

Durham E-Theses

The taxonomy and palaeoecology of Bryozoa from the upper Permian zechstein reef of N.E. England

Southwood, David Ashley

How to cite:

Southwood, David Ashley (1985) *The taxonomy and palaeoecology of Bryozoa from the upper Permian zechstein reef of N.E. England*, Durham theses, Durham University. Available at Durham E-Theses Online: <http://etheses.dur.ac.uk/6816/>

Use policy

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that:

- a full bibliographic reference is made to the original source
- a [link](#) is made to the metadata record in Durham E-Theses
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Please consult the [full Durham E-Theses policy](#) for further details.

**THE TAXONOMY AND PALAEOECOLOGY OF BRYOZOA FROM THE UPPER PERMIAN
ZECHSTEIN REEF OF N.E. ENGLAND**

by

David Ashley Southwood, B.A.

**A thesis presented for the degree of Doctor of Philosophy in the
University of Durham**

Volume 2 - Figures and Plates

The copyright of this thesis rests with the author.
No quotation from it should be published without
his prior written consent and information derived
from it should be acknowledged.

**Department of Geological Sciences
University of Durham**

September 1985

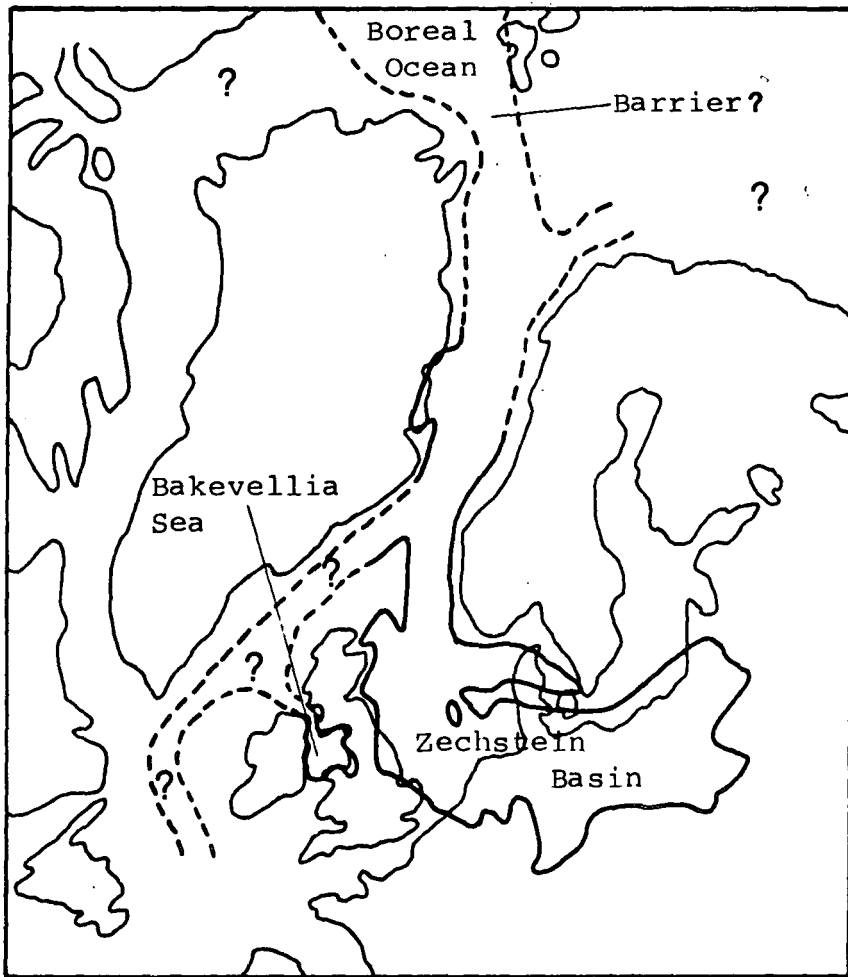


17 JUL 1986

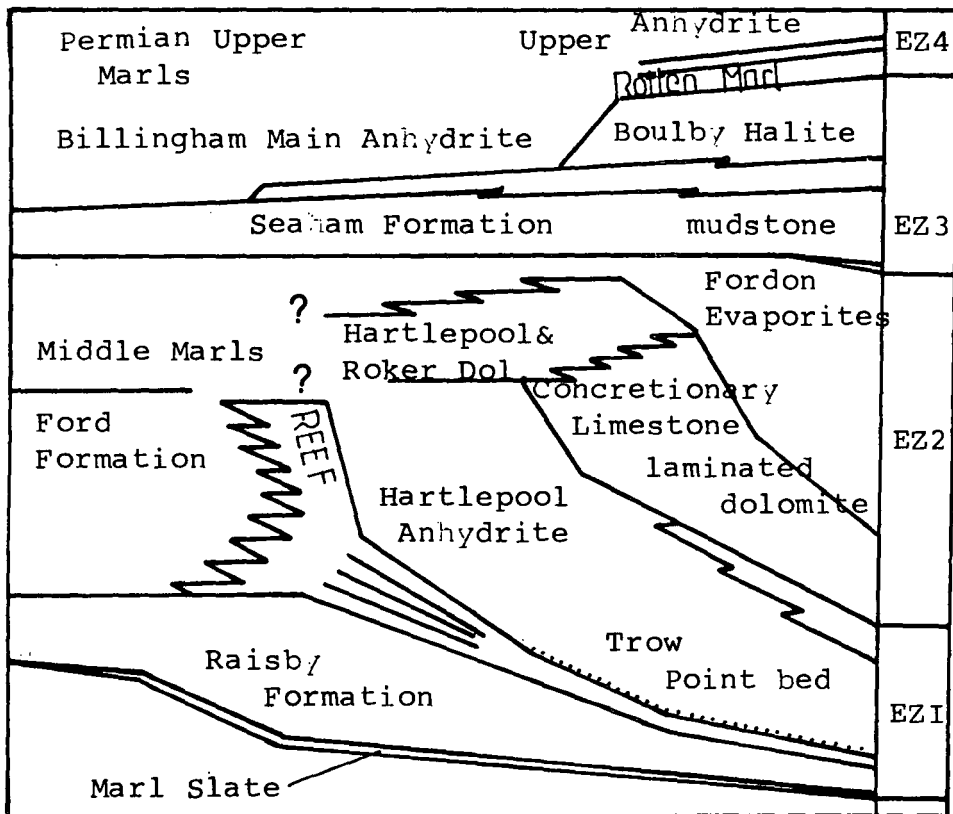
Theris
1985/500

Figure I. A. Zechstein palaeogeography of N.W.Europe.
(From Taylor(1984))

B. Diagrammatic representation of the relationships
of the main lithostratigraphic units in
the Permian of N.W.Europe.(After Smith(1981))



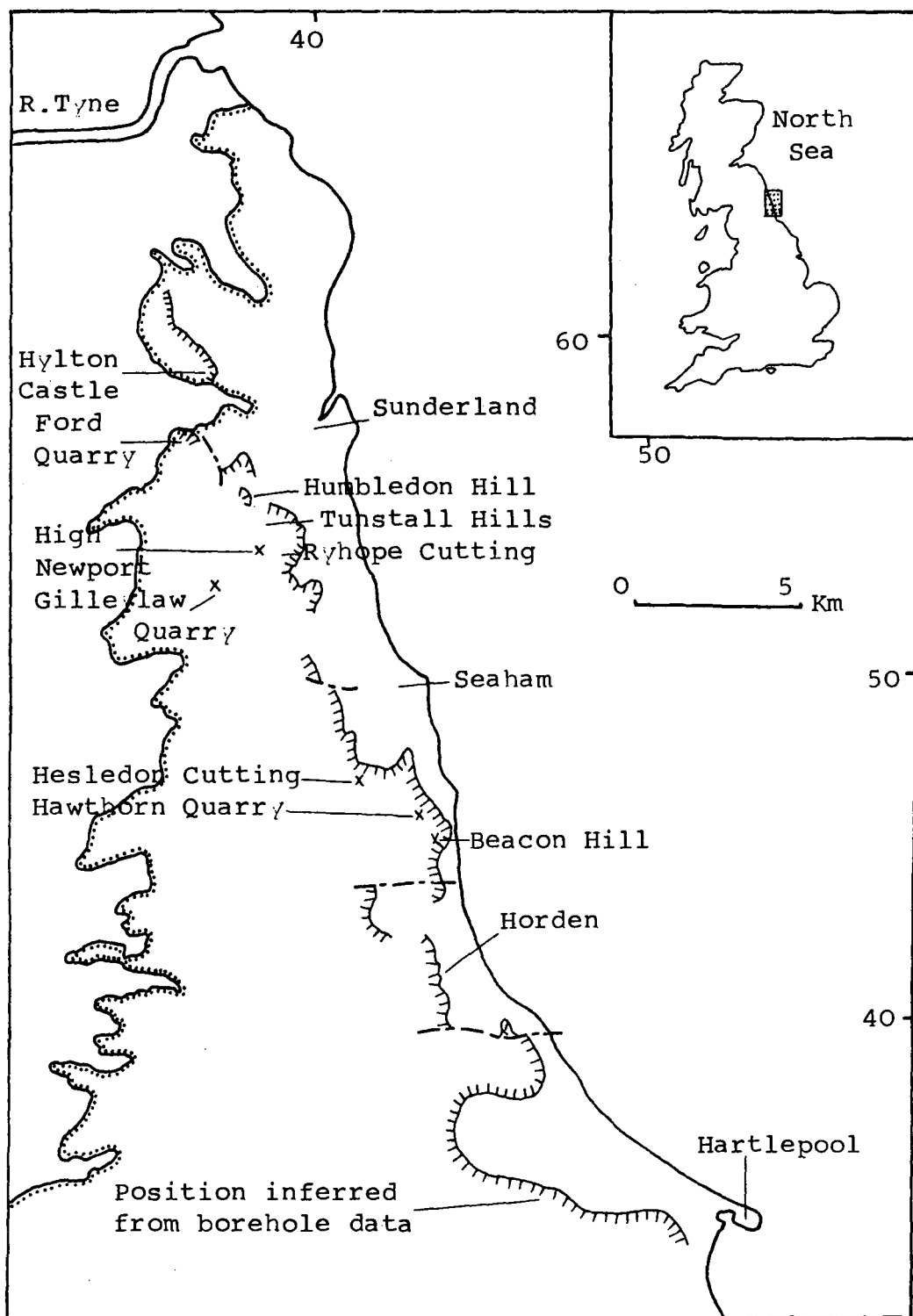
A



B



Figure 2. Map showing crest of shelf-edge reef
and main localities (From Smith(1981)).



Crest of Reef

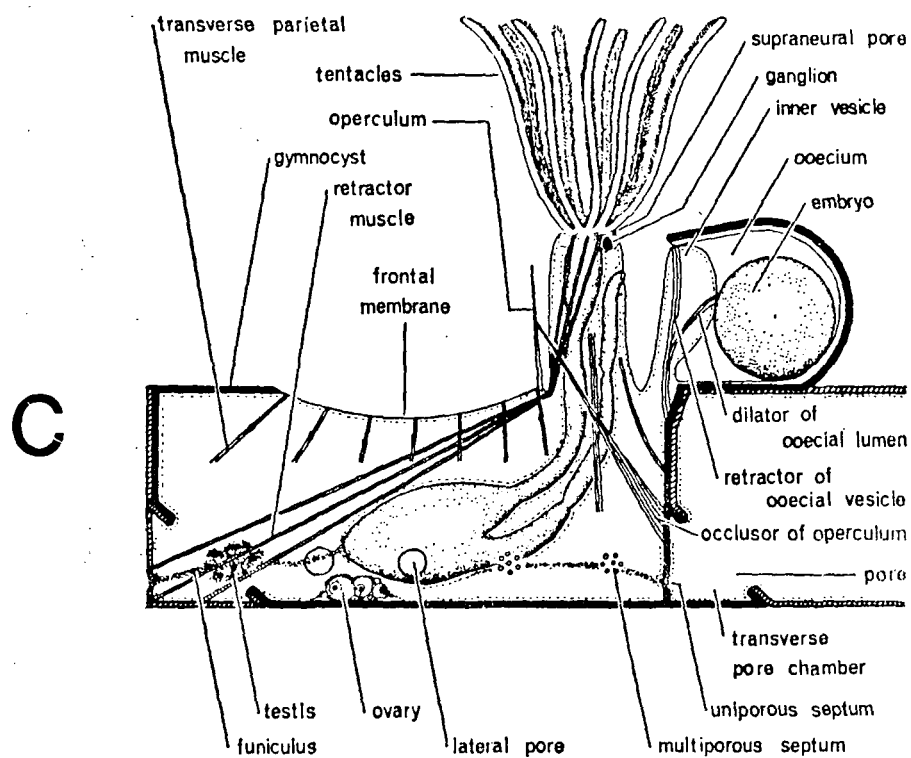
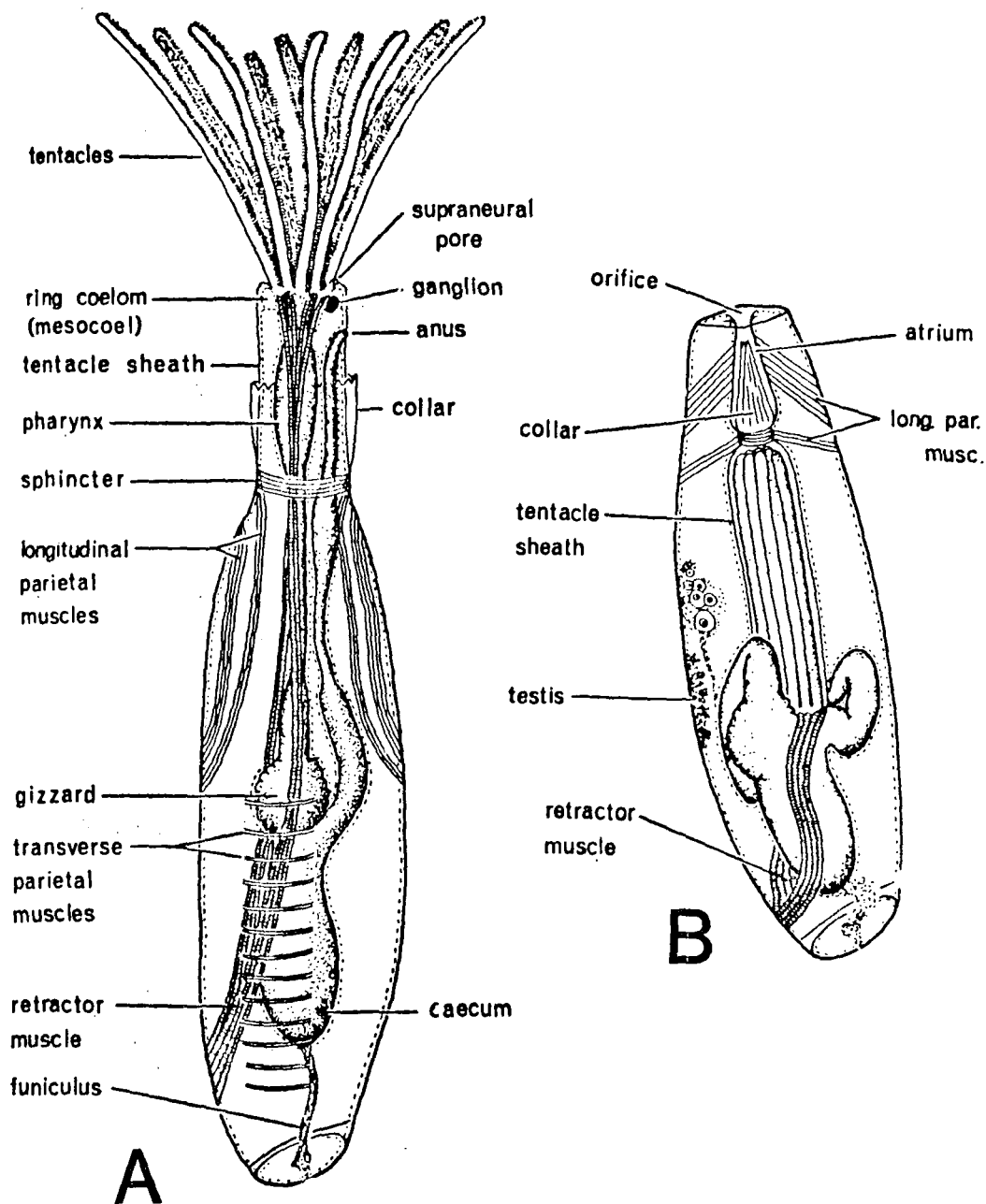


Faults



Western limit of Magnesian Limestone Outcrop

- Figure 3. A. Ctenostome zooid with tentacles expanded.
(From Ryland(1970))
- B. Ctenostome zooid (fully retracted).
(From Ryland(1970))
- C. Cheilostome zooid with tentacles expanded.
(From Ryland(1970))



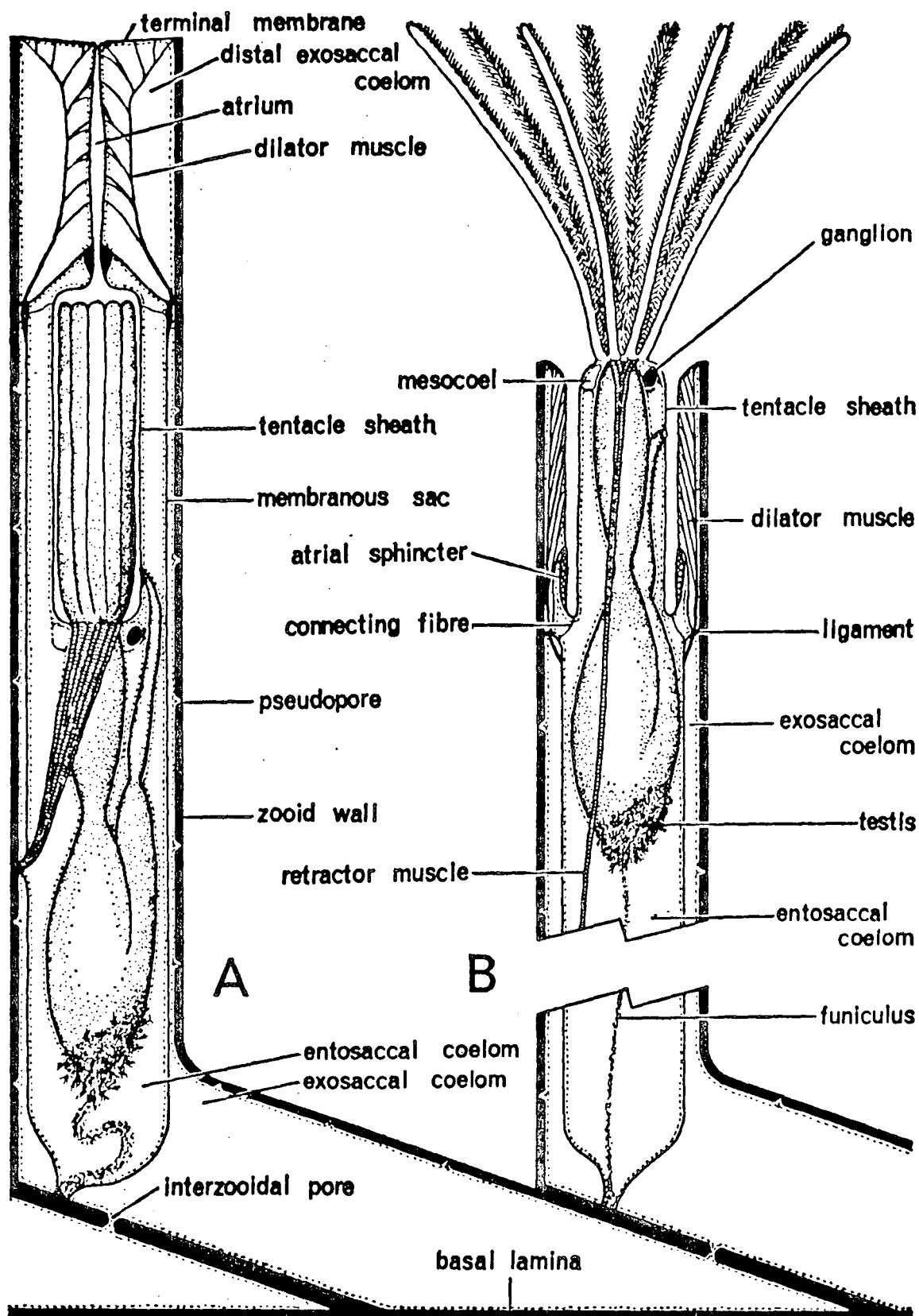


Figure 5. Stylized diagram of the relationship between hard and soft parts in a free-walled stenolaemate (Modified from Boardman (1971)). Tentacles retracted but not shown.

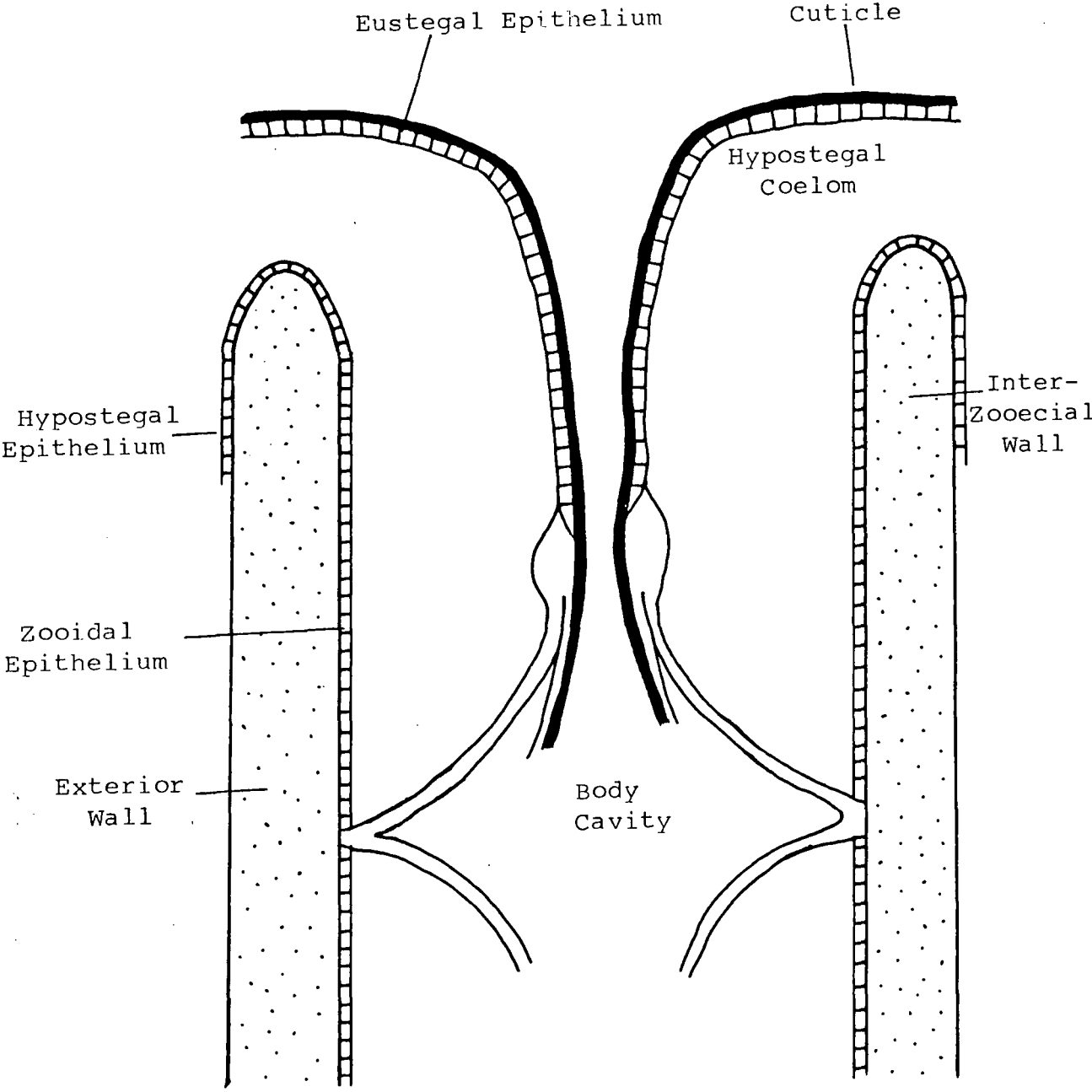
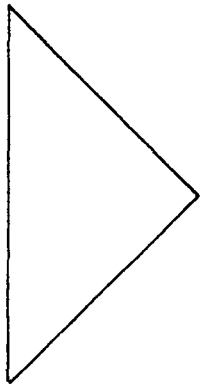
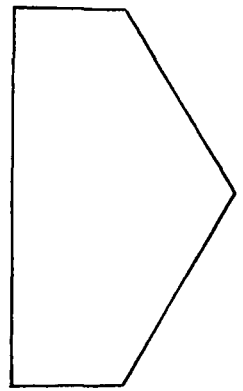


Figure 6. Examples of shapes used in the description of zooecial chambers.

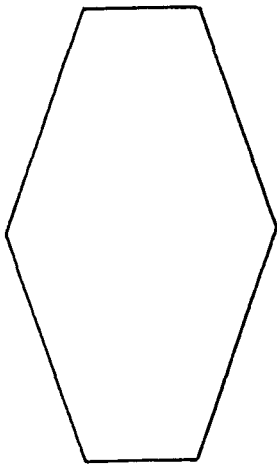
- (a) Triangular
- (b) Pentagonal, Hemi-hexagonal
- (c) Elongate hexagonal
- (d) Rhombic
- (e) Oval
- (f) Circular



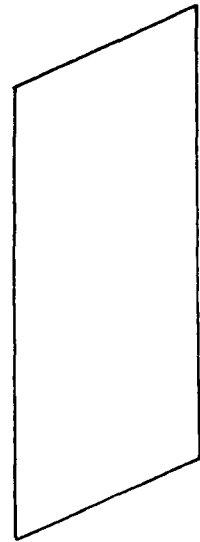
a



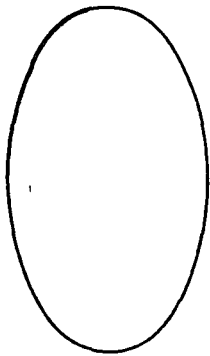
b



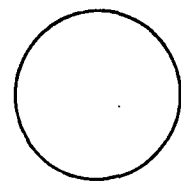
c



d



e



f

Figure 7. Inferred relationship of soft-parts to fossula. Fossula interpreted as anal opening. Stippled ornament=skeletal tissue. (From Gautier (1972)).

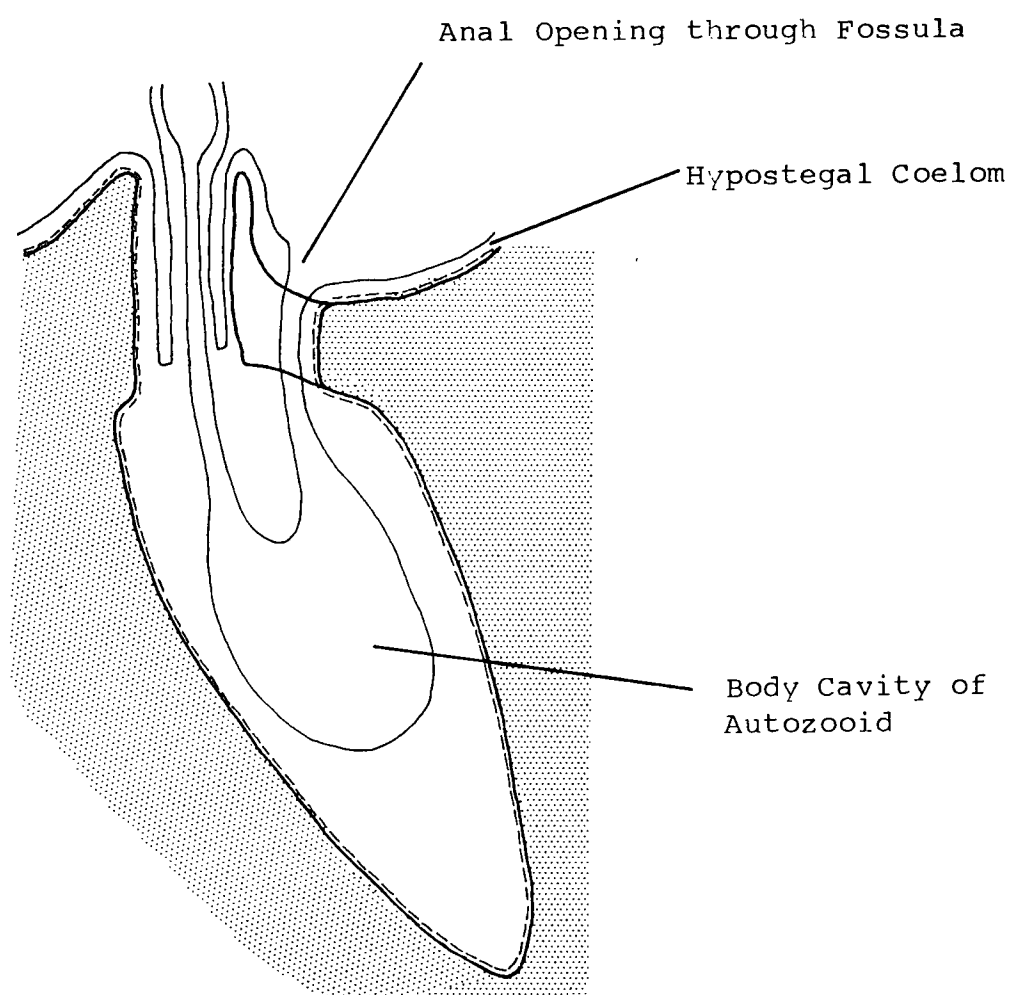


Figure 8. Transverse section of fenestellid branch to show elements of microstructure. The true extent of the primary granular layer in carinal nodes is not known and may be more restricted than is shown. It is not known if the 'Inner platy core' extends for the height of a node.

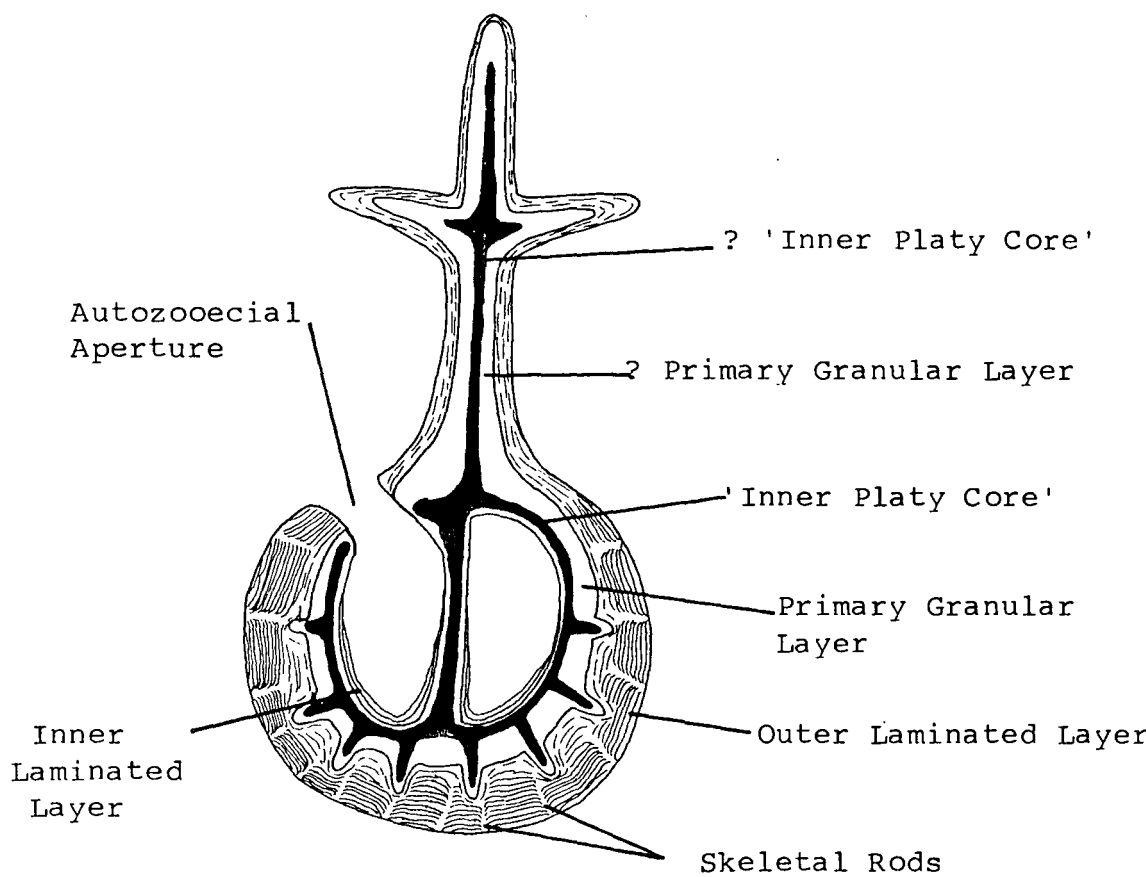
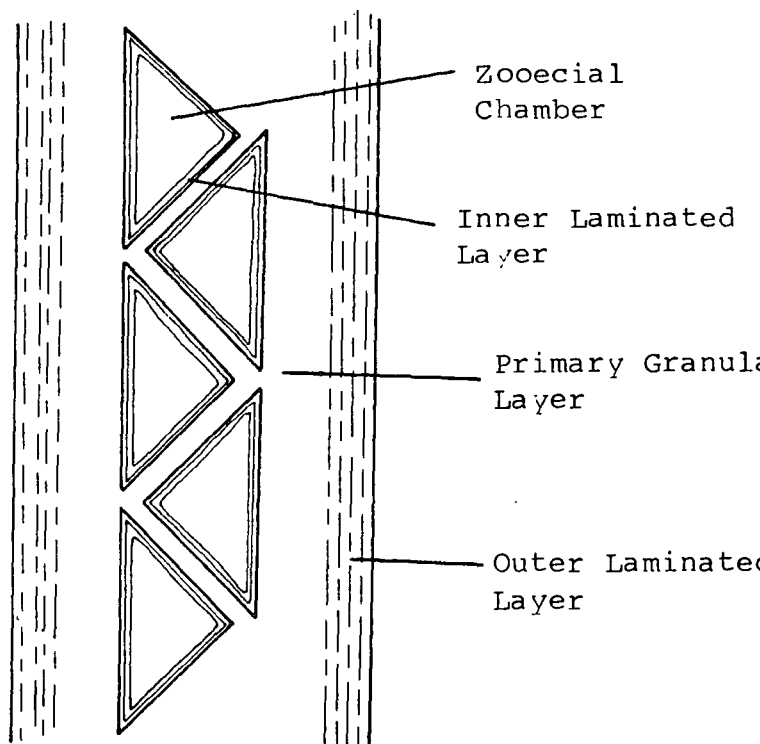


Figure 9. A. Tangential section of a fenestellid branch (close to zooecial chamber base), showing elements of microstructure.

B. Longitudinal section of a fenestellid branch showing elements of microstructure.

A



B

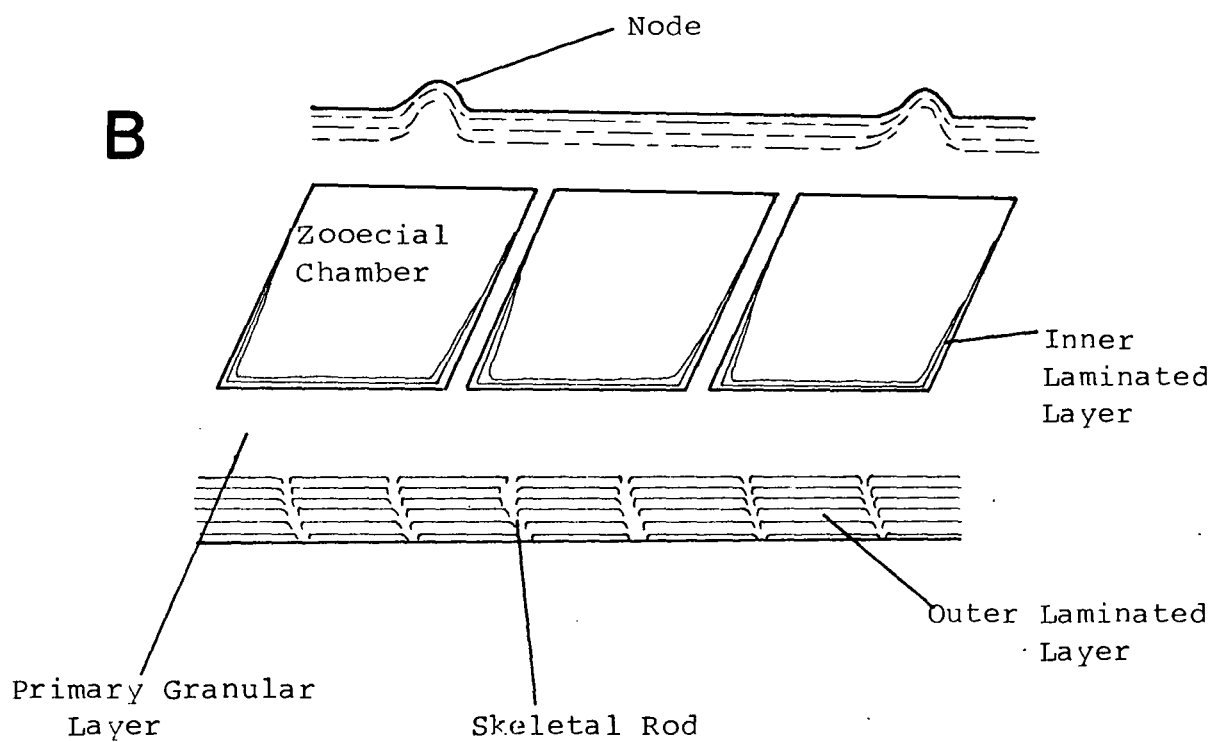


Figure IO. Tavener-Smith's (I969a) growth model for fenestellids.

A. Longitudinal section showing hard and soft parts in the "Double-walled" arrangement. Developing zooids attain adult size and shape prior to calcification (see text for discussion, p. 41).

B. Tangential section showing stages in the formation of a calcareous inter-zooecial wall (see text for discussion p. 41).

Figures 'A' and 'B' from Tavener-Smith (I969a).

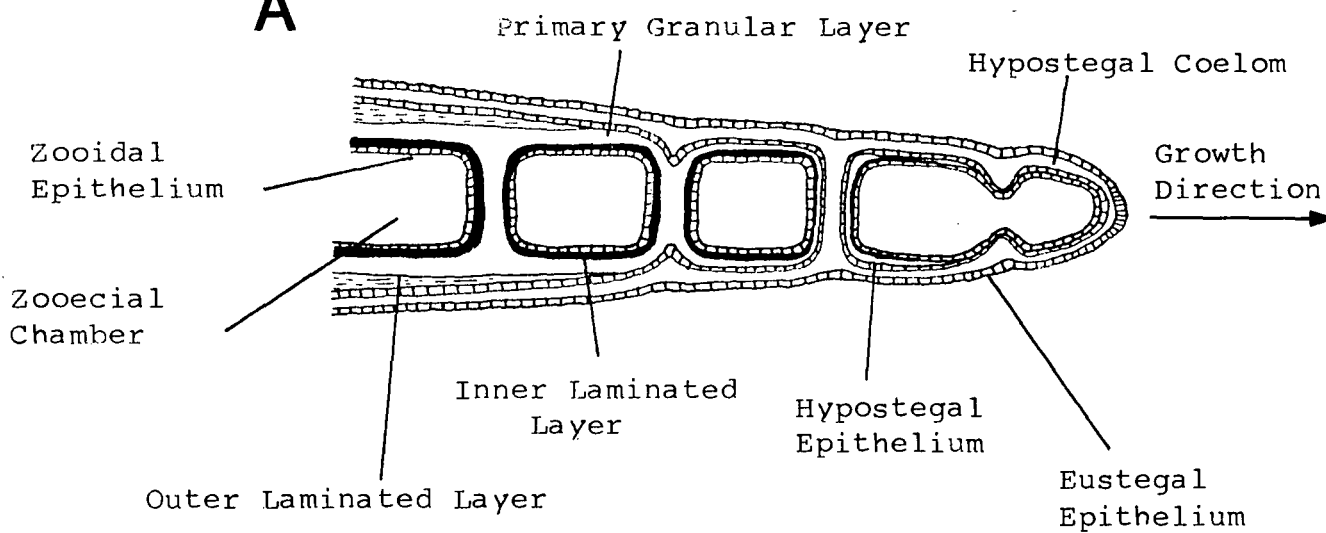
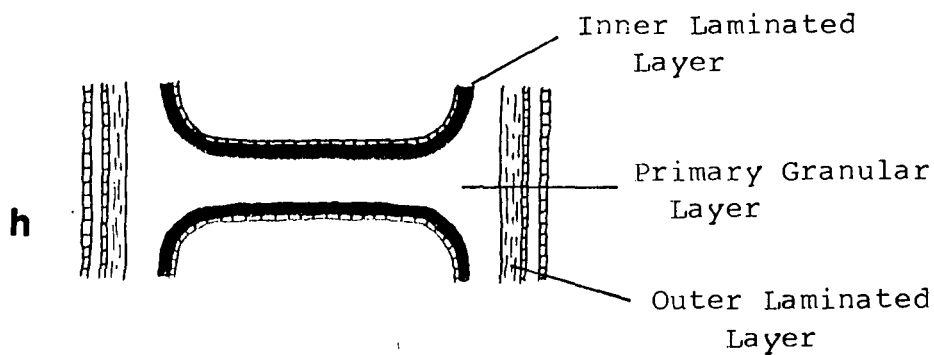
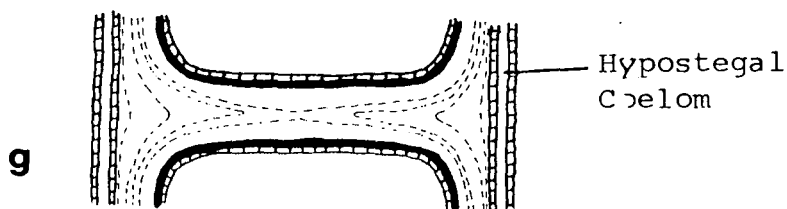
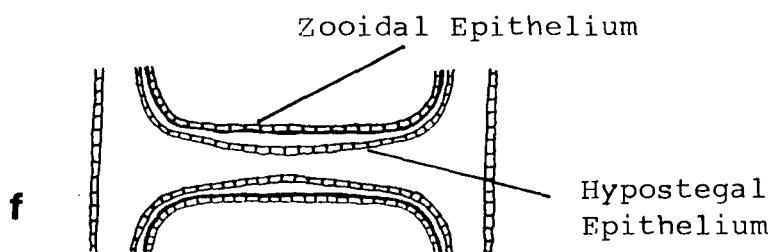
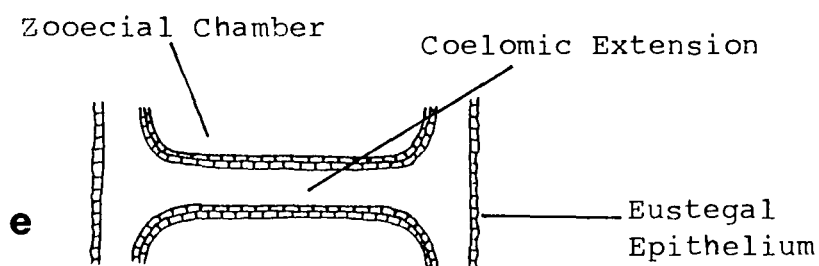
A**B**

Figure II. Modified growth model. Longitudinal section through a branch showing hard and soft parts - calcification of zooecial chambers commences prior to the complete development of a daughter zooid.
(Zooid omitted).

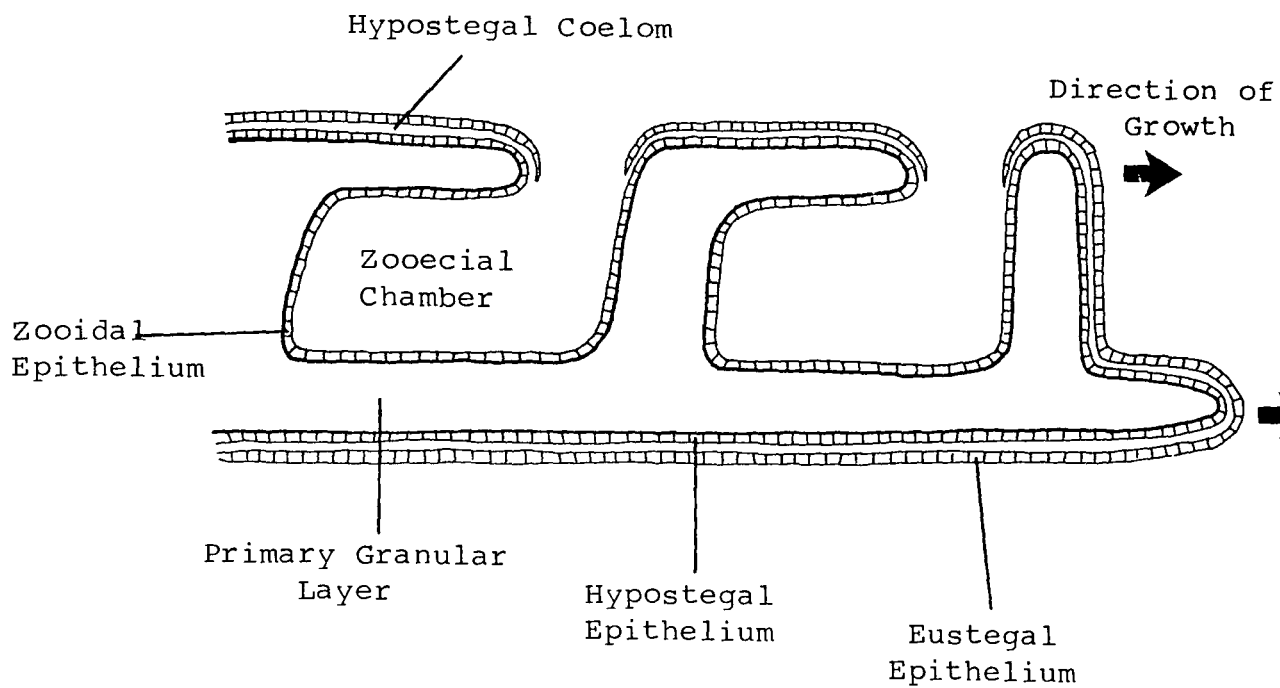


Figure I2. Growth model (Modified after Tavener-Smith (1969a)).

- A. Figure shows the ancestrula - evagination of the ancestrular epithelium creates a doubled epithelial layer.
- B. Epithelia extend by intussusception + calcification commences.
- C. Calcification of the first zooecial chamber distal to the ancestrula commences.
- D. The first asexually budded zooid is produced.

See text, p.41. for discussion.

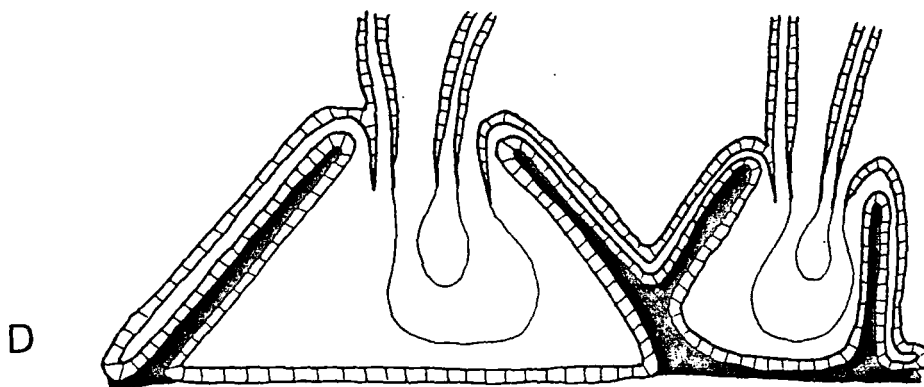
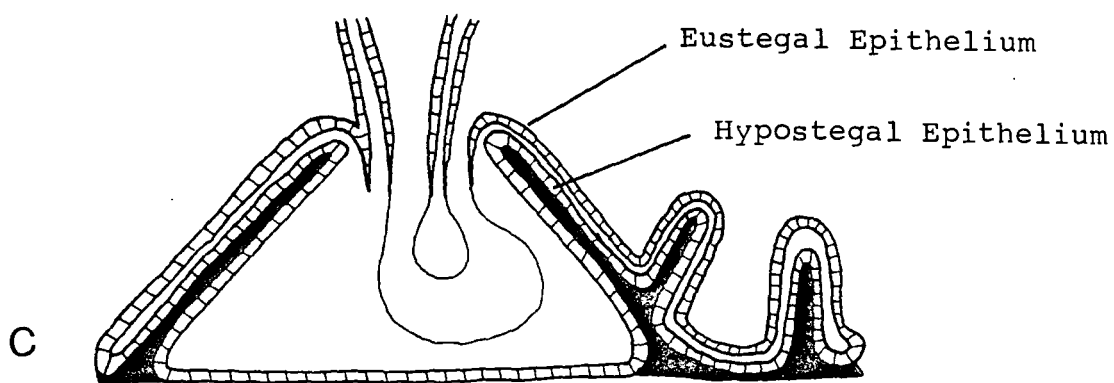
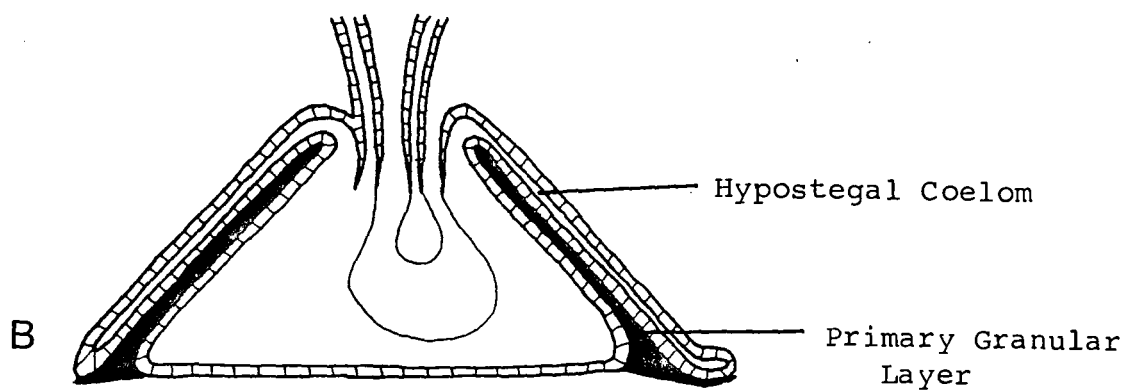
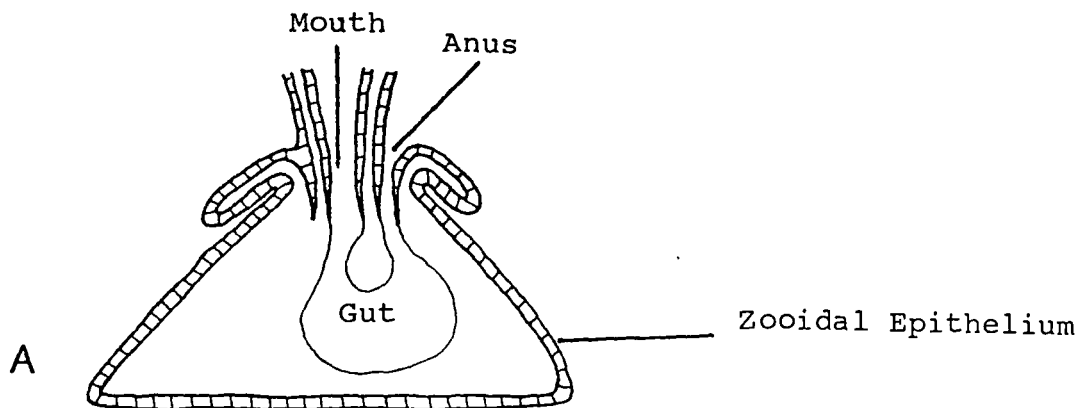


Figure I3. Ovicells in Palaeozoic Fenestrates.

- A. Longitudinal section through a branch of Fenestella cf. fanata Whidborne showing ovicellular inflation. (From Tavener-Smith(1966a)).
- B. Plan view of obverse surface of 'A'. (From Tavener-Smith(1966a)).
- C. Longitudinal section through a branch of Septatopora flemingi Engel showing ovicellular depression. (From Engel(1975)).
- D. Longitudinal section through a branch of Septatopora acarinata Crockford showing ovicellular pit. (From Engel(1975)).

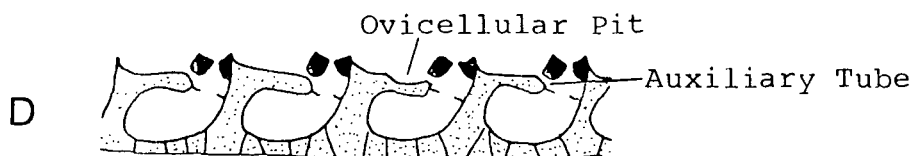
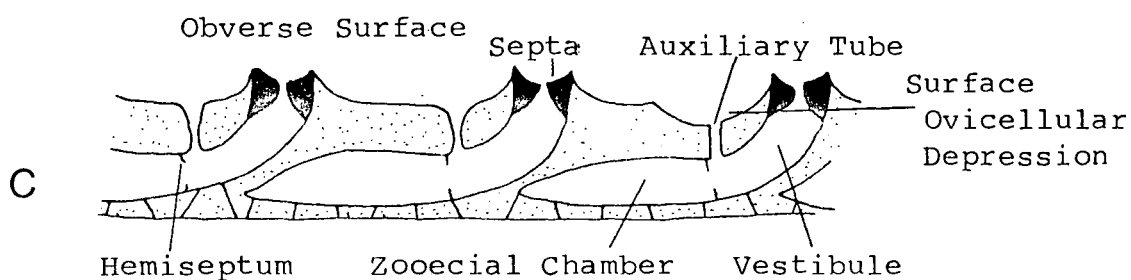
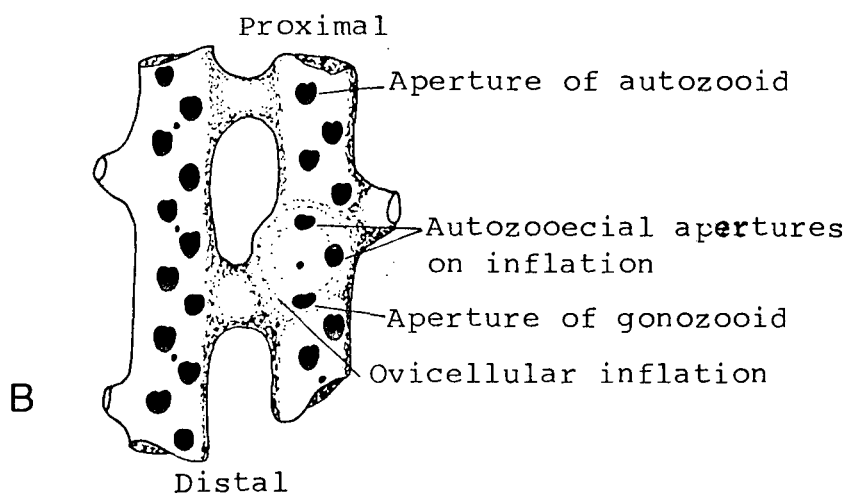
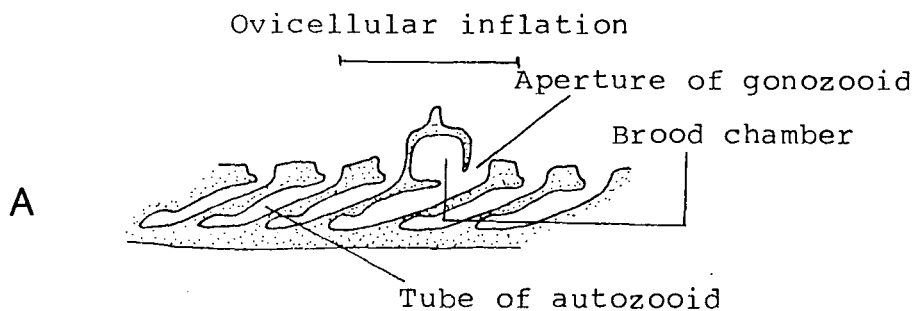
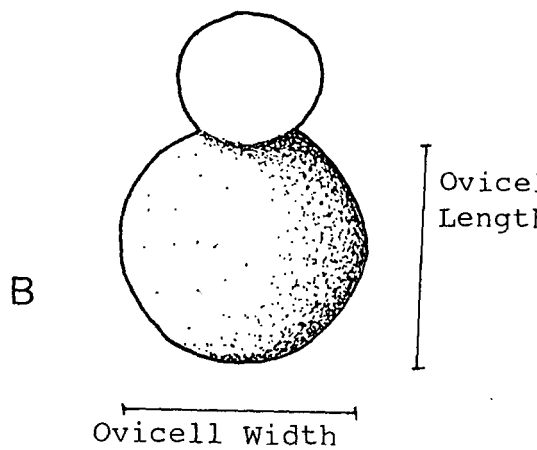
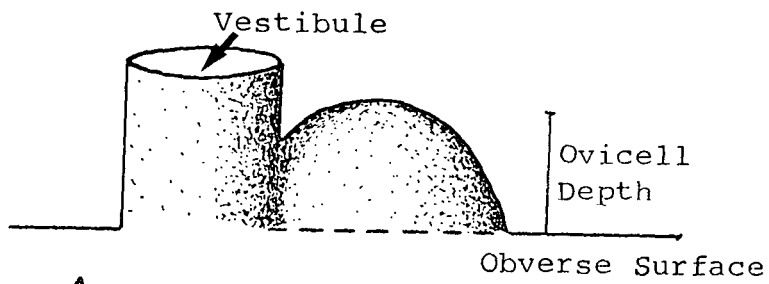


Figure I4. Ovicells.

- A. Side view of ovicell and distal part of vestibule in cast preservation.
- B. Plan view of 'A'.
- C. Oblique tangential section of Synocladia virgulacea showing ovicell close to the obverse surface. The numbers I-5 correspond to the numbers on the longitudinal section and show which level of the zooecial chamber is represented in the tangential section.
- D. Longitudinal section of Synocladia virgulacea showing ovicell and the levels in the section represented by the numbers I-5 in 'C'.
It is not known with certainty if the ovicell is completely enclosed within the branch.



O. Imm

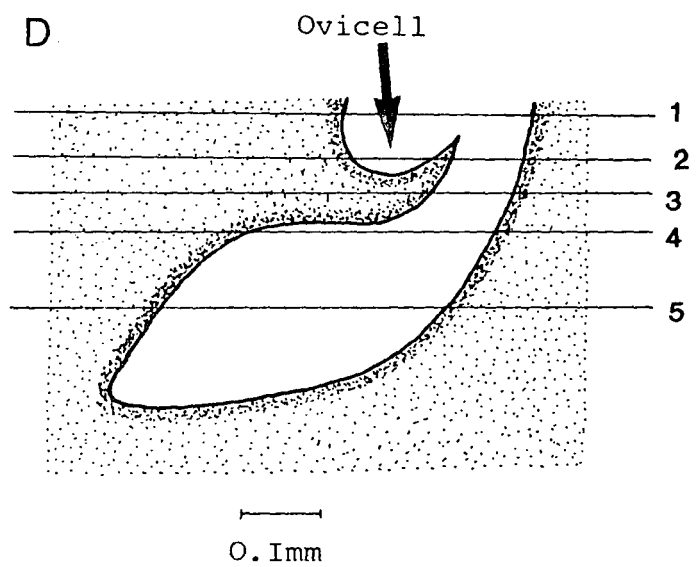
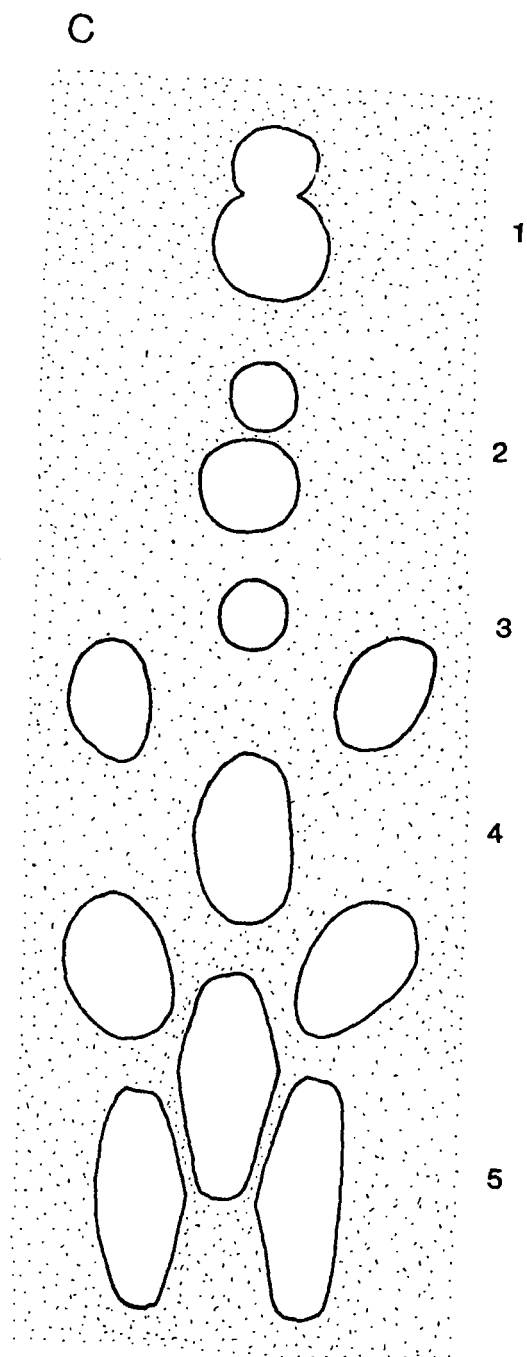


Figure I5. Obverse surface of a fenestellid showing the characters measured in the present study. The bottom right corner of the diagram shows characters measured internally.

EXTERNAL

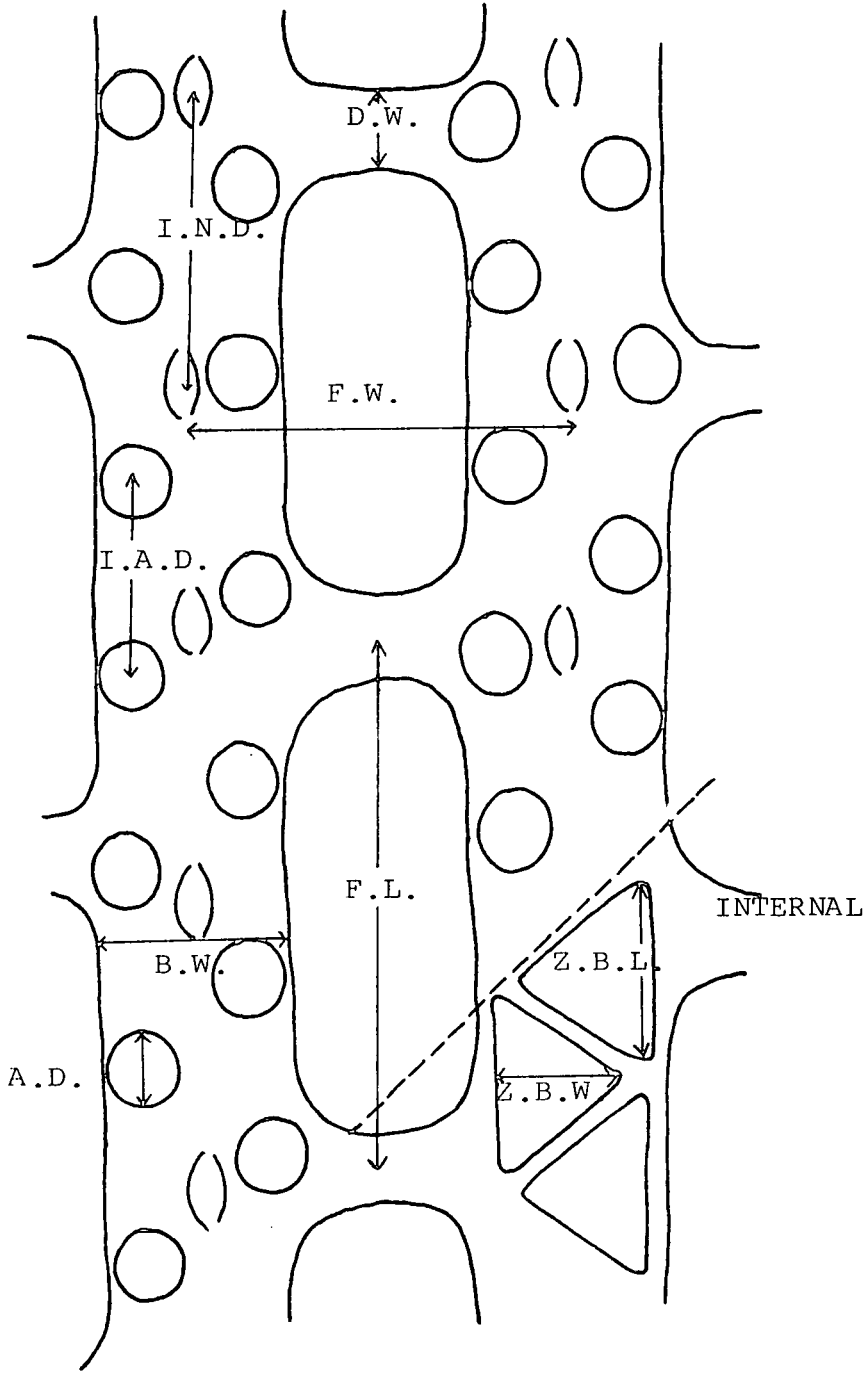


Figure I6. Orientation of thin sections for the genus Fenestella; Longitudinal, Transverse and Tangential. (After Bancroft (1984)).

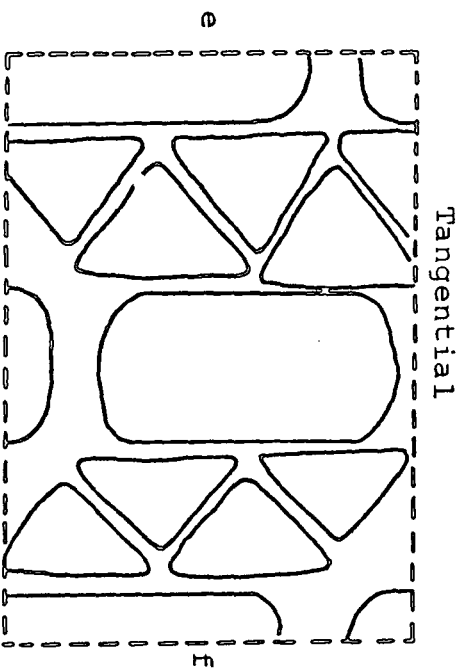
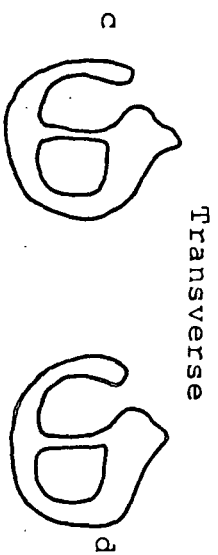
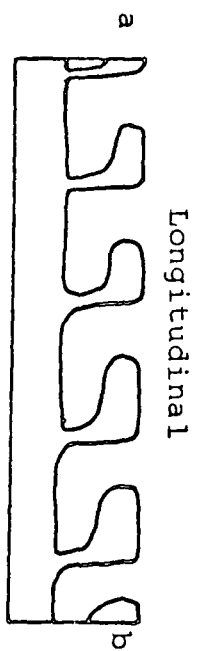
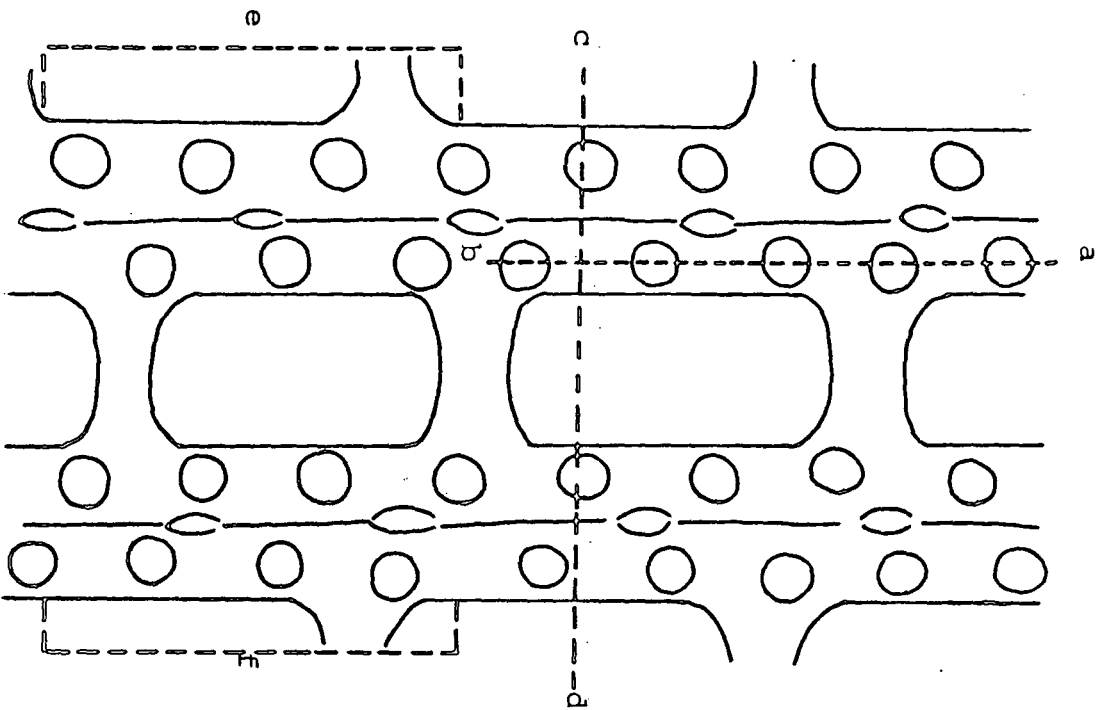


Figure I7. Fenestella retiformis Schlotheim

Obverse surface detail. Three nanate
zooecia occur close to the bifurcation
point. RH2.24.

Bar Scale=Imm

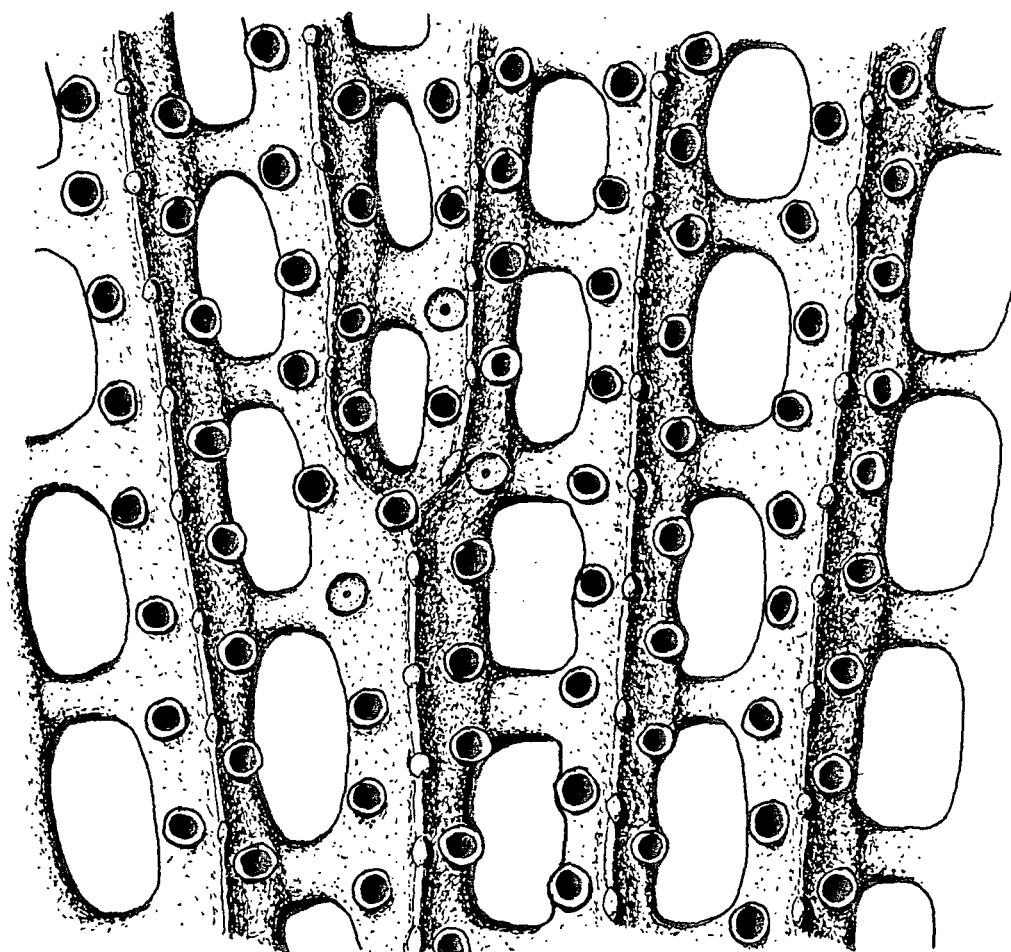
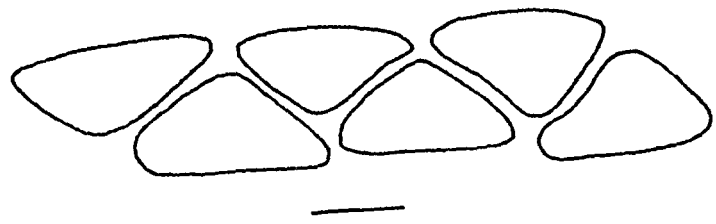


Figure 18. Fenestella retiformis Schlotheim

- A. Zooecial chamber base shape. Bar scale=O. Imm.
- B. Reverse surface detail. The second branch from the right shows longitudinal striae. Bar scale=Imm. RH2.26.

A



B

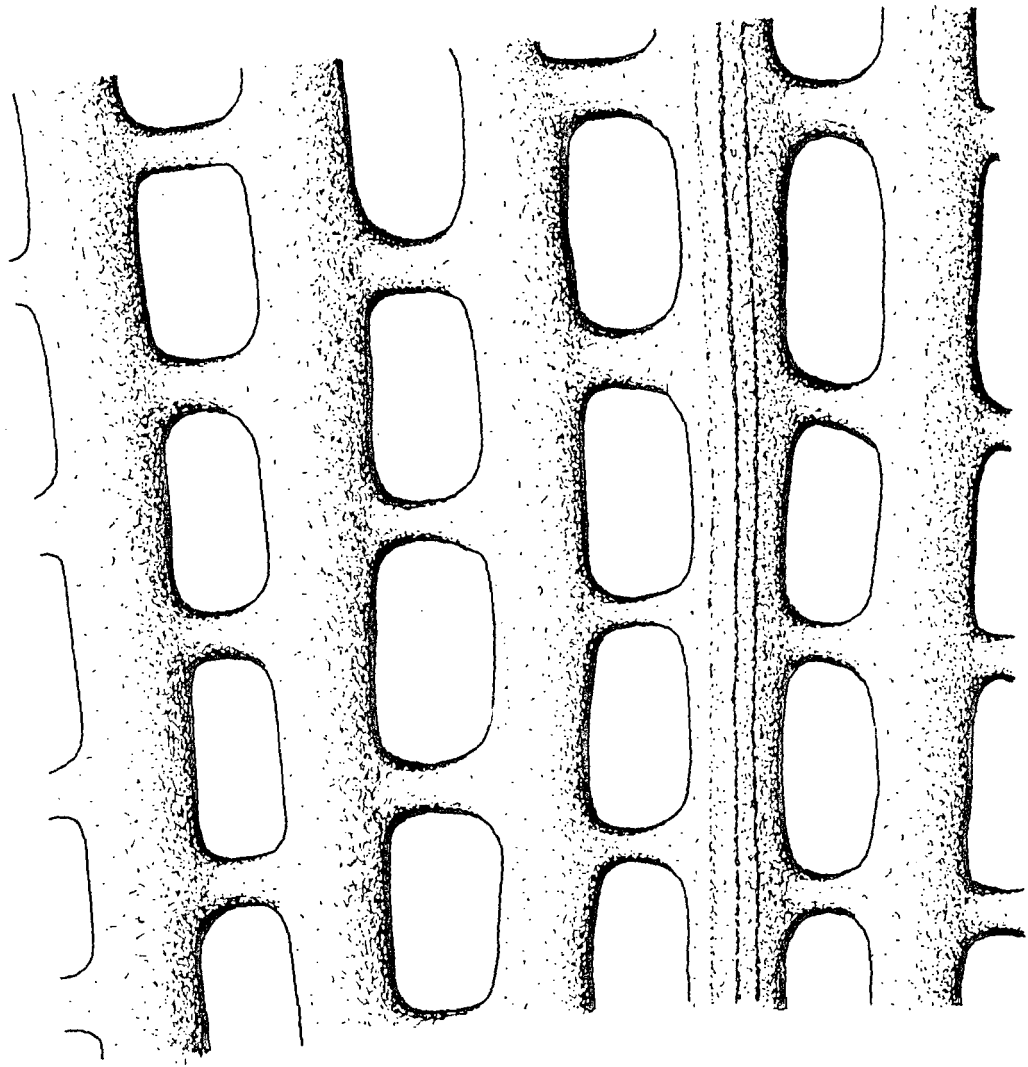


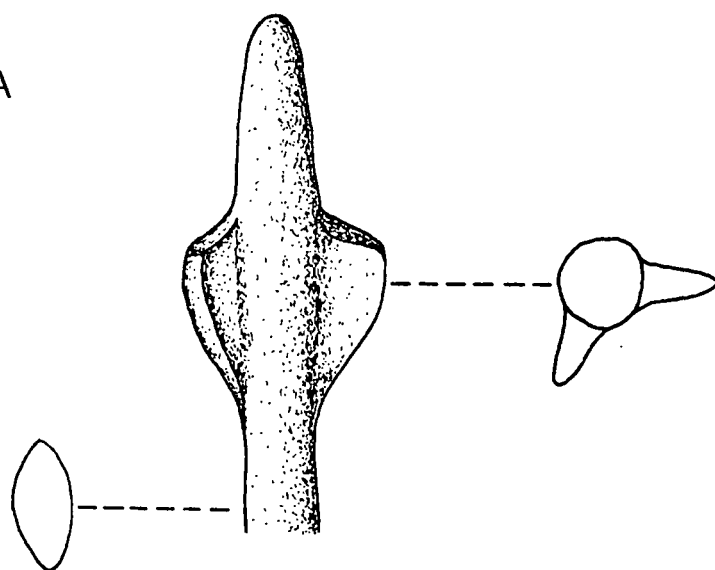
Figure I9. Nodes of Fenestella retiformis.

A. With transverse processes.

B. With a trifurcation.

The silhouette diagrams show the shape
of the node in transverse section.

A



B

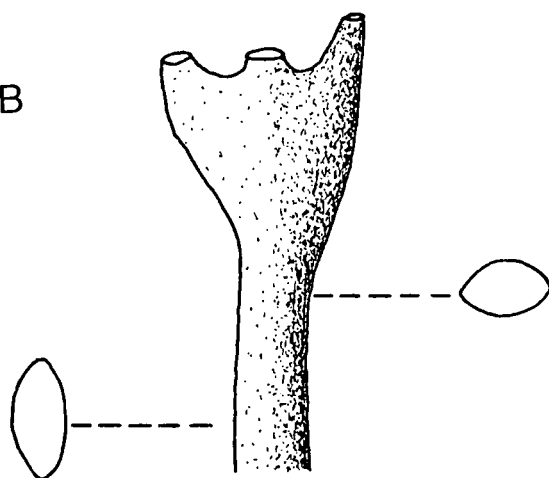


Figure 20. Histograms of Fenestrule Length and Fenestrule Width for Fenestella retiformis. Interval=0.02mm

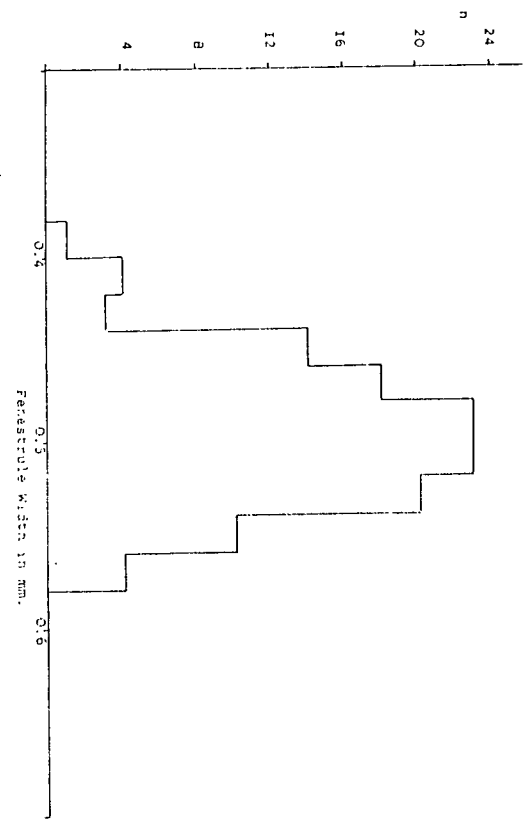
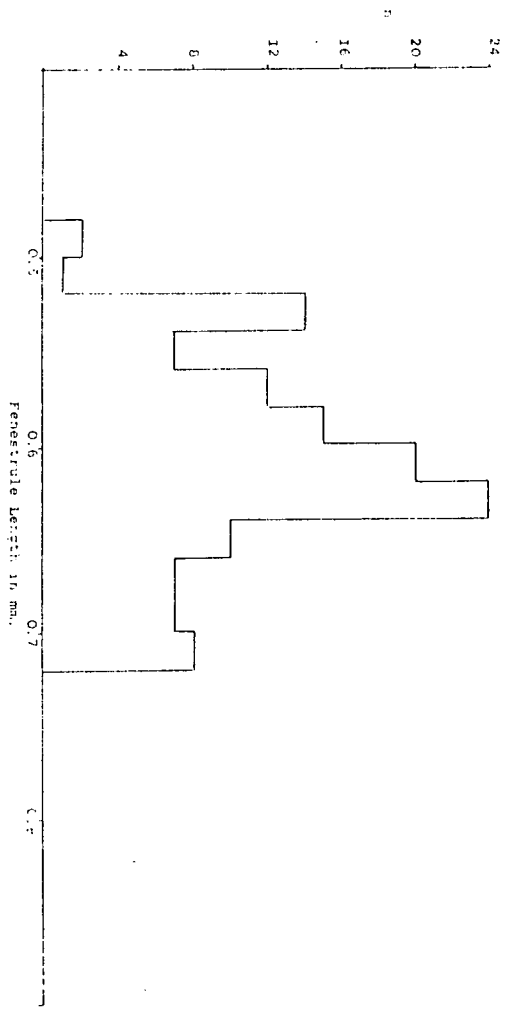


Figure 2I. Histograms of Branch Width and
Inter-apertural-distance for
Fenestella retiformis.
Interval=0.02mm.

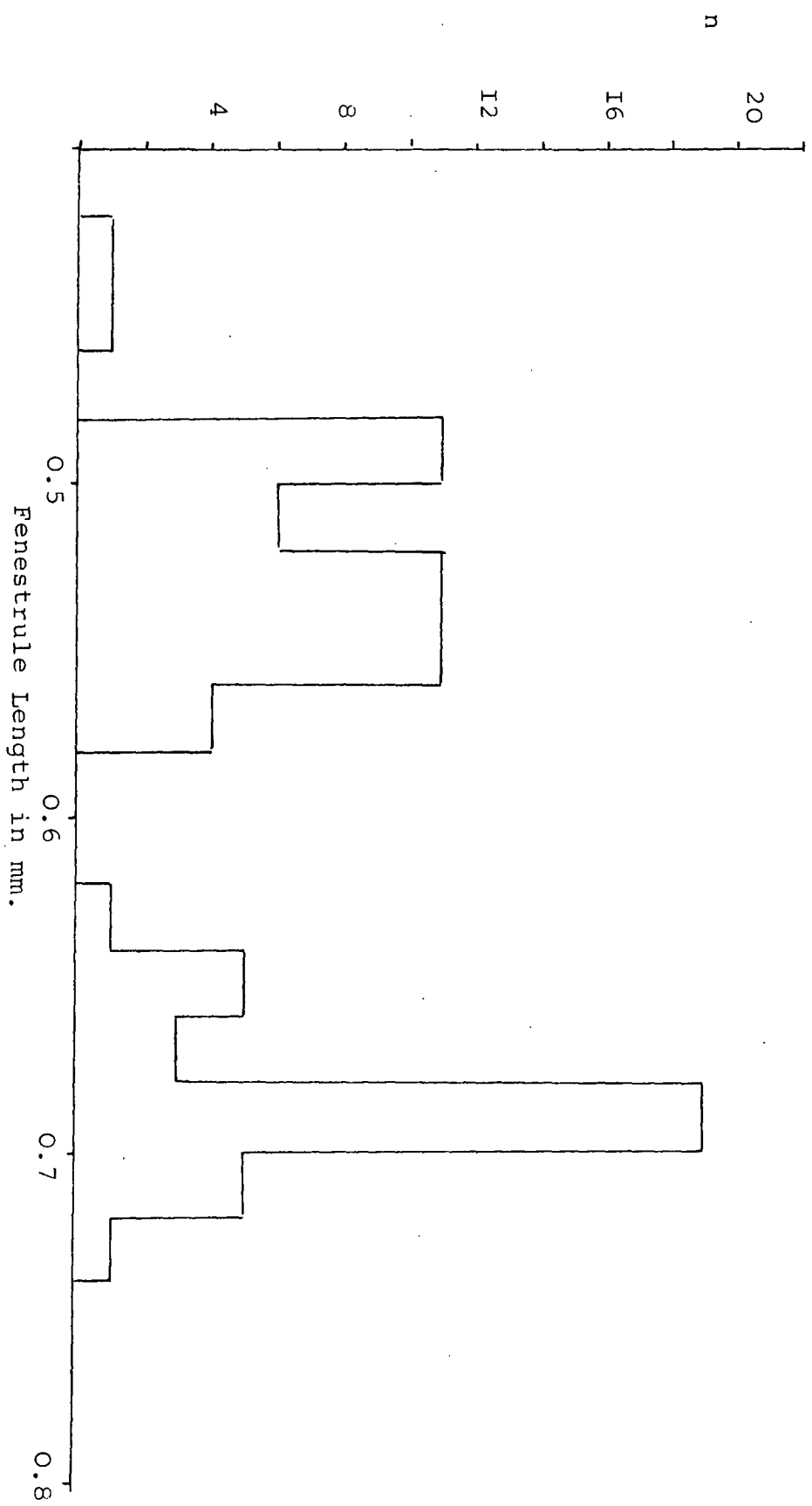
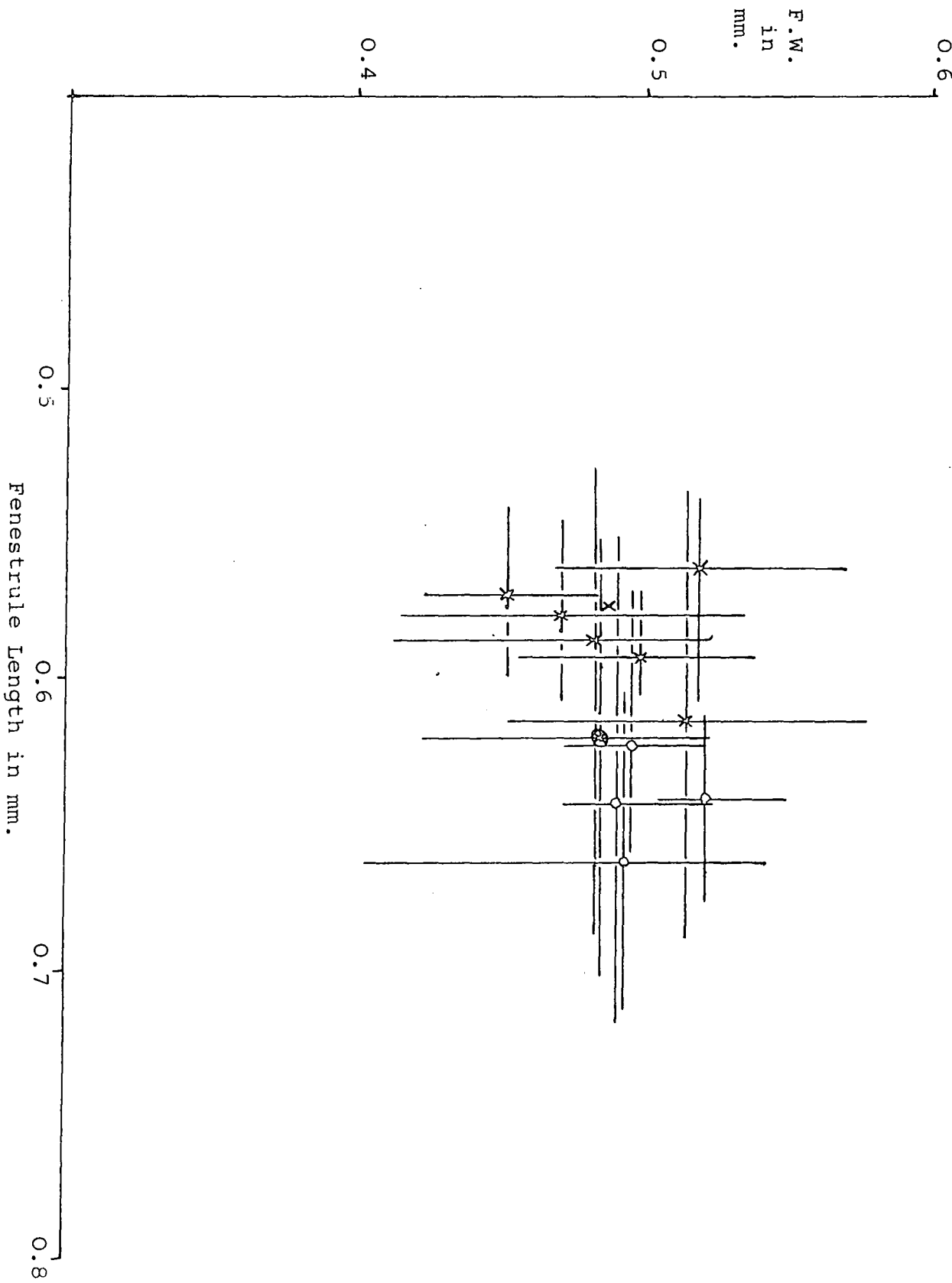


Figure 23. Graph of Fenestrule length $\sqrt{\text{Fenestrule width}}$ for Fenestella retiformis. Crosses are locality averages close to the top of the reef; circles are averages for localities close to the base of the reef. Bars represent the within-locality range.



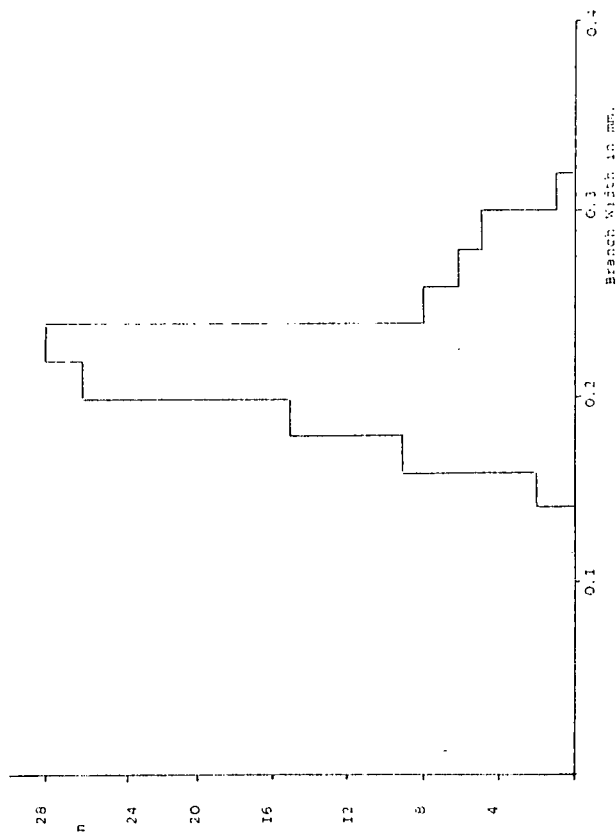
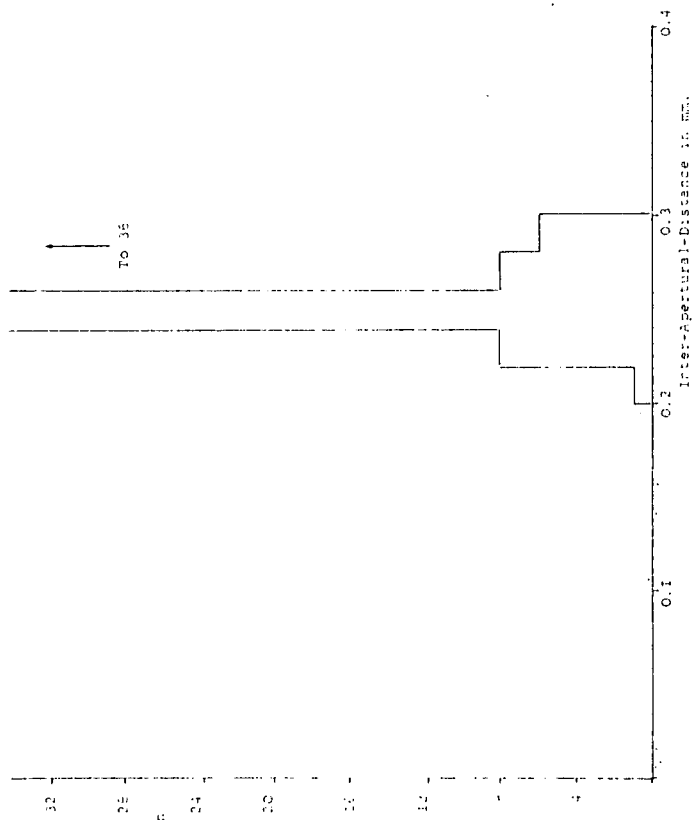


Figure 22. Histogram of Fenestrule length for a
biased sample of Fenestella retiformis.

Figure 24. Intra-colony coefficients of variation
for Branch width, Inter-nodal-distance,
Fenestrule length and Fenestrule width
in Fenestella retiformis.

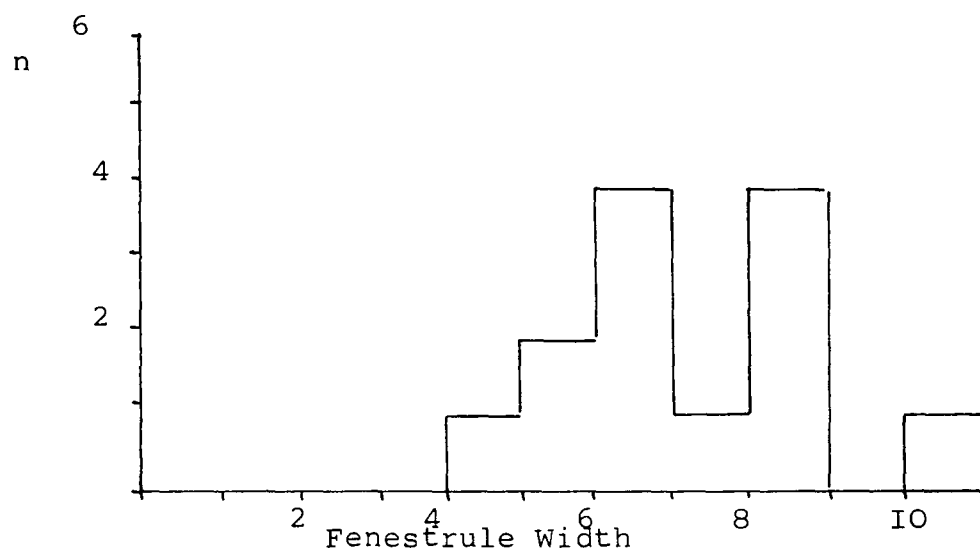
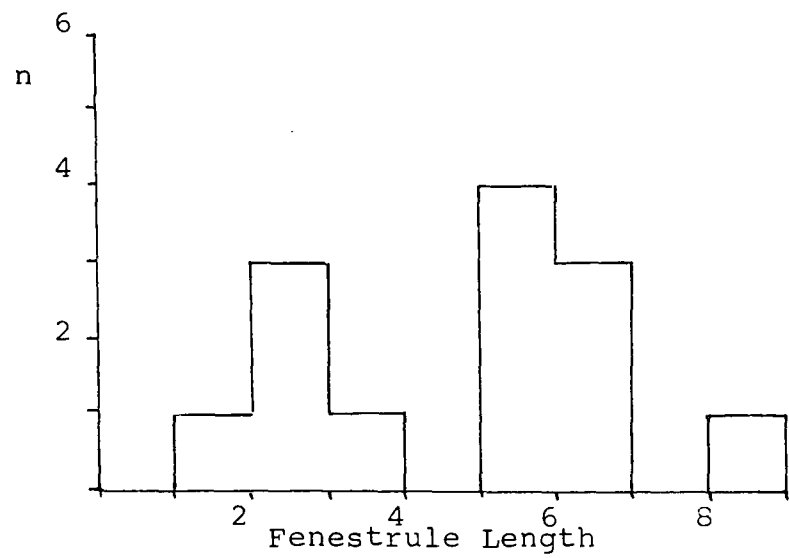
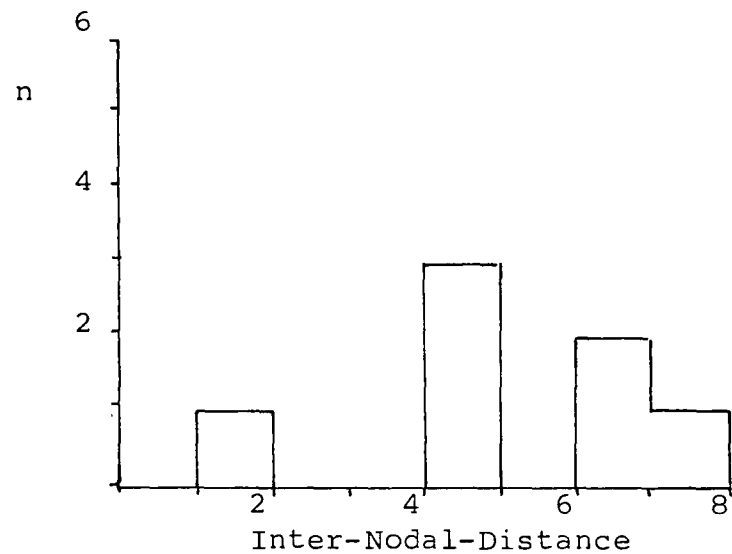
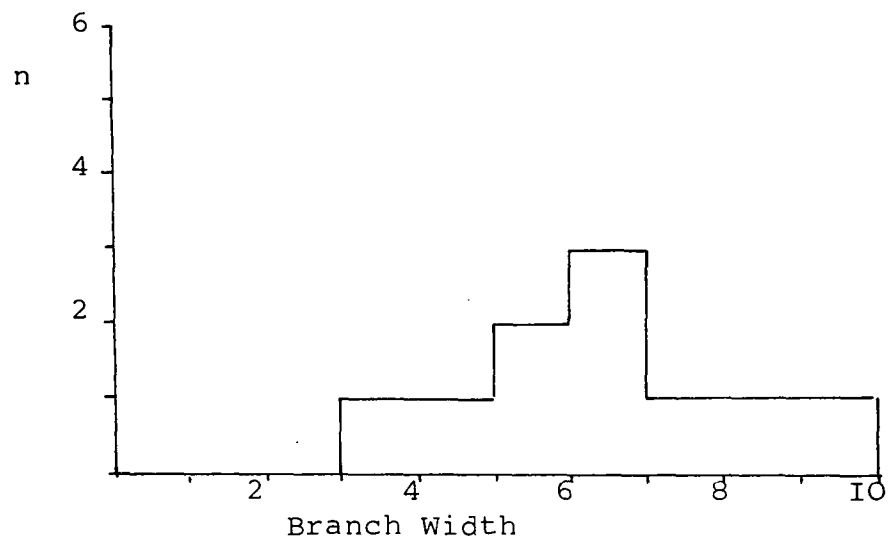


Figure 25. Histograms of Fenestrule length and
Fenestrule width for Fenestella retiformis
and Fenestella geinitzi combined.

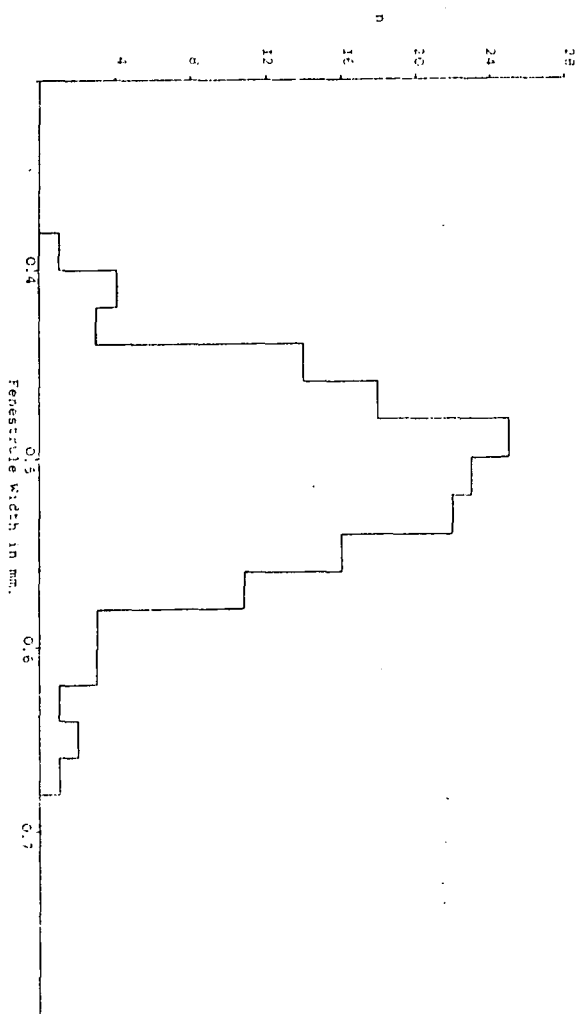
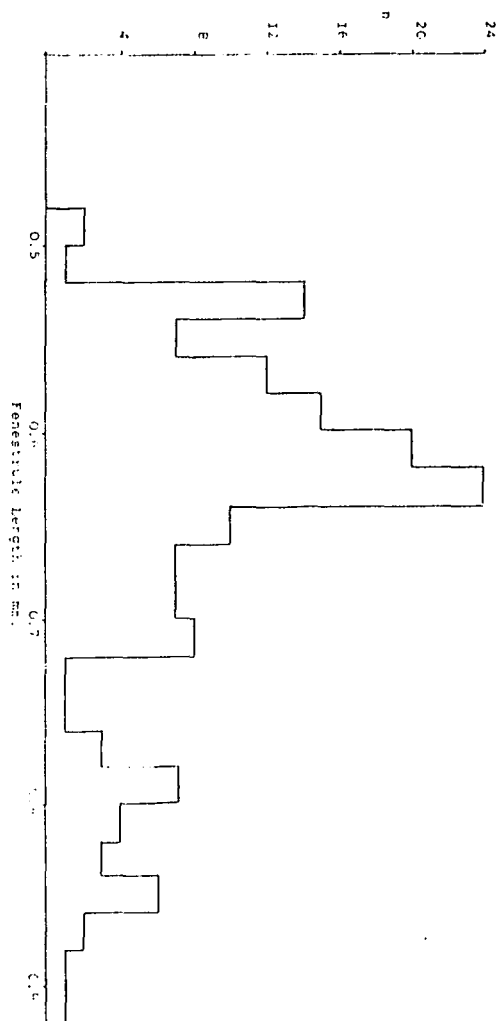
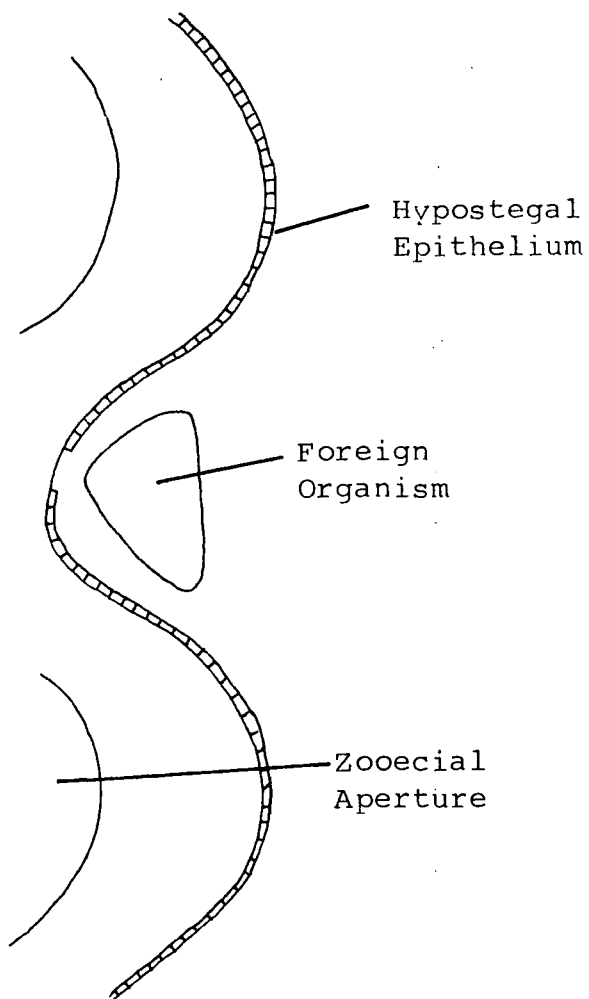


Figure 26. Bioimmuration in Fenestella retiformis.

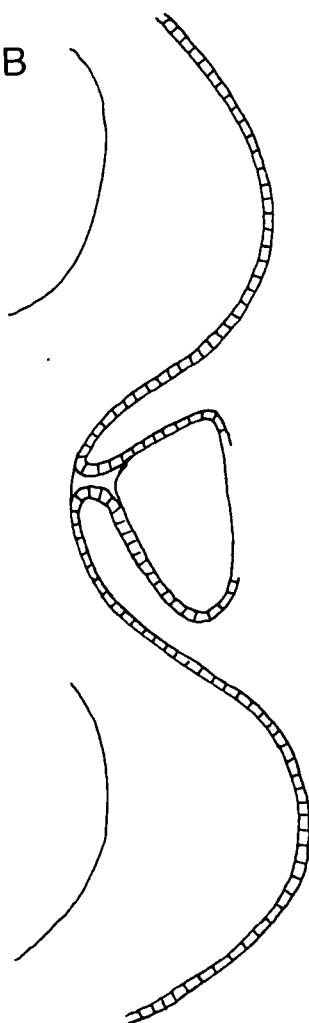
- A. A foreign organism becomes attached to the branch of F. retiformis out of the plane of the section. Epithelia are ruptured adjacent to the organism.
- B. Epithelia begin to grow around the organism.
- C. Epithelia fuse around the organism and deposition of weakly laminated skeleton takes place, extending out of the plane of the section.
- D. Epithelia continue to withdraw from the foreign organism depositing a thick layer of laminated skeleton which partly occludes the fenestrule.

(Eustegal epithelium omitted from diagram)

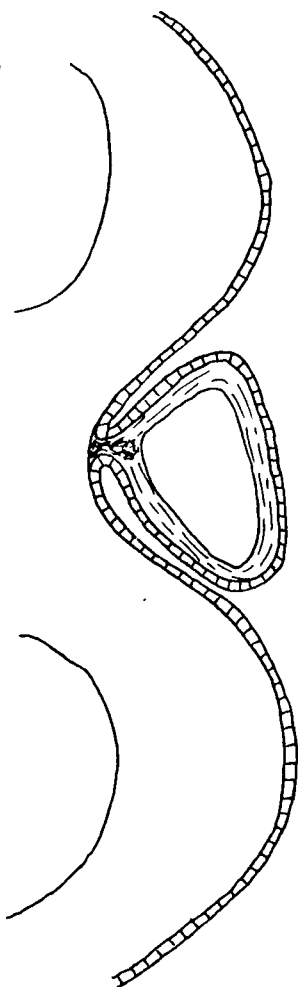
A



B



C



D

Outer Laminated Layer

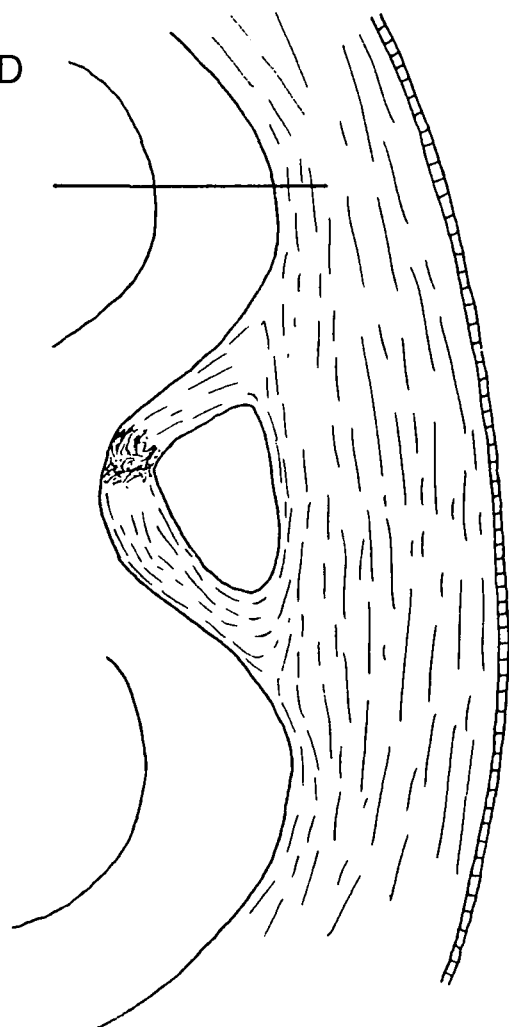


Figure 27. Fenestella geinitzi d'Orbigny
Obverse surface detail.RH4.27.
Bar scale=Imm

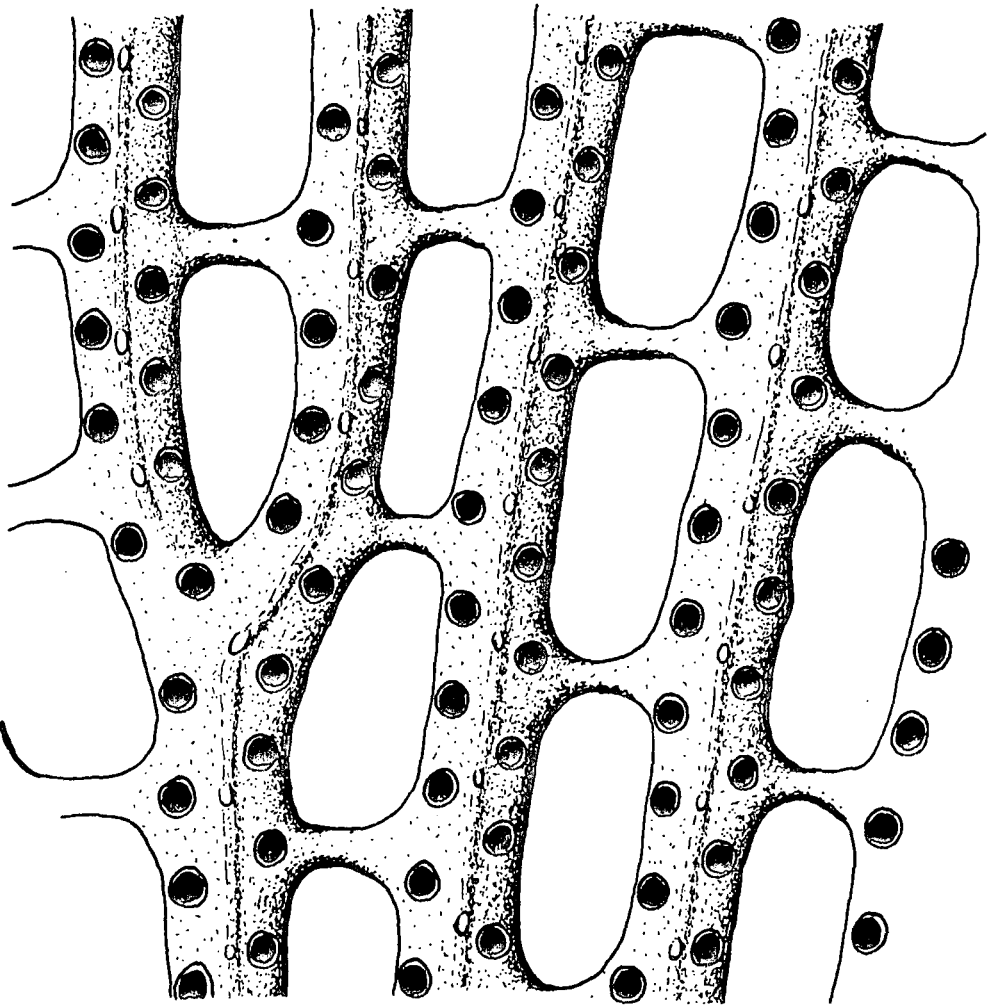


Figure 28. Fenestella geinitzi d'Orbigny
Reverse surface detail.HM7.6+3.
Bar scale-Imm

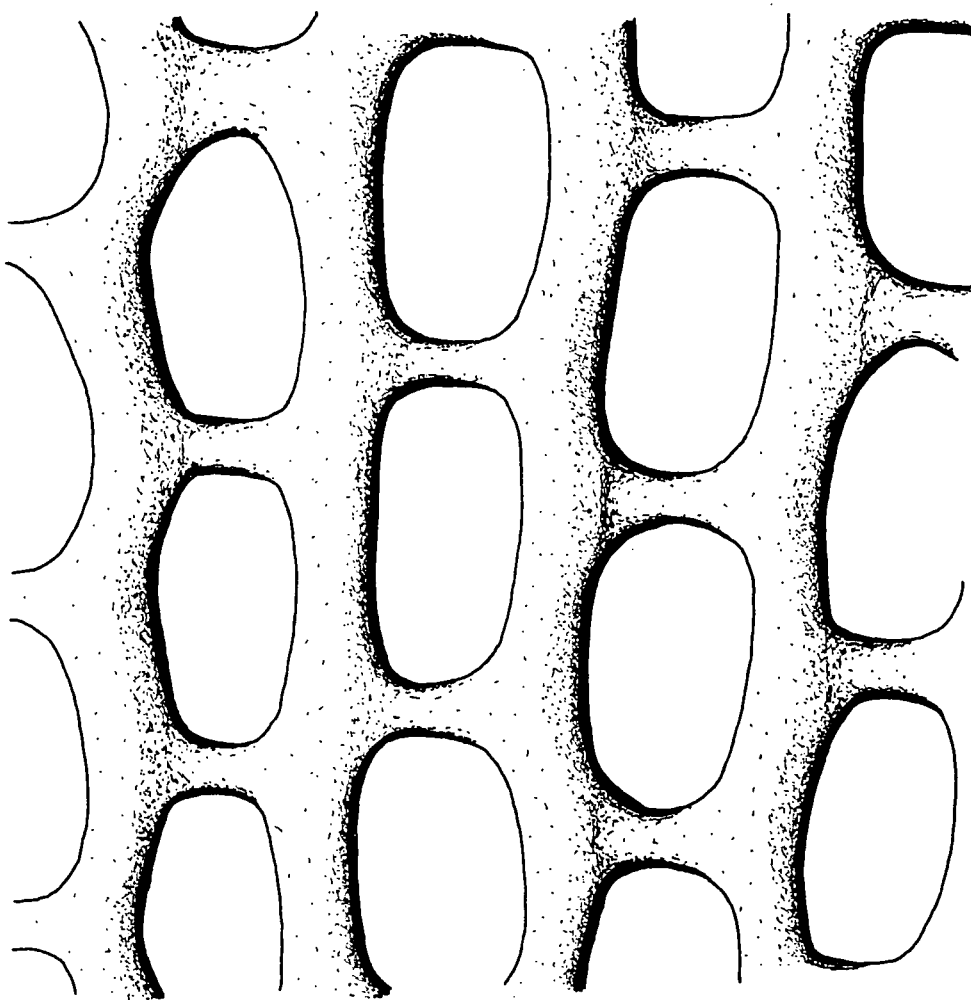


Figure 29. Histograms of Fenestrule length,
Fenestrule width, Branch width and Inter-
apertural-distance for Fenestella geinitzi.
In mm.

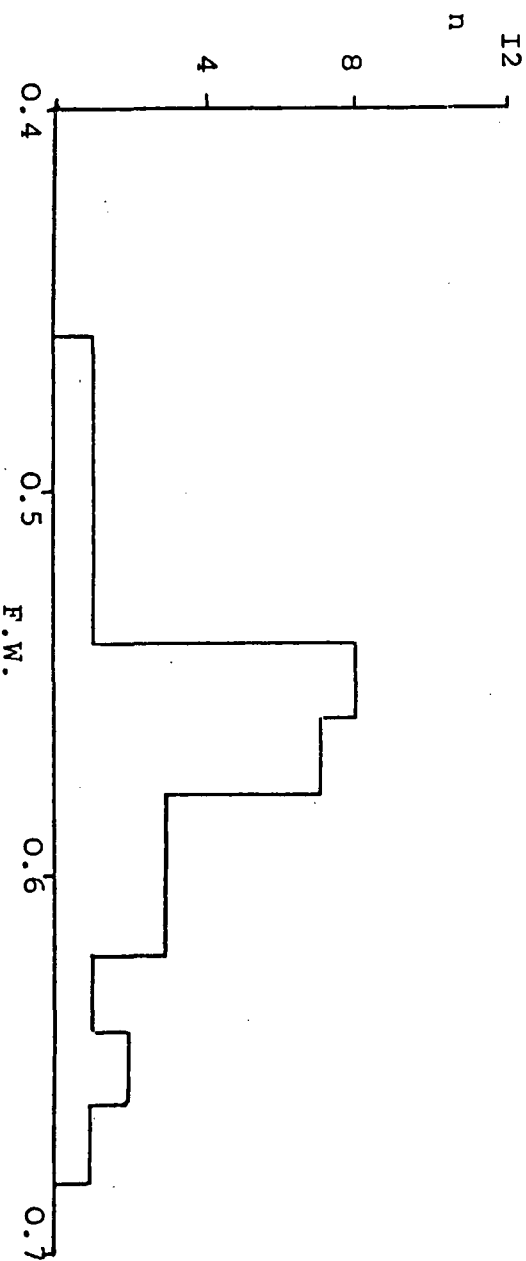
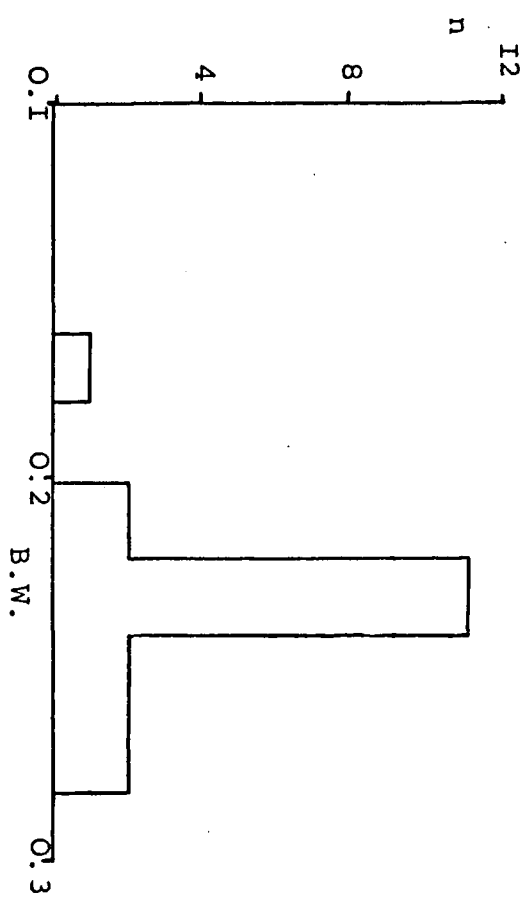
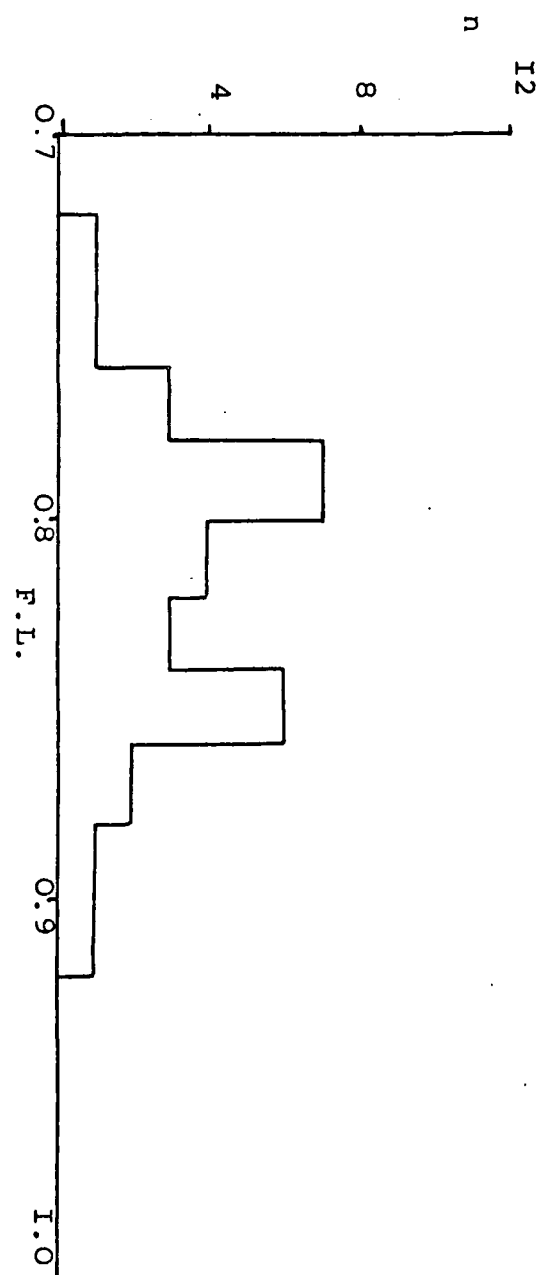
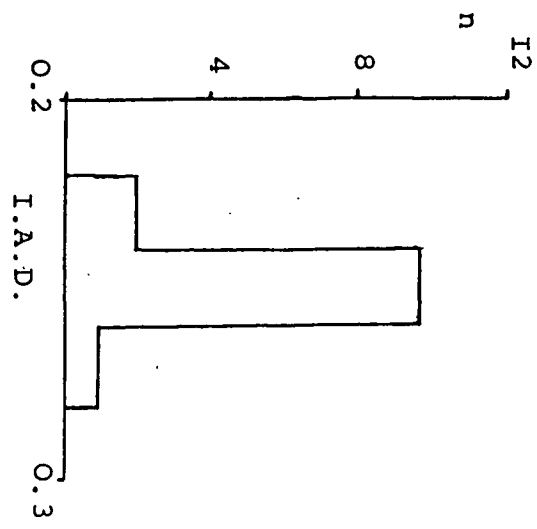


Figure 30. Diagram to show characters measured internally and externally on the genus Kingopora. See text, p. 131 for discussion.

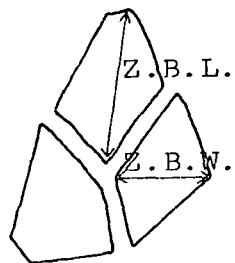
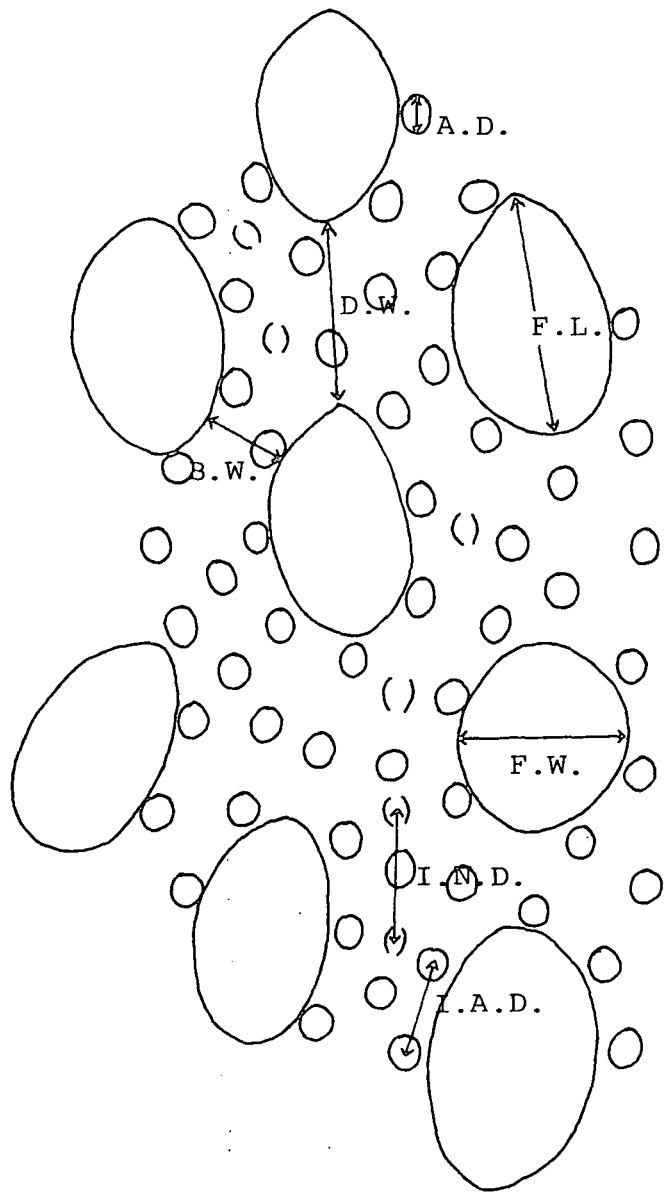


Figure 3I. Kingopora ehrenbergi Geinitz
Obverse surface detail.MP5.I2a.
Bar scale-Imm

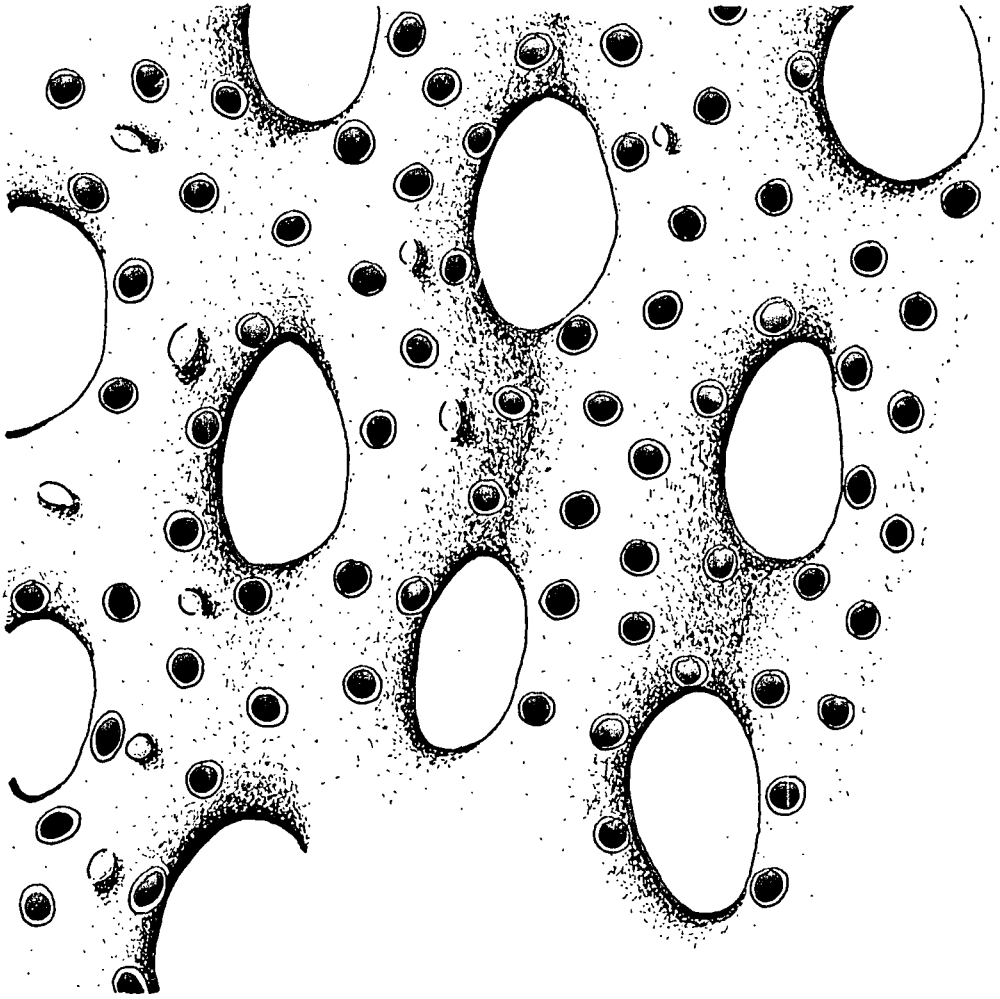


Figure 32. Kingopora ehrenbergi Geinitz

- A. Korn's (1930) text-fig.6a.?Colony origin of Kingopora ehrenbergi.Bar scale-Imm
- B. Korn's (op.cit.) text-fig.6b.?Colony origin of Kingopora ehrenbergi.Bar scale-Imm
- C. Reverse surface detail.GLT4.Bar scale-Imm

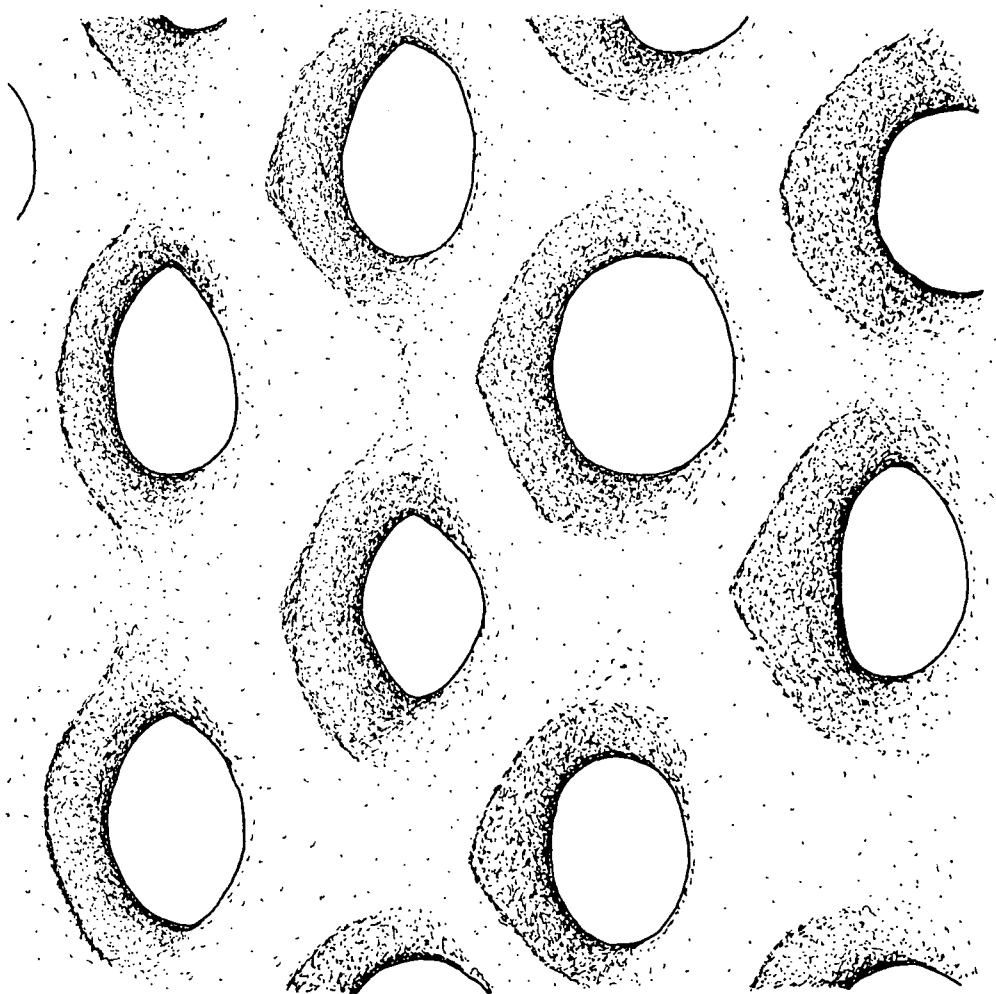
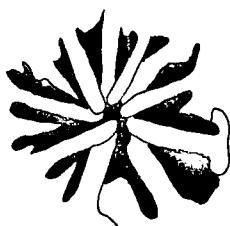
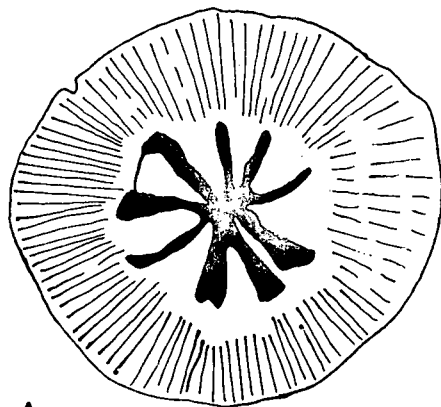


Figure 33. Histograms of Branch width and Dissepiment width(in mm) for Kingopora ehrenbergi.

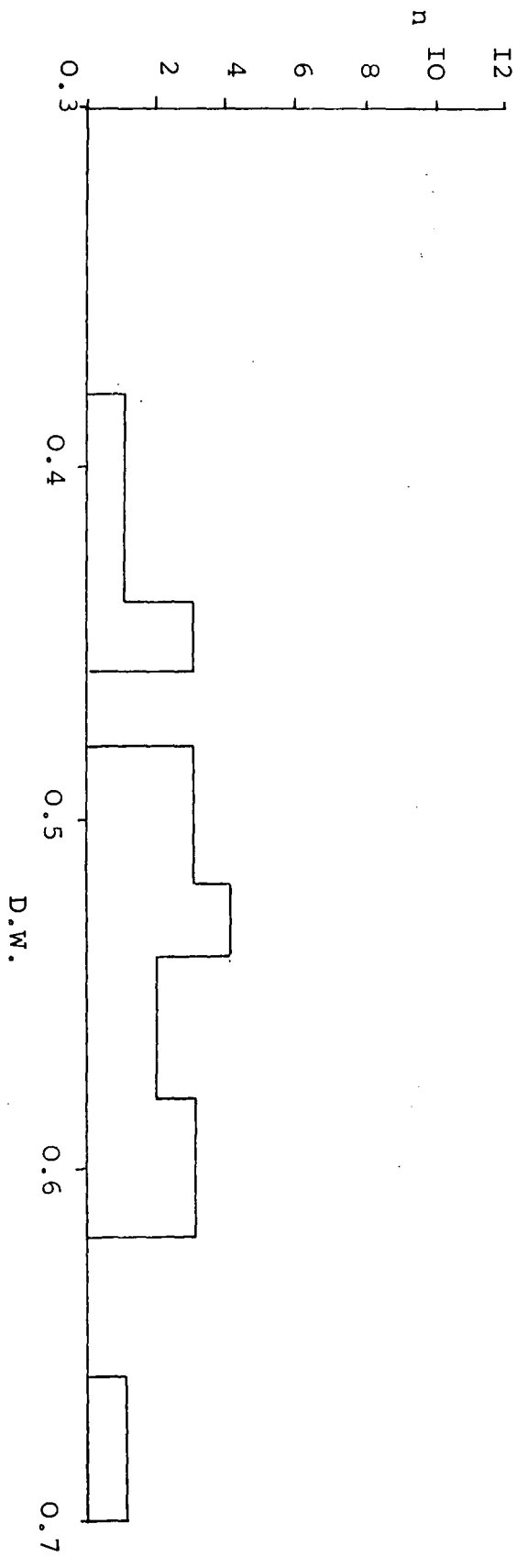
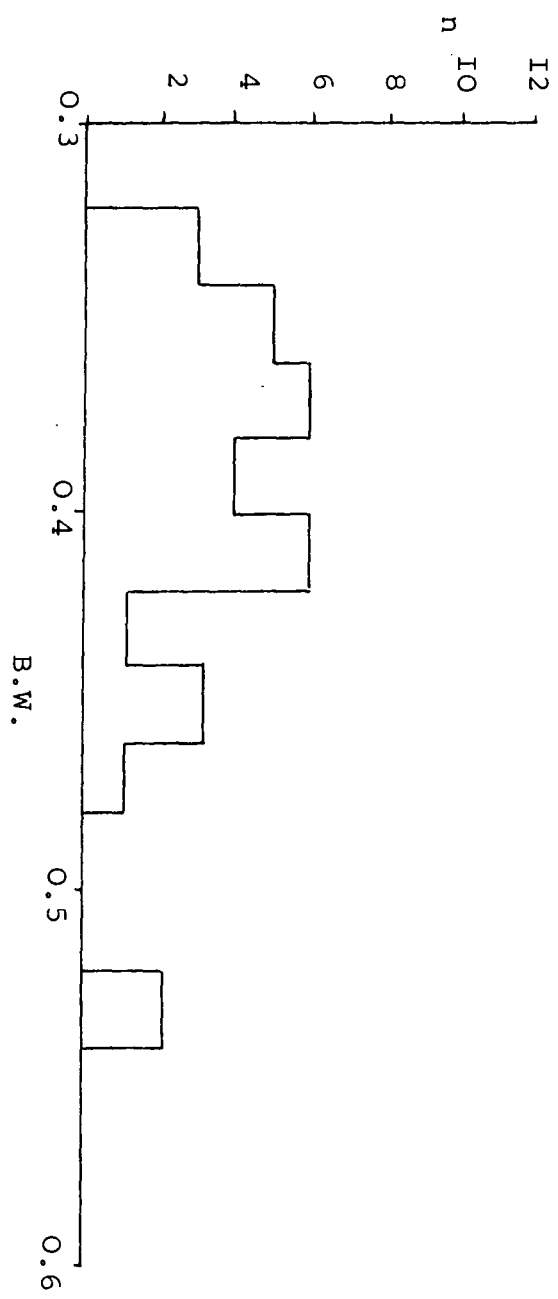


Figure 34. Histograms of Inter-apertural-distance,
Fenestrule width and Fenestrule length
(in mm) for Kingopora ehrenbergi.

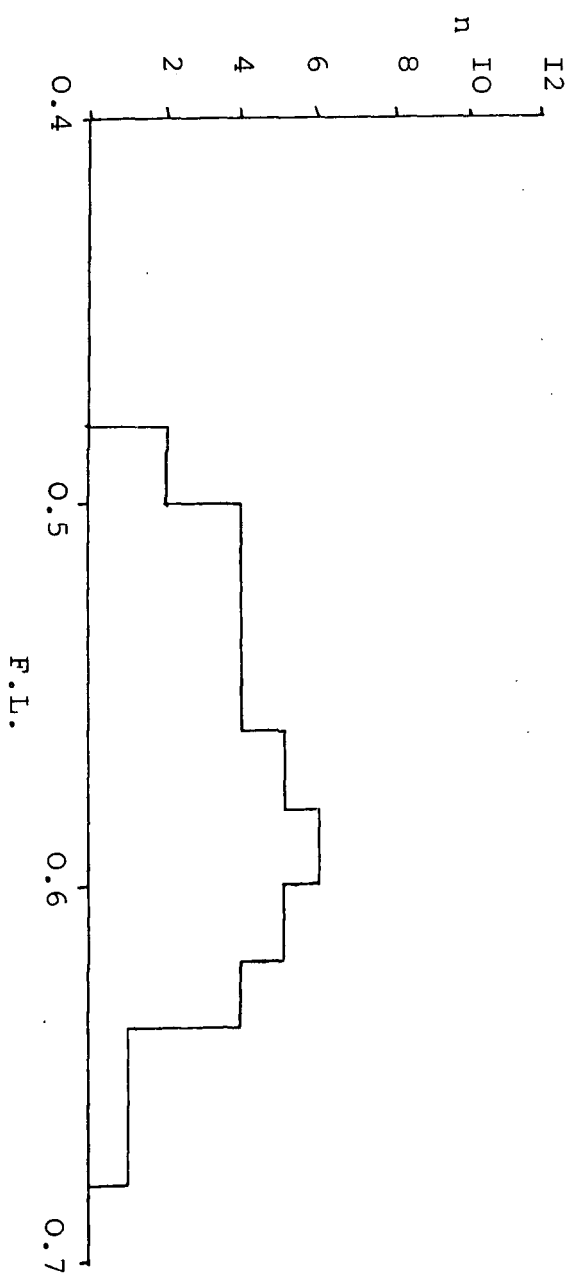
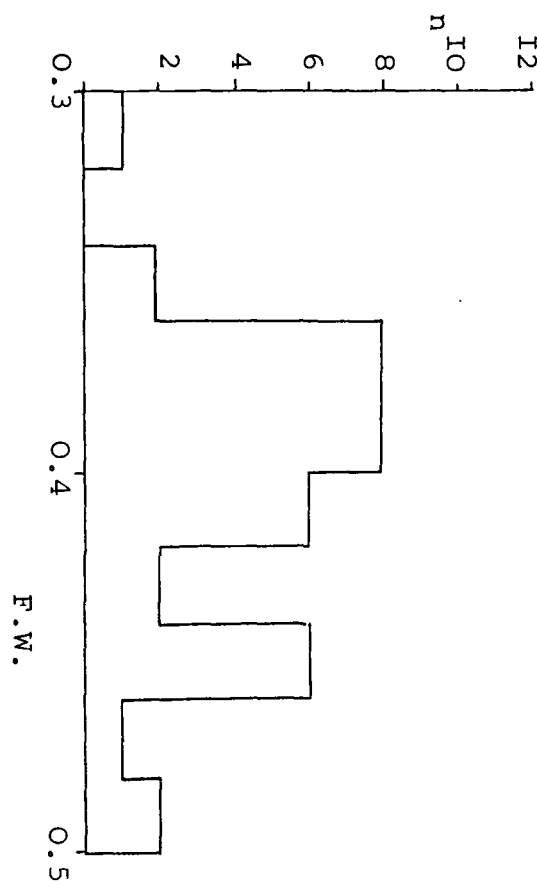
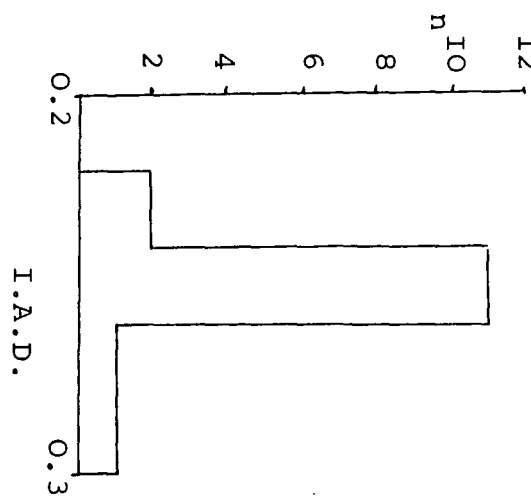


Figure 35. Diagram to show the characters measured internally and externally on the genus Synocladia.

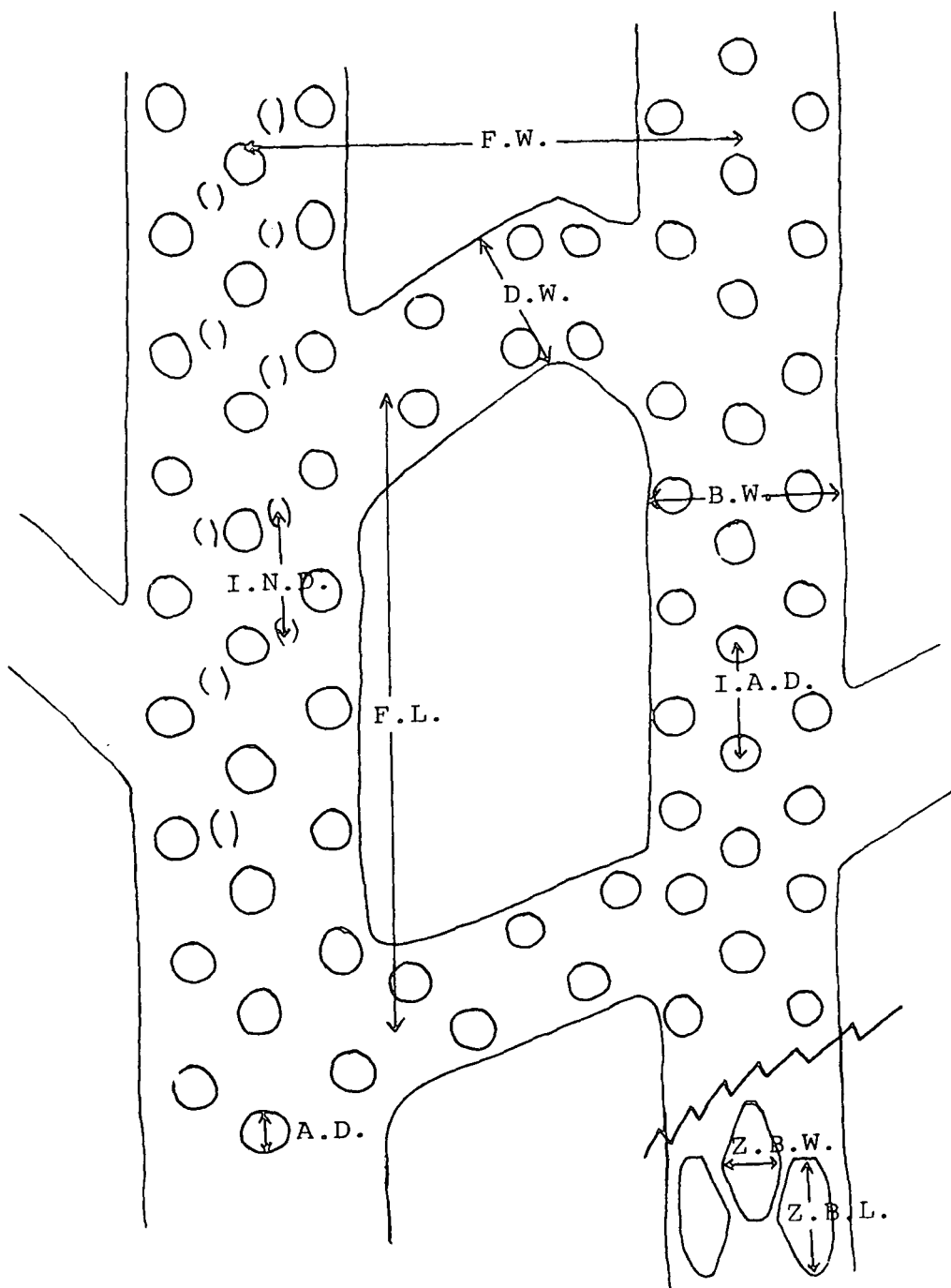


Figure 36. Synocladia virgulacea Sedgwick

Obverse surface detail. Composite drawing showing the variable appearance of the obverse surface which may result from poor preservation.
Bar scale-Imm

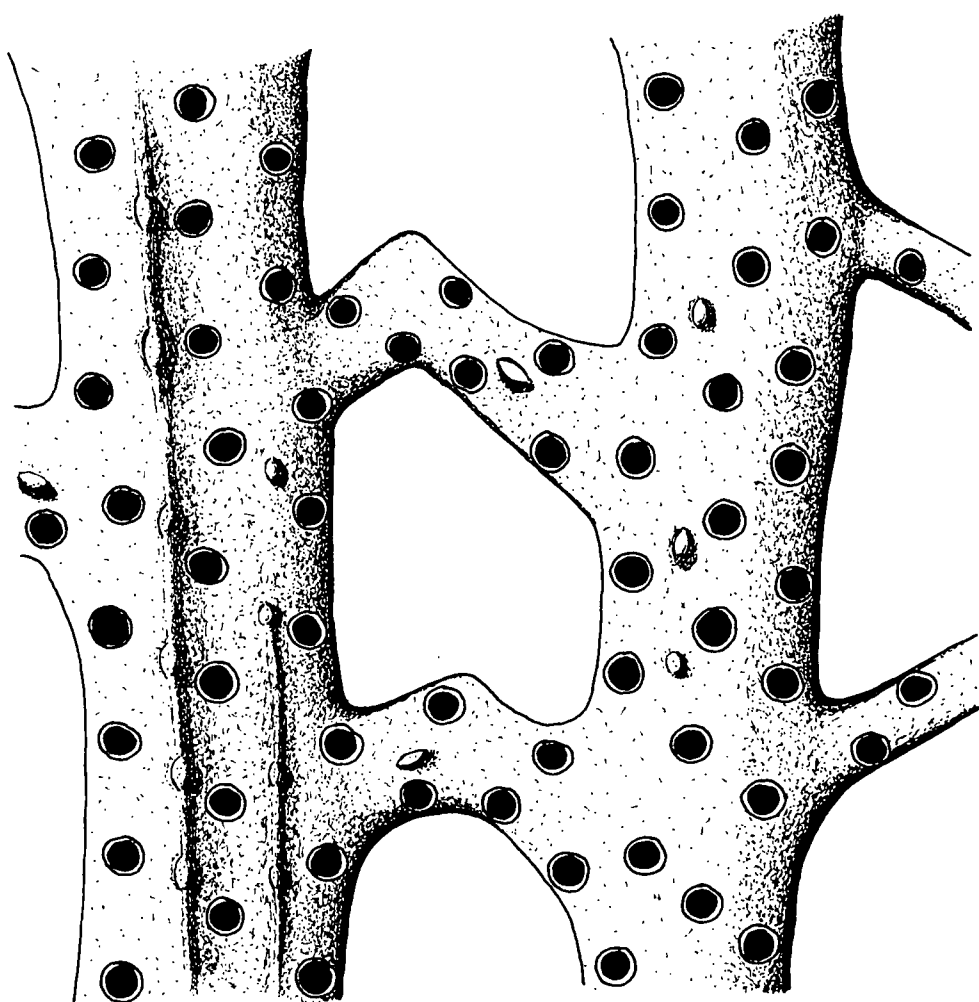


Figure 37. Synocladia virgulacea Sedgwick
Reverse surface detail.HM5.5.
Bar scale-5mm

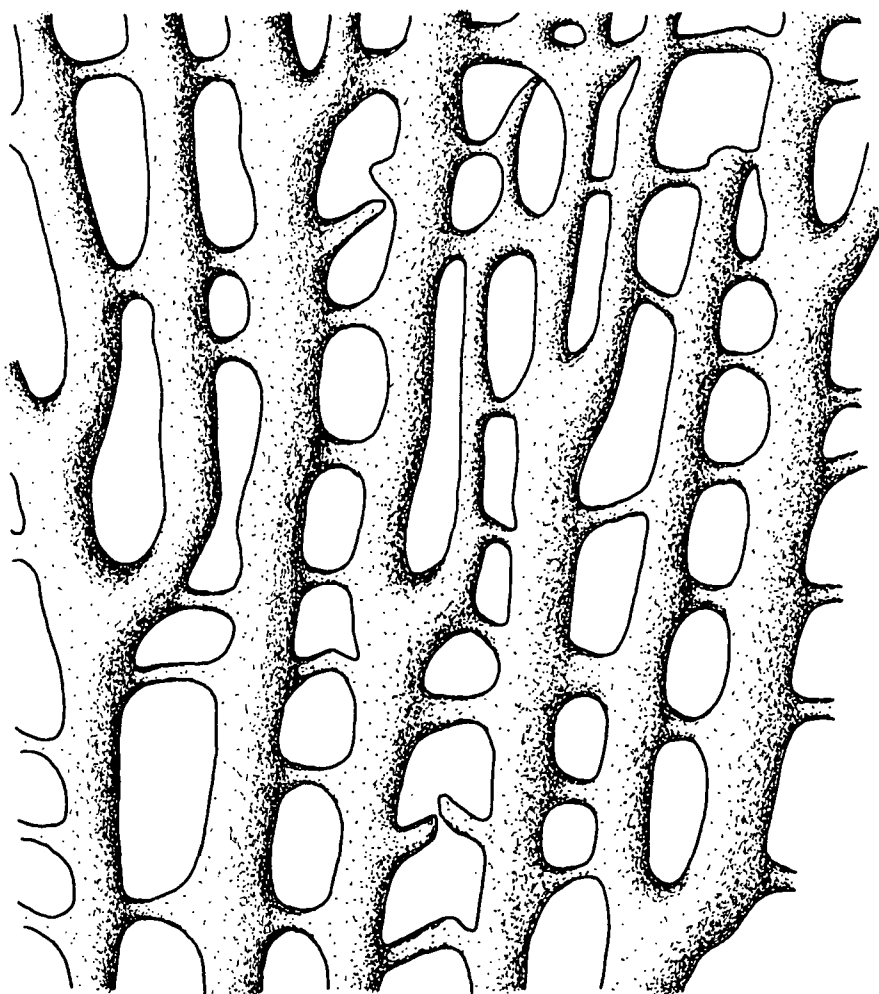


Figure 38. Histograms of Fenestrule length and
Fenestrule width for Synocladia virgulacea.
(in mm)

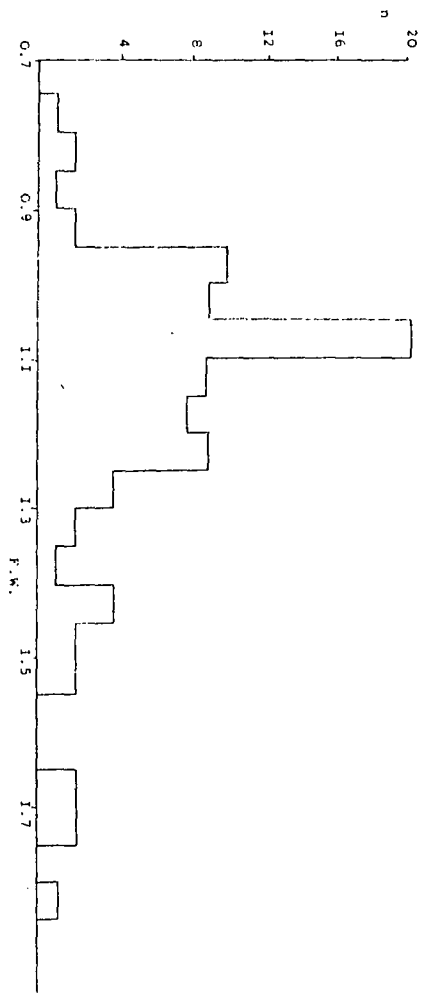
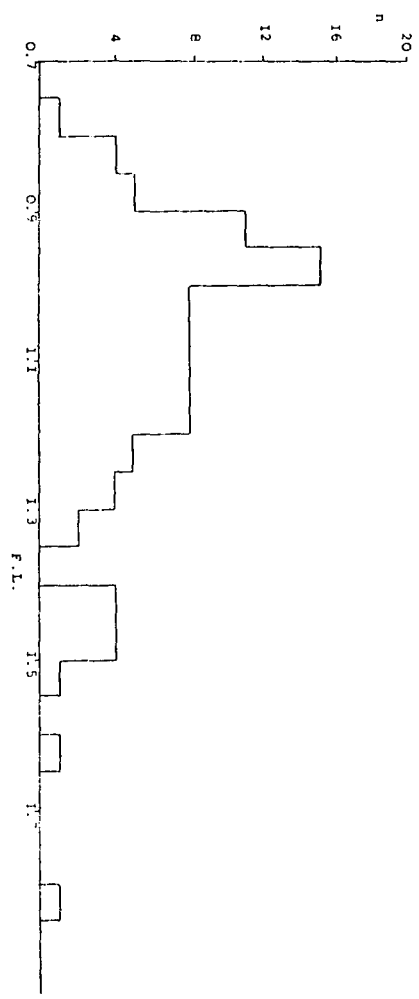
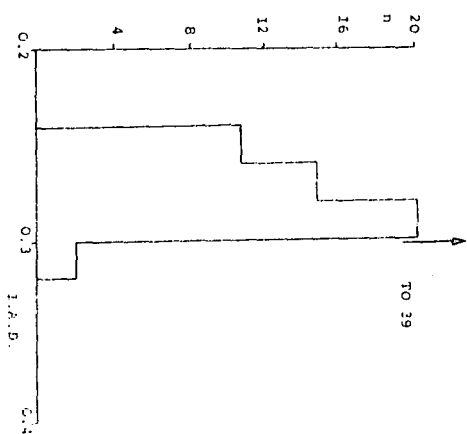
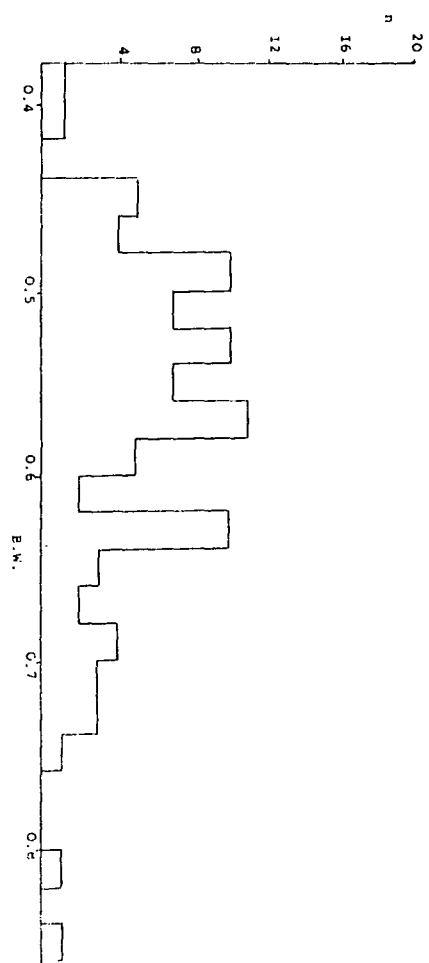
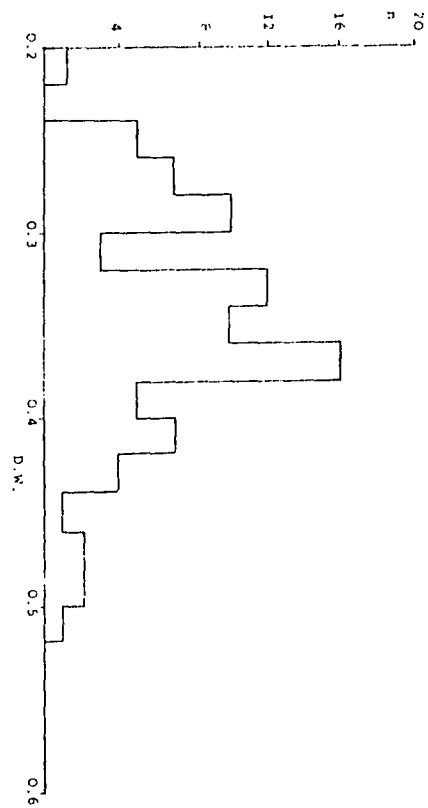


Figure 39. Histograms of Dissepiment width, Branch width and Inter-apertural-distance for Synocladia virgulacea. (in mm)



- Figure 40. A. Diagram to show characters measured on the genus Thamniscus (and Ryhopora). See text, p. 171 for discussion.
- B. Diagram to show the procedure for measurement of bifurcation angle, according to Harmelin (1973), based on studies of Idmonea atlantica.

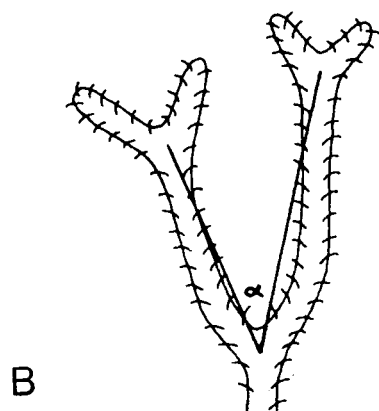
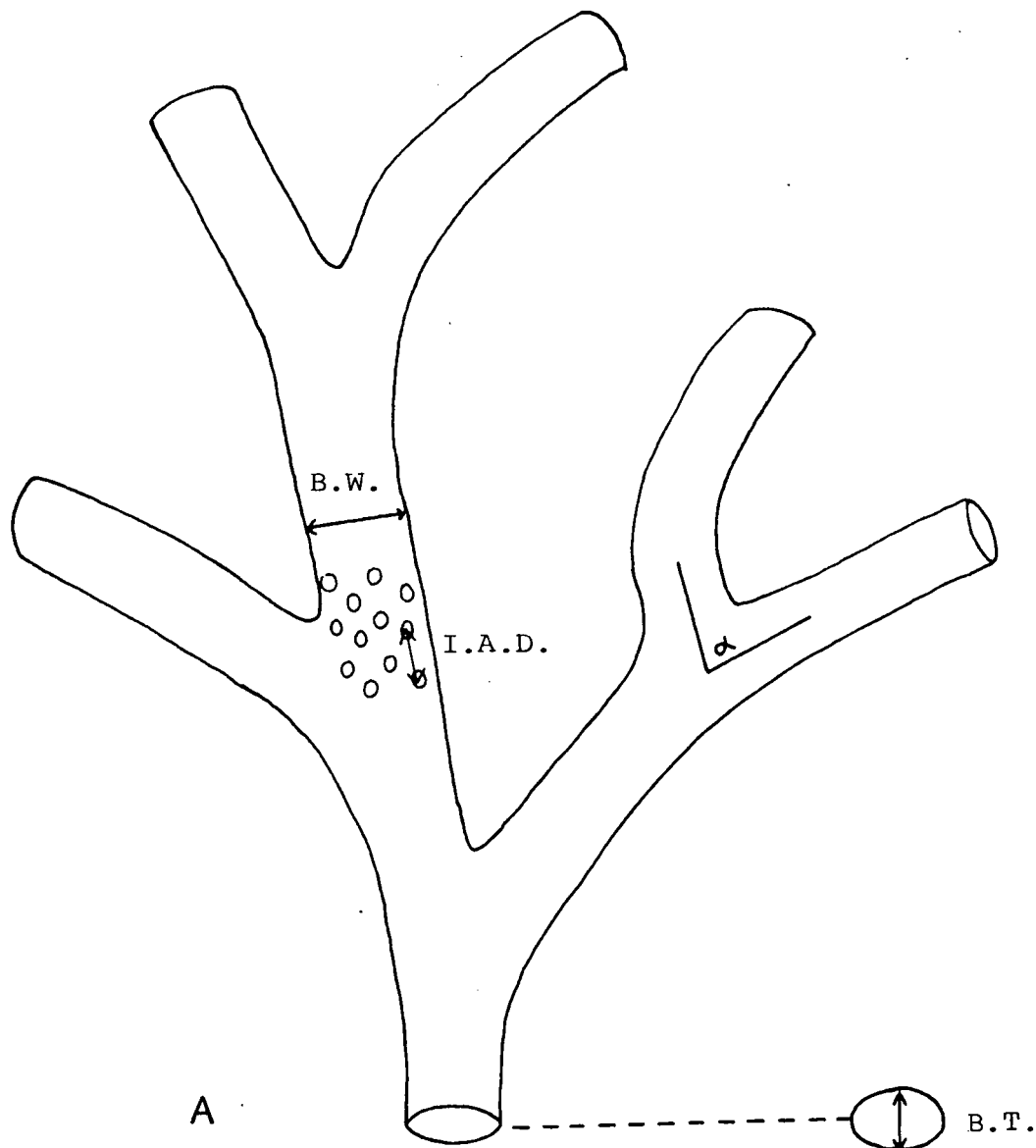
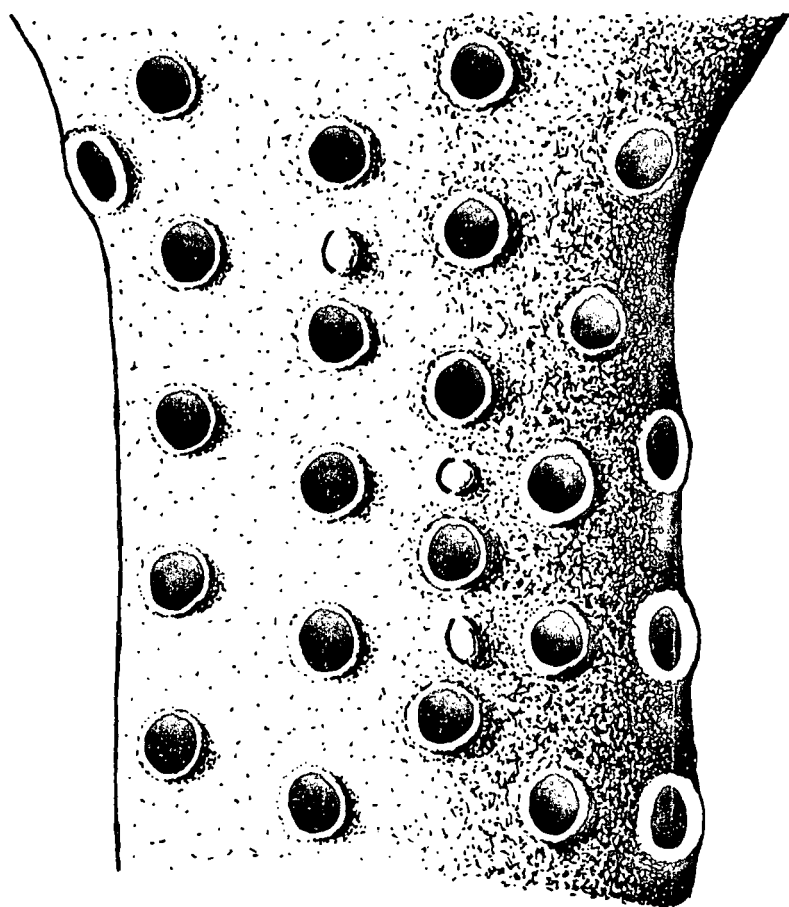


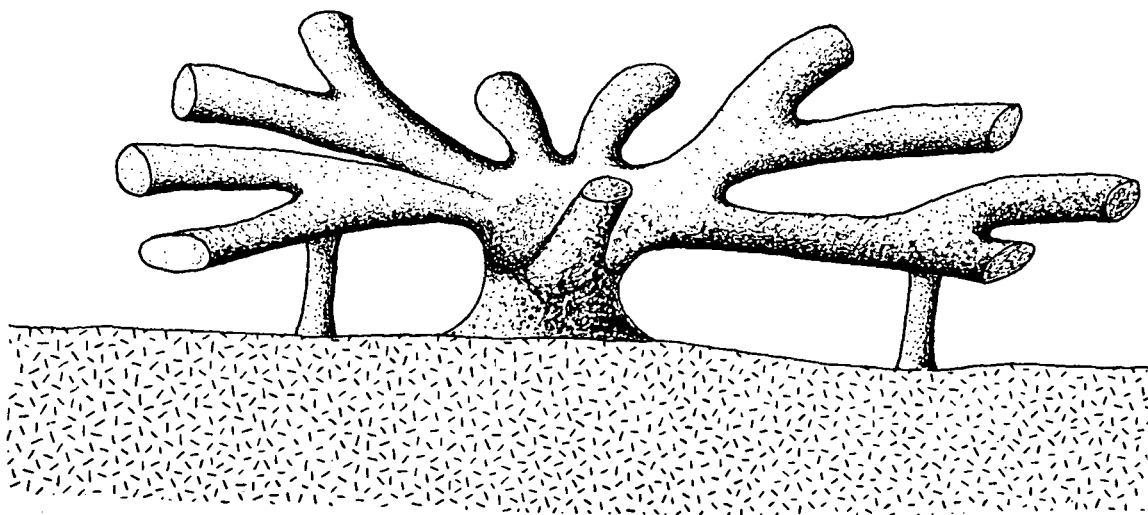
Figure 4I. Thamniscus dubius Schlotheim

Obverse surface detail. Composite drawing.
Bar scale-Imm



- Figure 42. A. Stylized diagram of colony origin of Thamniscus dubius (apertures not shown). This is hypothetical; the origin may instead consist of a single erect branch as in T. erectus Elias (1957).
- B. Thamniscus dubius Schlotheim
Reverse surface detail. Composite drawing. Bar scale--Imm

A



B

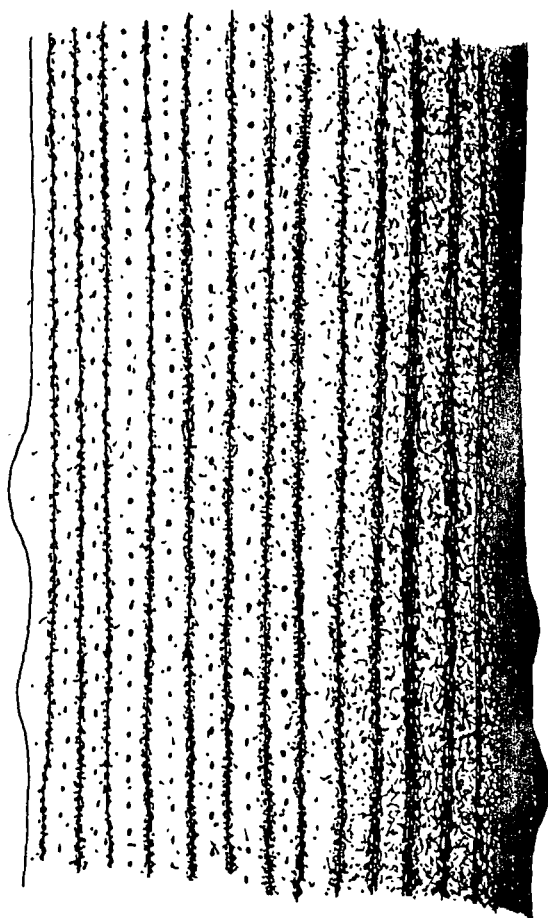


Figure 43. Histograms of Branch width and
Inter-apertural-distance for Thamniscus
dubius (in mm).

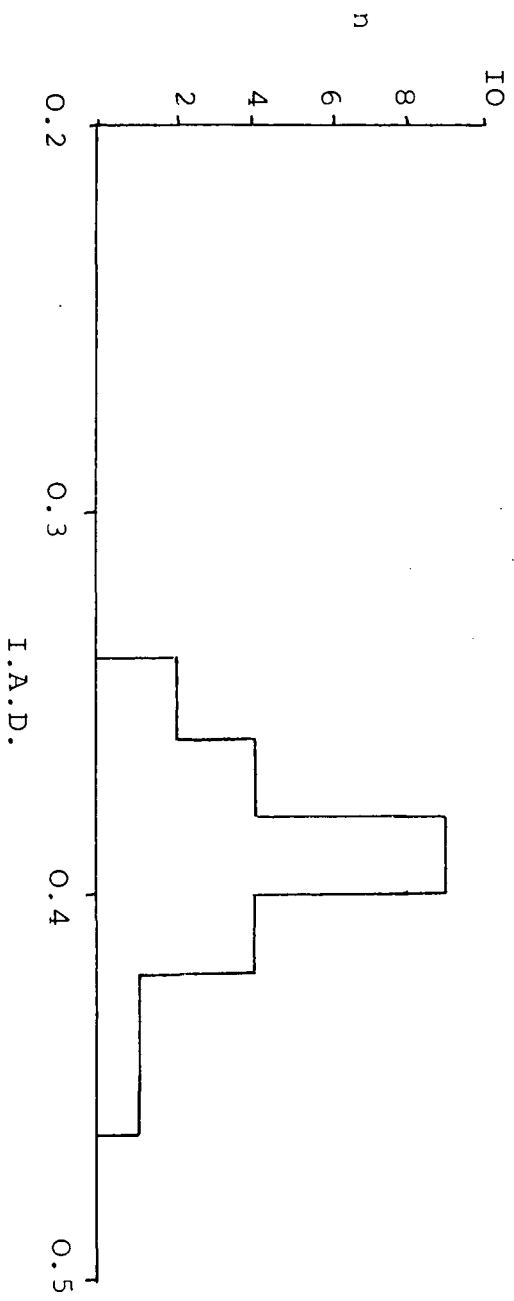
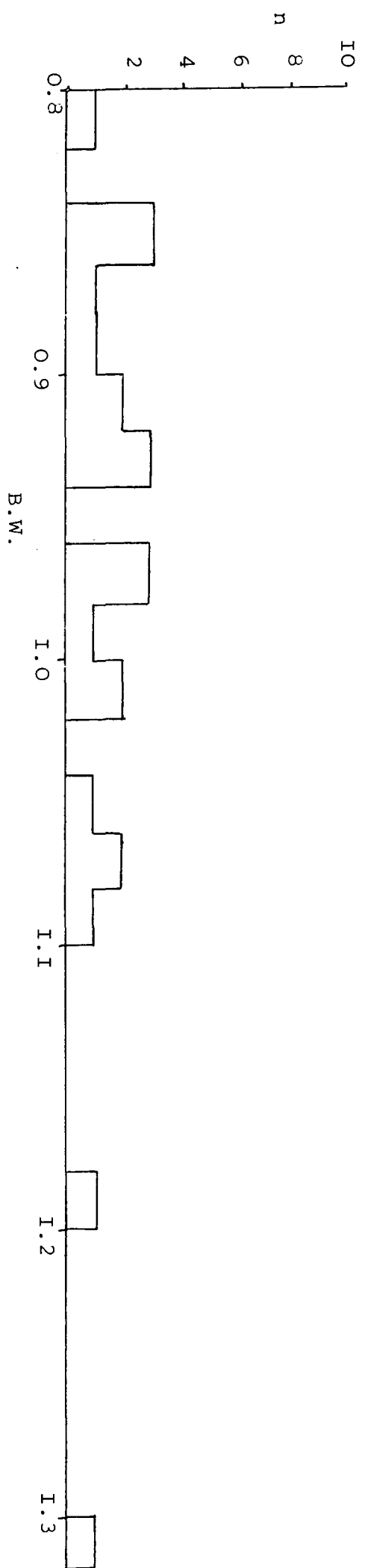


Figure 44. Thamniscus geometricus Korn

Obverse surface detail.MP5.59.

Bar scale-Imm

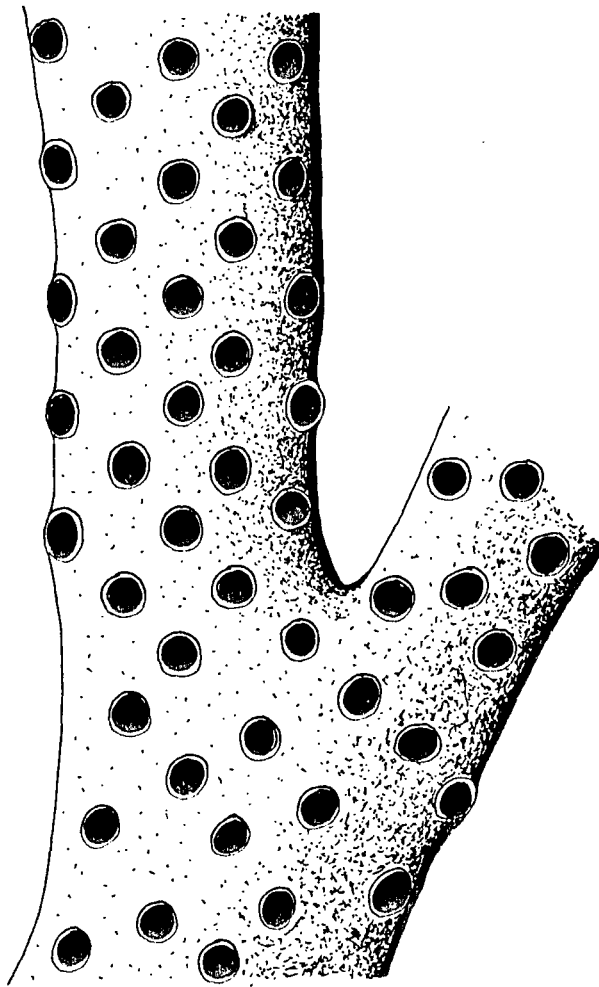


Figure 45. Thamniscus geometricus Korn

Reverse surface detail. Based on
HAW 63 and RH2.73a. Bar scale=Imm

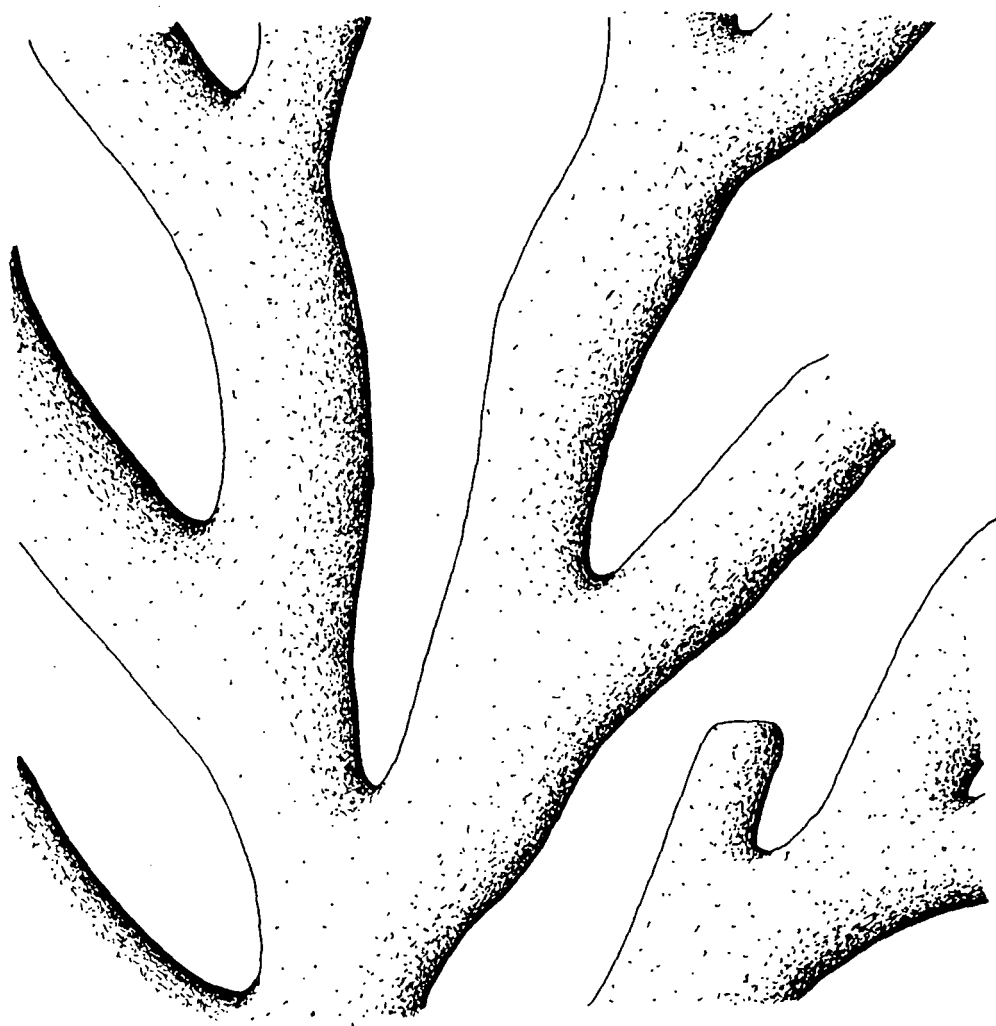
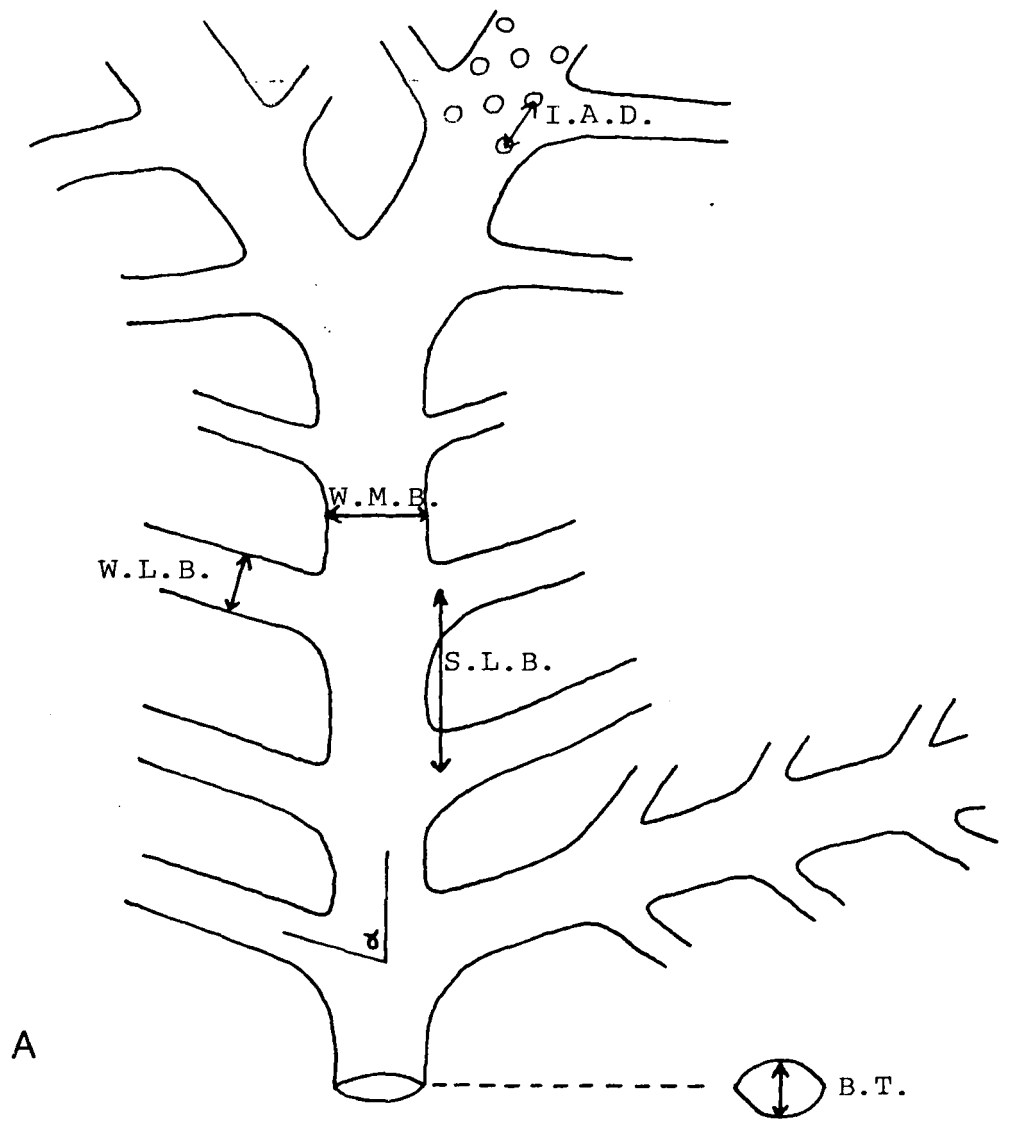


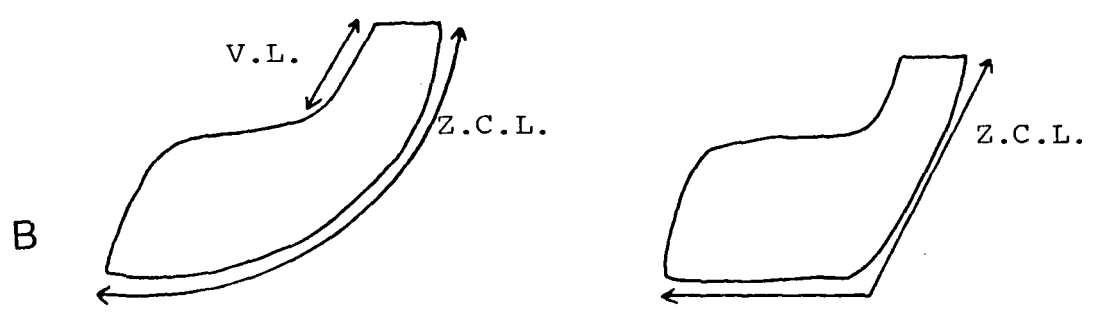
Figure 46. Characters measured on the genus
Acanthocladia (and Penniretepora).

A. External.

B. Measurement of zooecial chambers.



A



B

Figure 47. Acanthocladia anceps Schlotheim
Obverse surface detail.HAW I5.
Bar scale-Imm

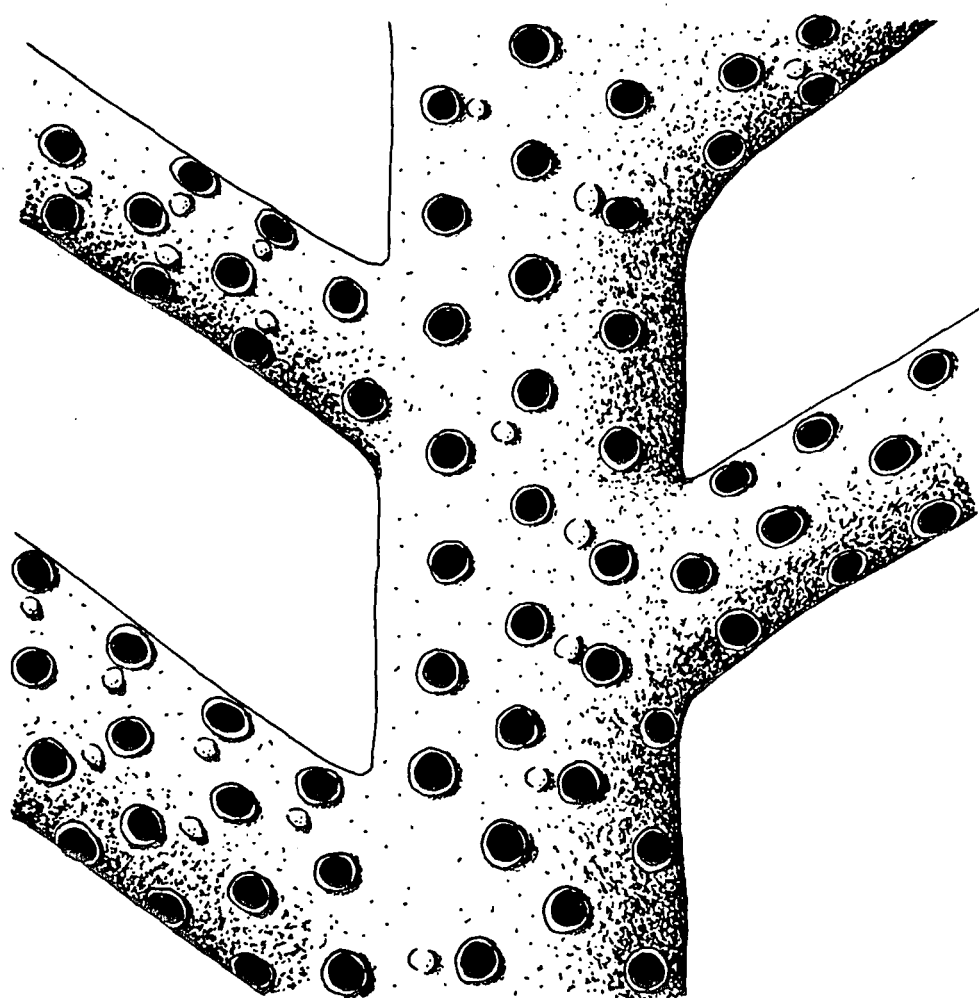
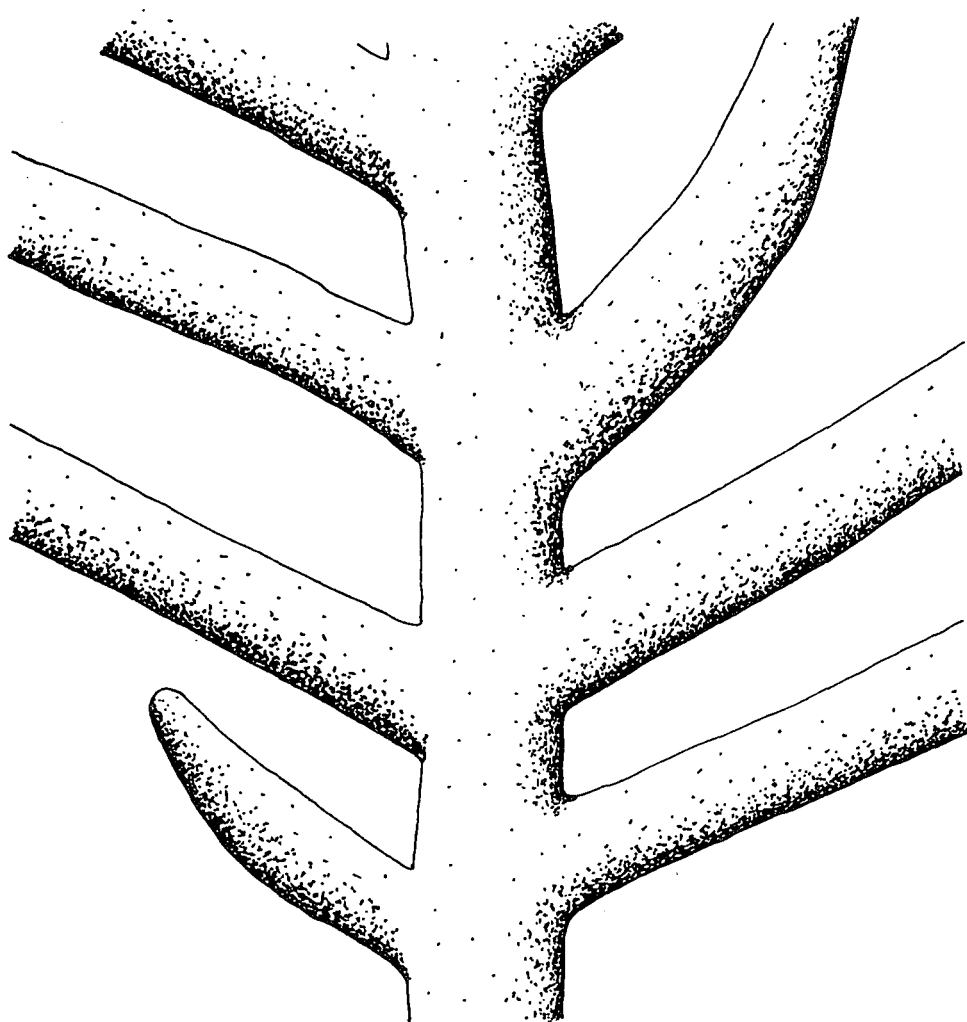


Figure 46. Acanthocladia anceps Schlotheim
Reverse surface detail.RH4.45.
Bar scale=Imm



—

Figure 49. Colony origin of ?Acanthocladia anceps
or ?A.laxa viewed from the underside.
Specimen MP4.I.Bar scale=Imm

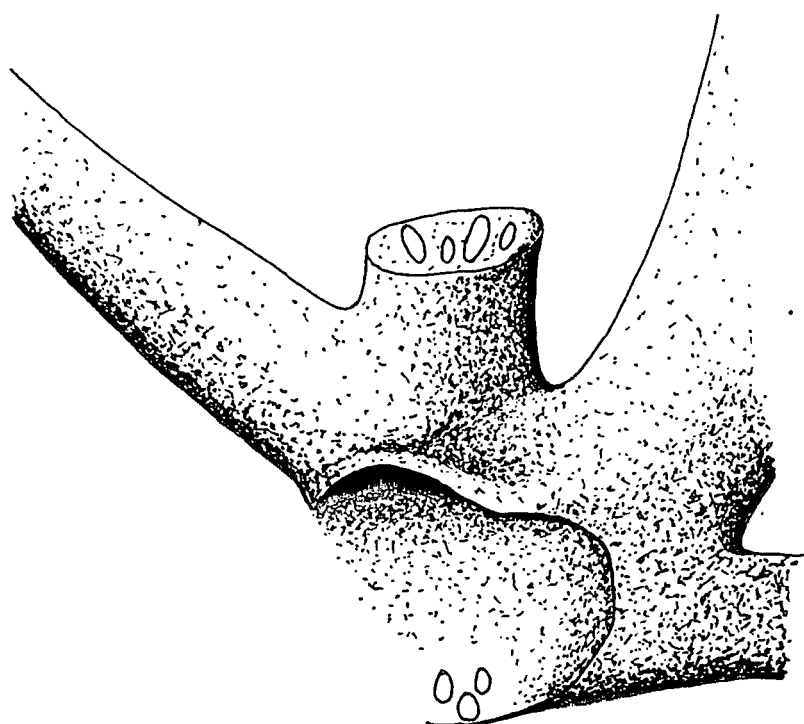
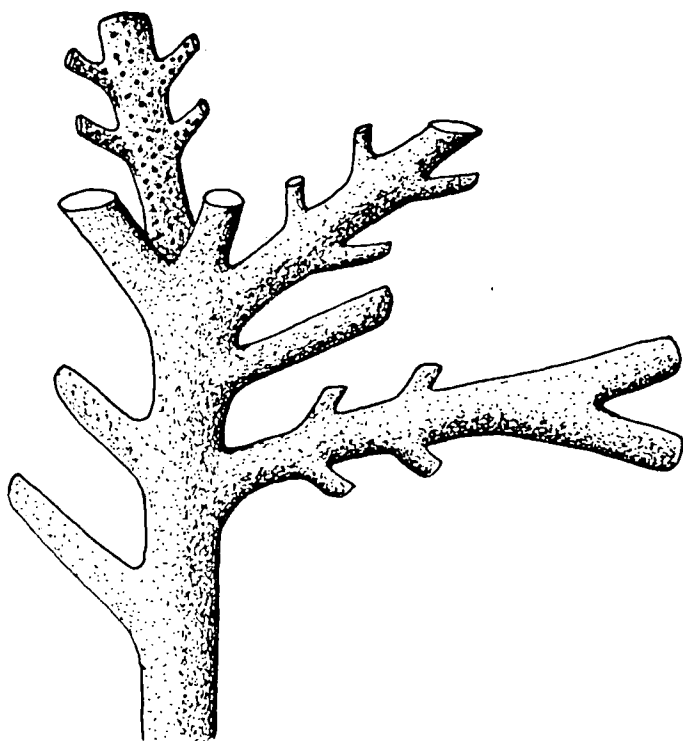


Figure 50. Colony form of Acanthocladia anceps.

- A. Colony origin consisting of a single erect branch.
- B. Colony origin consisting of a circle of radiating branches which expand in a sub-horizontal plane close to the substratum. Apertures not shown.

A



B

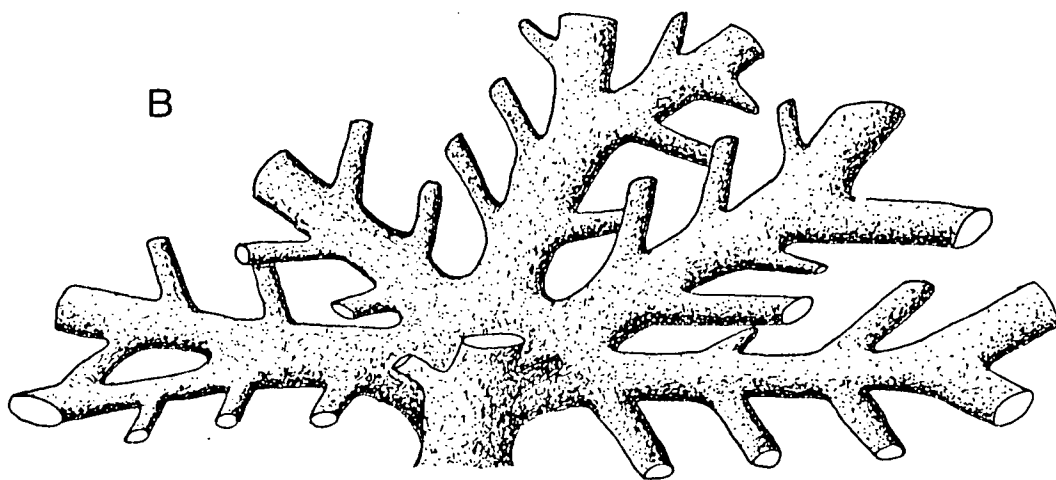
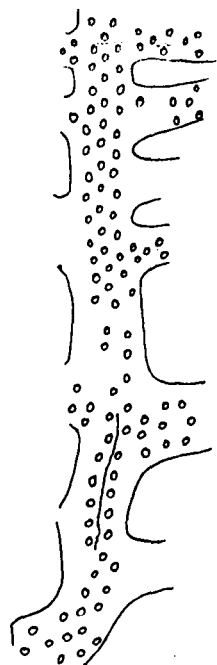


Figure 5I. A. Drawing of Acanthocladia anceps A
(from Dreyer (1961, pl. IX fig. 3)).

B. Acanthocladia anceps showing two
rows of apertures on part of the
main branch obverse surface.
HAW 26a. Bar scale-Imm

A



B

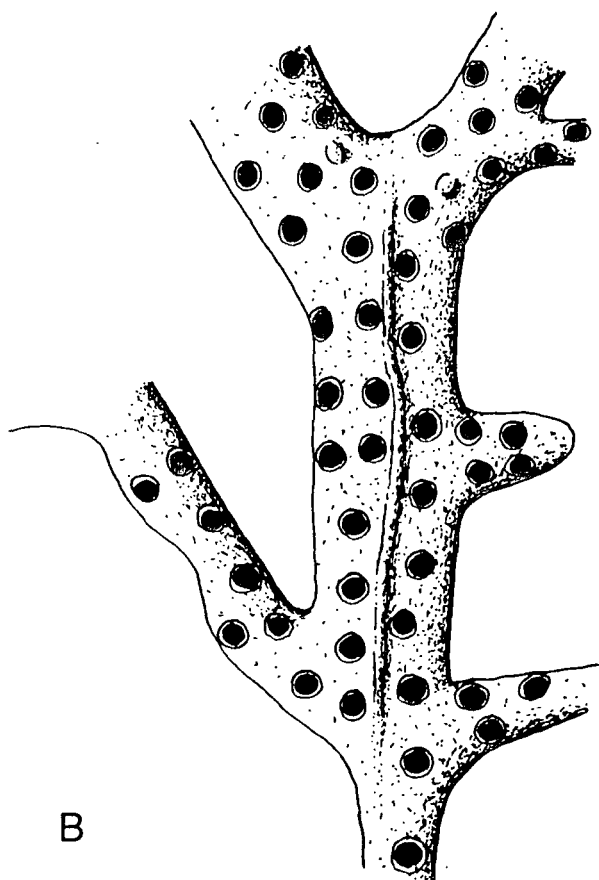


Figure 52. Acanthocladia anceps.
Silhouette drawing of specimen HAW 7
to show margin of colony which expands
by bifurcation.
Bar scale=10mm

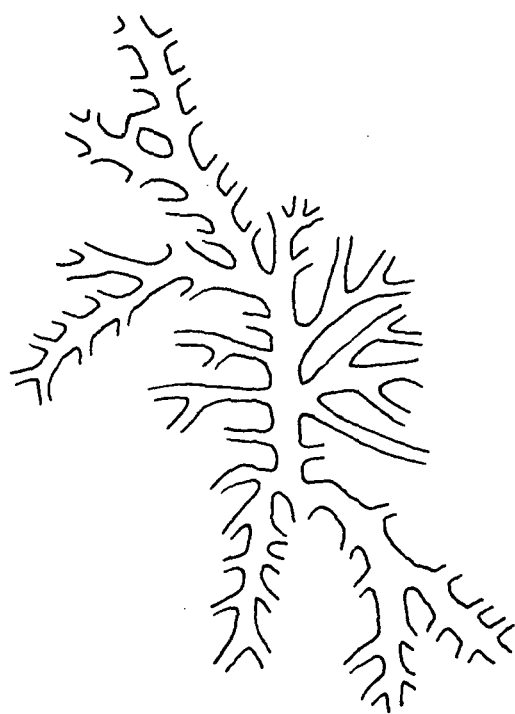


Figure 53. Histograms of measured parameters for Acanthocladia anceps, A.minor, A.magna, A.laxa and A.diffusus combined. Solid ornament=A.anceps, diagonal lines=A.minor, cross=A.magna, dots=A.laxa and A.diffusus=clear.

- A. Width of lateral branches (in mm).
- B. Spacing of lateral branches (in mm).

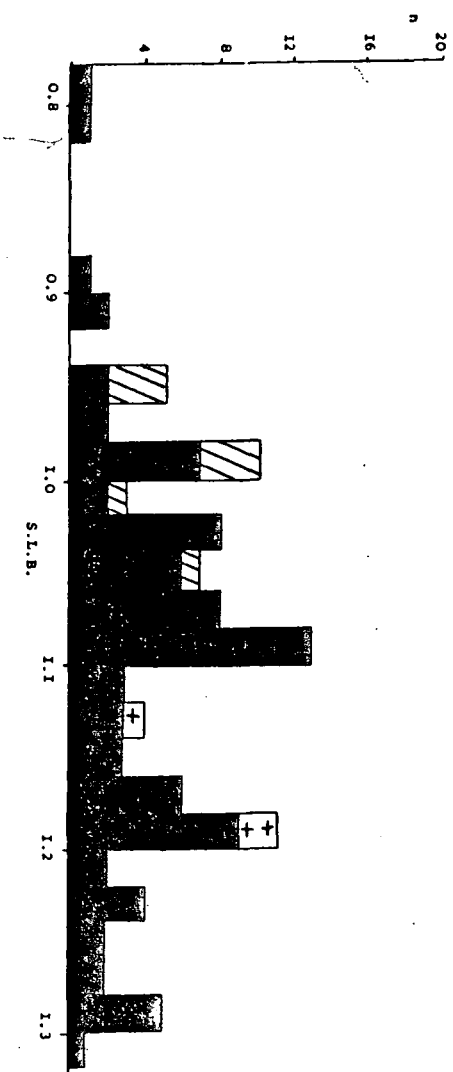
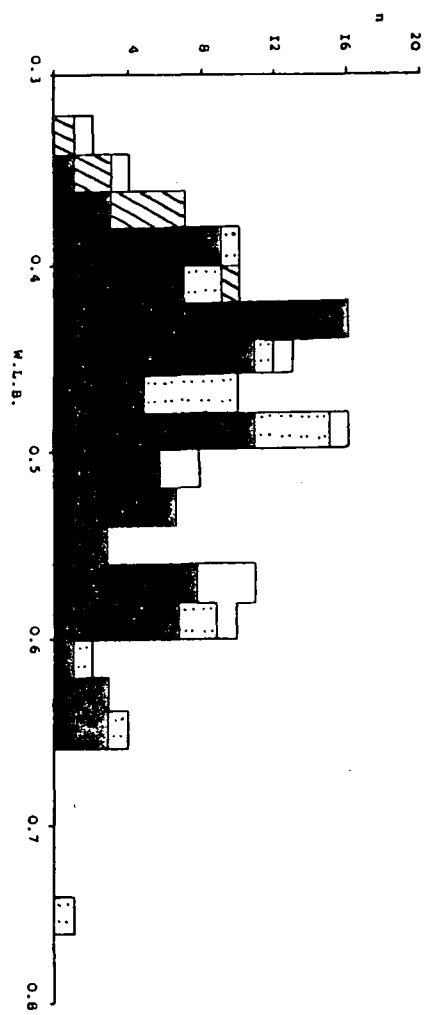


Figure 54. Histograms of measured parameters for
Acanthocladia anceps, A.minor, A.magna,
A.laxa, A.diffusus.
Ornament as in Figure 53.

- A. Width of main branch(in mm).
- B. Branch thickness(in mm).

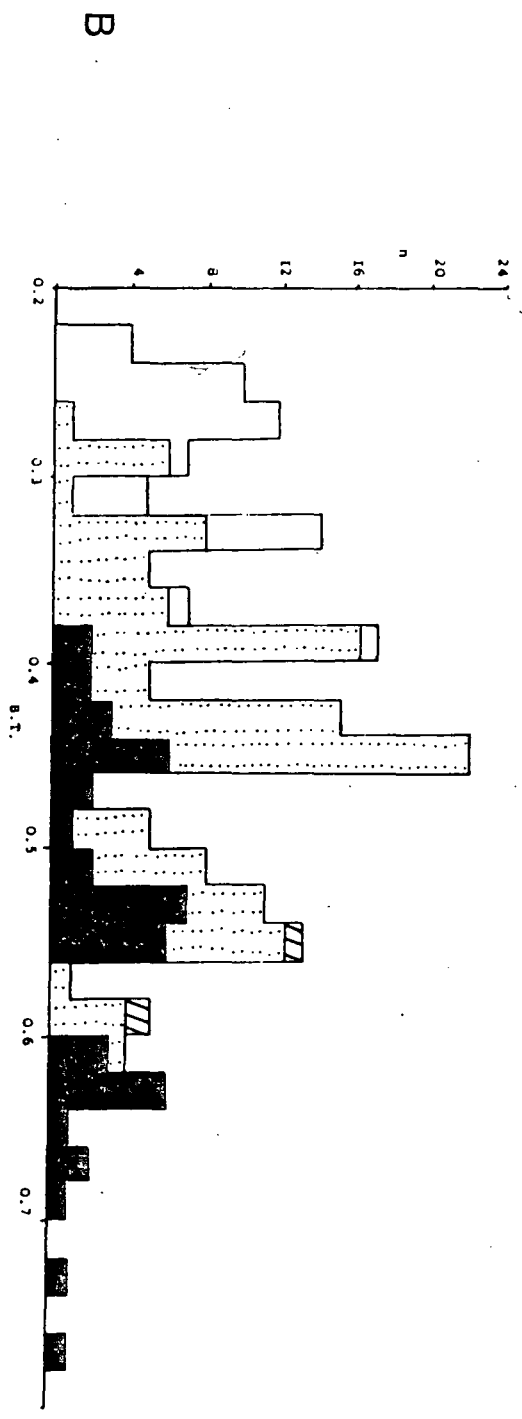
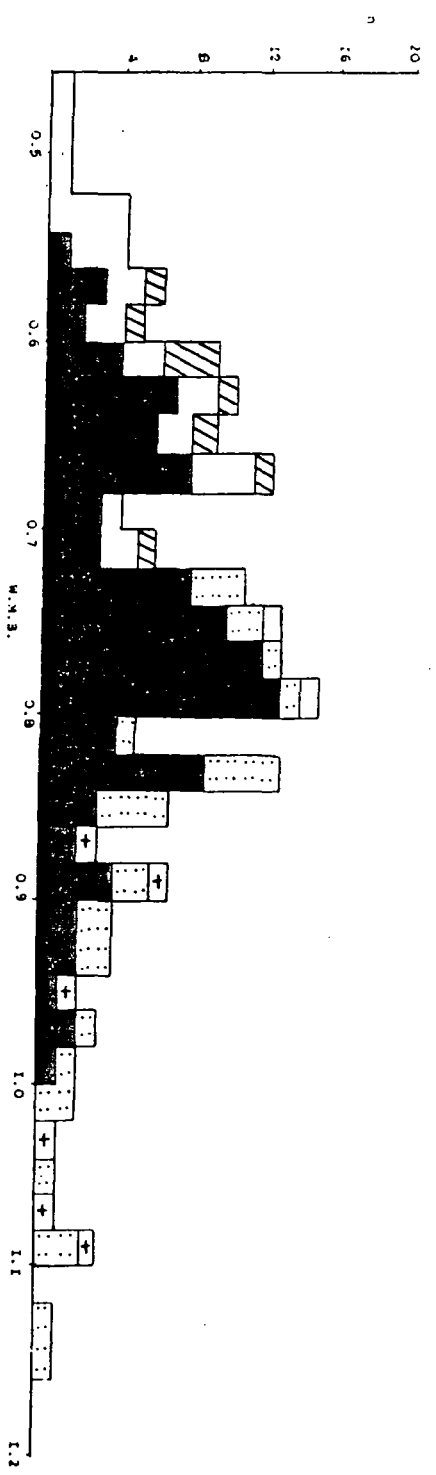


Figure 55. Acanthocladia minor Korn

Obverse surface detail.RH2.55.

Bar scale-Imm

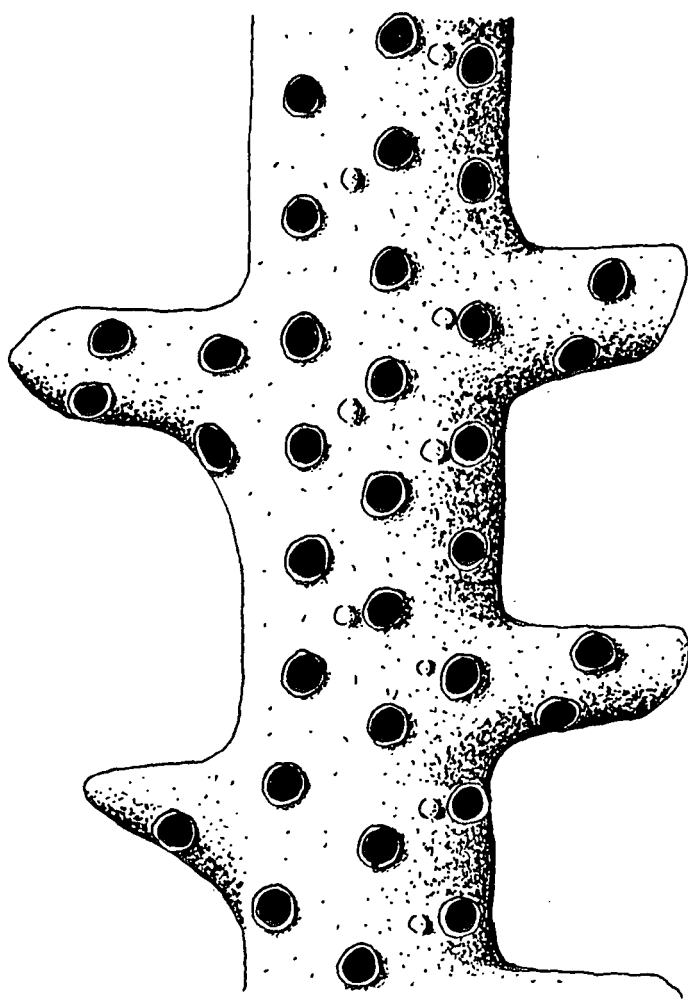
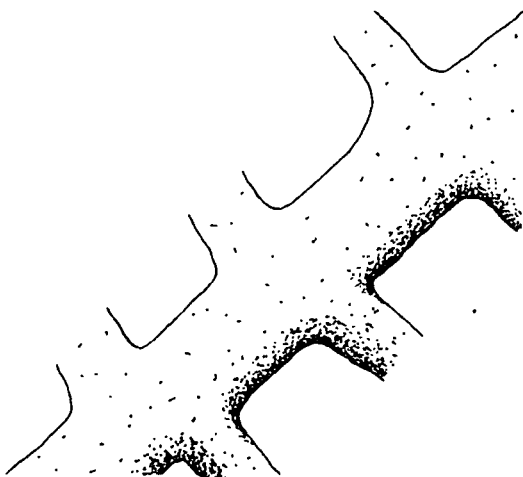
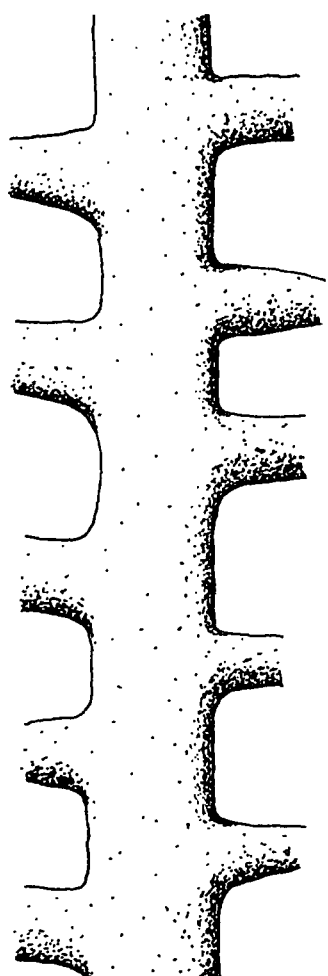


Figure 56. Acanthocladia minor Korn

Reverse surface detail.RHI.15.

Bar scale-Imm



—

Figure 57. Graph of Width of main branch $\sim$
Width of lateral branch for Acanthocladia
anceps and A.minor combined.
Filled circles=A.anceps, unfilled circles
=Schlotheim's specimens of A.anceps,
crosses=A.minor.
In mm.

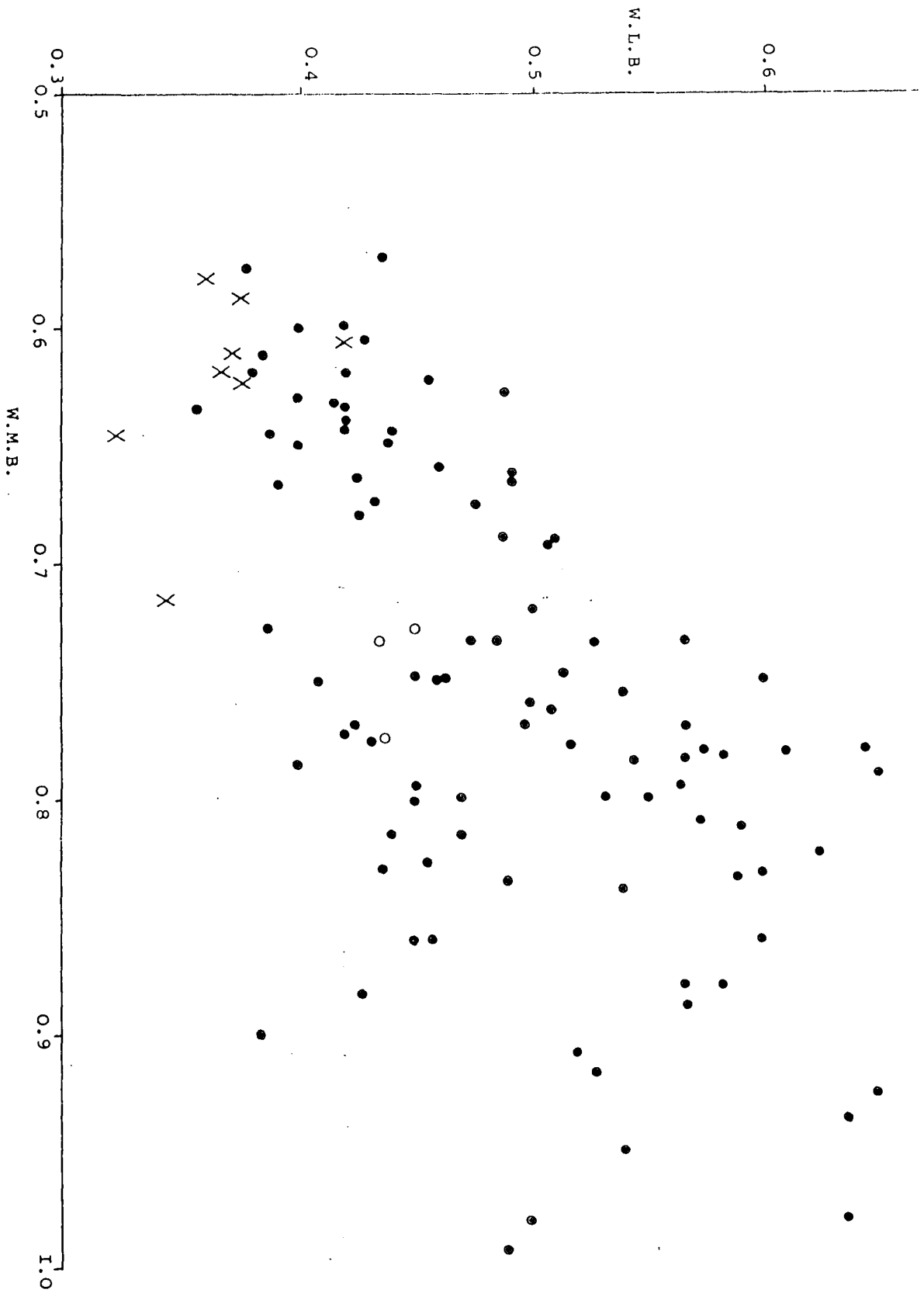


Figure 58. Acanthocladia magna sp.nov.

Obverse surface detail. Composite drawing,
RH2.43 and RH2.70a. The proximal part
of the main branch shows five nanate
zooecia.

Bar scale=Imm

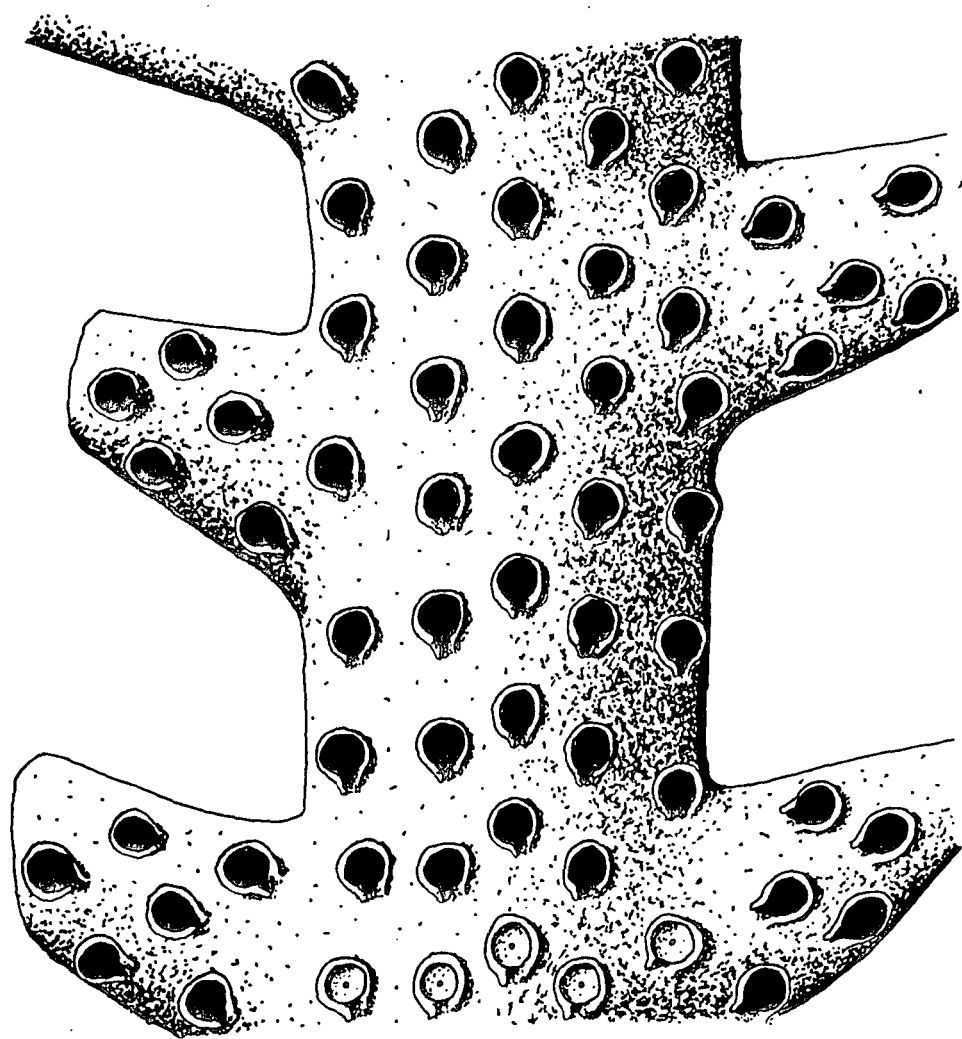


Figure 59. Acanthocladia laxa Korn

Reverse surface detail.MP5.38a.

Bar scale=Imm

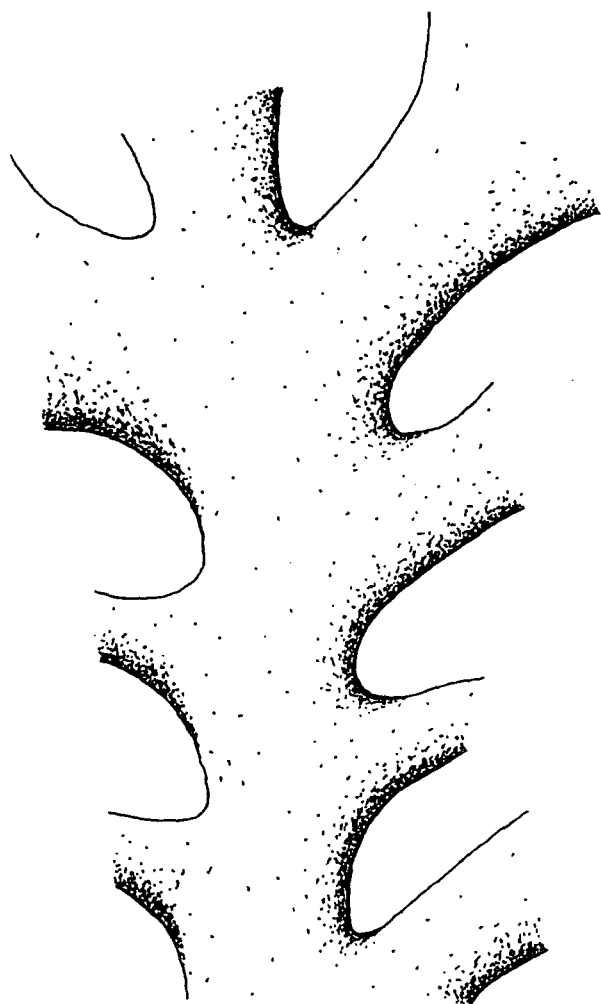
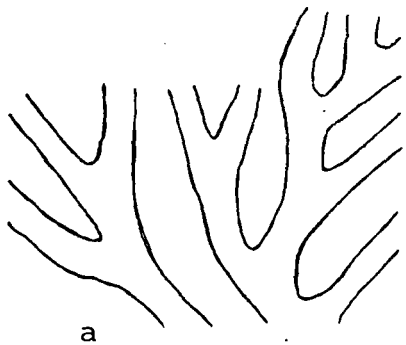
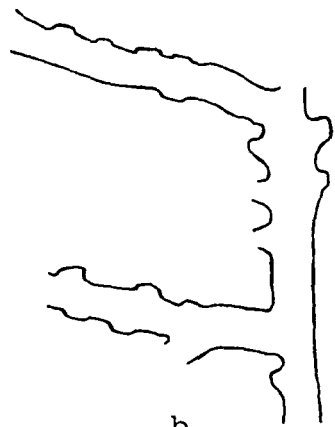


Figure 60. Zoaria of Acanthocladia species-outline drawings. Comparison of zoarial regularity, see text ,p.228 .

- a. A.anceps.HAW 7.(Magnification approx.1.4X all other diagrams).
- b. A.magna.RH2.43.
- c. A.minor.RH2.55.
- d. A.minor.RHI.15.
- e. A.minor.RHI.15.
- f. A.anceps.RH4.44.
- g. A.anceps.RH2.50.
- h. A.anceps.RH2.51.
- j. A.anceps.RH4.45.
- k. A.anceps.HAWI.
- l. A.anceps.HAW 10.
- m. A.anceps.RH4.34.
- n. A.anceps.HAW 1.
- p. A.anceps.HAW 13b.
- q. A.anceps.HAW 3a.
- r. A.anceps.HAW 13b.
- s. A.anceps.RH2.68.



a



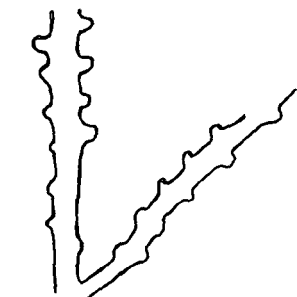
b



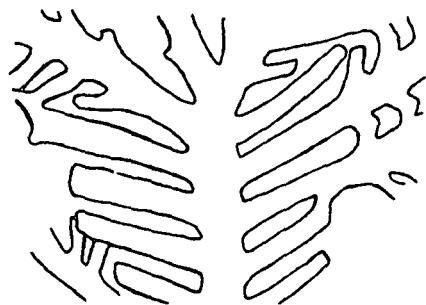
c



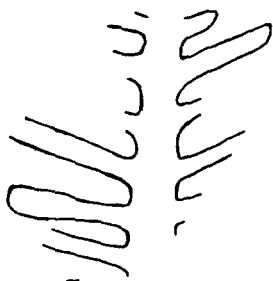
d



e



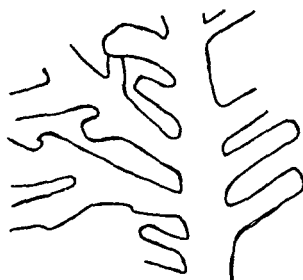
f



g



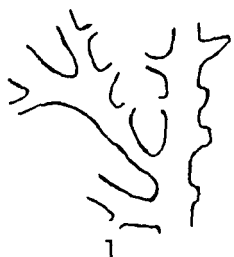
h



j



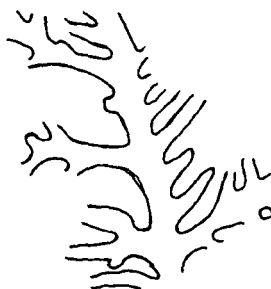
k



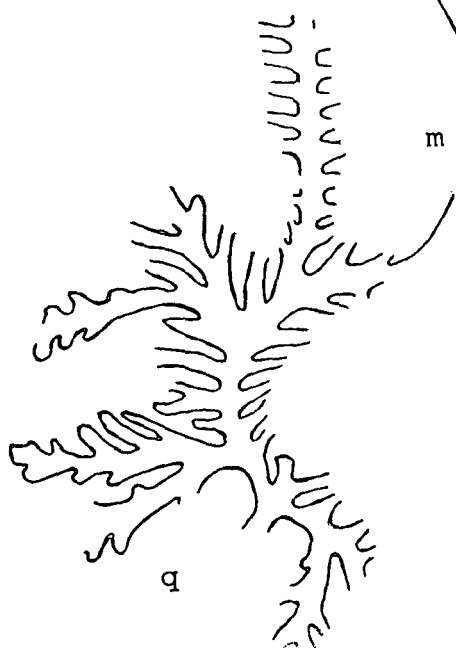
l



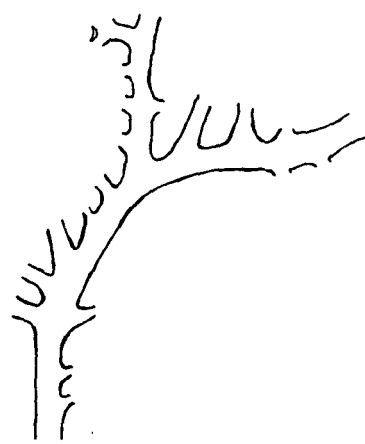
m



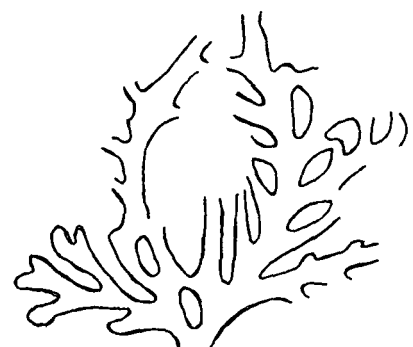
n



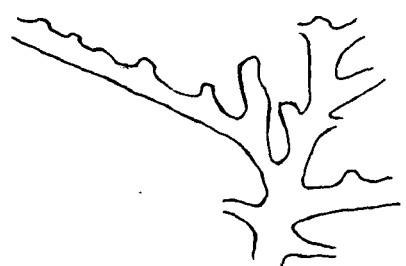
q



r



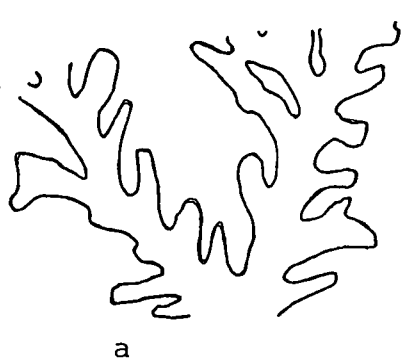
p



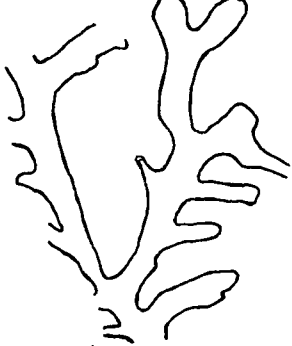
s

Figure 6I. Zoaria of Acanthocladia species-outline drawings. Comparison of zoarial regularity, see text, p. 228 .

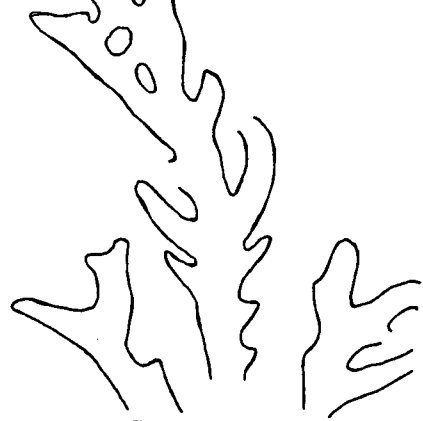
- a. A. anceps.RH2.45.
- b. A. anceps.RH2.48a.
- c. A. laxa.HDN 7.
- d. A. laxa.GLQ 36.
- e. A. laxa.RHI.I3.
- f. A. laxa.RHI.I2.
- g. A. laxa.RHI.I.
- h. A. laxa.HM7.I3.
- j. ?A. laxa.RHI.2
- k. ?A. diffusus.RHI.4I.
- l. A. diffusus.RHI.37.
- m. ?A. diffusus.RHI.46.
- n. ?A. diffusus.RH4.4I.
- p. A. diffusus.RHI.48.
- q. A. diffusus.BH I2.
- r. A. diffusus.HYR I8.
- s. A. diffusus.HYR I6.



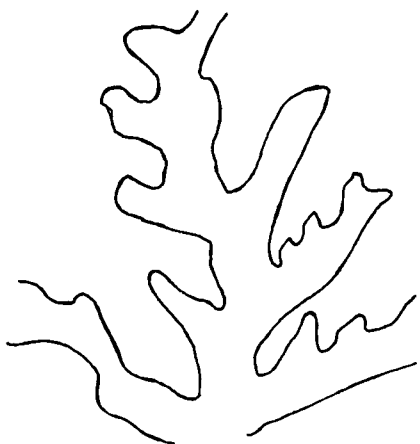
a



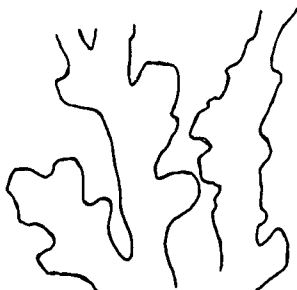
b



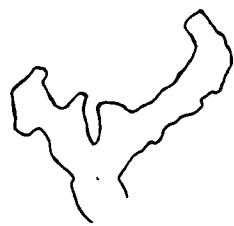
c



d



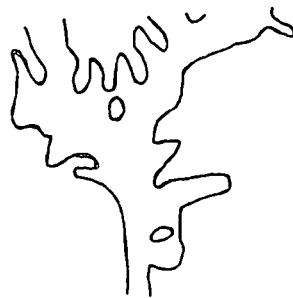
e



f



g



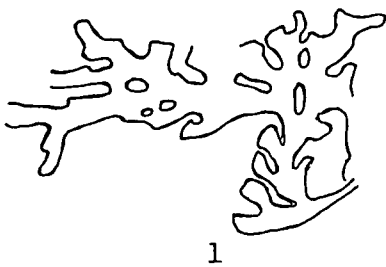
h



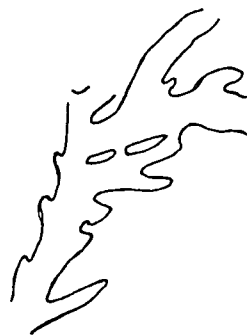
j



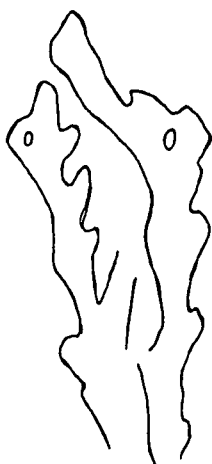
k



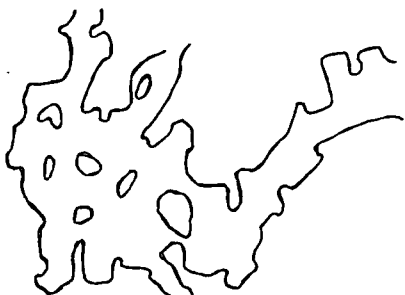
l



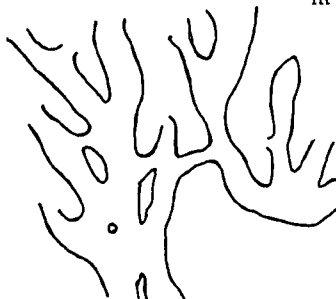
m



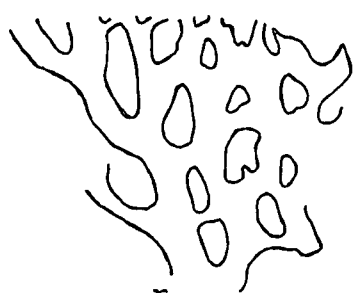
n



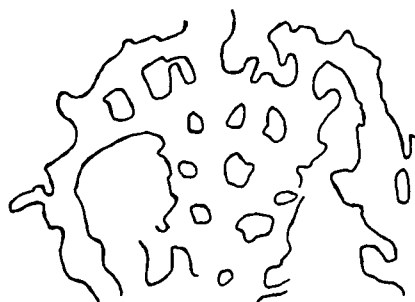
p



q



r



s

Figure 62. Acanthocladia diffusus Korn

Obverse surface detail. HTQ 4.

Bar scale=Imm

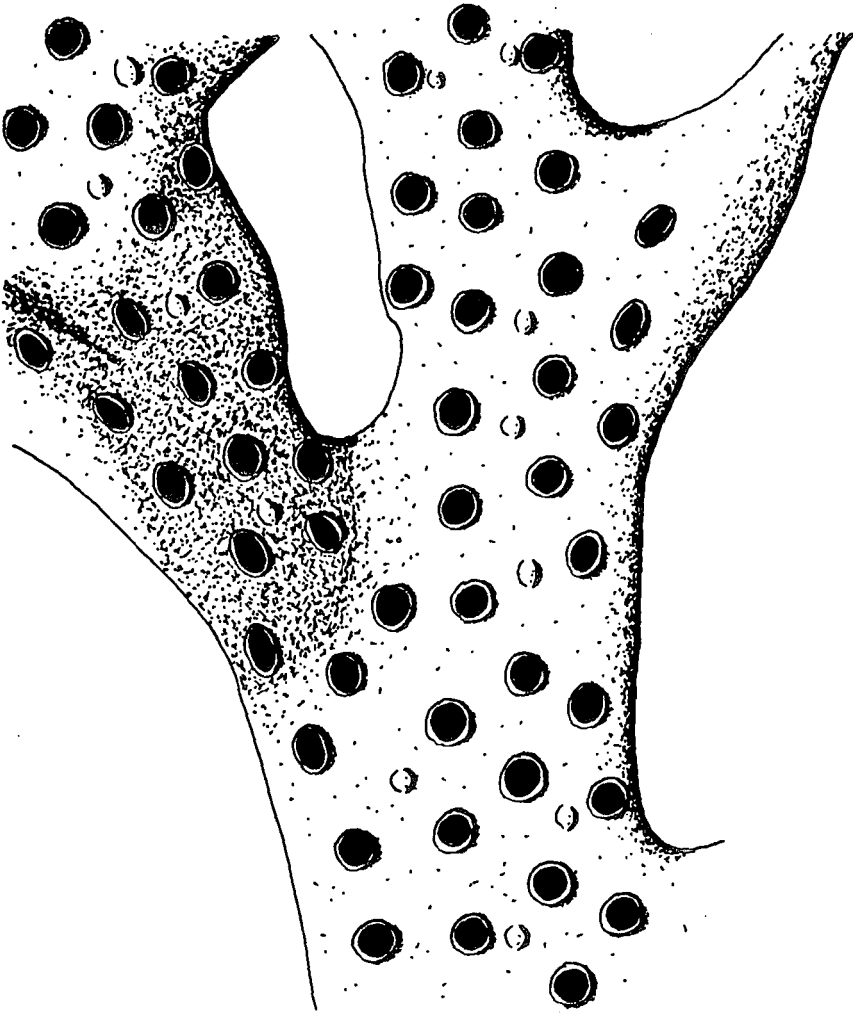


Figure 63. Acanthocladia diffusus Korn

Reverse surface detail. BH I2.

Bar scale=Imm

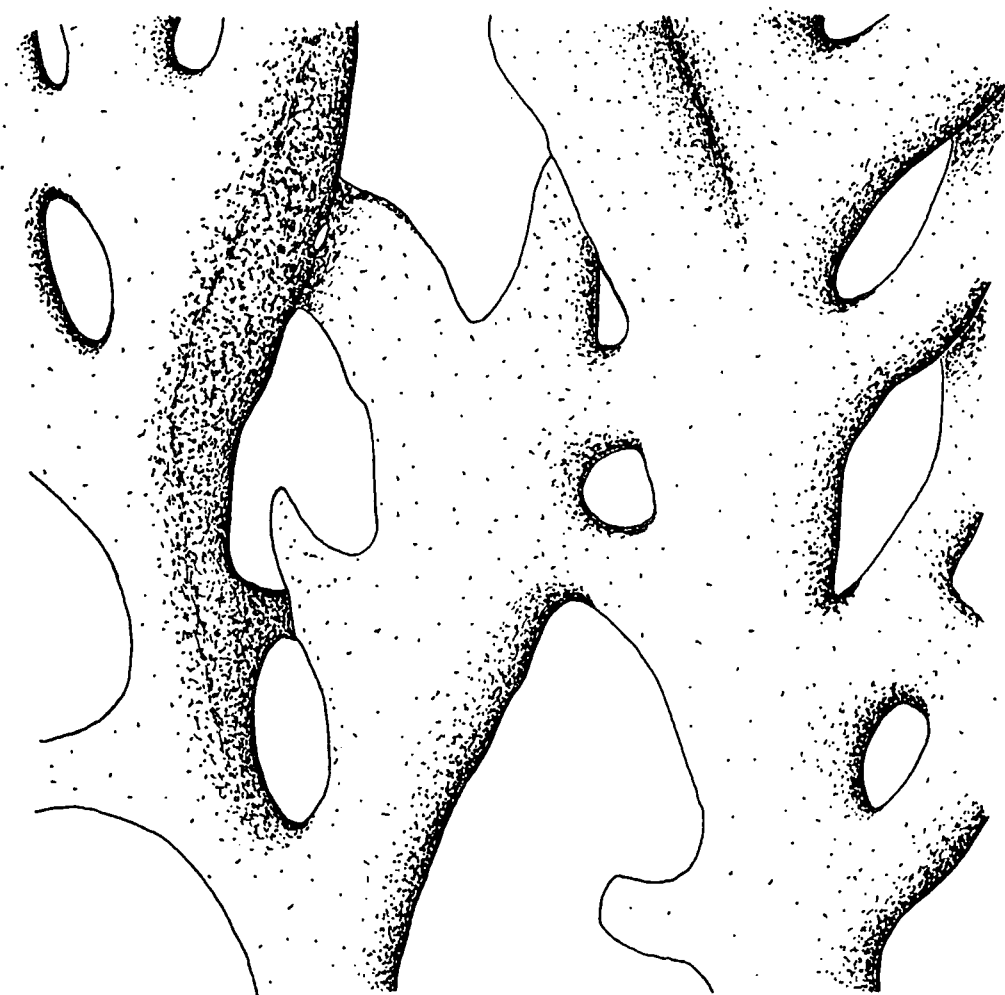


Figure 64. Correlation of zoarial morphology with habitat for "Idmonea"atlantica (from Harmelin(1973)). Colonies growing in obscure recesses are less robust and less regularly branched than those in a more open environment.

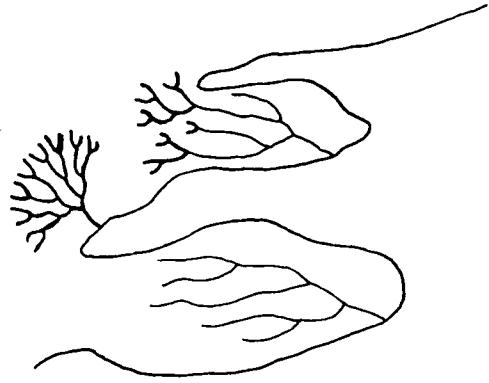


Figure 65. Kalvariella typica Morozova

Obverse surface detail. BH IOb.

Bar scale=Imm

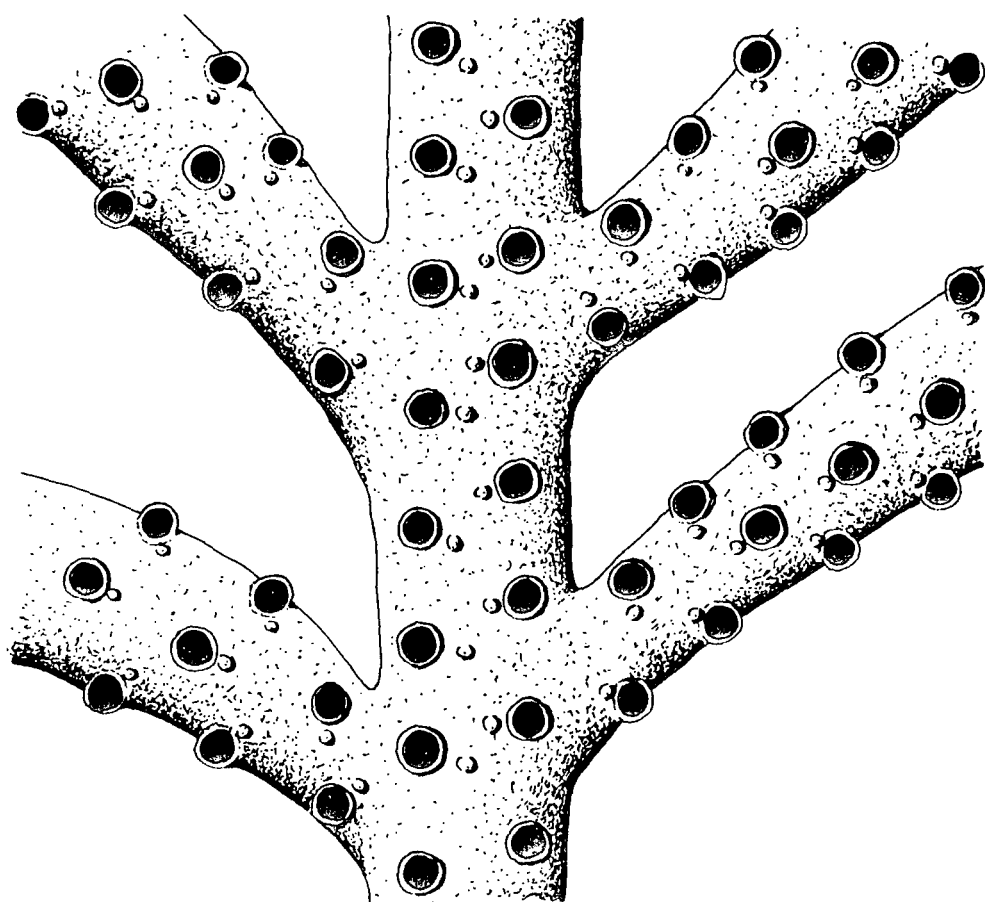


Figure 66. Penniretepora waltheri Korn
Reverse surface detail.HYR28.
Bar scale=Imm

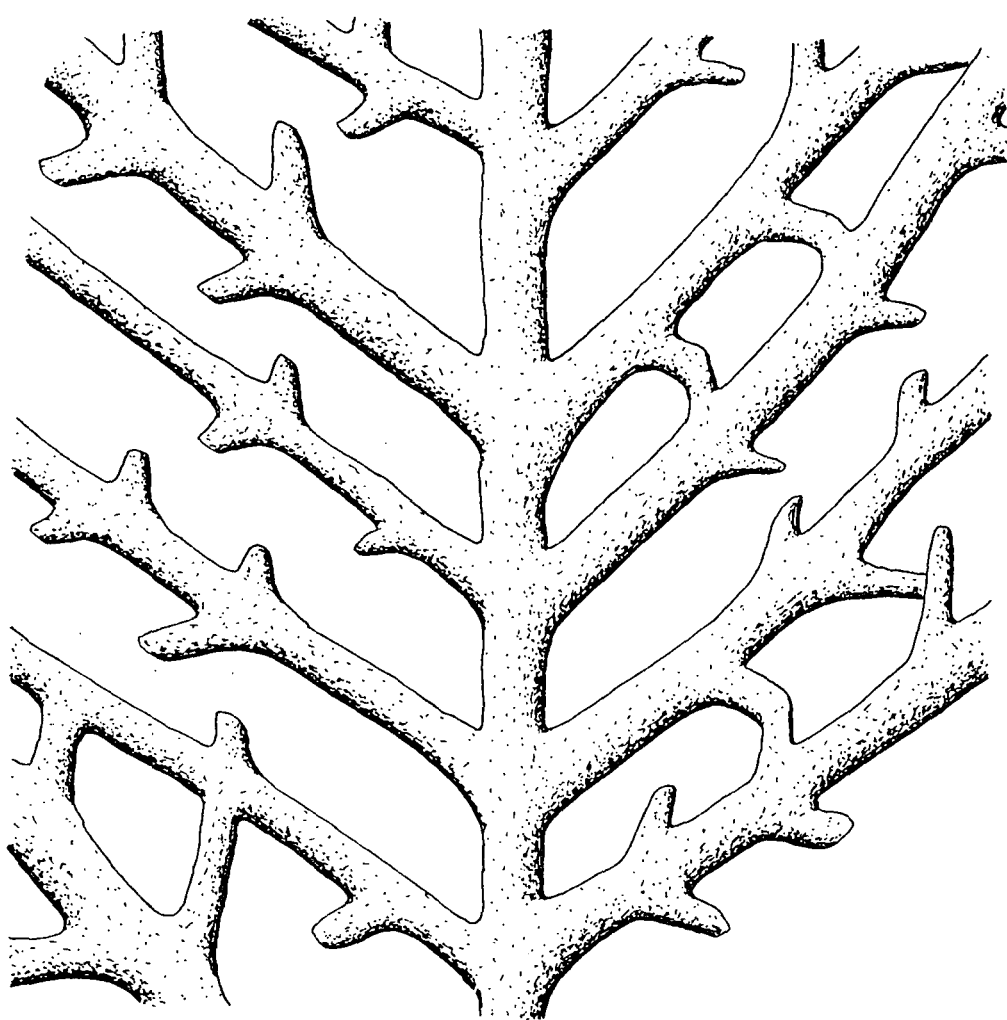


Figure 67. Penniretepora waltheri noda subsp.nov.
Obverse surface detail.Composite drawing,
RH2.28 and RH2.Ib.
Bar scale=Imm

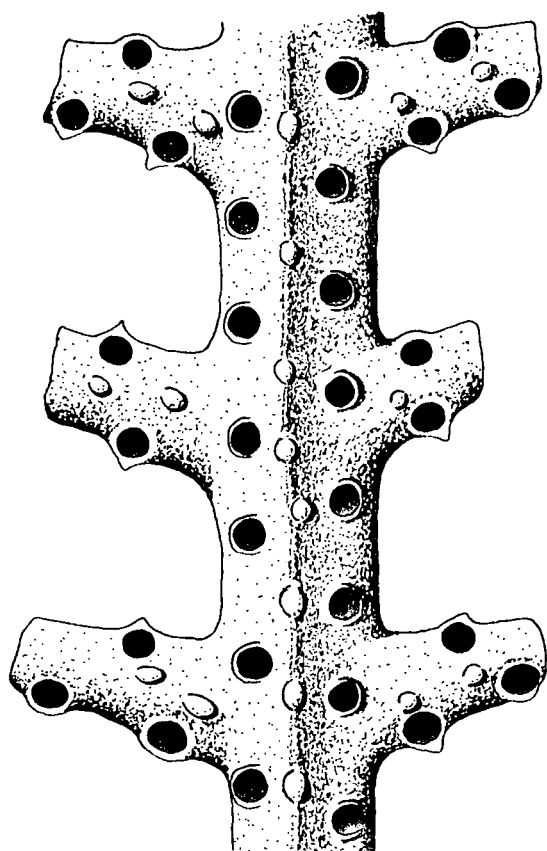


Figure 68. Penniretepora waltheri noda subsp.nov.
Reverse surface detail.RH2.42.
Bar scale=Imm

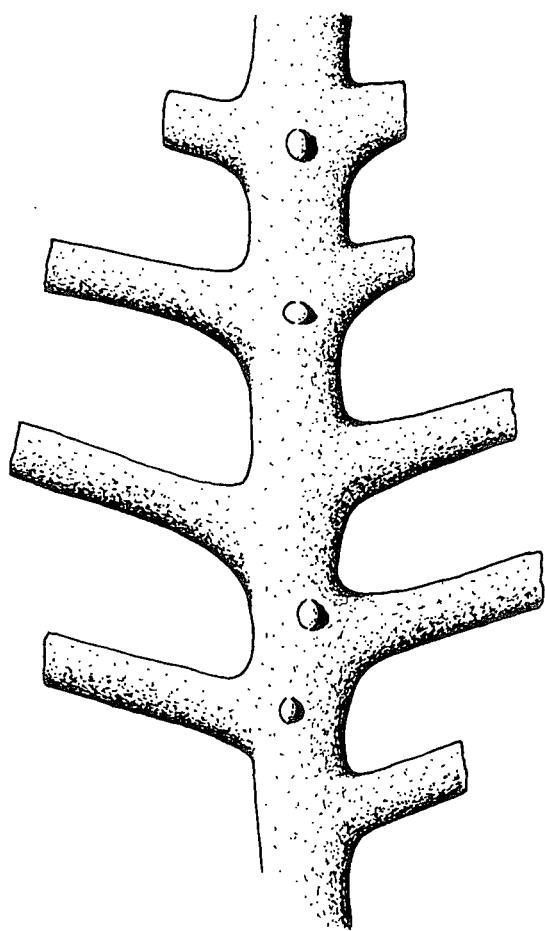


Figure 69. Ryhopora delicata gen.nov.,sp.nov.

Obverse surface detail.RH2.3Ob.

Bar scale=Imm

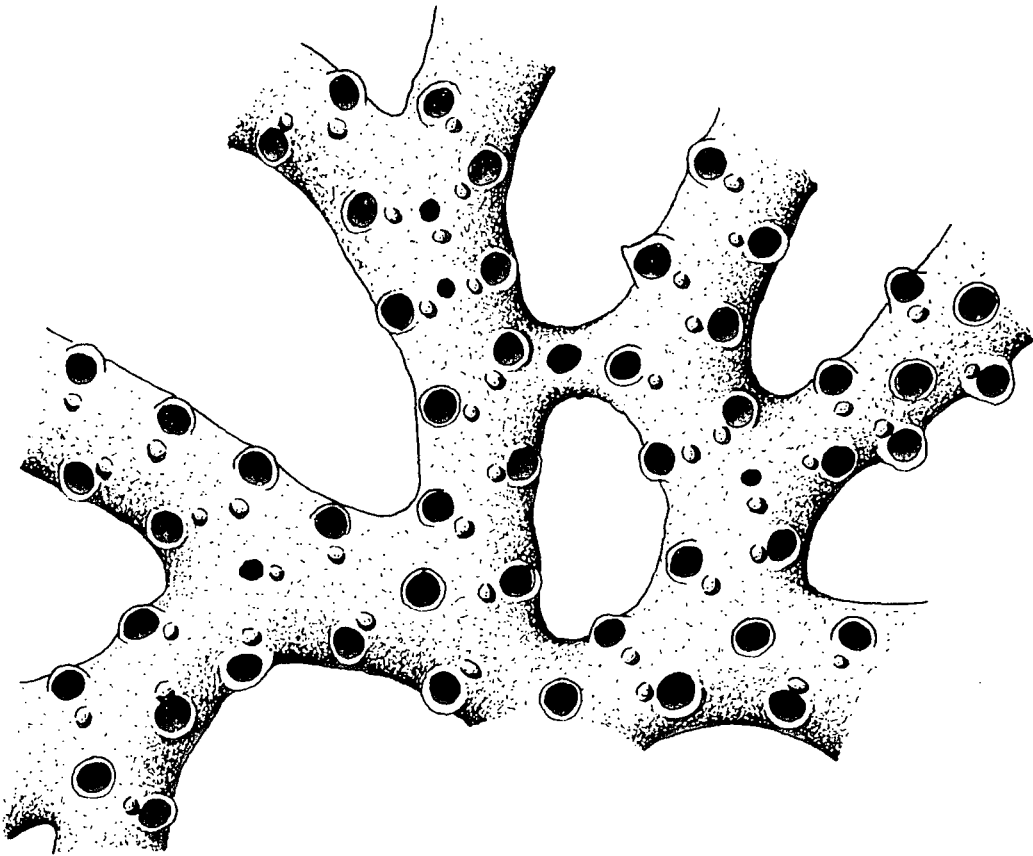
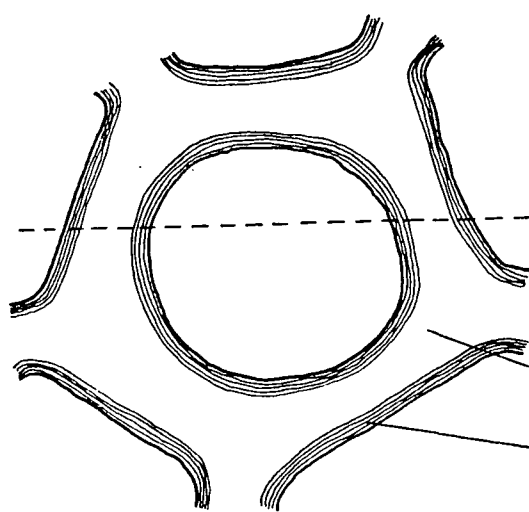


Figure 70. A and B. Inter-zooecial wall laminae in the Trepostomata.

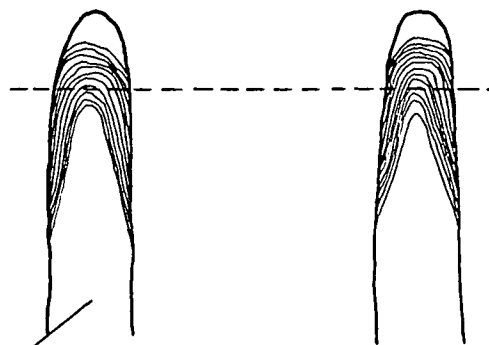
- A. Tangential section showing the inter-zooecial wall with an apparent granular core surrounded by laminated skeleton.
- B. Longitudinal section-dashed line= level of diagram A. The appearance of a granular core flanked by laminated skeleton in A is a result of the angle of intersection of the plane with the wall laminae, being steeper at the edge of the inter-zooecial wall but sub-parallel to the plane in the centre.

C and D. Growth of wall laminae in the Trepostomata. (From Boardman and Cheetham (1969)).

- C. Laminae oblique orally, grown one at a time, parallel to depositing epithelium.
- D. Laminae oblique aborally, growth by simultaneous edgewise extension of several laminae which are not parallel to the depositing epithelium.

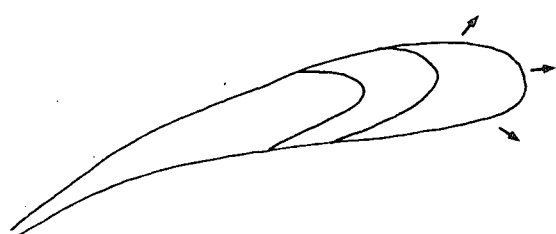


A



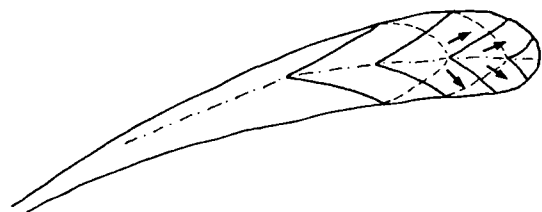
B

Inter-zooecial Wall
Laminae



C

— Laminae
→ Direction of crystal growth



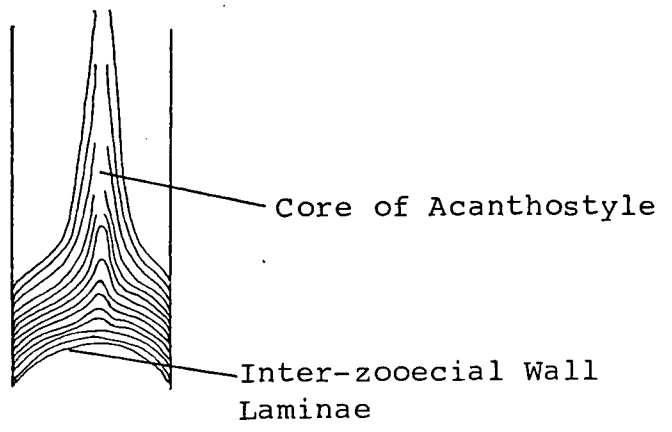
D

----- Accretion surfaces
..... Inception surface

Figure 7I. A. Longitudinal section to show oral flexure of inter-zooecial wall laminae to produce an acanthostyle which consists of a granular core with sub-parallel wall laminae. (Partly after Tavener-Smith(1969b)).

B. Longitudinal section through the distal part of an autozooecium. Laminae of the diaphragm are continuous orally with those lining the zooecial chamber and with those of the inter-zooecial wall.

A



B

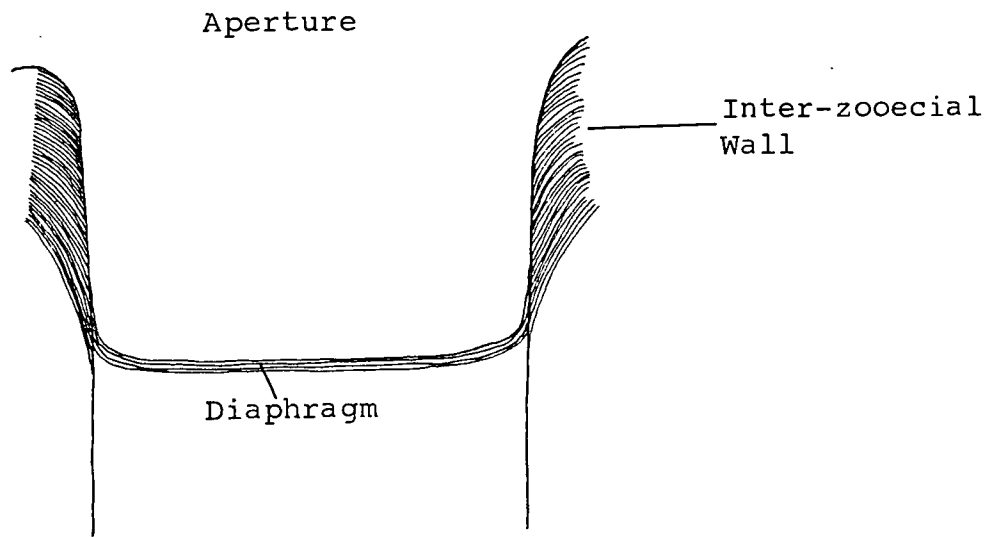
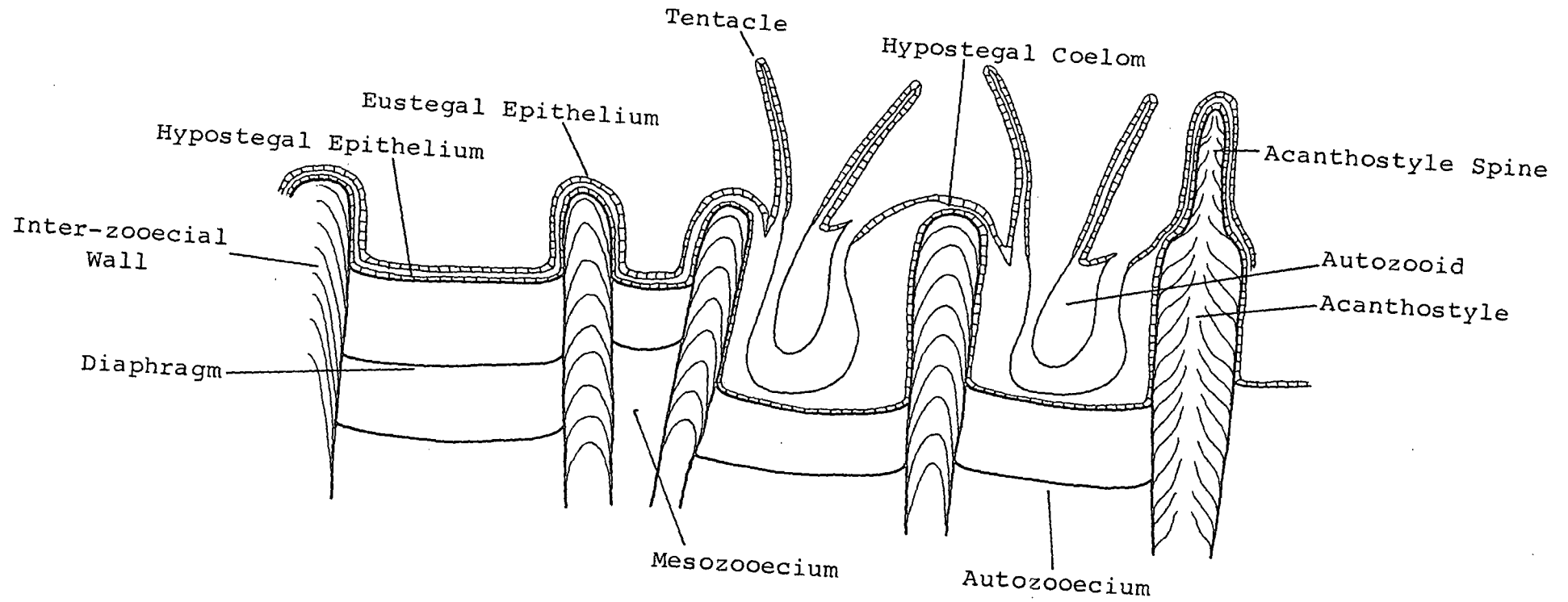
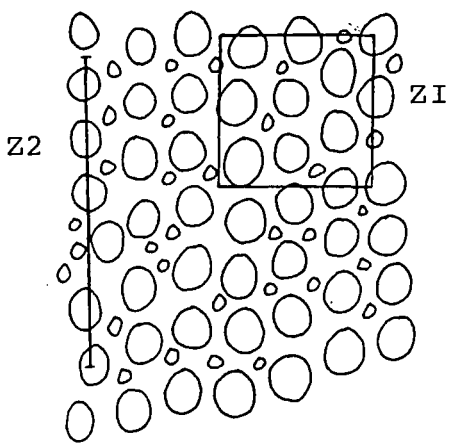


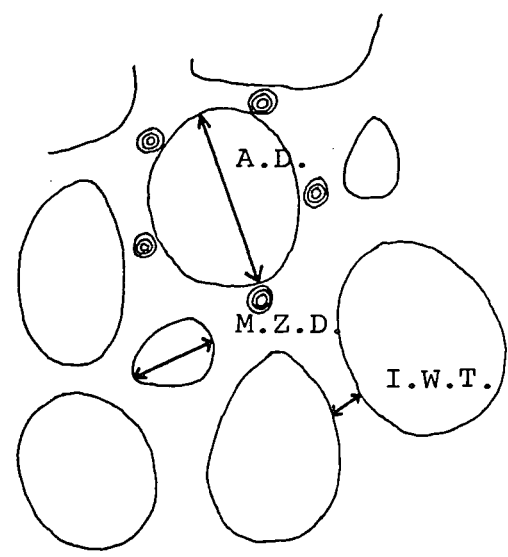
Figure 72. Diagrammatic reconstruction of the relationship between hard and soft parts in the Trepostomata.
(Partly after Tavener-Smith(1969b)).



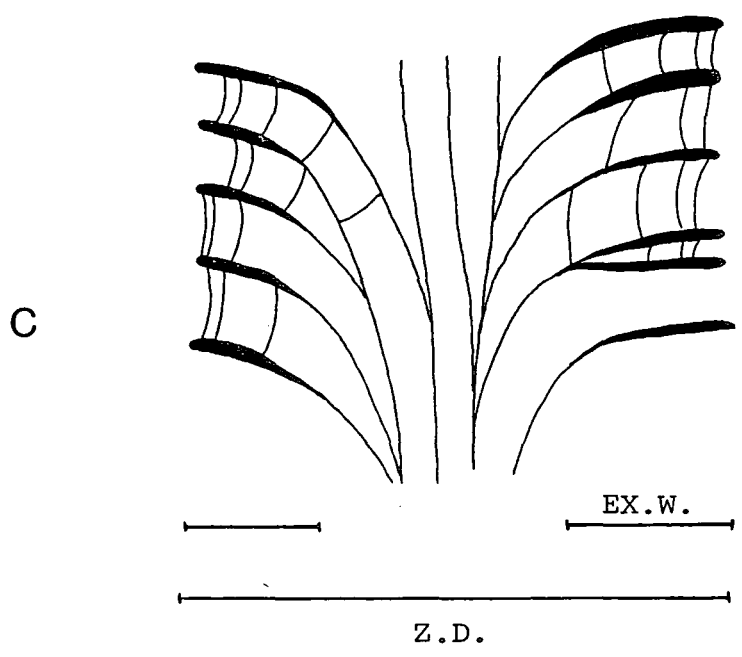
- o | Figure 73. Characters measured on bryzoans of the
Order Trepostomata in the present study.
- A. Counts of Zooecial apertures, made on
the external surface.
 - B. Measurements made on the external surface.
 - C. Measurements made in longitudinal section.
- See text, p. 287 for discussion.



A



B



C

Figure 74. Diagrams to explain the morphology of the secondary overgrowth seen in thin section GLQIOI (represented diagrammatically by fig.B).

- A. The colony of Dyscritella columnaris is attached to a substrate.
- C. Partial degeneration of the colony takes place, then an overgrowth is initiated by regeneration at the distal margin of the colony. Sediment is deposited (or cement is precipitated) around the base of the colony. The overgrowth extends proximally and eventually grows out over the layer of sediment. Thus the basal layer of the overgrowth is not in contact with the exozone below. The plane of section in 'C' corresponds with the transverse section, 'B'.

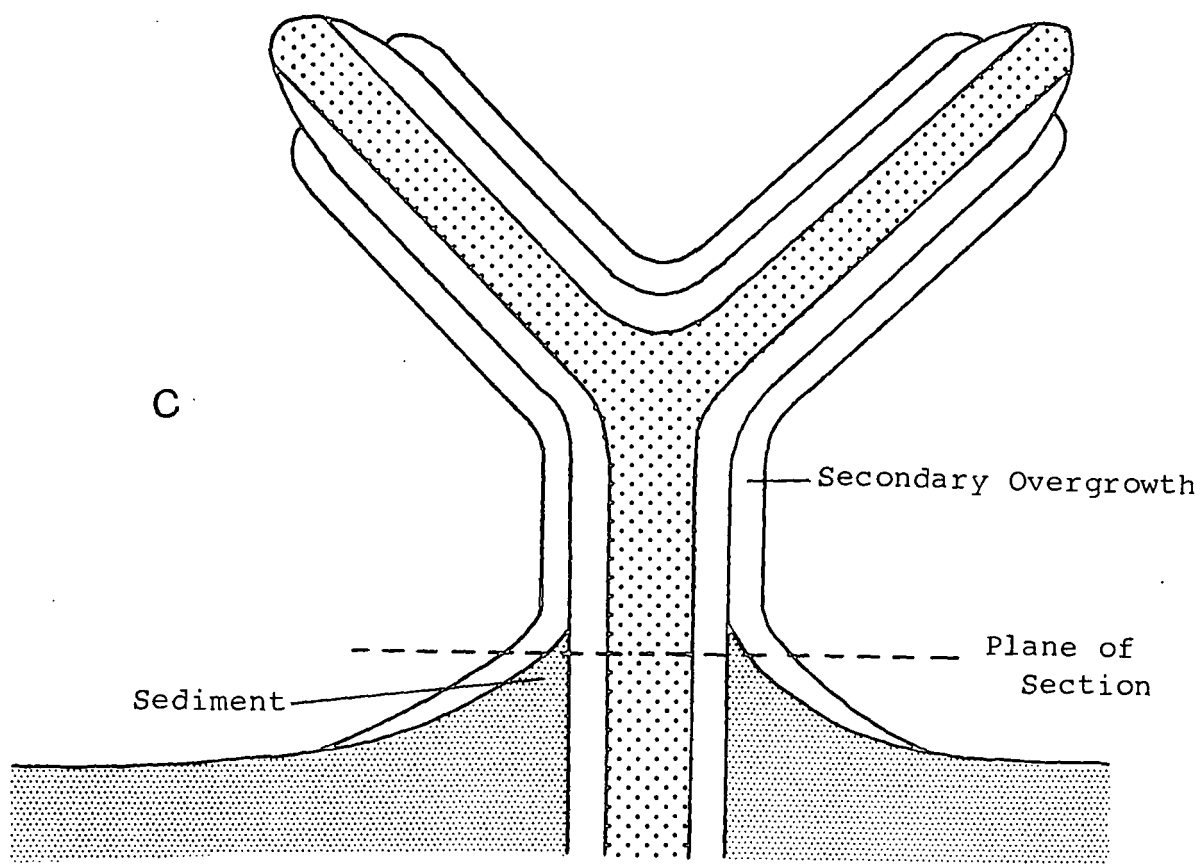
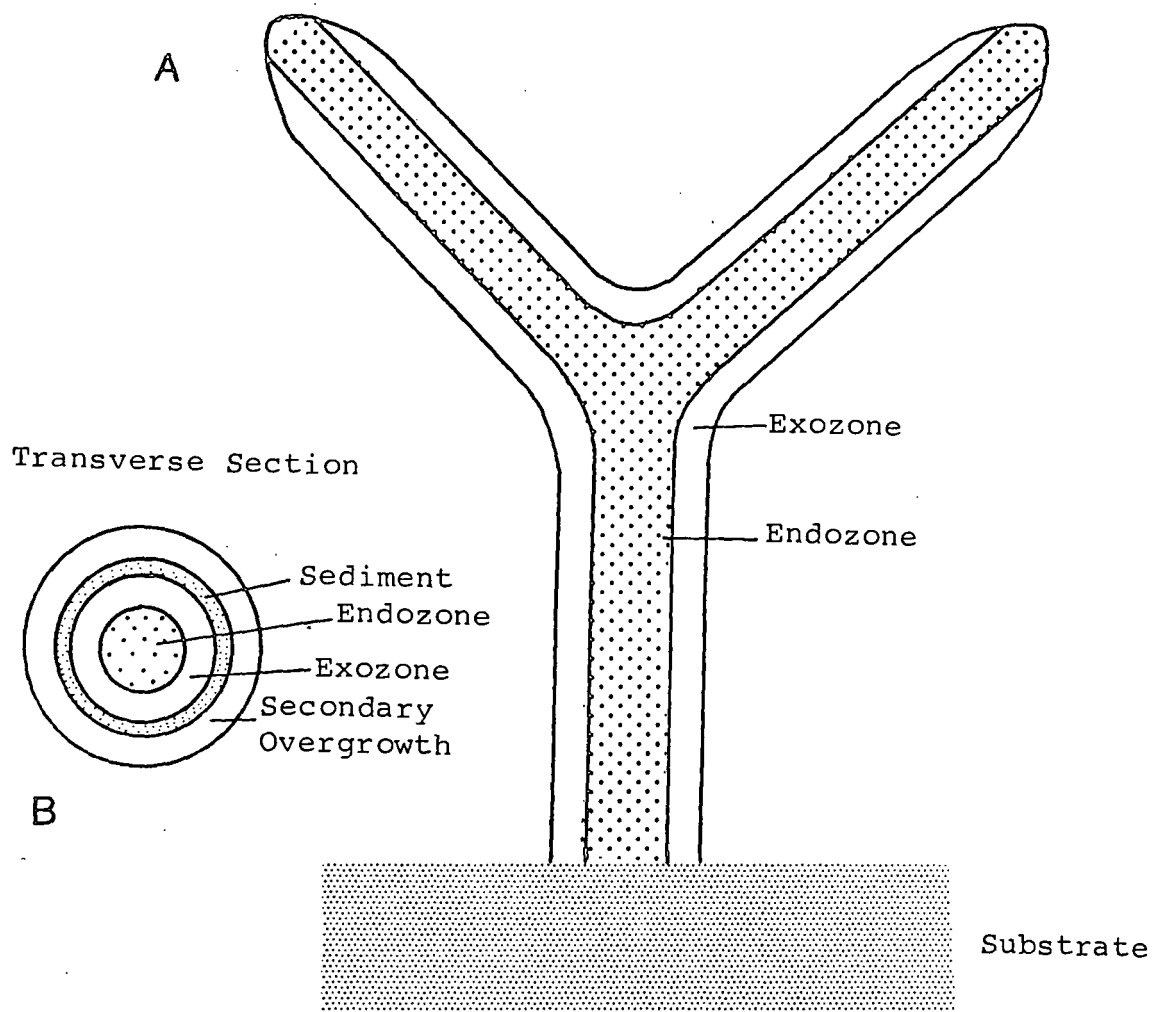


Figure 75. A. Diagram to show measurements made on the genus Corynotrypa. See text, p. 3II for discussion.

B. Longitudinal section through zooecia of an encrusting cyclostome such as Corynotrypa.
"A" and "B" after Taylor(1977).

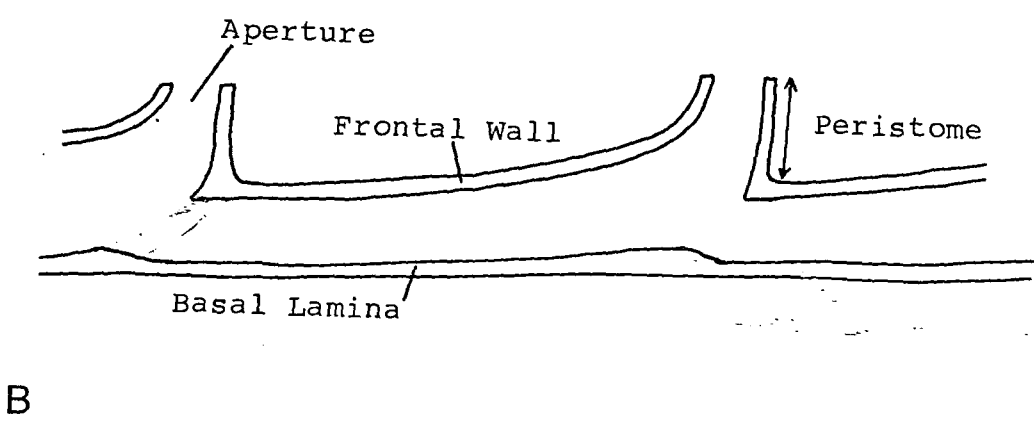
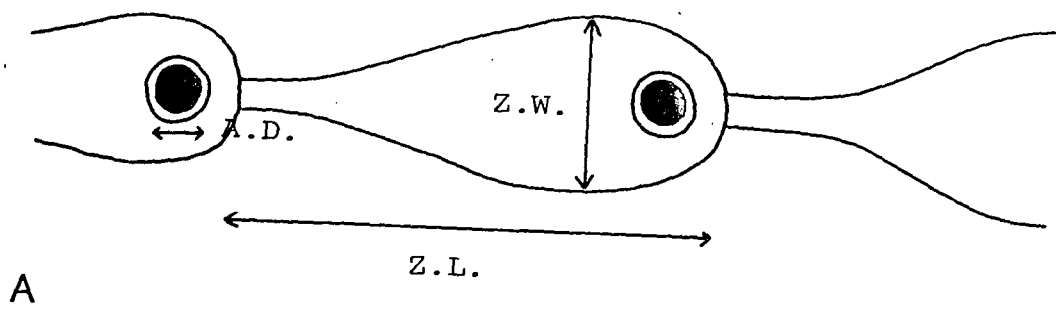


Figure 76. Corynotrypa voigtiana King

Zooecia encrusting a specimen of the
brachiopod Horridonia.RH3.I.

Bar scale=Imm

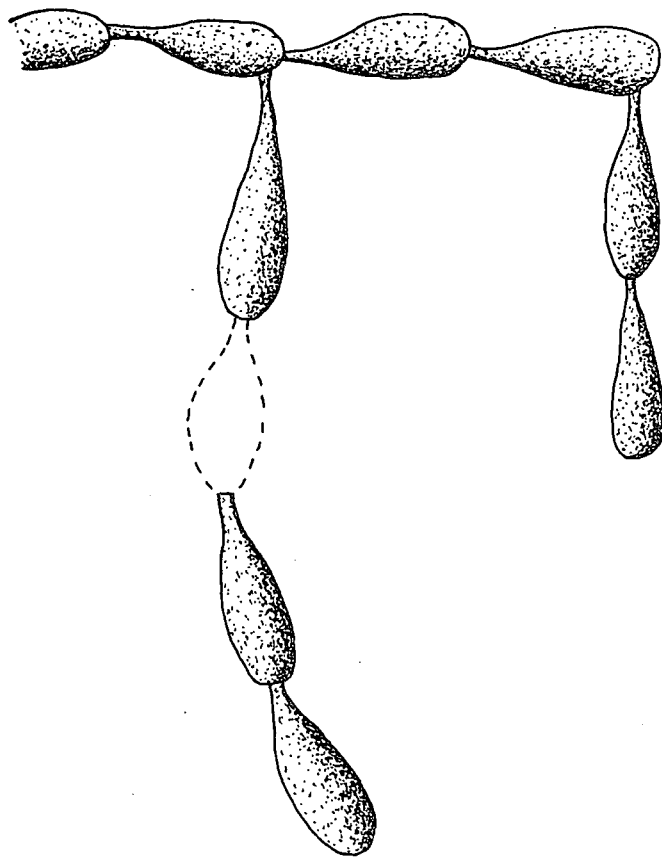


Figure 77. Corynotrypa voigtiana King

Zooecia encrusting the reverse surface of
Fenestella retiformis.RH2.26.

Bar scale=Imm

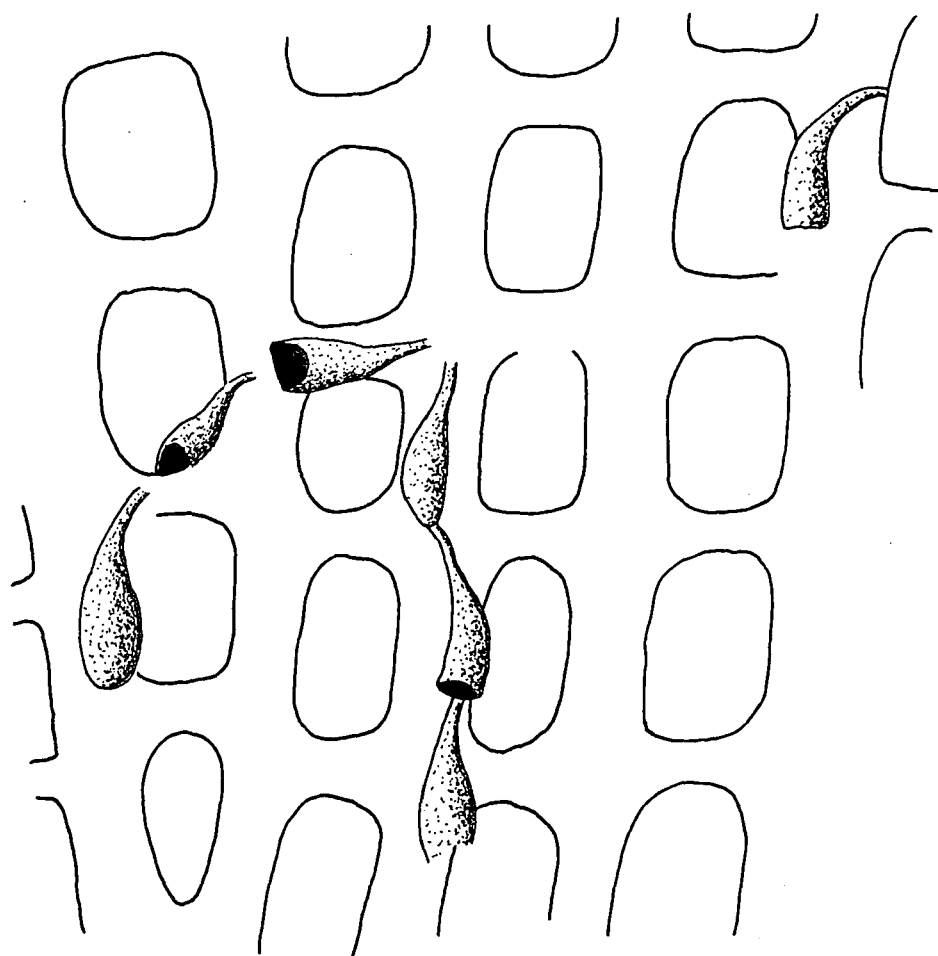


Figure 78. Corynotrypa voigtiana King

Zooecia encrusting the reverse surface of
Synocladia virgulacea.RH2.I.

Bar scale=Imm

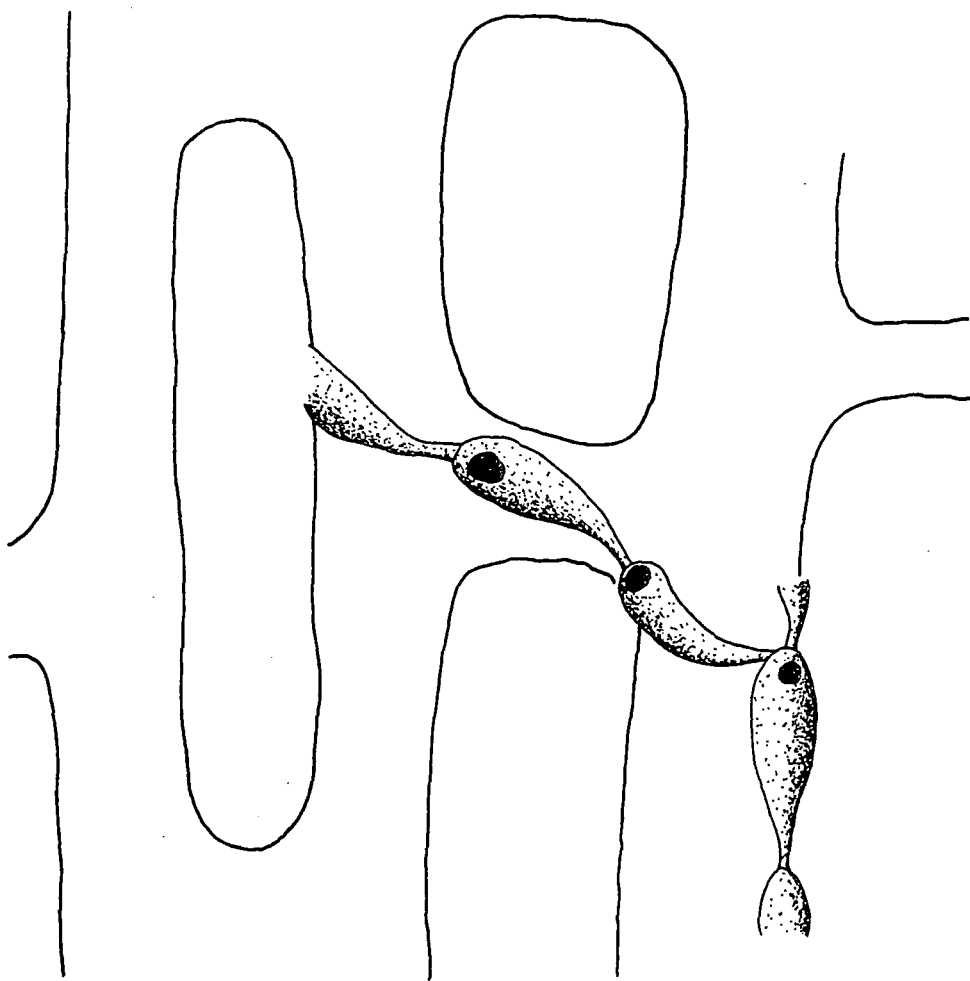


Figure 79. Diagrammatic profile of the Zechstein reef (Tunstall member of the Ford formation) showing the main reef sub-environments. From Smith (1981).

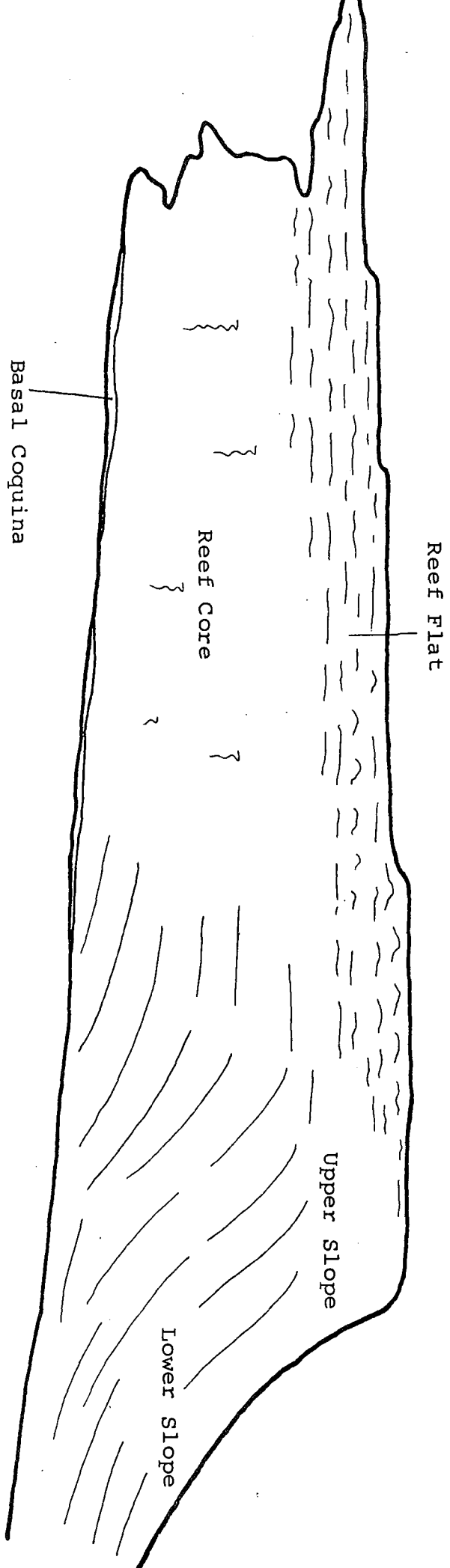


Figure 80. Diagrammatic profile of Zechstein reef
showing inferred positions of localities
in relation to reef sub-environments.
After Smith(1981).

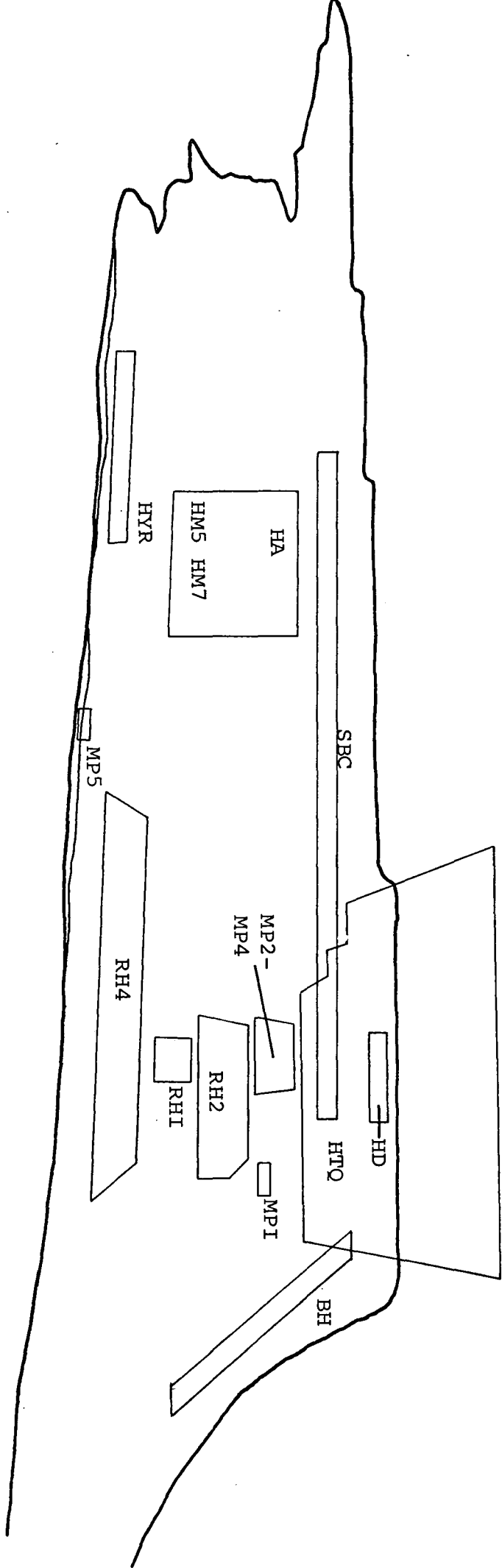
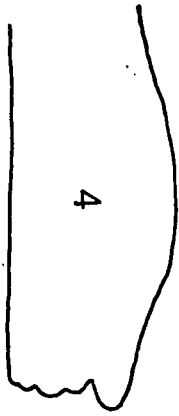


Figure 8I. Diagrammatic profile of the main reef and patch reef to show the characteristic distributions of bryozoan species in relation to reef sub-environments.

- I - Dyscritella columnaris, Acanthocladia laxa and A. diffusus are the dominant bryozoans of the reef-flat, to the almost total exclusion of other species.
- 2 - Synocladia virgulacea is characteristically abundant in the upper reef slope.
- 3 - Fenestella retiformis is very abundant in the reef core. Thamniscus dubius and F. geinitzi occur in almost no other sub-environment and are particularly characteristic forms.
- 4 - Kingopora ehrenbergi is very rare throughout the main reef but is relatively common in patch reefs of the back-reef environment.

Patch Reef



Back-reef Environment

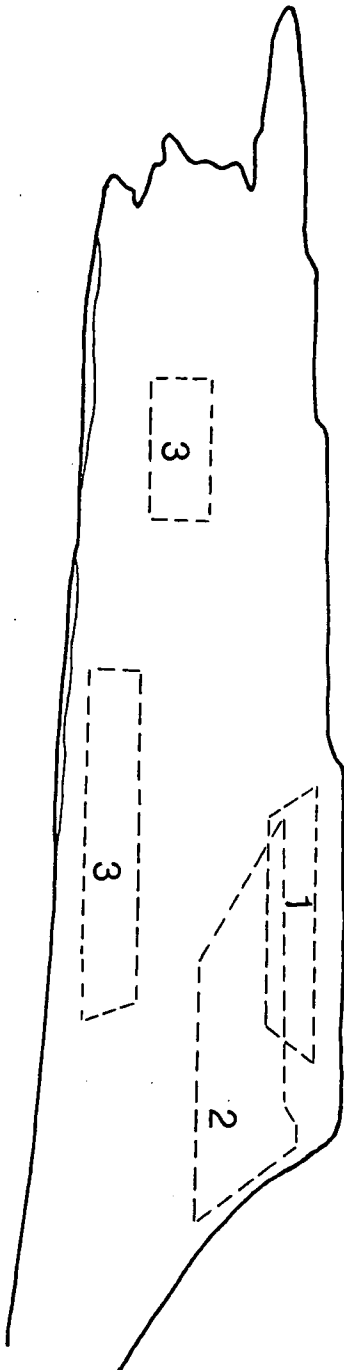


Figure 82. Histogram of species abundances at locality MP5. Abundance categories I-7 are defined in the text, p. 32. I 6 is very common and I is very rare.

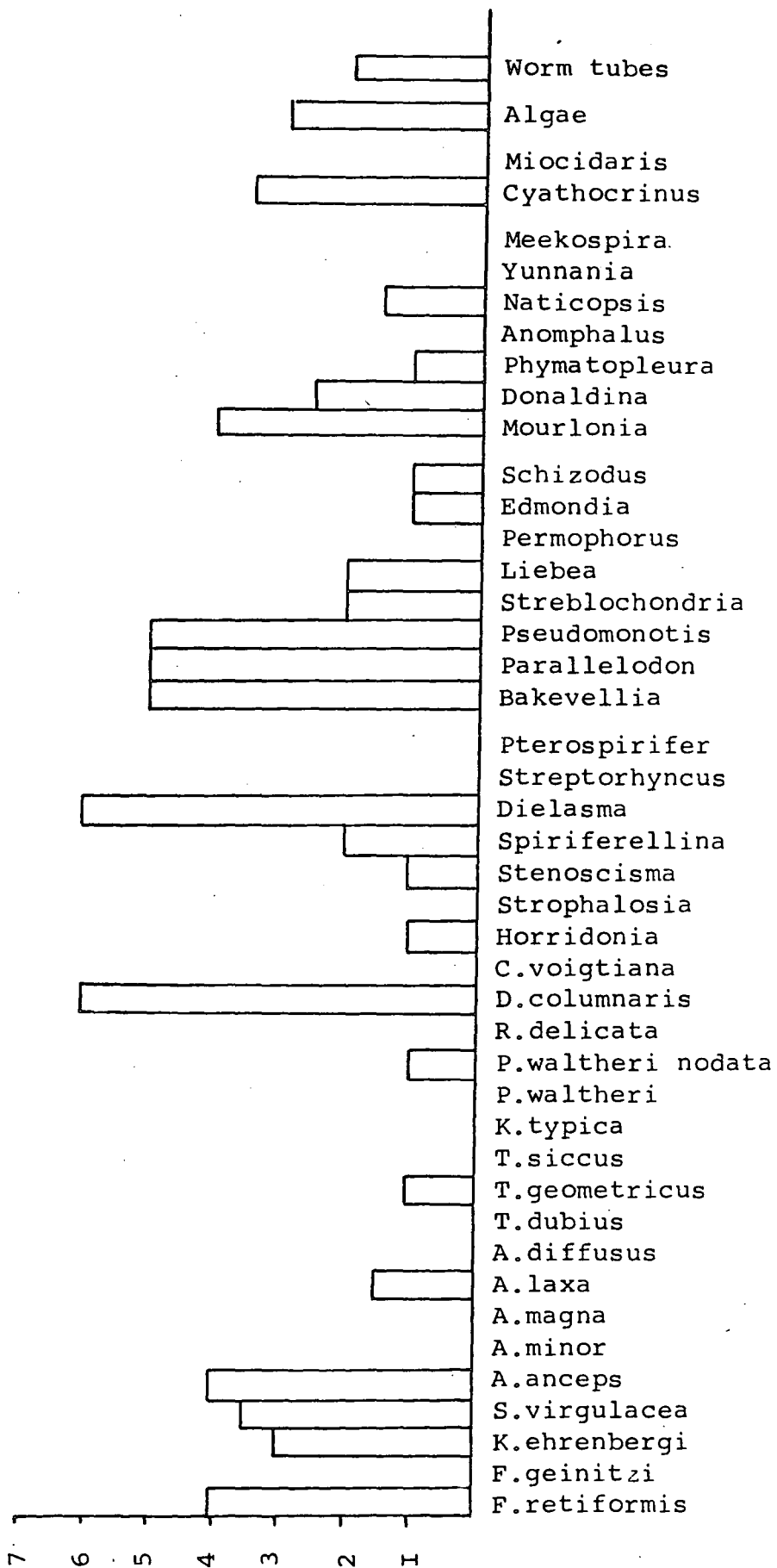


Figure 83. Histogram of species abundances at
locality HYR.

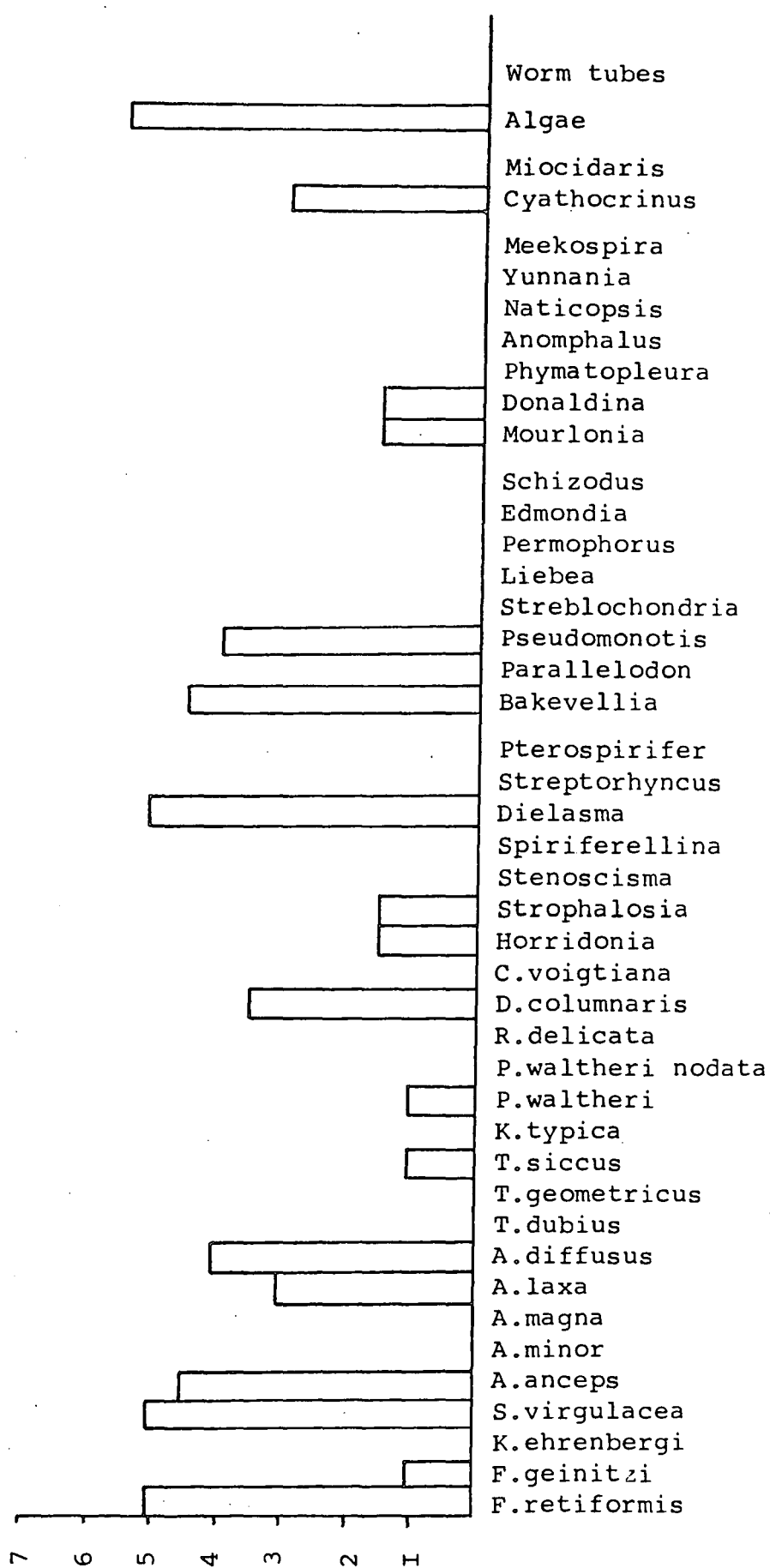


Figure 84. Histogram of species abundances at locality RH4.

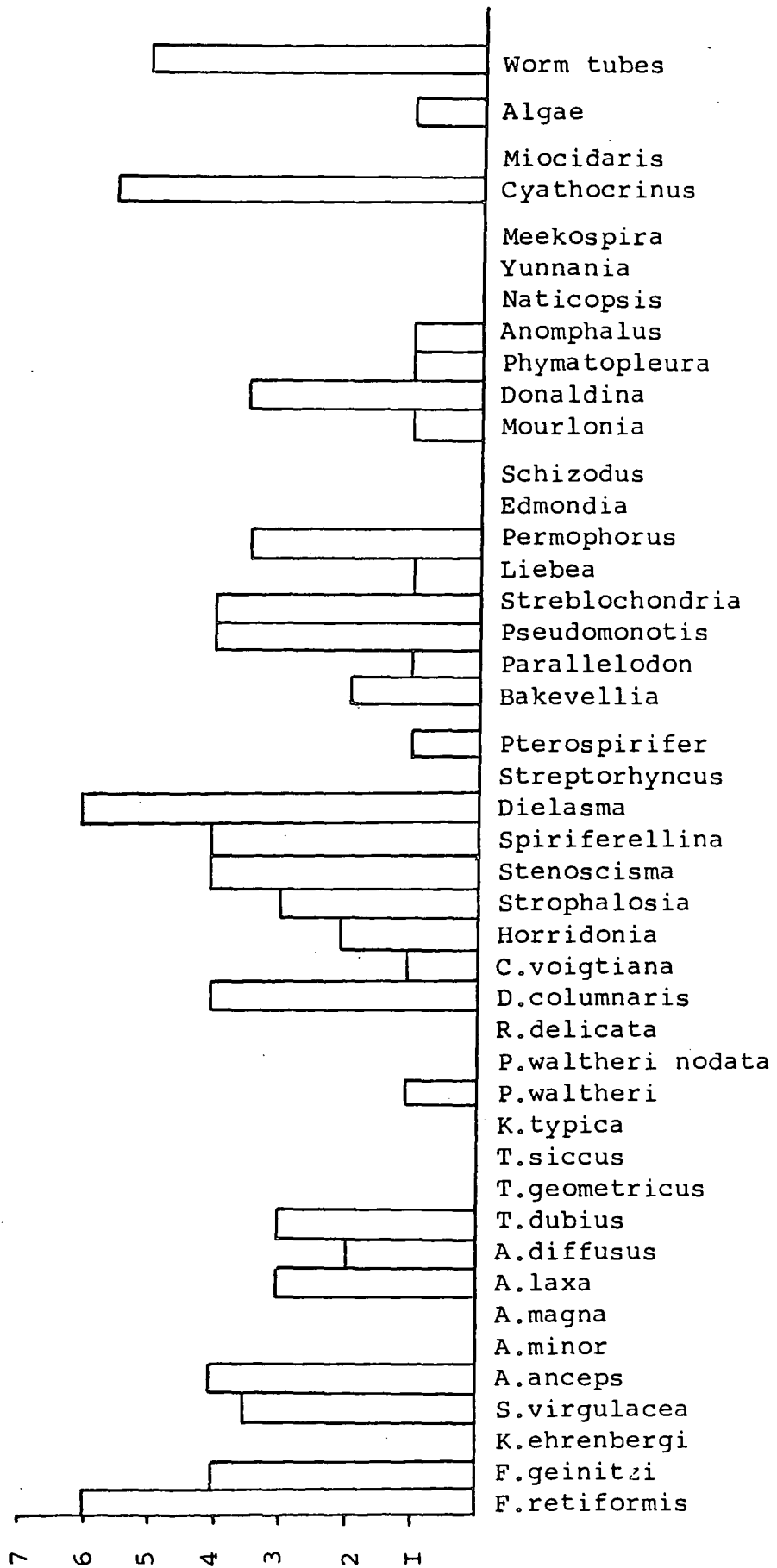


Figure 85. Histogram of species abundances at locality
RHI.

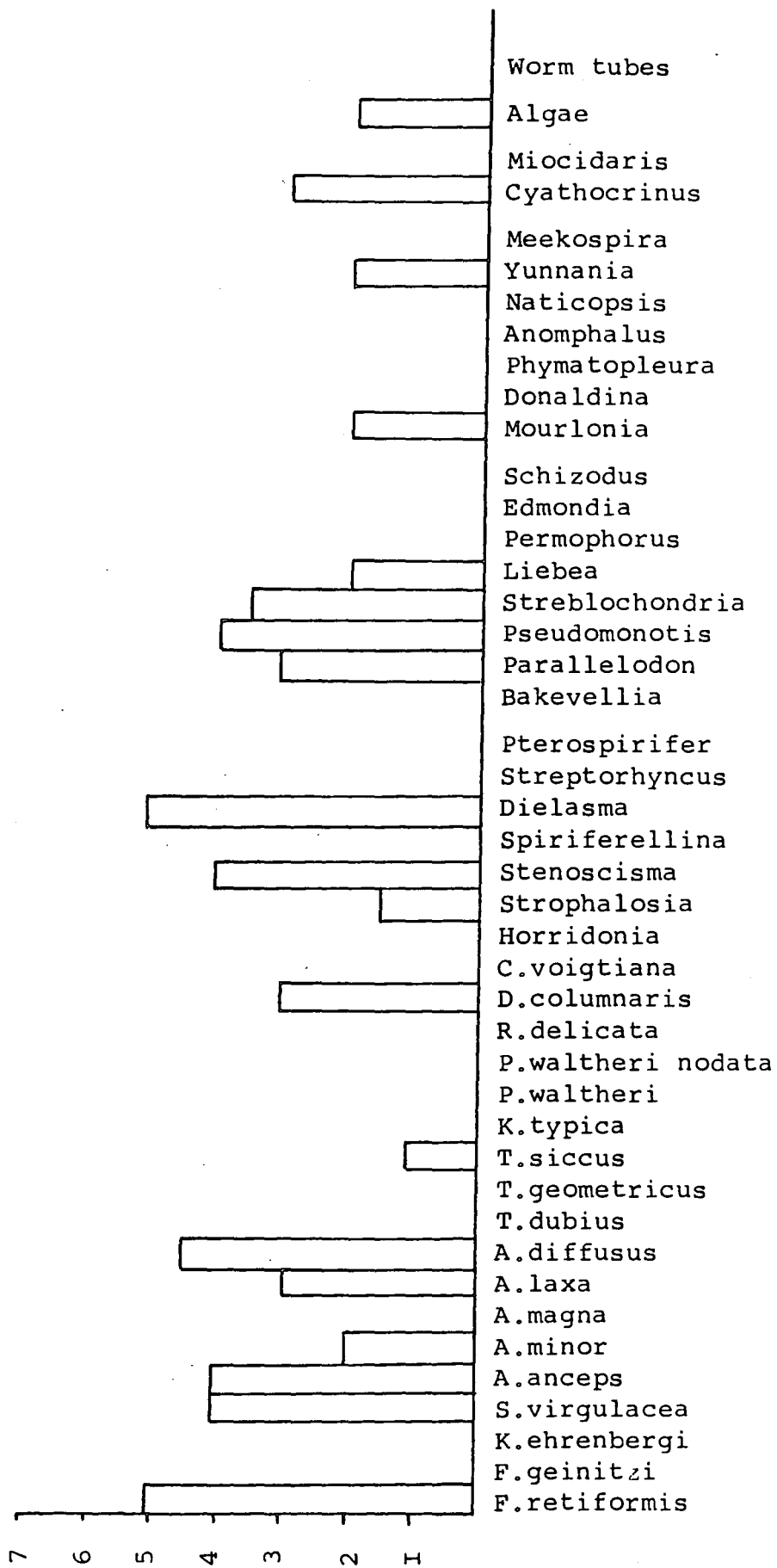


Figure 86. Histogram of species abundances at locality RH2.

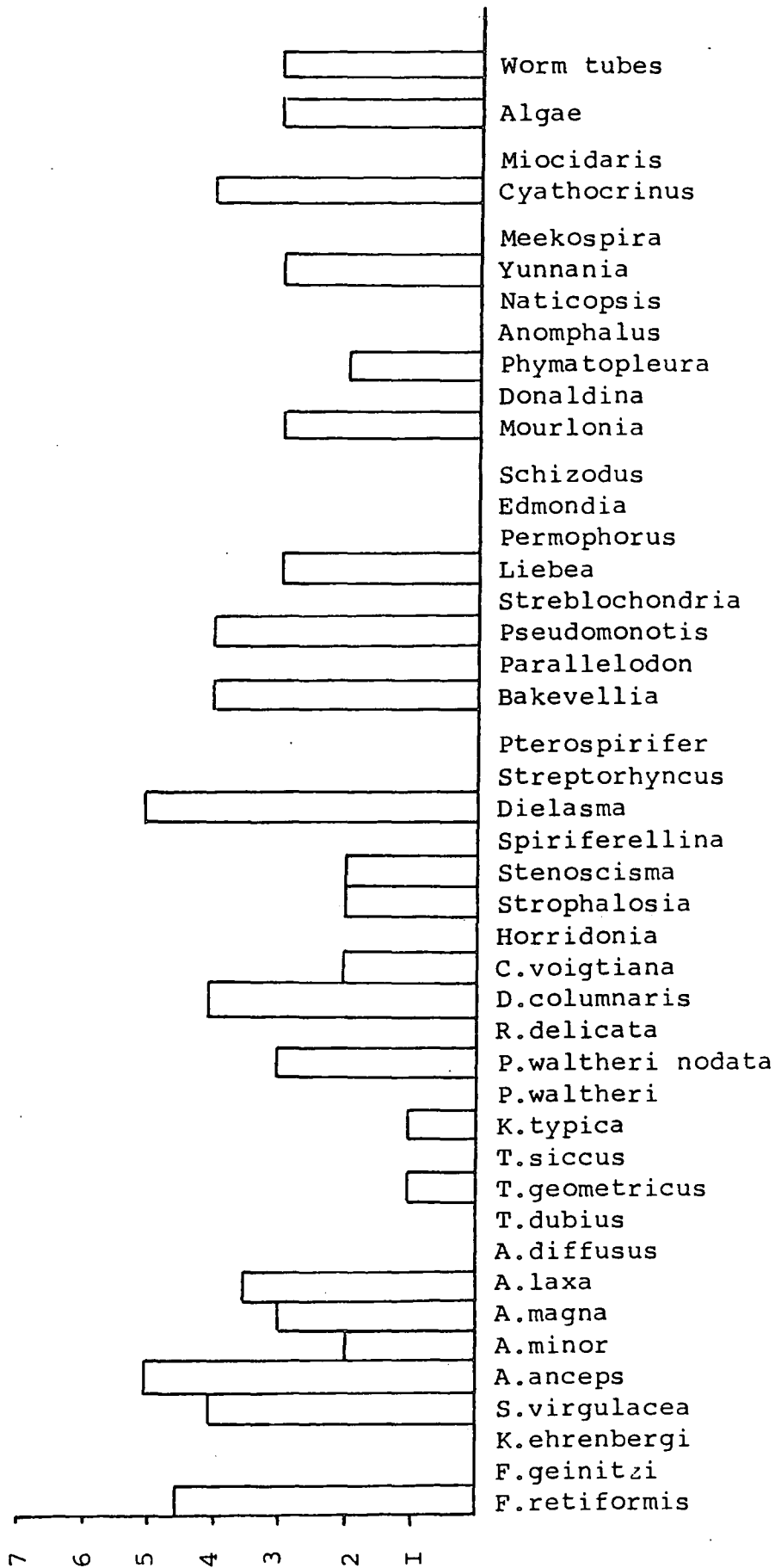


Figure 87. Histogram of species abundances at locality MPI.

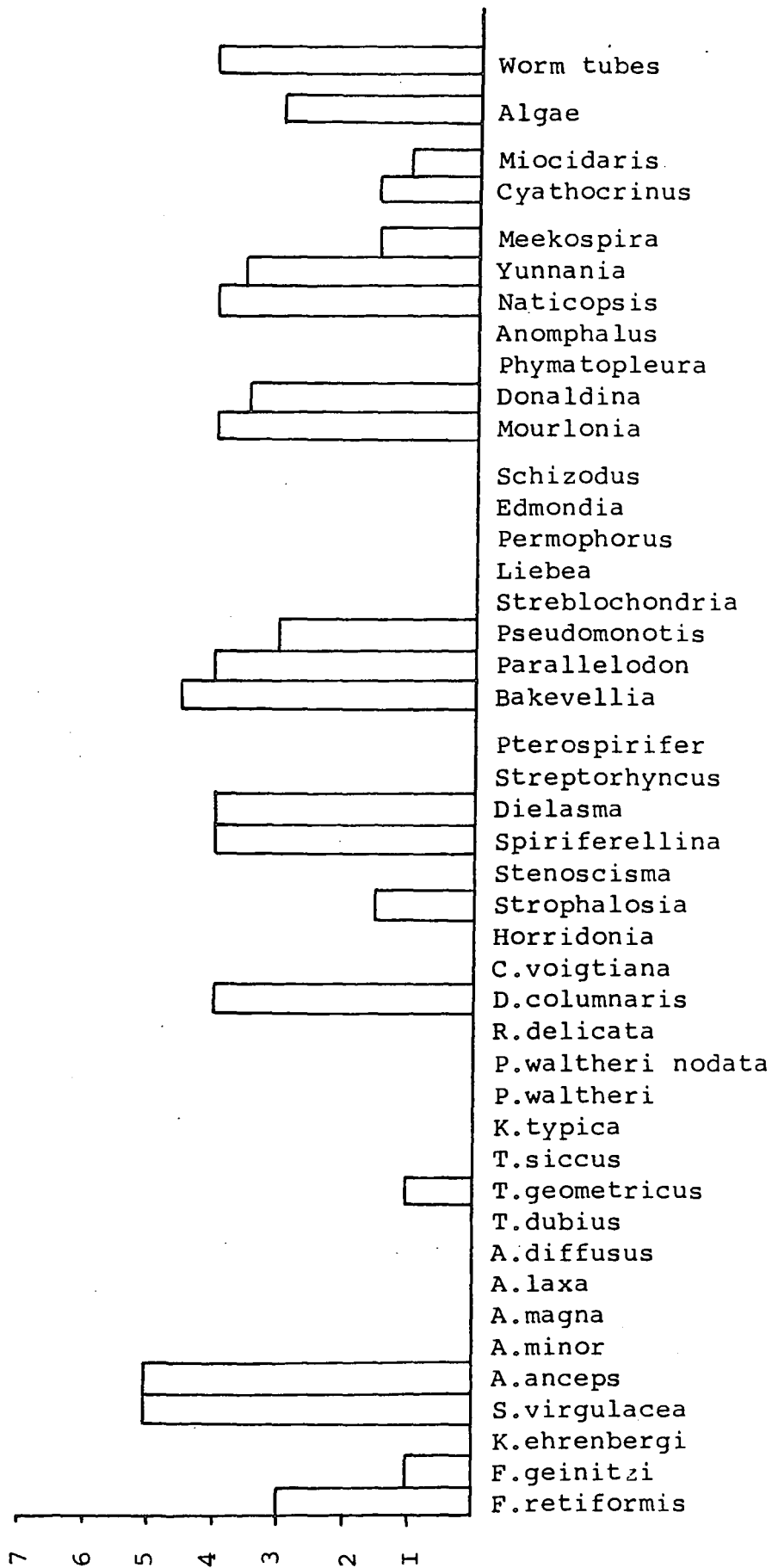


Figure 88. Histogram of species abundances at
locality BH.

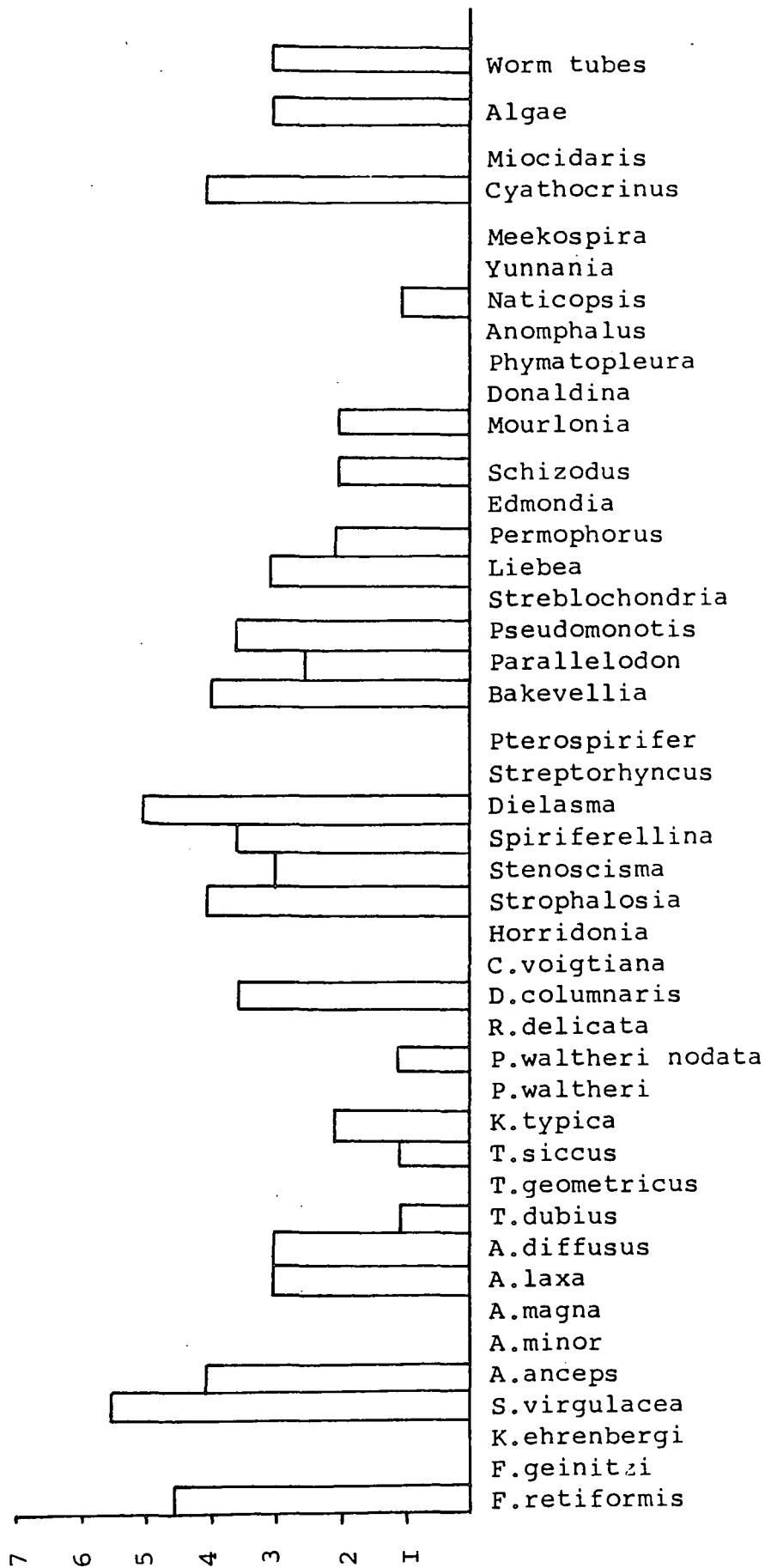


Figure 89. Histogram of species abundances at localities HM5 and HM7 combined.

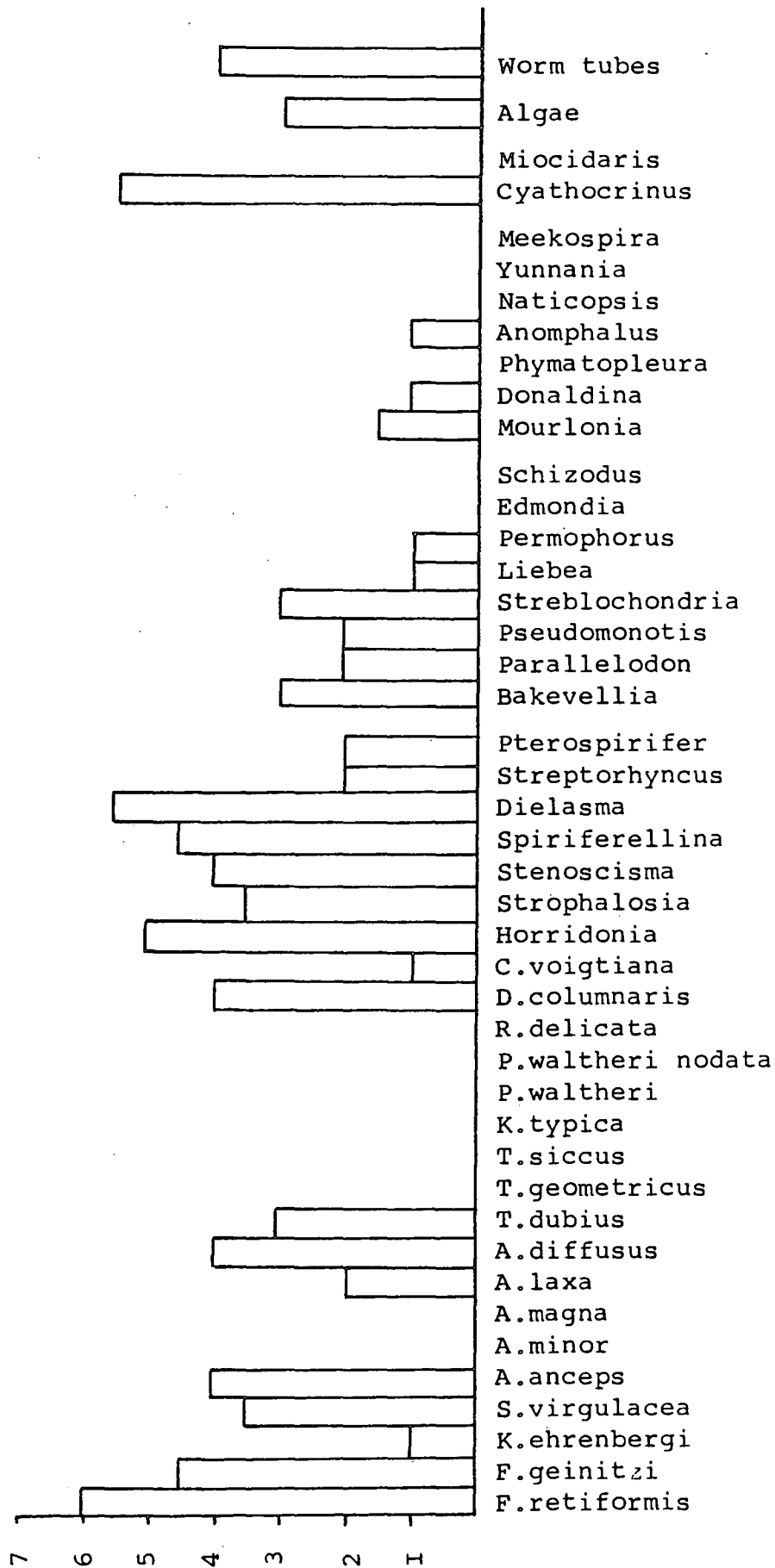


Figure 90. Histogram of species abundances at localities HAW,HAG and HA combined.

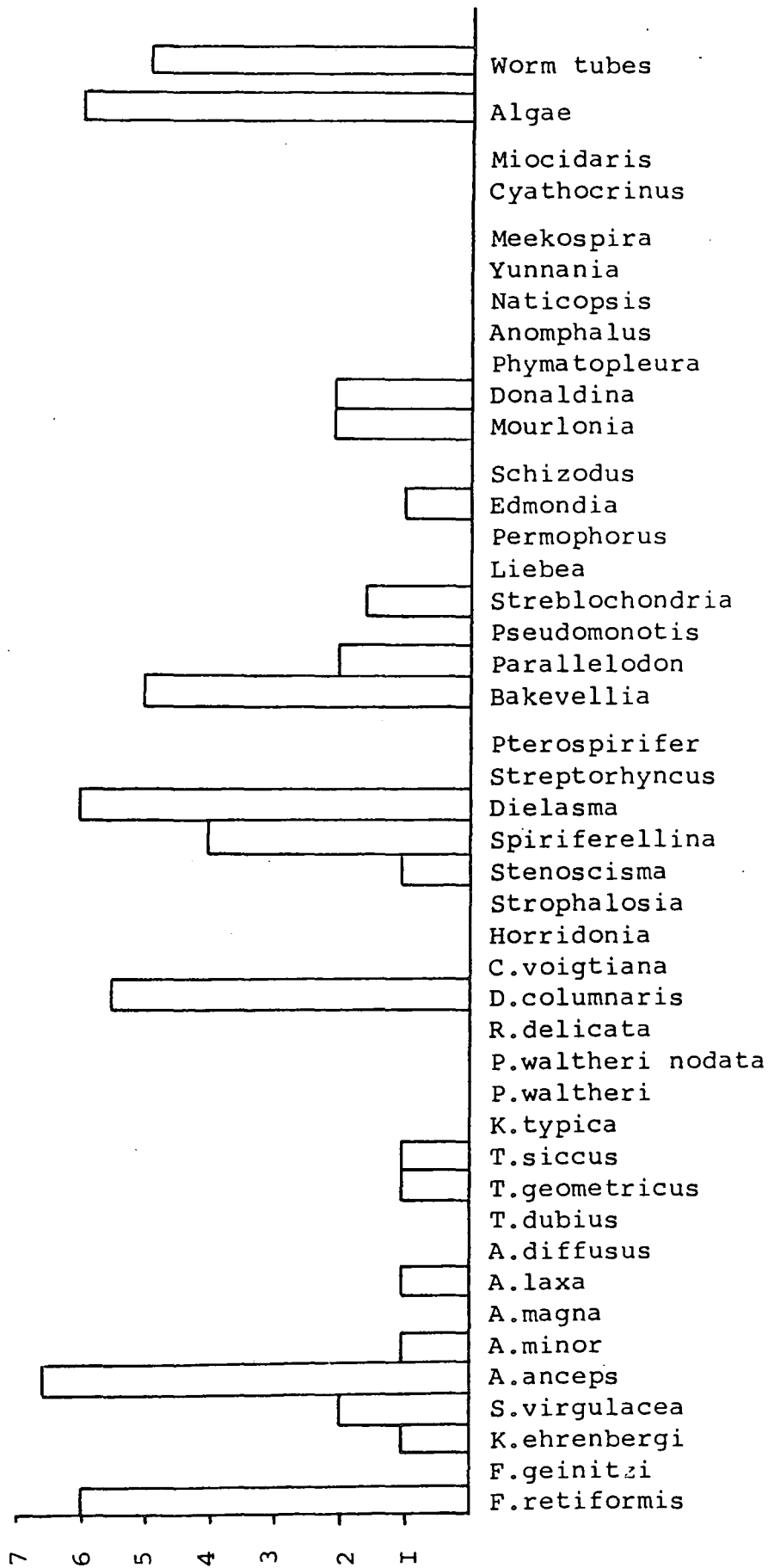


Figure 9I. Histogram of species abundances at locality SBC.

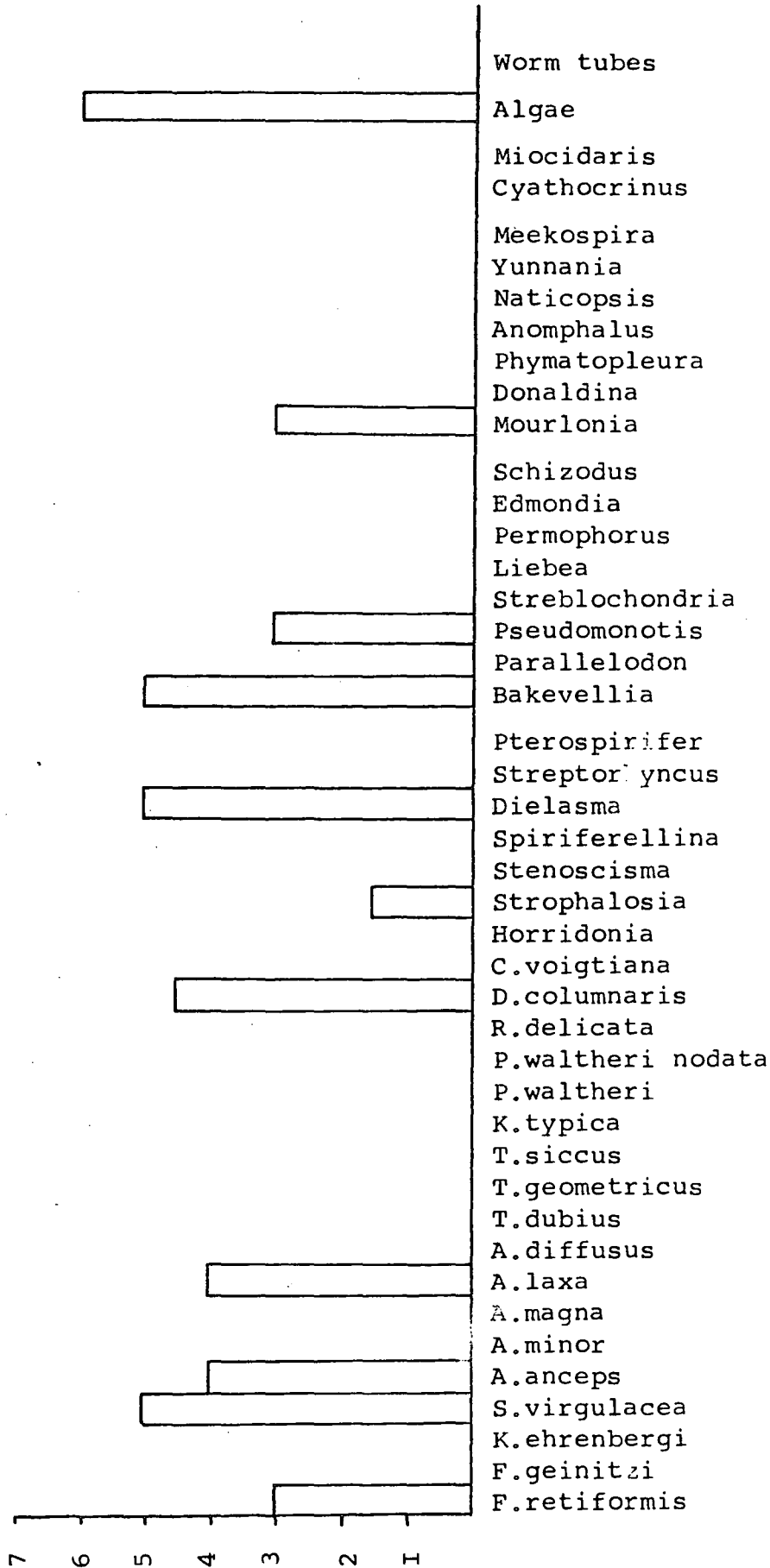


Figure 92. Histograms of species abundances at
locality HD.

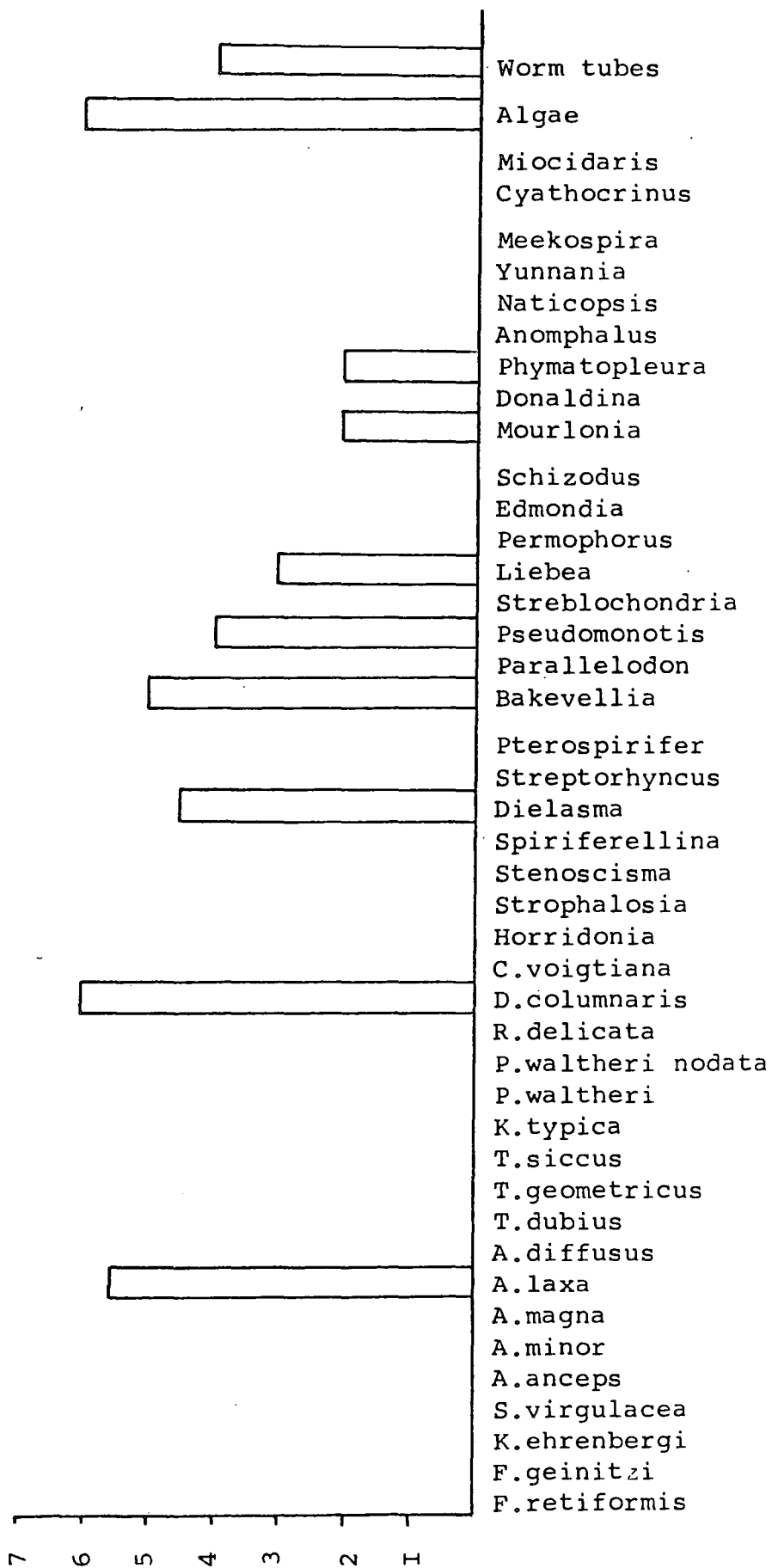


Figure 93. Histogram of species abundances at locality HTQ.

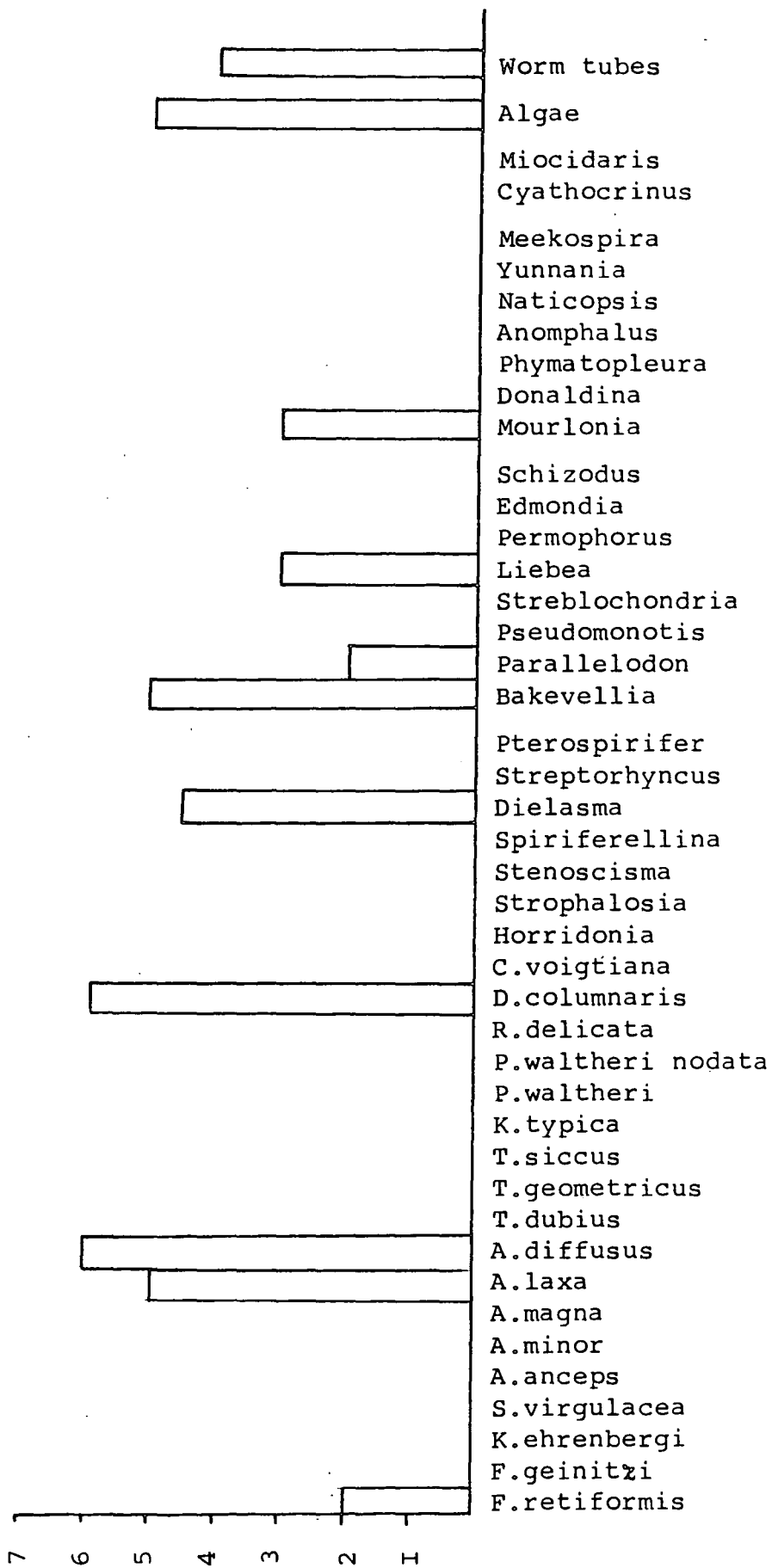


Figure 94. Histogram of species abundances at
locality GLT.

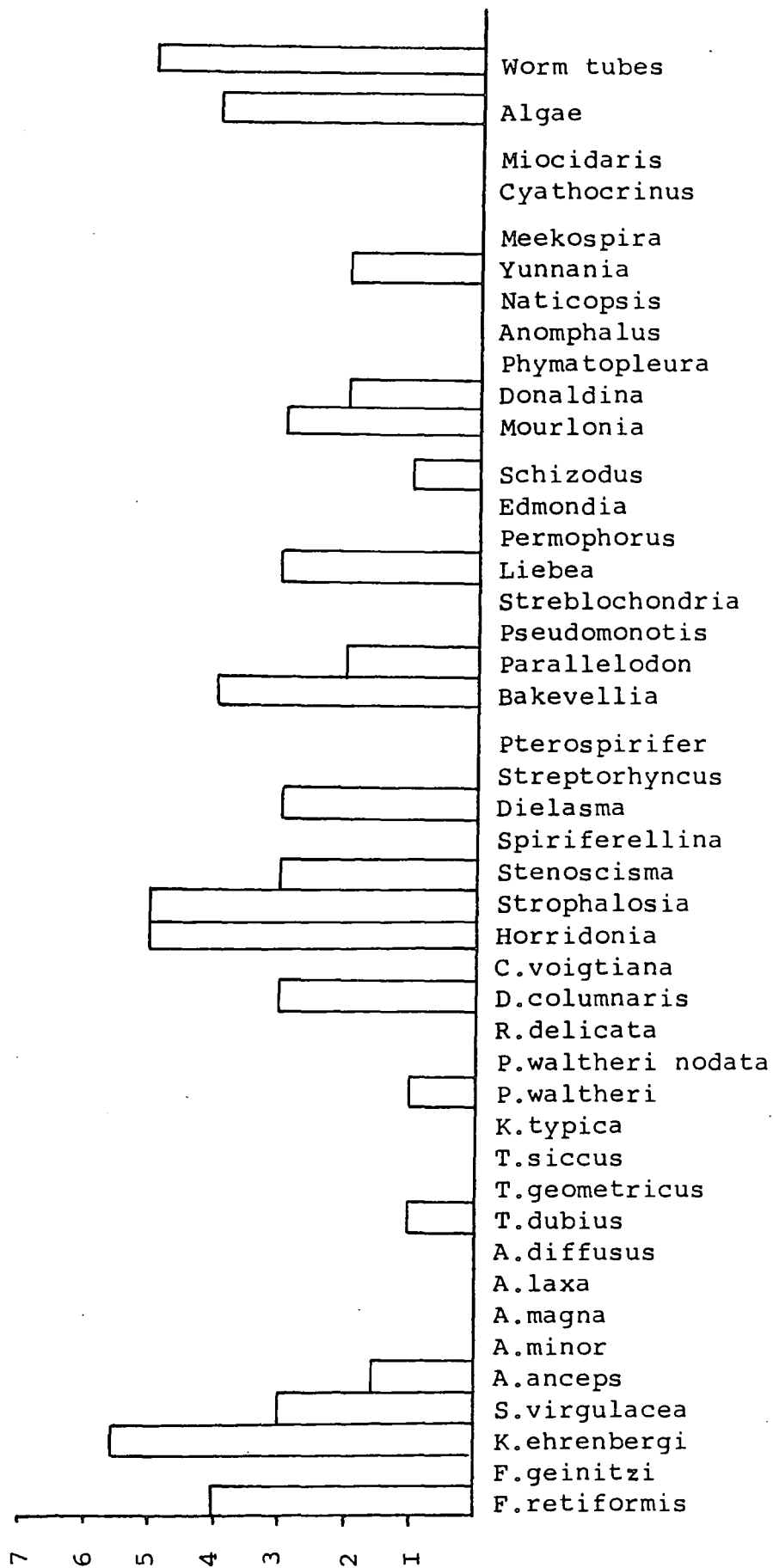


Figure 95. Histogram of species abundances at
locality GLQ.

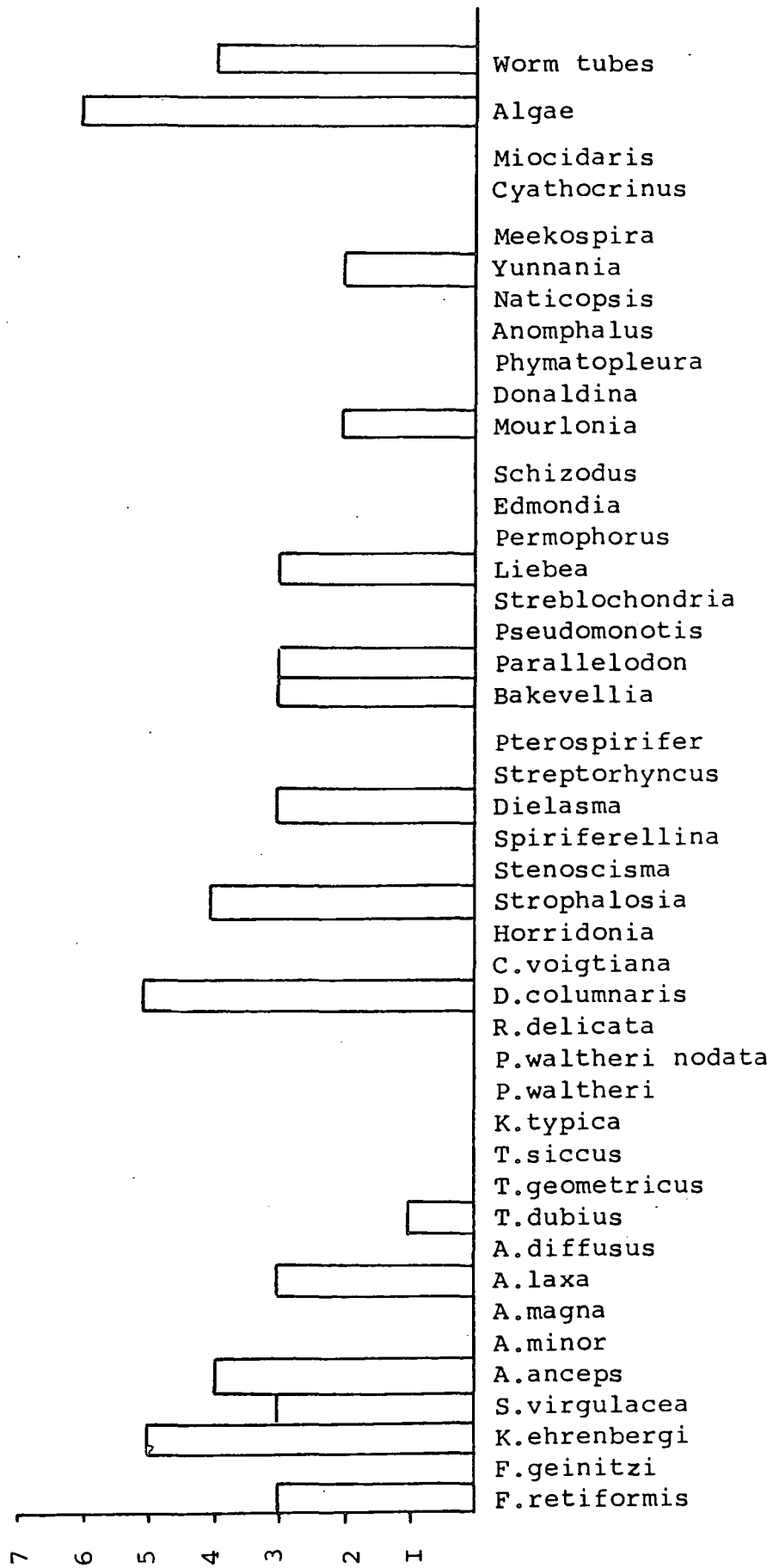


Figure 96. Histogram of species abundances at locality HN.

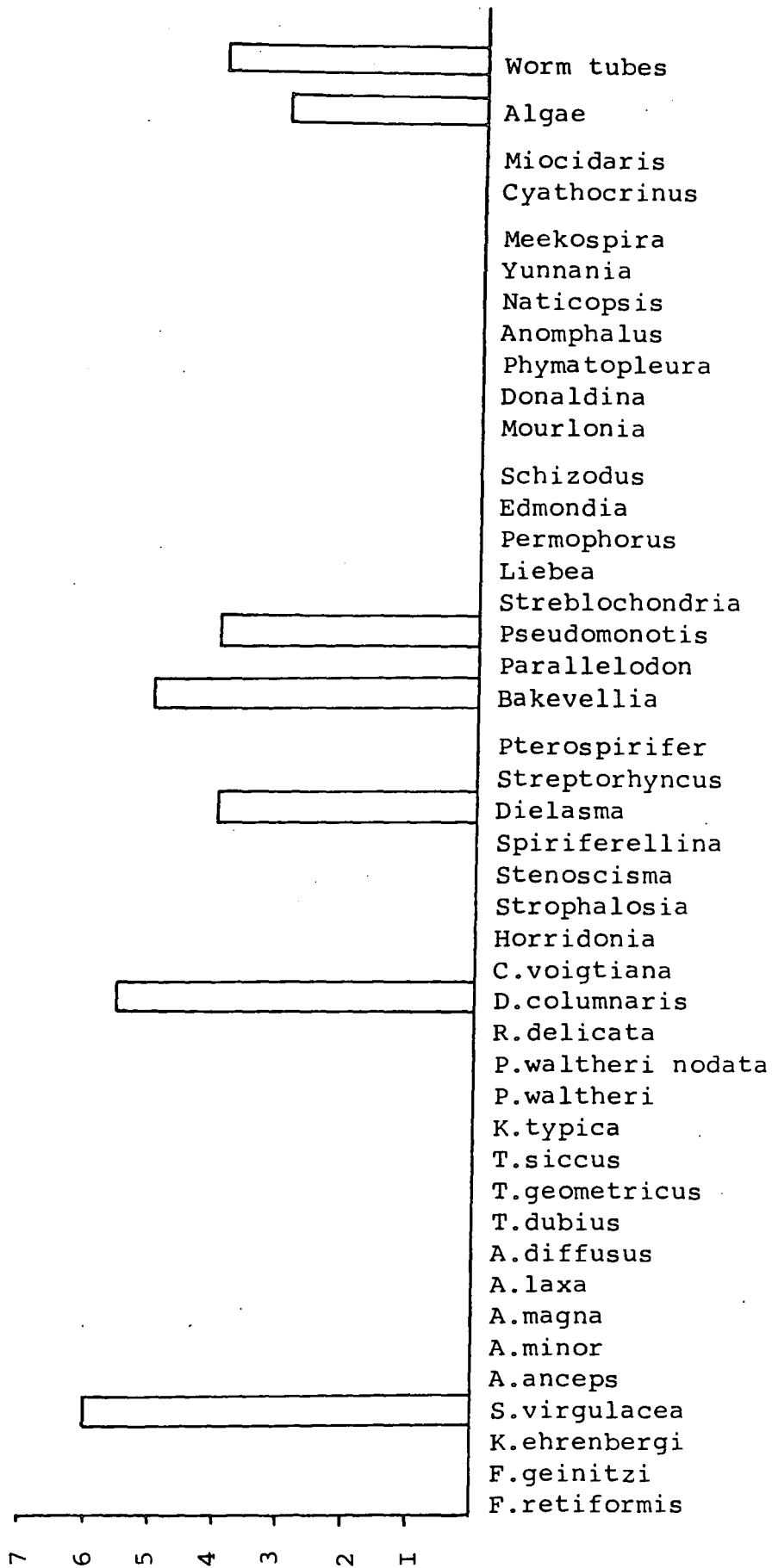


Figure 97. Lithified crust. Diagrammatic representation, see also Plates 53 and I36.

Unit "B" is the crust, averaging about 2cm. in thickness.

Unit "A" is above the crust and contains a relatively diverse fauna - a colony of Dyscritella encrusts the hardground but has been overgrown by a colony of Kingopora ehrenbergi (shown in outline drawing).

The lower surface of Unit "B" acts as substratum for algae and ?worm tubes which clearly grow downwards from the surface.

Unit "C" is interpreted as the former site of a crevice beneath the lithified crust - its base is not seen.

The heavy black lines represent the top and bottom of the lithified crust.

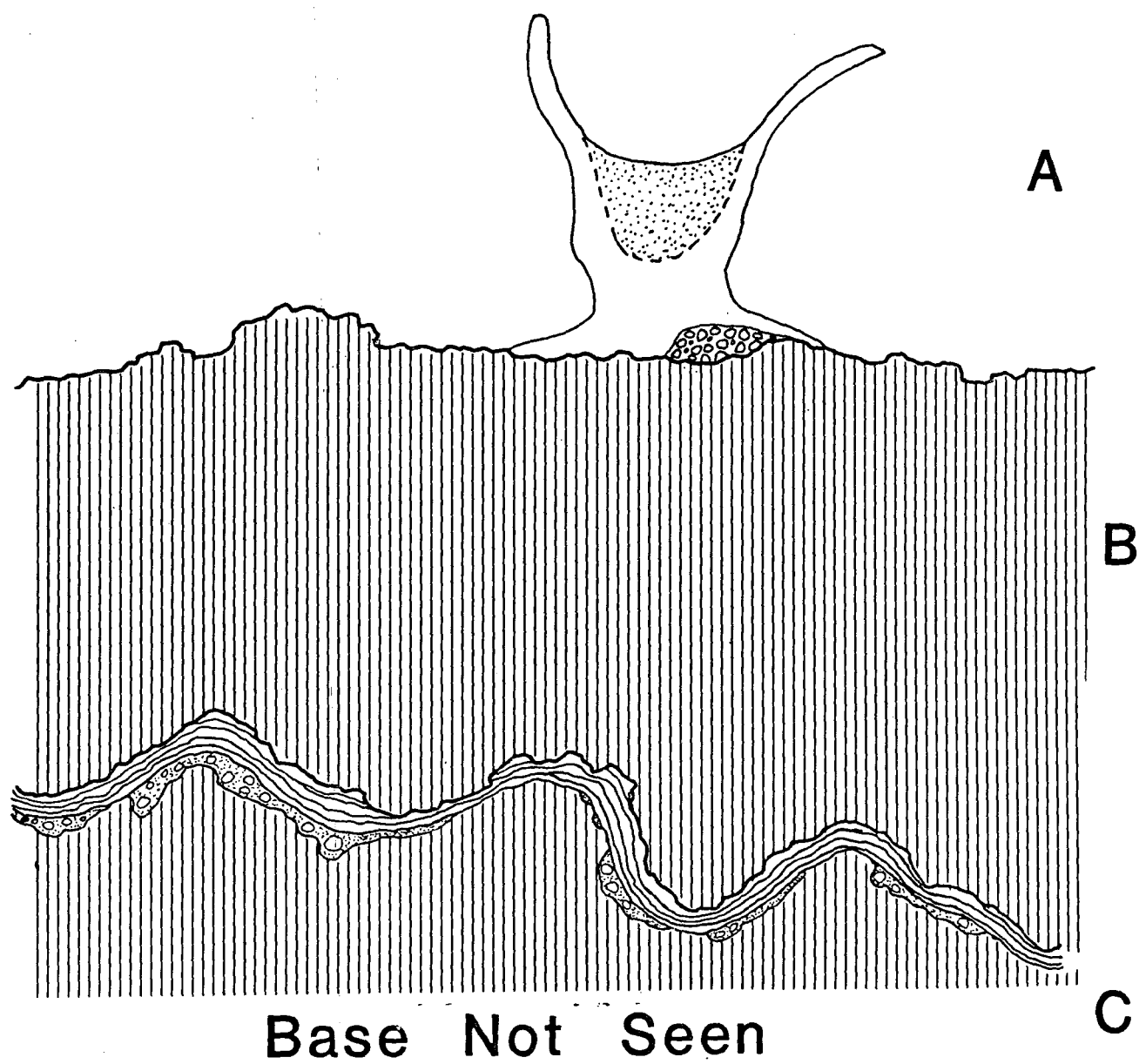


Figure 98. Schematic diagram of Synocladia virgulacea (MPI.80) to show growth of branches 'below' the level of the colony origin - thus demonstrating the existence of small scale topographic irregularities (see Pl.I37).

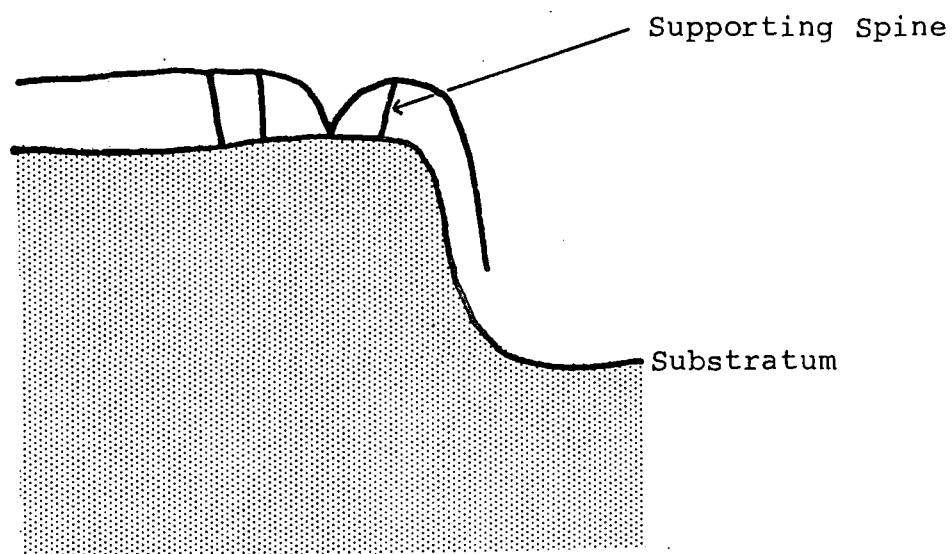


Figure 99. A. Cross-section through a bryozoan tentacle crown to show the passage of food particles (After Strathmann(1973)). Unbroken line= path of particle when bryozoan is not feeding. Broken line= path of particle retained during active feeding.

B. Cowen and Rider's (1972) model for active filter-feeding in fenestellids. Tentacle crowns are expanded laterally into fenestrules and draw a unidirectional current from the obverse to the reverse side, through the fenestrules. See p.351 for discussion.

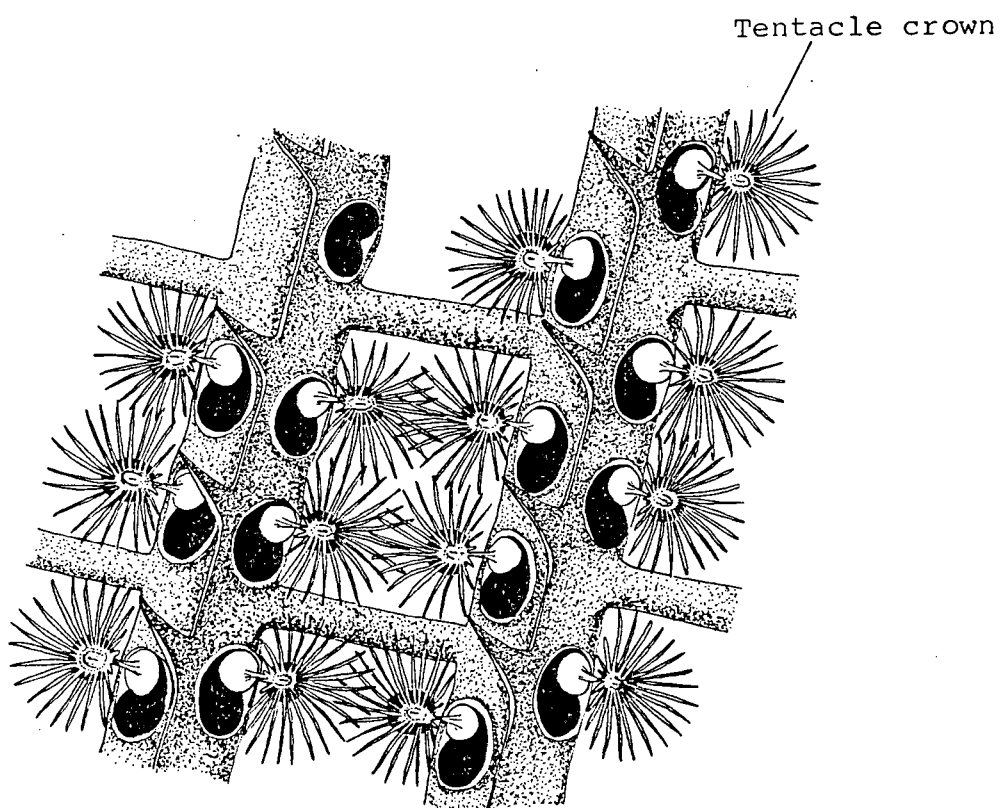
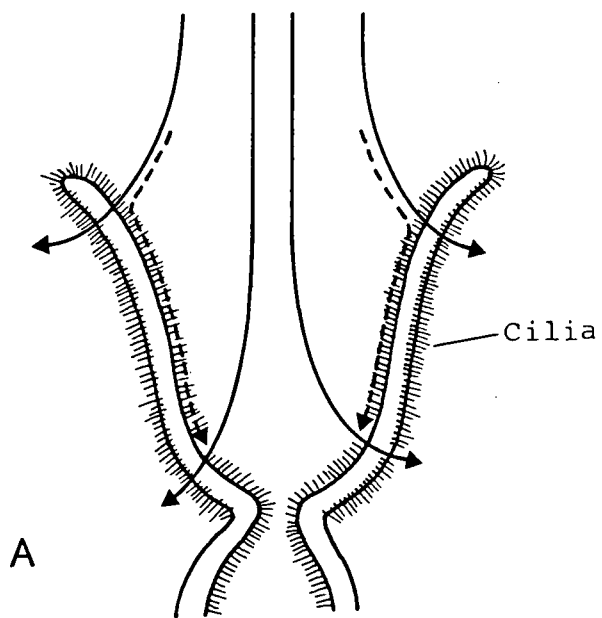
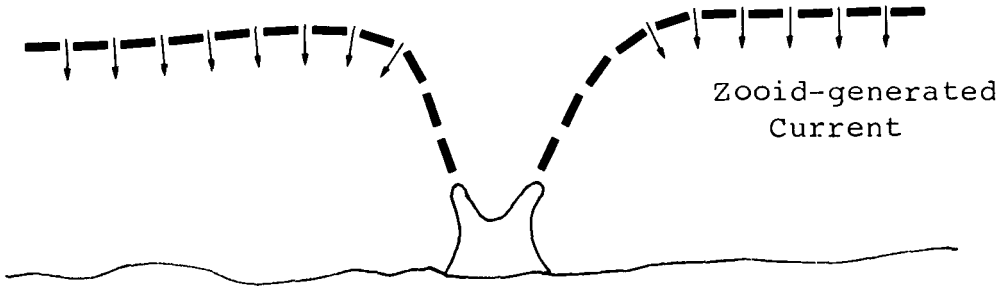


Figure 100. Zooid-generated currents in relation to unidirectional ambient currents for colonies of Fenestella retiformis (assuming filtering from the obverse to the reverse surface).

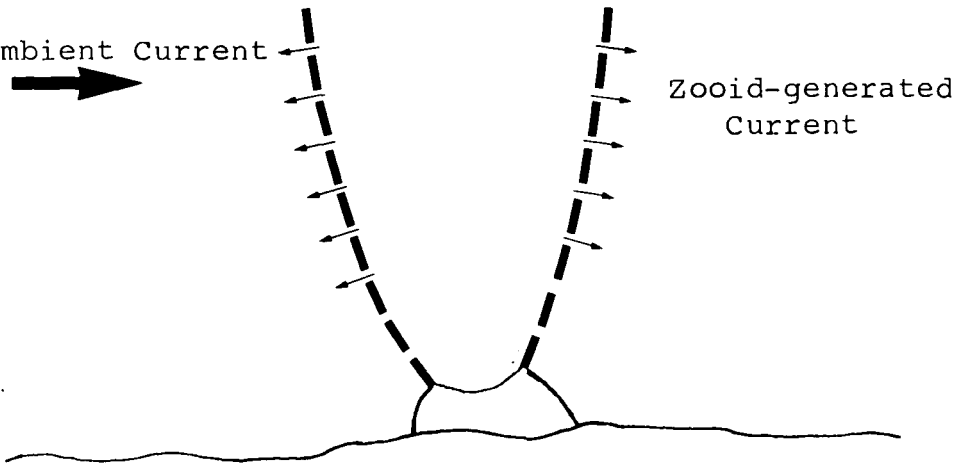
- A. When the zoarium forms a sub-horizontal expansion tentacle crowns are on the upper surface and zooid-generated flow is relatively unperturbed by high energy ambient currents.
- B. When the zoarium forms a steeply erect cone, ambient currents impinging on the reverse surface may disrupt zooid-generated flow over a substantial part of the zoarium.

Ambient Current



A

Ambient Current

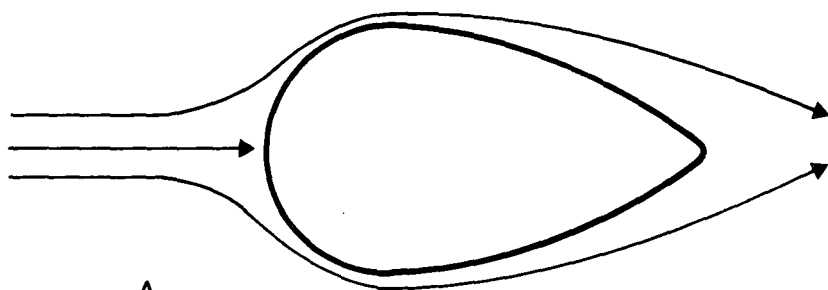


B

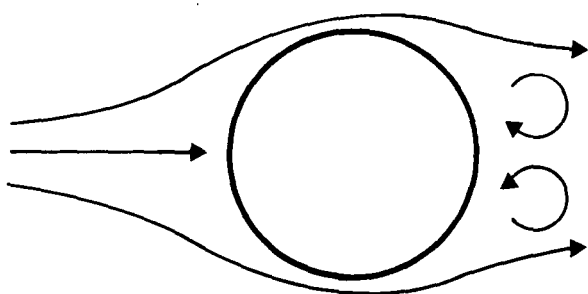
Figure IOI. Flow around various shaped bodies.
Reynolds number approx.=10.
(From Michell (1970)).

- A. Streamlined body - laminar flow maintained.
- B. Cylindrical body - eddies develop on the lee-side.
- C. Flat disc - eddies develop on the lee-side.

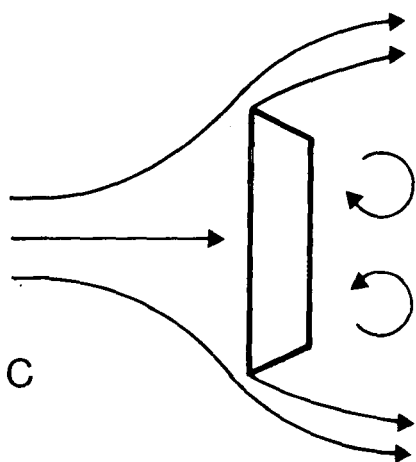
The maintenance of eddies on the lee-side requires energy which is derived from the main stream.



A

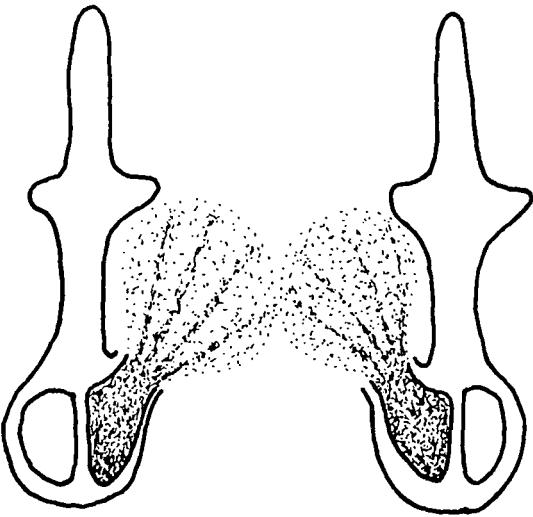


B



C

Figure IO2. Transverse section of branches of Fenestella retiformis showing two zooids with tentacles protruded into the fenestrule. Drawn to scale to allow estimation of probable tentacle crown size.



0.5mm

Figure IO3. The relative cross-sectional areas of the open ends of zoaria of Kingopora ehrenbergi - one a perfect cone, the other bilaterally compressed. With the same circumference in each case a perfect cone has a much larger cross-sectional area. Assuming the same pressure head, the velocity of flow through the smaller area is greater.

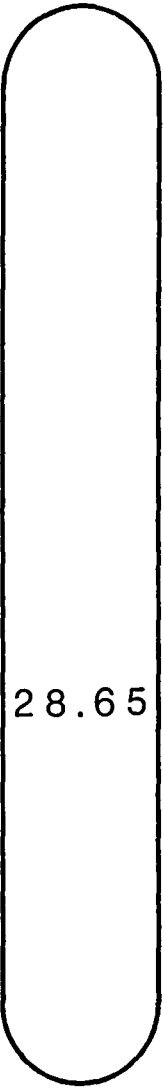
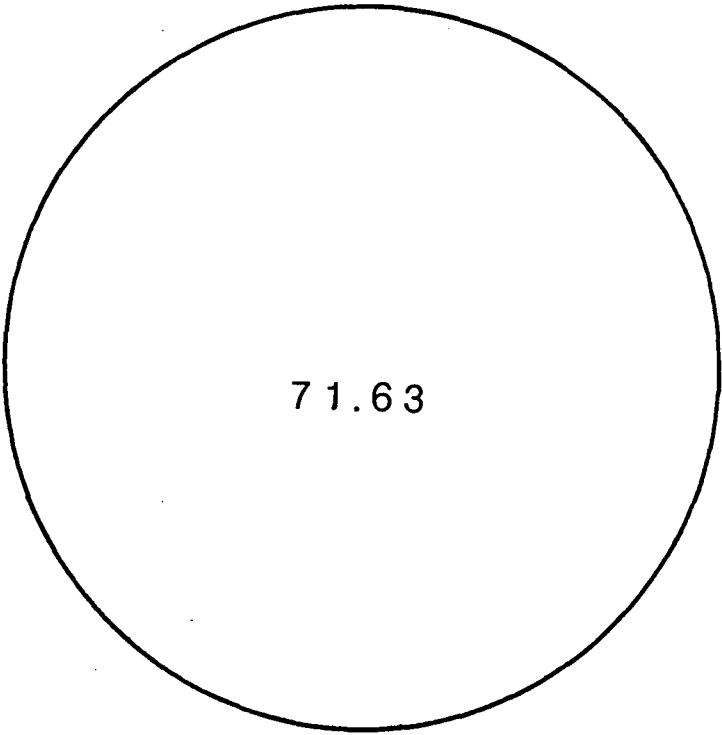


Plate I. Fenestella retiformis Schlotheim

Fig.a Sub-horizontal expansion of a zoarium.
HYR 5.Bar scale-1cm

Fig.b Zoarial morphology - festoons well-developed.
B34.Bar scale-1cm

Fig.c Zoarial morphology - festoons well-developed.
B42.Bar scale-3cm

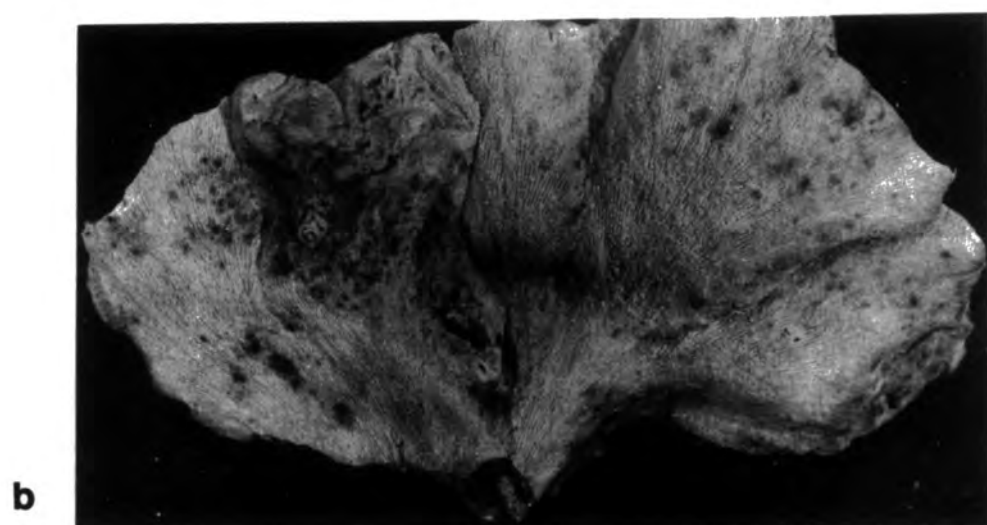
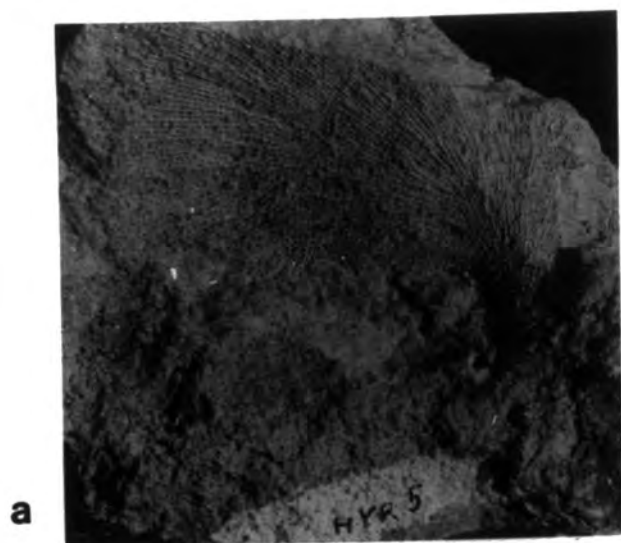


Plate 2. Fenestella retiformis Schlotheim

- Fig.a Zoarial morphology-festoons well-developed.
HAI.Bar scale-Icm
- Fig.b Spines clustered around the zoarial
origin.Silicone mould of specimen B27.
Bar scale-Icm
- Fig.c Zoarial morphology showing a small area
with constricted fenestrules (arrowed).
HM2.Bar scale-Icm

a



b



c



Plate 3. Fenestella retiformis Schlotheim

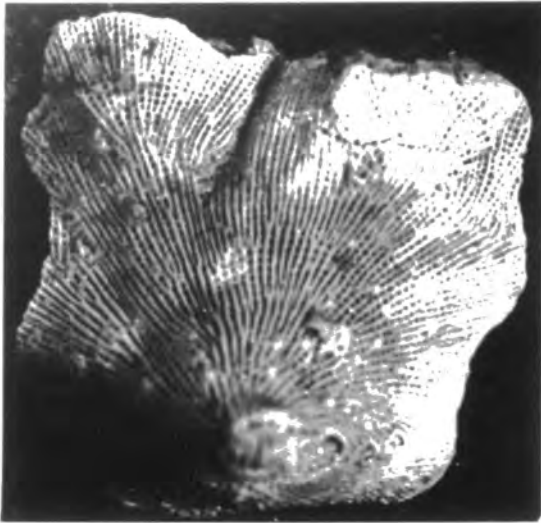
Fig.a Intra-zoarial fusion of branches.
HAW80.Bar scale-Icm

Fig.b Intra-zoarial fusion of branches.
HAW55.Bar scale-Icm

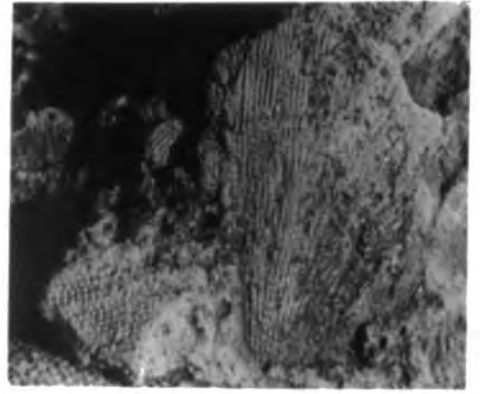


Plate 4. Fenestella retiformis Schlotheim

- ✓
Fig.a The occurrence of several branch bifurcations at the same level in the zoarium causes crowding of branches. Colony-wide increase in bifurcations may be related to exogenous factors. BI2I. Bar scale=Icm
- Fig.b Growth of branches at right angles to the main colony growth direction. HA7. Bar scale=Icm
- Fig.c Fusion of the opposite ends of a spiral zoarial lamina. MPI.63. Bar scale=Icm
- Fig.d Branches at a high angle to the main growth direction (arrowed). B35A. Bar scale=Icm



a



b



c



d

Plate 5. Fenestella retiformis Schlotheim

Fig.a Fusion of the branches of two separate colonies of the species.HA20.Bar scale=Icm

Fig.b Detail of above!Bar scale=Icm

a



b

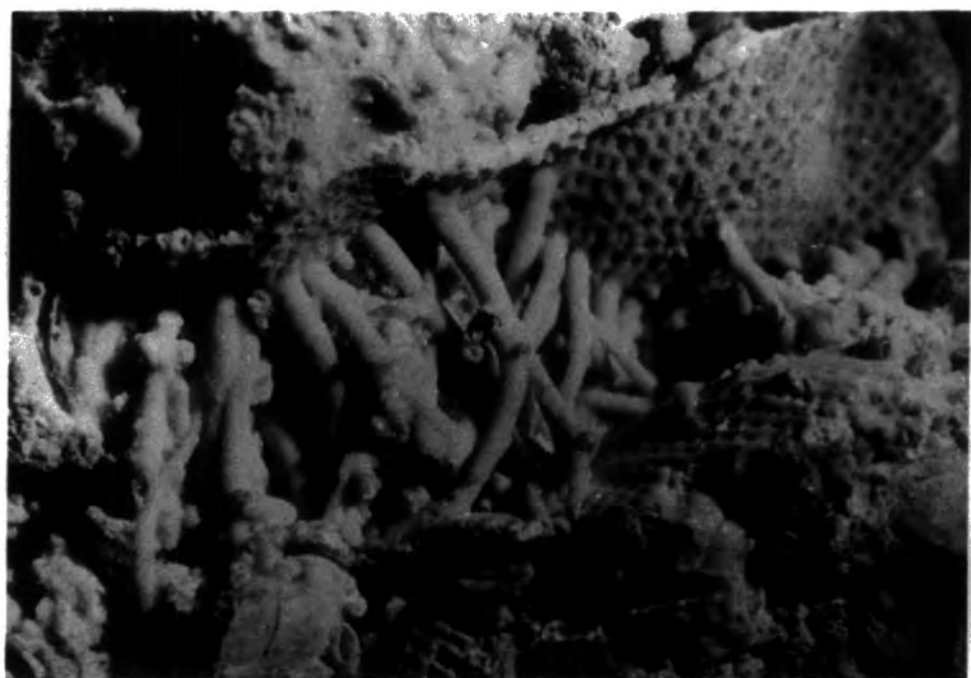


Plate 6. Fenestella retiformis Schlotheim

Fig.a Numerous densely-spaced spines joining two zoarial laminae(probably of separate colonies).G3.55.I.Bar scale=Icm

Fig.b Zoarium showing moulds of spines which link adjacent zoarial laminae.
B28.Bar scale=Icm

a



b

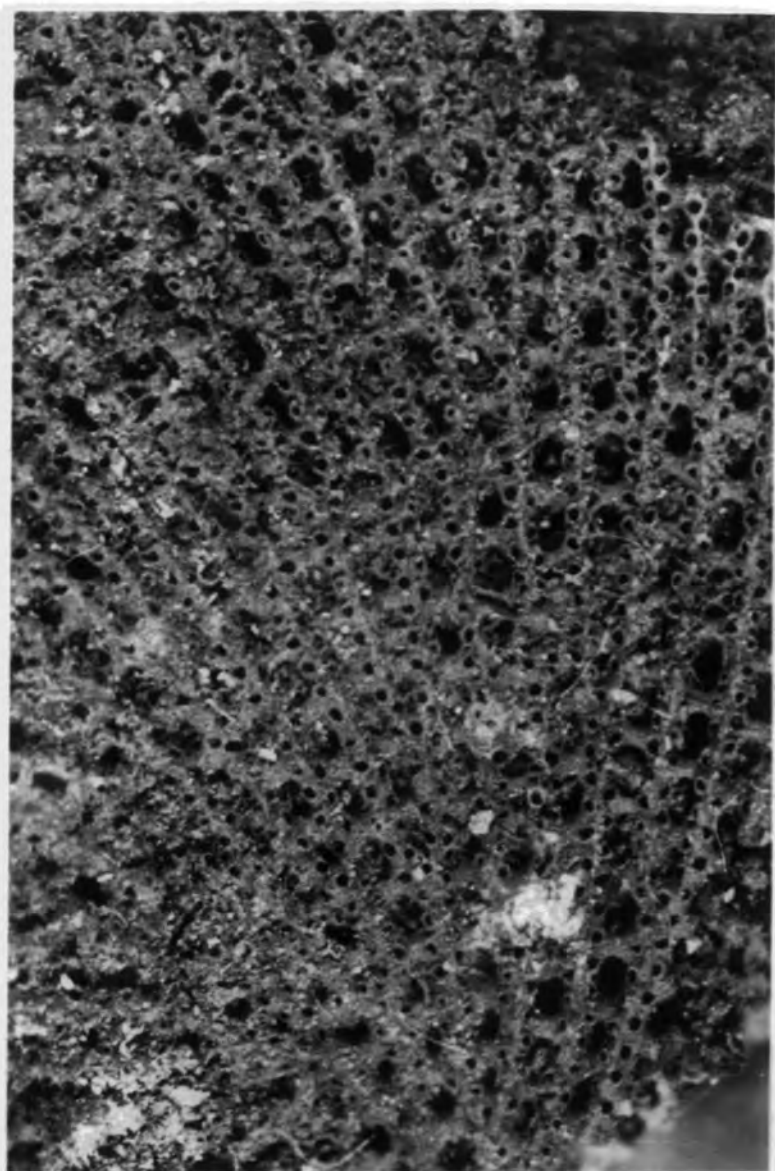


Plate 7. Fenestella retiformis Schlotheim

Fig.a Obverse surface detail.RH2.24.
Bar scale=Imm

Fig.b S.E.M. photomicrograph.Obverse surface.
RH2.24.Bar scale=Imm

a



b



Plate 8. Fenestella retiformis Schlotheim

- Fig.a S.E.M. photomicrograph. Obverse surface.
Nanate zooecium is visible in the centre
of the figure, proximal to the bifurcation.
RH2.24. Bar scale=Imm
- Fig.b As above, showing nanate zooecium.
Bar scale=0. Imm
- Fig.c Obverse surface detail. BIO2D.
Bar scale=Imm

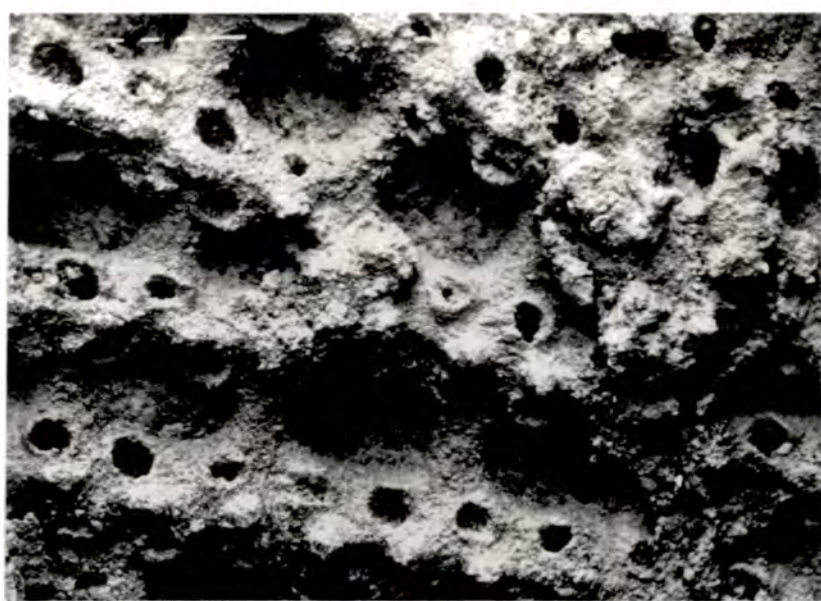


Plate 9. Fenestella retiformis Schlotheim

Fig.a Transverse section showing the highly developed node with lateral projections. GLFI. Bar scale=0.5mm

Fig.b Transverse section. MP5.48. Bar scale=Imm

Fig.c As above at higher magnification, showing bifurcation of a node. Bar scale=0.5mm

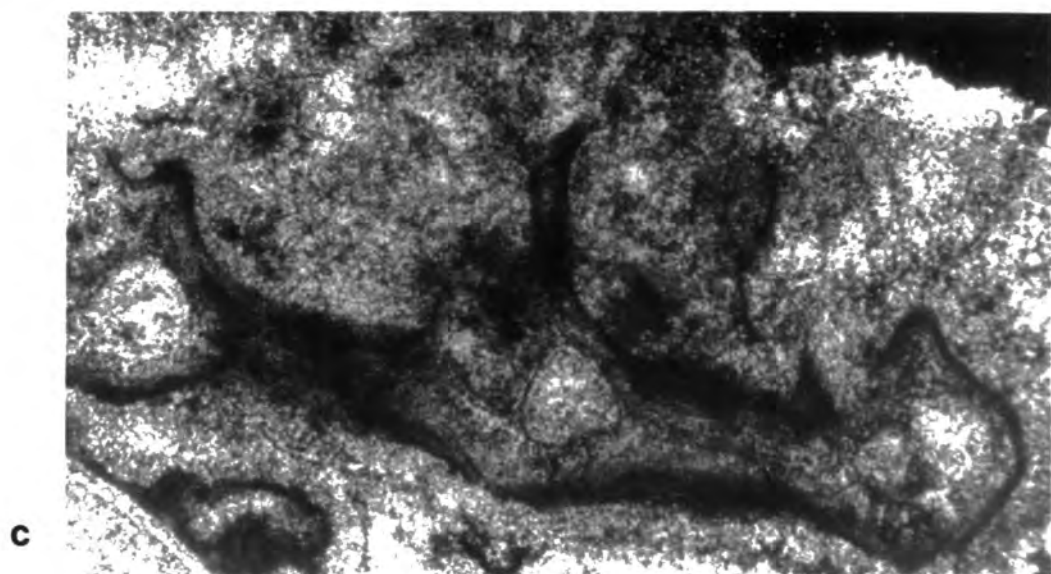
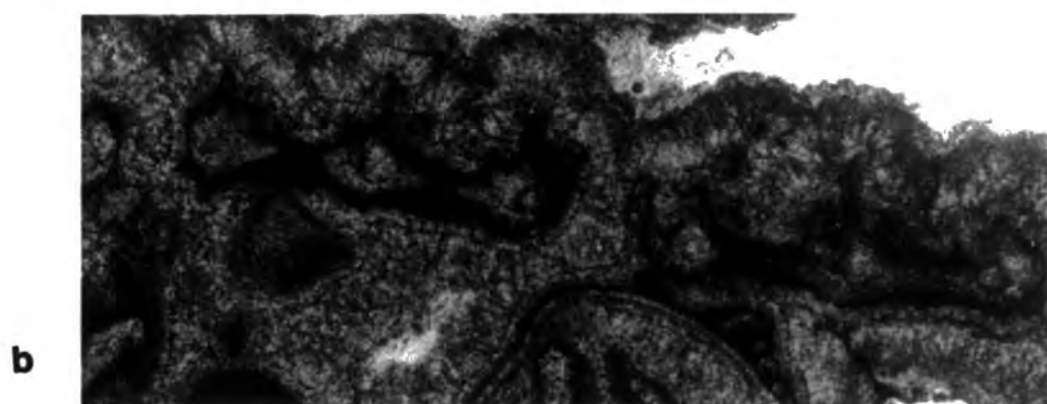
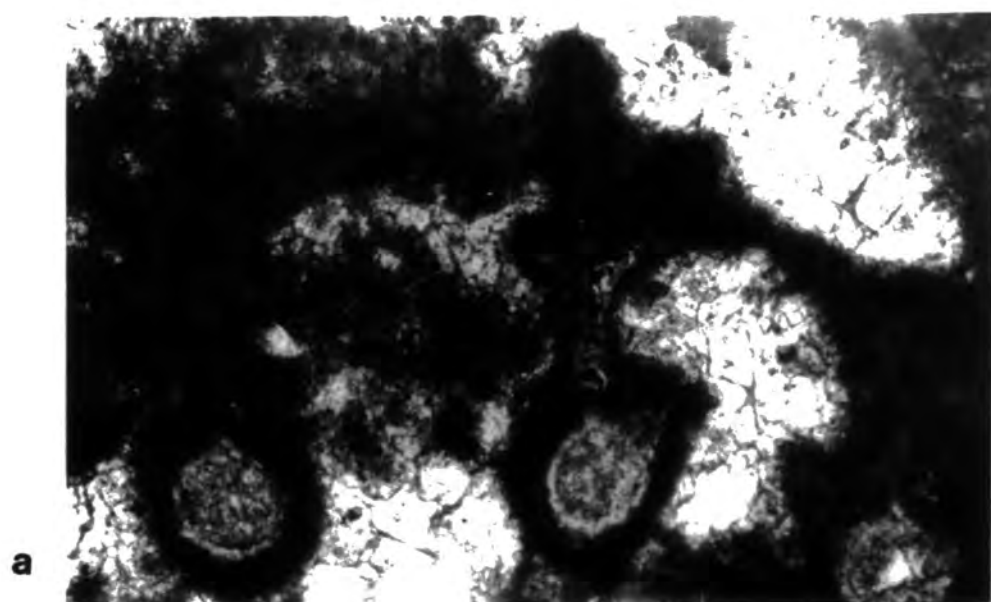
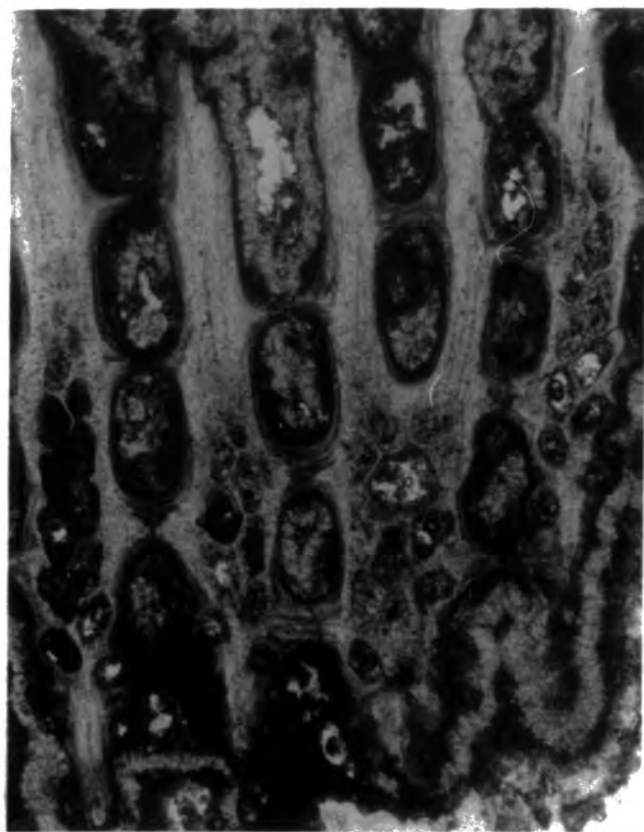


Plate IO. Fenestella retiformis Schlotheim

Fig.a Oblique tangential section, showing kenozoecium
proximal to branch bifurcation.MP5/5.
Bar scale=Imm

Fig.b As above at higher magnification.
Bar scale=0.Imm

a



b

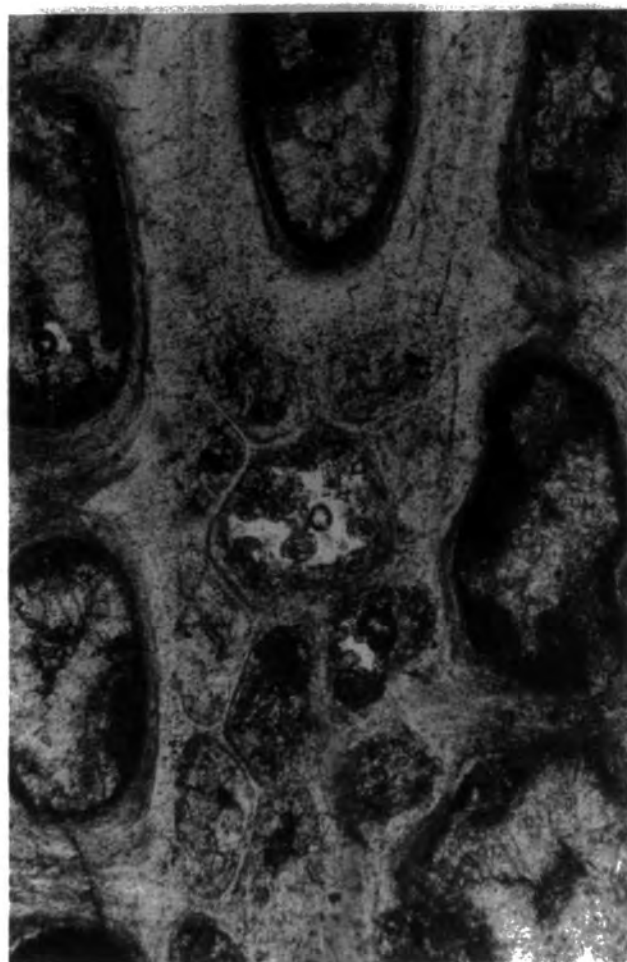
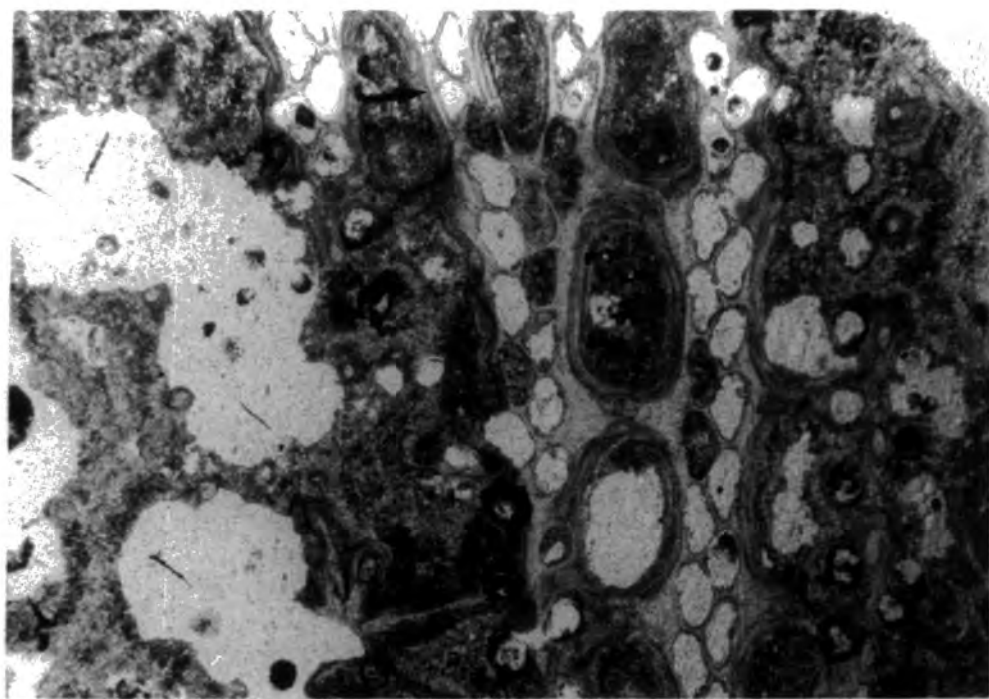
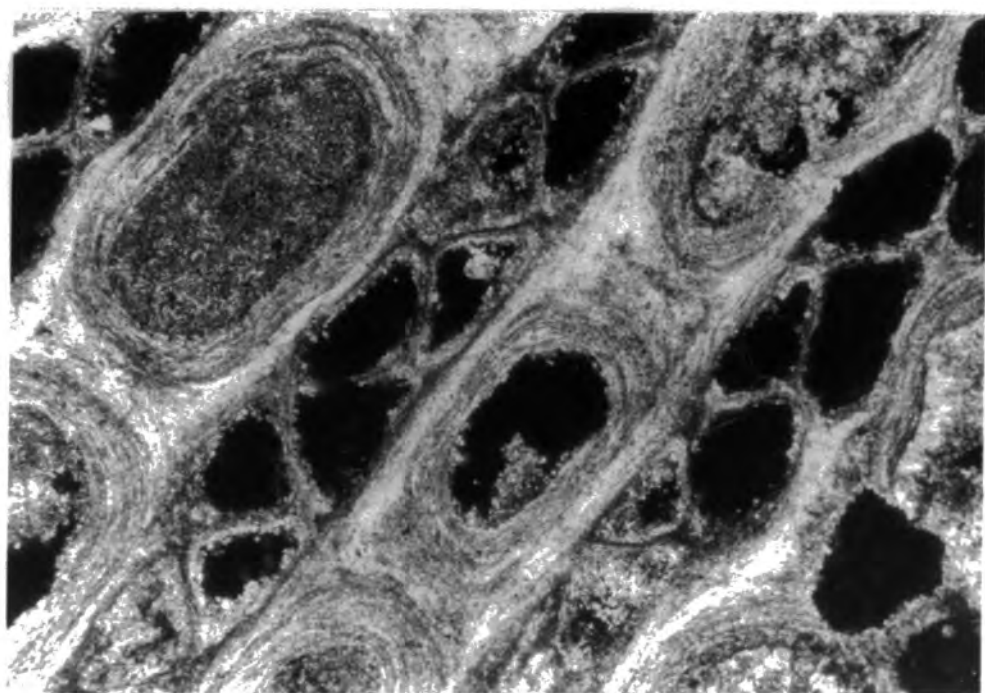


Plate II. Fenestella retiformis Schlotheim

- Fig.a Slightly oblique tangential section.
Partition at the distal end of a zooecium
arrowed. The proximal margin of the specimen
shows processes developed around carinal
nodes. MP5.29. Bar scale=Imm
- Fig.b Tangential section, showing zooecial chamber
base shape and elements of the microstructure
visible in crossed polars. MP5.29.XPL.
Bar scale=0.Imm



a



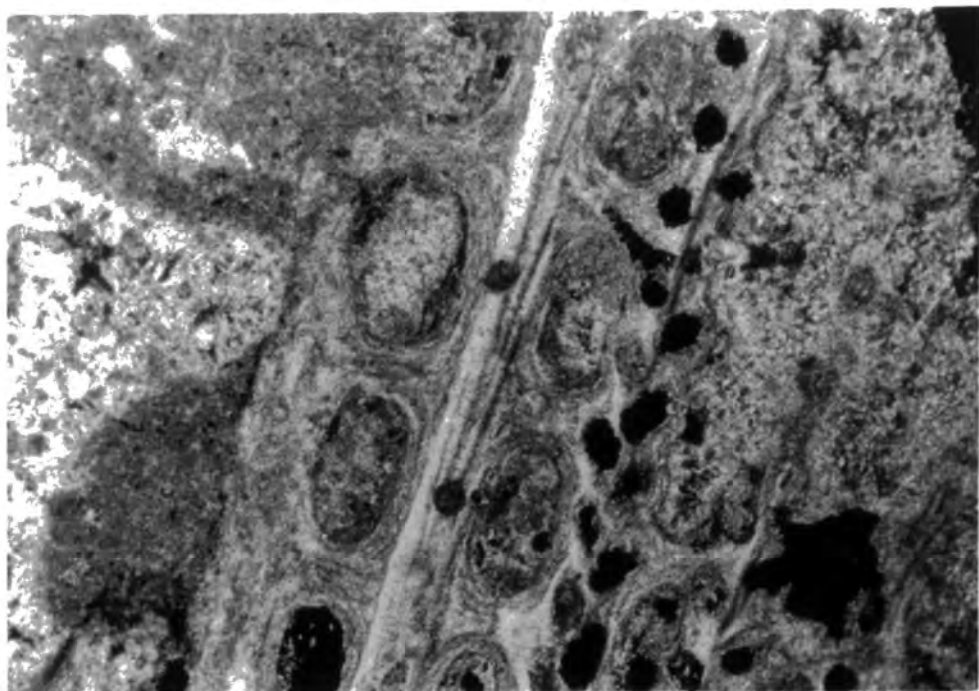
b

Plate I2. Fenestella retiformis Schlotheim

Fig.a Oblique tangential section showing two
 borings which cut through the longitudinal
 striae(cf.accessory pores).MP5.29.XPL.
 Bar scale=Imm

Fig.b As above at higher magnification.
 Bar scale=0.Imm

a



b

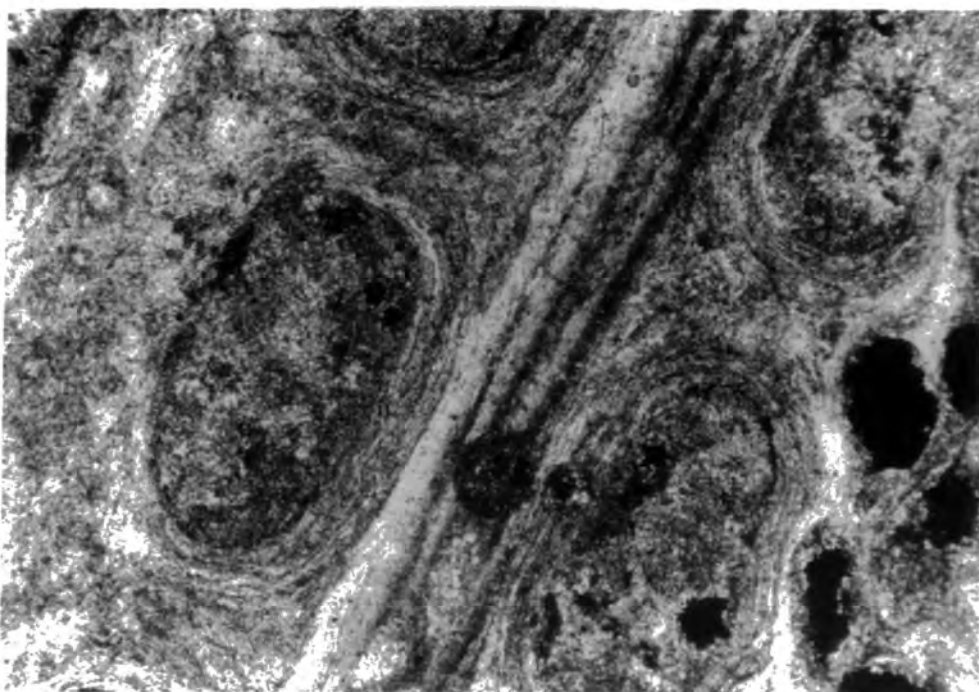
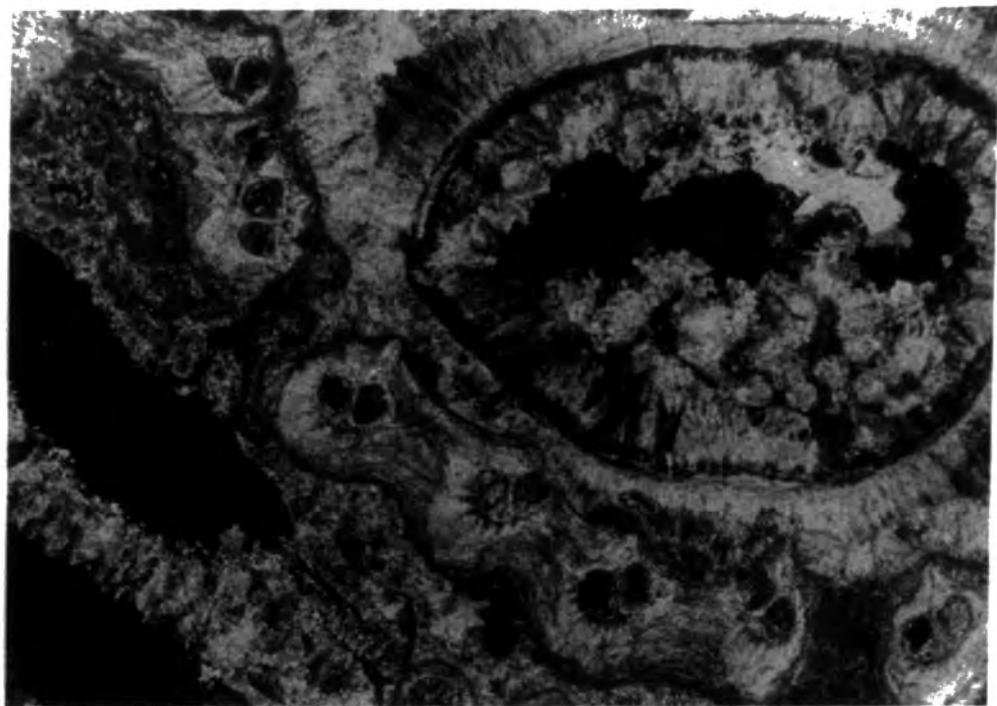


Plate I3. Fenestella retiformis Schlotheim

Fig.a Transverse section.MP5.62.XPL.
Bar scale=Imm

Fig.b Transverse section showing the extent
of the 'inner platy core'(in extinction).
MP5/3.XPL.Bar scale=0.Imm

a



b

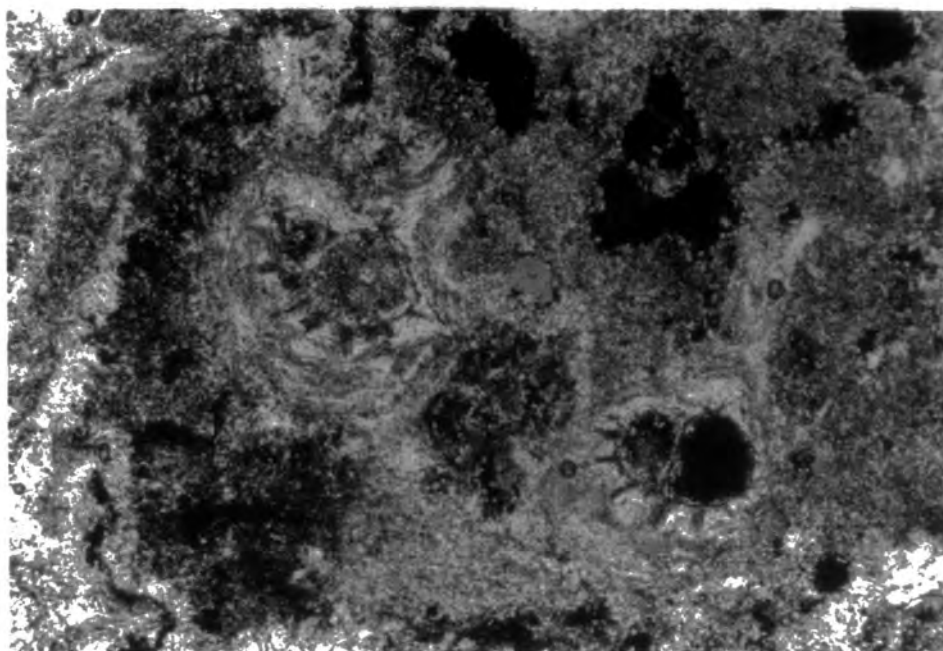


Plate I4. Fenestella retiformis Schlotheim

Fig.a Transverse section showing the distinction between primary granular layer and outer laminated layer.MP5 FI.Bar scale=0.Imm

Fig.b As above in crossed polars.

Fig.c Transverse section.MP5 FI.Bar scale=Imm

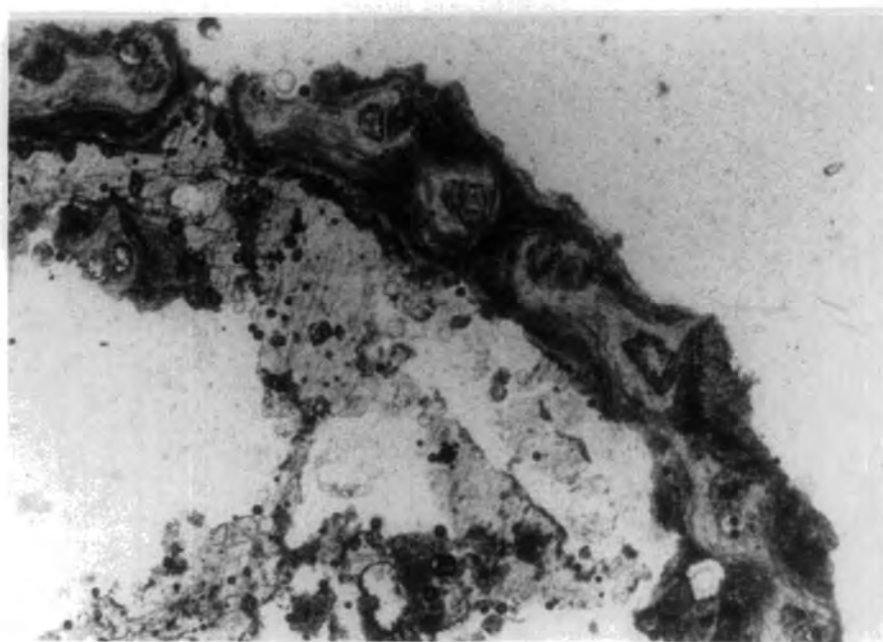
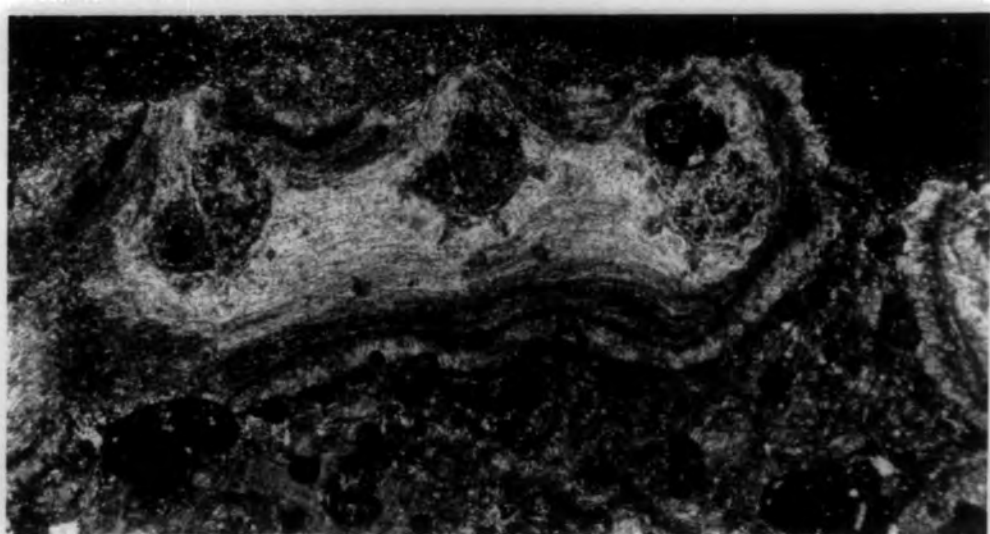
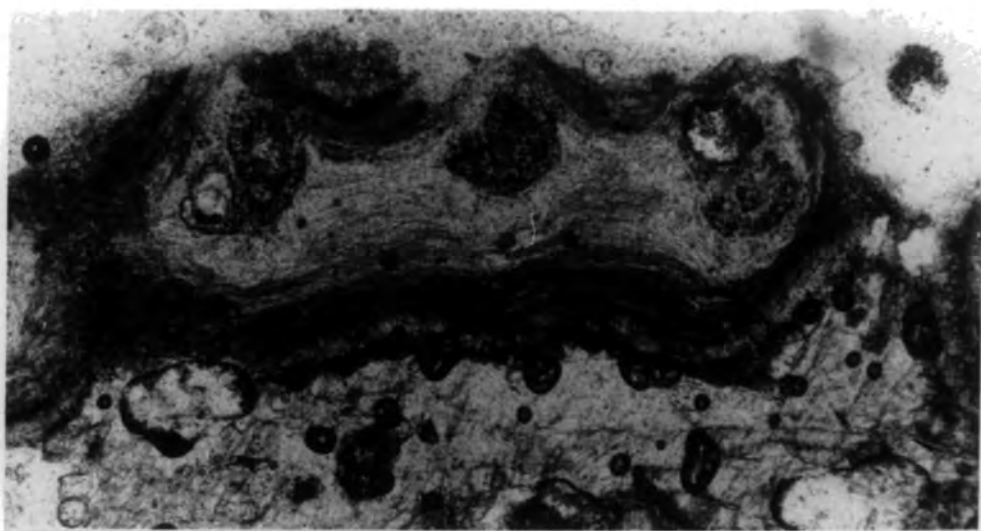


Plate I5. Fenestella retiformis Schlotheim

Fig.a Transverse section showing traces of laminar structure within the primary granular layer.
MP5 FI.Bar scale=0.1mm

Fig.b As above in crossed polars.

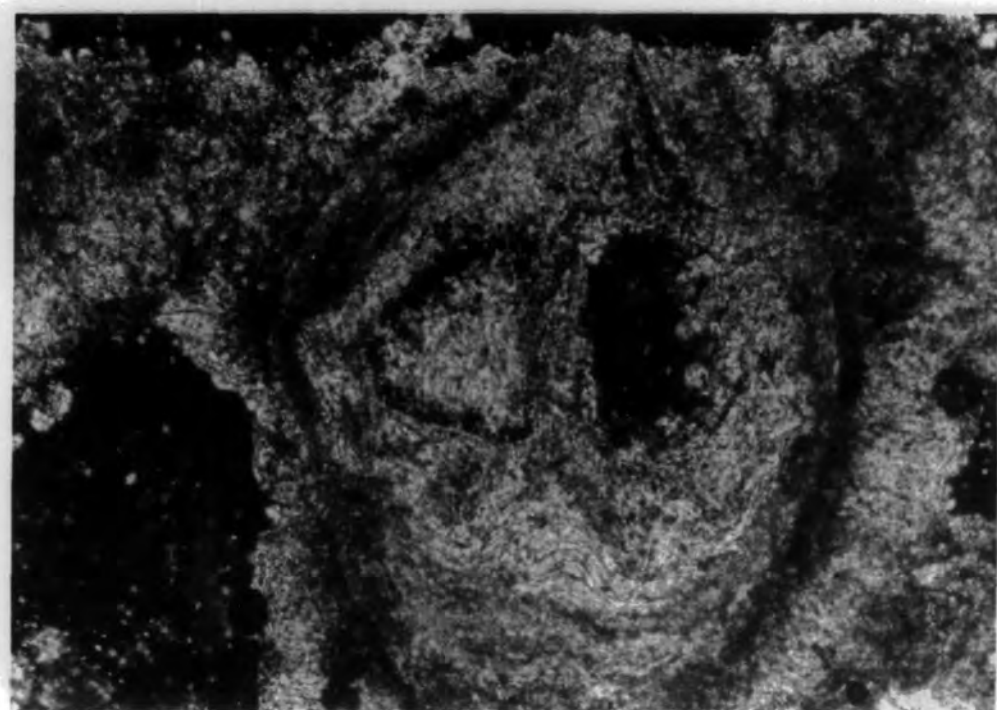
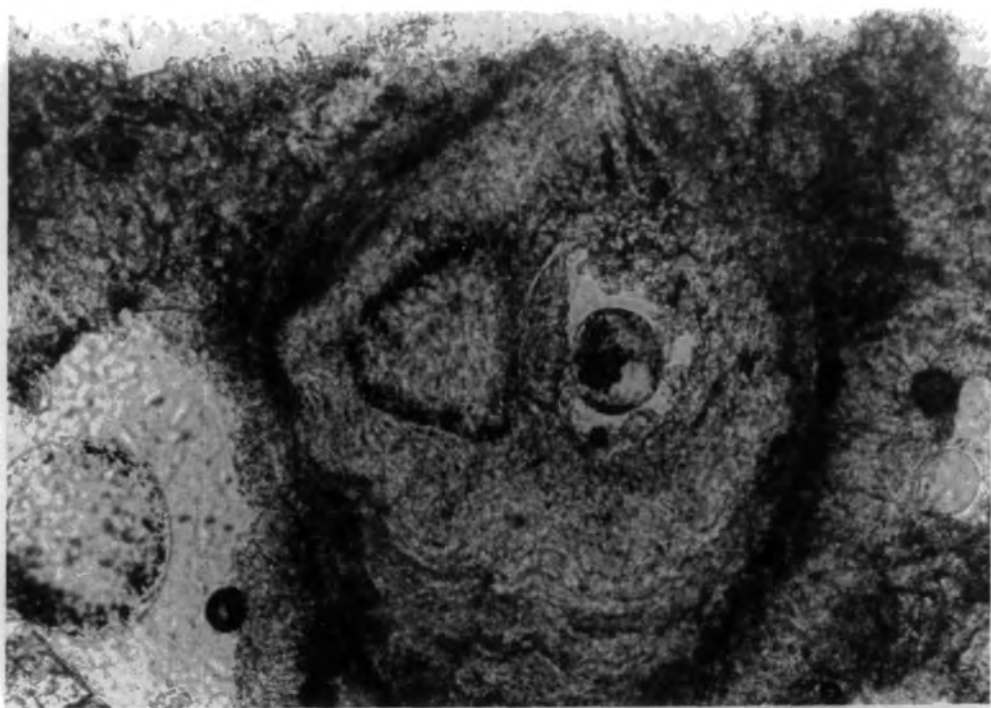
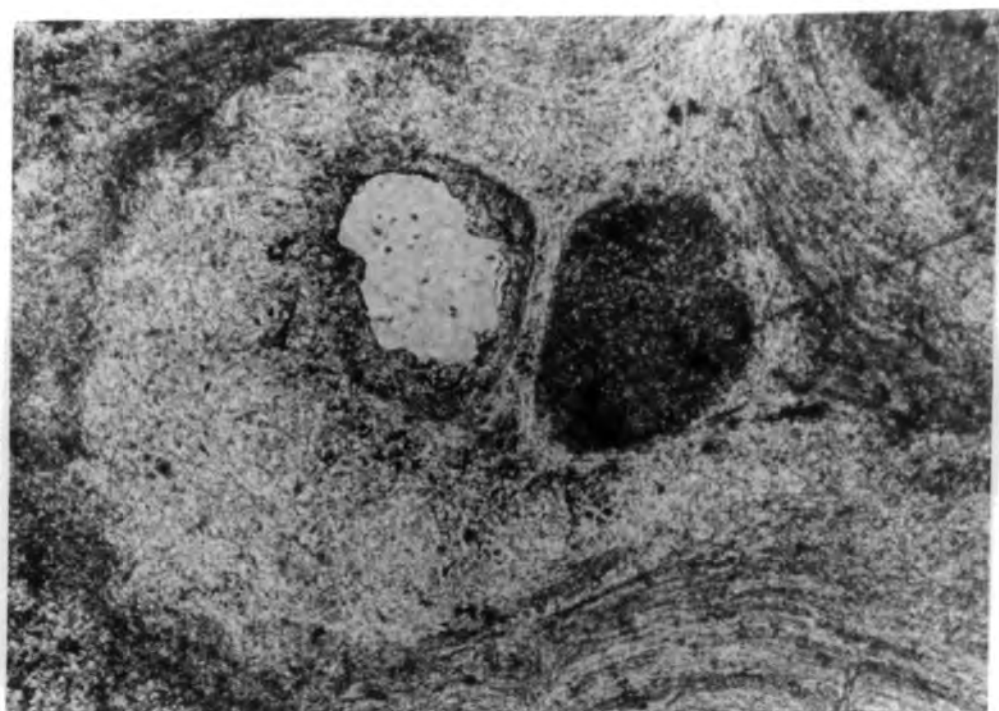


Plate I6. Fenestella retiformis Schlotheim

Fig.a Transverse section showing fine dark granules
within the 'inner platy core'.MP5.62.
Bar scale=0.1mm

Fig.b As above in crossed polars.

a



b

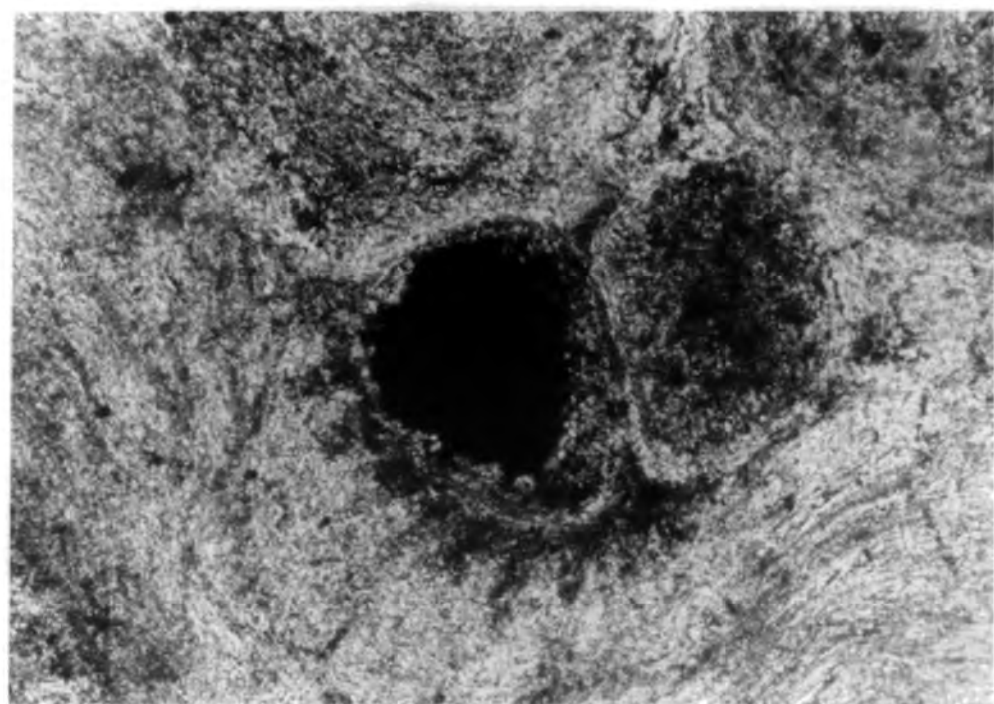


Plate I7. Fenestella retiformis Schlotheim

Fig.a Longitudinal section which shows the irregularity of the boundary between the primary granular layer and the outer laminated layer.MP5.50.

Bar scale=0.5mm

Fig.b Longitudinal section showing deflection of laminae around a presumed skeletal rod (centre bottom of figure).MP5.52a.

Bar scale=0.1mm

a



b

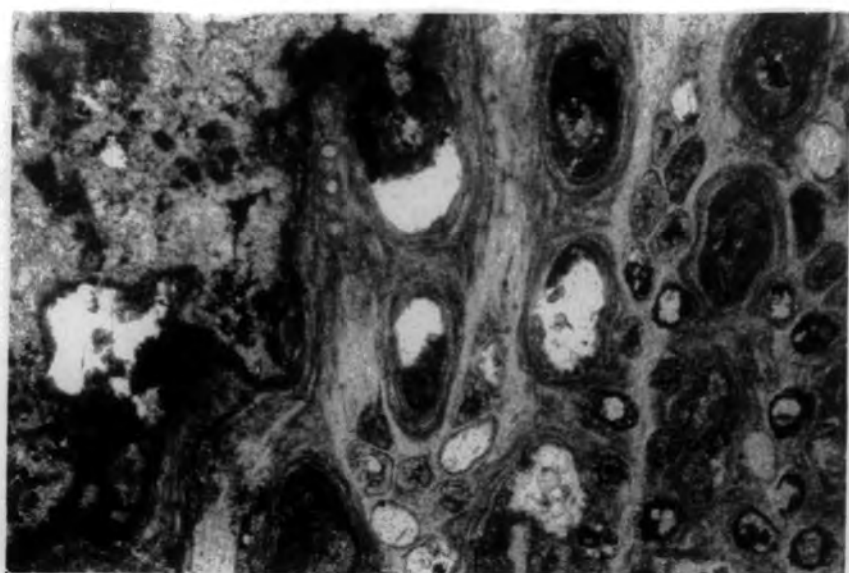


Plate I8. Fenestella retiformis Schlotheim

Fig.a Oblique tangential section showing three
reverse surface nodes.MP5.29.
Bar scale=Imm

Fig.b As above at higher magnification.The nodes
have a granular core surrounded by laminated
skeleton.Bar scale=0.5mm

a



b

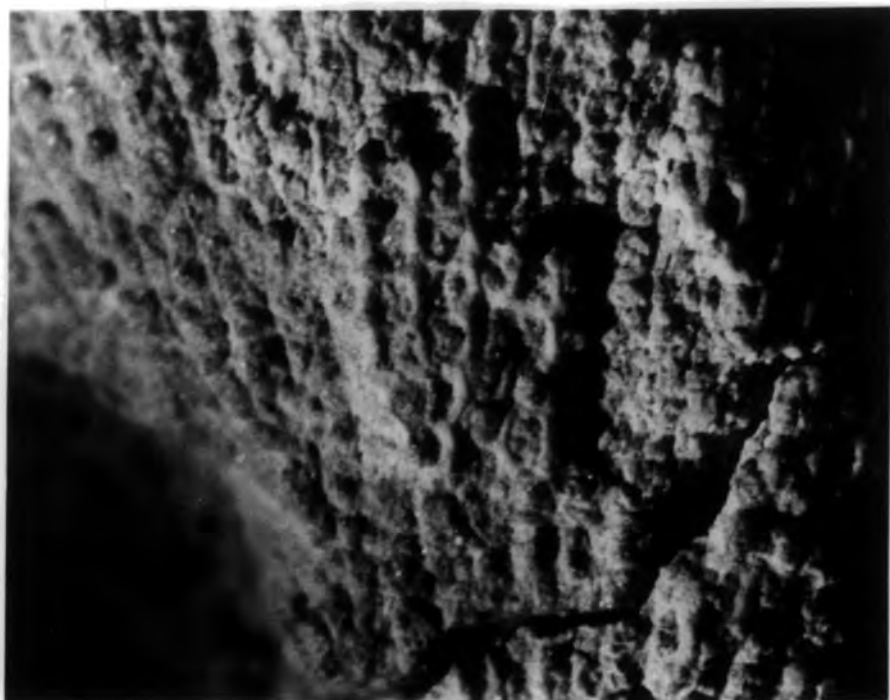


Plate I9. Fenestella retiformis Schlotheim

Fig.a Reverse surface and mould.K2O,from
Schlotheim's collection.
Bar scale=Imm

Fig.b As above at lower magnification.
Bar scale=Icm

a



b



Plate 20. Fenestella retiformis Schlotheim

Fig.a Specimen Taf.I fig.1,2 from the Korn
collection.Bar scale=Icm

Fig.b Specimen Taf.I fig.4 from the Korn collection.
Bar scale=Icm

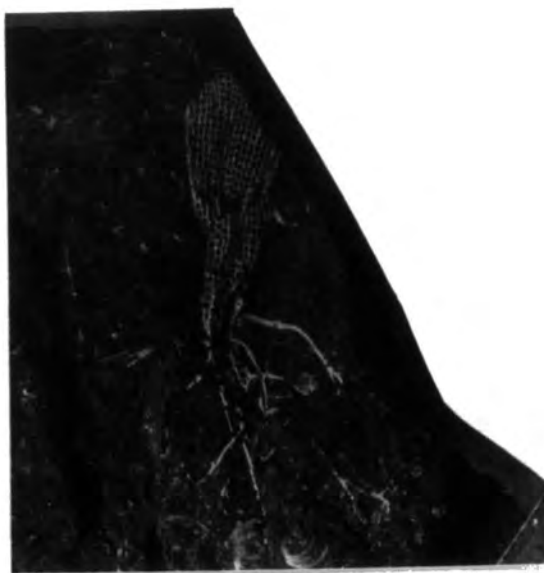


Plate 2I. Fenestella retiformis Schlotheim

Fig.a Specimen Taf.I fig.I3,I4,Taf.III fig.IO,
assigned to "Fenestella minuta" by Korn(1930).
Bar scale=Icm

Fig.b As above at higher magnification.Bar scale=Icm

a



b

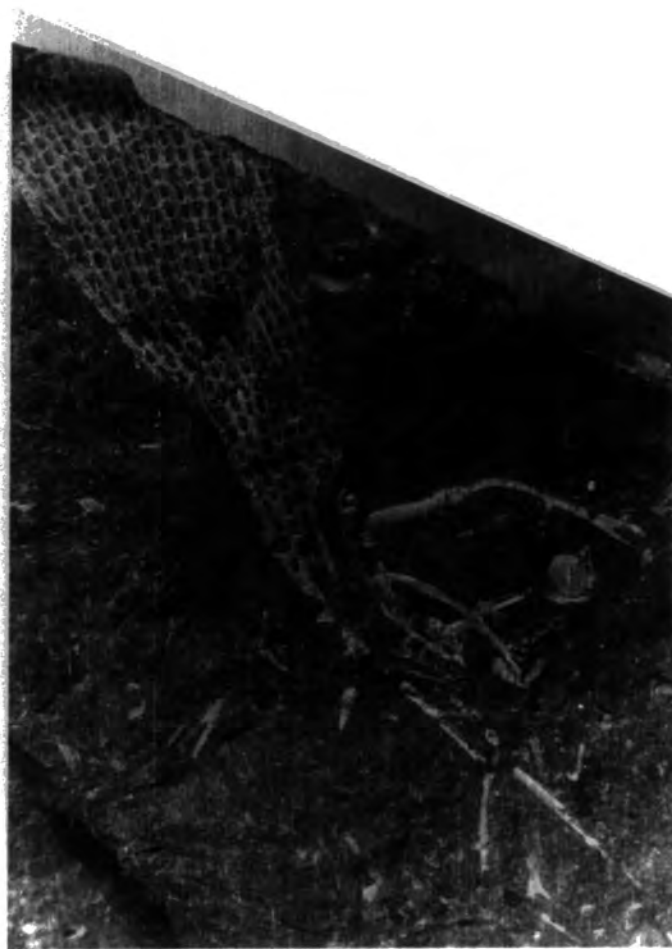


Plate 22. Fenestella retiformis var. thuringiaca Korn

Fig.a Specimen Taf.I fig.5,assigned to Fenestella
geinitzi var.thuringiaca by Korn(1930).
Bar scale=1cm

Fig.b As above at higher magnification.Bar scale=1cm

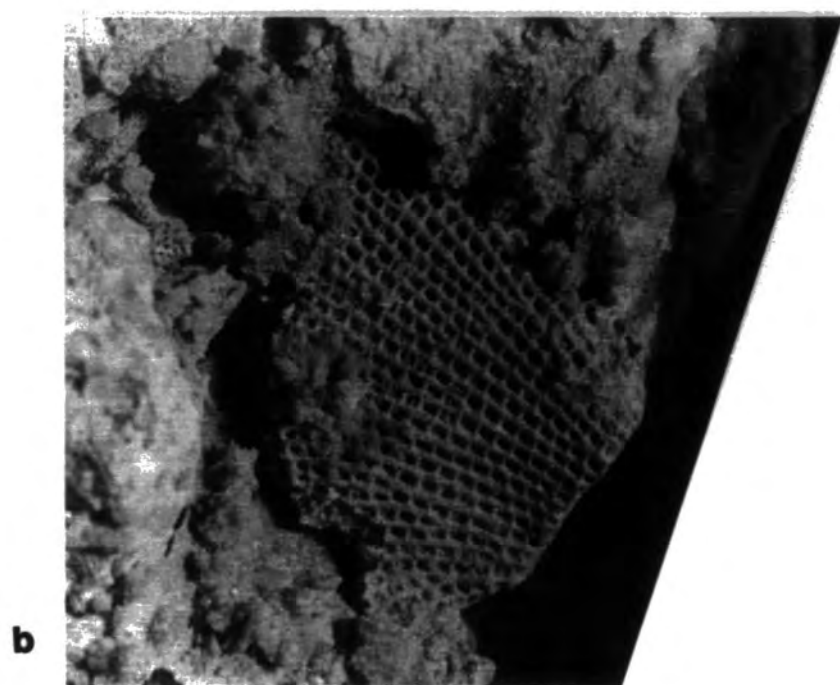
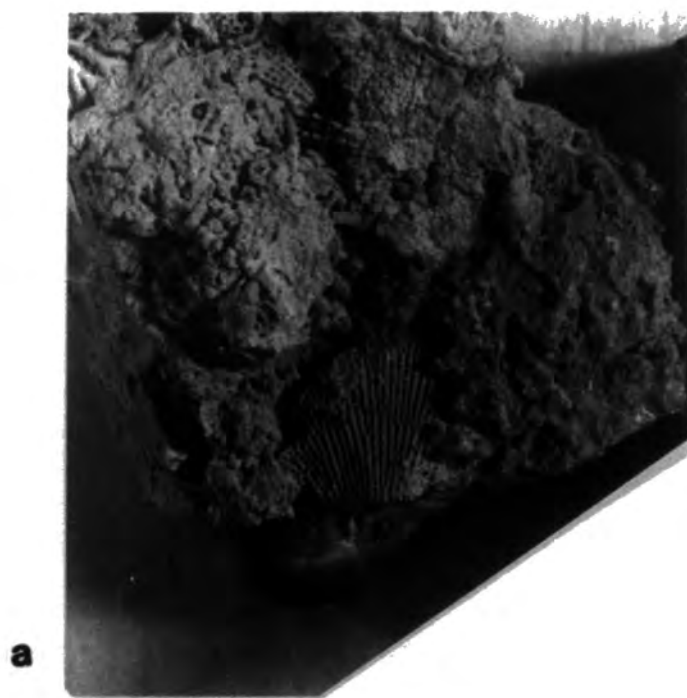
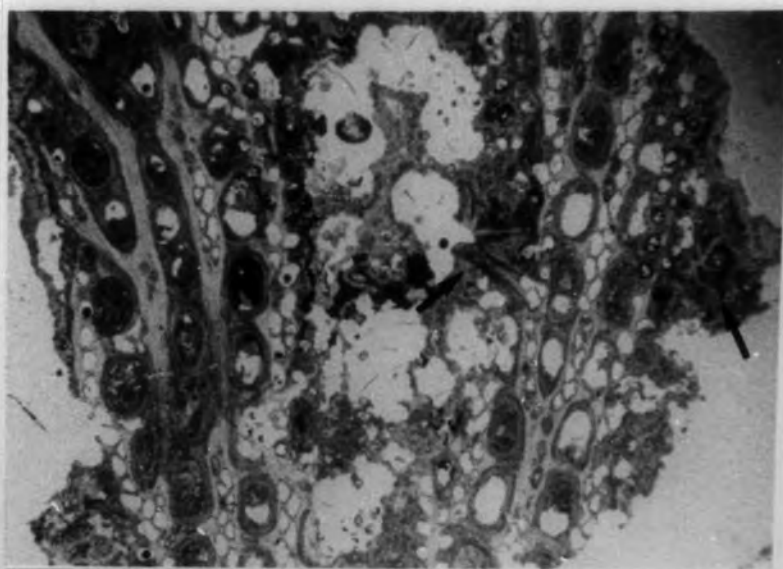
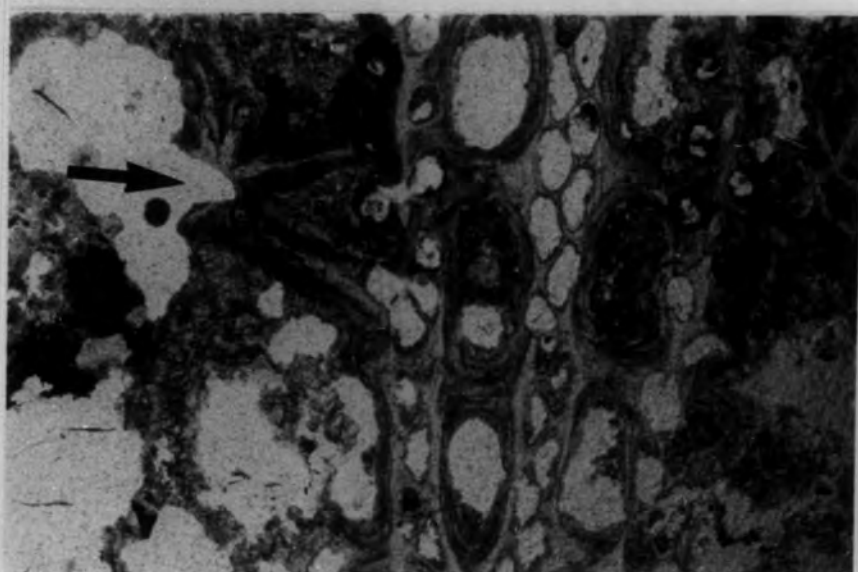


Plate 23. Fenestella retiformis Schlotheim

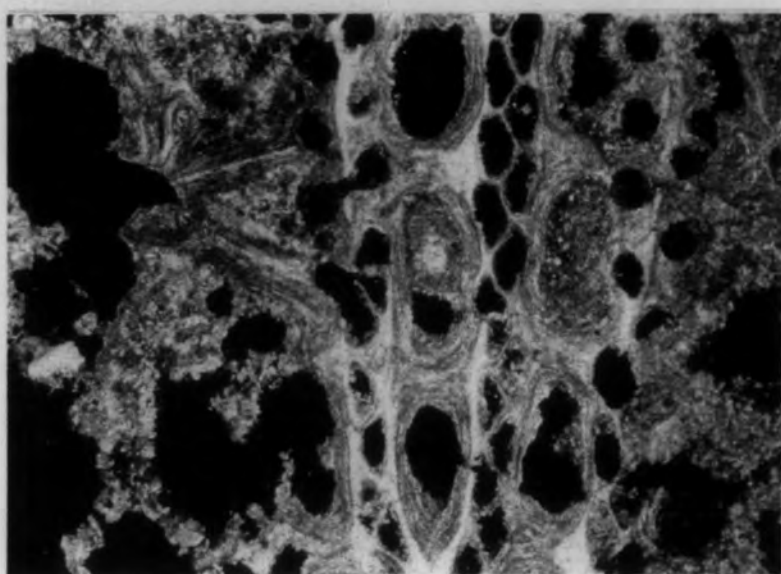
- Fig.a Tangential section. Arrowed are stellate processes which are interpreted as the tips of zoarial spines which expand palmately where they contact the obverse surface. MP5.29. Bar scale=1cm
- Fig.b As above at higher magnification. Bar scale=1cm
- Fig.c As in fig.b above but in crossed polars. The primary granular core of the spinose process is visible and is surrounded by outer laminated skeleton. The granular core of the process extends around the outside of the outer laminated layer of the branch which it is in contact with.



a



b



c

Plate 24. Fenestella retiformis Schlotheim

Fig.a Detail of spinose process. Short arrow marks
 the primary granular core of the process.
 Long arrow marks the node which the process
 is centred on. MP5.29.
 Bar scale=0. Imm

Fig.b As above but in crossed polars.

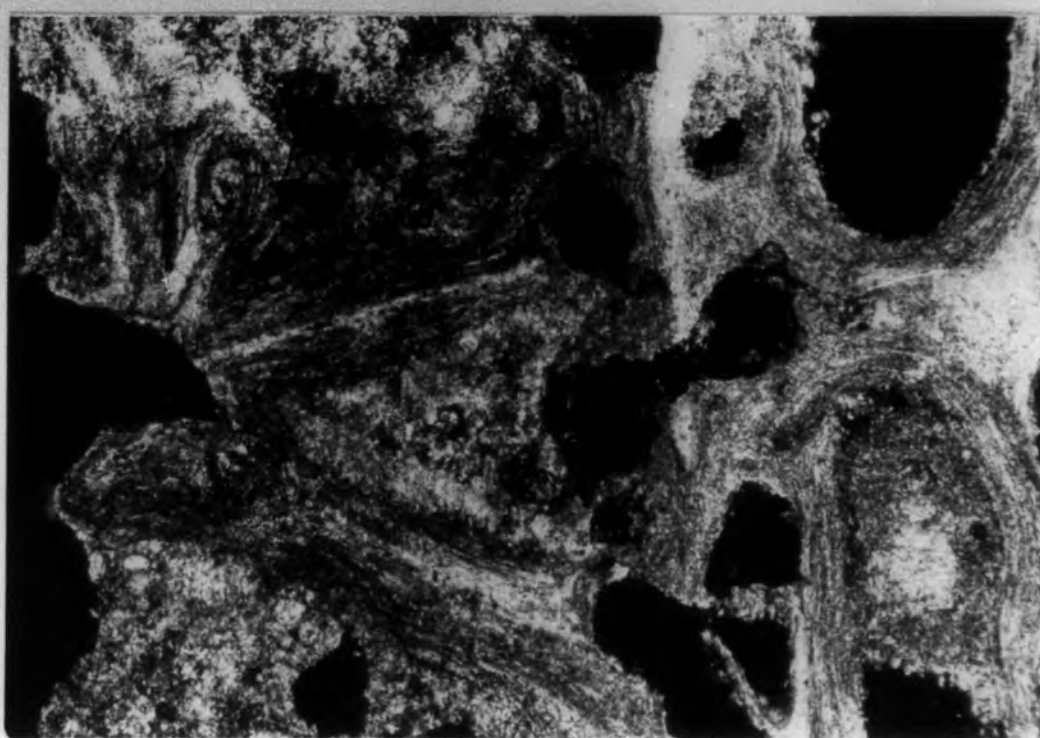
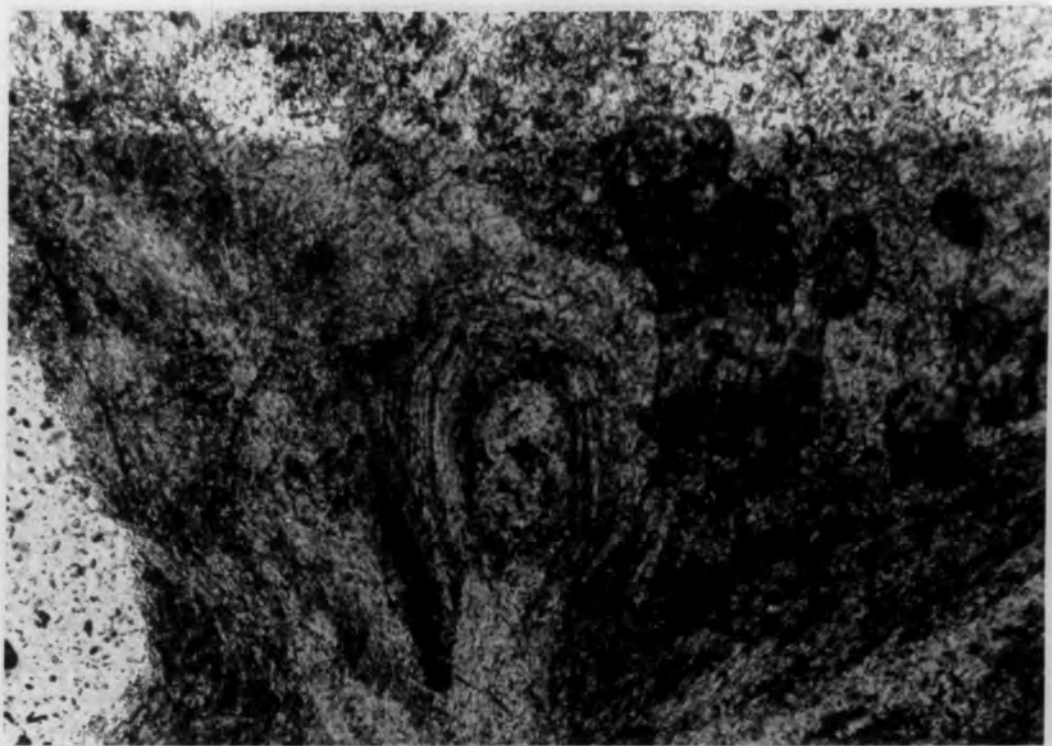


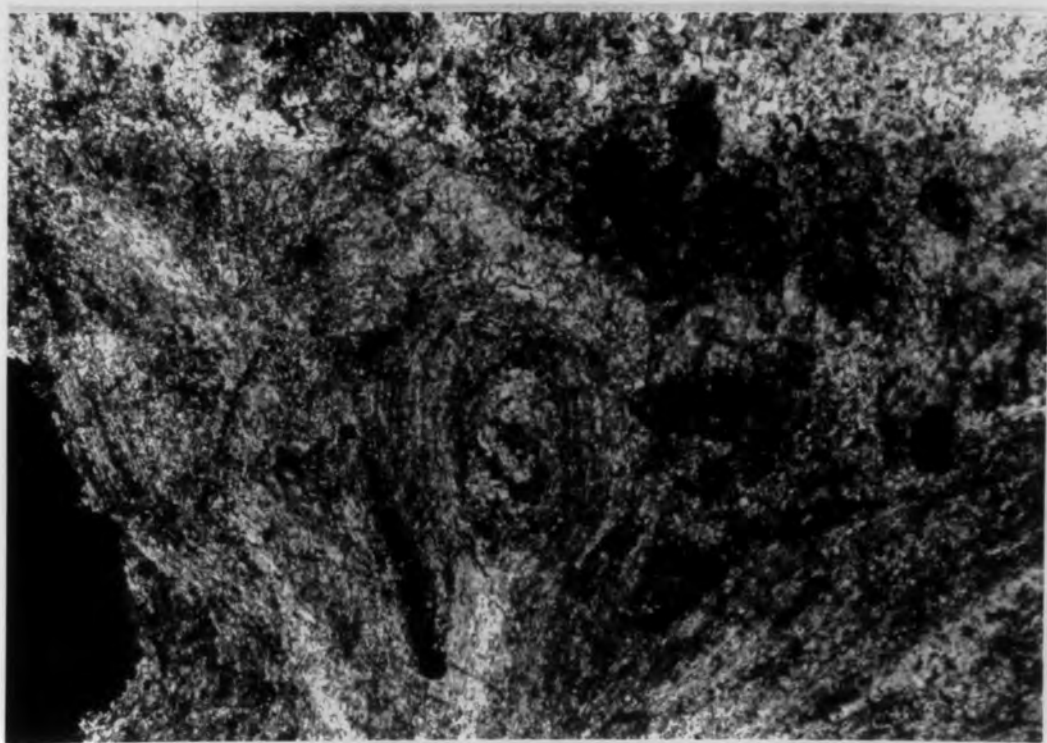
Plate 25. Fenestella retiformis Schlotheim

Fig.a Close-up of node in tangential section
with skeleton of the spinose process
surrounding it, not in optical continuity.
MP5.29. Bar scale=0.1mm

Fig.b As above in crossed polars.



a

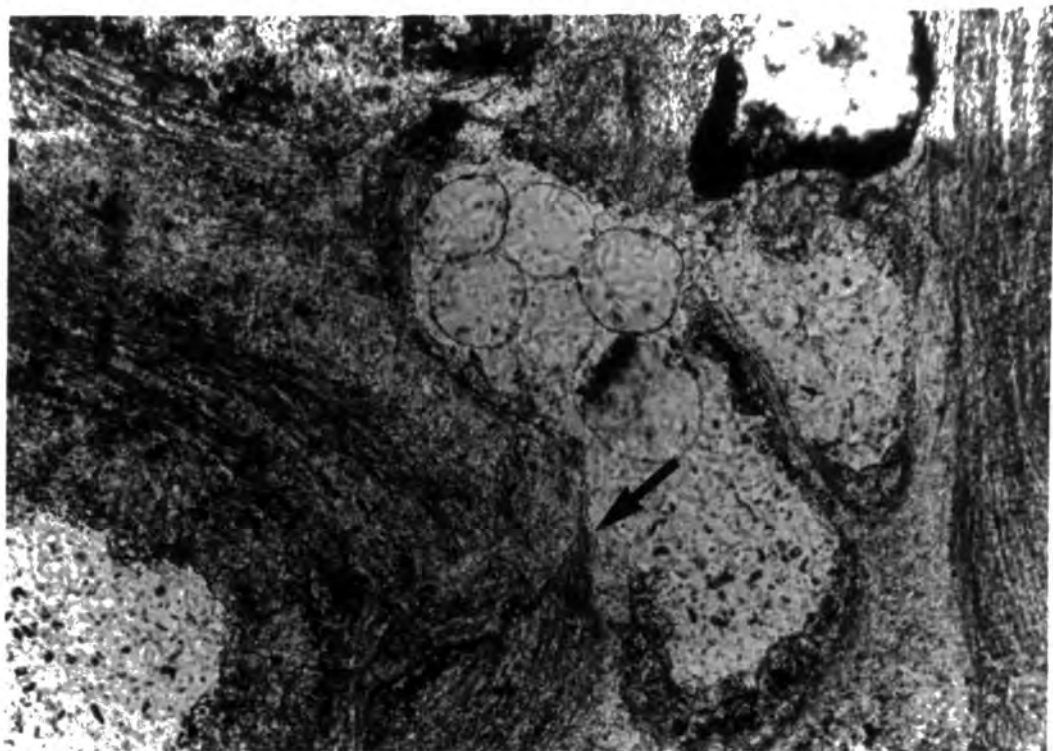


b

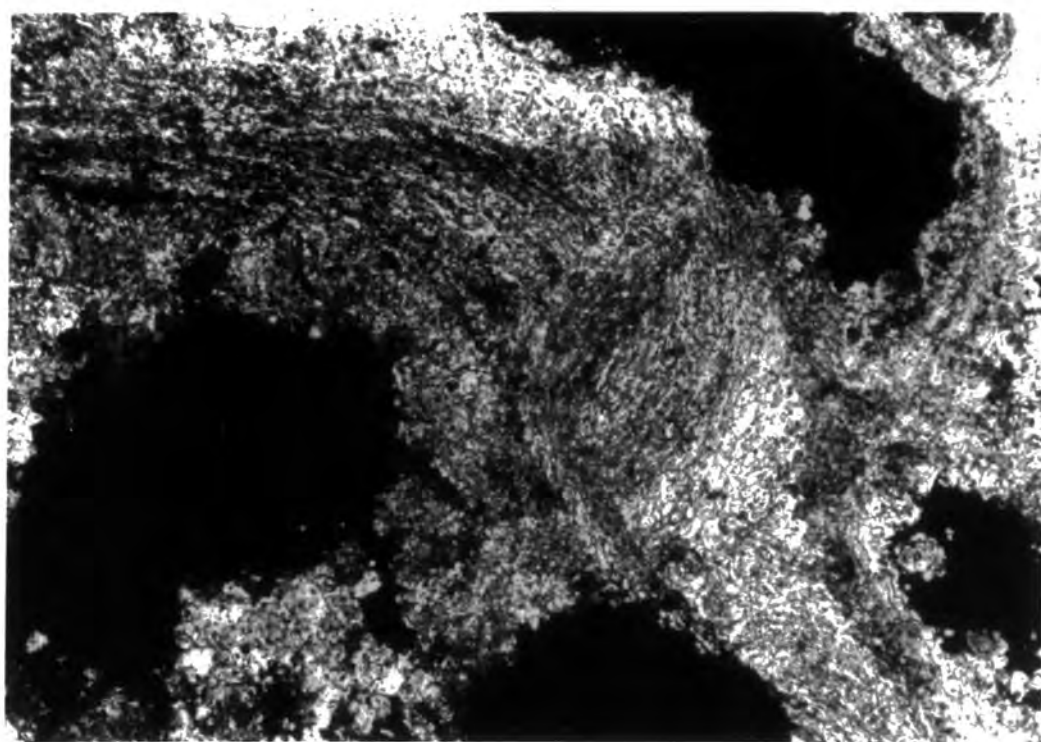
Plate 26. Fenestella retiformis Schlotheim

Fig.a Contact between skeleton of the spinose
 process and that of the branch against which
 it abuts (arrowed). MP5.29.
 Bar scale=0.1mm

Fig.b As above in crossed polars.



a

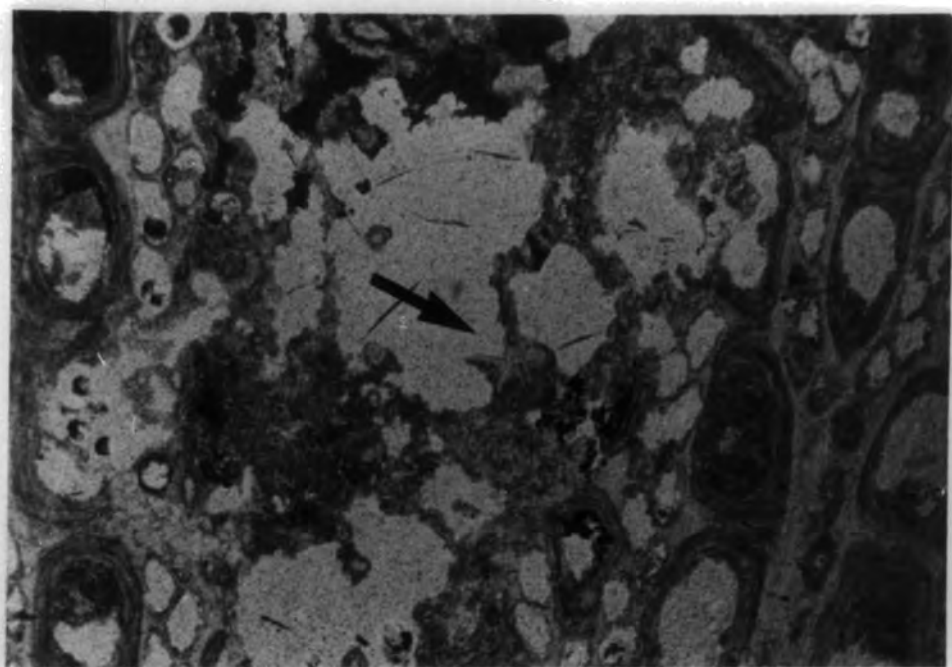


b

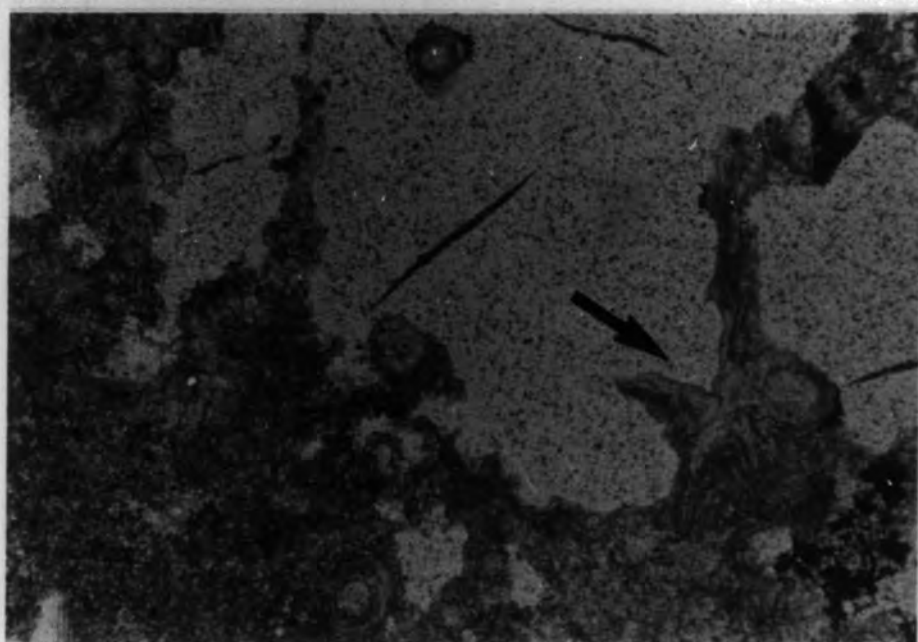
Plate 27. Fenestella retiformis Schlotheim

- Fig.a Tangential section showing stellate process
 centred on a carinal node (arrowed). MP5.29.
 Bar scale=Imm
- Fig.b As above at higher magnification.
 Bar scale=0.Imm
- Fig.c As in fig.b above but in crossed polars.

a



b



c

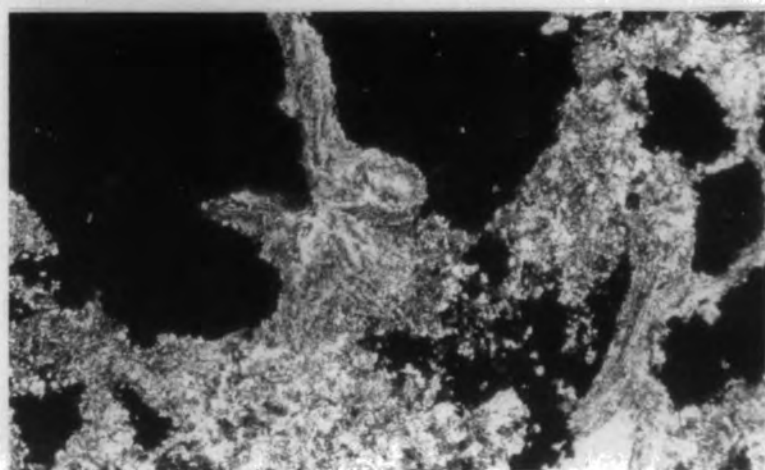
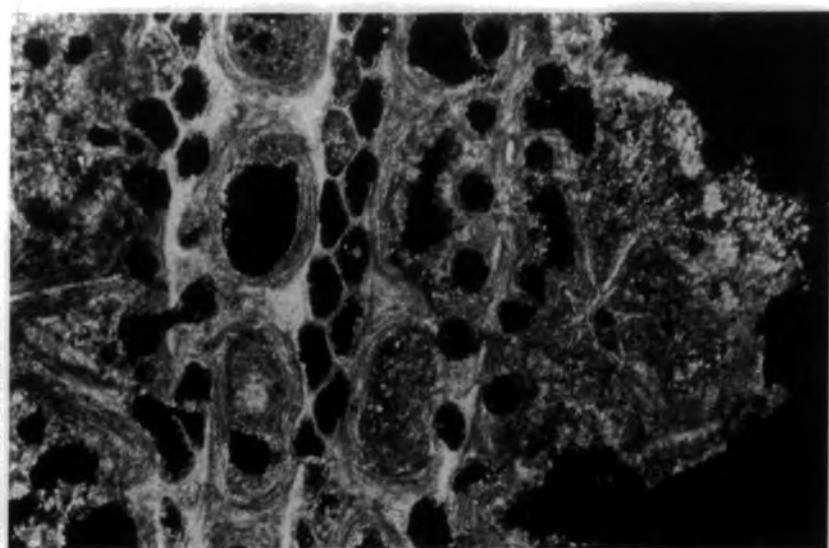


Plate 28. Fenestella retiformis Schlotheim

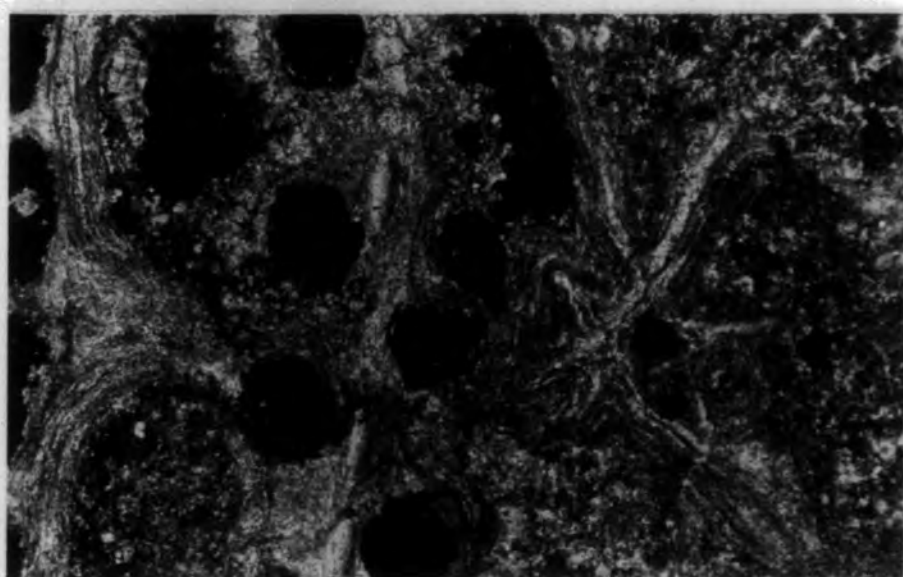
Fig.a Tangential section showing stellate
process.MP5.29.XPL.Bar scale=Imm

Fig.b As above at higher magnification.Bar scale=0.Imm

Fig.c As above at higher magnification and
in plane polarised light.The granular core
is surrounded by outer laminated layer.
Bar scale=0.Imm



a



b



c

Plate 29. Fenestella retiformis Schlotheim

- Fig.a Colony origin.MP5.2.Bar scale=Icm
- Fig.b As above at higher magnification.
Bar scale=Imm.Surface polished close to
origin.
- Fig.c Colony origin.Side view showing a robust
supporting spine.MP5.57.
Bar scale=Imm
- Fig.d As in fig.c above,viewed from above.
Bar scale=Imm

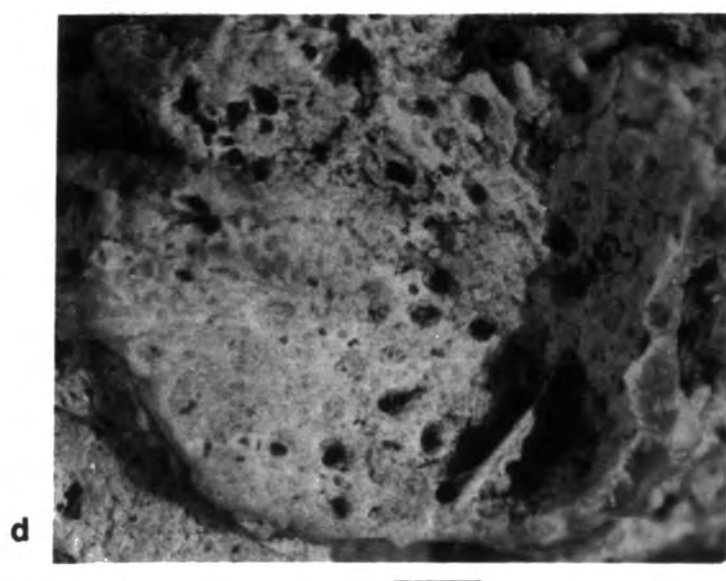
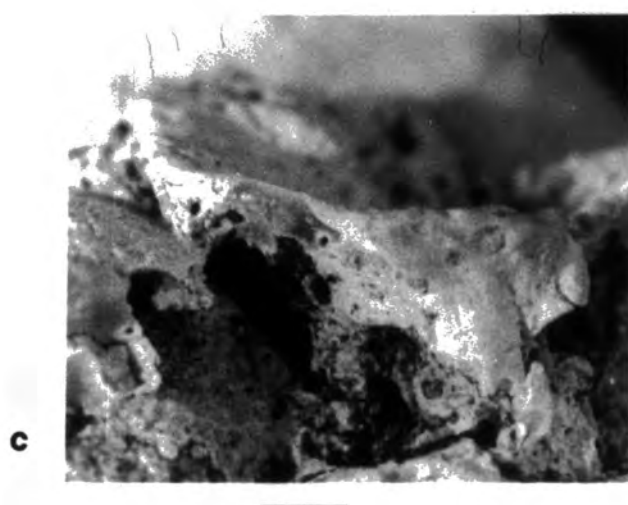
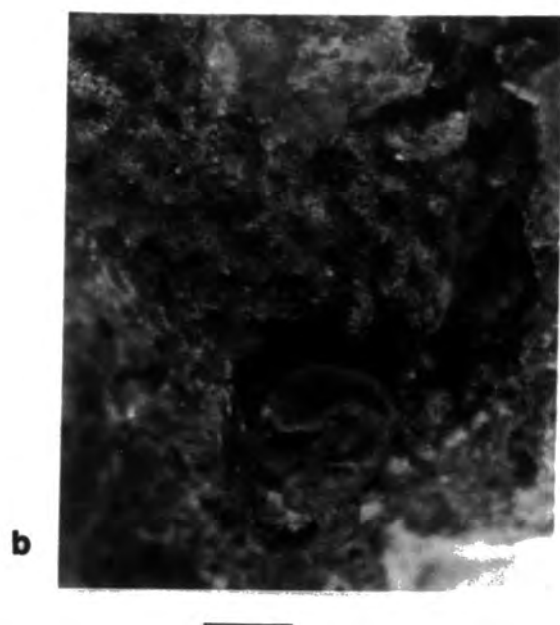
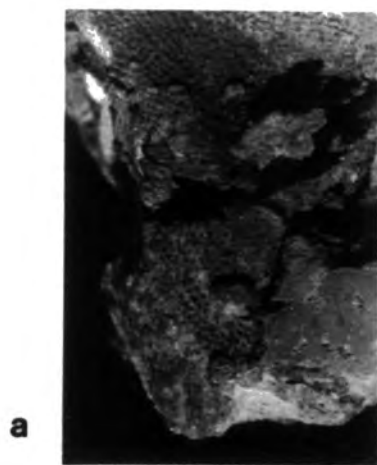


Plate 30. Fenestella retiformis Schlotheim

Tangential section showing deflection of
the wall of the zooecial chamber towards
a dissepiment (arrowed). MP5/3.

Bar scale=0.1mm



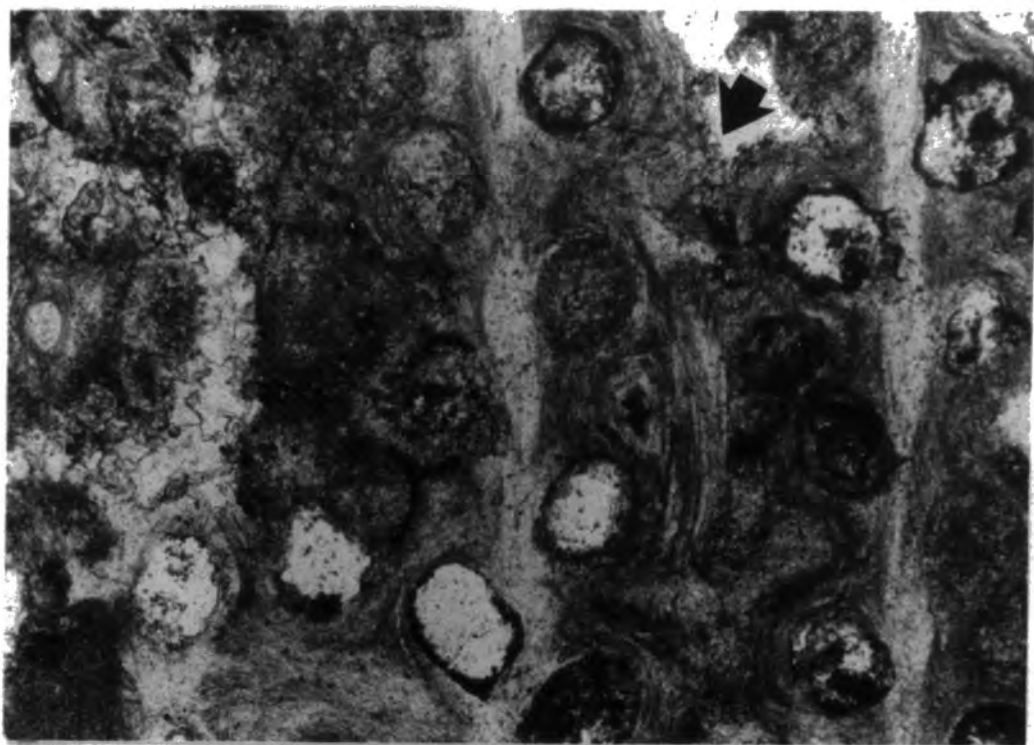
—

Plate 3I. Fenestella retiformis Schlotheim

Fig.a Tangential section showing ?bioimmuration
at the branch margin. A sub-triangular
cavity is lined by laminated skeleton
which extends well into the fenestrule.
MP5.29. Bar scale=0.1mm

Fig.b Close-up of above structure. Bar scale=0.1mm

a



b

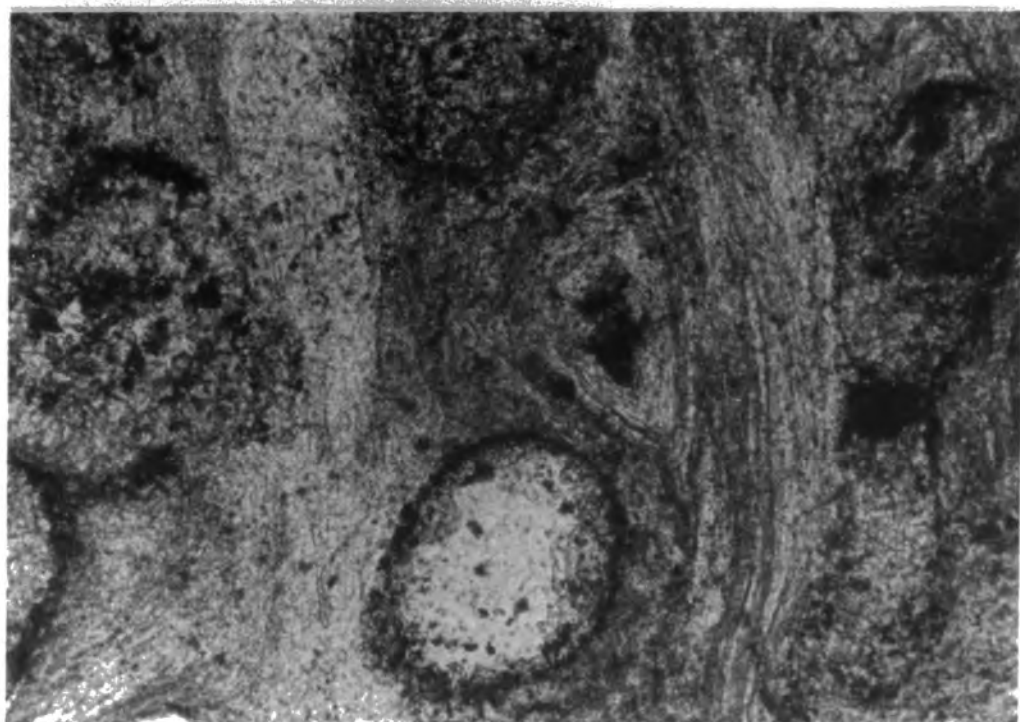
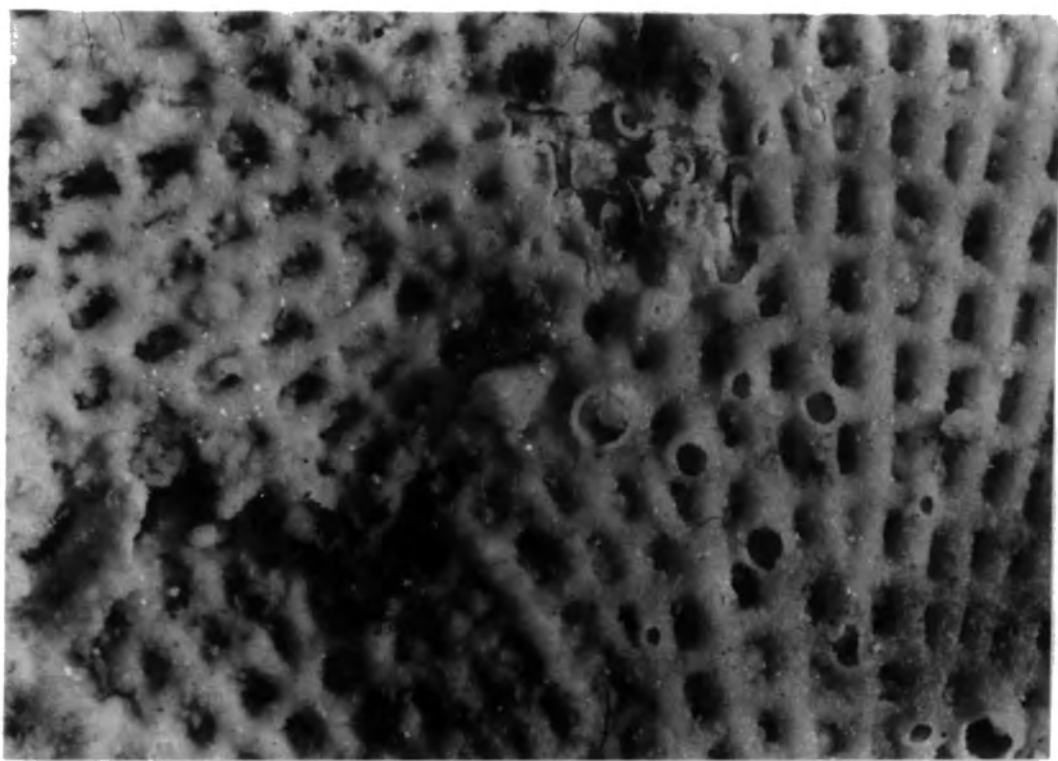


Plate 32. Fenestella geinitzi d'Orbigny

- Fig.a Reverse surface.Specimen heavily encrusted with dolomite but the former positions of spines can be seen.RH4.28.
Bar scale=Imm
- Fig.b Reverse surface.Some of outer laminated skeleton removed in top left corner of specimen revealing longitudinal striae.
HM7.6+3.Bar scale=Imm

a



b

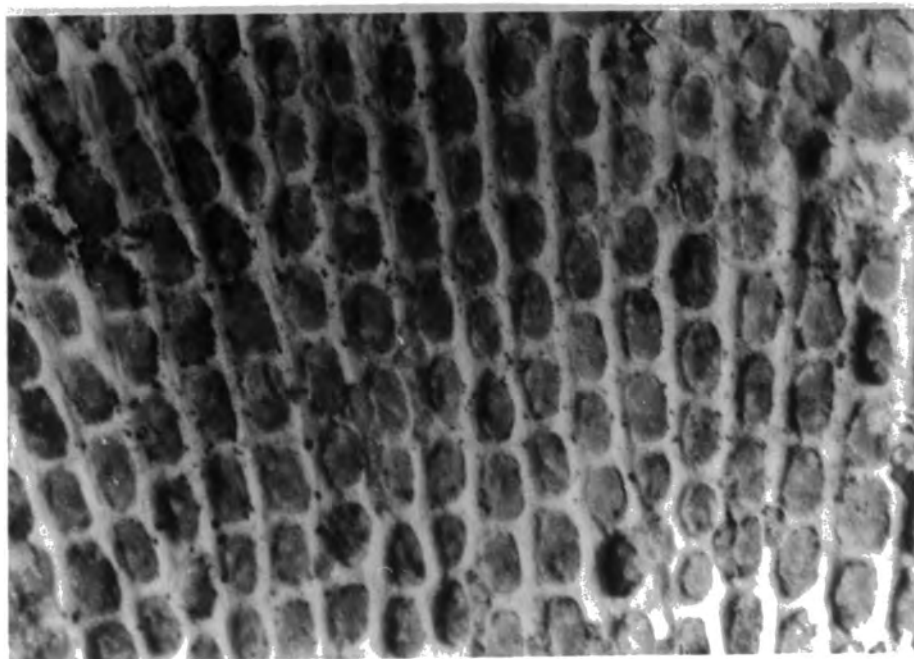


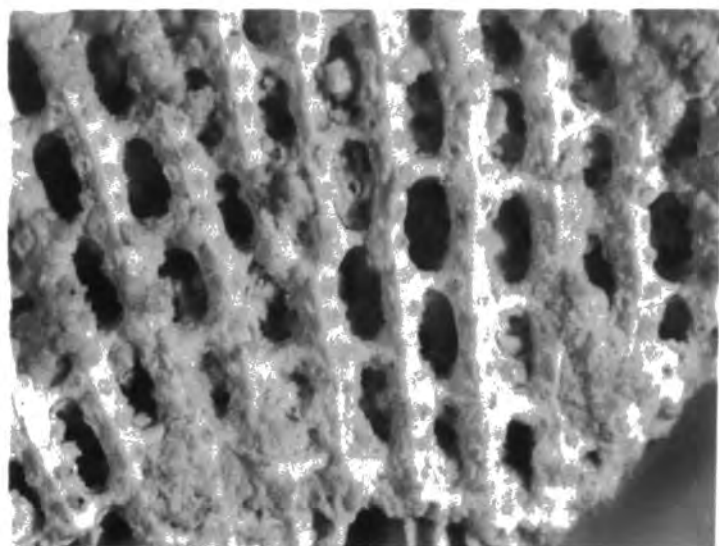
Plate 33. Fenestella geinitzi d'Orbigny

Fig.a Obverse surface detail.RH4.27.
Bar scale=Imm

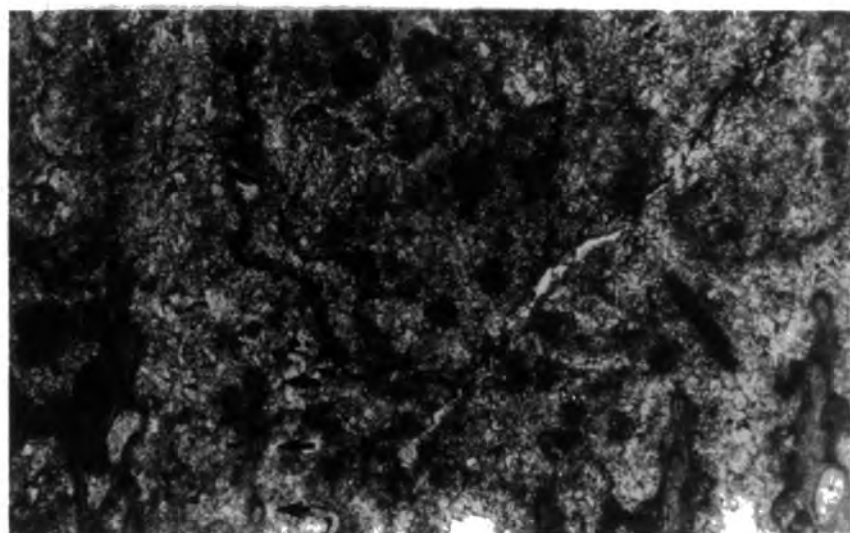
Fig.b Tangential section.Carinal nodes arrowed.
RH4.10.Bar scale=Imm

Fig.c Slightly oblique tangential section showing
longitudinal striae and zooecial chamber shape.
RH4.12.Bar scale=0.Imm XPL.

a



b



c



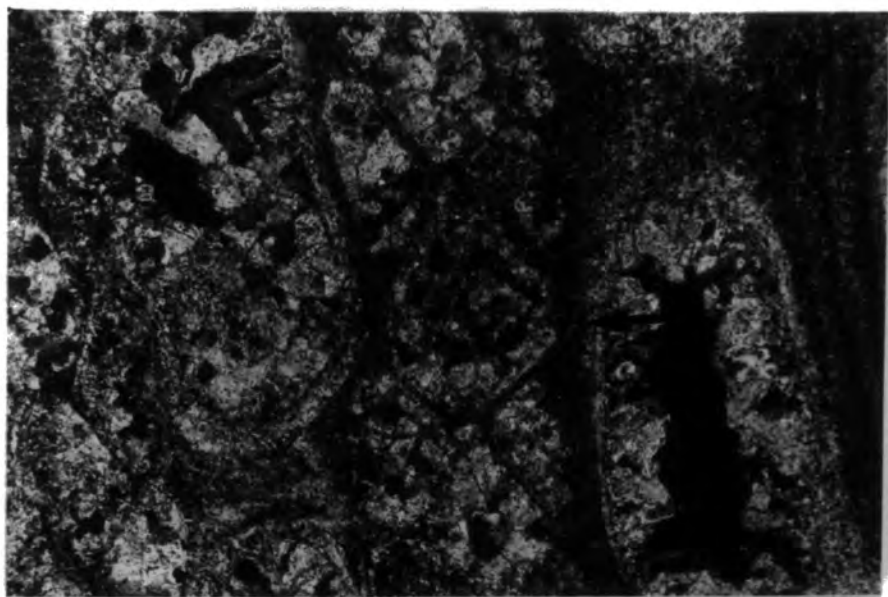
Plate 34. Fenestella geinitzi d'Orbigny

Fig.a Tangential section.Abnormal zooecial chamber
(kenozooecium) arrowed.HM5/I.
Bar scale=0.Imm

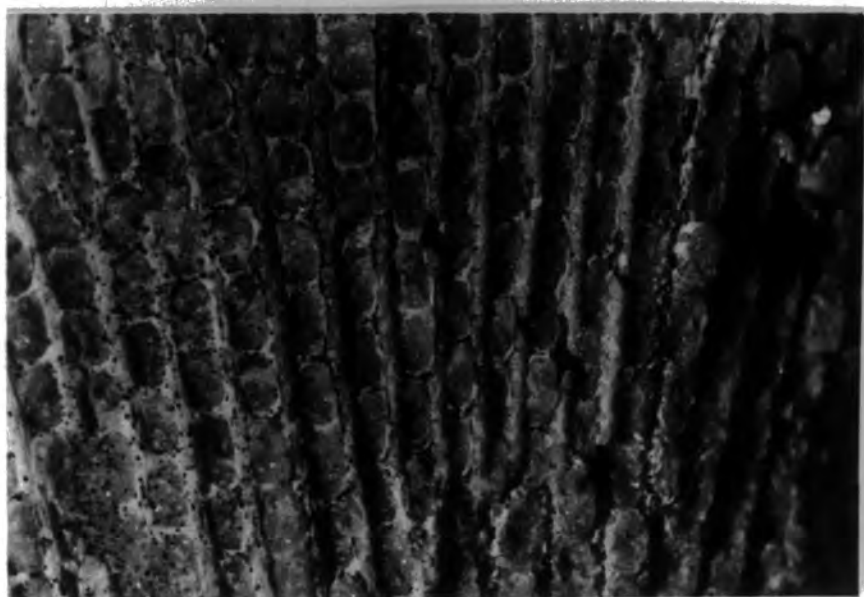
Fig.b Reverse surface.Skeleton removed over most
of specimen revealing zooecial chambers in
cast preservation.HM7.6.
Bar scale=Imm

Fig.c Specimen Taf.I fig.3 from the Korn collection,
labelled as Fenestella retiformis by Korn(1930).
Bar scale=10mm

a



b



c

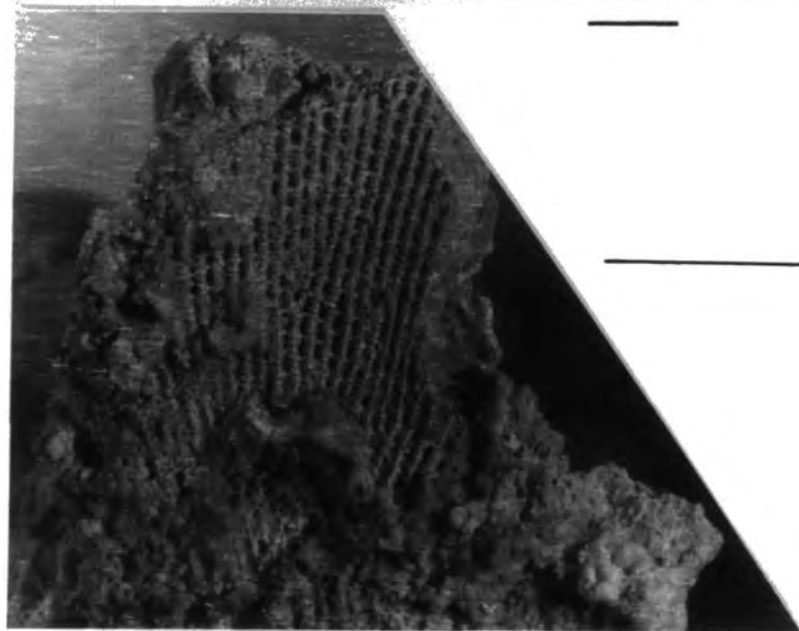


Plate 35. Kingopora ehrenbergi Geinitz

- Fig.a Zoarial morphology.B52A.Bar scale=3cm
- Fig.b Zoarial morphology,showing colony origin.
Apertures open onto the outside of the cone.
NHI.Bar scale=10mm
- Fig.c Zoarial morphology.Zoarium a bilaterally
compressed cone.GLT 3b.
Bar scale=10mm
- Fig.d As above,fig.c.Bar scale=10mm

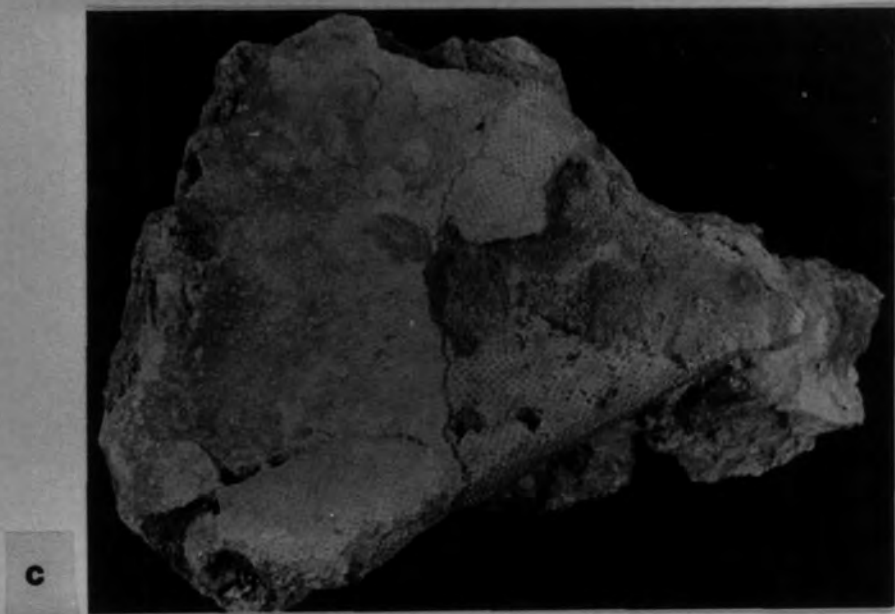
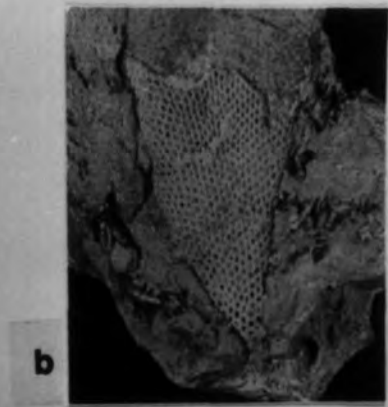


Plate 36. Kingopora ehrenbergi Geinitz

- Fig.a Origin of zoarium, attached to the
 brachiopod Strophalosia.GLT4a.
 Bar scale=10mm
- Fig.b As above.GLT4.Bar scale=10mm
- Fig.c As above,fig.a,at higher magnification.
 Bar scale=10mm.Thick development of
 extrazoidal skeleton around colony
 origin is visible.

a



b



c



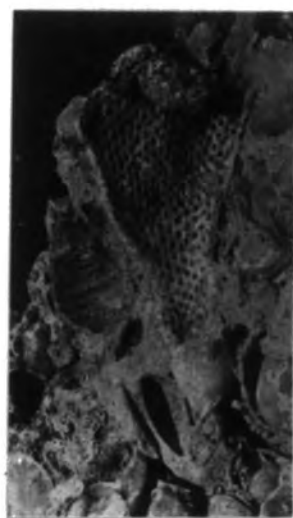
Plate 37. Kingopora ehrenbergi Geinitz

- Fig.a Polished section of colony origin, showing vesicular skeleton. Longitudinal section. GLQ2. Bar scale=Imm
- Fig.b Zoarial morphology, showing colony origin. MP5.I. Bar scale=10mm
- Fig.c Colony origin with extrazoooidal skeleton, seen in transverse section. GLQ3. Bar scale=Imm
- Fig.d Colony origin showing spines encrusting the reverse surface (arrowed). GLT5. Bar scale=10mm

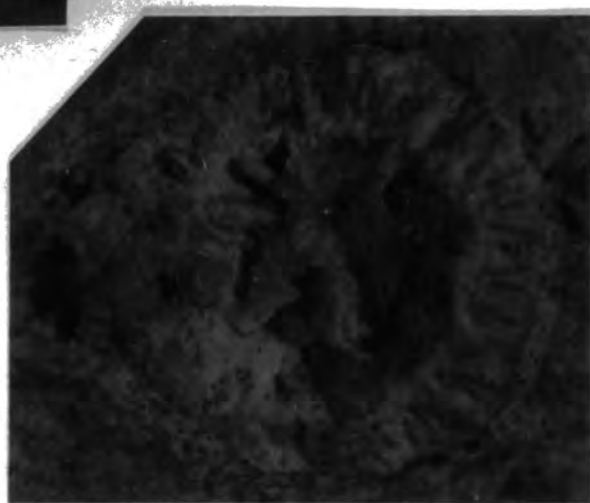
a



b



c



d

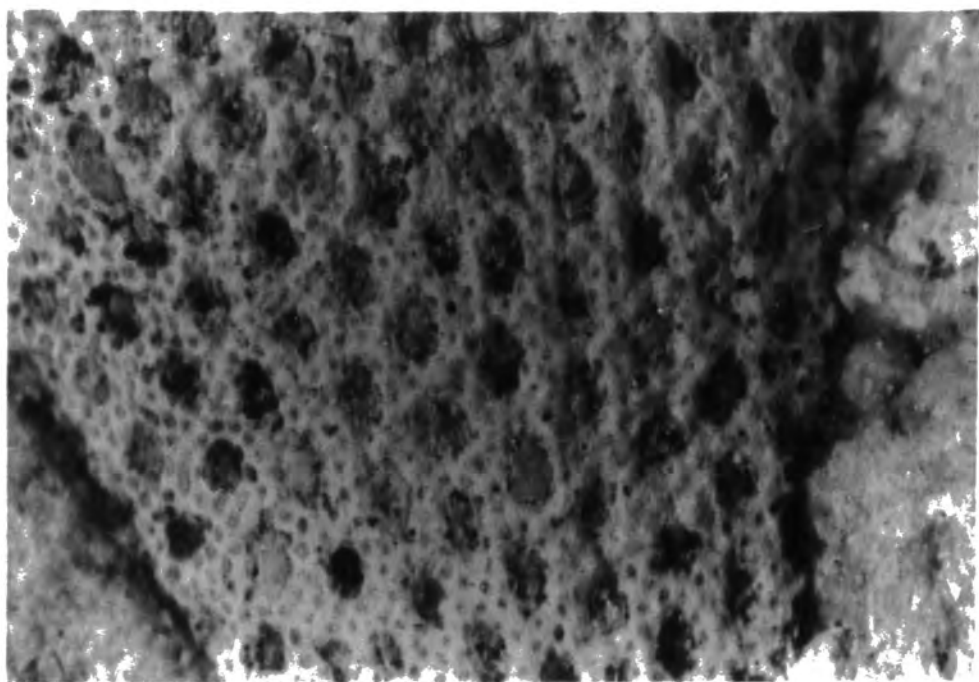


Plate 38. Kingopora ehrenbergi Geinitz

Fig.a Obverse surface detail.NHI.
Bar scale=Imm

Fig.b Obverse surface detail.MP5.I2a.
Bar scale=Imm

a



b

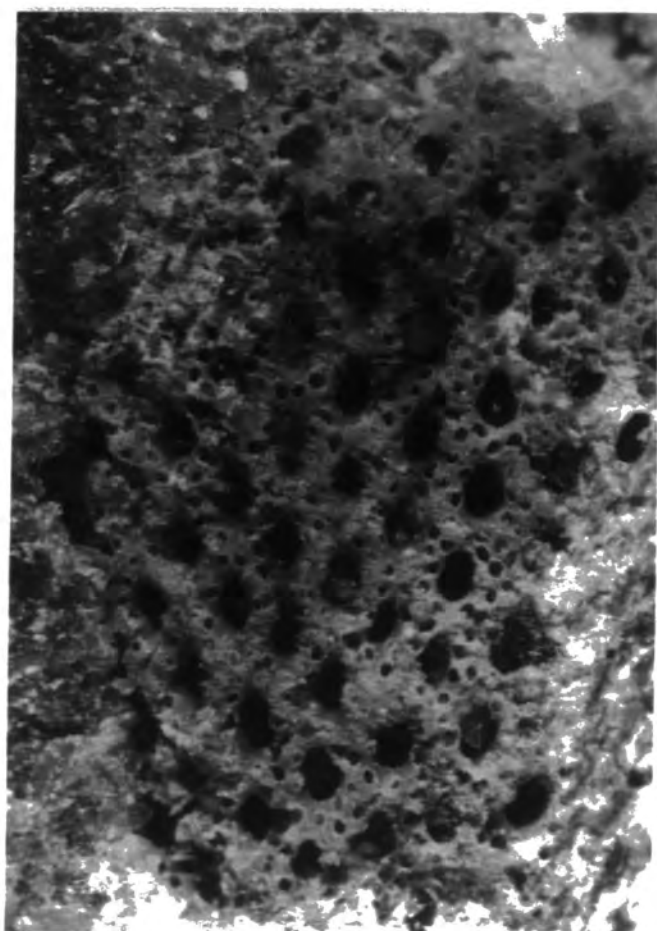


Plate 39. Kingopora ehrenbergi Geinitz

Fig.a Reverse surface detail.GLQI8.
Bar scale=Imm

Fig.b Reverse surface detail.BIO8B.
Bar scale=Imm

Fig.c Reverse surface detail,showing reverse
surface nodes (arrowed).GLTI4.
Bar scale=Imm

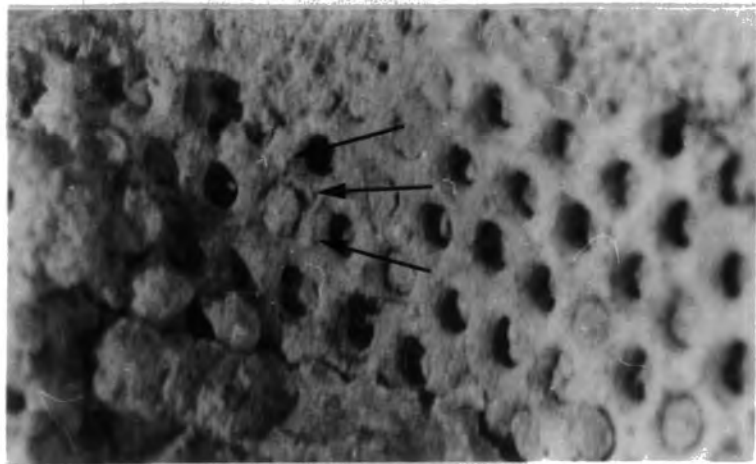
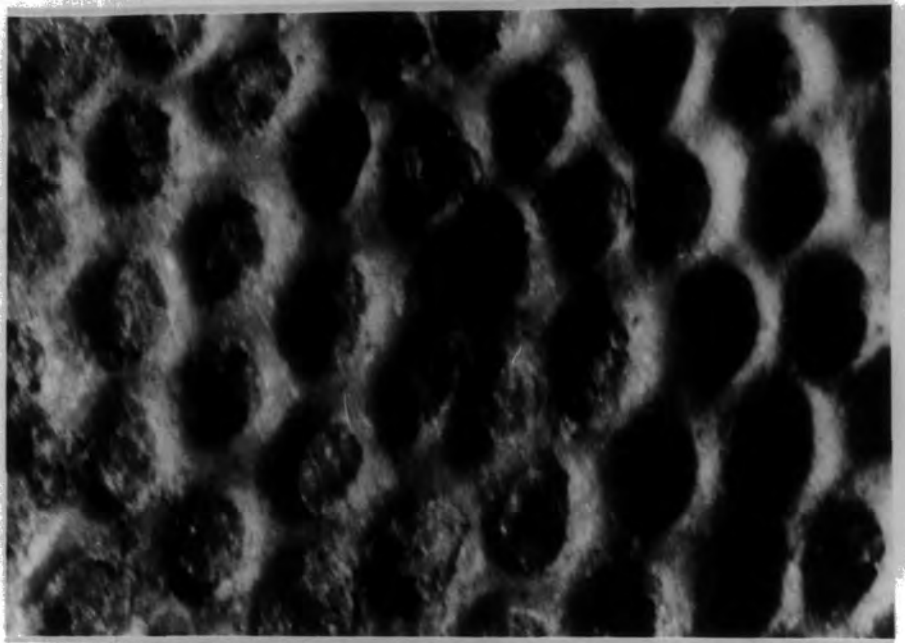
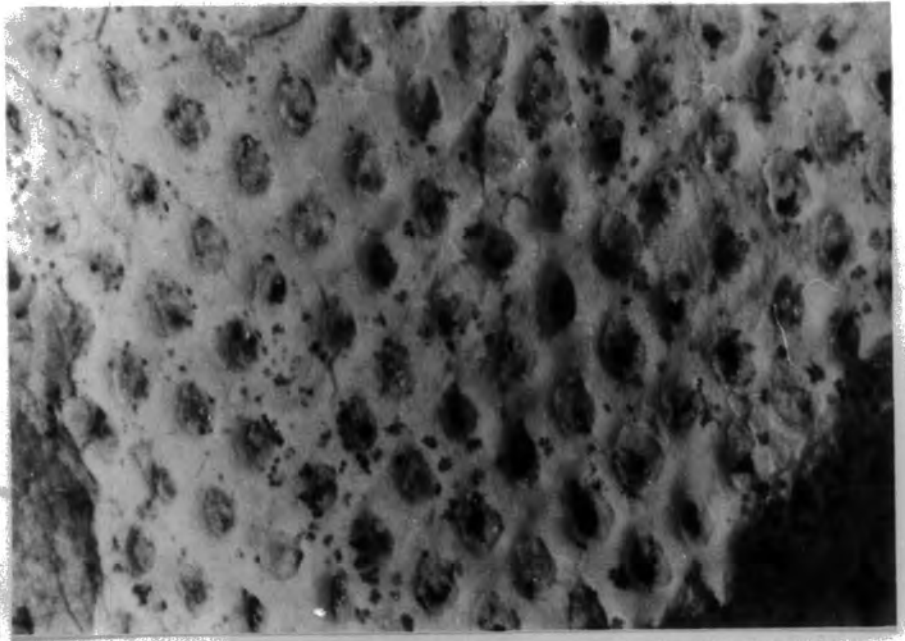


Plate 40. Kingopora ehrenbergi Geinitz

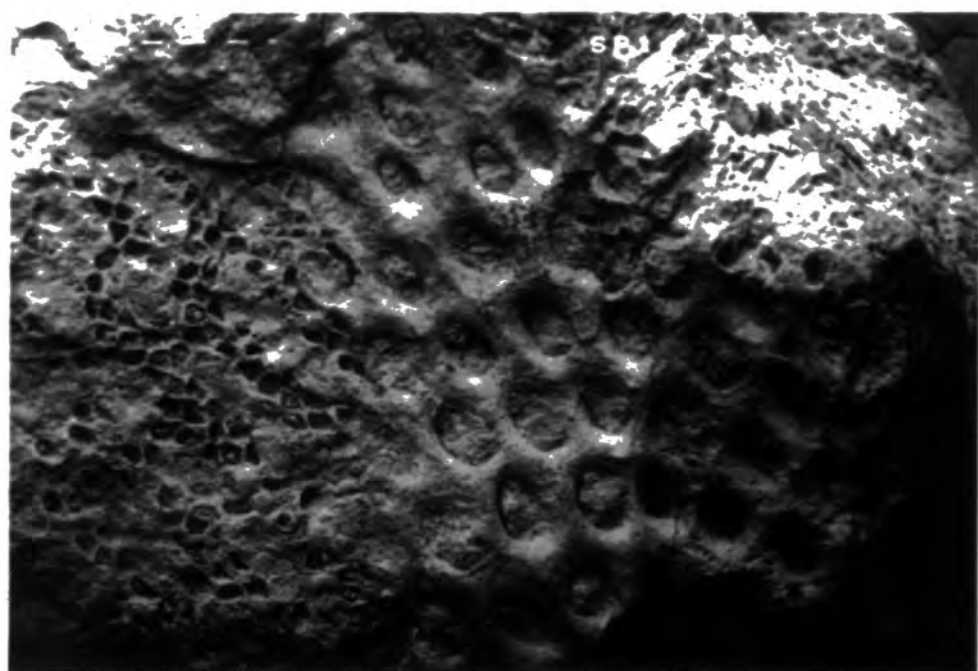
Fig.a S.E.M. photomicrograph showing the reverse surface and the shapes of zooecial chamber bases.BIO8G.

Bar scale=Imm

Fig.b As above at higher magnification.

Bar scale=Imm

a



b

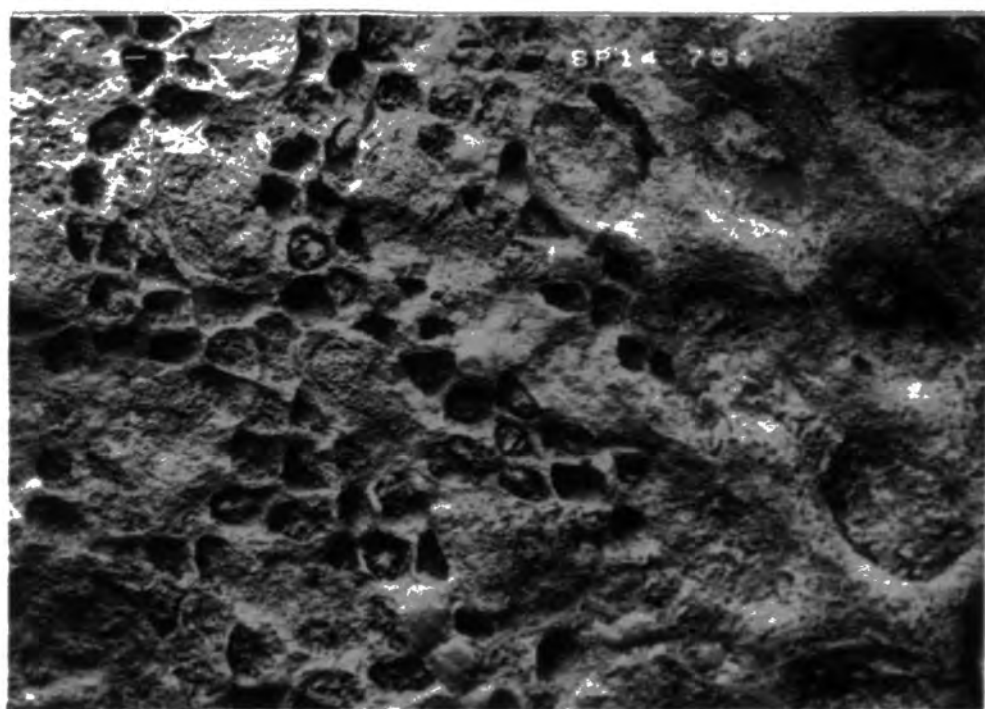
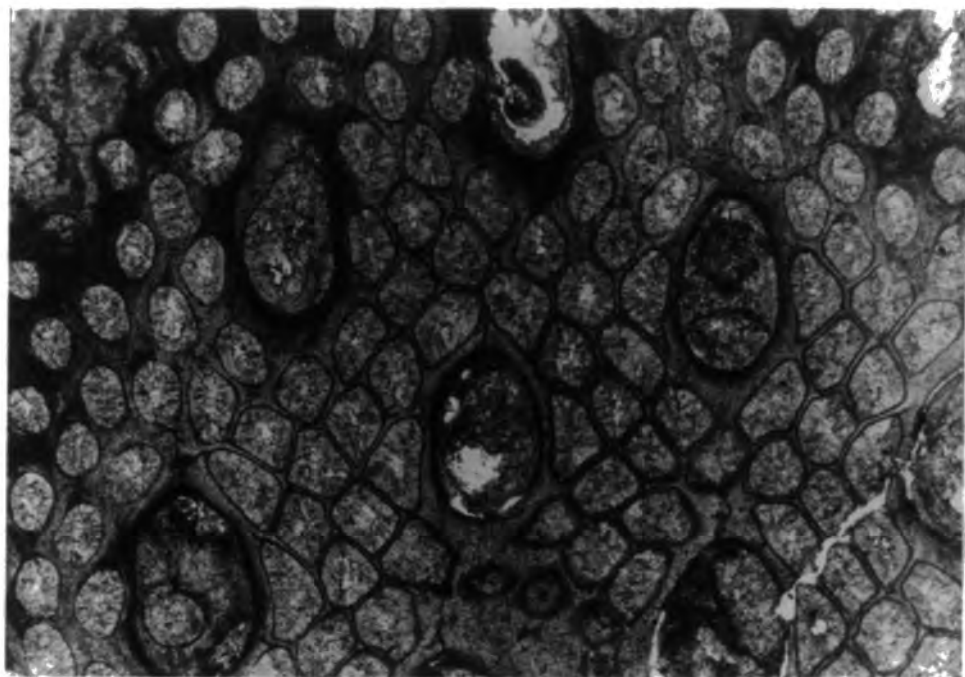


Plate 4I. Kingopora ehrenbergi Geinitz

Fig.a Tangential section.GLQI5.
Bar scale=Imm

Fig.b Tangential section.XPL.MP5-I3.
Bar scale=Imm

a



b

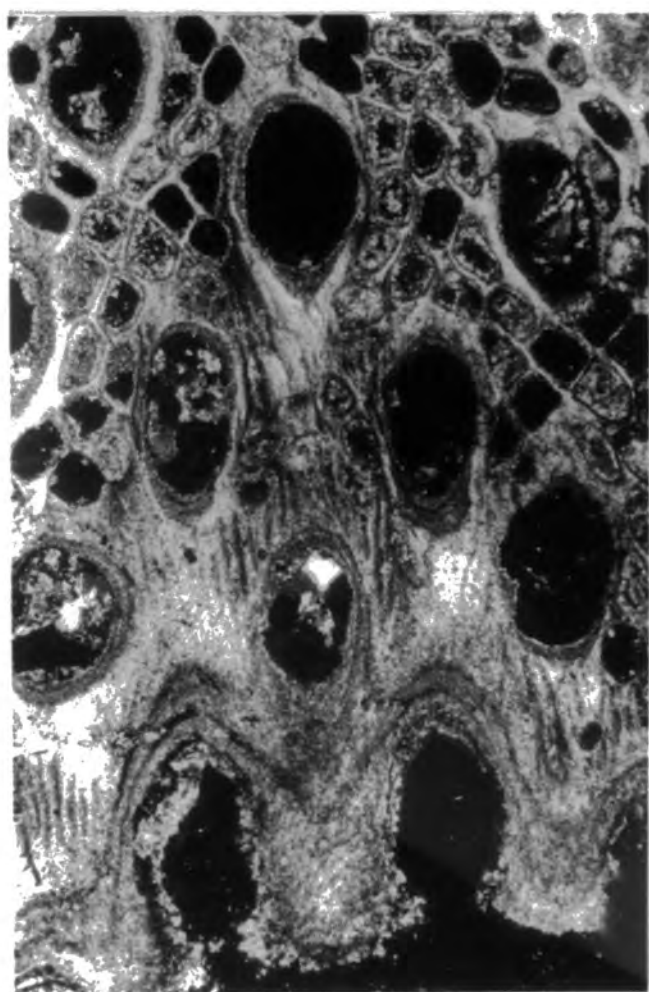
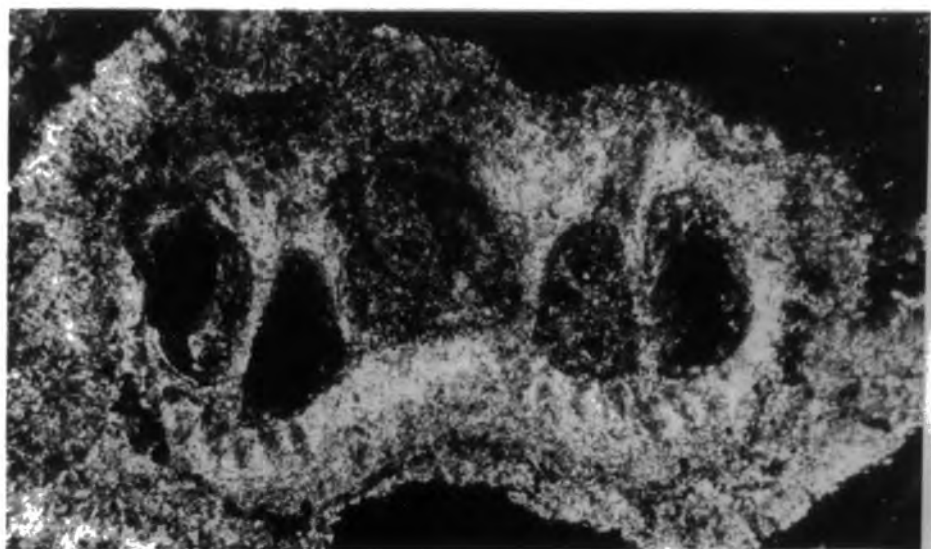


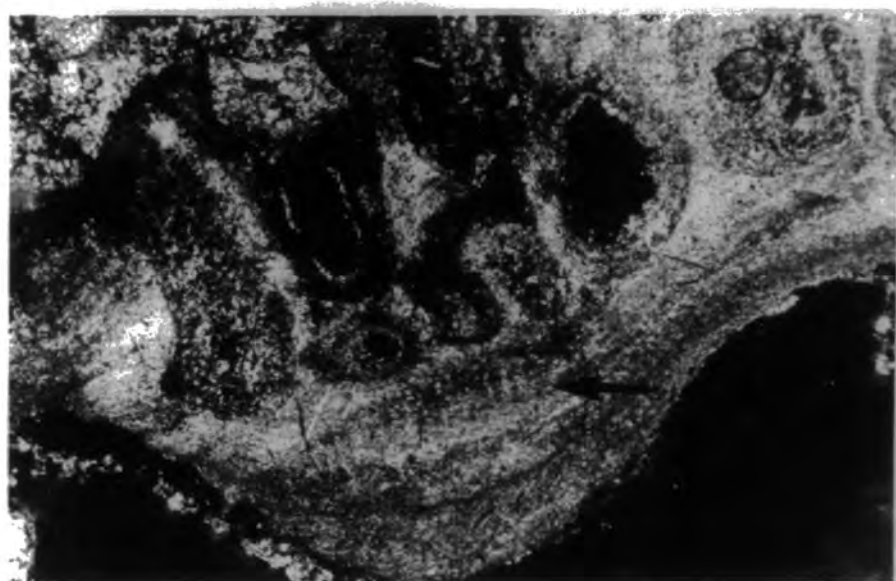
Plate 42. Kingopora ehrenbergi Geinitz

- Fig.a Transverse section.The 'inner platy core'
 of the longitudinal striae is in extinction.
 MP5.2.XPL.Bar scale=0.Imm
- Fig.b Transverse section.Skeletal rods arrowed.
 MP5-I3.XPL.Bar scale=0.Imm
- Fig.c As above,fig.b at higher magnification to
 show skeletal rods.XPL.
 Bar scale=0.Imm

a



b



c

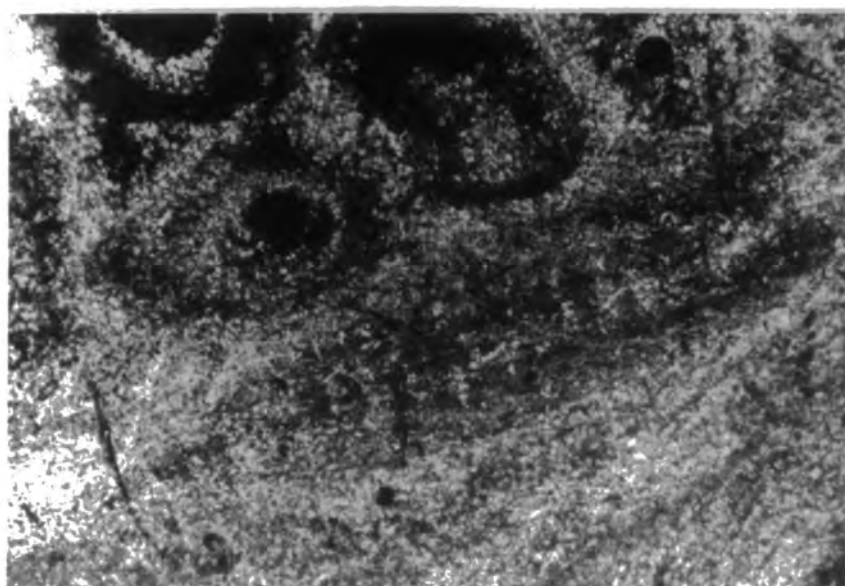


Plate 43. Kingopora ehrenbergi Geinitz

Fig.a Transverse/Longitudinal section.GLQI8.
Bar scale=Imm

Fig.b Transverse/Longitudinal section.GLQI8.
Bar scale=Imm

Fig.c As above,fig.b at higher magnification.
Inner laminated layer arrowed.Its thickness
decreases distally in a zooecial chamber.
Bar scale=0.Imm

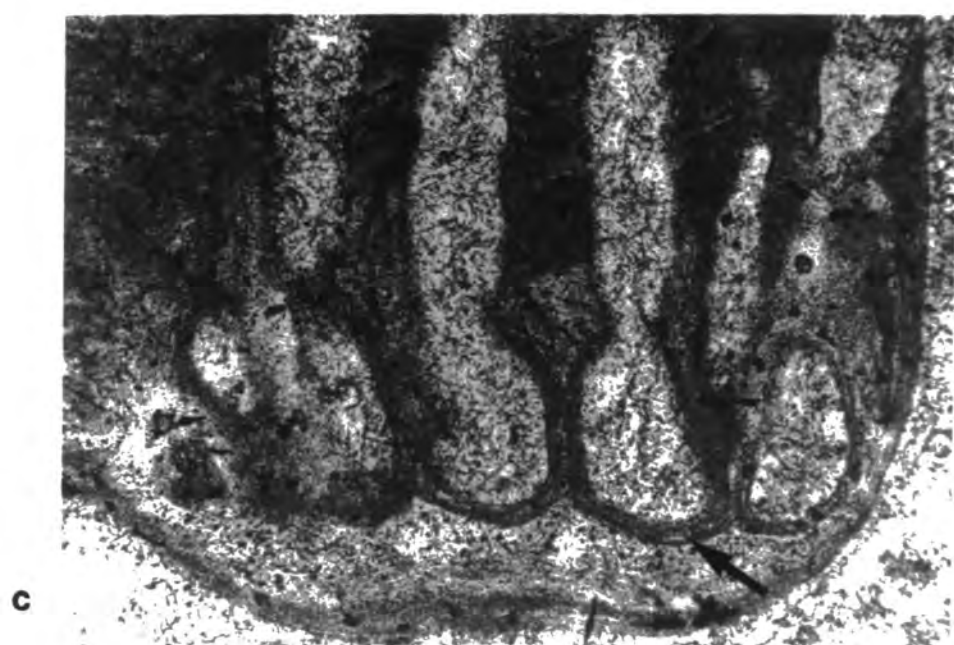
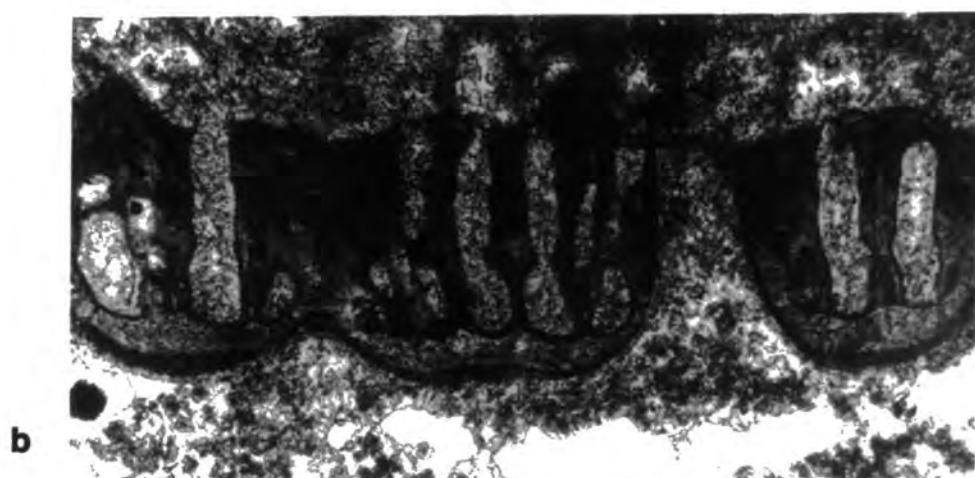
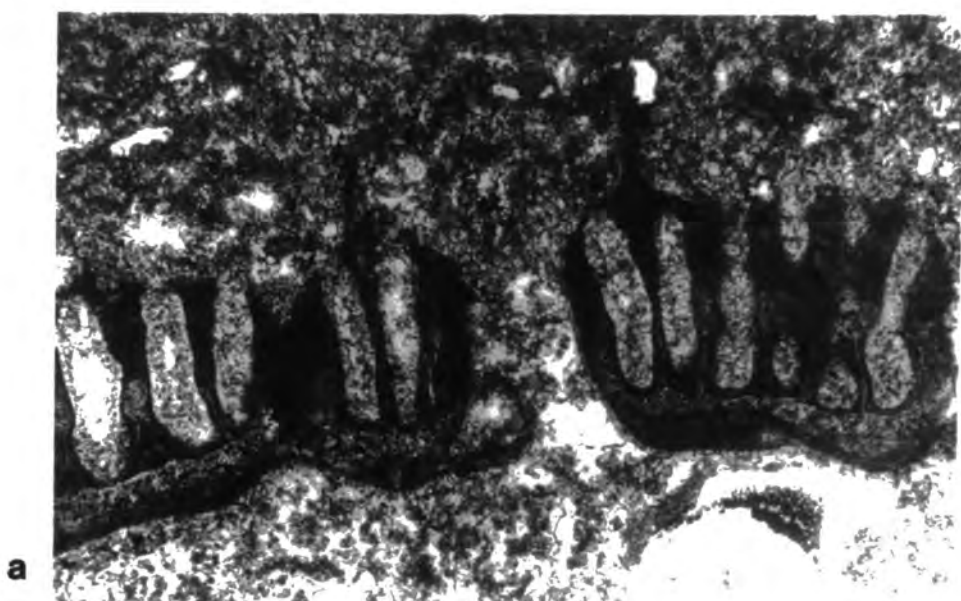


Plate 44. Kingopora ehrenbergi Geinitz

Fig.a Specimen Taf.III fig.7 from the Korn collection.Bar scale=5mm

Fig.b Specimen Taf.III fig.I2 from the Korn collection, assigned to "Phyllopora solida" by Korn(1930). Bar scale=5mm (Mould preservation).

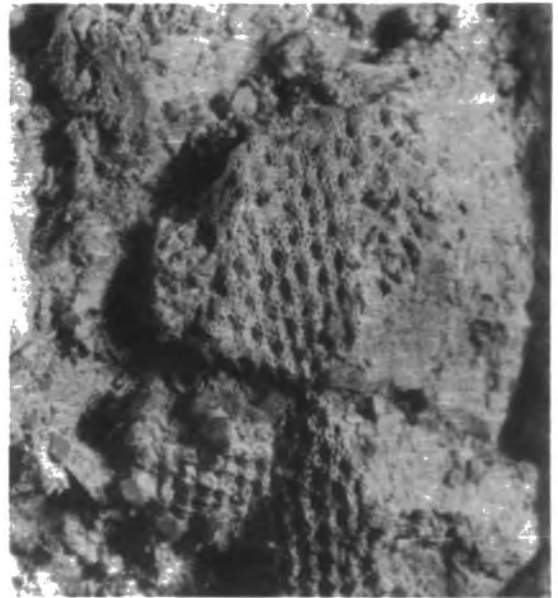
Fig.c Specimen Taf.IV fig.I from the Korn collection, assigned to "Phyllopora solida" by Korn(1930). Bar scale=5mm



a



b



c

Plate 45. Kingopora ehrenbergi Geinitz

Fig.a Longitudinal section through colony origin
showing vesicular skeleton.GLQ2.

Bar scale=Imm

Fig.b As above at higher magnification to show
vesicular extrazooidal skeleton.

Bar scale=Imm

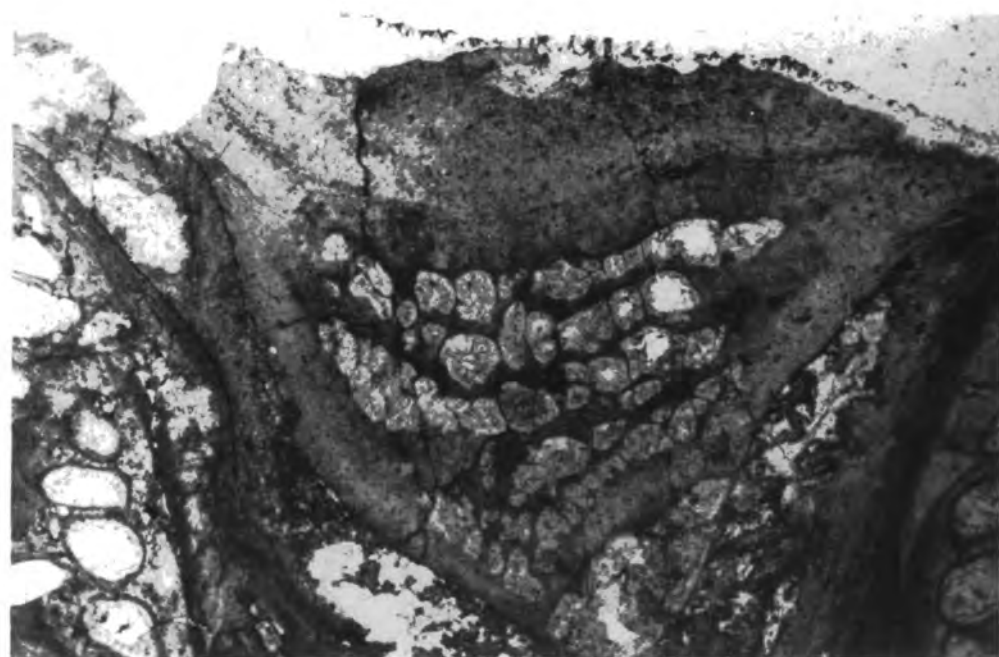


Plate 46. Kingopora ehrenbergi Geinitz

Fig.a Colony origin showing robust spine(arrowed),
developed from the obverse surface.GLT8.
Bar scale=10mm

Fig.b As above at higher magnification.
Bar scale=Imm

a



b



Plate 47. Kingopora ehrenbergi Geinitz

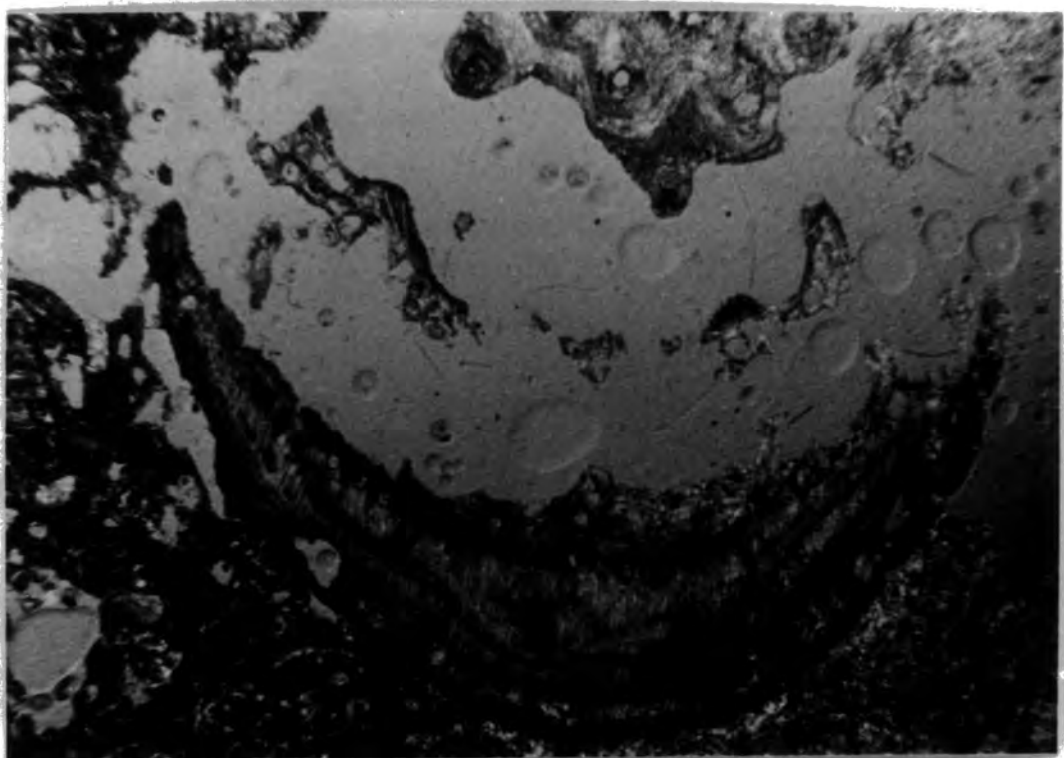
Fig.a Striated extrazoooidal skeleton of a colony
 origin.MP5-6.

Bar scale=Imm

Fig.b As above at higher magnification showing
 discontinuities perpendicular to the striae.
 MP5-6.XPL.

Bar scale=0.Imm

a

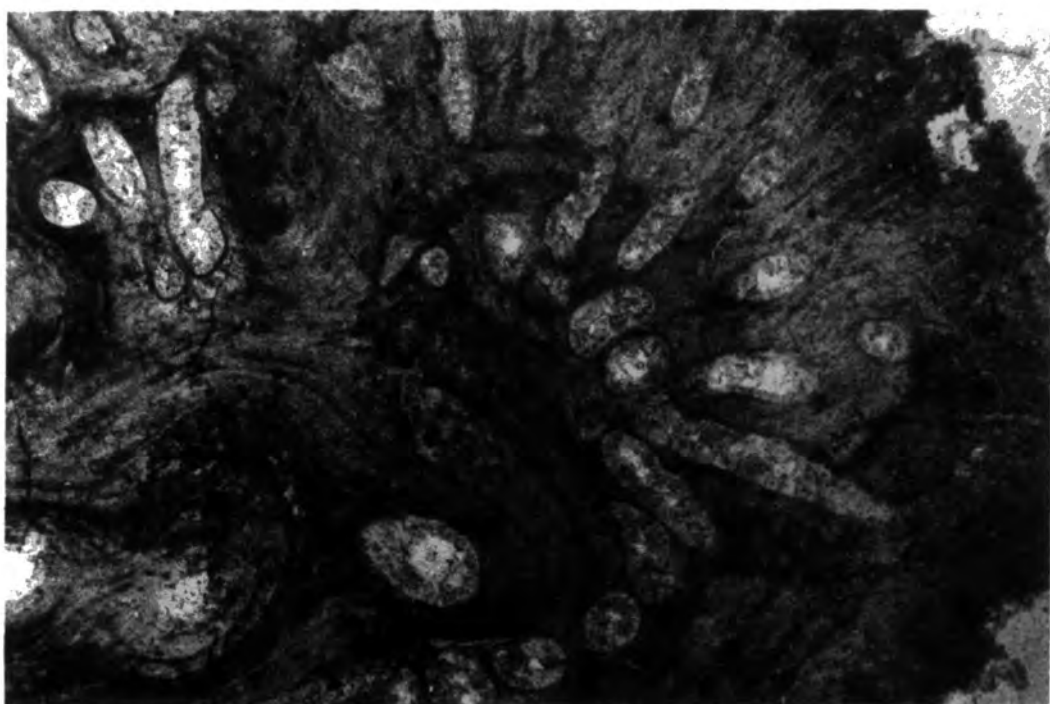


b

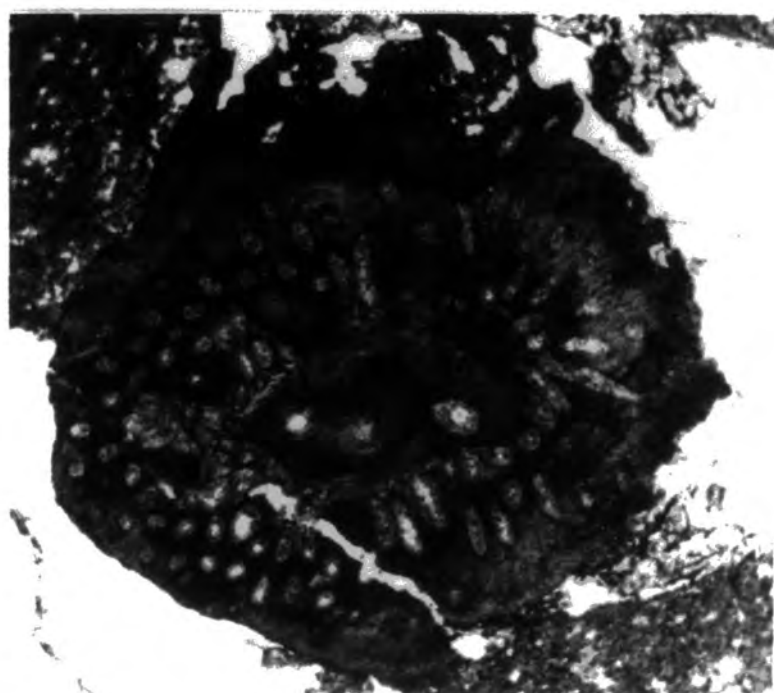


Plate 48. Kingopora ehrenbergi Geinitz

- Fig.a Transverse section close to colony origin,
showing particularly elongate zooecial
chamber in bottom right corner.GLQ4.
Bar scale=Imm
- Fig.b As above at lower magnification.
Bar scale=Imm



a



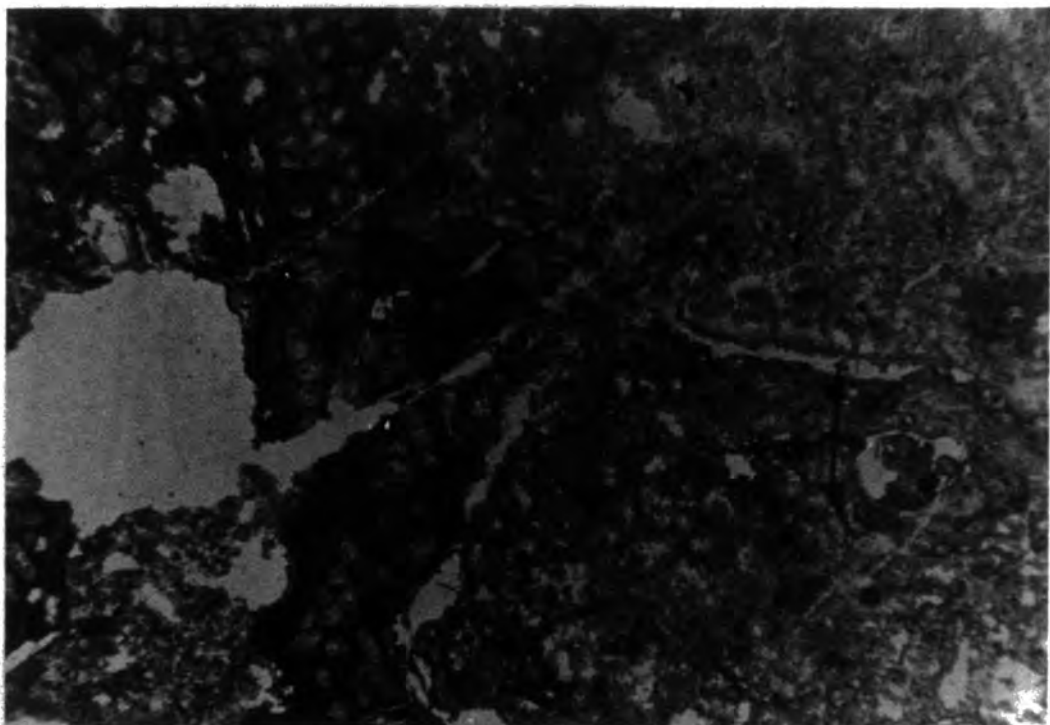
b

Plate 49. Kingopora ehrenbergi Geinitz

Fig.a Supplementary lateral lamina (arrowed).
GLQ6. Bar scale=Imm

Fig.b As above at higher magnification.
Bar scale=Imm

a



b

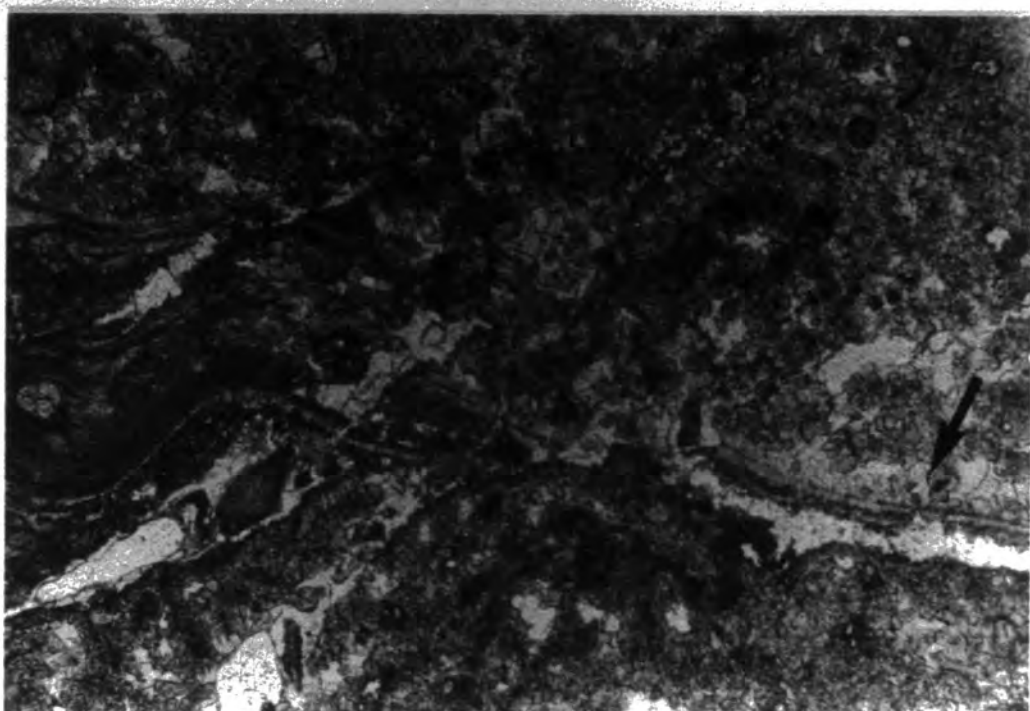
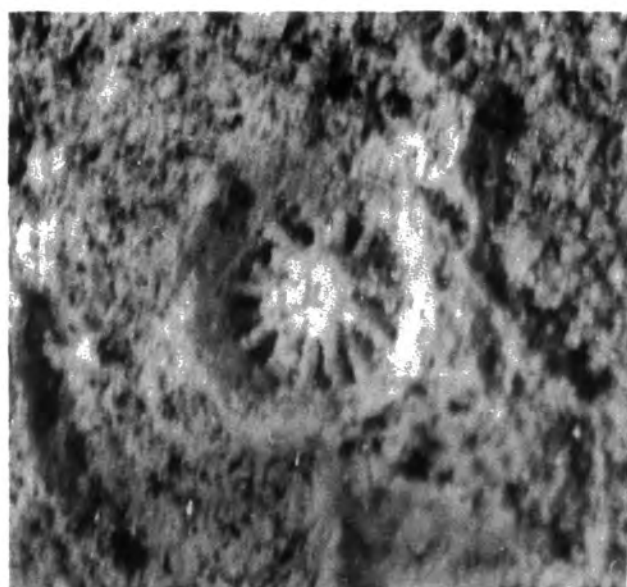


Plate 50.

- Fig.a "Dingeria depressa" Geinitz (1861), interpreted
as part of the holdfast of Kingopora ehrenbergi
by Korn (1930). Specimen with no number.
Bar scale=5mm
- Fig.b Trepostome in cast preservation. GLQIO.
Bar scale=Imm



a



b

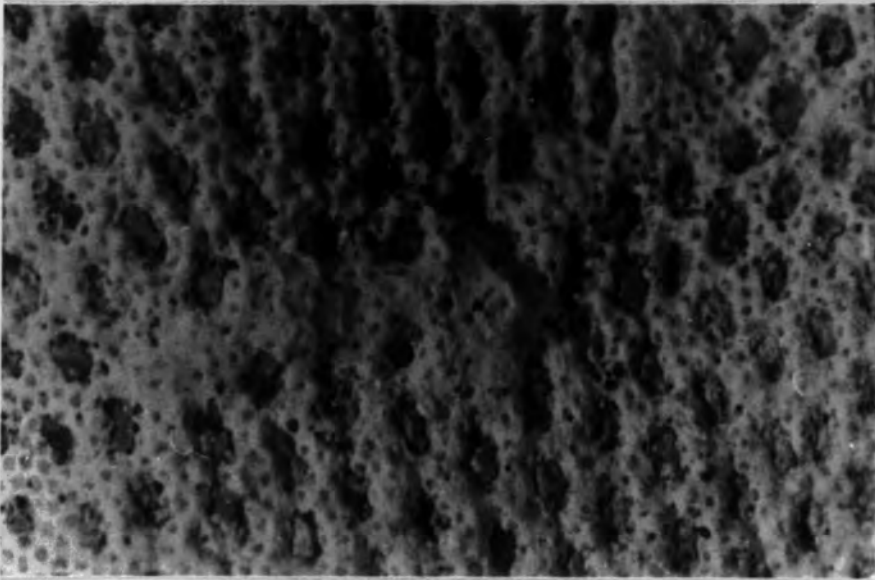


Plate 5I. Kingopora ehrenbergi Geinitz

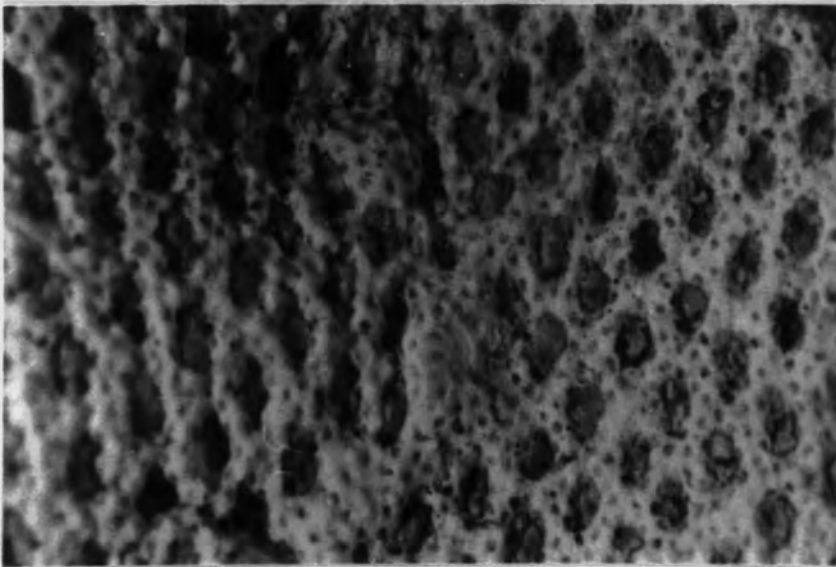
- Fig.a Obverse surface showing structures
interpreted as ovicells (arrowed). NHI.
Bar scale=10mm
- Fig.b As above at higher magnification, showing
?ovicells. Bar scale=Imm
- Fig.c Close-up of ?ovicells. NHI.
Bar scale=Imm



a



b



c

Plate 52. Kingopora ehrenbergi Geinitz

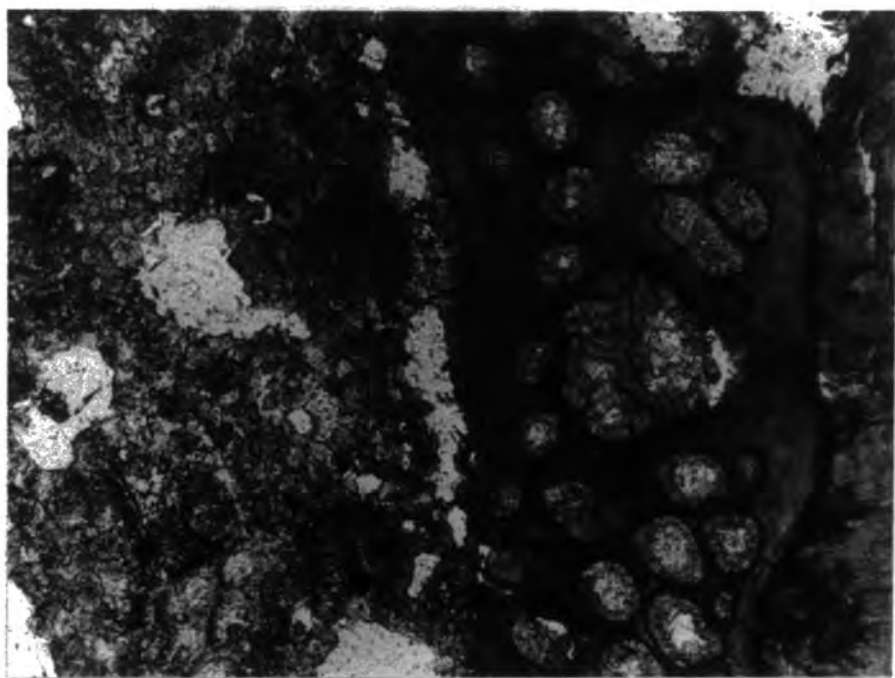
Fig.a Oblique section showing thin skeletal walls developed in a fenestrule - interpreted as ?representing ovicells, or a stage in their development. GLQI5.

Bar scale=Imm

Fig.b As above at higher magnification.

Bar scale=0.1mm

a



b

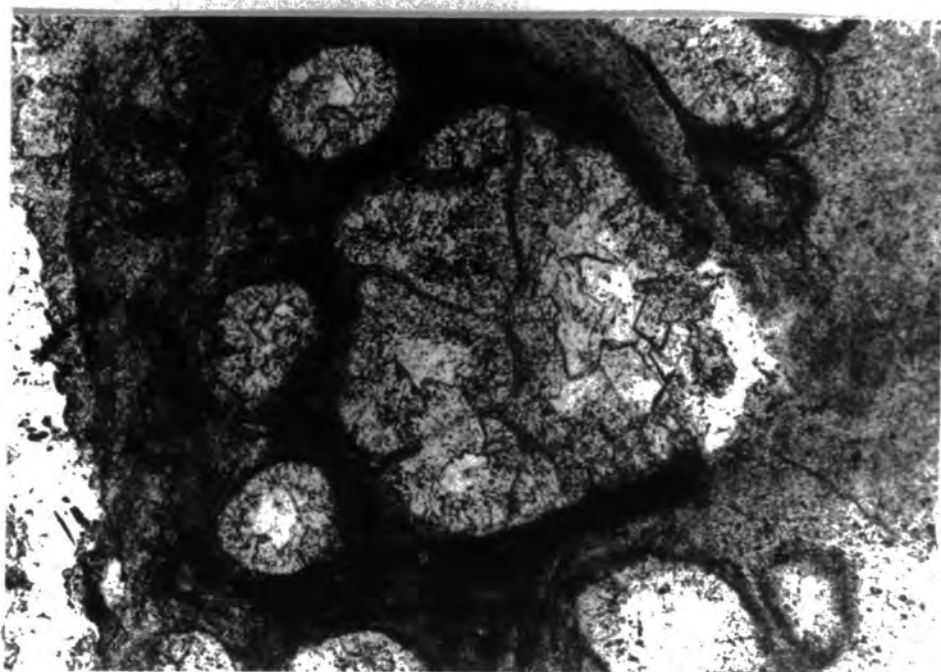
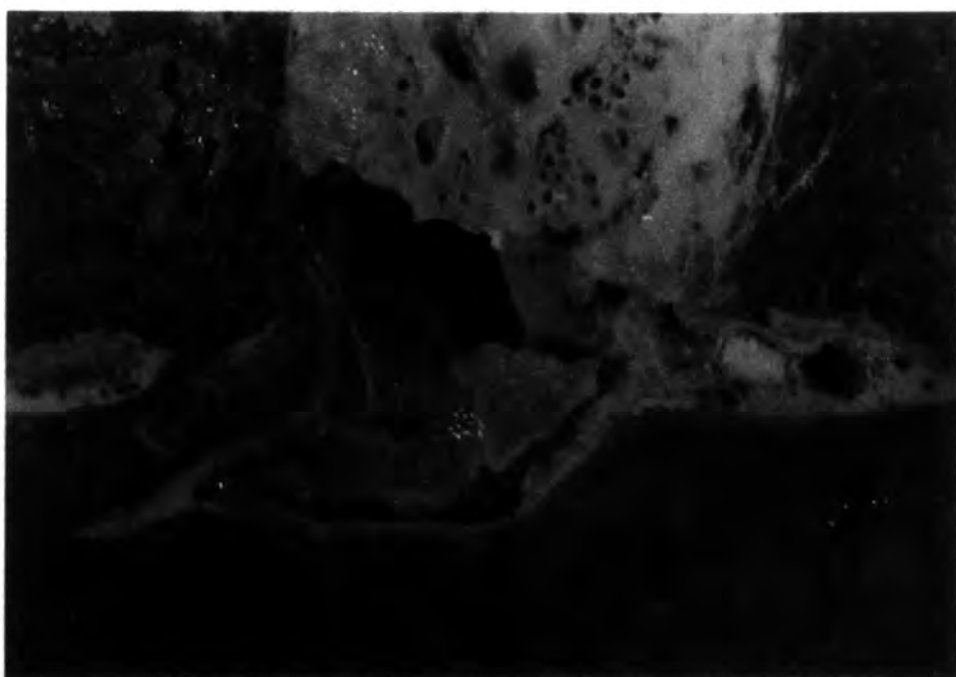


Plate 53. Kingopora ehrenbergi Geinitz

Fig.a Polished section showing colony origin,
encrusting a hard substratum and overgrowing
a colony of Dyscritella.MP5.3/I.Bar scale=Imm

Fig.b As above at lower magnification, showing
lithified crust.
Bar scale=10mm

a



b

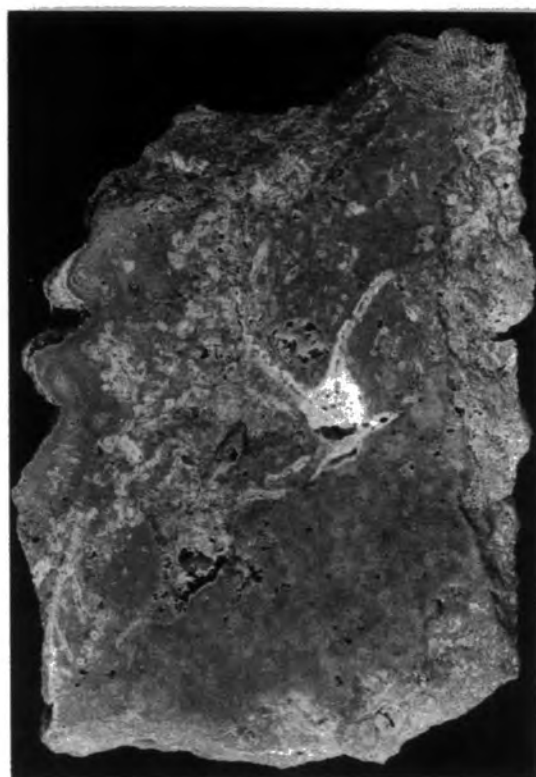


Plate 54. Synocladia virgulacea Sedgwick

Fig.a Zoarial morphology.B45.
Bar scale=5cm

Fig.b Zoarial morphology, showing assymetrical
development of bifurcations.B43A.
Bar scale=3cm

Fig.c Specimen showing development of spiral
zoarial morphology.HYQII.
Bar scale=2cm

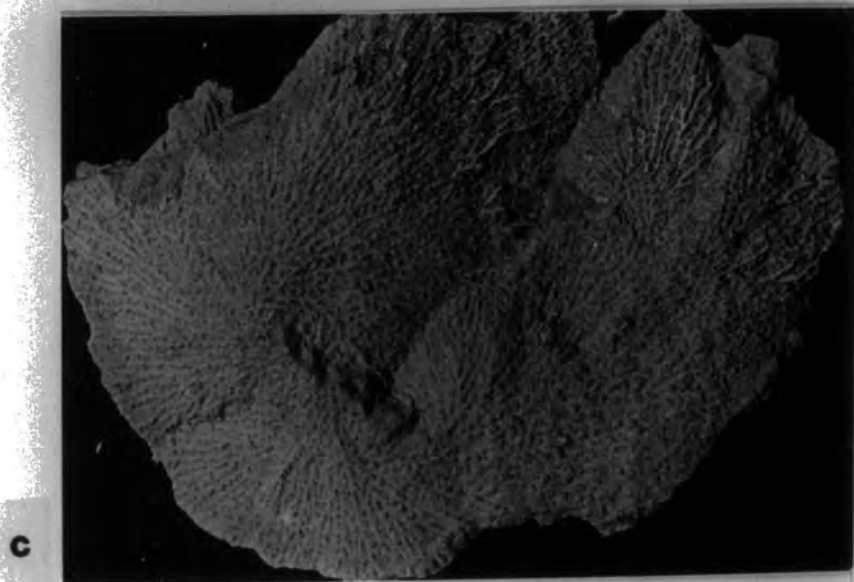
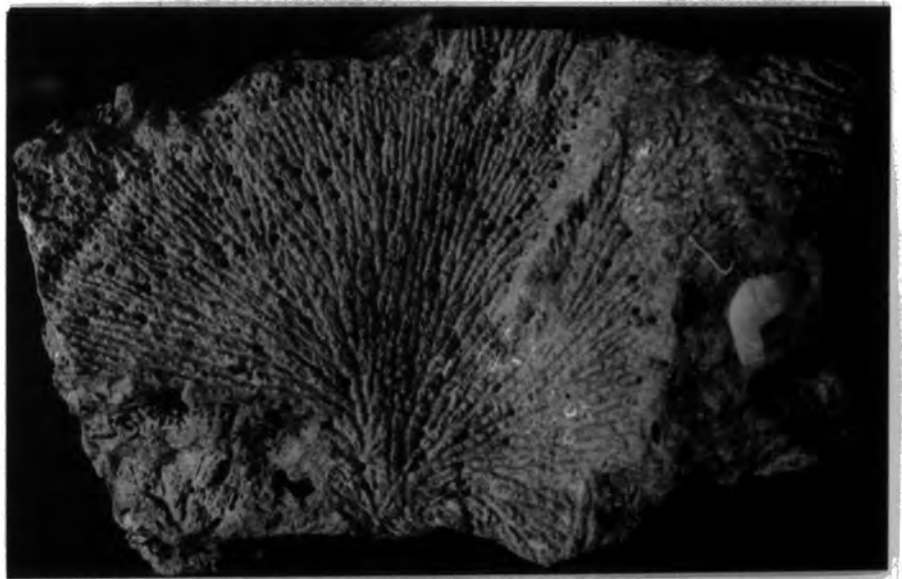


Plate 55. Synocladia virgulacea Sedgwick

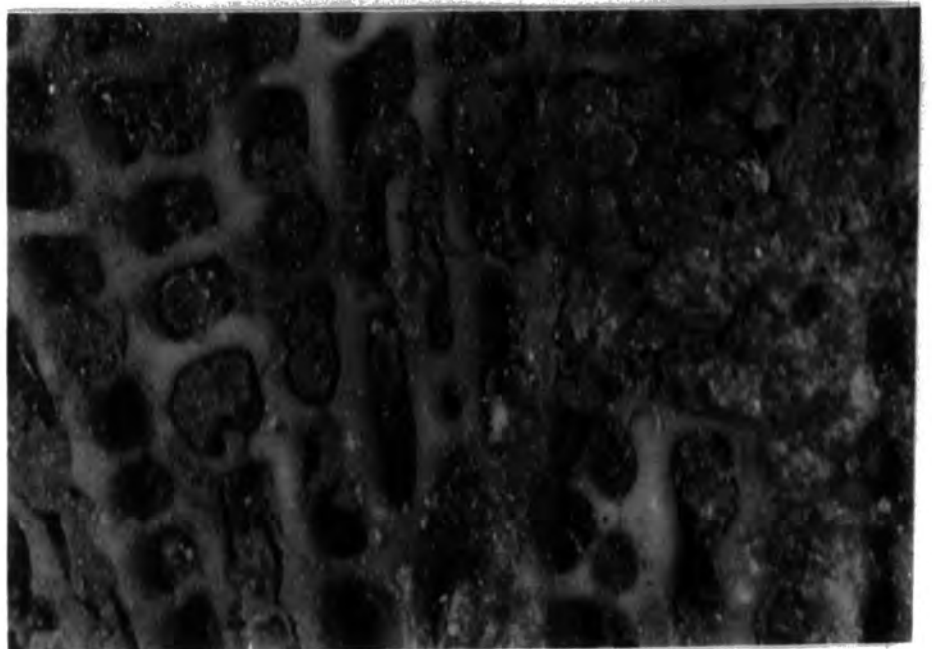
- Fig.a Reverse surface, showing crowding of branches
at distal edge of zoarium.B100.
Bar scale=Icm
- Fig.b Mould of zoarium showing the positions
of reverse surface spines.B30.
Bar scale=Icm
- Fig.c Reverse surface detail.RH2.I.
Bar scale=Imm



a



b



c

Plate 56. Synocladia virgulacea Sedgwick

- Fig.a Latex cast of specimen B29B, showing
 uncharacteristically wide fenestrules.
 Bar scale=Icm
- Fig.b As above at higher magnification, showing
 minor secondary branches developed from
 dissepiments where fenestrules are
 especially wide (arrowed).
 Bar scale=Imm
- Fig.c Reverse surface detail, skeleton removed
 revealing zooecial chambers in cast
 preservation. B100.
 Bar scale=Imm

a



b



c

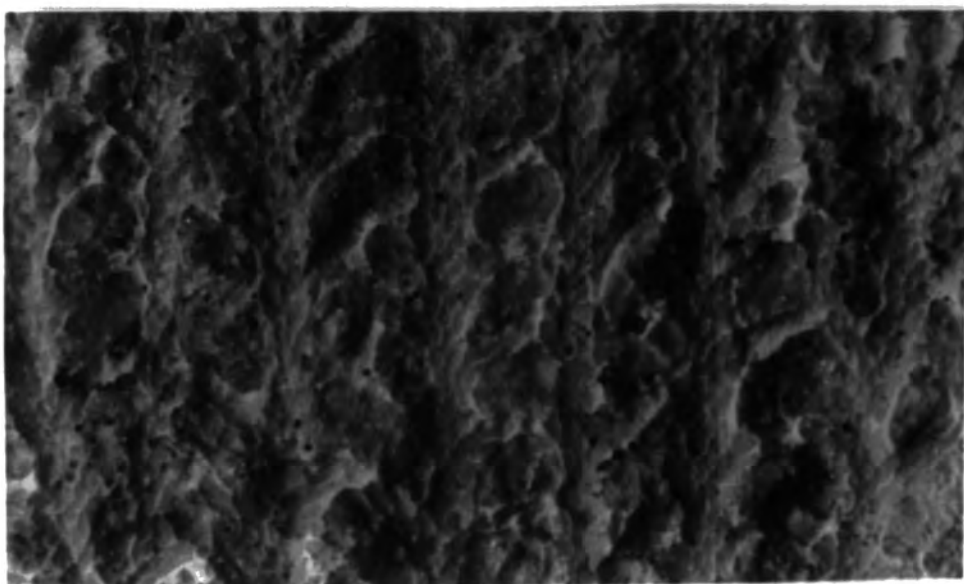


Plate 57. Synocladia virgulacea Sedgwick

Fig.a Tangential section.HM5.5tang.
Bar scale=Imm

Fig.b Tangential section,showing longitudinal
striae and origin of a reverse surface spine.
MP5.23.XPL.
Bar scale=Imm



a



b

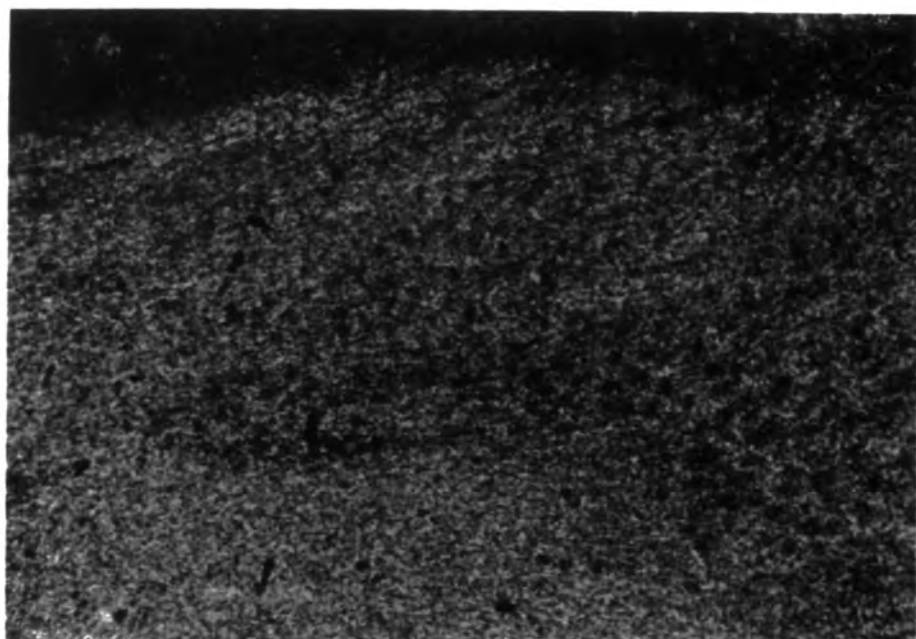


Plate 58. Synocladia virgulacea Sedgwick

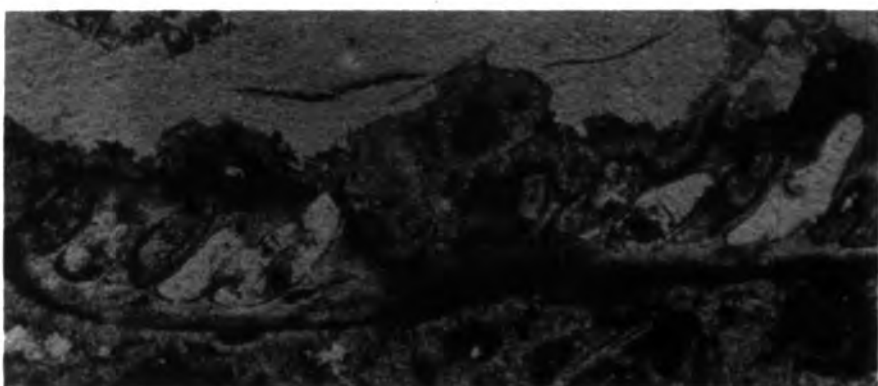
Fig.a Tangential section, showing skeletal rods.
MP5.23. Bar scale=0.1mm

Fig.b Longitudinal section. MP5.25.
Bar scale=1mm

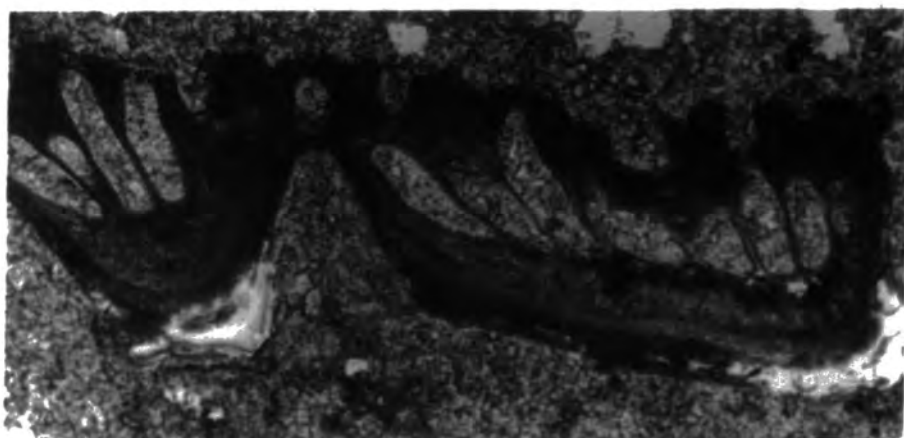
Fig.c Oblique longitudinal section. SBC4a.
Bar scale=1mm



a



b

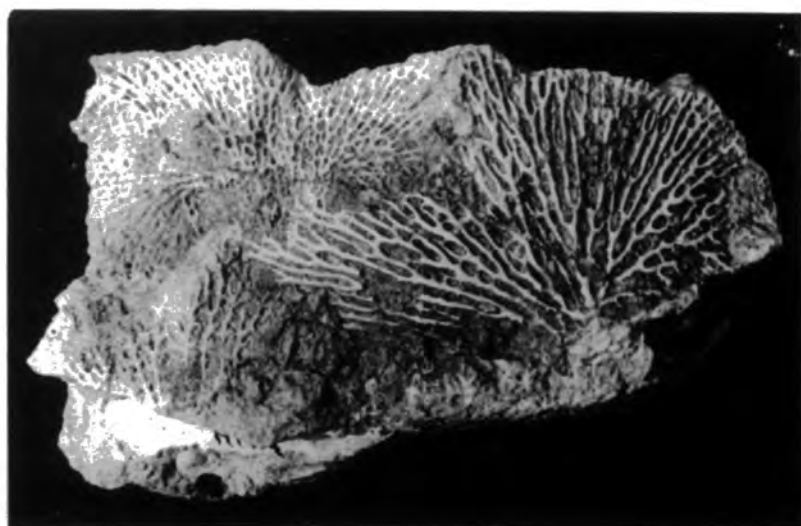


c

Plate 59. Synocladia virgulacea Sedgwick

- Fig.a Specimen showing a clear dichotomy of fenestrule dimensions between proximal and distal parts of the zoarium.HN9.
Bar scale=2cm
- Fig.b Zoarium(preserved as a mould) with a 'sub-colony' developed at its distal margin.Specimen from Sunderland museum with no number.Bar scale=6cm
- Fig.c As above,fig.b,at higher magnification.
Bar scale=5cm

a



b



c

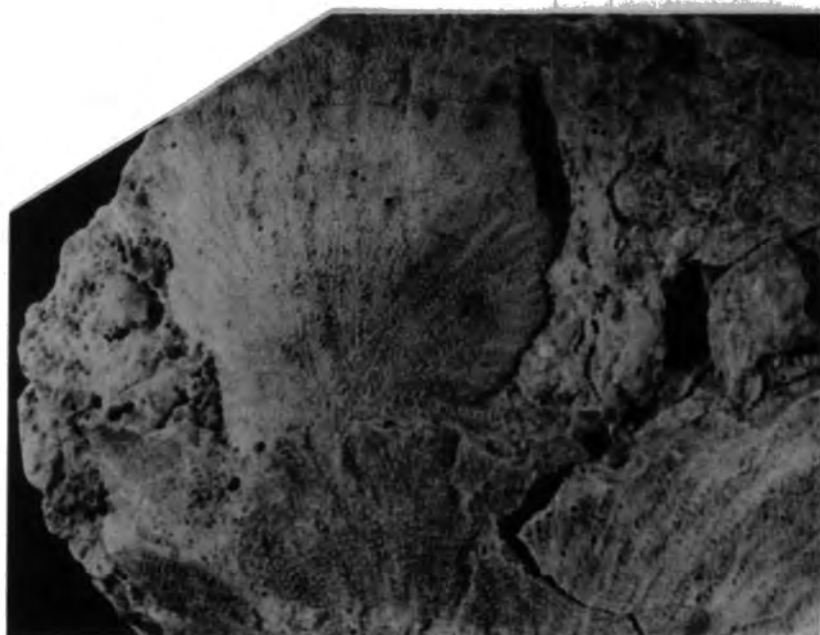


Plate 60. Synocladia virgulacea Sedgwick

- Fig.a Specimen Taf.I fig.10, Taf.II fig.I from the Korn collection, assigned to Synocladia weigelti by Korn(1930).
Bar scale=10mm
- Fig.b Specimen Taf.II fig.5,6 from the Korn collection, assigned to Synocladia dux by Korn(1930).
Bar scale=10mm
- Fig.c Reverse surface of specimen with unusually wide fenestrules.MPI.100.
Bar scale=10mm

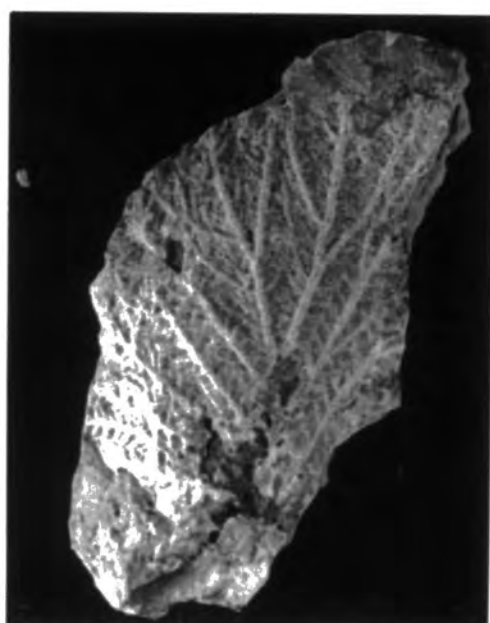


Plate 6I. Synocladia virgulacea Sedgwick

Fig.a Obverse surface,mineralogically overgrown.
MPI.49.Bar scale=10mm

Fig.b Reverse surface of a particularly delicate
zoarium.MPI.23.
Bar scale=10mm

Fig.c Reverse surface of a particularly delicate
zoarium.MPI.83.
Bar scale=10mm



Plate 62. Synocladia virgulacea Sedgwick

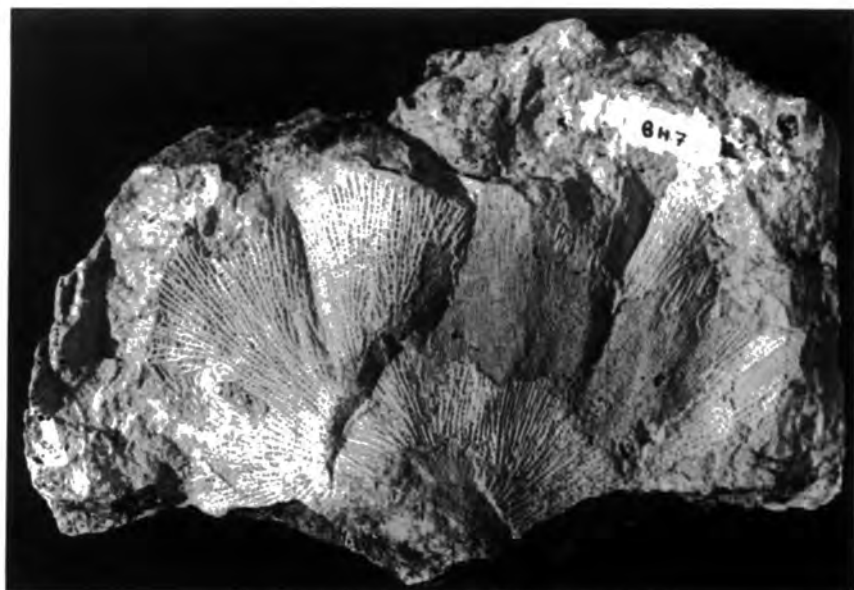
Fig.a Zoarial morphology.BH7.
Bar scale=20mm

Fig.b Zoarial morphology,showing branches developed
at right angles to the growth direction
of the parent branch.RH2.6.
Bar scale=10mm

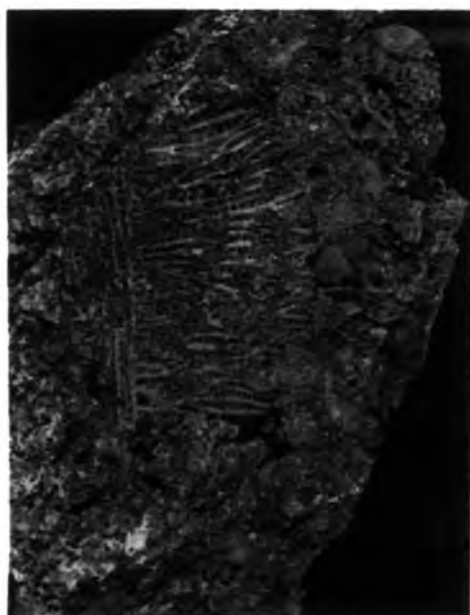
Fig.c Zoarial morphology,showing sudden expansion
from one level.B43B.
Bar scale=10mm

Fig.d Zoarial morphology,showing branches developed
at right angles to the growth direction
of the parent branch.B29A.
Bar scale=10mm

a



b



c



d



Plate 63. Synocladia virgulacea Sedgwick

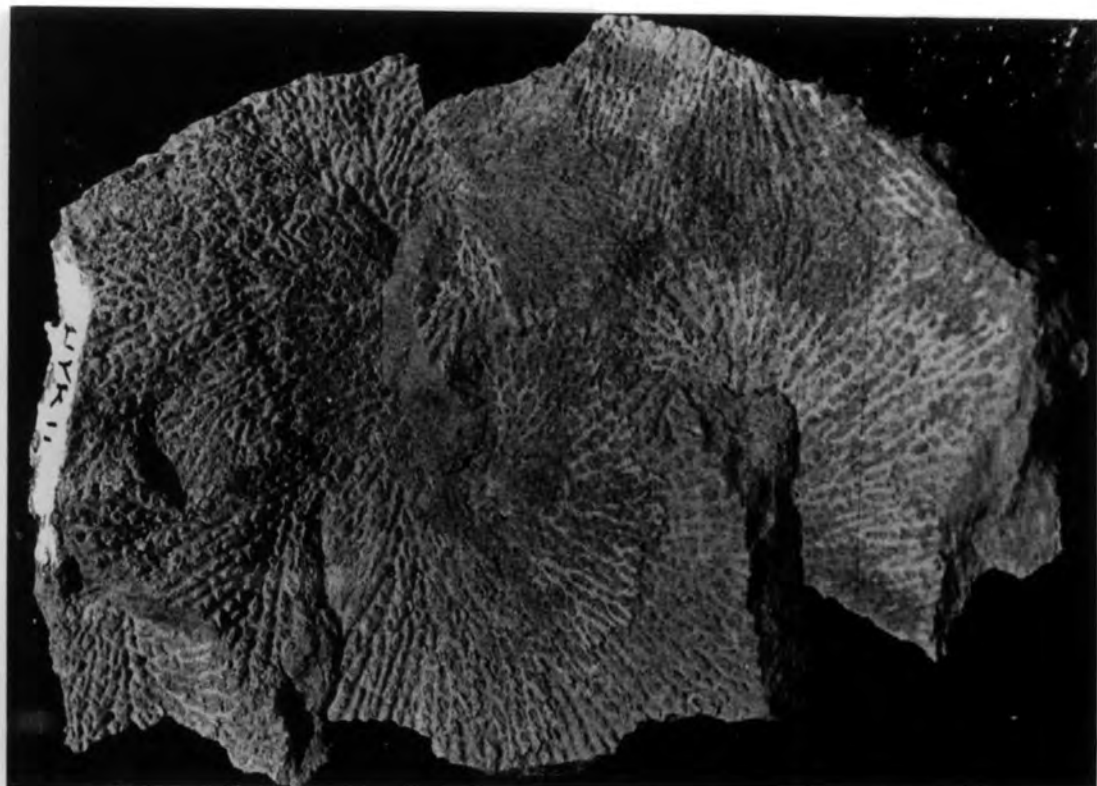
Fig.a Zoarium with a spiral, multi-laminar
morphology. HYQII.

Bar scale=10mm

Fig.b Zoarium with a spiral, multi-laminar
morphology. HYQI2.

Bar scale=20mm

a



b



Plate 64. Synocladia virgulacea Sedgwick

Fig.a S.E.M. photomicrograph showing the obverse surface and abundant nanate zooecia.HNI.

Bar scale=Imm

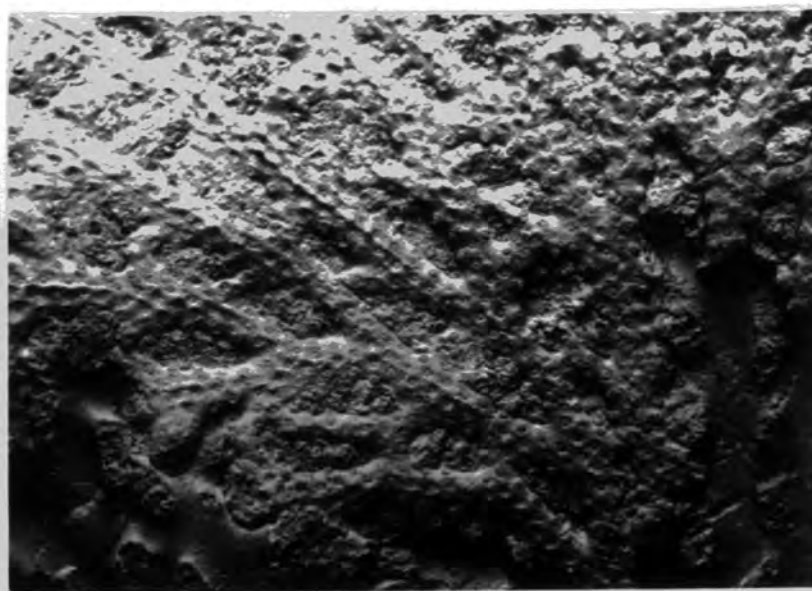
Fig.b As above at higher magnification.

Bar scale=Imm

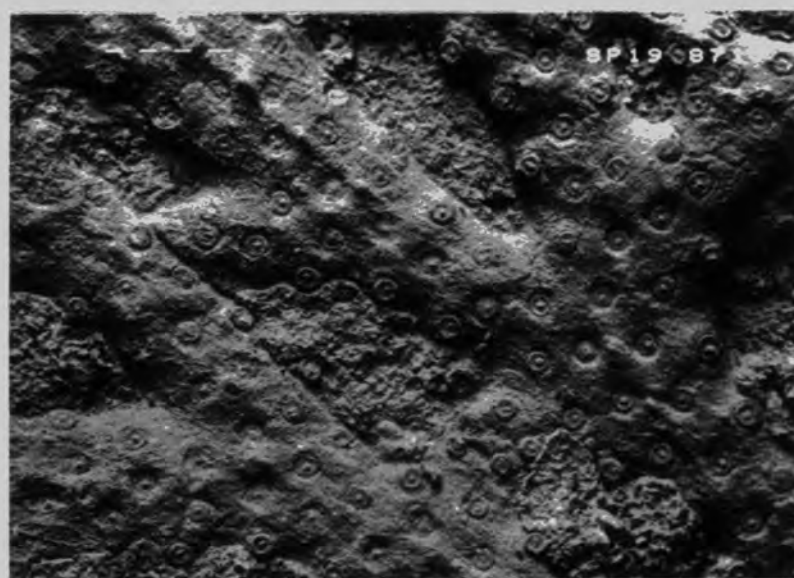
Fig.c As above at higher magnification, showing nanate zooecia in cast preservation.

Bar scale=0.Imm

a



b



c



Plate 65. Synocladia virgulacea Sedgwick

Section (XPL) showing origin of zoarium.
Ancestrula and earliest zooecial chambers
are not visible. Colony attached to a
fragment of Acanthocladia.MP5.23.

Bar scale=Imm

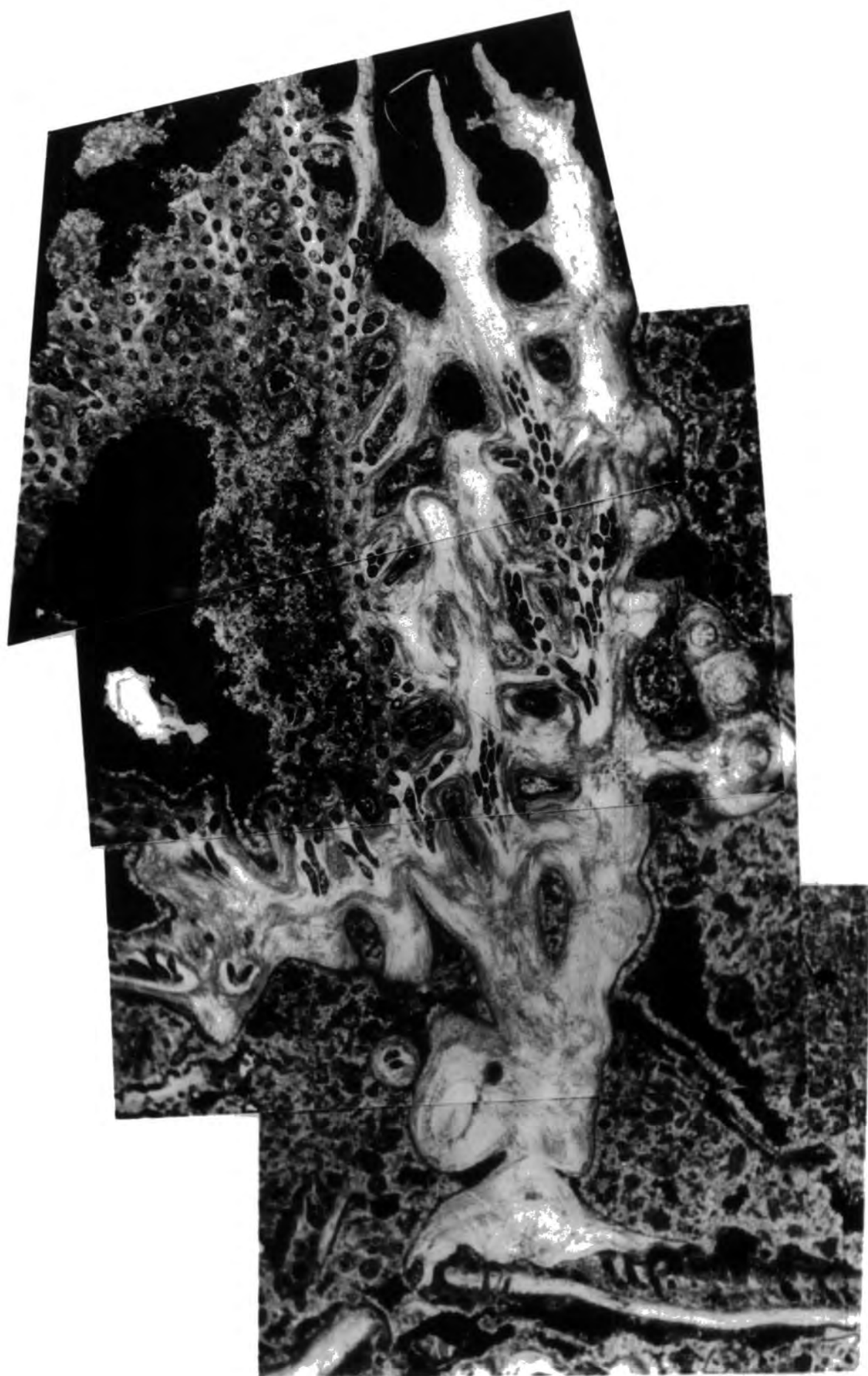
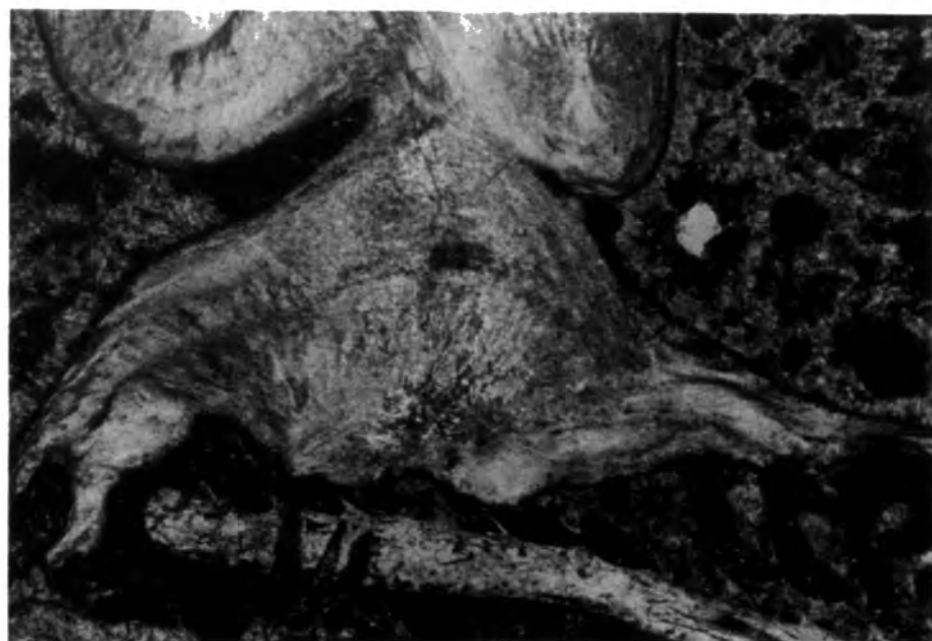


Plate 66. Synocladia virgulacea Sedgwick

- Fig.a Close-up of colony origin(see Pl.65),
showing irregularity of interface between
S.virgulacea and substratum(Acanthocladia).
MP5.23.Bar scale=Imm
- Fig.b As above at higher magnification, showing
chevron-like folds in the primary granular
layer.Bar scale=0.Imm XPL
- Fig.c As above,fig.b,at higher magnification.
XPL.Bar scale=0.Imm

a



b



c

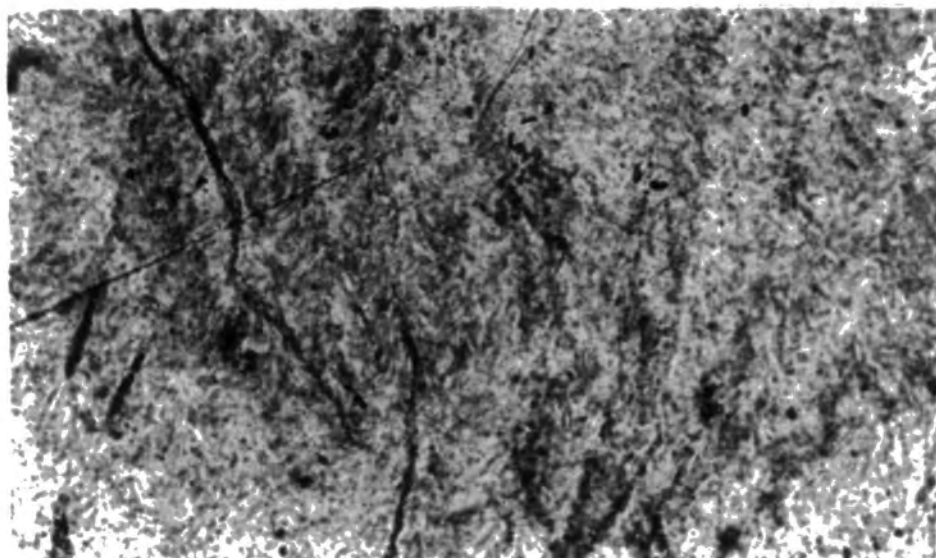
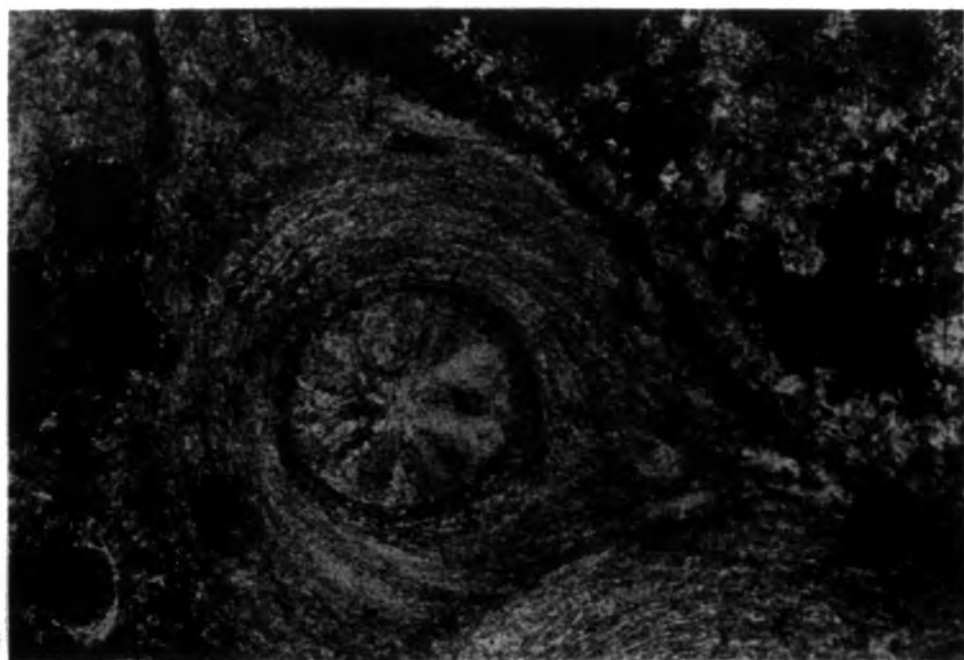


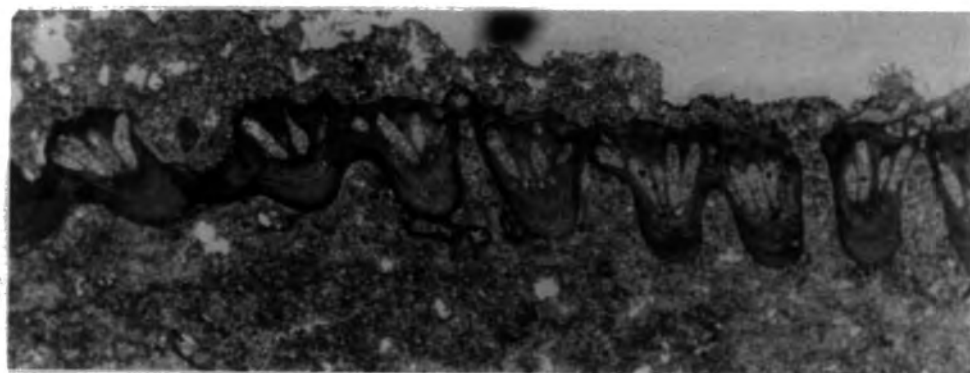
Plate 67. Synocladia virgulacea Sedgwick

- Fig.a Transverse section through a spine, showing granular core surrounded by outer laminated skeleton.MP5.23.XPL
Bar scale=0.Imm
- Fig.b Transverse Section.SBC4a.
Bar scale=Imm
- Fig.c As above at higher magnification.The cylindrical object in the top centre of the figure may be a worm tube which has suffered bioimmuration.
Bar scale=Imm

a



b



c

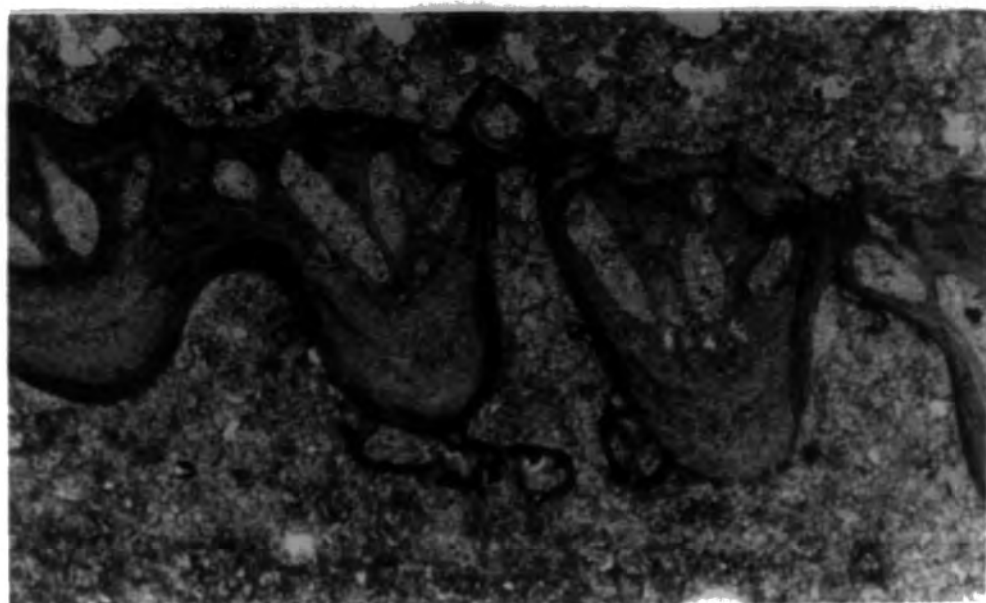
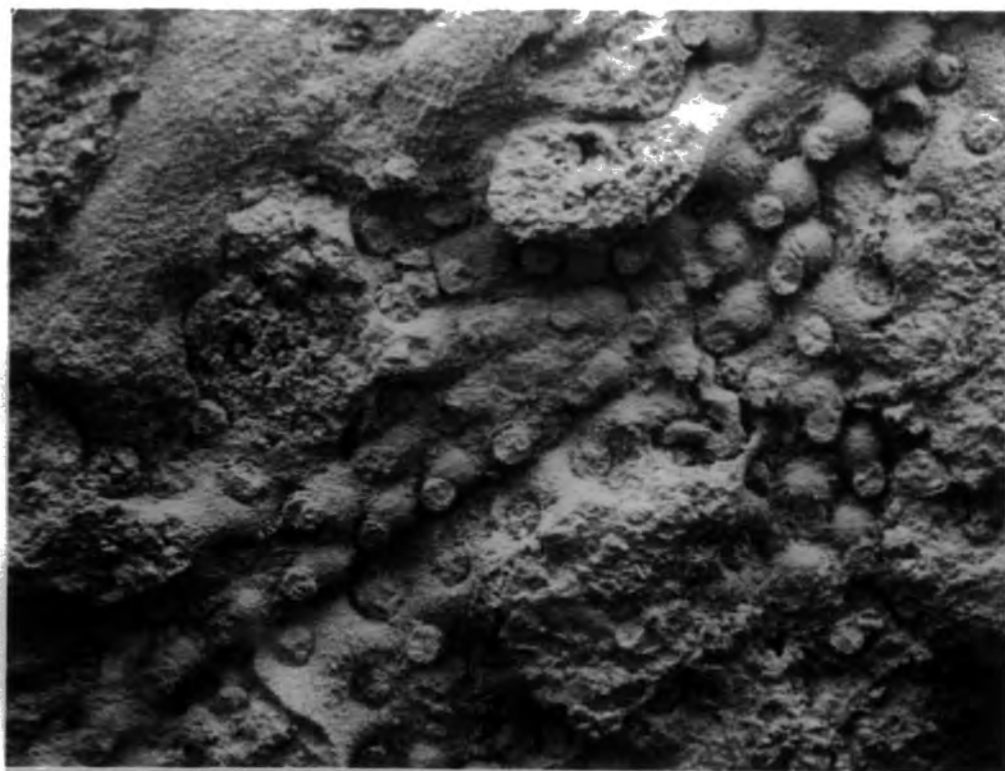


Plate 68. Synocladia virgulacea Sedgwick

Fig.a S.E.M. photomicrograph showing ovicells in cast preservation where part of the branch has been removed. Branch growth direction is towards the bottom left corner of the figure. MPI. I8.
Bar scale=Imm

Fig.b As above at higher magnification.
Bar scale=0.Imm

a



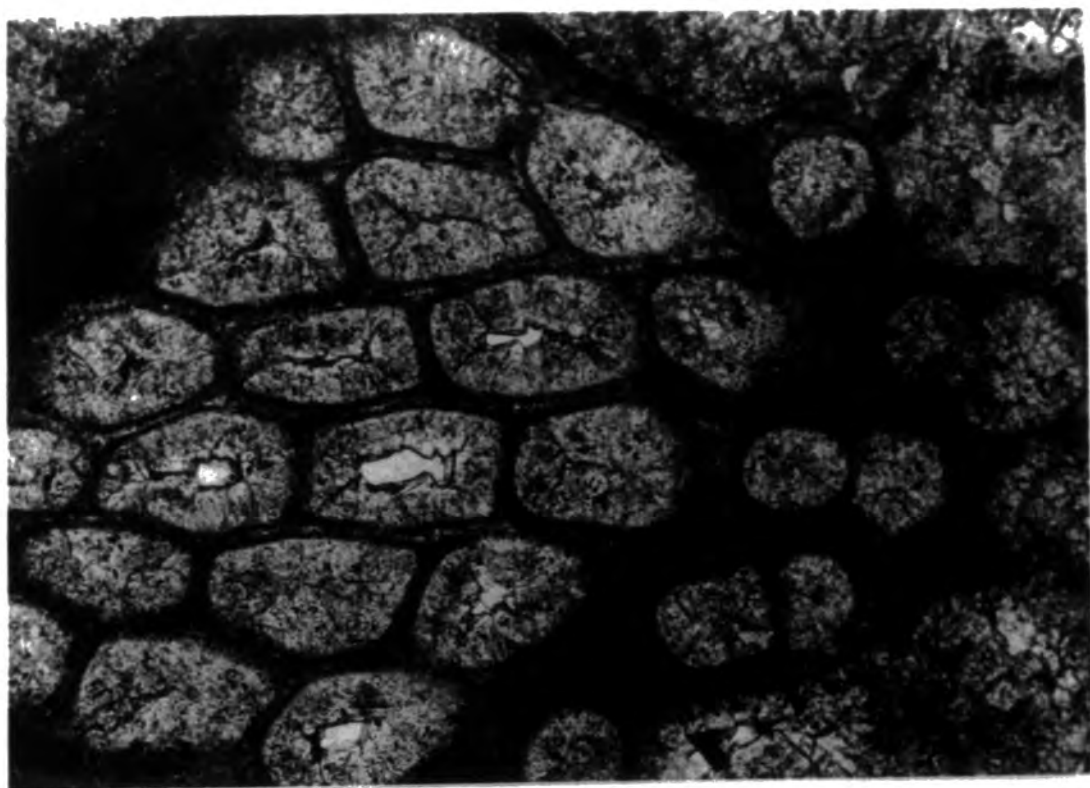
b



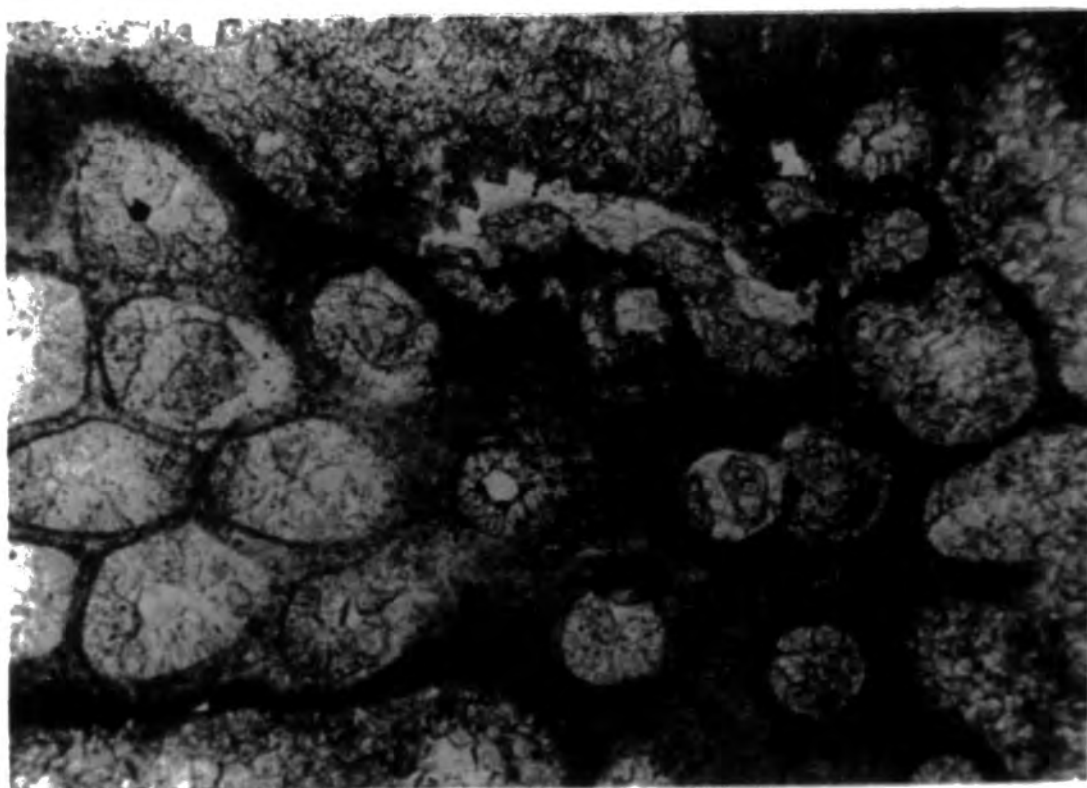
Plate 69. Synocladia virgulacea Sedgwick

Fig.a Oblique tangential section, showing ovicells
proximal to zooecial apertures. MPI.b.
Bar scale=0.1mm

Fig.b Oblique tangential section, showing ovicells
proximal to zooecial apertures. MPI.b.
Bar scale=0.1mm



a



b



Plate 70. Synocladia virgulacea Sedgwick

- Fig.a Specimen K40 from the Schlotheim collection,
labelled as "Keratophytes dubius".
Bar scale=10mm
- Fig.b Specimen K45.I from the Schlotheim collection,
labelled as "Keratophytes dubius".
Bar scale=10mm
- Fig.c Specimen K40, Schlotheim collection, labelled
as "Keratophytes dubius". Close-up of zooecial
chambers in cast preservation.
Bar scale=1mm
- Fig.d Specimen C20 from the Schlotheim collection,
labelled as "Keratophytes dubius". Preserved
as a mould.
Bar scale=10mm

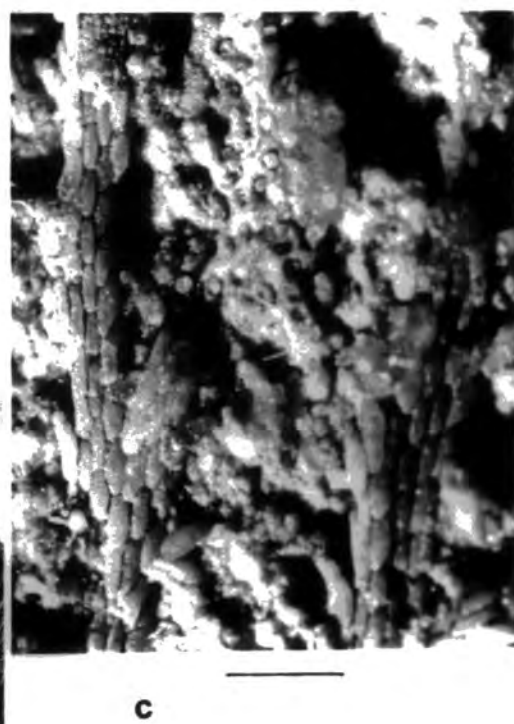
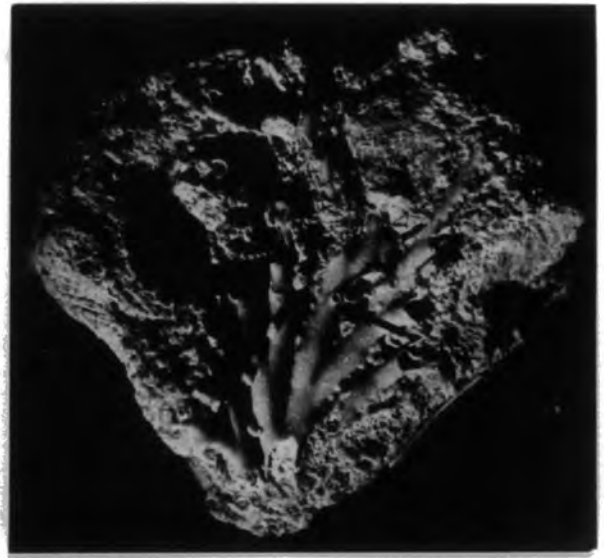


Plate 7I. Thamniscus dubius Schlotheim

- Fig.a Reverse surface,mineralogically overgrown.
Original position of reverse surface spine
arrowed.7I2F.
Bar scale=10mm
- Fig.b As above at higher magnification.
Bar scale=1mm
- Fig.c Zoarium supported above a substrate of
Fenestella by reverse surface spines(arrowed).
RH4.36.Bar scale=10mm

a



b



c

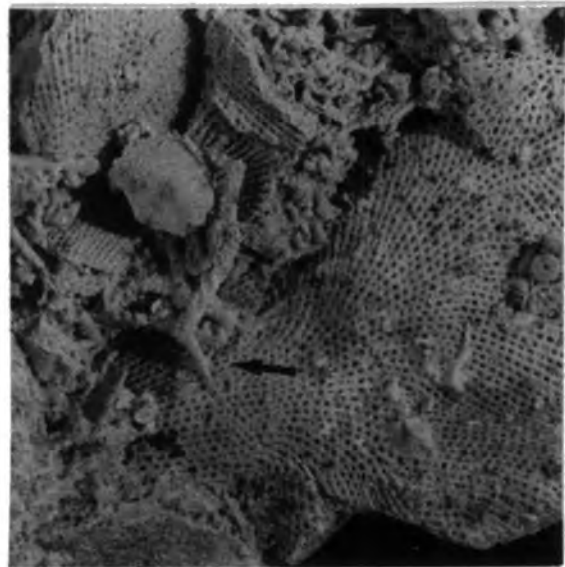


Plate 72. Thamniscus dubius Schlotheim

- Fig.a Obverse surface, showing colony form.
B90A. Bar scale=10mm
- Fig.b Reverse surface. B92D.
Bar scale=10mm
- Fig.c Reverse surface. B92A.
Bar scale=10mm
- Fig.d Reverse surface and cast preservation. B92C.
Bar scale=10mm
- Fig.e Reverse surface, mineralogically overgrown.
B92B. Bar scale=10mm

a



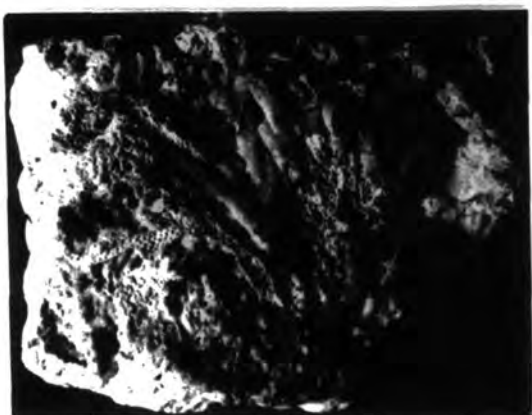
b



c



d



e



Plate 73. Thamniscus dubius Schlotheim

Fig.a Reverse surface,mineralogically overgrown.
Origin of reverse surface spine arrowed.
RH4.33.Bar scale=10mm

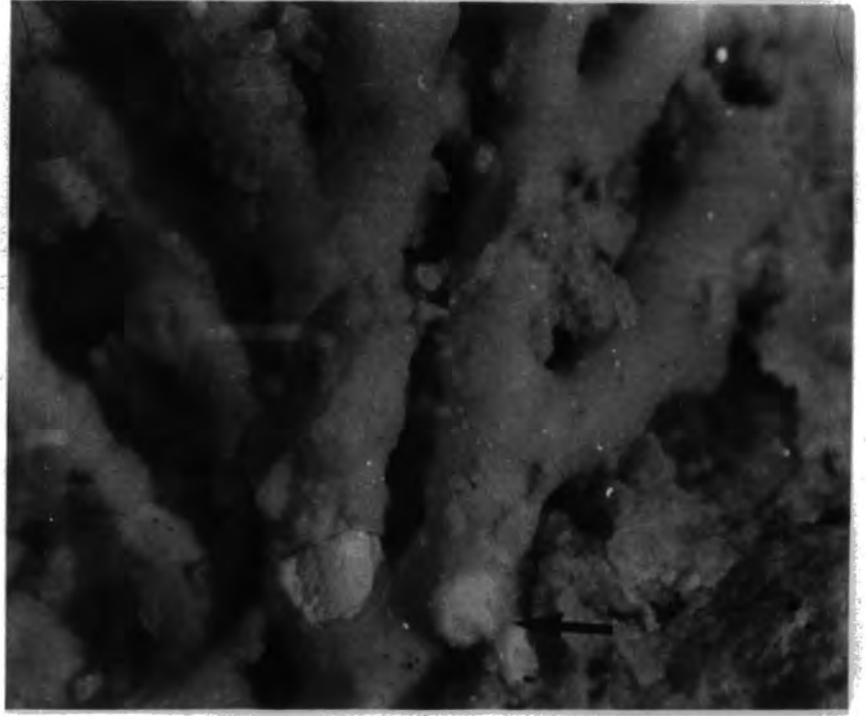
Fig.b As above at higher magnification.
Bar scale=Imm

Fig.c Reverse surface revealing zooecial chambers
in cast preservation.7IOF.
Bar scale=Imm

a



b



c

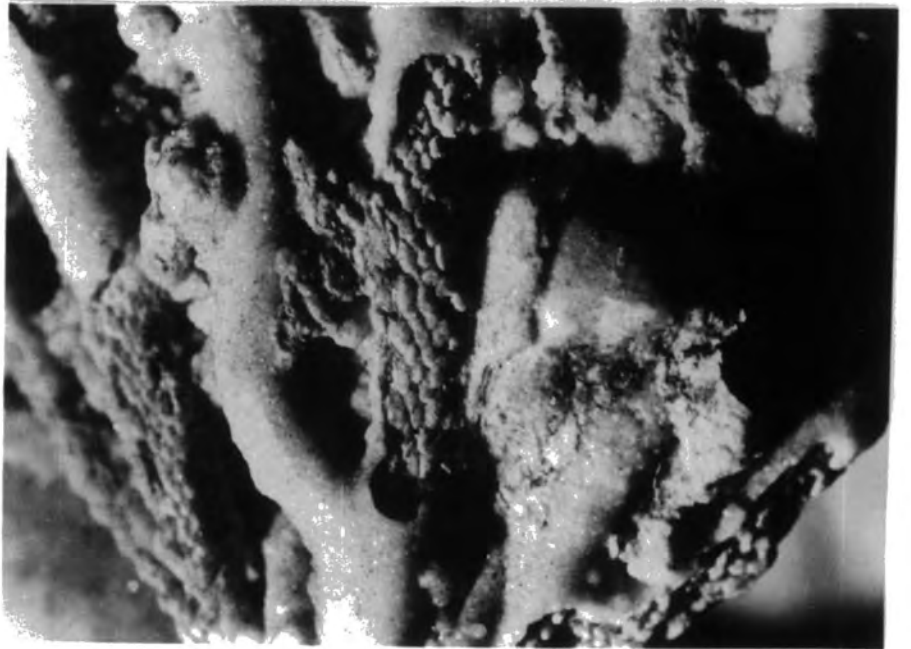


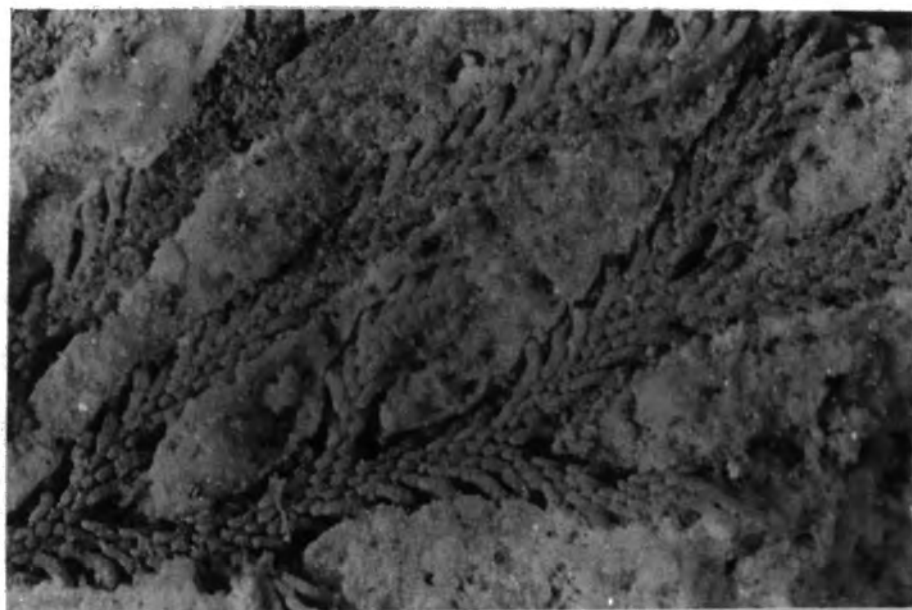
Plate 74. Thamniscus dubius Schlotheim

Fig.a Zooecial chambers in cast preservation,
seen from the reverse side.HM5.Ia.
Bar scale=Imm

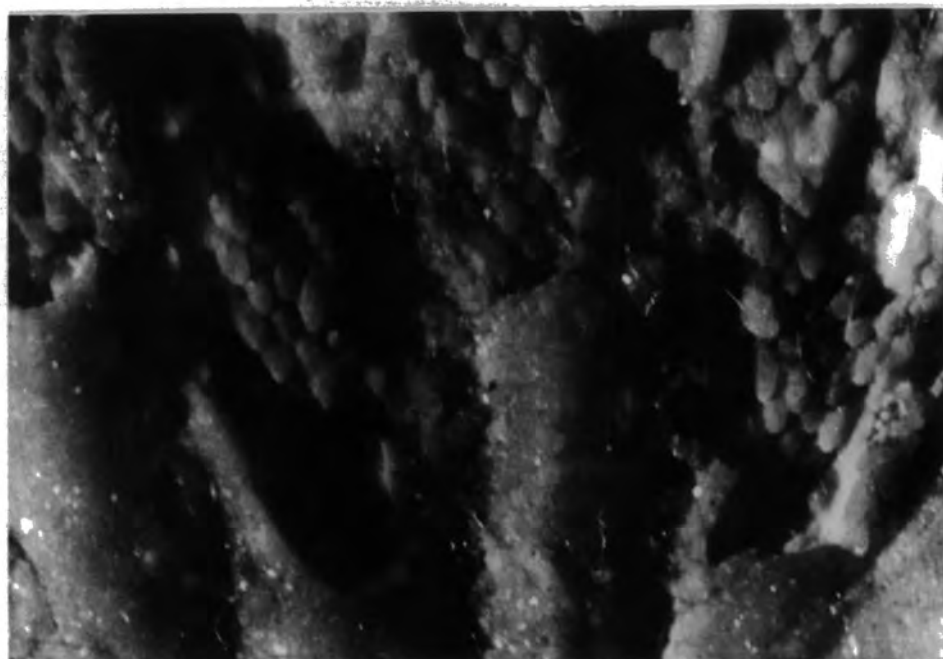
Fig.b Reverse surface revealing zooecial chambers
in cast preservation.B92B.
Bar scale=Imm

Fig.c Reverse surface.Irregularly distributed
circular holes resemble accessory pores
but are probably the work of some boring
organism.B92A.
Bar scale=Imm

a



b



c



Plate 75. Thamniscus dubius Schlotheim

Fig.a Obverse surface,mineralogically overgrown.
RH4.30.Bar scale=10mm

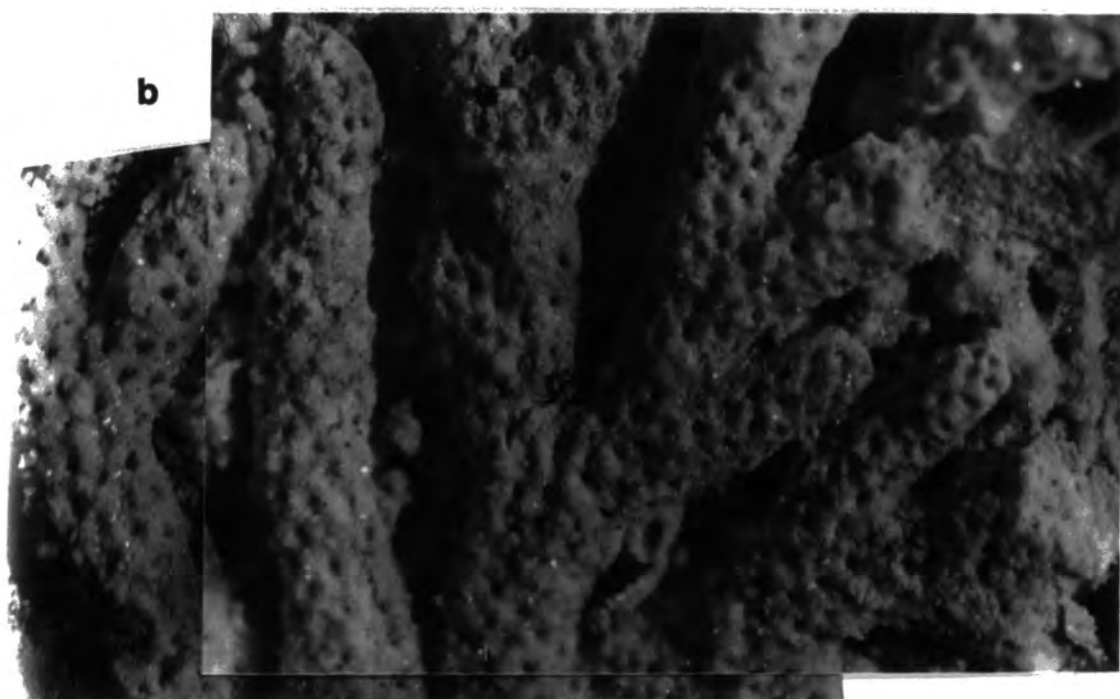
Fig.b As above at higher magnification.
Bar scale=1mm

Fig.c Obverse surface detail,mineralogically
overgrown.B90A.
Bar scale=1mm

a



b



c

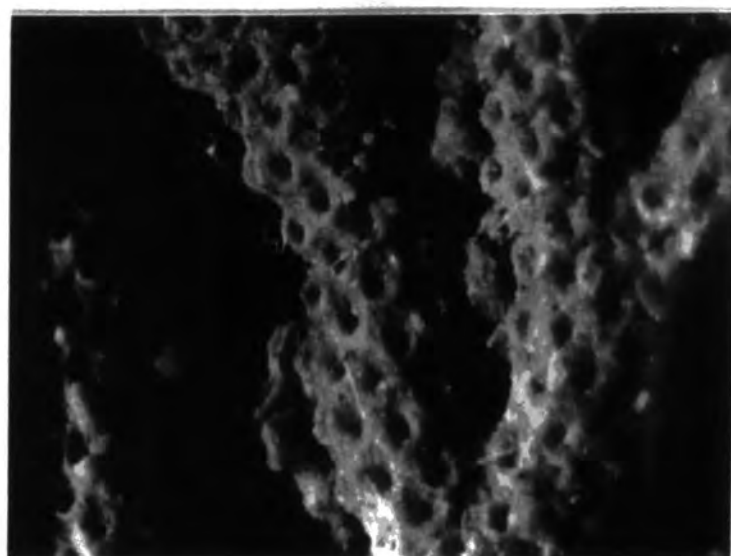


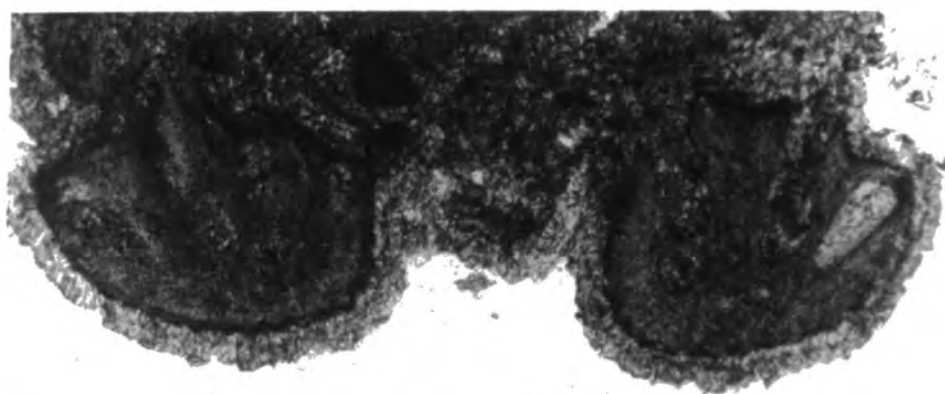
Plate 76. Thamniscus dubius Schlotheim

Fig.a Transverse section.RH4.3.
Bar scale=Imm

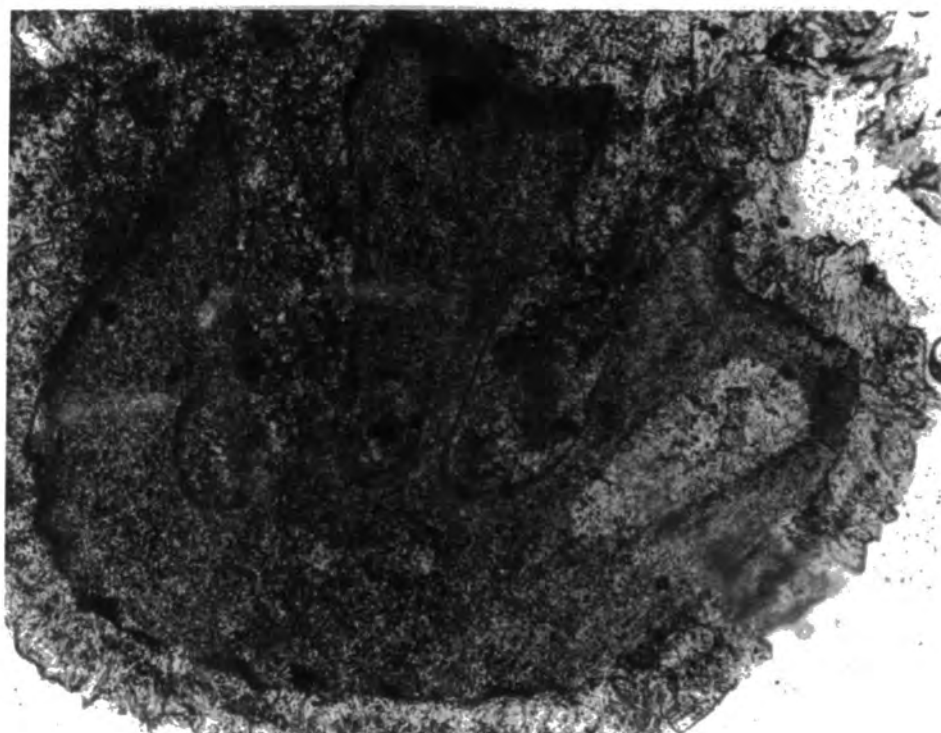
Fig.b As above at higher magnification.
Bar scale=0.Imm

Fig.c Oblique longitudinal section.Reverse
surface spine developed in bottom left
corner of figure.RH4.39a.
Bar scale=Imm

a



b



c

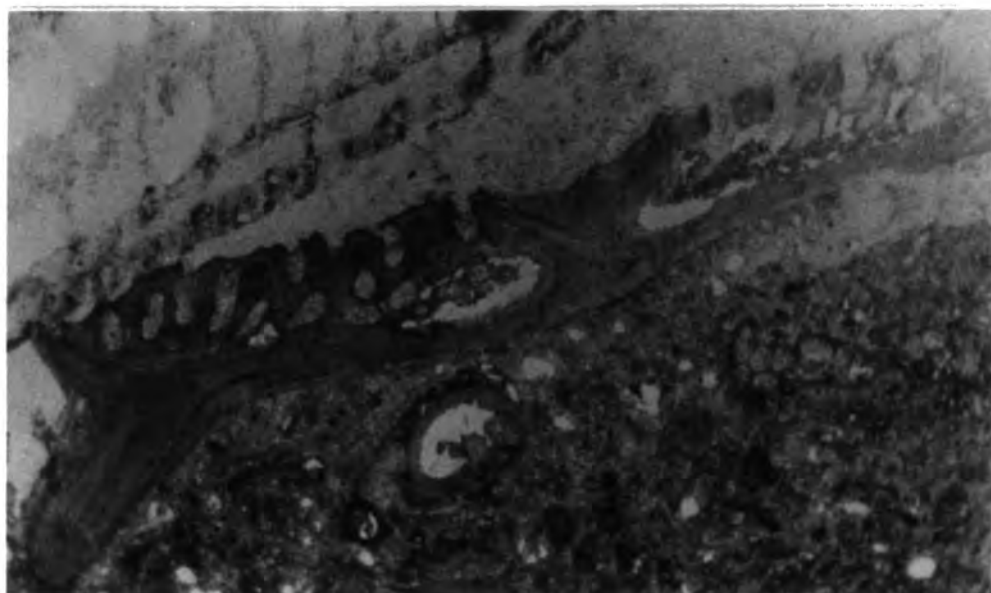
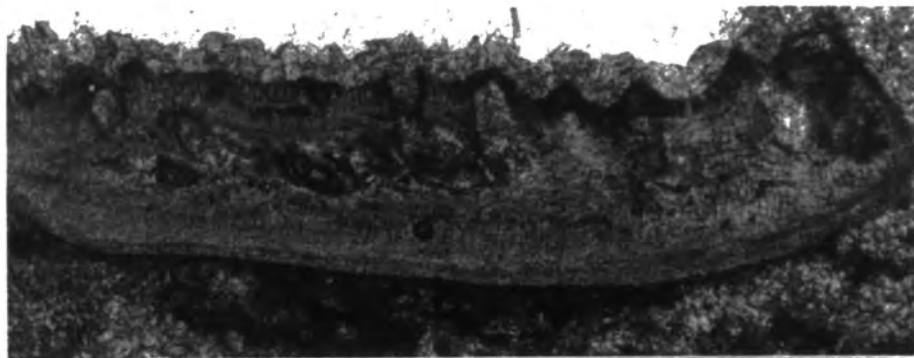


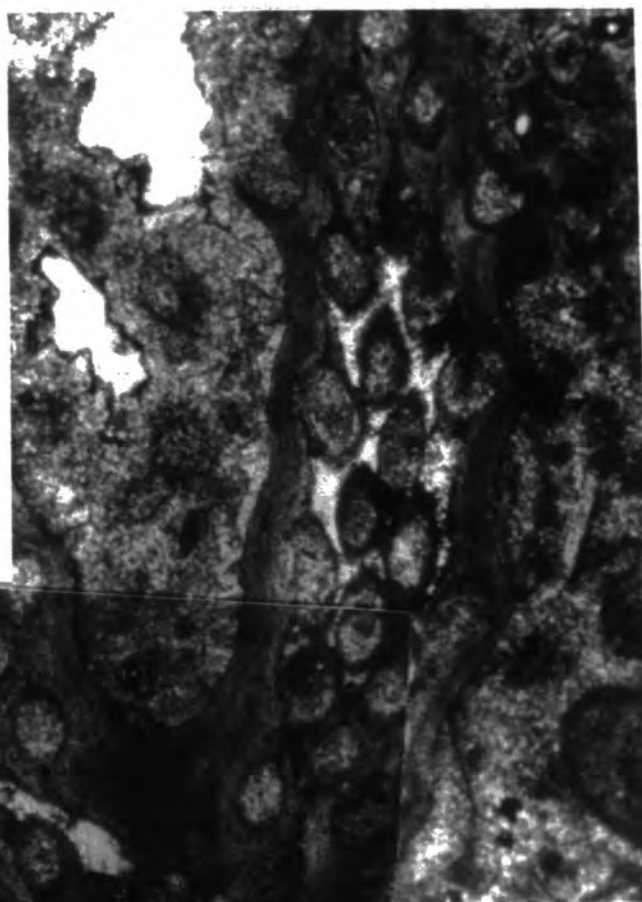
Plate 77. Thamniscus dubius Schlotheim

Fig.a Slightly oblique longitudinal section.
RH4.IO.Bar scale=Imm

Fig.b Tangential section, showing bifurcation.
RH4.IO.Bar scale=Imm



a



b

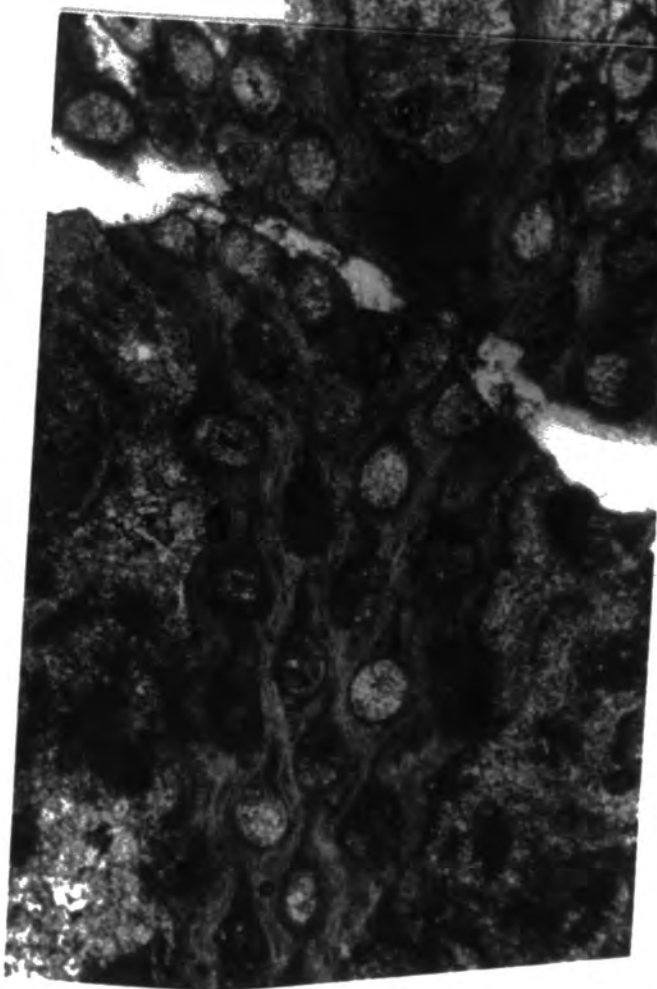
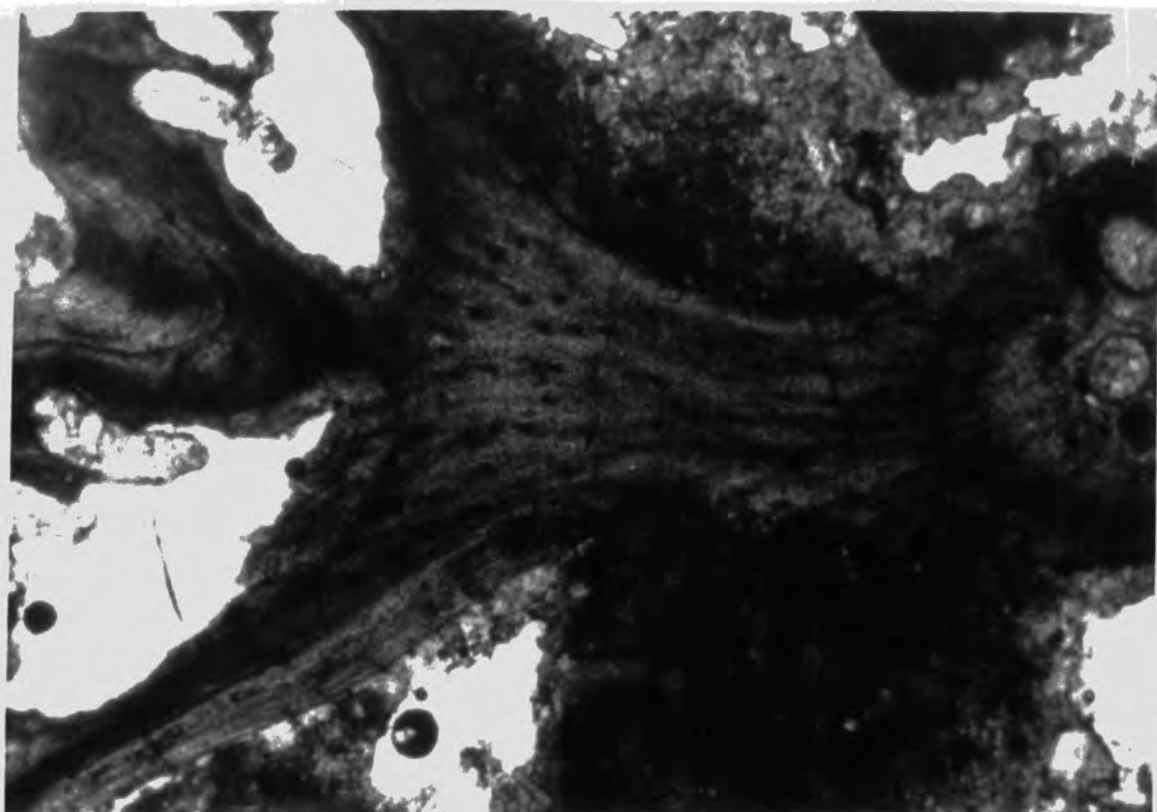


Plate 78. Thamniscus dubius Schlotheim

Fig.a Oblique section, showing ?skeletal rods. RH4.39.
Bar scale=Imm

Fig.b Oblique section showing longitudinal striae.
RH4.39.XPL.
Bar scale=Imm

a



b

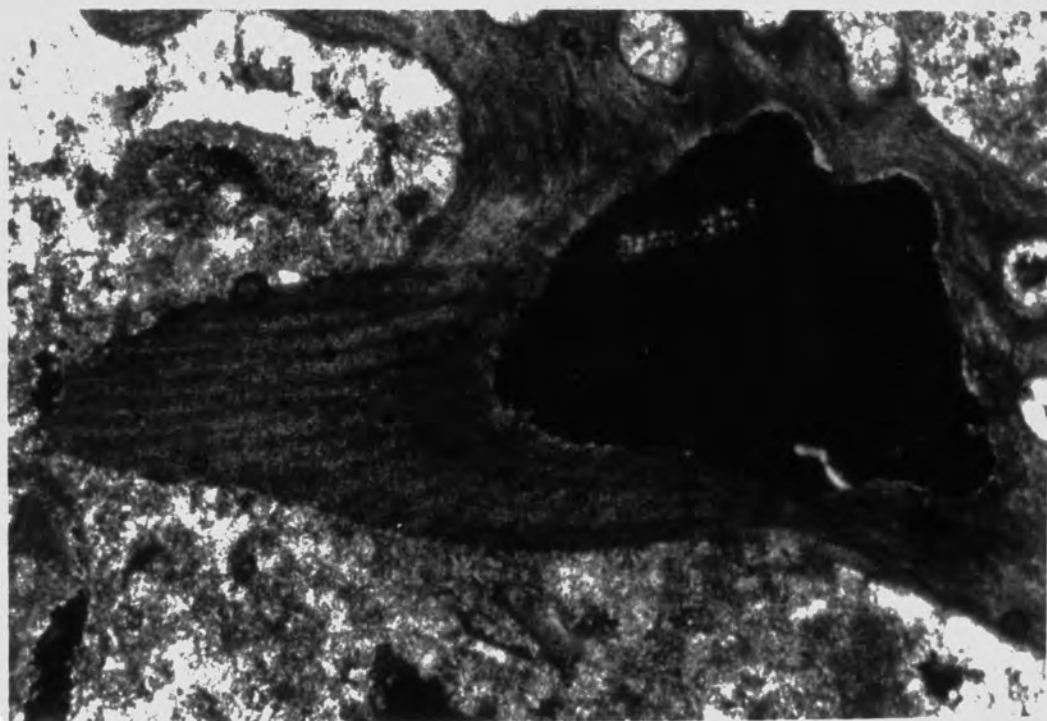
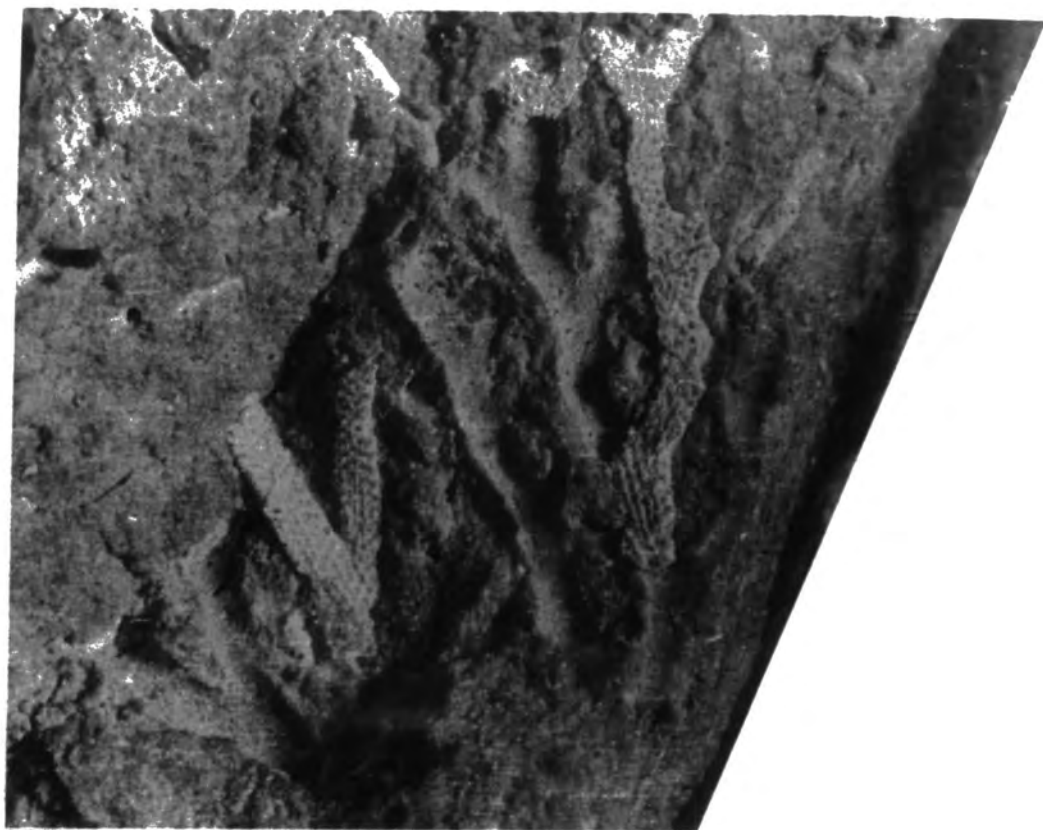


Plate 79. Thamniscus dubius Schlotheim

Fig.a Specimen Taf.III fig.I, Taf.II fig.8,
from the Korn collection.
Bar scale=10mm

Fig.b Specimen Taf.III fig.2, from the Korn
collection, assigned to Thamniscus geometricus
by Korn(1930).
Bar scale=10mm

a



b



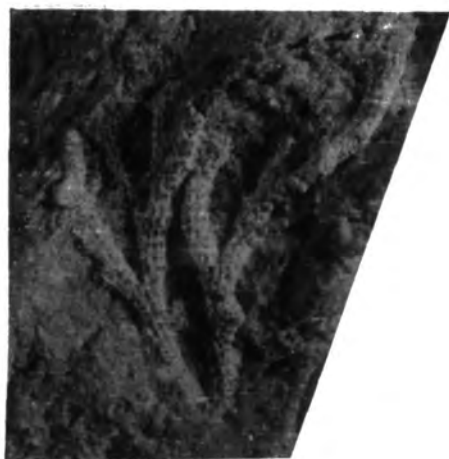
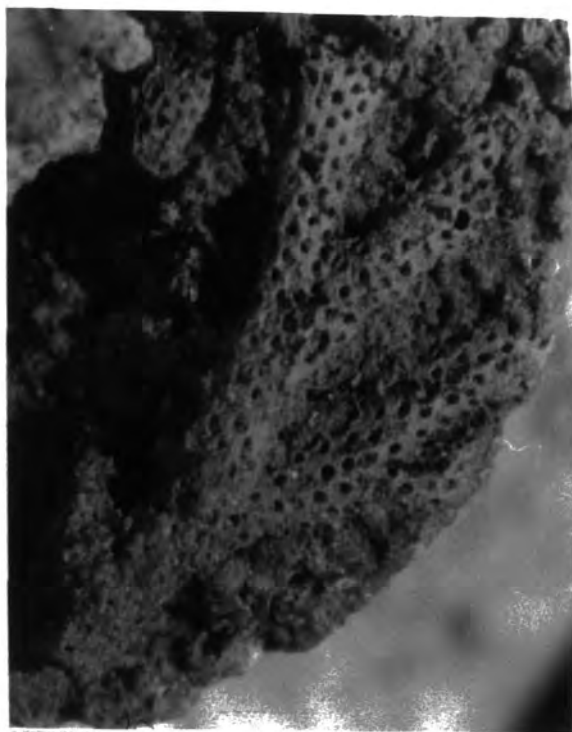
Plate 80. Thamniscus geometricus Korn

- Fig.a Specimen Taf.III fig.4 from the Korn collection.
Obverse surface,dissepiment arrowed.
Bar scale=10mm
- Fig.b Obverse surface detail.MP5.59.
Bar scale=1mm
- Fig.c Specimen Taf.III fig.5 from the Korn collection.
Bar scale=10mm
- Fig.d Reverse surface detail.RH2.73a.
Bar scale=1mm

a



b



d

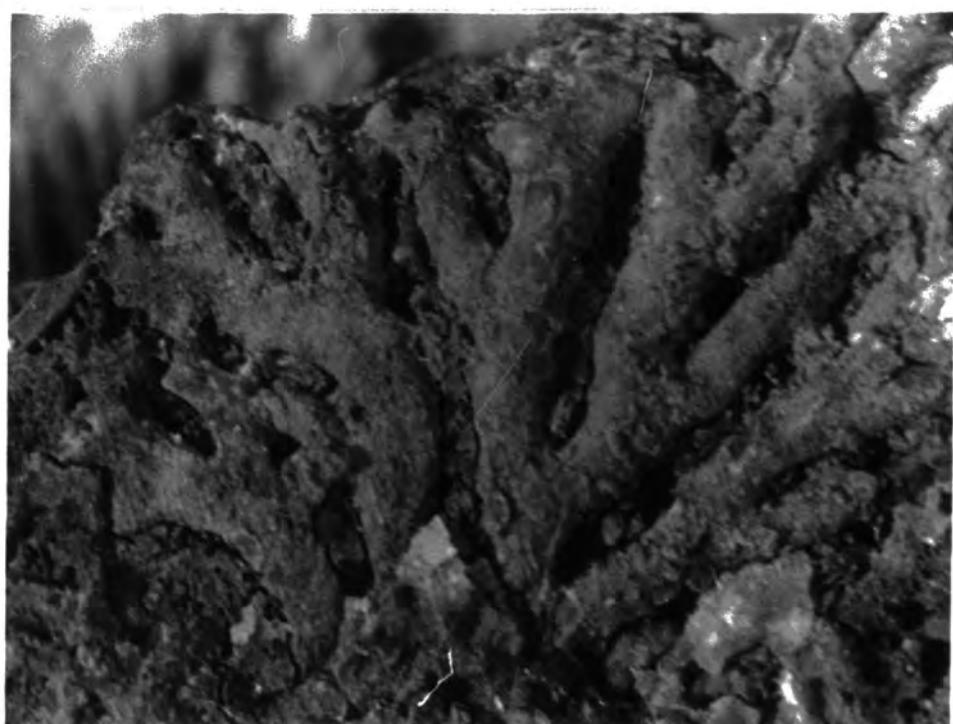


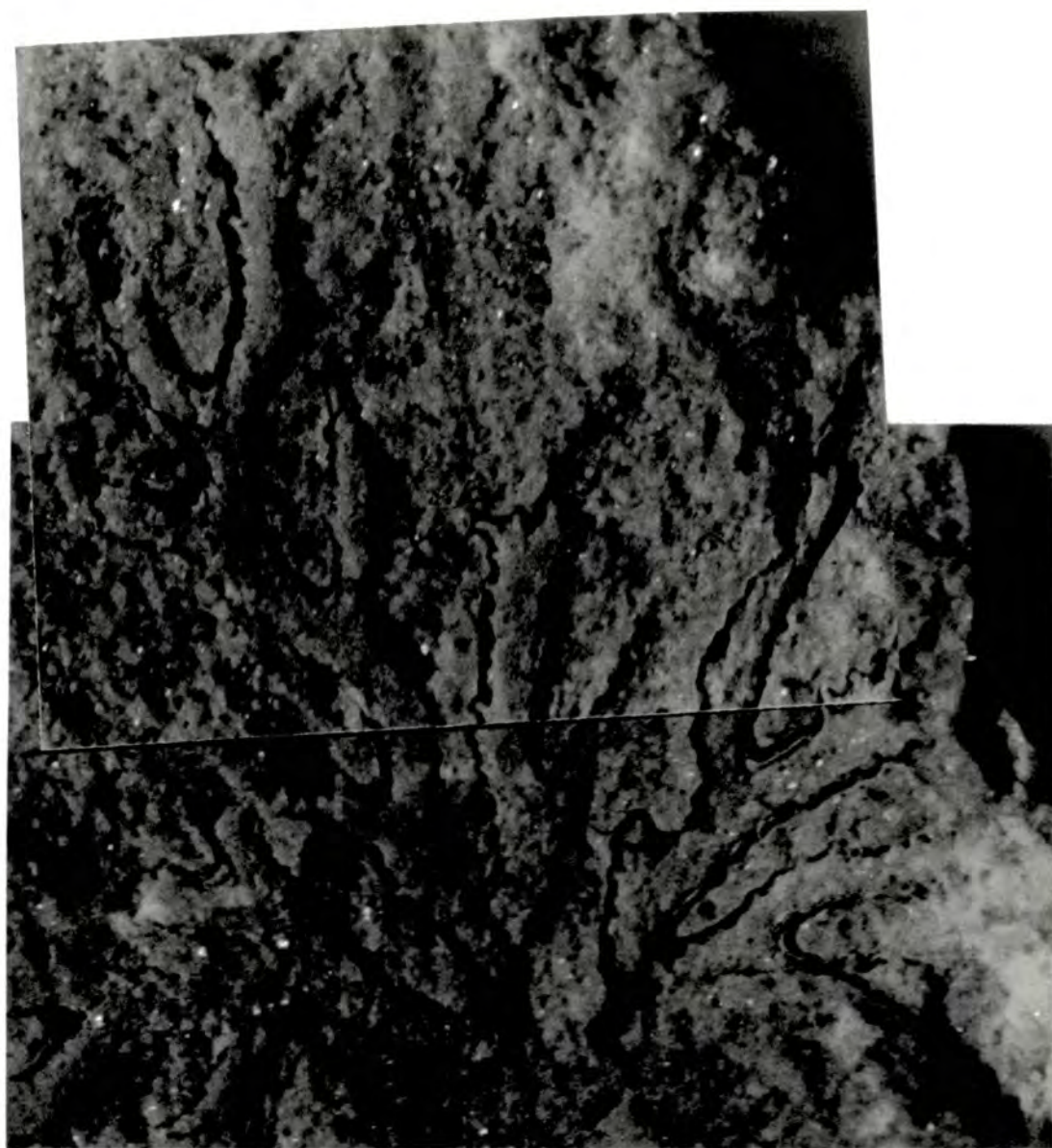
Plate 8I. Thamniscus geometricus Korn

Fig.a Reverse surface, cast preservation. HAW63.
Bar scale=Imm

Fig.b Specimen Taf.III fig.3 from the Korn
collection.
Bar scale=10mm

Fig.c Specimen Taf.II fig.I7 from the Korn
collection.
Bar scale=10mm

a



b



c



Plate 82. Thamniscus siccus Dreyer

Fig.a Taf.VIII fig.4 from Dreyer(1961).
Bar scale=10mm

Fig.b Reverse surface detail.RHI.I8.
Bar scale=Imm

Fig.c Taf.VIII fig.2 and fig.3 from Dreyer(1961).
Bar scale=Imm

Fig.d Taf.VIII fig.I from Dreyer(1961).
Bar scale=Imm

Fig.e Obverse surface detail.BHIOc.
Bar scale=Imm

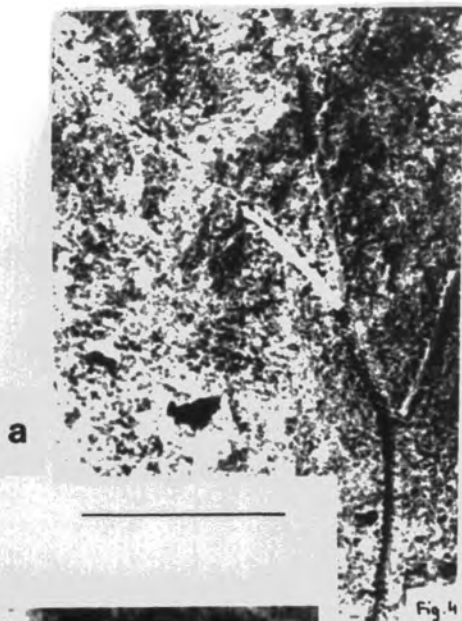
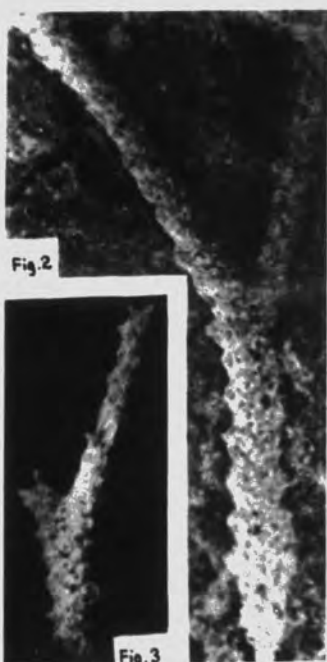
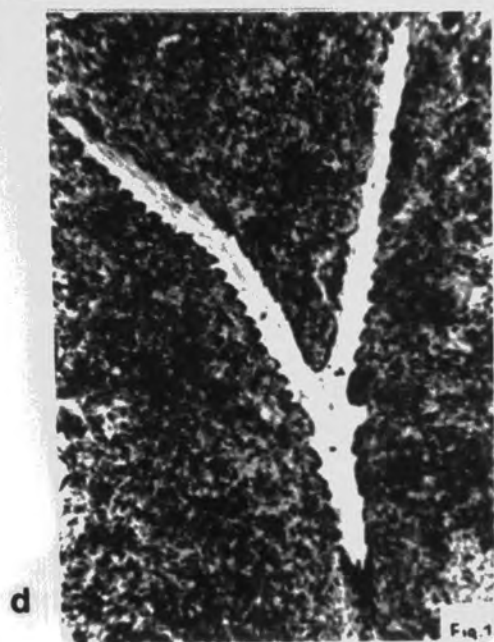


Fig. 4



b

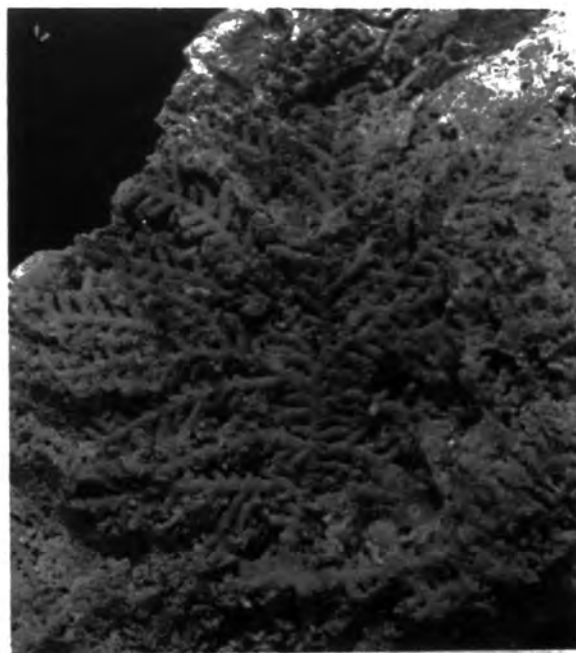


e



Plate 83. Acanthocladia anceps Schlotheim

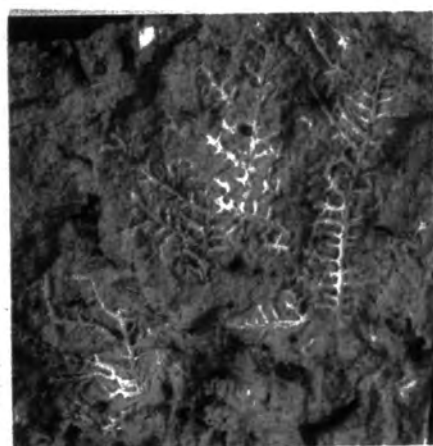
- Fig.a Zoarial morphology.Specimen mineralogically
overgrown.MP5.34.
Bar scale=10mm
- Fig.b Zoarial morphology.Specimen mineralogically
overgrown.RH4.45.
Bar scale=10mm
- Fig.c Zoarial morphology.B94.
Bar scale=10mm
- Fig.d Zoarial morphology.B78A.
Bar scale=10mm
- Fig.e Zoarial morphology.HYR19.
Bar scale=10mm
- Fig.f Zoarial morphology.BH4a.
Bar scale=10mm
- Fig.g Zoarial morphology,cast preservation.GLQ33.
Bar scale=10mm



b



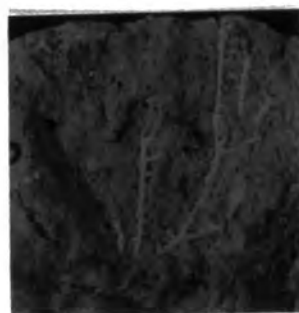
c



d



e



f



g

Plate 84. Acanthocladia anceps Schlotheim

Fig.a Zoarial morphology.?Growth of colony in an original cavity within the reef framework.
MP5.30a.Bar scale=10mm

Fig.b As above at higher magnification.Supportive spines arrowed.
Bar scale=1mm

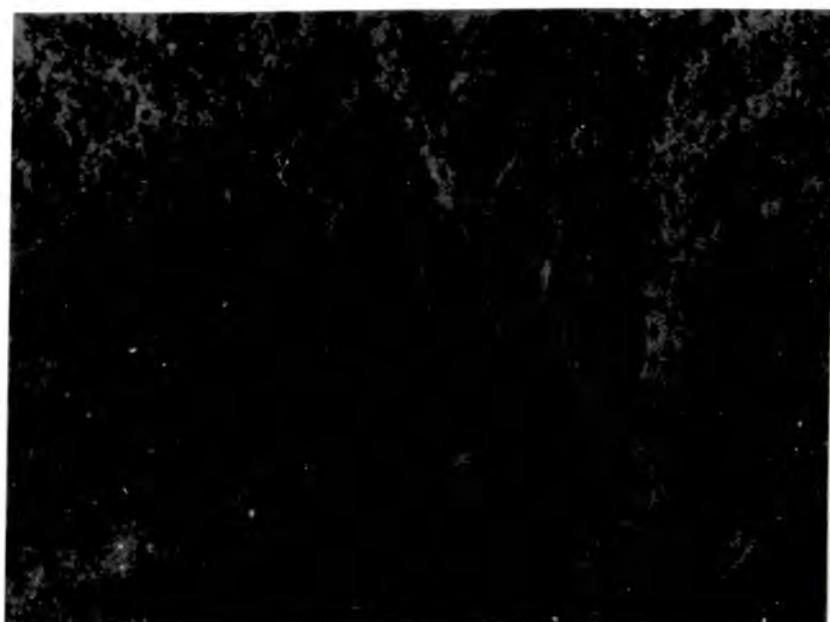
Plate 85. Acanthocladia anceps Schlotheim

Fig.a Obverse surface detail.HAWIO.
Bar scale=Imm

Fig.b S.E.M. photomicrograph of obverse surface.
Small proximal notch (?fossula) is visible
in some apertures.RH2.66.
Bar scale=Imm

Fig.c S.E.M. photomicrograph of obverse surface.
B83B.Bar scale=IOmm

a



b



c

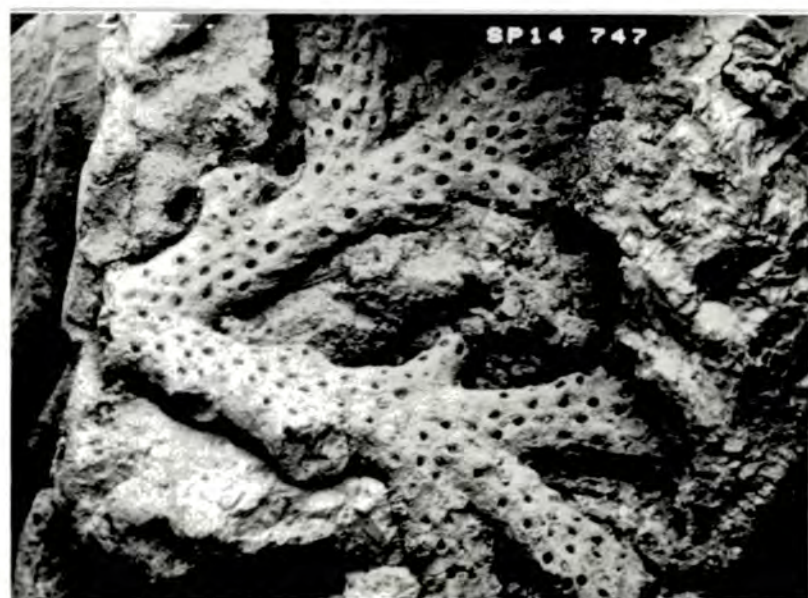


Plate 86. Acanthocladia anceps Schlotheim

- Fig.a S.E.M. photomicrograph showing obverse surface detail. Several apertures show a small proximal notch(?fossula). B83B.
Bar scale=Imm
- Fig.b Reverse surface detail. RH2.5I.
Bar scale=Imm
- Fig.c Obverse surface detail. The proximal part of the main branch has three rows of apertures but the distal part prior to bifurcation has only two rows separated by a median keel.
HAW26a. Bar scale=Imm

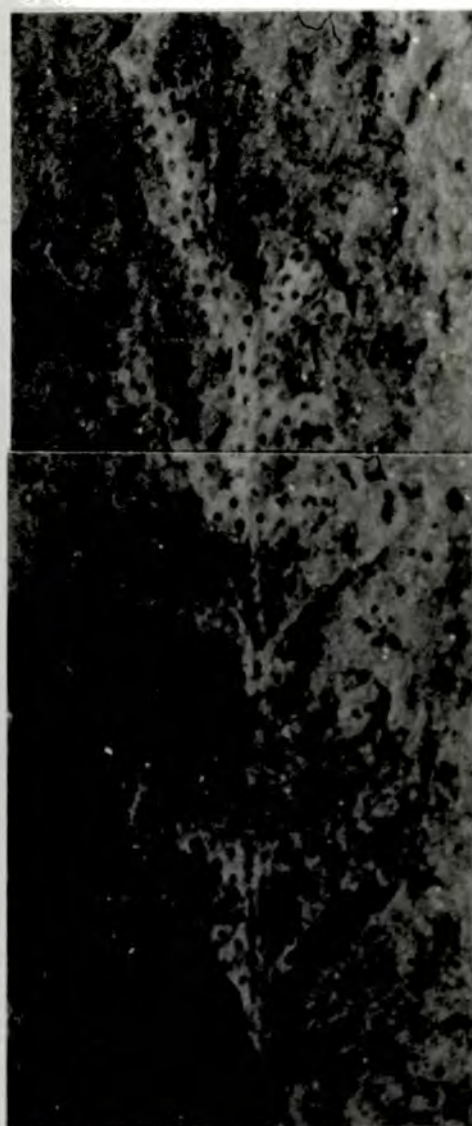


Plate 87. Acanthocladia anceps Schlotheim

Fig.a S.E.M. photomicrograph showing zooecial chambers in cast preservation.B94.
Bar scale=Imm

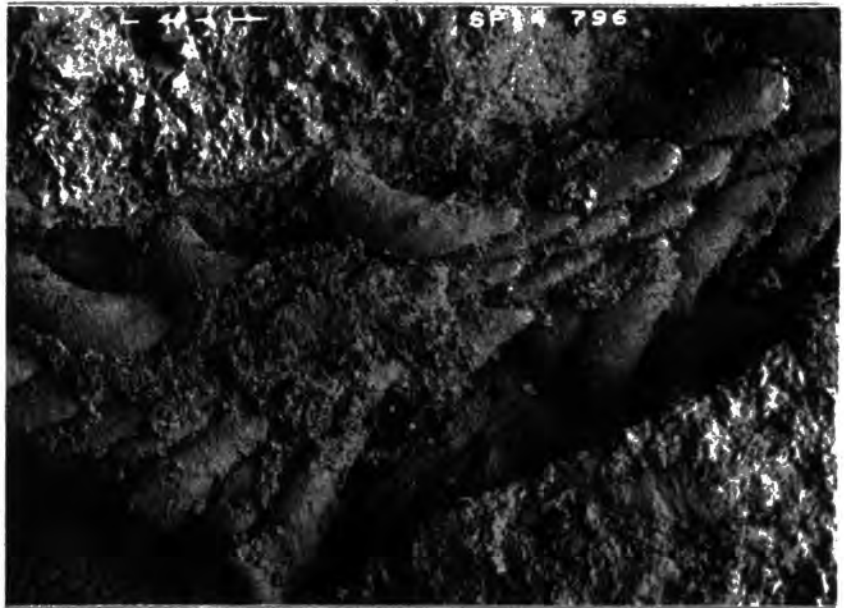
Fig.b As above at higher magnification.
Bar scale=Imm

Fig.c As above at higher magnification,demonstrating the variability of zooecial chamber shape which may occur within a single zoarium.
Bar scale=Imm

a



b



c

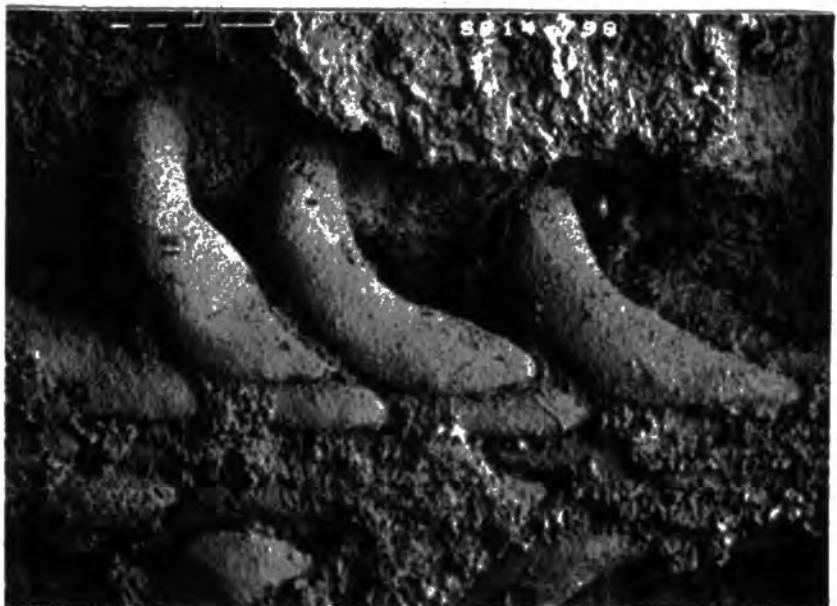


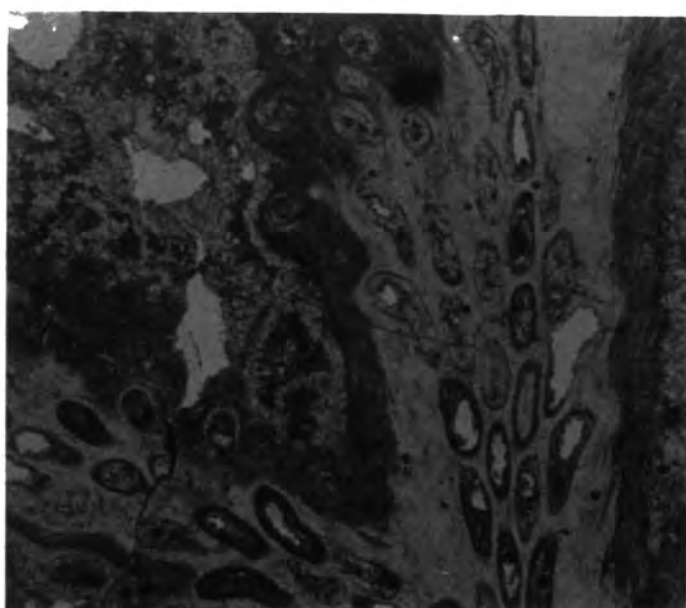
Plate 88. Acanthocladia anceps Schlotheim

- Fig.a Tangential section, showing zooecial chamber base shape and longitudinal striae. MP5.46.
Bar scale=Imm
- Fig.b Tangential section. MP5.8I.
Bar scale=Imm
- Fig.c As above, fig.a, at higher magnification.
Bar scale=0. Imm
- Fig.d Shallow tangential section, showing the distal parts of vestibules and ovicells. MP5.46.
Bar scale=0. Imm

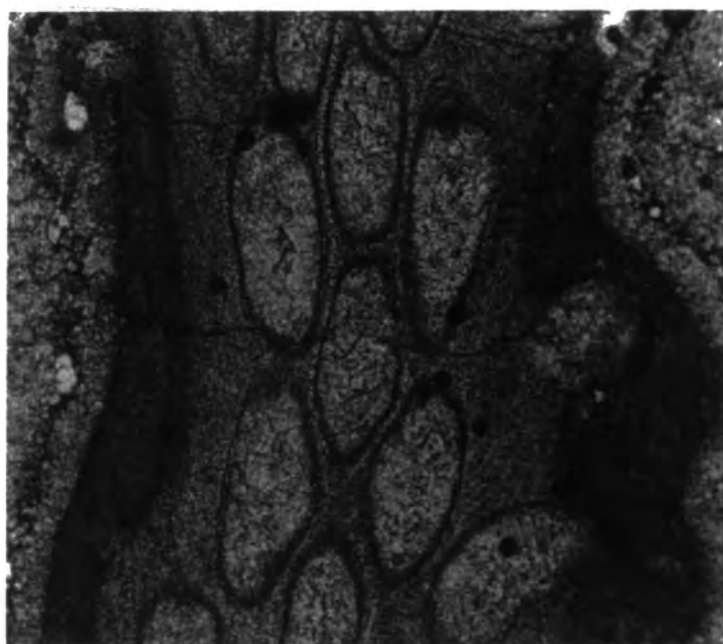
a



b



c



d

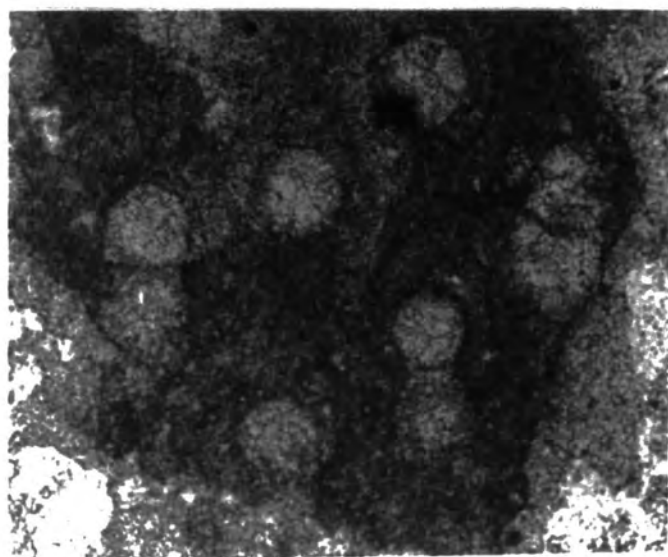


Plate 89. Acanthocladia anceps Schlotheim

Fig.a Shallow tangential section, showing skeletal rods and apertures.MP5.80.
Bar scale=0.Imm

Fig.b Oblique longitudinal section, showing zooecial chambers and skeletal rods.MP5.I50.XPL.
Bar scale=0.Imm

Fig.c Longitudinal section.RH4.5I.
Bar scale=Imm

Fig.d Longitudinal section.MP5.65.
Bar scale=Imm

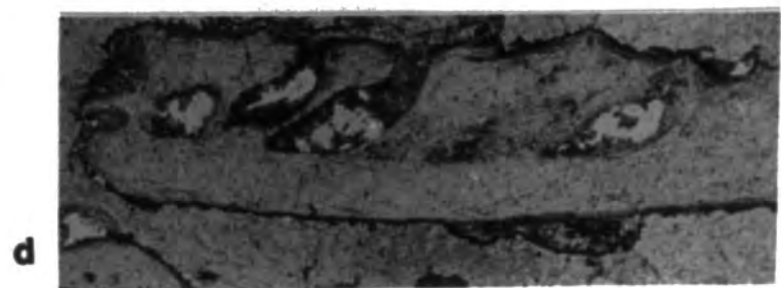
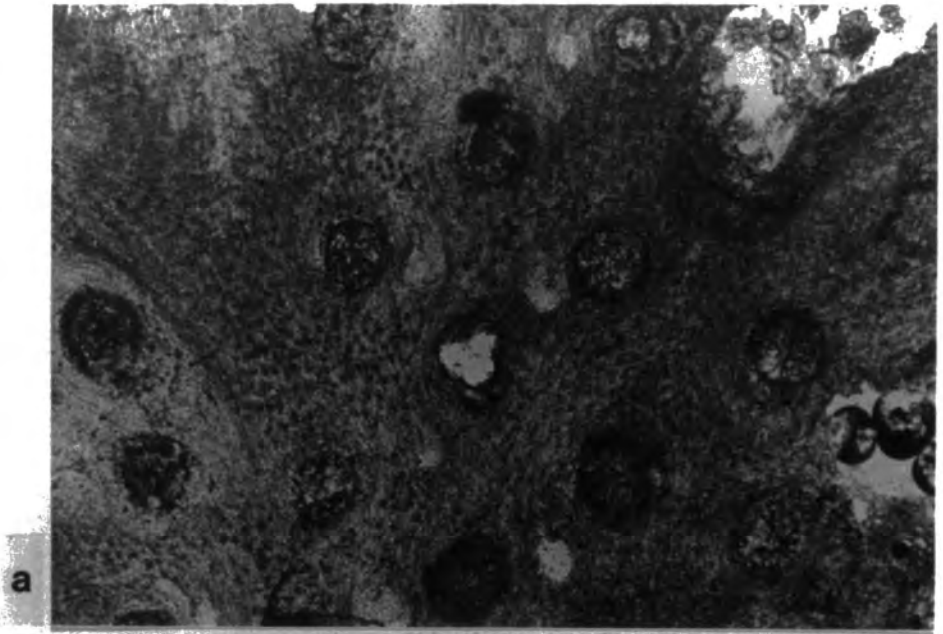
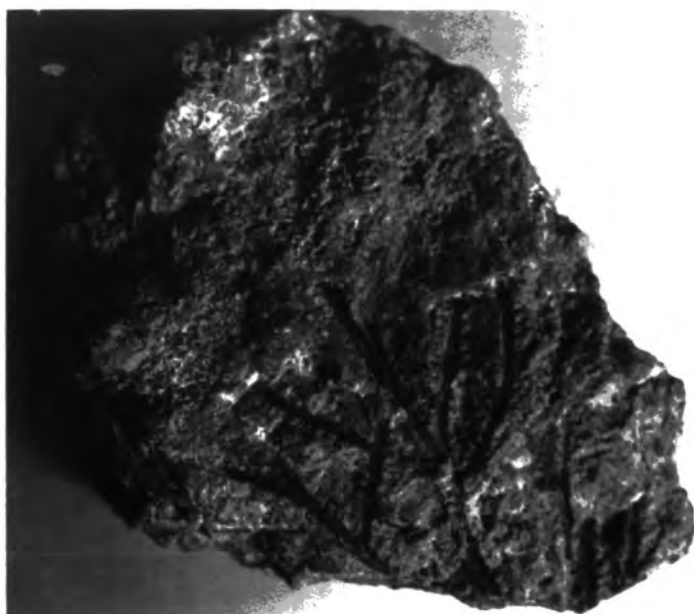


Plate 90. Acanthocladia anceps Schlotheim

- Fig.a Specimen K57.3 from the Schlotheim collection.
Mould preservation.Bar scale=10mm
- Fig.b Specimen K57.2 from the Schlotheim collection.
Mould preservation.Bar scale=10mm
- Fig.c Specimen K57.2 from the Schlotheim collection.
Mould and cast preservation.Bar scale=10mm
- Fig.d Specimen K57.3 from the Schlotheim collection.
Mould and cast preservation.Bar scale=10mm

a



b



c



d



Plate 9I. Acanthocladia anceps Schlotheim

- Fig.a Specimen K57.1 from the Schlotheim collection,
close-up showing longitudinal striae where
the outermost skeleton has been removed.
Bar scale=Imm
- Fig.b Specimen K57.2 from the Schlotheim collection
showing zooecial chambers in cast preservation
where original skeleton has been removed.
Bar scale=Imm
- Fig.c S.E.M. photomicrograph of K57.2 showing
ovicells and distal part of vestibules
in cast preservation.
Bar scale=Imm

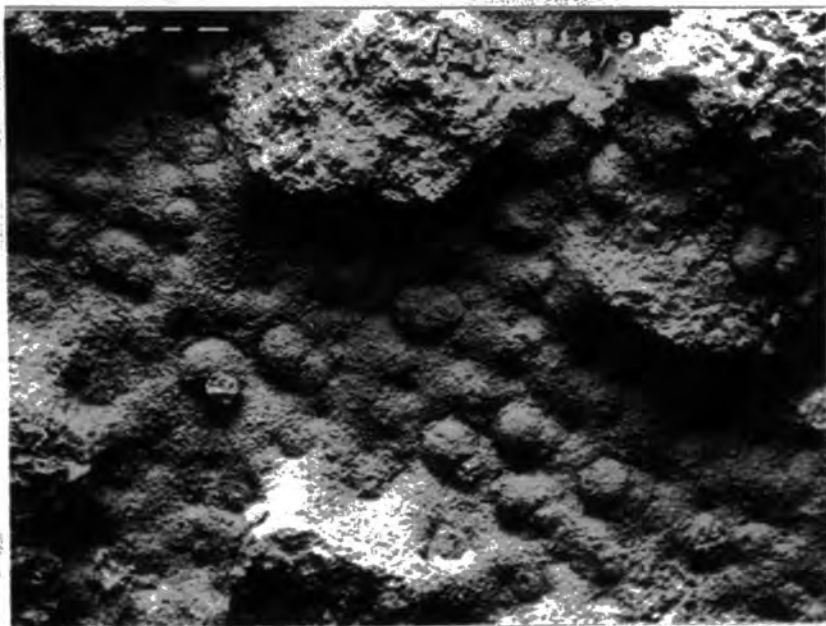
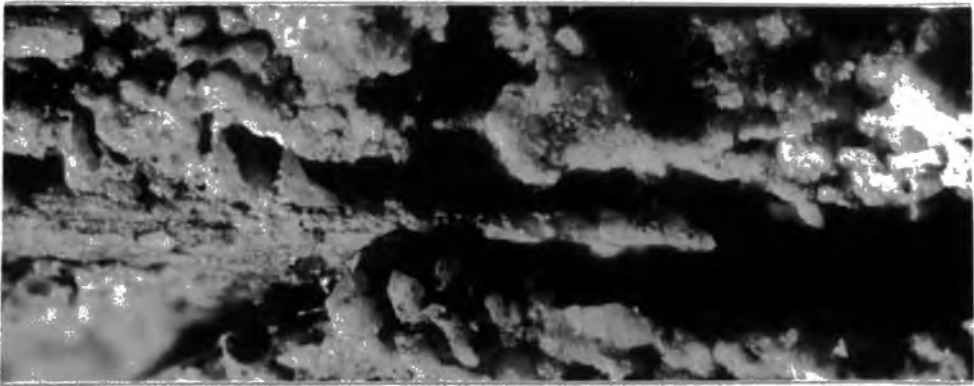
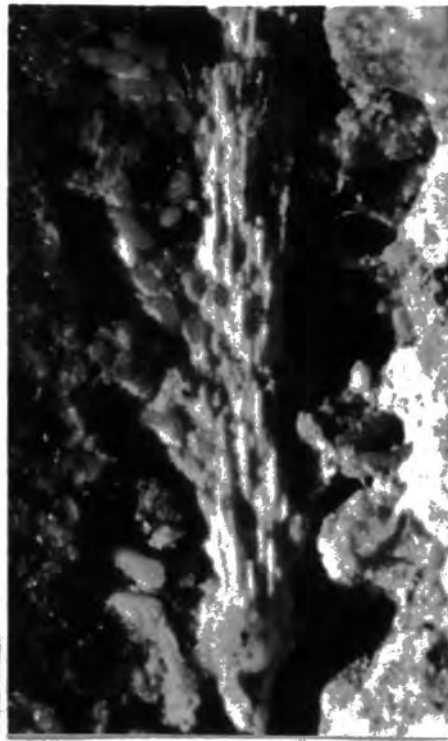


Plate 92. Acanthocladia laxa Korn

Fig.a Zoarial morphology.HDNI2.
Bar scale=10mm

Fig.b Zoarial morphology.HDN7.
Bar scale=10mm

Fig.c Reverse surface detail,longitudinal striae
visible where outermost skeleton has been
removed.HDN7.
Bar scale=Imm

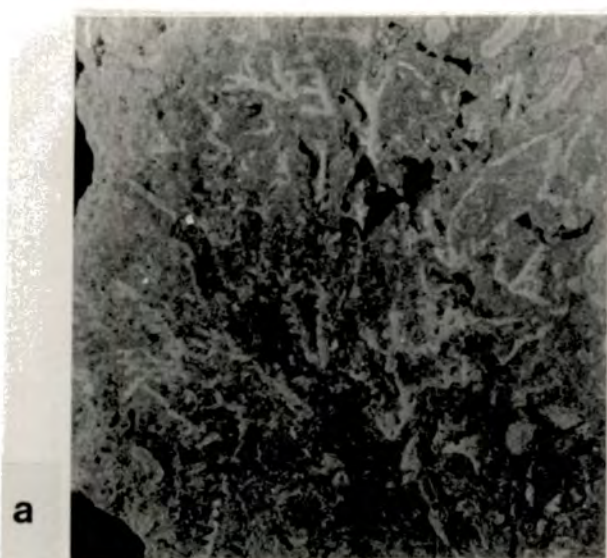


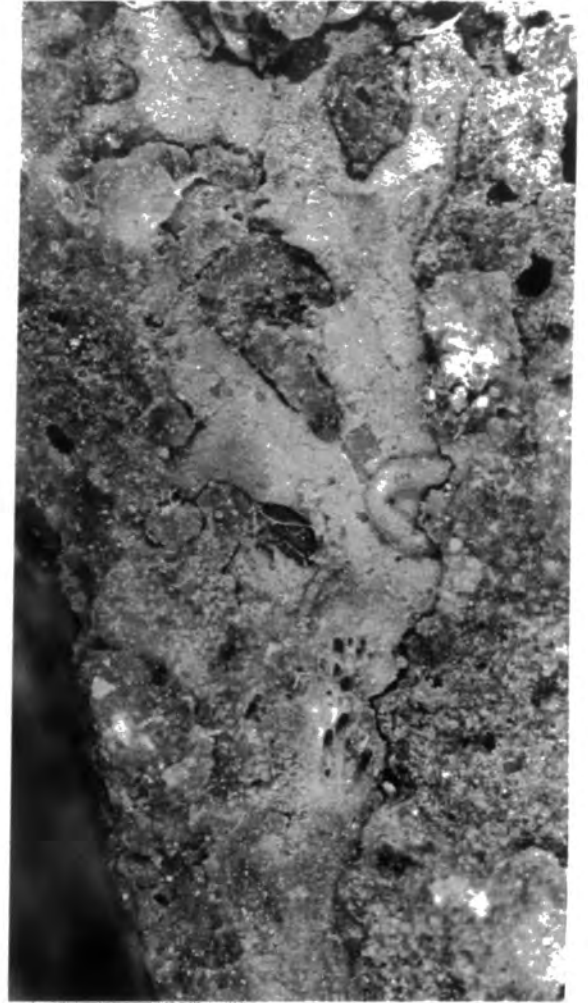
Plate 93. Acanthocladia laxa Korn

Fig.a Reverse surface detail.Encrusted by ?worm
tube.RH2.59.

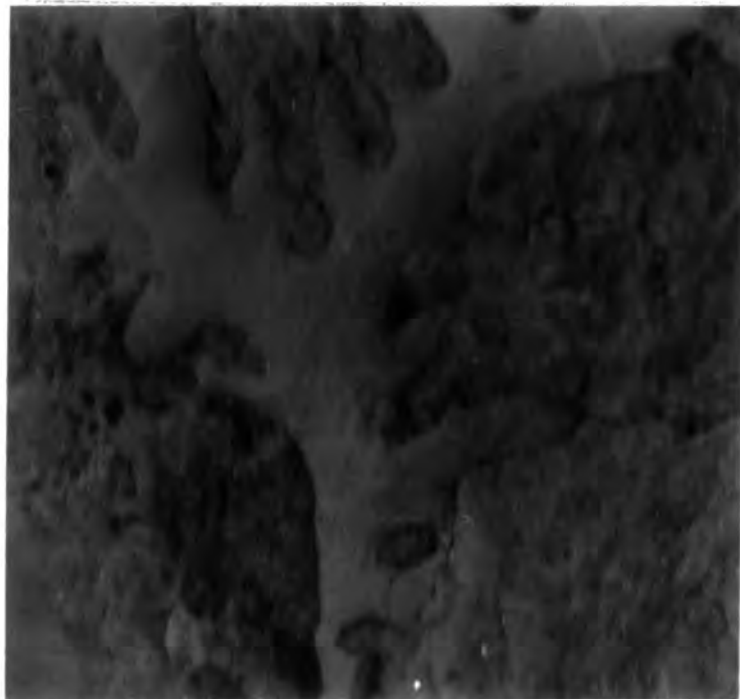
Bar scale=Imm

Fig.b Reverse surface detail.HM7.I3.

Bar scale=Imm



a



b



Plate 94. Acanthocladia laxa Korn

- Fig.a Reverse surface detail.Outermost skeleton removed in parts revealing zooecial chamber bases.RHI.I3.
Bar scale=Imm
- Fig.b Reverse surface detail.Outermost skeleton removed revealing longitudinal striae.
RHI.I.Bar scale=Imm
- Fig.c Colony origin,viewed from underside.
(Specimen may be truly referrable to A.anceps).
MP4.I.Bar scale=Imm

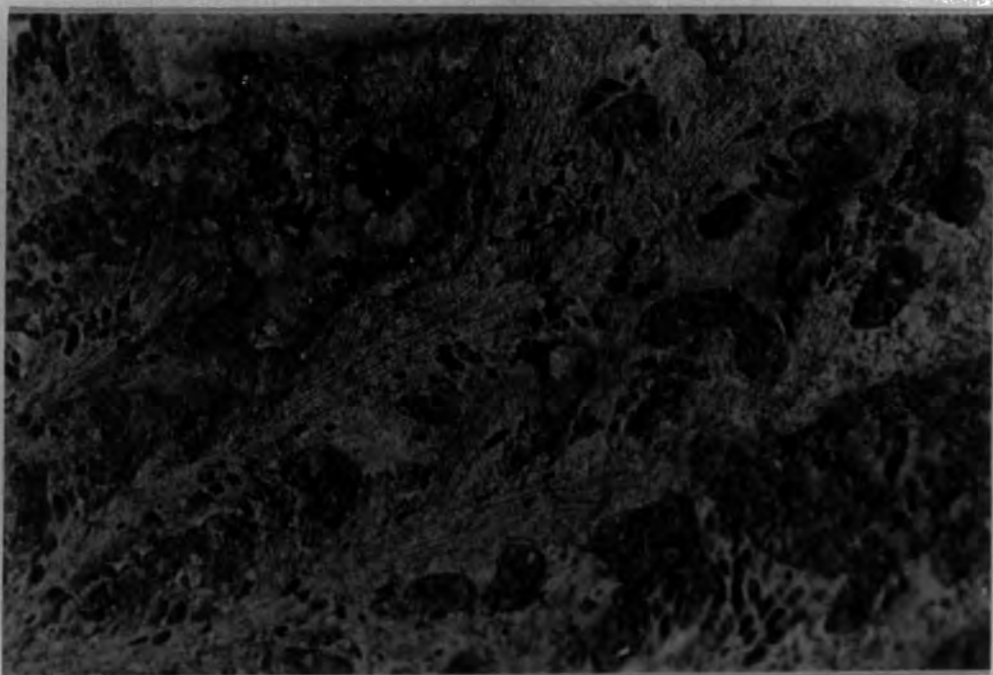
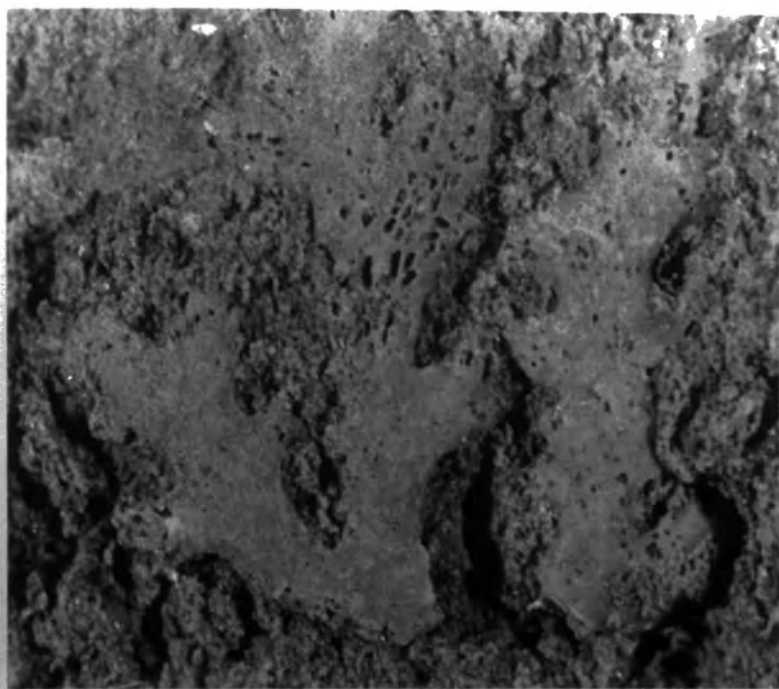


Plate 95. Acanthocladia laxa Korn

Fig.a Specimen Taf.IV fig.6 from the Korn collection.
Bar scale=10mm

Fig.b Specimen Taf.IV fig.7 from the Korn collection,
designated lectotype by Dreyer(1961).
Bar scale=10mm

a



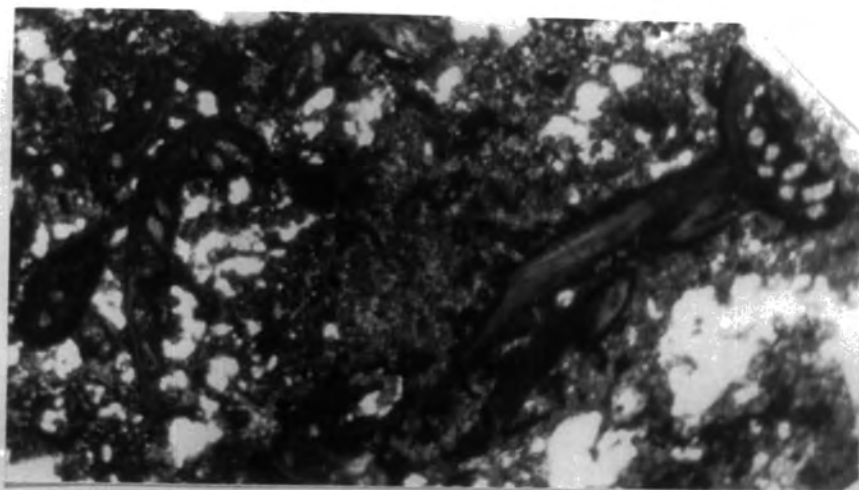
b



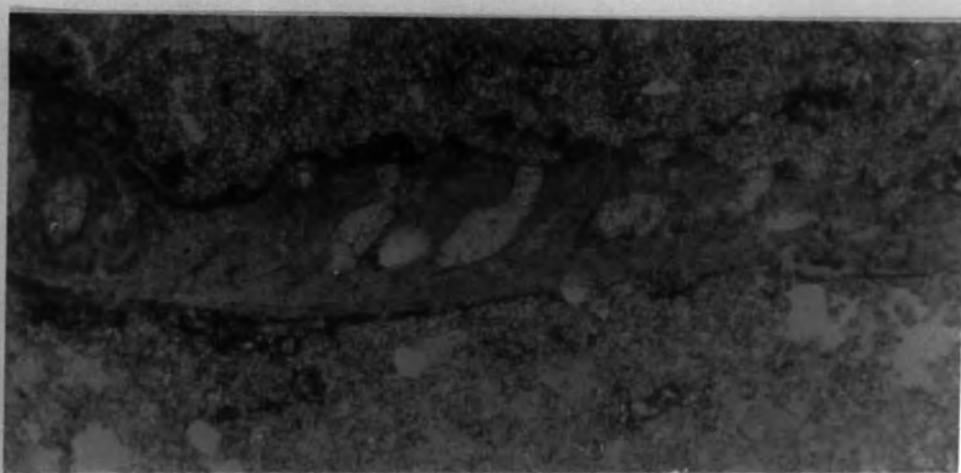
Plate 96. Acanthocladia laxa Korn

- Fig.a Section showing well-developed reverse
 surface spine.HDNI6.
 Bar scale=Imm
- Fig.b Longitudinal section.HDN5.
 Bar scale=Imm
- Fig.c Longitudinal/Oblique section.HDNI9a.
 Bar scale=Imm
- Fig.d Longitudinal section.HDN4.
 Bar scale=Imm

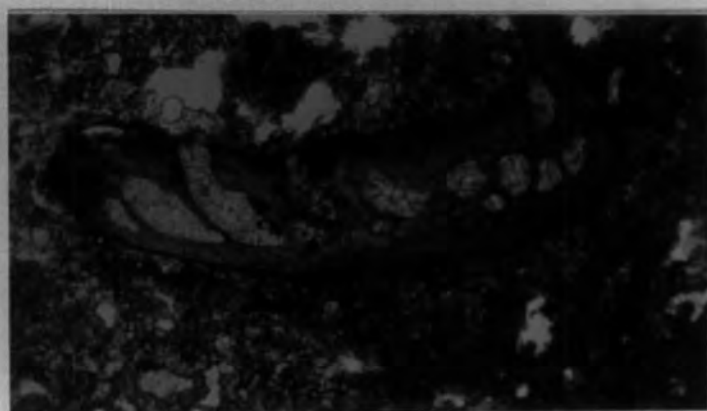
a



b



c



d

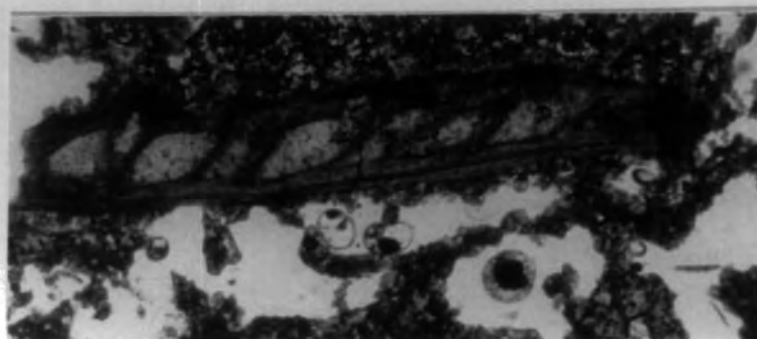


Plate 97. Acanthocladia laxa Korn

Fig.a Longitudinal section.HDN6.
Bar scale=0.Imm

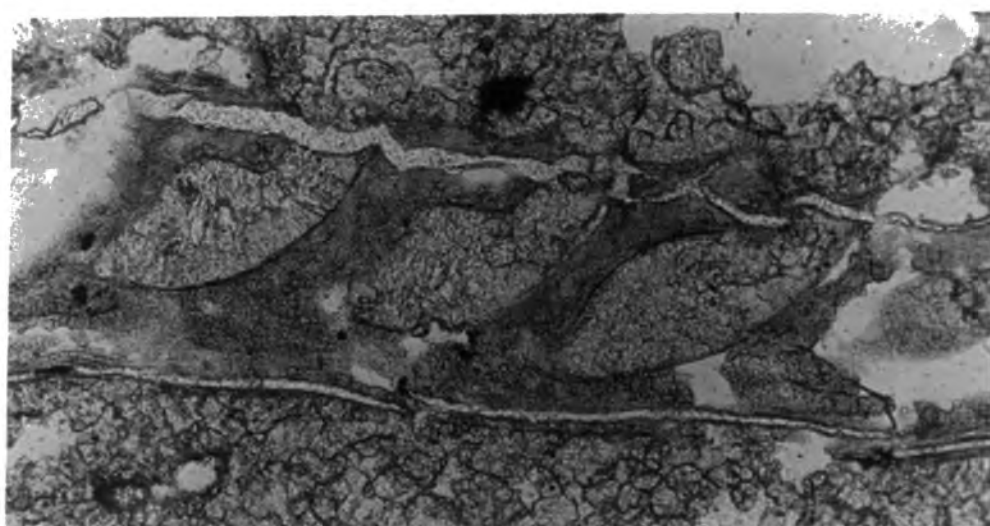
Fig.b Longitudinal section through the same branch
as in fig.a above.Thus demonstrating the
shape variability of zooecial chambers which
is a result of plane of section and which
may occur within a single specimen.HDN6.
Bar scale=0.Imm

Fig.c Oblique section,showing skeletal rods.HDN3.
XPL.Bar scale=0.Imm

a



b



c

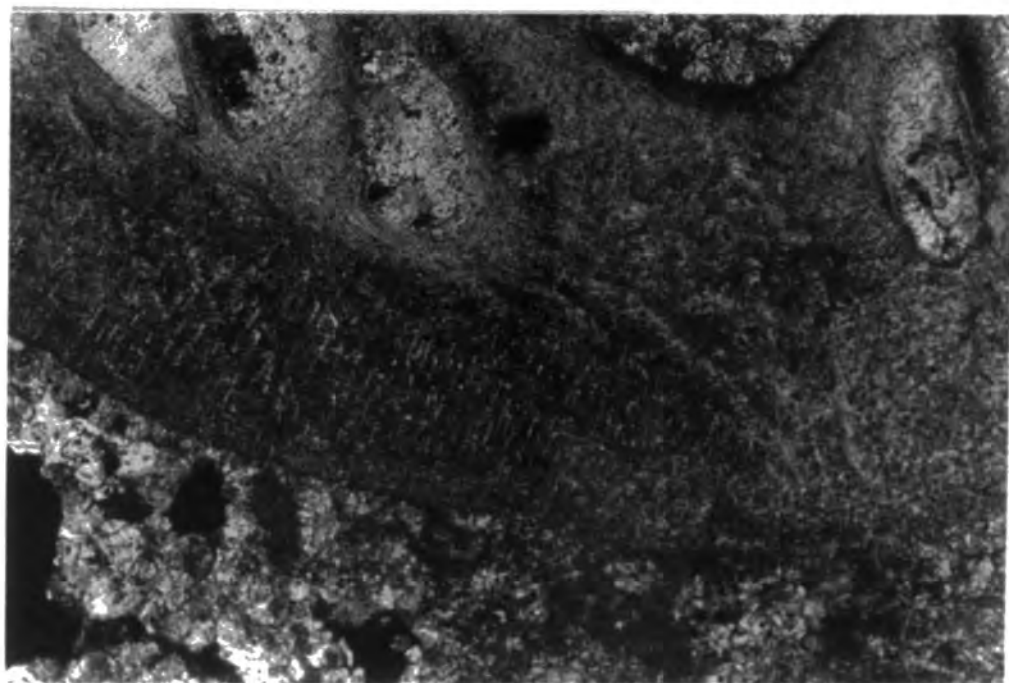
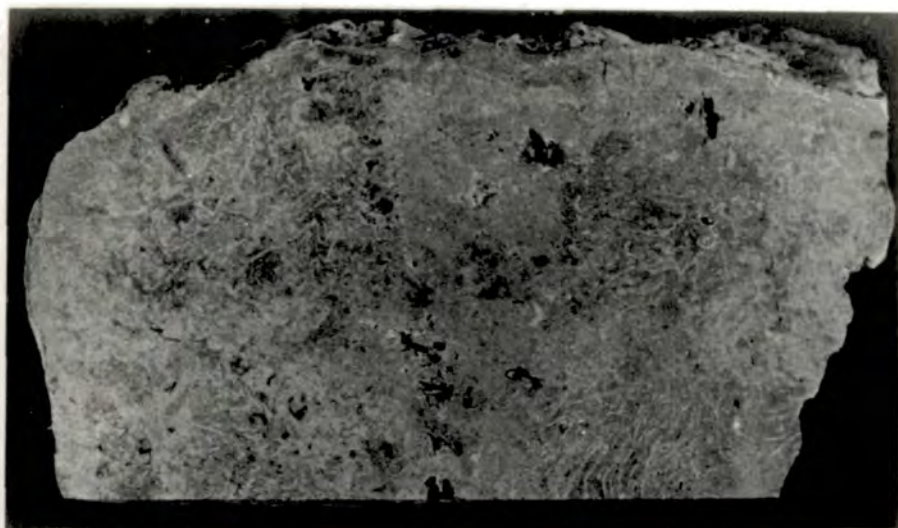


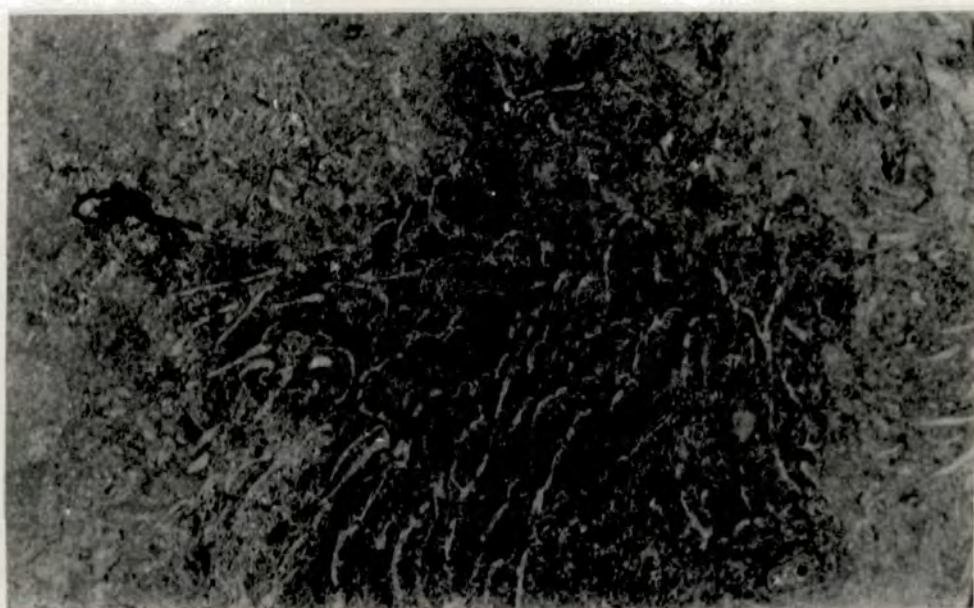
Plate 98. Acanthocladia diffusus Korn

- Fig.a Polished block showing zoarial morphology
in section.HYR25.
Bar scale=20mm
- Fig.b As above at higher magnification.
Bar scale=10mm
- Fig.c Polished block showing preferred orientation
of obverse surface.HM7.18.
Bar scale=10mm

a



b



c

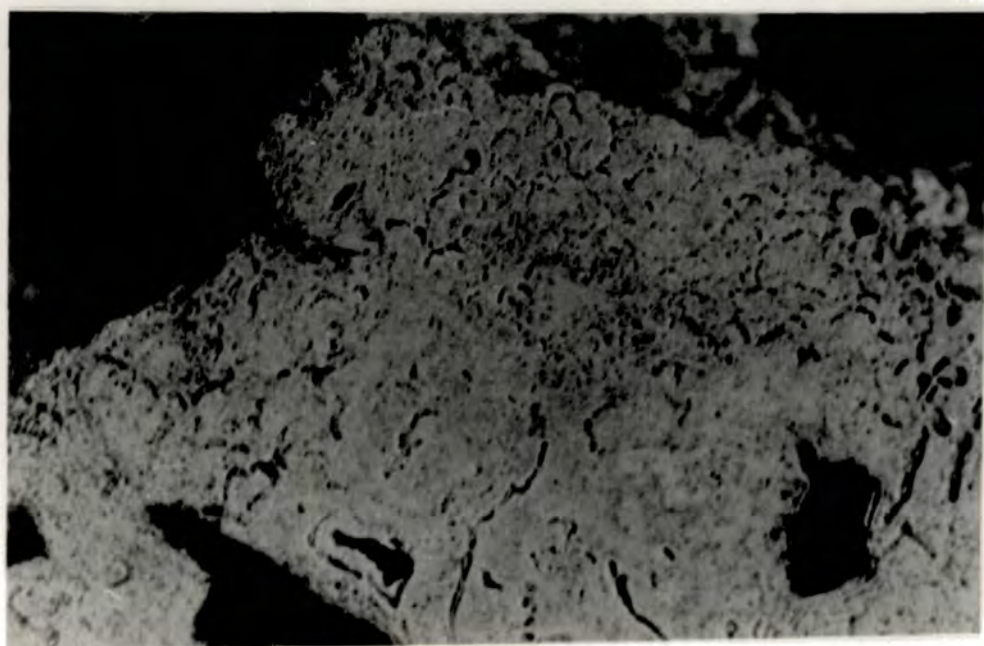


Plate 99. Acanthocladia diffusus Korn

- Fig.a Zoarial morphology. Zoarium seen in transverse section. MP5.58a.
Bar scale=20mm
- Fig.b Zoarial morphology. Several zoaria occur in close proximity. MP5.58a.
Bar scale=20mm
- Fig.c Two zoaria, probably in life position -
'a' appears to be growing from left to right, 'b' appears to be growing upwards.
Growth of these colonies may thus have been in a cavity within the reef structure.
BHI6. Bar scale=10mm

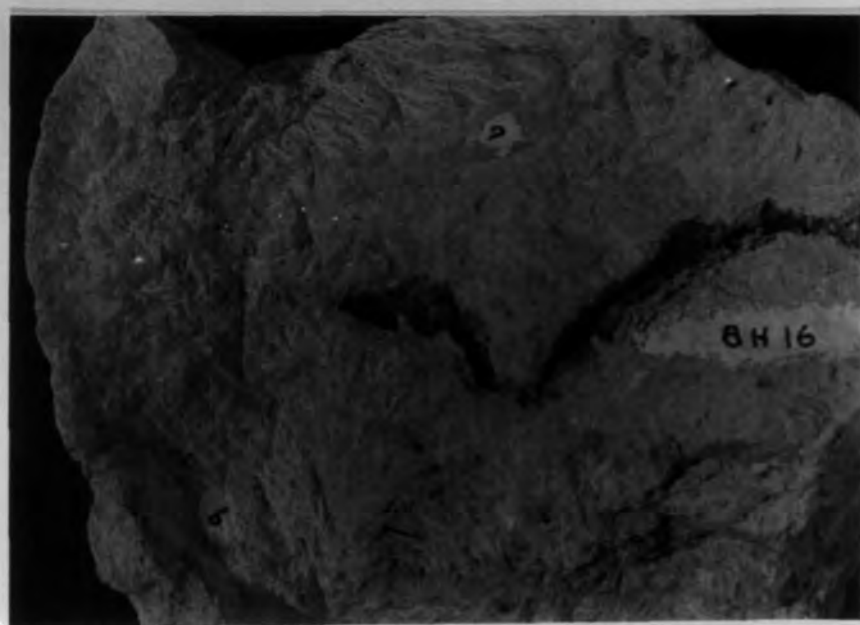
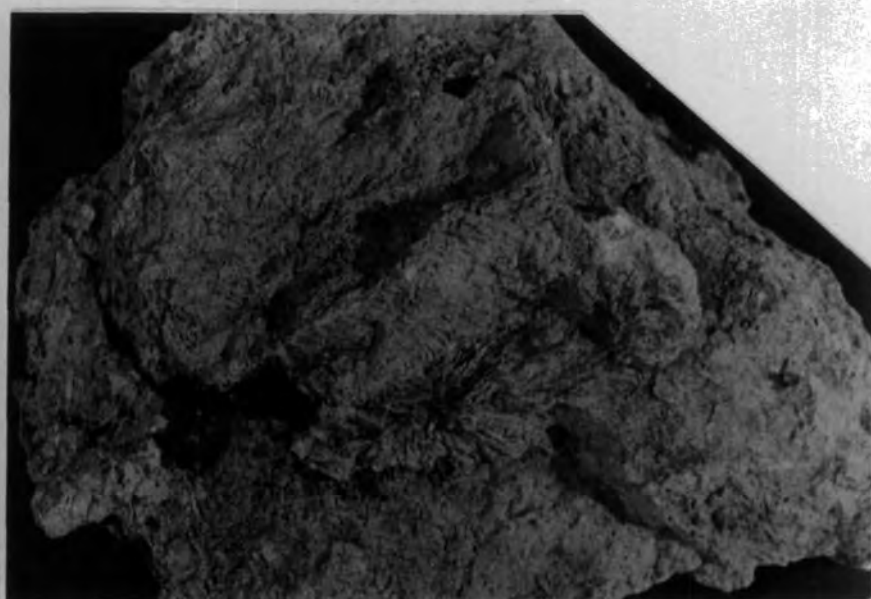


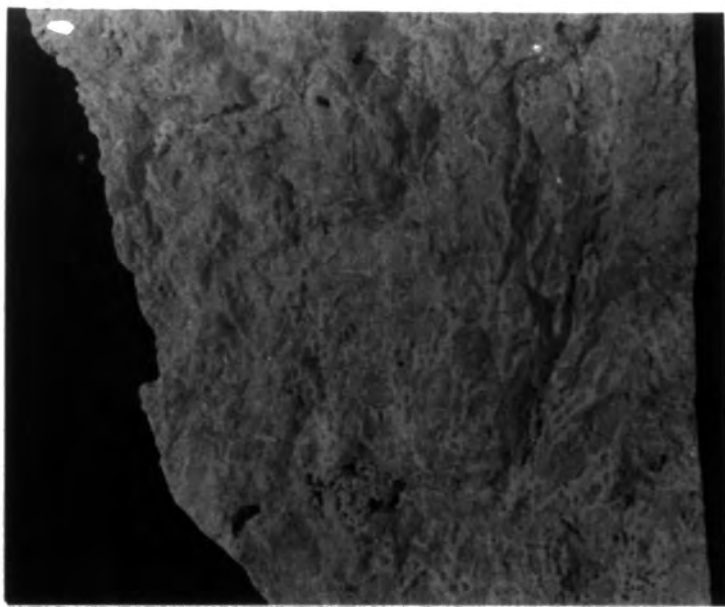
Plate 100. Acanthocladia diffusus Korn

Fig.a Zoarial morphology.BHI2.
Bar scale=10mm

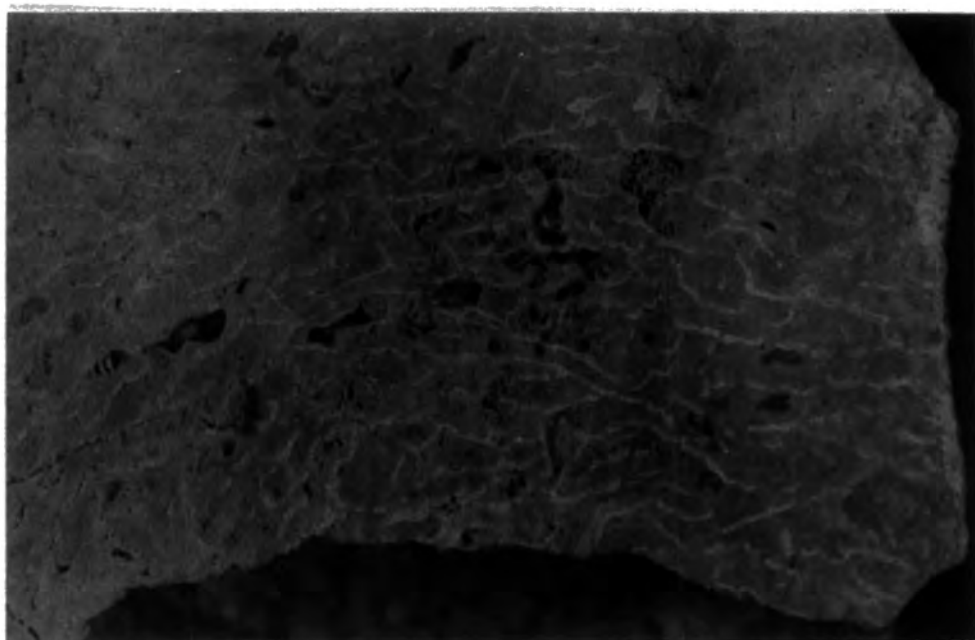
Fig.b Polished block showing one or more zoaria
with densely-spaced branches and characteristic
preferred orientation of the obverse
surface.BHI2.
Bar scale=10mm

Fig.c Reverse surface detail.BHI2.
Bar scale=Imm

a



b



c

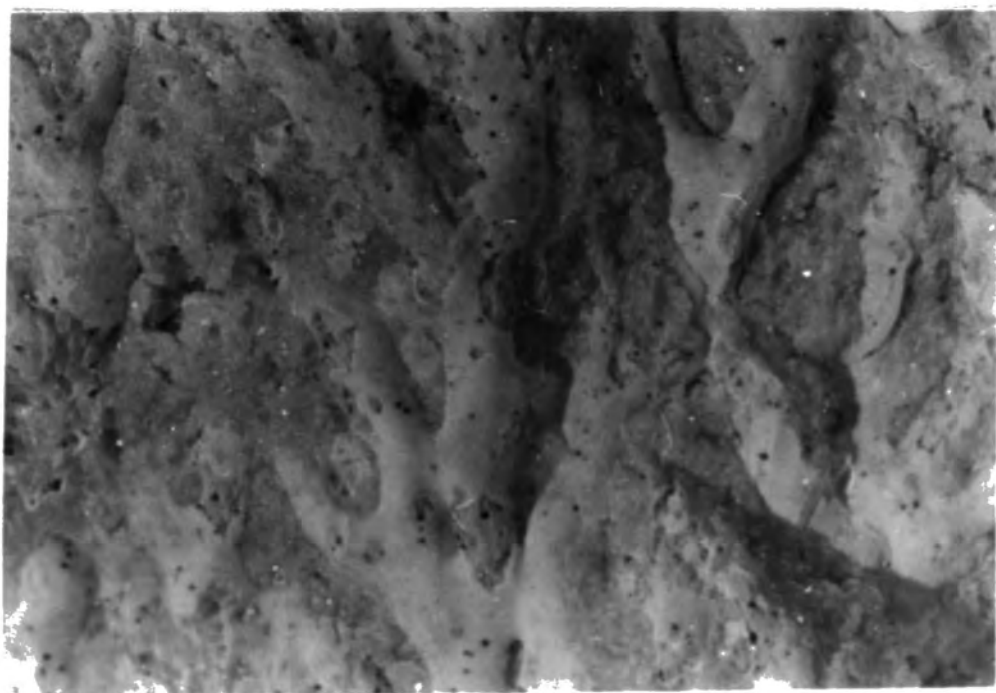


Plate IOI. Acanthocladia diffusus Korn

Fig.a Reverse surface detail.HYRI6.
Bar scale=Imm

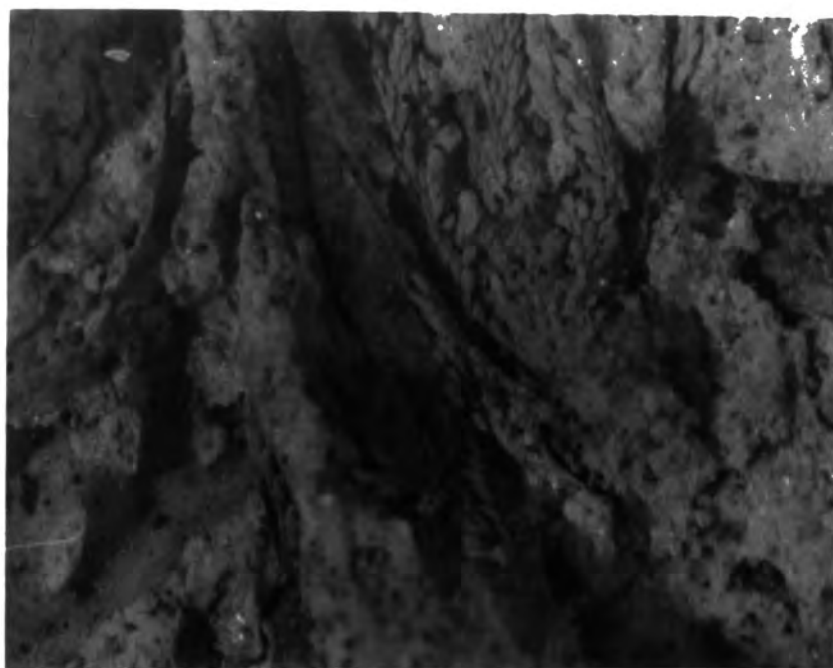
Fig.b Reverse surface detail.HYRI8.
Bar scale=Imm

Fig.c Obverse surface detail.HTQI.
Bar scale=Imm

Plate IO2. Acanthocladia diffusus Korn

- Fig.a Zoarium in cast preservation, showing
zooecial chambers. HM7.18.
Bar scale=Imm
- Fig.b Zoarial morphology. Colony origin arrowed -
colony appears to have grown down from
its substratum of attachment. RHI.36.
Bar scale=10mm
- Fig.c Zooecial chambers in cast preservation.
HM7.18. Bar scale=Imm
- Fig.d Zoarial morphology. Cast preservation.
RHI.38. Bar scale=10mm

a



b



c



d



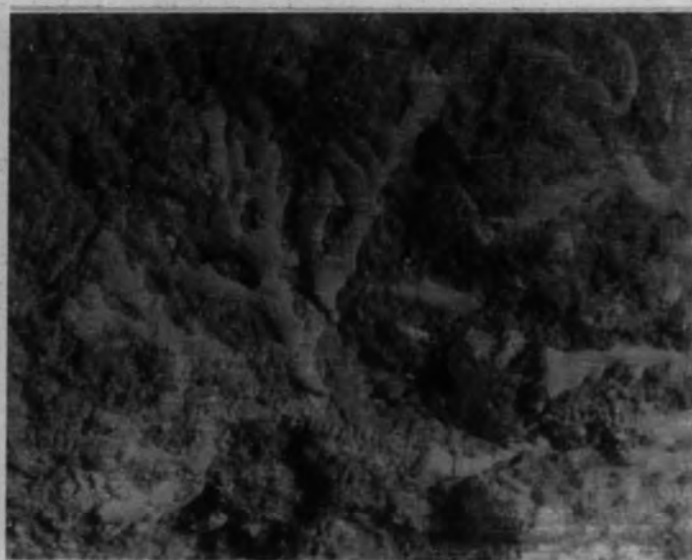
Plate IO3. Acanthocladia diffusus Korn

- Fig.a Specimen Taf.II fig.I5 from the Korn collection,selected as neotype to replace the missing lectotype.
Bar scale=IOmm
- Fig.b Specimen Taf.II fig.I6 from the Korn collection.Bar scale=IOmm
- Fig.c Specimen Taf.II fig.7 from the Korn collection,referred to Thamniscus dubius by Korn(1930).
Bar scale=IOmm

a



b



c



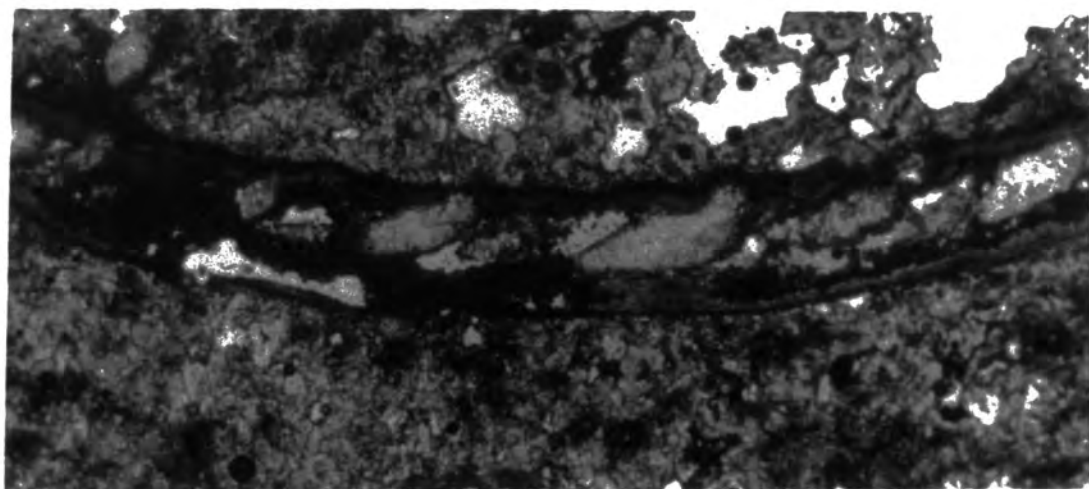
Plate IO4. Acanthocladia diffusus Korn

Fig.a Longitudinal section.HYR20.
Bar scale=Imm

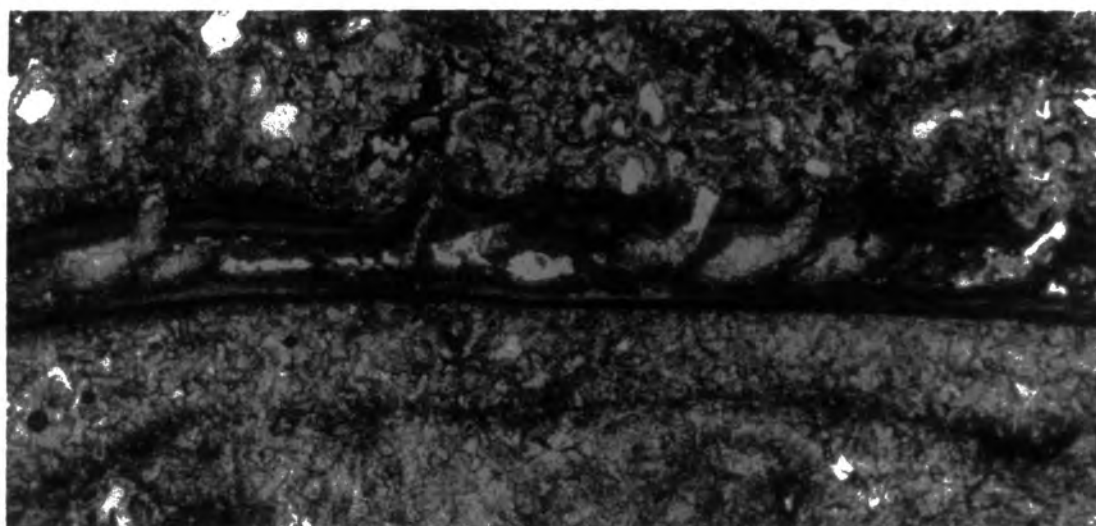
Fig.b Longitudinal section.HYR20.
Bar scale=Imm

Fig.c Longitudinal section.HYR20.
Bar scale=Imm

a



b



c

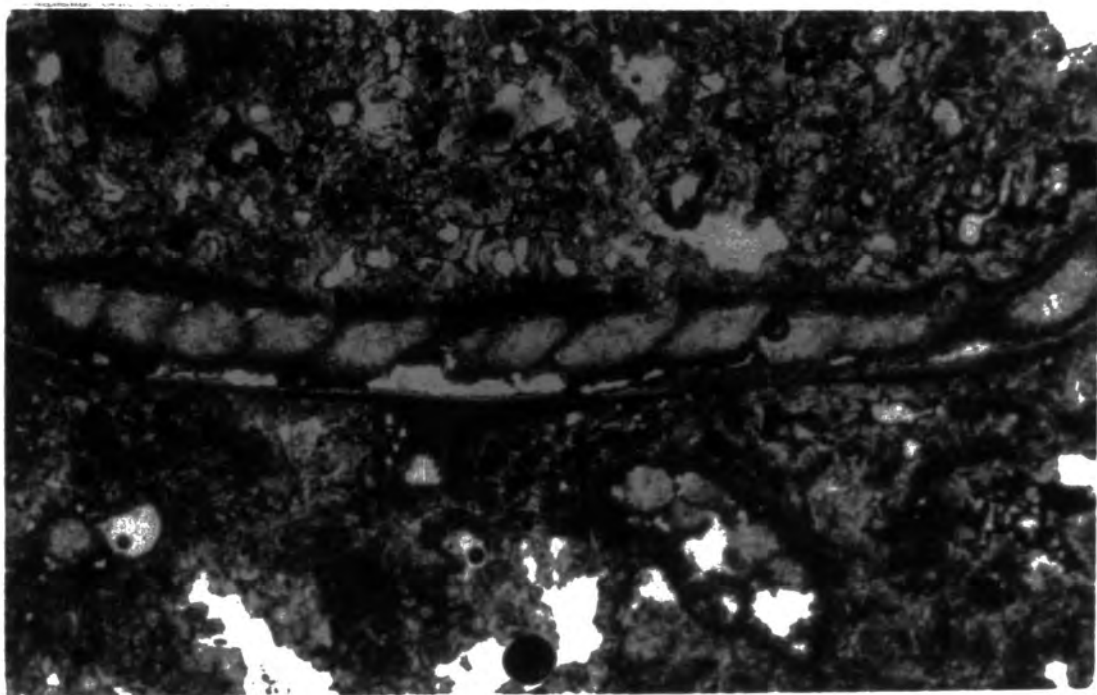


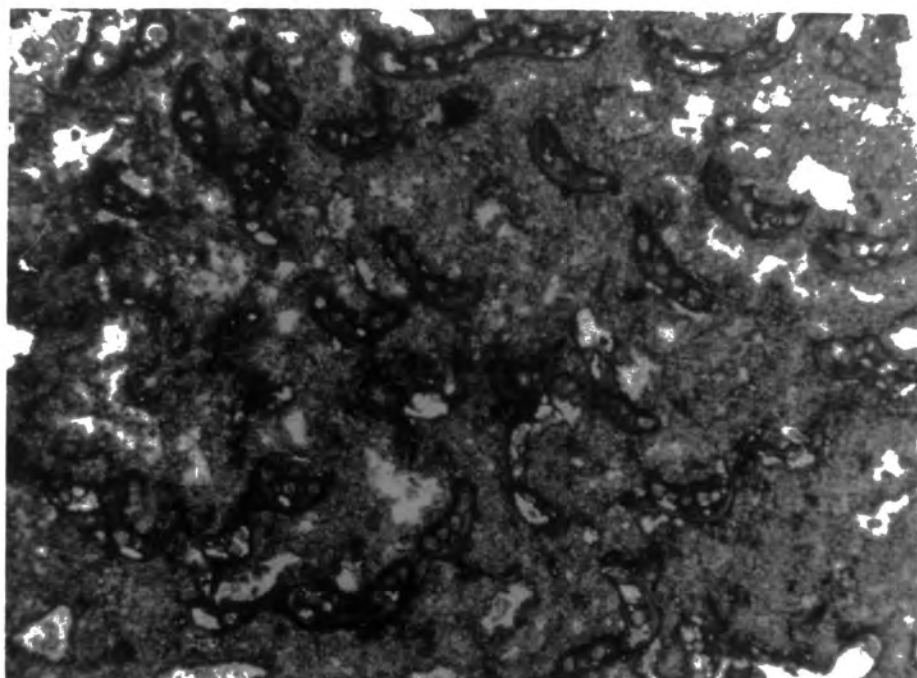
Plate IO5. Acanthocladia diffusus Korn

Fig.a Transverse section through branches
which are assumed to be of the same
zoarium.HYRI4a.
Bar scale=Imm

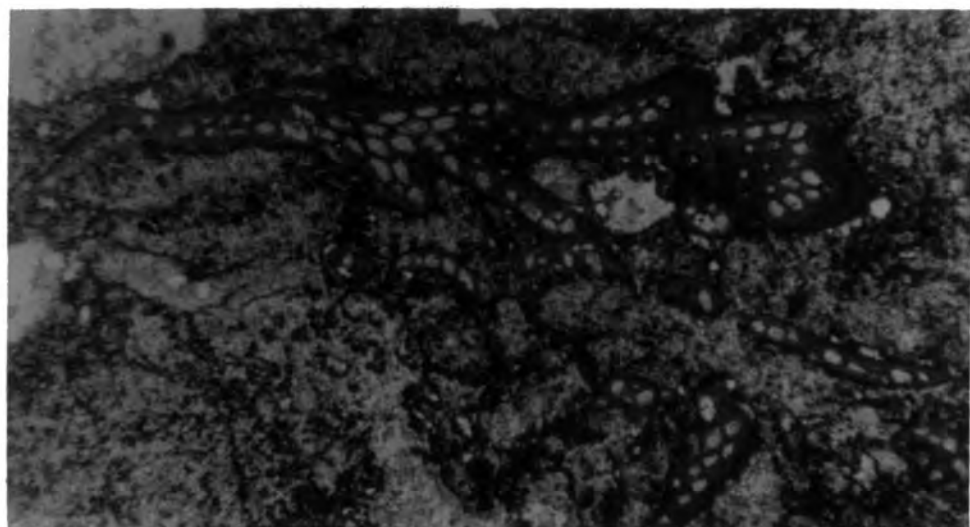
Fig.b Oblique tangential section.HYR2I.
Bar scale=Imm

Fig.c Oblique tangential section.HYR23.
Bar scale=Imm

a



b



c

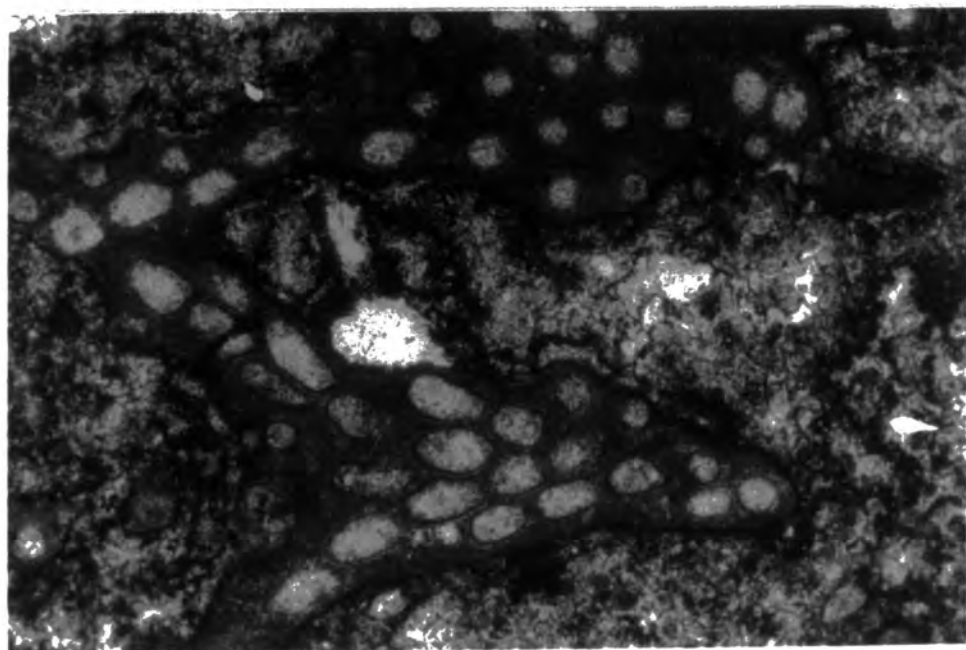


Plate 106. Acanthocladia diffusus Korn

Fig.a Oblique longitudinal sections.HYR20.
Bar scale=Imm

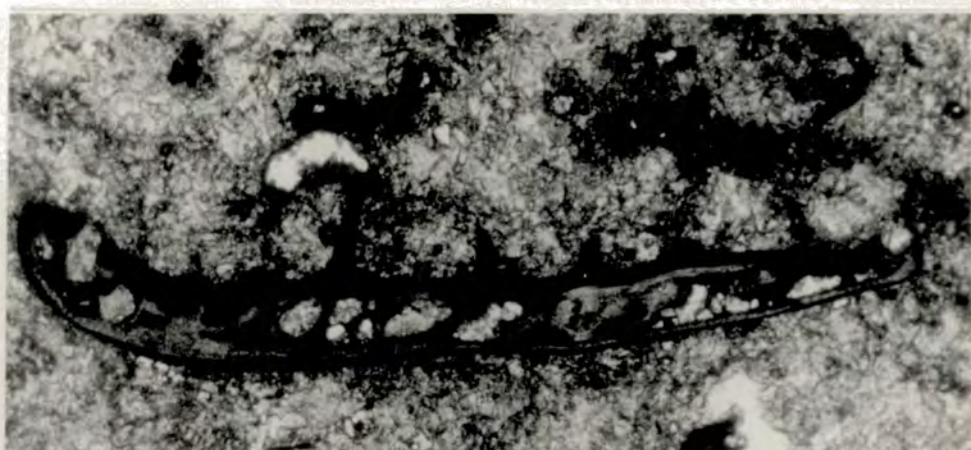
Fig.b As above at higher magnification, showing
large obverse surface node.
Bar scale=Imm

Fig.c Oblique section.HYR15a.
Bar scale=Imm

a



b



c

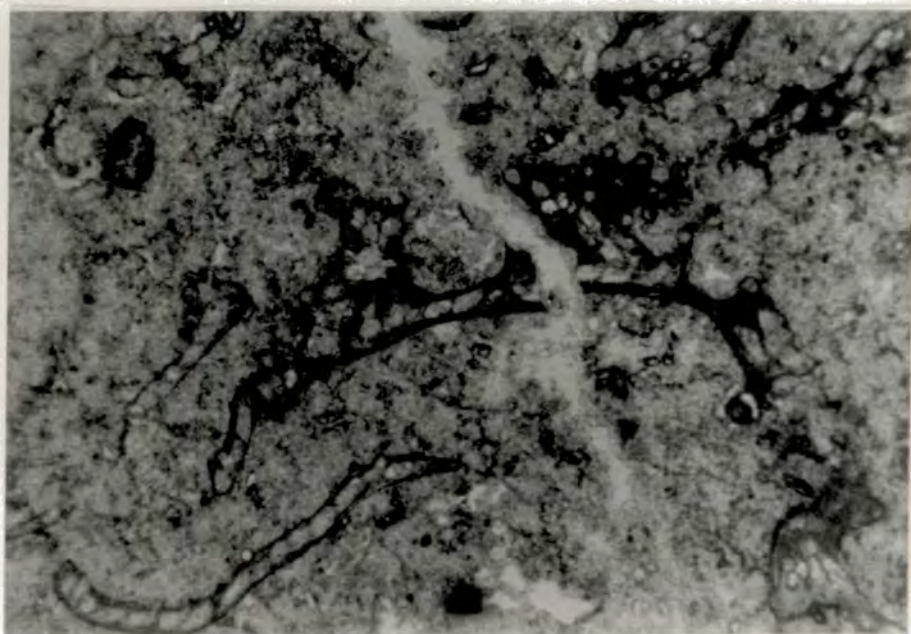
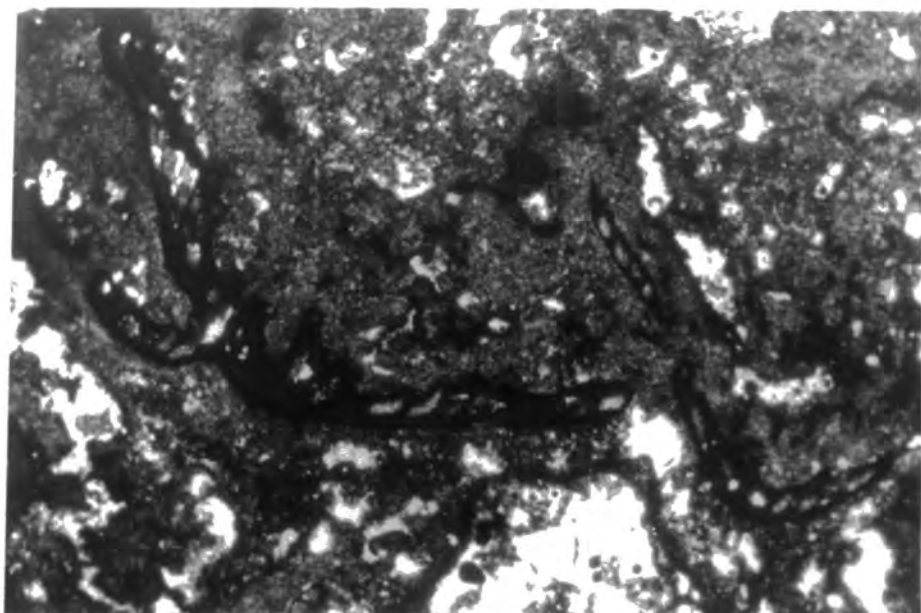


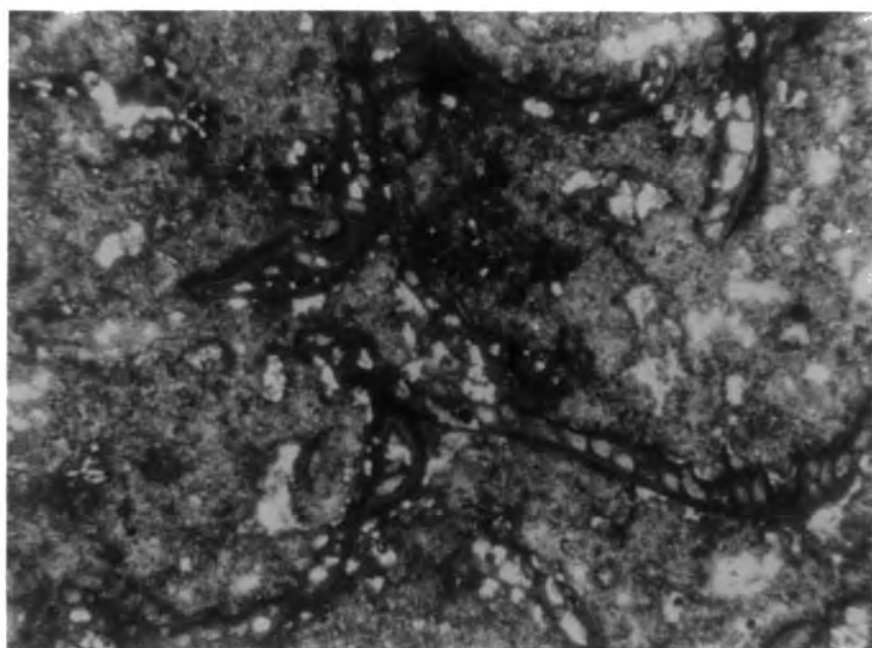
Plate IO7. Acanthocladia diffusus Korn

- Fig.a Oblique section showing fusion of branches
 from adjacent zoarial laminae(left side of
 figure).HYRI4.
 Bar scale=Imm
- Fig.b Oblique section,showing fusion of branches.
 HYRI4a.Bar scale=Imm
- Fig.c Transverse section showing very large
 reverse surface spine.HYRI4.
 Bar scale=Imm

a



b



c

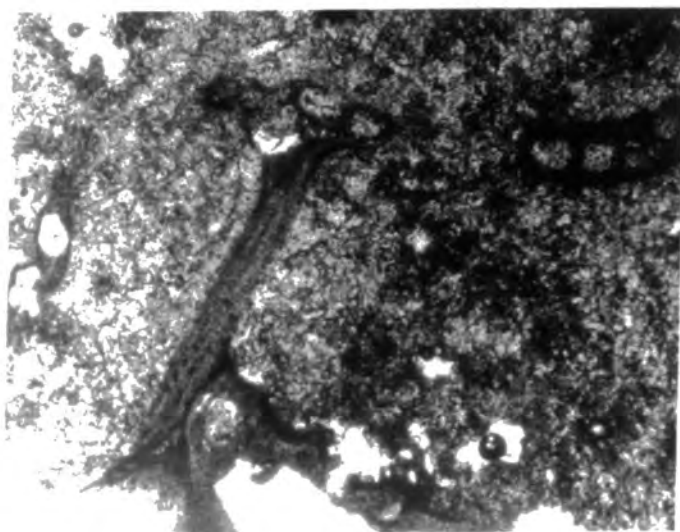


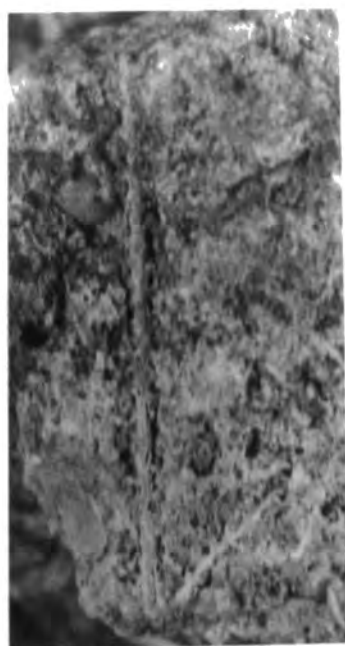
Plate IO8. Acanthocladia minor Korn

- Fig.a Specimen Taf.IV. fig.I2, from the Korn collection, chosen as lectotype by Dreyer (1961).
Bar scale=10mm
- Fig.b Reverse surface, showing branch bifurcation.
RHI.I5. Bar scale=10mm
- Fig.c Obverse surface detail. RH2.55.
Bar scale=Imm
- Fig.d Reverse surface detail - outermost skeleton not preserved. RHI.I5.
Bar scale=Imm

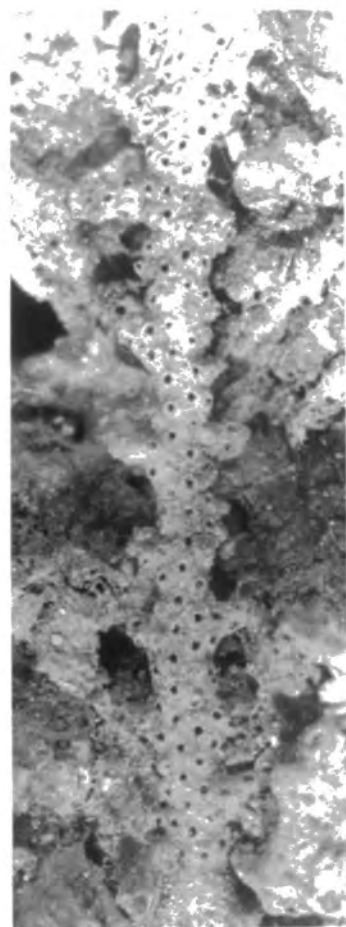
a



b



c



d

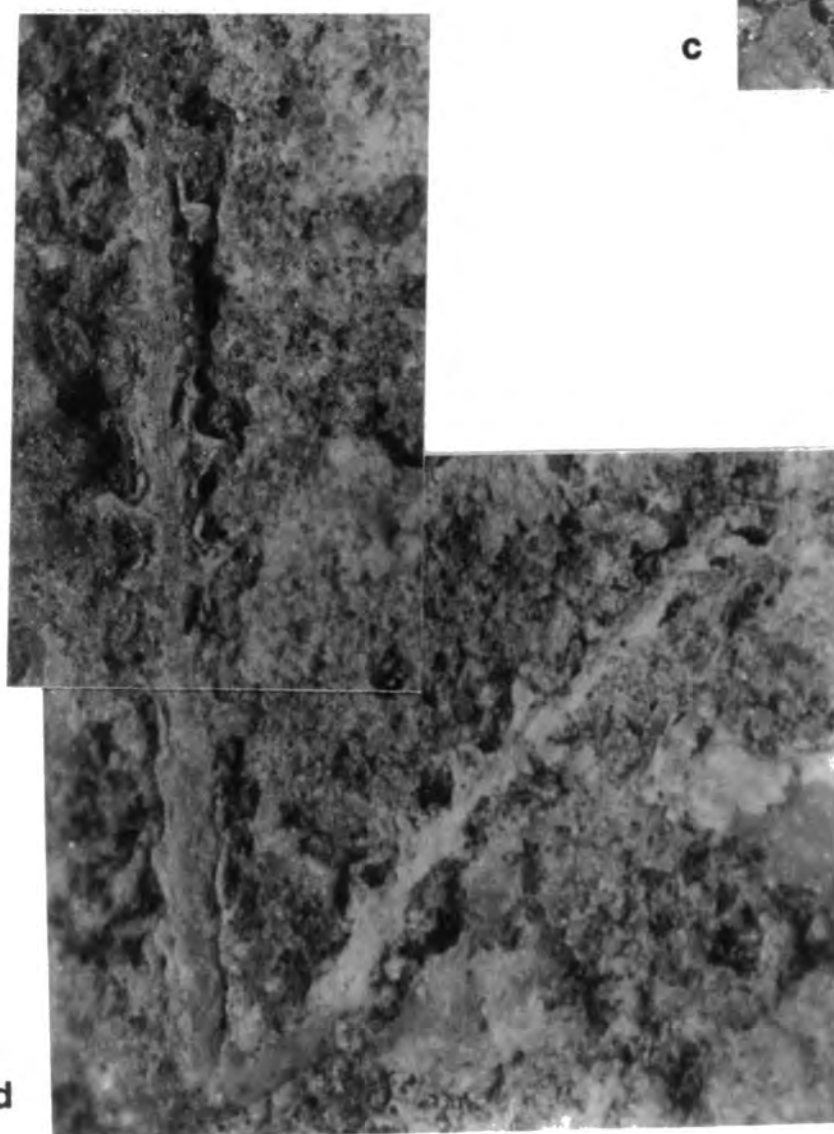


Plate 109. Acanthocladia magna sp.nov.

- Fig.a Obverse surface detail of holotype,
RH2.43.
Bar scale=1mm
- Fig.b Zoarial morphology, Holotype. RH2.43.
Bar scale=10mm
- Fig.c Obverse surface detail, showing
well-developed peristomes, often
with a small notch at their proximal
margin. Several nanate zooecia occur
at the proximal end of the branch.
RH2.70. Paratype. Bar scale=1mm
- Fig.d Obverse surface detail, mineralogically
overgrown. RH2.73b (Paratype).
Bar scale=1mm

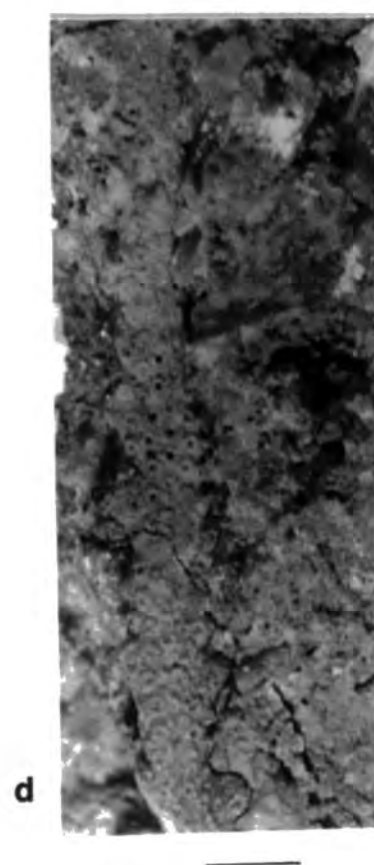
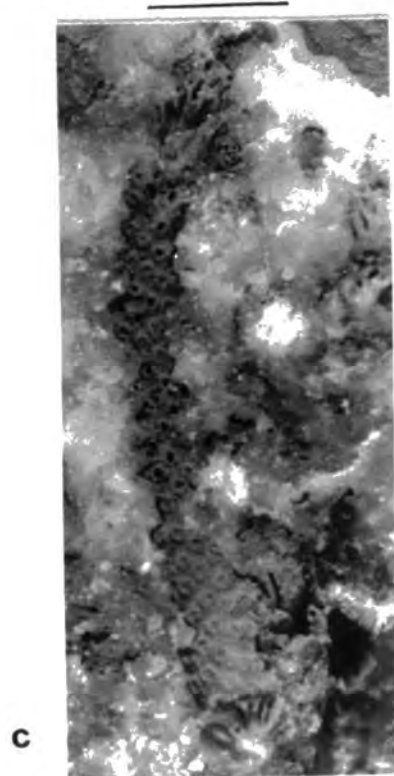
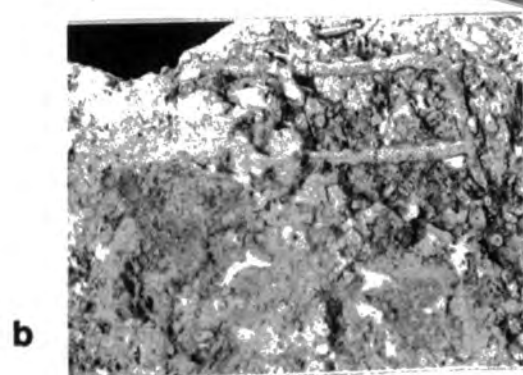
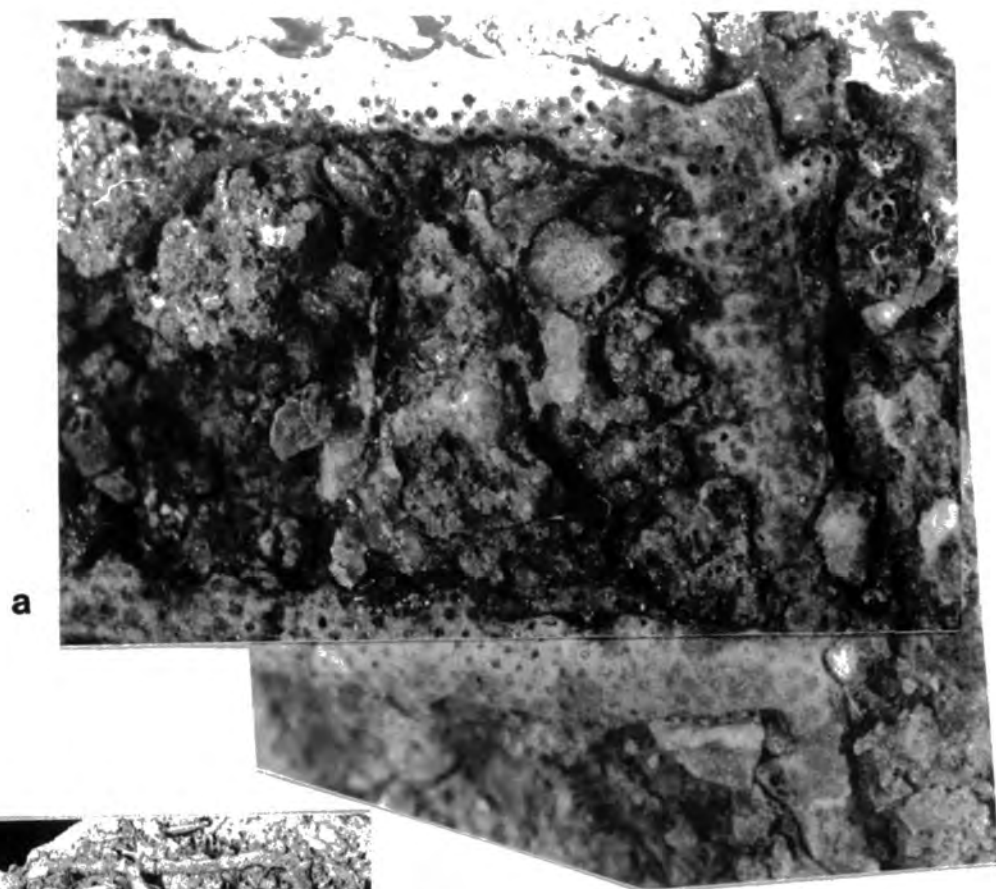


Plate 110. Acanthocladia magna sp.nov.

Tangential section, questionably
referred to A.magna. GLQ 16.

Bar scale=1mm

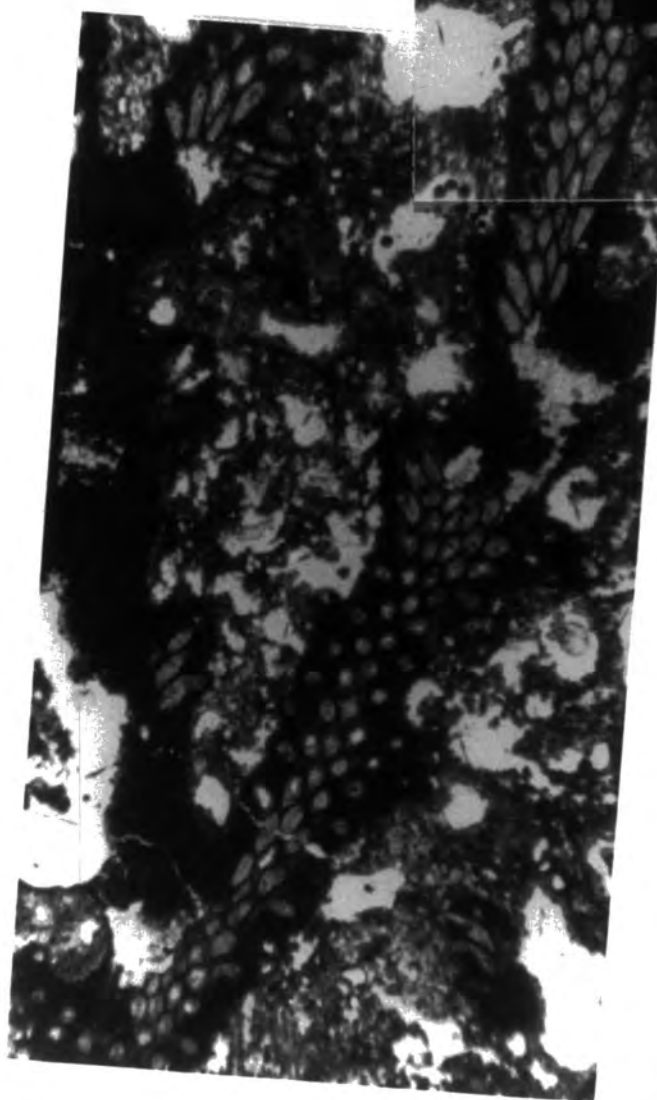
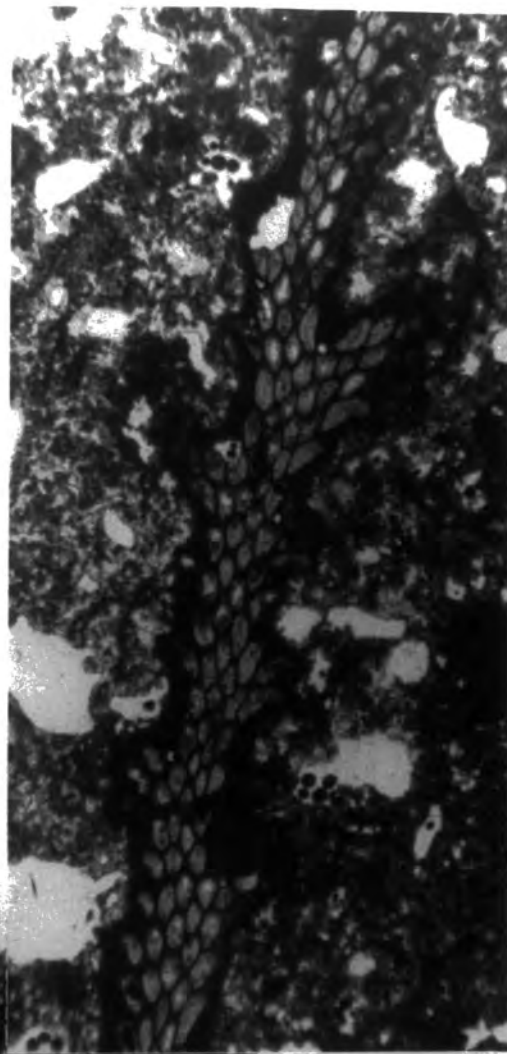


Plate III. Kalvariella typica Morozova

Fig.a Zoarial morphology.BHIOb.
Bar scale=10mm

Fig.b Obverse surface detail.BHIOb.
Bar scale=Imm



a



b

Plate II2. Kalvariella typica Morozova

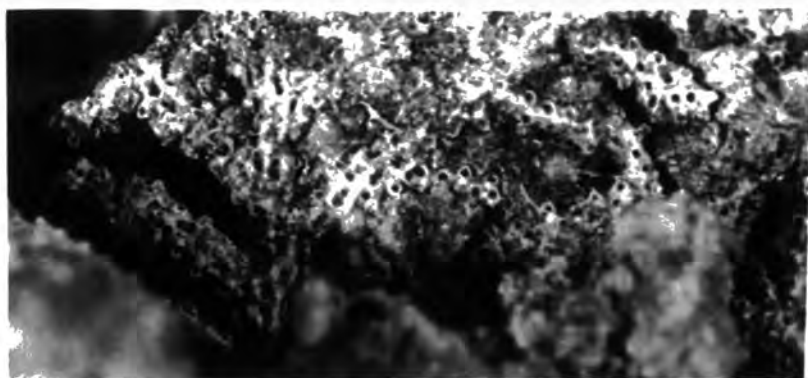
Fig.a Obverse surface detail.RH2.52b.
Bar scale=Imm

Fig.b S.E.M. photomicrograph,obverse surface
detail.Specimen questionably referred
to K.typica.RH2.6I.
Bar scale=Imm

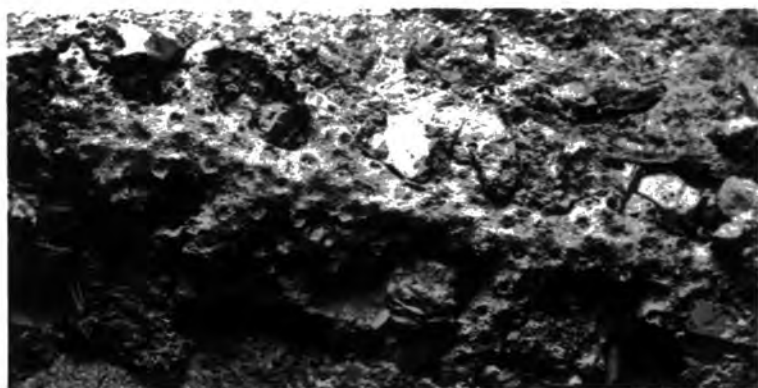
Fig.c As above,fig.b,at higher magnification,
showing nanate zooecia.S.E.M. photomicrograph.
Bar scale=Imm

Fig.d S.E.M. photomicrograph of nanate zooecium.
RH2.6I.Bar scale=0.Imm

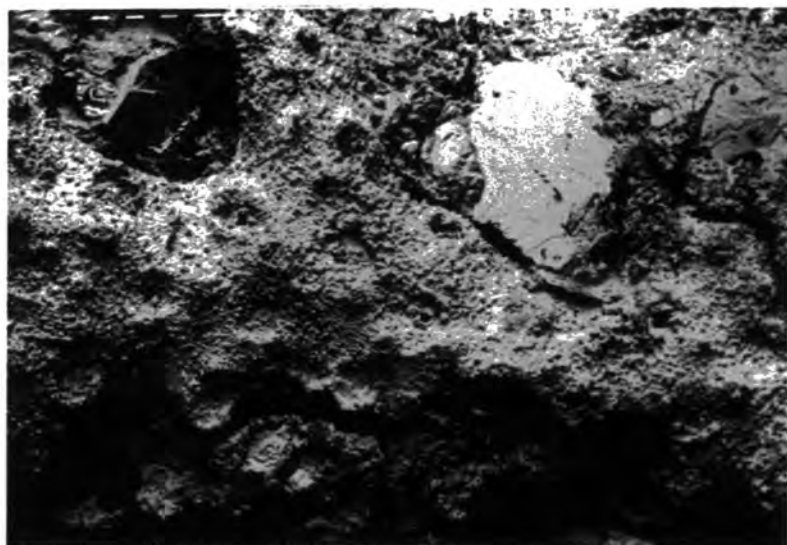
a



b



c



d

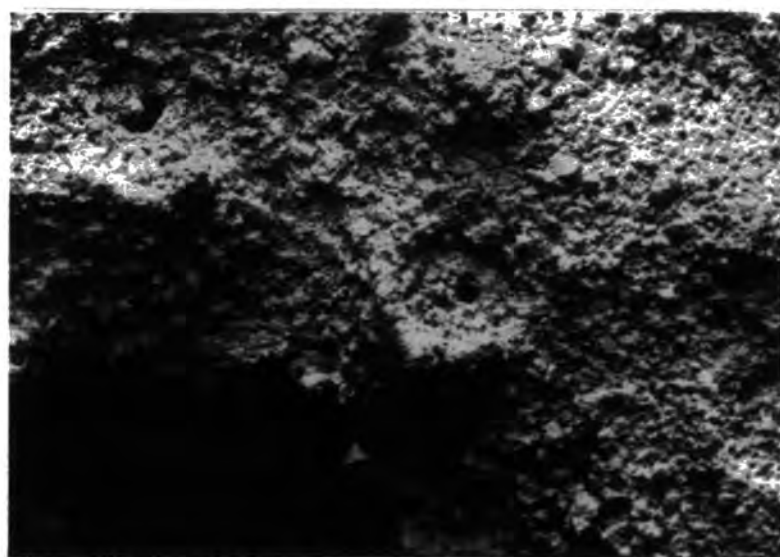


Plate II3. Penniretepora waltheri Korn

Fig.a Zoarial morphology,?close to colony origin.
HYR28.Bar scale=10mm

Fig.b Reverse surface detail.HYR28.
Bar scale=Imm



a



b

Plate II4. Penniretepora waltheri Korn

Fig.a Specimen Taf.IV fig.I6 from the Korn
collection.Reverse surface.
Bar scale=10mm

Fig.b Specimen Taf.IV fig.I4,I5 from the Korn
collection,chosen as lectotype by Dreyer(1961).
Bar scale=10mm.Obverse surface.



a

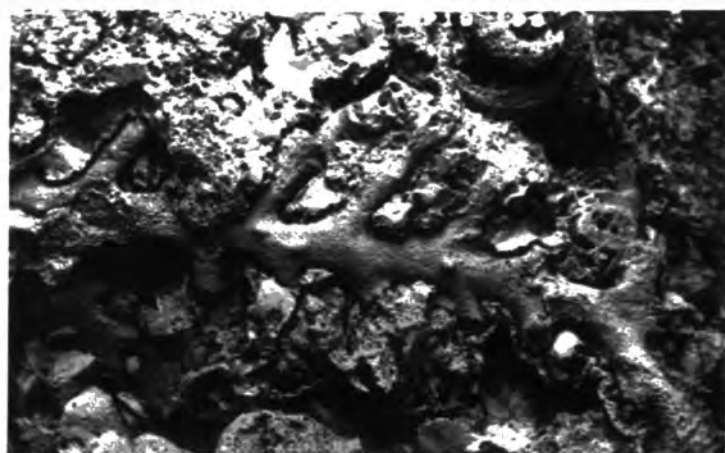


b

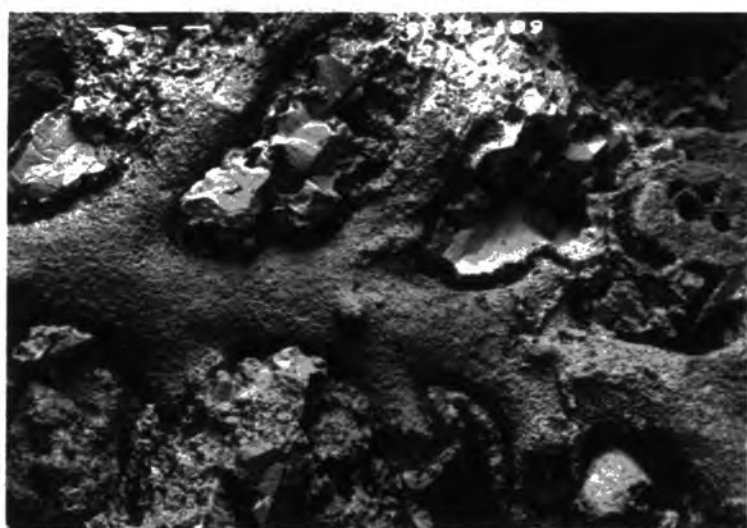
Plate II5. Penniretepora waltheri noda subsp.nov.

- Fig.a S.E.M. photomicrograph, showing reverse surface with characteristic nodes.RH2.42. Holotype.Bar scale=Imm
- Fig.b As above at higher magnification. Bar scale=Imm
- Fig.c Reverse surface detail.RH2.32. Bar scale=Imm
- Fig.d Reverse surface detail.Node arrowed. RH2.36.Bar scale=Imm
- Fig.e Reverse surface detail.RH2.34. Bar scale=Imm
- Fig.f Internal detail of specimen fractured along mid-line of branch.RH2.33a. Bar scale=Imm

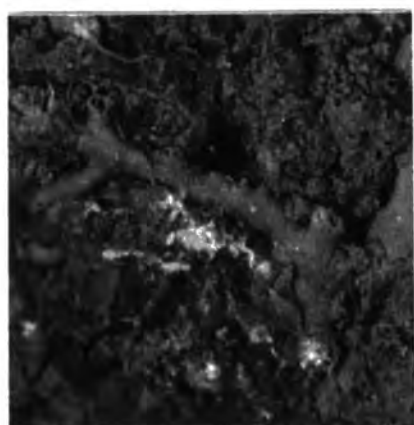
a



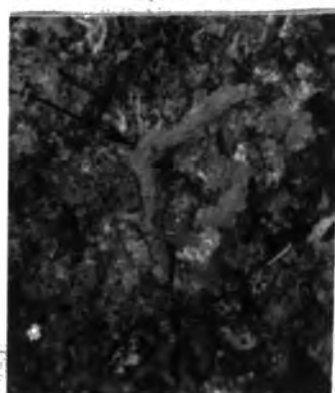
b



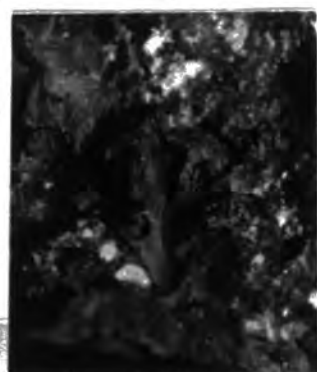
c



d



e



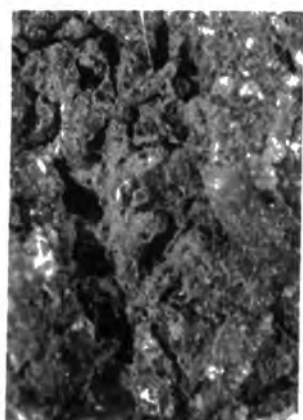
f



Plate II6. Penniretepora waltheri nodata subsp.nov.

- Fig.a Obverse surface detail.RH2.28.
Bar scale=Imm
- Fig.b Main branch seen in profile, showing
lateral branches in transverse section
and obverse surface nodes with characteristic
spacing.RH2.Ib.
Bar scale=Imm
- Fig.c Obverse surface detail.RH2.Ib.
Bar scale=Imm
- Fig.d S.E.M. photomicrograph of obverse surface.
Slightly aberrant form - lateral branch in
top right corner of figure has three rows
of apertures for a short distance.RH2.Ia.
Bar scale=Imm
- Fig.e As above at higher magnification.
Bar scale=Imm

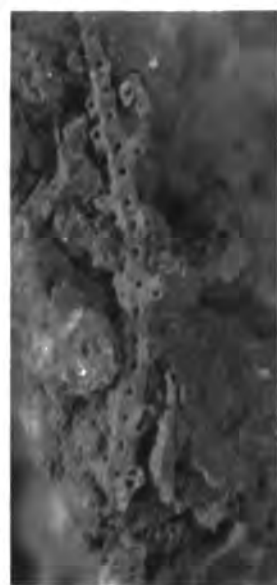
a



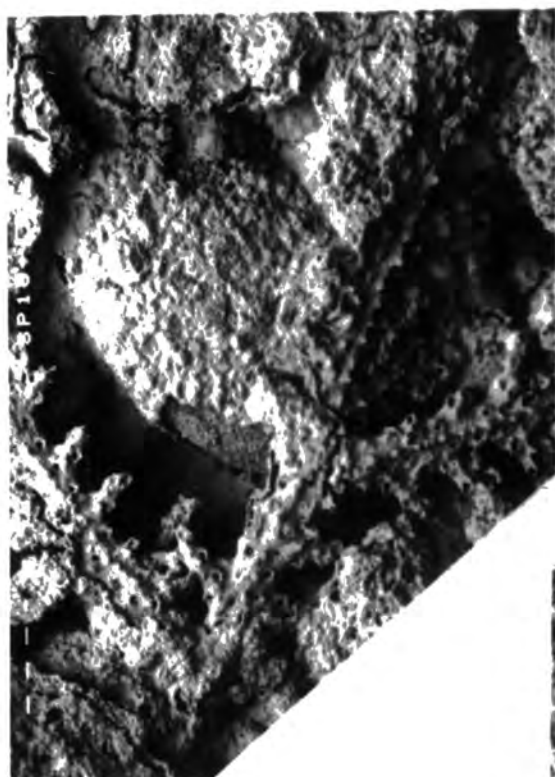
b



c



d



e

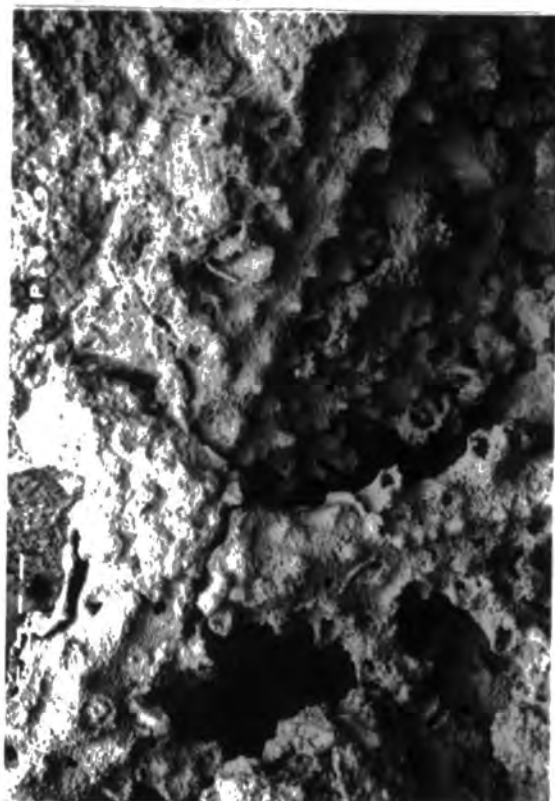
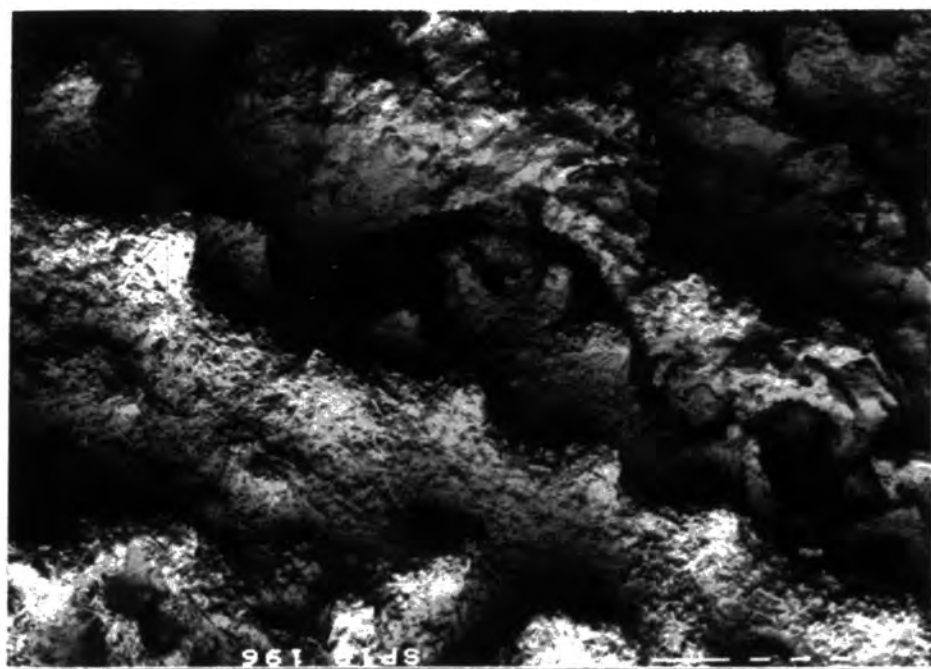


Plate II7. Penniretepora waltheri nodata subsp.nov.

Fig.a S.E.M. photomicrograph showing obverse
surface nodes.RH2.Ia.
Bar scale=0.Imm

Fig.b S.E.M photomicrograph of obverse surface.
Ovicells occur proximal to some autozooecial
apertures(hard parts which probably enclosed
the ovicells have not been preserved).Node
which is developed on the edge of a peristome
is arrowed.RH2.Ia.
Bar scale=Imm

a



b

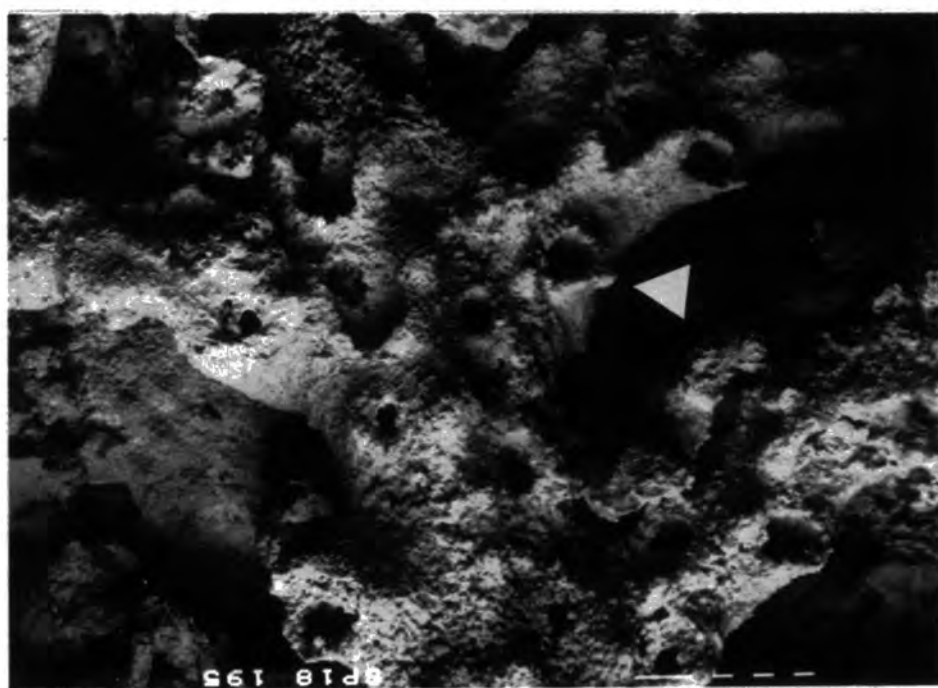


Plate II8. Penniretepora waltheri nodata subsp.nov.

Fig.a Tangential section in XPL.The dark line
along the centre of the branch is the
'inner platy core'.MP5.60.
Bar scale=Imm

Fig.b As above in plane polarised light.
(Scale as above).

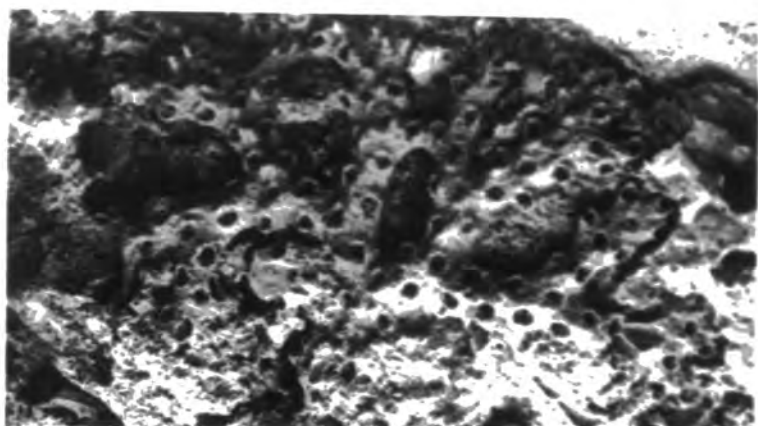


—

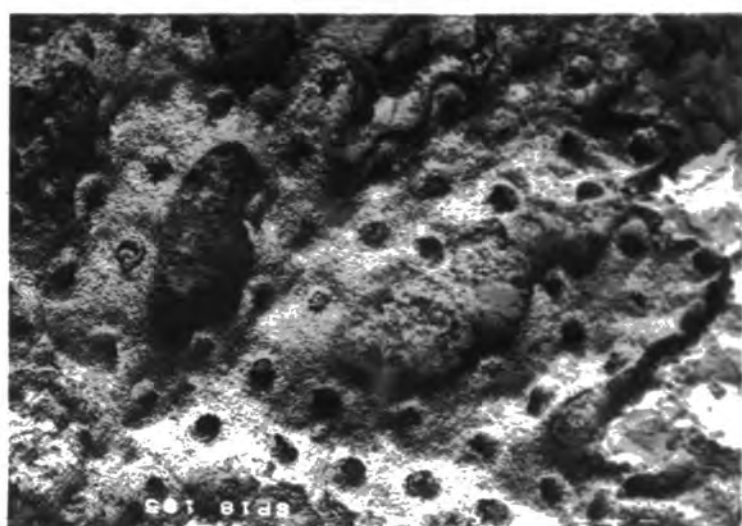
Plate II9. Ryhopora delicata gen.nov.,sp.nov:

- Fig.a S.E.M. photomicrograph showing zoarial morphology.RH2.3Ob.Holotype.
Bar scale=Imm
- Fig.b As above at higher magnification.S.E.M.
photomicrograph.Bar scale=Imm
- Fig.c As above at higher magnification,showing
obverse surface detail.S.E.M. photomicrograph.
Bar scale=0.Imm
- Fig.d As above at higher magnification.S.E.M.
photomicrograph.
Bar scale=0.Imm

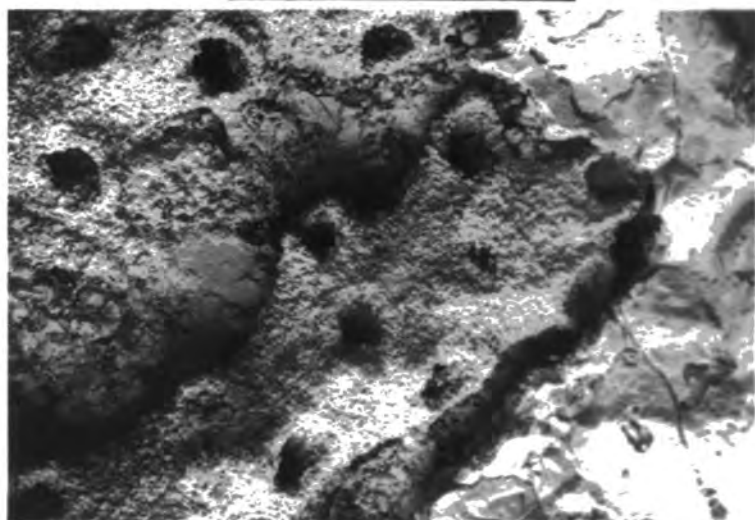
a



b



c



d

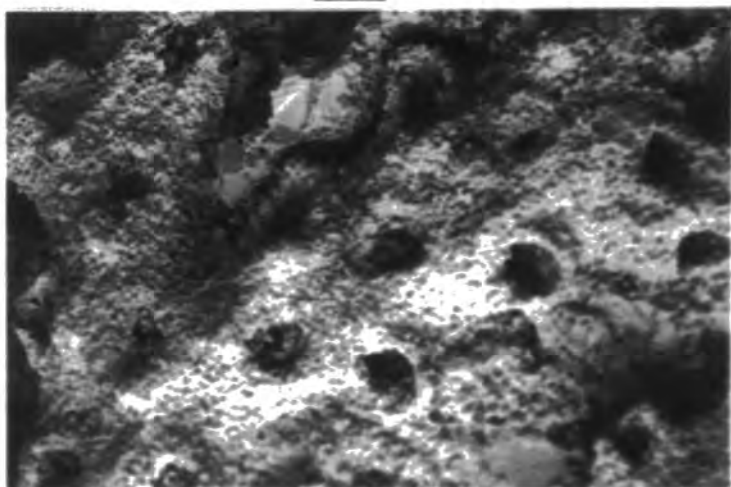


Plate I20. Ryhopora delicata gen.nov.,sp.nov.

Fig.a Tangential section.Questionably referred
to R.delicata.MP5.I00a.
Bar scale=Imm

Fig.b As above in XPL.
Bar scale=Imm

Plate I2I. Dyscritella columnaris Schlotheim

- Fig.a Colony encrusting a crinoid stem.
BII9A.Bar scale=IOmm
- Fig.b Zoarial morphology,showing zooecial
chambers in cast preservation.694F.
Bar scale=IOmm
- Fig.c Colony attached to the brachiopod
Dielasma.Preservation of D.columnaris
below the level of the obverse surface.
MP5.43.Bar scale=Imm
- Fig.d Zoarial morphology,showing intra-zoarial
fusion of branches.MP5.43.
Bar scale=IOmm
- Fig.e Colony encrusting the reverse surface
of Synocladia virgulacea,showing growth
front.RH2.43.
Bar scale=Imm
- Fig.f Zoarial morphology,cast preservation.
MP5.45.Bar scale=IOmm
- Fig.g S.E.M. photomicrograph,showing apertures
of autozooecia and mesozooecia.Overgrown
by dolomite.BI34B.
Bar scale=Imm

a



b



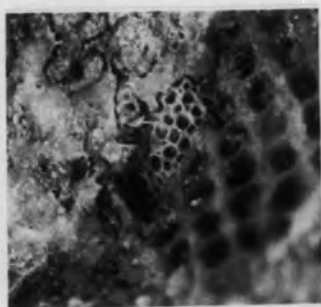
c



d



e



f



g

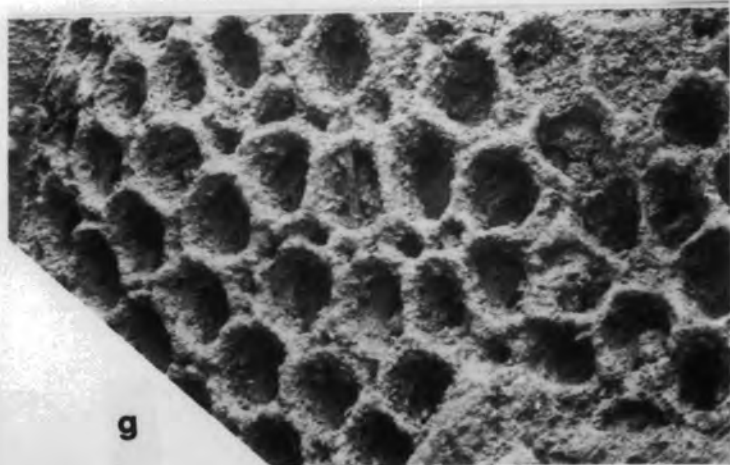
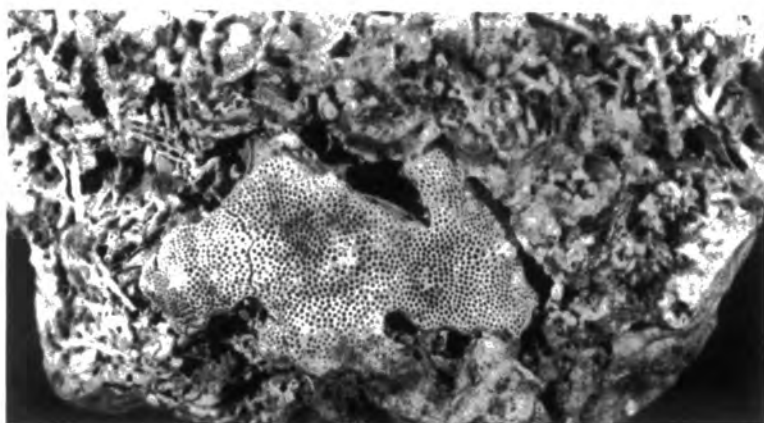


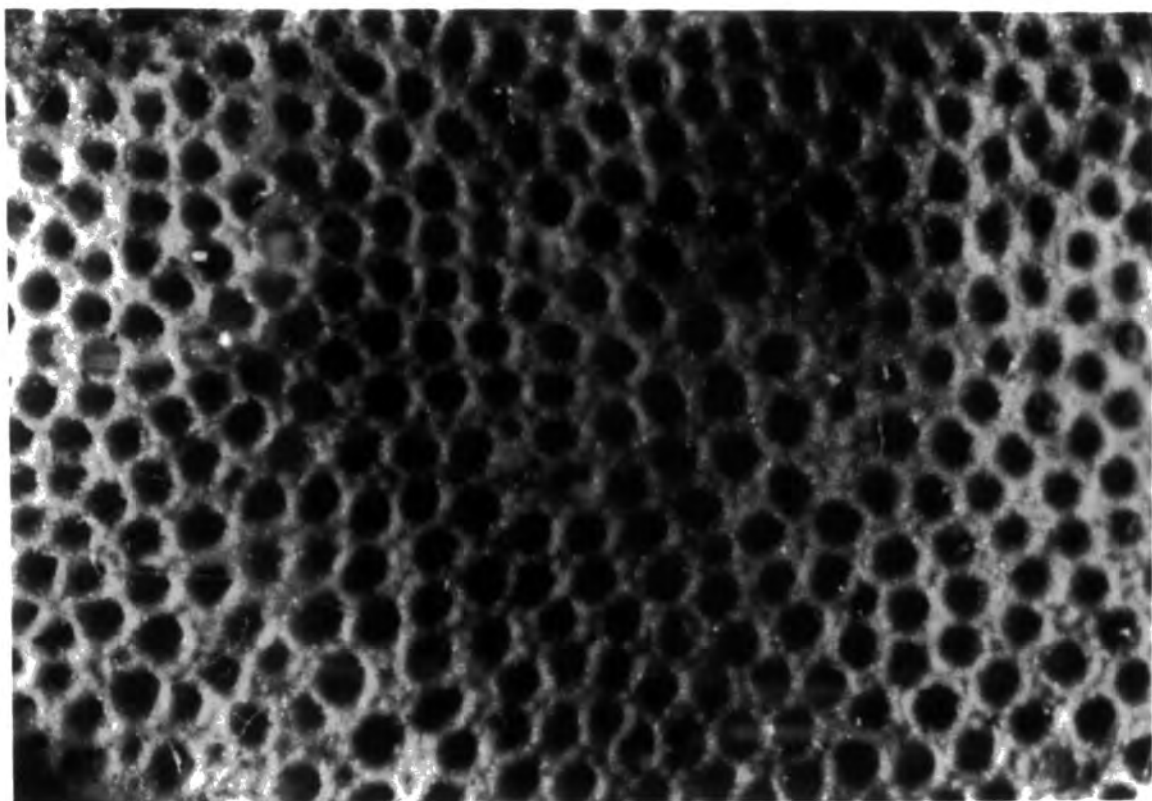
Plate I22. Dyscritella columnaris Schlotheim

- Fig.a Encrusting zoarium referred to
 "Alveolites buchiana" King by King (1850).
 Tentatively placed in synonymy with
 D.columnaris here. BII8.
 Bar scale=10mm
- Fig.b As above at higher magnification. In
 spite of the poor preservation it is
 clear that very few mesozooecia are
 developed.
 Bar scale=1mm
- Fig.c Zooecial chambers in cast preservation.
 694F. Bar scale=1mm

a



b



c

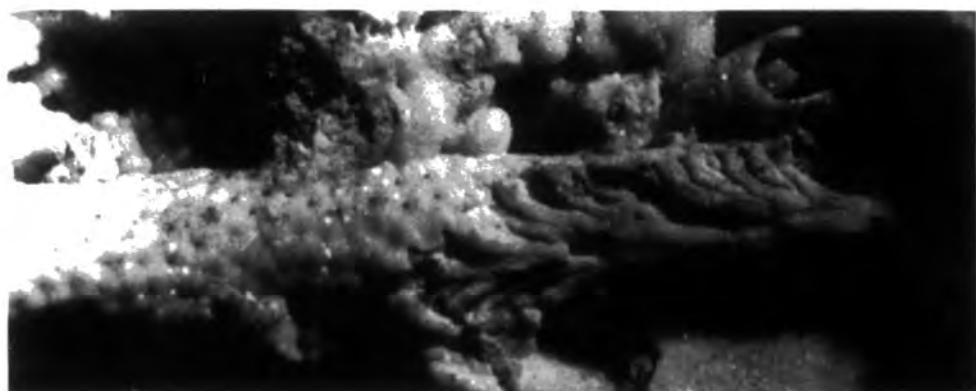


Plate I23. Dyscritella columnaris Schlotheim

Fig.a Transverse section.MP5.209.
Bar scale=Imm

Fig.b As above at higher magnification.
Bar scale=Imm

Fig.c As above at higher magnification, showing
secondary overgrowth and acanthostyles.
Bar scale=0.Imm

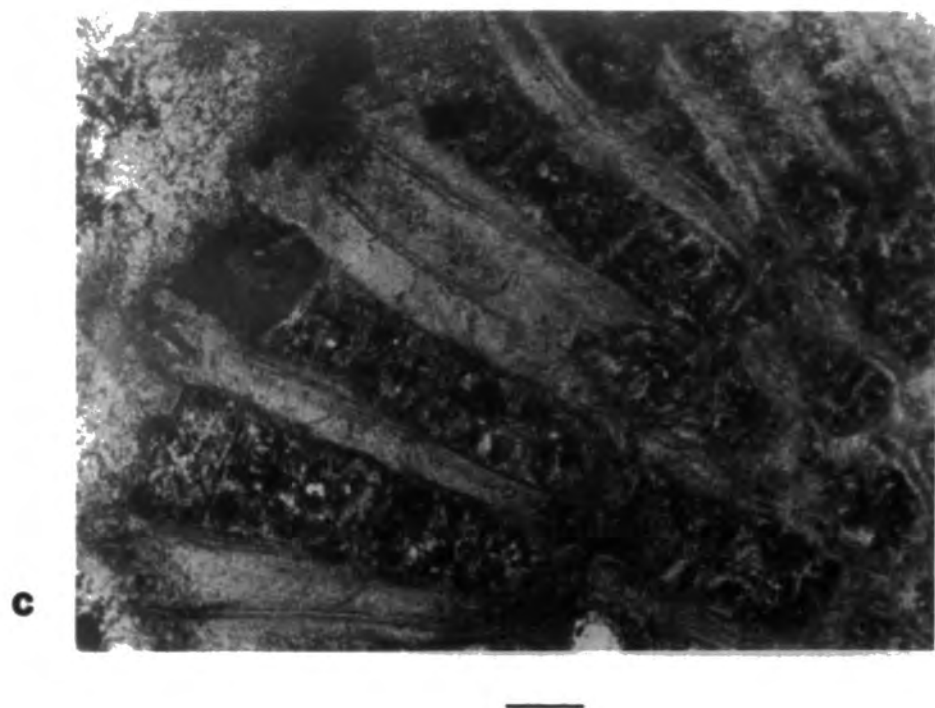
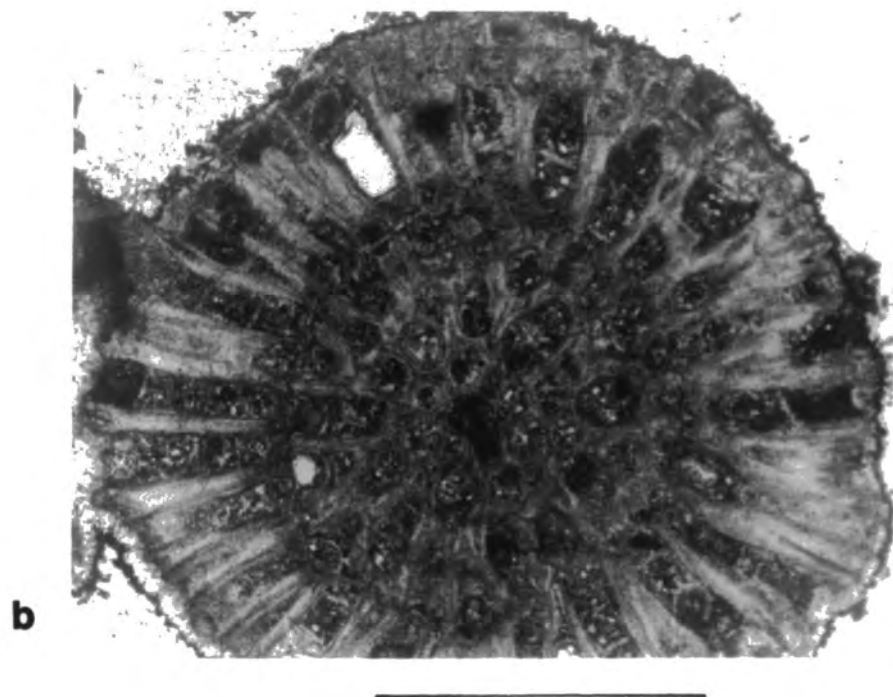
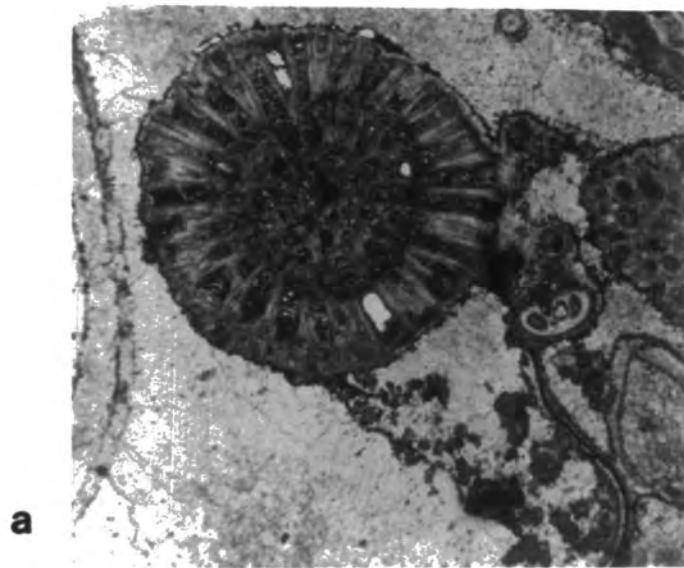


Plate I24. Dyscritella columnaris Schlotheim

Fig.a Longitudinal section. Atypical specimen showing no diaphragms. MP5.2I4.

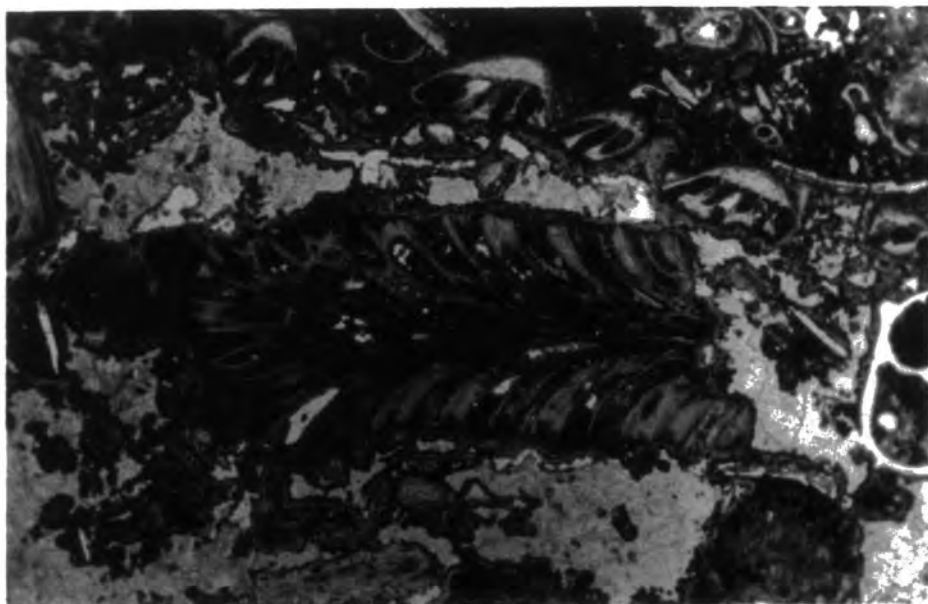
Bar scale=Imm

Fig.b As above at higher magnification.

Bar scale=Imm

Fig.c Longitudinal section, showing diaphragms and curvature of zooecial chambers in the exozone. HDN50.

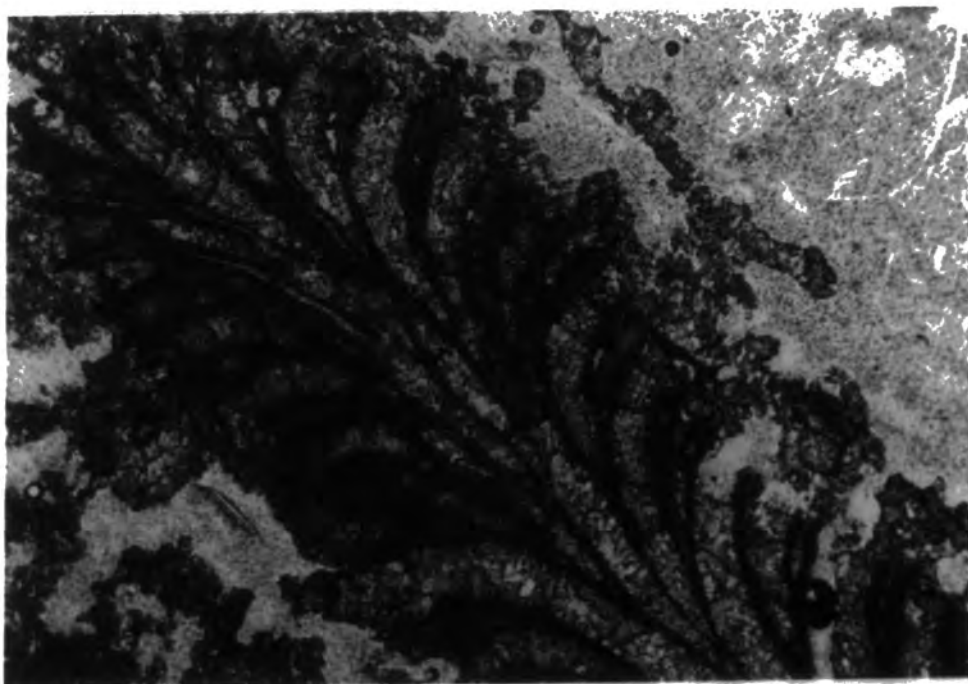
Bar scale=Imm



a



b



c

Plate I25. Dyscritella columnaris Schlotheim

Zoarium in longitudinal and shallow
tangential sections.MP5.2I2.

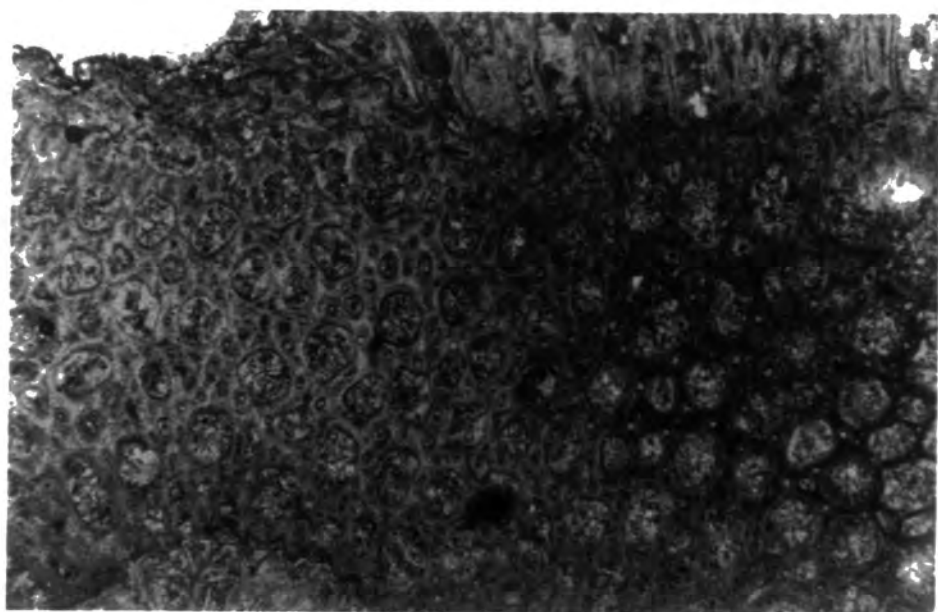
Bar scale=Imm



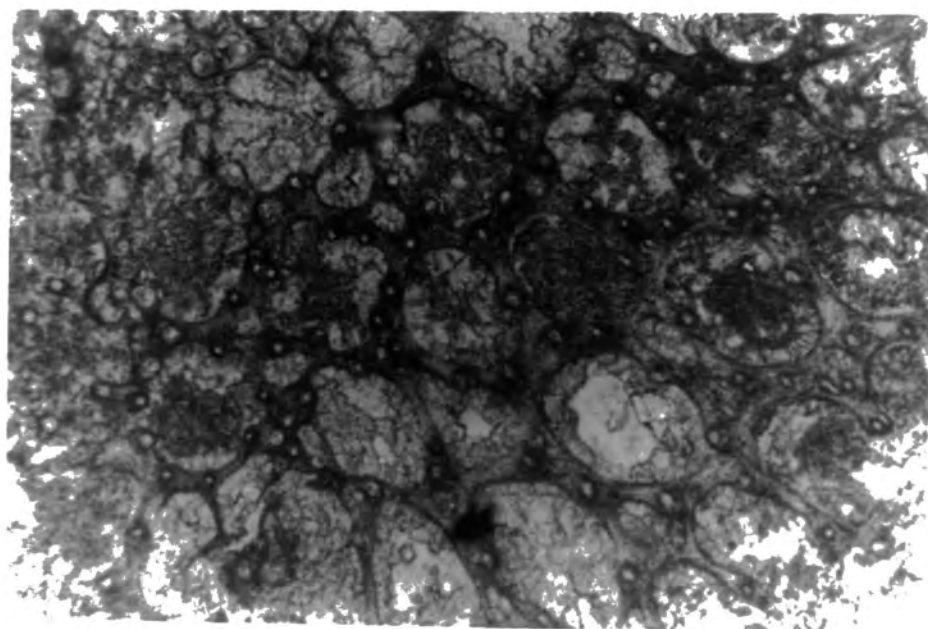
Plate I26. Dyscritella columnaris Schlotheim

- Fig.a Shallow tangential section showing
autozooecial and mesozooecial apertures
and acanthostyles. Secondary overgrowth
developed. MP5.2I2.
Bar scale=Imm
- Fig.b Shallow tangential section showing
acanthostyles which indent the walls
of autozooecia in places. HDN52.
Bar scale=0. Imm
- Fig.c Shallow tangential section. MP5.203.
Bar scale=Imm

a



b



c

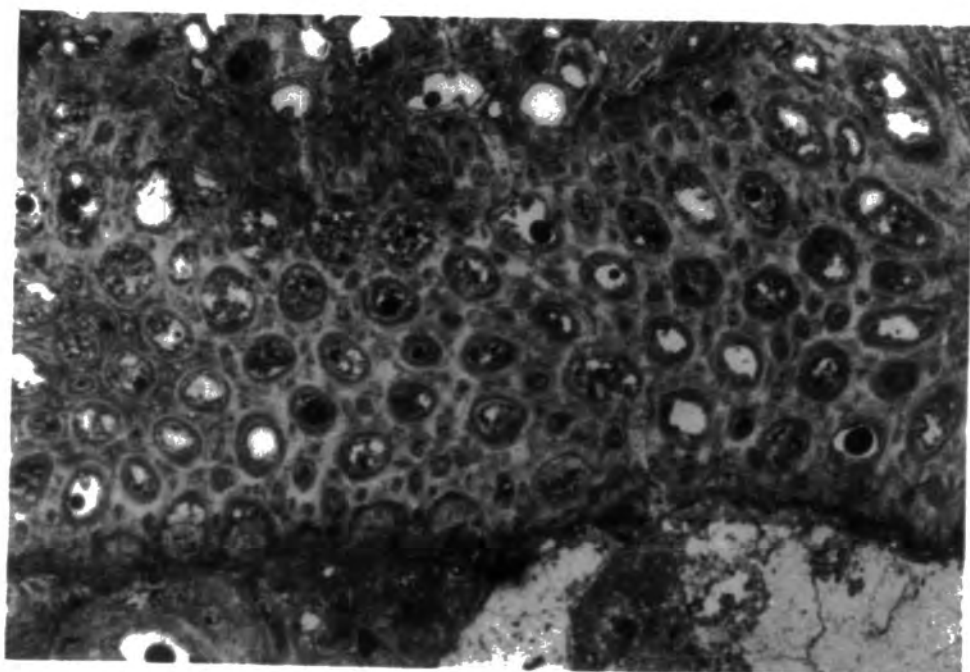


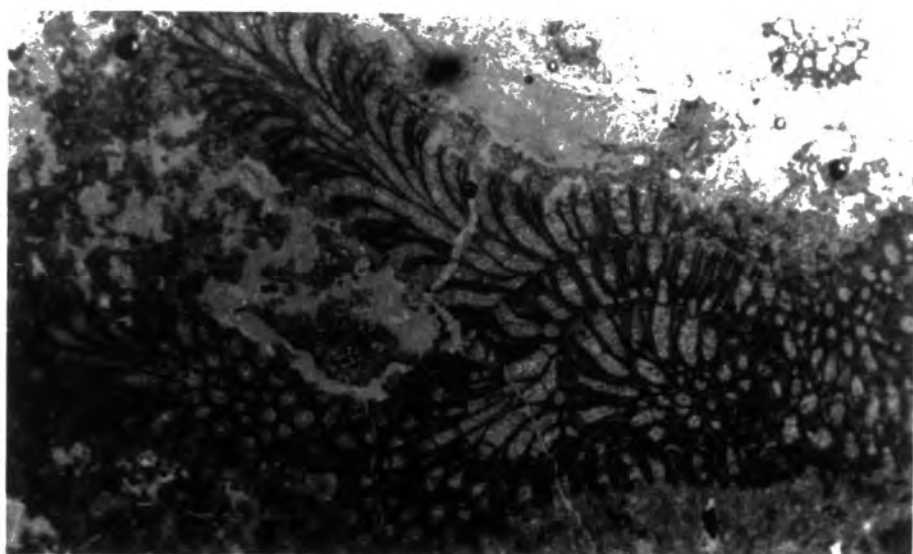
Plate I27. Dyscritella columnaris Schlotheim

Fig.a Zoarium with two layers of secondary overgrowth.HDN50.
Bar scale=Imm

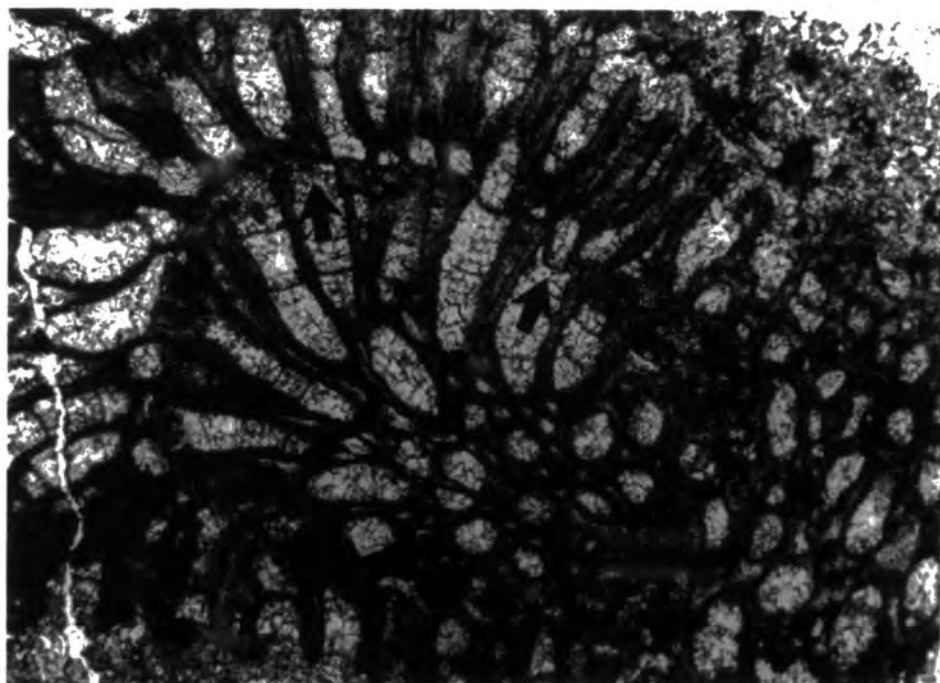
Fig.b As above at higher magnification.The arrow on the left shows an area where the basal lamina is raised above the level of the exozone below.The arrow on the right shows the basal lamina extending down into a zooecial chamber.HDN50.
Bar scale=Imm

Fig.c Close-up of secondary overgrowth showing the basal lamina'draped'over an acanthostyle (left centre of figure).HDN50.
Bar scale=0.Imm

a



b



c

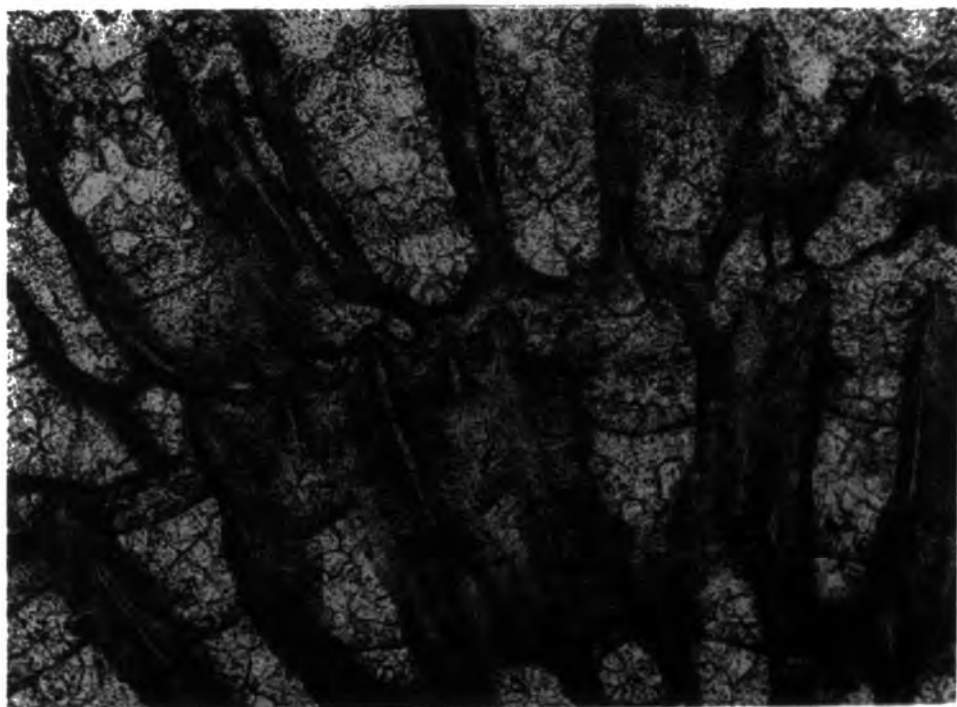


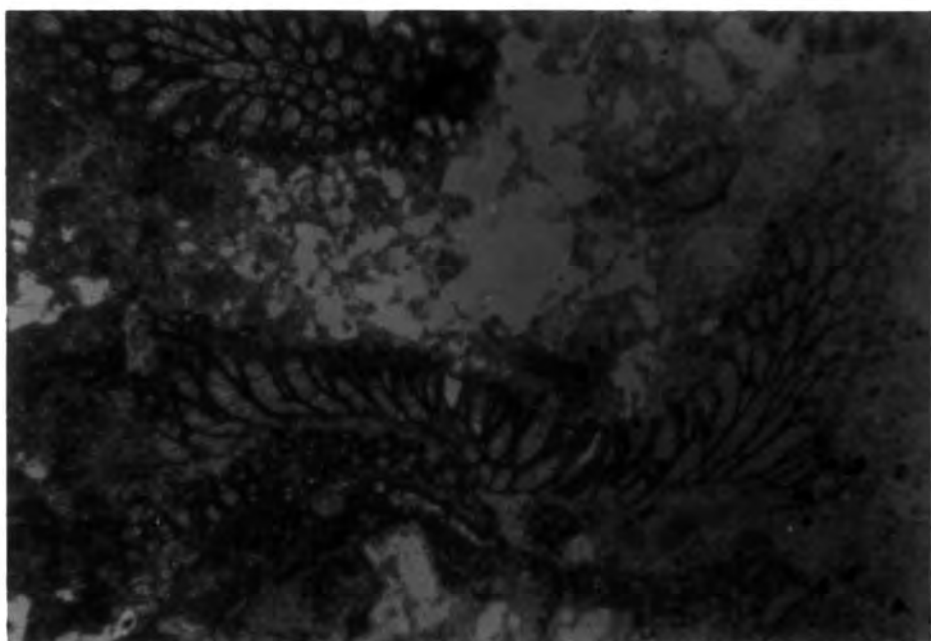
Plate I28. Dyscritella columnaris Schlotheim

Fig.a Adnate and erect growth within the same zoarium.HDNI5.
Bar scale=Imm

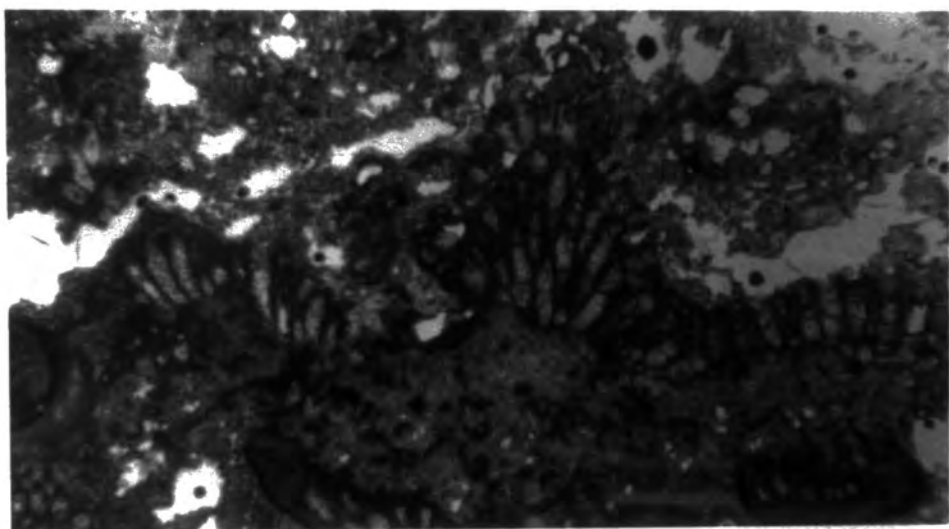
Fig.b Adnate zoarium with the beginning of erect growth.Zoarium encrusting a lithified substratum.HDNI4.
Bar scale=Imm

Fig.c Zoarium with seven layers of secondary overgrowth(only five visible in figure). MP5.206.Bar scale=Imm

a



b



c

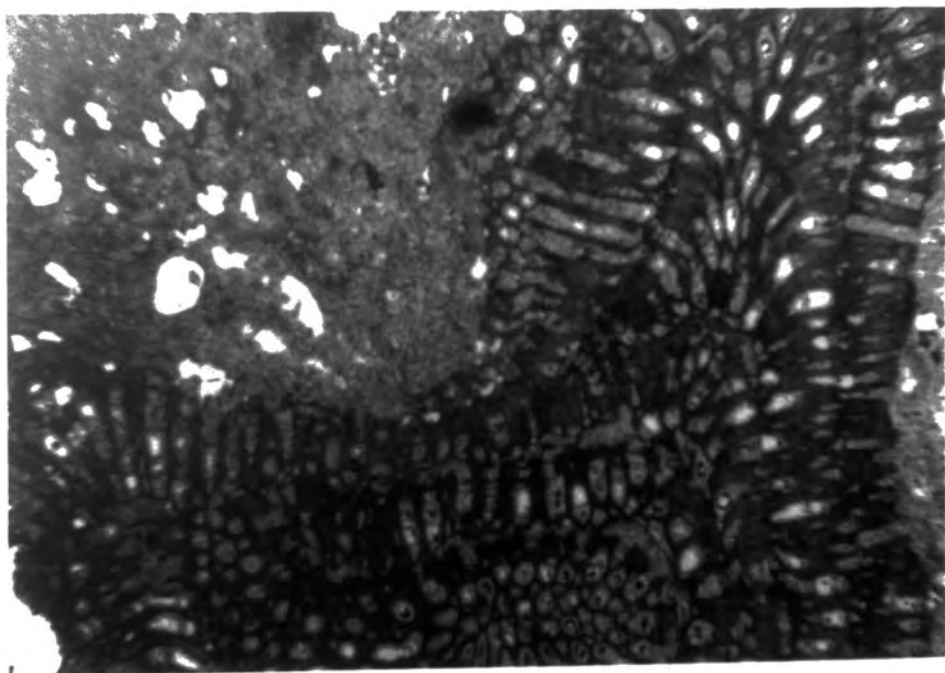
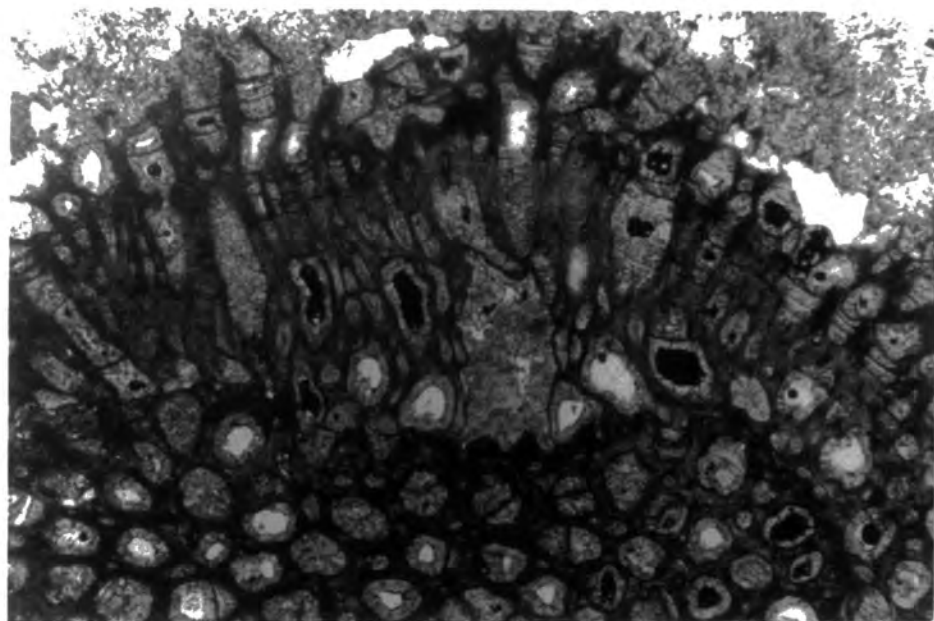


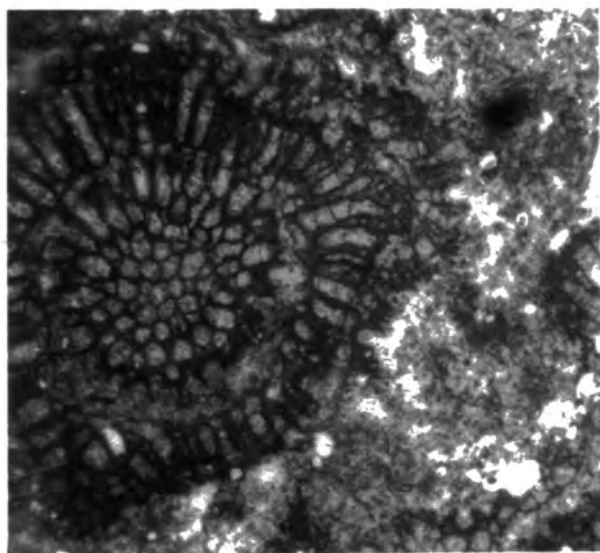
Plate I29. Dyscritella columnaris Schlotheim

- Fig.a Secondary overgrowth with the basal lamina sharply deflected above the underlying exozone.MP5.7I.
Bar scale=Imm
- Fig.b Secondary overgrowth whose basal lamina is raised above the level of the underlying exozone throughout most of its length.For interpretation of a similar feature see figure 74.
GLQ100.Bar scale=Imm
- Fig.c Secondary overgrowth with the basal lamina raised above the level of the underlying exozone.HDNI5.
Bar scale=0.Imm

a



b



c

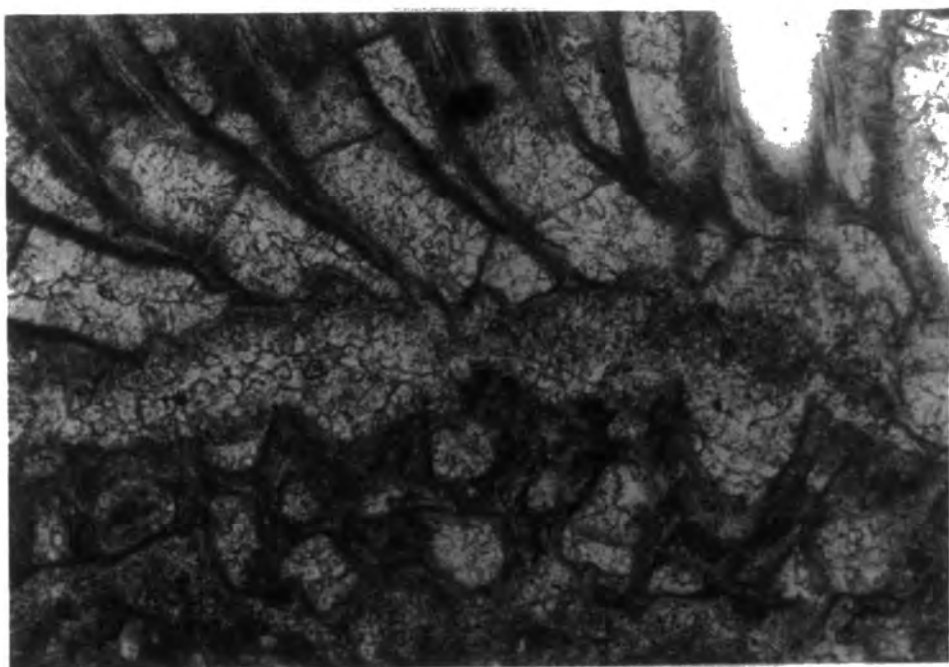


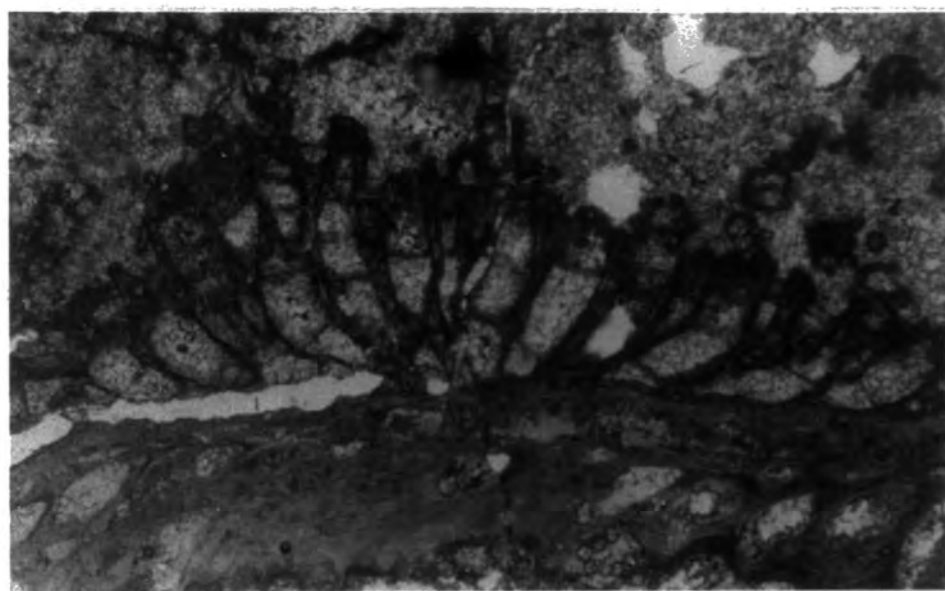
Plate I30. Dyscritella columnaris Schlotheim

- Fig.a Secondary overgrowth, showing deflection
 of basal lamina around an acanthostyle.
 HDNI5. Bar scale=0. Imm
- Fig.b Colony encrusting the reverse surface of
 Acanthocladia laxa. HDNI5.
 Bar scale=Imm
- Fig.c Cavity within a zoarium. It may
 represent the former position of a
 foreign body which was incorporated
 into the colony during growth but
 which is not now present. MP5.205.
 Bar scale=Imm

a



b



c

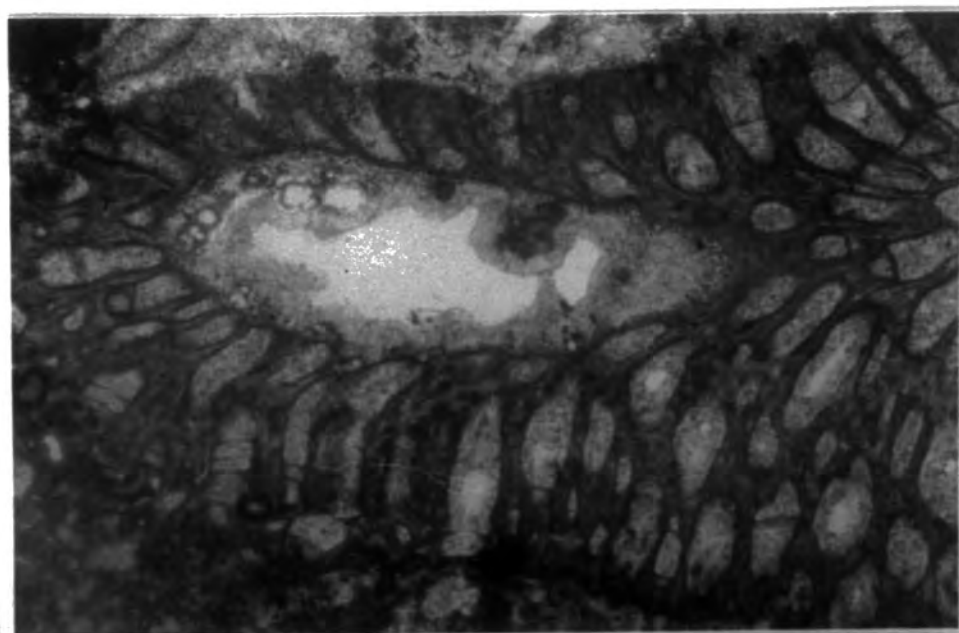


Plate I3I. Dyscritella columnaris Schlotheim

- Fig.a Branch of Acanthocladia ?laxa encrusted by D.columnaris. overgrowth of Acanthocladia may have taken place while it was in life position(?and while the colony was still alive) since the branch is completely surrounded by zooecia of D.columnaris. GLQ100. Bar scale=Imm
- Fig.b Encrusting algae or worm tubes incorporated within a secondary overgrowth(arrowed). They are attached to a terminal diaphragm. The overgrowth extends for the whole width of the zoarium, see text p. 305 for discussion. HDN51. Bar scale=Imm
- Fig.c ?Encrusting foram incorporated within a zoarium of D.columnaris. GLQ100. Bar scale=Imm
- Fig.d Zoarium encrusting a lithified substratum. HDN17. Bar scale=Imm

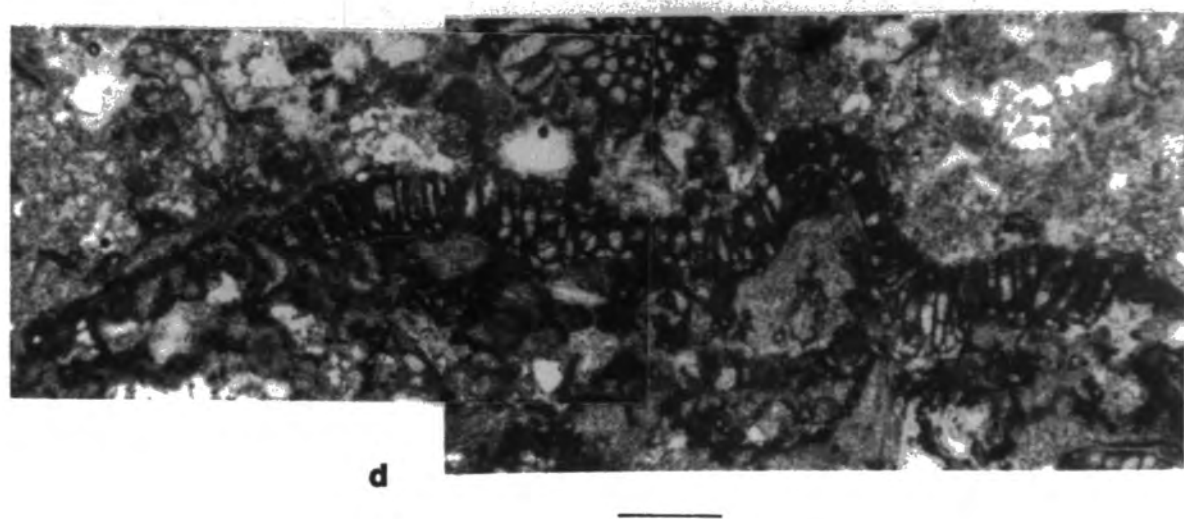
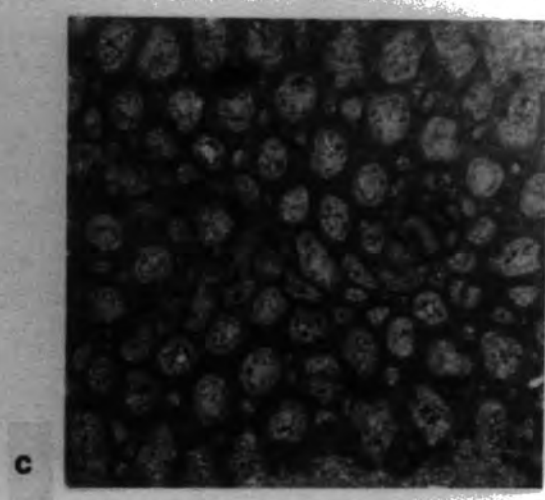
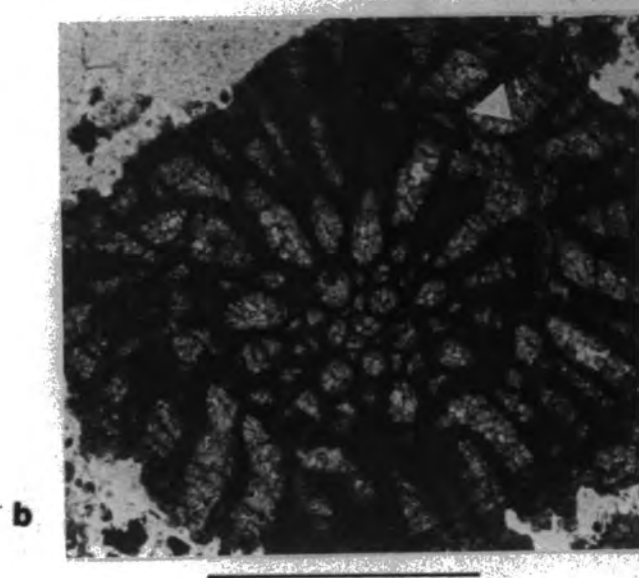
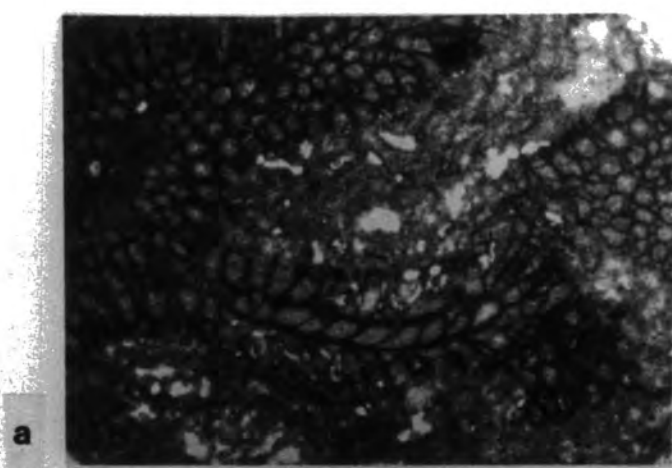


Plate I32. Dyscritella columnaris Schlotheim .

Adnate and erect growth within the same
zoarium, encrusting a lithified substratum.
HDNI7. Bar scale=Imm

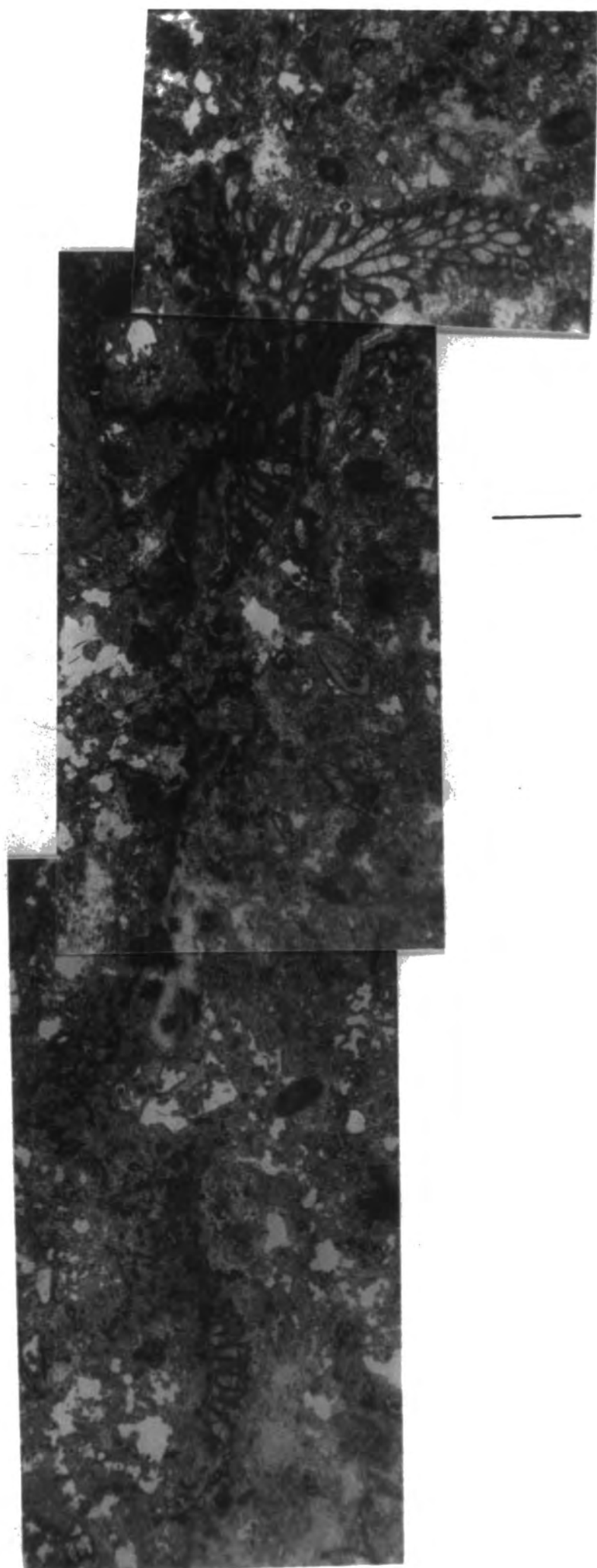
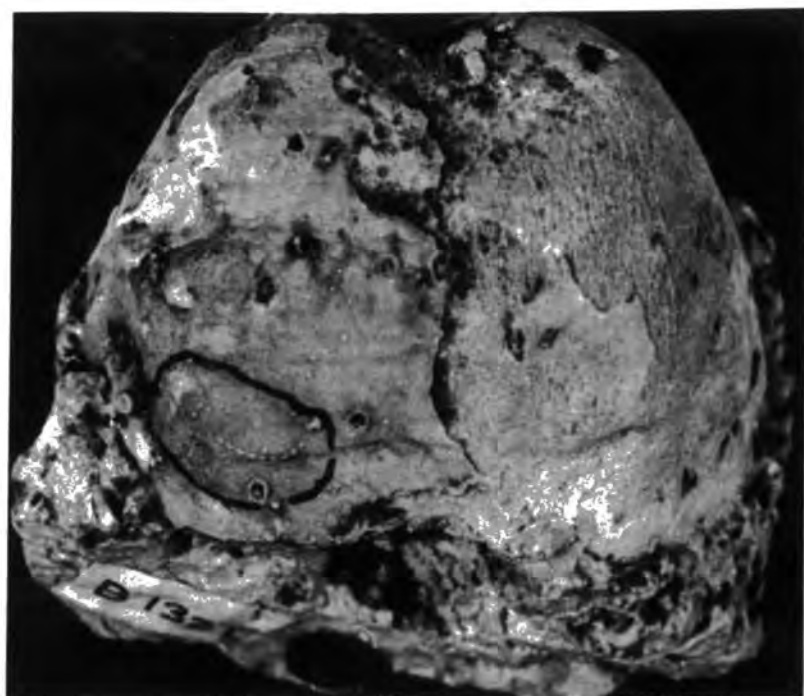


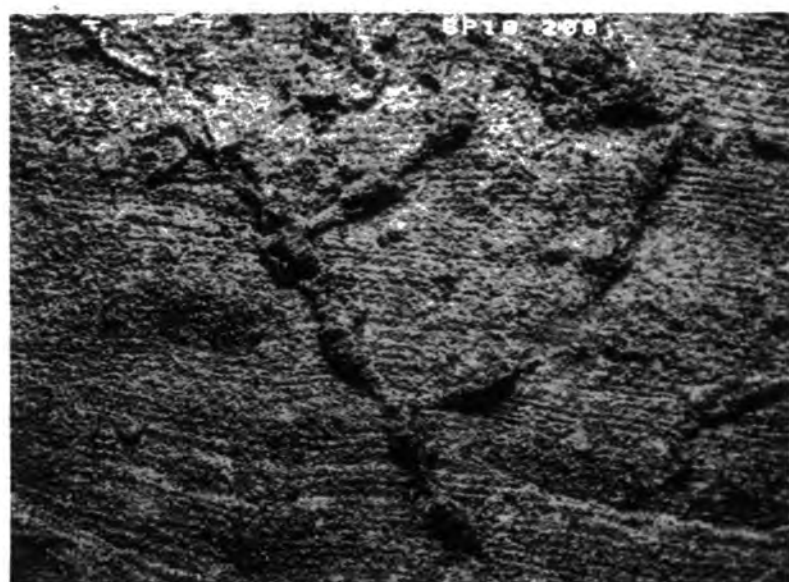
Plate I33. Corynotrypa voigtiana King

- Fig.a Lectotype, specimen BI32, from the King collection, encrusting the brachiopod Horridonia.
Bar scale=10mm
- Fig.b S.E.M. photomicrograph showing parent branch with two lateral branches; the more proximal branch diverges at an angle greater than 90° . RH3.I, encrusting Horridonia.
Bar scale=Imm
- Fig.c S.E.M. photomicrograph showing paired lateral branches. RH3.I, encrusting Horridonia.
Bar scale=Imm

a



b



c

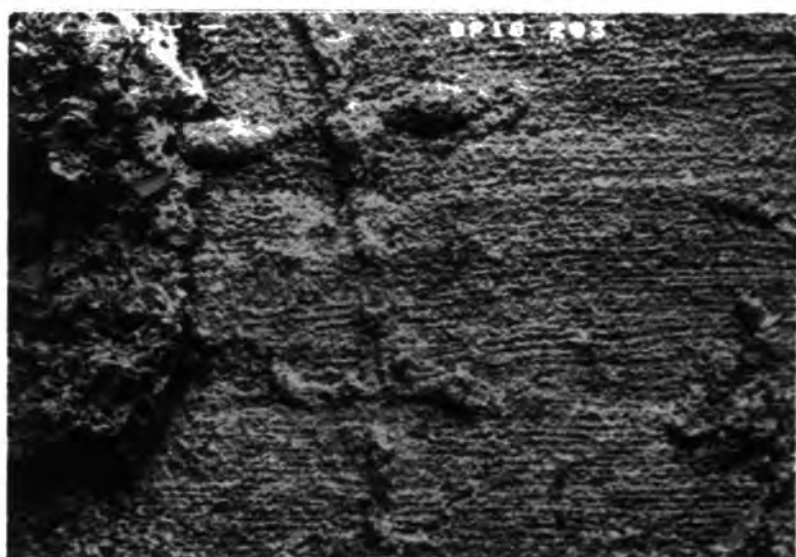


Plate I34. Corynotrypa voigtiana King

- Fig.a S.E.M. photomicrograph showing colony encrusting the reverse surface of Fenestella retiformis.RH2.26.
Bar scale=Imm
- Fig.b As above at higher magnification, showing zooecium which is distorted and shorter than normal, probably as a result of the constraints imposed on morphology by the substratum (arrowed). S.E.M. photomicrograph. Bar scale=Imm
- Fig.c Close-up of zooecia. S.E.M. photomicrograph. RH2.26. Bar scale=0. Imm

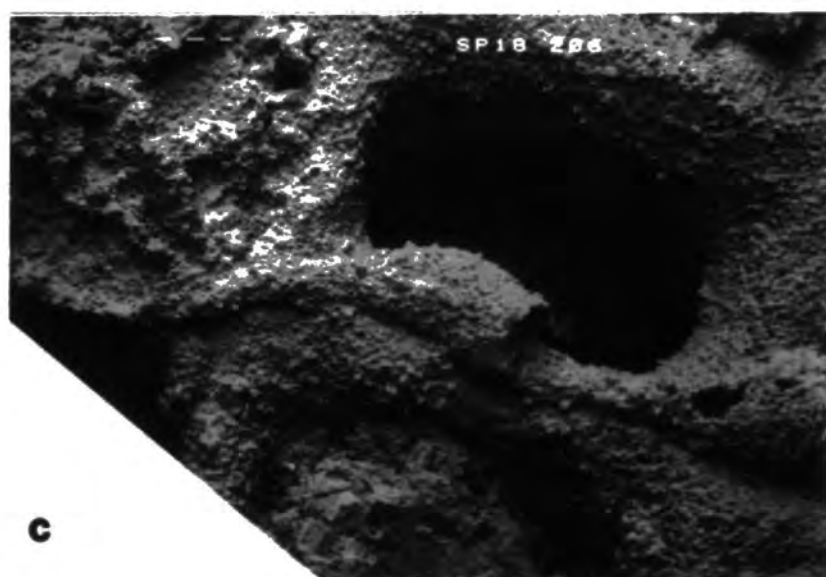
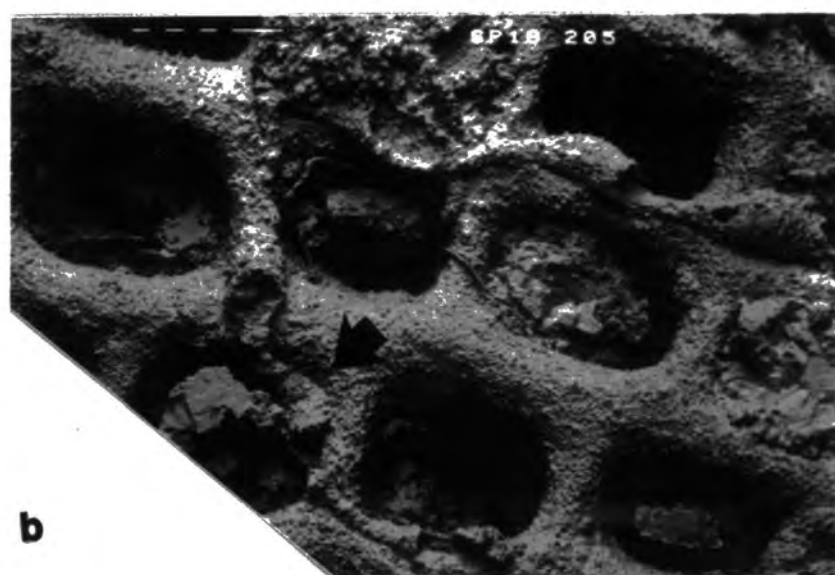
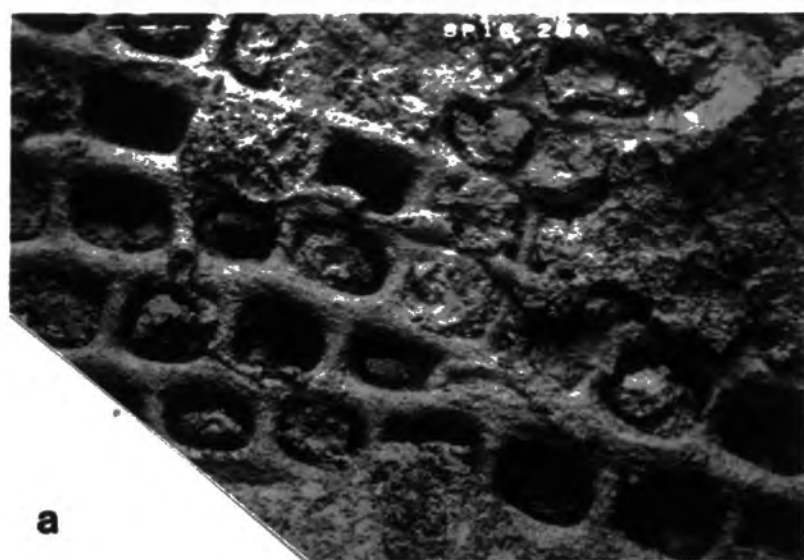


Plate I35. Corynotrypa voigtiana King

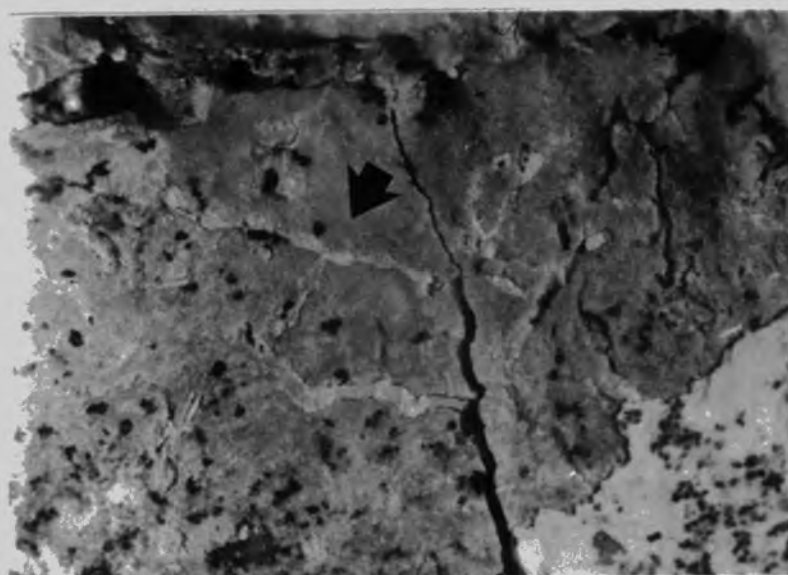
Fig.a Horridonia encrusted by C.voigtiana.
See figs.'b' and 'c' below.RH4.29.
Bar scale=10mm

Fig.b Zoarium in cast preservation with
substratum of attachment(Horridonia)
removed.Arrowed is apparent colony
origin consisting of a group of three
radiating zooecia;the absence of a
protoecium suggests this may represent
an example of colony regeneration
after fragmentation(e.g.Taylor(1985)).
RH4.29a.Bar scale=Imm

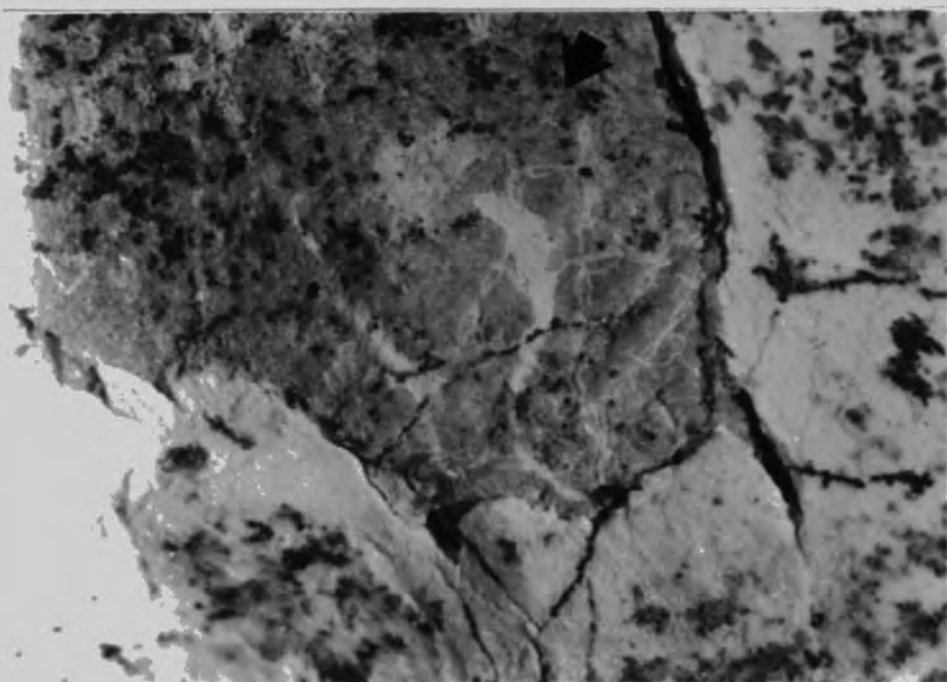
Fig.c Zoarium(arrowed) preserved as in fig.b
above.Lateral zooecium abuts against
adjacent branch which may or may not
be from the same colony.RH4.29b.
Bar scale=Imm



a



b



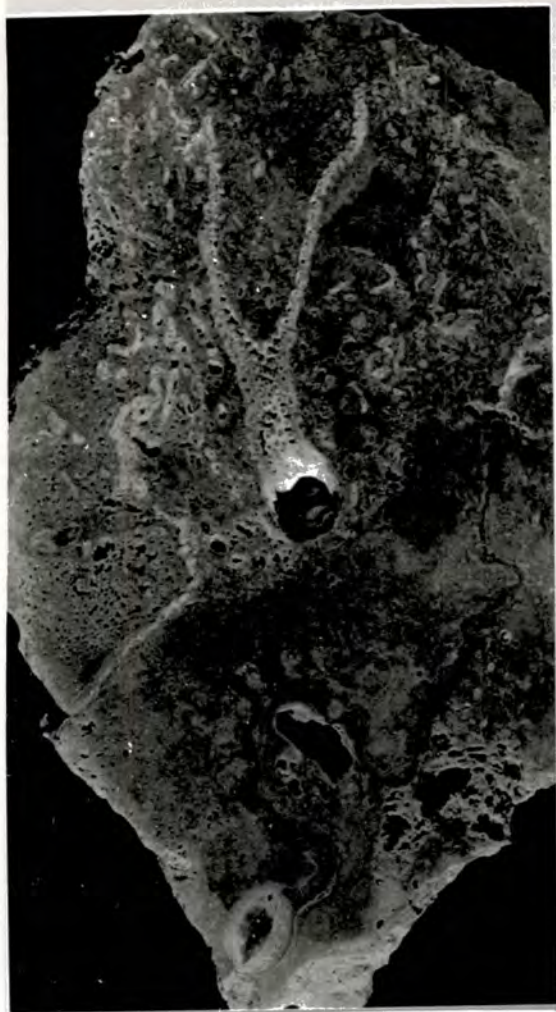
c

Plate I36. Lithified crust.

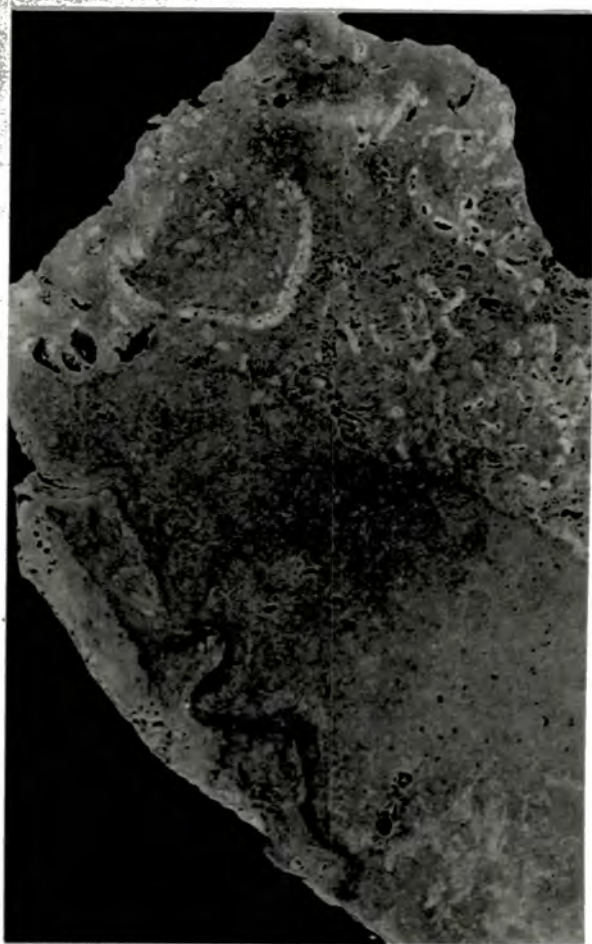
— /
Fig.a Polished section of lithified crust,
showing zoarium of Kingopora above the
crust (and probably attached to it) and
sharply re-entrant angles developed in
the lower surface of the crust. MP5.3/2.
Bar scale=10mm

Fig.b Polished section of lithified crust; zoarium
of Kingopora above the crust. MP5.3/3.
Bar scale=10mm

Fig.c Polished section of lithified crust.
MP5.3/4. Bar scale=10mm



b



c

Plate I37. Synocladia virgulacea Sedgwick

Zoarium preserved as a mould. Branches
on the right side of the specimen grow
'below' the level of the colony origin.
(See fig.98 for interpretation).MPI.80.
Bar scale=10mm



—

Plate I38. Bryozoa as substrata.

- Fig.a Obverse surface of Fenestella retiformis
encrusted by algal filaments.RH2.22.
Bar scale=Imm
- Fig.b Acanthocladia with an algal filament
or worm tube growing from a zooecial
chamber onto the obverse surface.MP5.28.
Bar scale=Imm
- Fig.c As above,fig.b,at higher magnification.
Bar scale=0.Imm

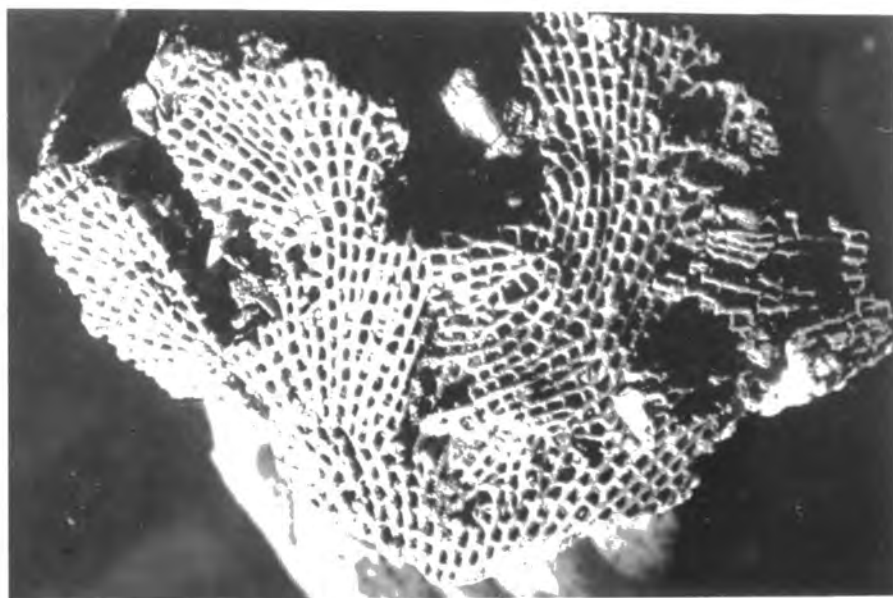
Plate I39. Predation.

Fig.a Zoarium of Fenestella retiformis where some branches appear to have grown back across a hole in the meshwork (centre of figure). This may be an example of colony repair of damage caused by predation.
717F. Bar scale=10mm

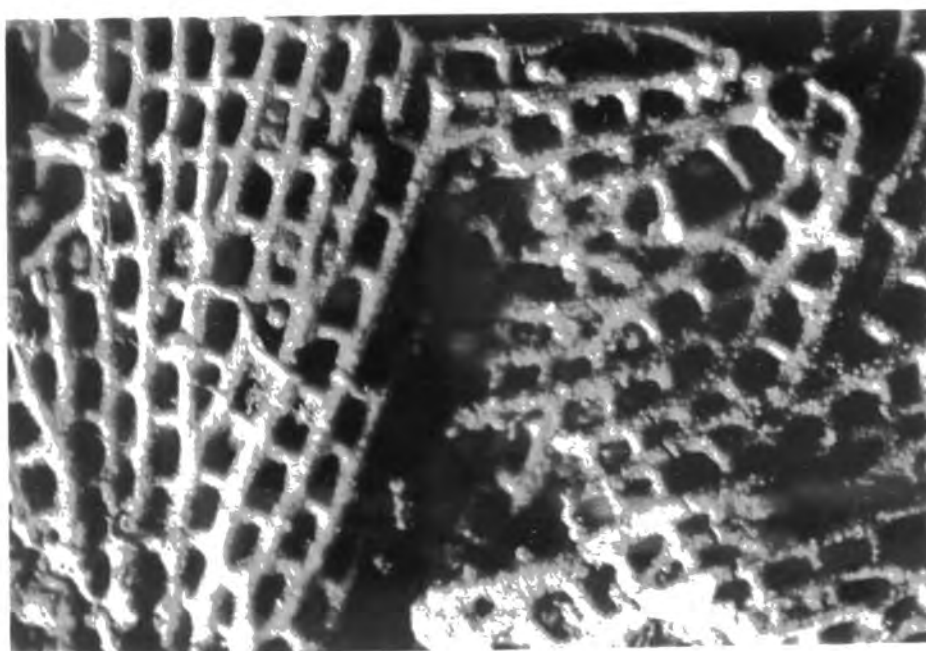
Fig.b As above at higher magnification, showing 'repaired' part of zoarium.
Bar scale=1mm

Fig.c Tooth of the fish Acrolepis, not previously known from the Zechstein reef. /
Bar scale=1mm

Fig.d Tooth of the fish Janassa, known to be a predator of bryozoans in the K pferschiefer (Schaumberg (1979)).
Specimen belonging to N.T.J. Hollingworth. /
Bar scale=1mm



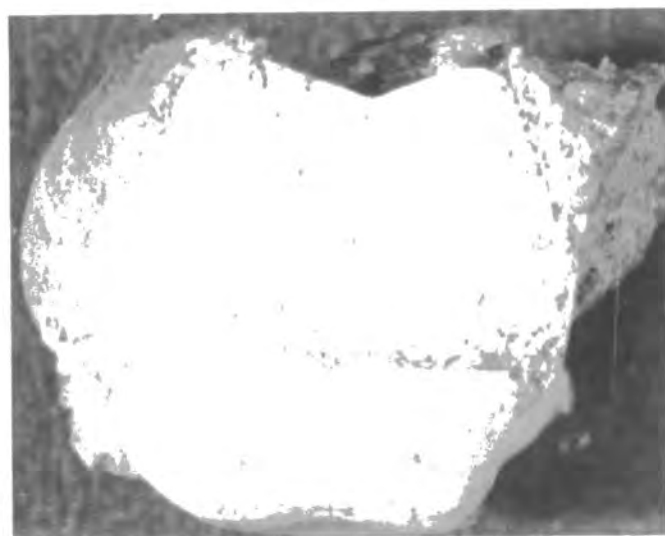
a



b



c



d

Plate I40. Locality HYR, Road cut at Hylton Castle.

Fig.a General view. Algal laminites are dominant in lithologies of the foreground.

Fig.b Central part of exposure, composed mostly of bryozoan biolithite. Fenestella retiformis and Synocladia virgulacea occur abundantly in life position in the upper part of the face. Small patch of densely-spaced zoaria of Acanthocladia diffusus is arrowed.

a



b



Plate I4I. Locality HYR, Road cut at Hylton Castle.

Fig.a Algal laminites of the stratigraphically
lowest part of the outcrop.
Hammer is 50cm long.

Fig.b Detail of algal laminites.
Hammer is 50cm long.

Fig.c Thin lensoid bed of comminuted bryozoan
and shelly debris, occurring within the
algal laminites.
Diameter of lens cap is 6cm.

a



b



c



Plate I42. Localities HYR and HYQ. Hylton Castle.

Fig.a Patch of Acanthocladia diffusus, approx.
 $\frac{1}{2}\text{m}^2$ in extent. Hammer is 50cm long.

— / Fig.b HYQ. Zoaria of Synocladia virgulacea,
seen in transverse section, which appear
to have grown from a near vertical
substratum. Zoaria are stacked one on top of
another. Diameter of lens cap is 6cm.

a



b



Plate I43. Locality HM5.Humbledon hill.

Fig.a Transition from bedded dolomite to
massive reef rock.
Cat is 30cm long.

Fig.b Transition from bedded dolomite to
massive reef rock.As above,from a
distance.



a



b

Plate I44. Locality SBC.Cold Hesledon,railway cutting.

Fig.a Algal laminites of the reef flat which outcrop in the western part of the cutting.

Fig.b Steeply dipping algal laminar encrustation, upper reef slope ($\frac{1}{2}$ m to right of hand).

Fig.c Zoaria of Synocladia virgulacea which appear to have grown downwards from algal mounds.

a



b



c



Plate I45. Locality HD.Townfield quarry.

Fig.a Algal laminites with an easterly dip,
outcropping at the top of the quarry.

Fig.b Fossiliferous block with characteristic
association of Dyscritella columnaris
and Acanthocladia laxa.

a



b

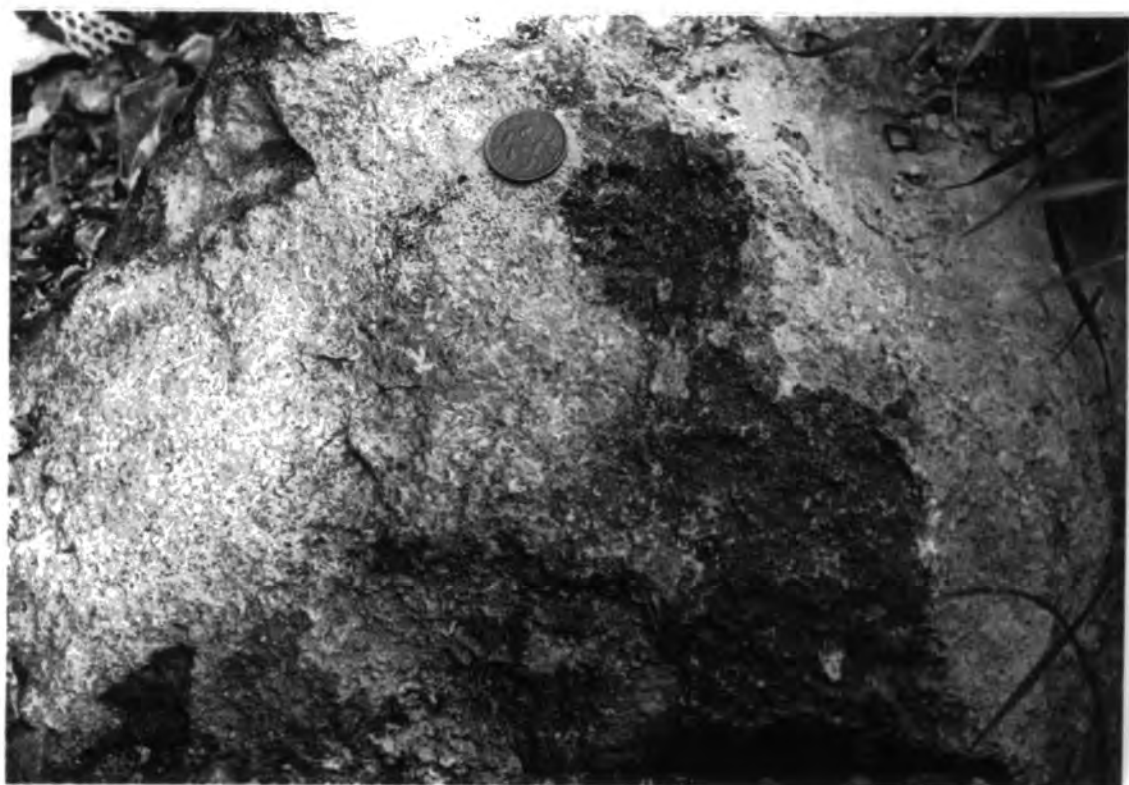


Plate I46. Locality HTQ.Hawthorn Quarry.

Fig.a General view.Lowest bench is in the reef,the second bench is in the Hesleden Dene stromatolite biostrome.

Fig.b Close-up of lowest bench.

Fig.c Typical reef lithology at this locality, consisting of densely-spaced zoaria of Acanthocladia diffusus.Pencil for scale in top left corner of figure.

a



b



c



Plate I47. Locality HN.High Newport,railway cutting.

Fig.a Zoaria of Synocladia virgulacea which appear to have grown from a near vertical surface,and are stacked one on top of another.Car keys for scale.

Fig.b As above.



a



b

