) and *S. similis* (ROM 1530HR). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|  | <i>S. peculiaris</i> |                                 |      | <i>S. similis</i> |                                 |      | Mann-Whitney<br>U Statistic |
|--|----------------------|---------------------------------|------|-------------------|---------------------------------|------|-----------------------------|
|  | n                    | Mean $\pm$ S.E.                 | S.D. | n                 | Mean $\pm$ S.E.                 | S.D. |                             |
| Number of zooecia in 2 mm in intermonticular area                          | 20                   | 11.00 $\pm$ 0.32<br>(9-13)      | 1.41 | 20                | 8.85 $\pm$ 0.18<br>(8-10)       | 0.81 | 44.0 ***                    |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 20                   | 0.75 $\pm$ 0.10<br>(0-1)        | 0.44 | 20                | 1.45 $\pm$ 0.13<br>(0-2)        | 0.60 | 85.0 ***                    |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 20                   | 29.3 $\pm$ 0.10<br>(23-26)      | 3.90 | 20                | 18.7 $\pm$ 0.25<br>(17-20)      | 1.10 | 0.0 ***                     |
| Maximum apertural diameter of zooecia in monticules                        | 19                   | 0.20 $\pm$ 0.006<br>(0.18-0.25) | 0.25 | 20                | 0.16 $\pm$ 0.003<br>(0.14-0.19) | 0.02 | 25.0 ***                    |
| Maximum apertural diameter of zooecia in intermonticular area              | 20                   | 0.15 $\pm$ 0.002<br>(0.14-0.17) | 0.01 | 20                | 0.12 $\pm$ 0.004<br>(0.10-0.14) | 0.16 | 10.0 ***                    |



Table 7 Comparison and measurable characters of *Stigmatella ramosa* (ROM 1317HR) and *S. vulgaris* (ROM 1091HR). Measurements are given in millimetres. Figures in parentheses denote ranges. See Materials and Methods for key to asterisks.

|  | <i>S. ramosa</i> |                                 |      | <i>S. vulgaris</i> |                                 |      | Mann-Whitney |     |
|--|------------------|---------------------------------|------|--------------------|---------------------------------|------|--------------|-----|
|  | n                | Mean $\pm$ S.E.                 | S.D. | n                  | Mean $\pm$ S.E.                 | S.D. | U Statistic  |     |
| Number of zoecia in 2 mm in intermonticular area                           | 10               | 9.10 $\pm$ 0.22<br>(8-10)       | 0.70 | 30                 | 7.90 $\pm$ 0.11<br>(7-9)        | 0.59 | 37.0         | *** |
| Number of entire mesopores in 1 mm <sup>2</sup> in intermonticular area    | 10               | 1.10 $\pm$ 0.22<br>(0-2)        | 0.70 | 30                 | 1.60 $\pm$ 0.15<br>(0-3)        | 0.79 | 98.0         | ns  |
| Number of entire acanthopores in 1 mm <sup>2</sup> in intermonticular area | 10               | 9.1 $\pm$ 0.49<br>(7-12)        | 1.60 | 30                 | 22.8 $\pm$ 0.72<br>(19-29)      | 3.20 | 0.0          | *** |
| Maximum apertural diameter of zoecia in monticules                         | 10               | 0.24 $\pm$ 0.005<br>(0.22-0.26) | 0.02 | 30                 | 0.26 $\pm$ 0.005<br>(0.22-0.29) | 0.02 | 45.5         | *   |
| Maximum apertural diameter of zoecia in intermonticular area               | 10               | 0.17 $\pm$ 0.005<br>(0.15-0.20) | 0.17 | 30                 | 0.16 $\pm$ 0.003<br>(0.14-0.19) | 0.02 | 95.5         | ns  |













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