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THE USE OF DISSOCIATED CRINOID OSSICLES AS BIOSTRATIGRAPHICAL AND PALAEOECOLOGICAL TOOLS IN THE CARBONIFEROUS OF NORTHWEST IRELAND

VOLUME 2 of 2

TRINITY COLLEGE
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Kay Mannifield

A thesis submitted for the degree of Doctor in Philosophy to

the University of Dublin, Trinity College

2000

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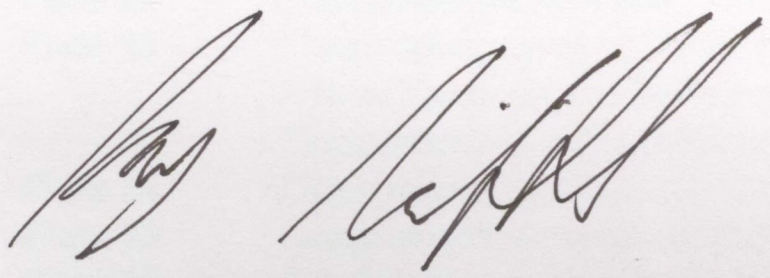

Kay Mannifield

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APPENDIX A

LOCALITY MAPS AND SEDIMENTARY LOGS

A1 Legend for maps and sedimentary logs belonging to Appendix A

A2 Downpatrick Head - locality map

A3 Downpatrick Head - sedimentary log Locality DP1

A4 Downpatrick Head - sedimentary log Locality DP3a

A5 Kilcummin Head and Ballinlena Pier - locality map

A6 Kilcummin Head - sedimentary log Locality KK3

A7 Ballinlena Pier - sedimentary log Locality BL

A8 Easky - locality map

A9 Easky - sedimentary log Locality EY1

A10 Lackavarna - locality map

A11.*a-c* Lackavarna - sedimentary log Locality LV

A12 Carrickphatrick - locality map

A13 Carrickphatrick - sedimentary log Locality CP1

A14 Pollnadivva Pier - locality map

A15 Doonycoy - locality map

A16 Pollnamoghilly - locality map

A17 Serpent Rock - locality map

A18 Streedagh Point - locality map

A19 Streedagh Point - sedimentary log Locality STa

A20.*a-f* Streedagh Point - sedimentary log Localities ST1-5

A21 Streedagh Point - sedimentary log Locality ST10

A22 Benbulben Mountain - locality map

A23 Gleniff - locality map

A24 Tievebaun Mountain - locality map

A25 Bundoran - locality map

A26.*a-b* Bundoran - sedimentary log Locality BD:A

A27 Bundoran - sedimentary log Locality BD:B

A28 Bundoran - sedimentary log Locality BD:C

A29 Bundoran - sedimentary log Locality BD:D

A30 Bundoran - sedimentary log Locality BD:E

A31 Bundoran - sedimentary log Locality BD:F

A32 Bundoran - sedimentary log Locality BD:H

A33 Bundoran - sedimentary log Locality BD:I

A34 Bundoran - sedimentary log Locality BD:J

A35 Bundoran - sedimentary log Locality BD:K

A36 Bundoran - sedimentary log Locality BD:L

A37 Bundoran - correlation between sedimentary logs; Localities BD:A-E

A list of grid references is available in Appendix B.

NB: Geological boundaries on the following maps are approximate after Long *et al.* (1992), MacDermot *et al.* (1996) and Graham (1996).

LITHOLOGIES

- Mudrock
- Shale
- Limestone
- Argillaceous limestone
- Sandy limestone
- Siltstone
- Sandstone
- Lenticular limestone
- Interbedded limestone and shale

SEDIMENTARY STRUCTURES

- Parallel lamination
- Cross lamination
- Cross bedding
- Stylolites
- Nodules
- Septarian concretions
- Slight/Intense bioturbation
- Planar, sharp contact
- Uneven/wavy, sharp contact
- Gradational contact
- Section break/missing

FOSSILS

- Crinoid debris
- Productoids
- *Spirifer*
- Brachiopods (undifferentiated)
- Solitary corals
- Compound corals
- Fish material
- Bryozoans
- Gastropods
- Bivalves
- Sponge spicules
- Echinoids
- Ostracods
- Foraminifera
- Trilobites
- Burrows
- Blastoids
- Worms

MAP INFORMATION

- BD:C3* Bed/Locality sampled
- F Fault with slip direction
- Dyke outcrop/inferred
- Anticline
- Palaeocurrent direction
- County boundaries

Figure A.1. Legend for lithology, sedimentary structures and fossils for sedimentary logs and general information for locality maps in Appendix A.

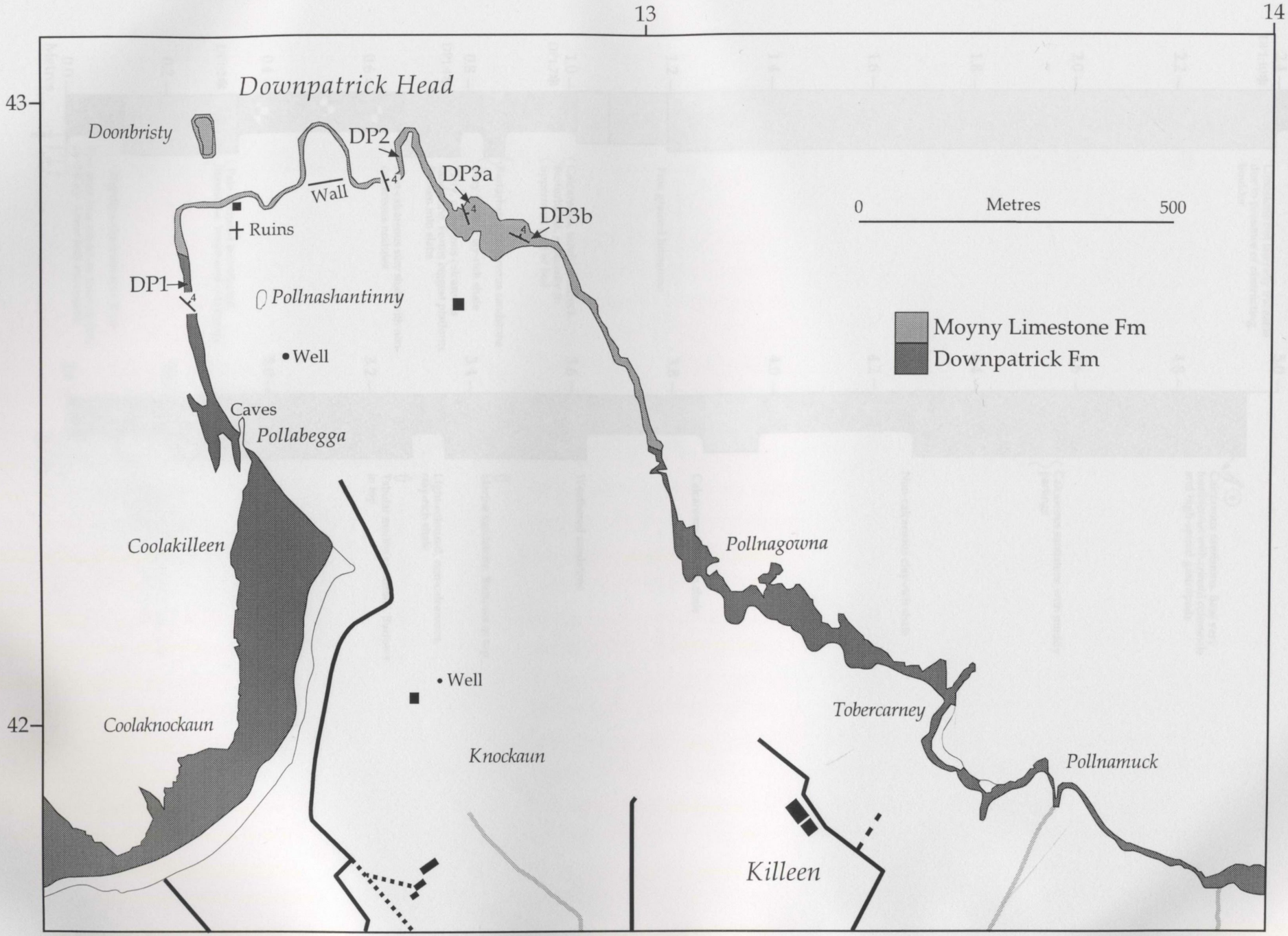


Figure A.2. Locality map for Downpatrick Head, County Mayo.

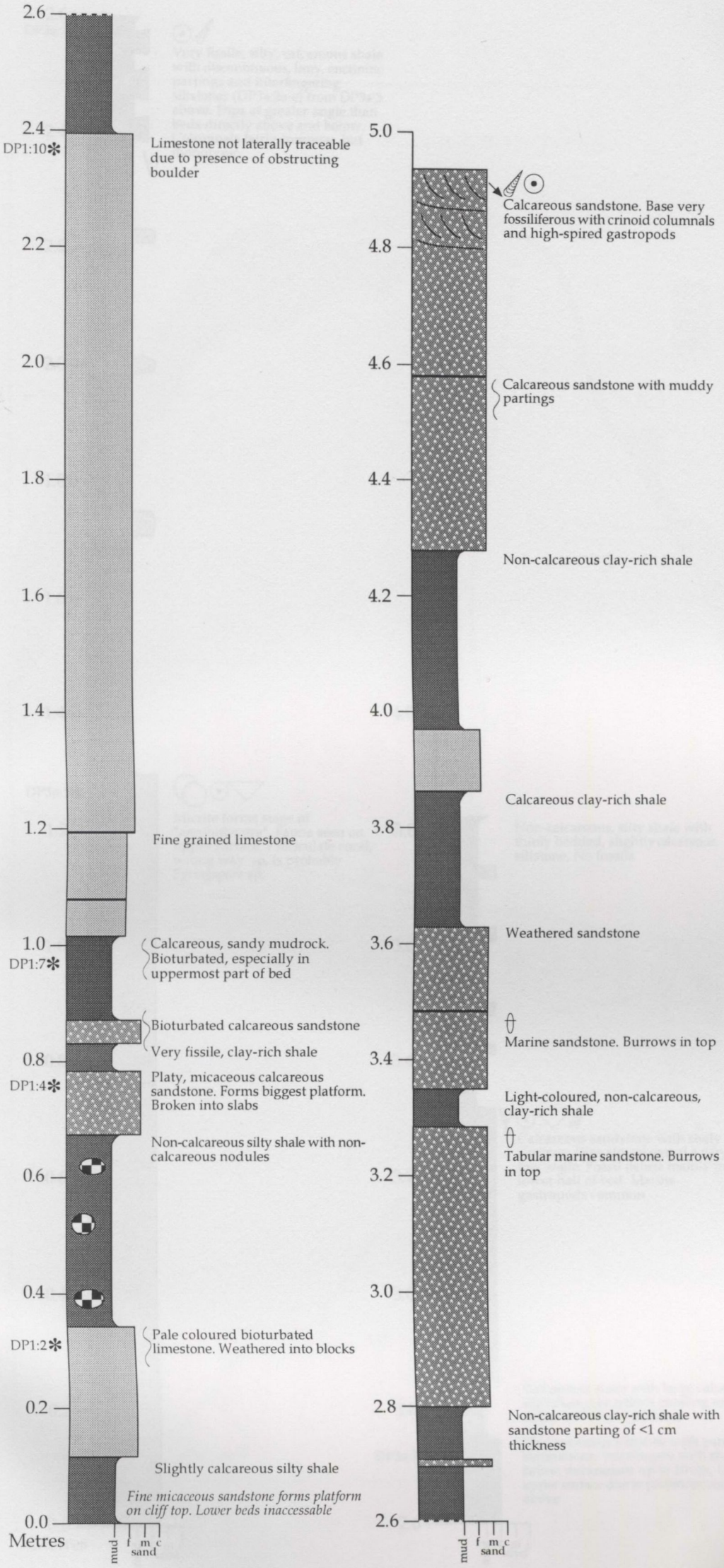


Figure A.3. Stratigraphical log of Locality 1 on the western side of Downpatrick Head (GR 1231 4273). Log shows beds DP1:1 to DP1:20 in the Downpatrick Formation.

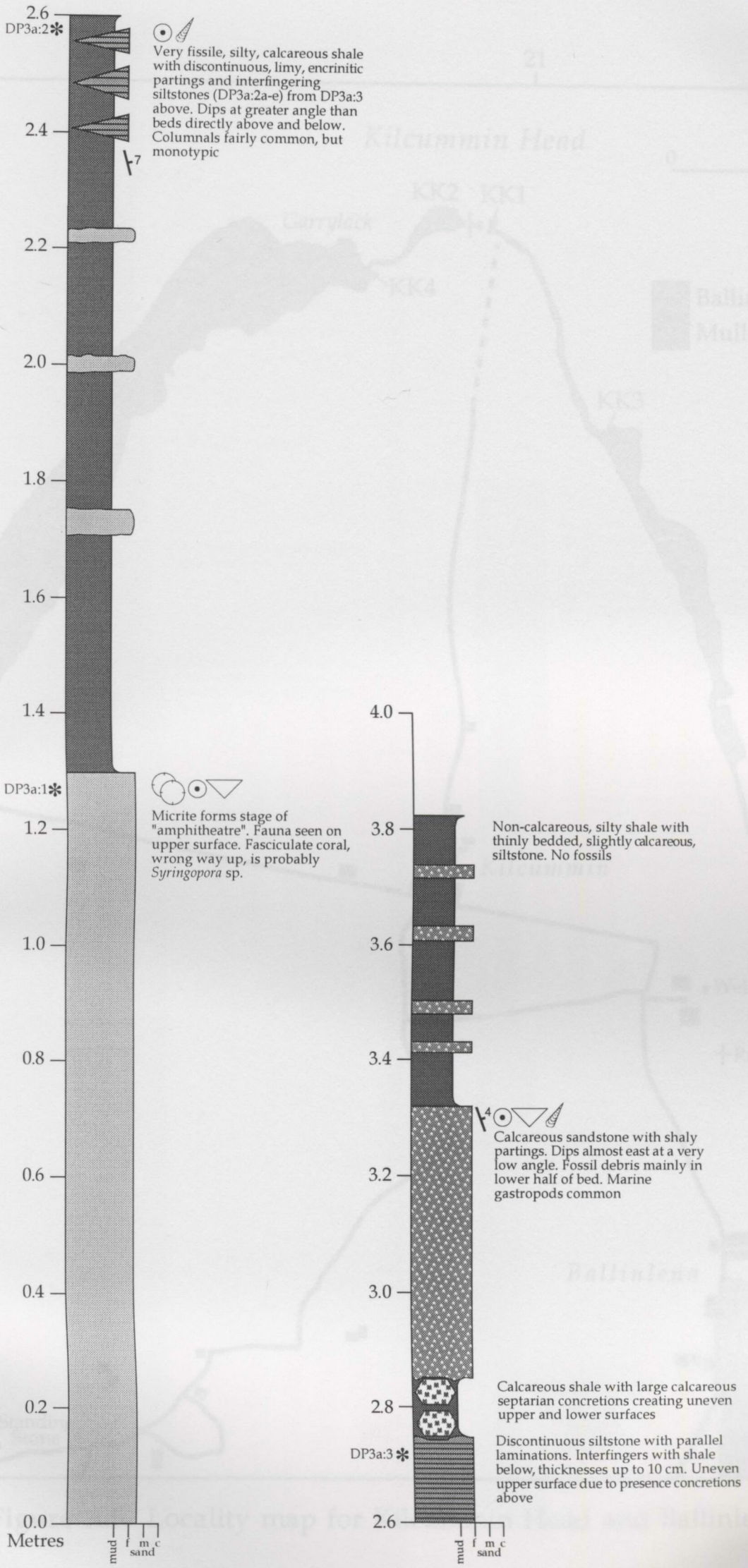


Figure A.4. Stratigraphical log of Locality 3a ('amphitheatre') on the eastern side of Downpatrick Head (GR 1277 4282). Log shows beds DP3a:1 to DP3a:7 in the Moyny Limestone Formation.

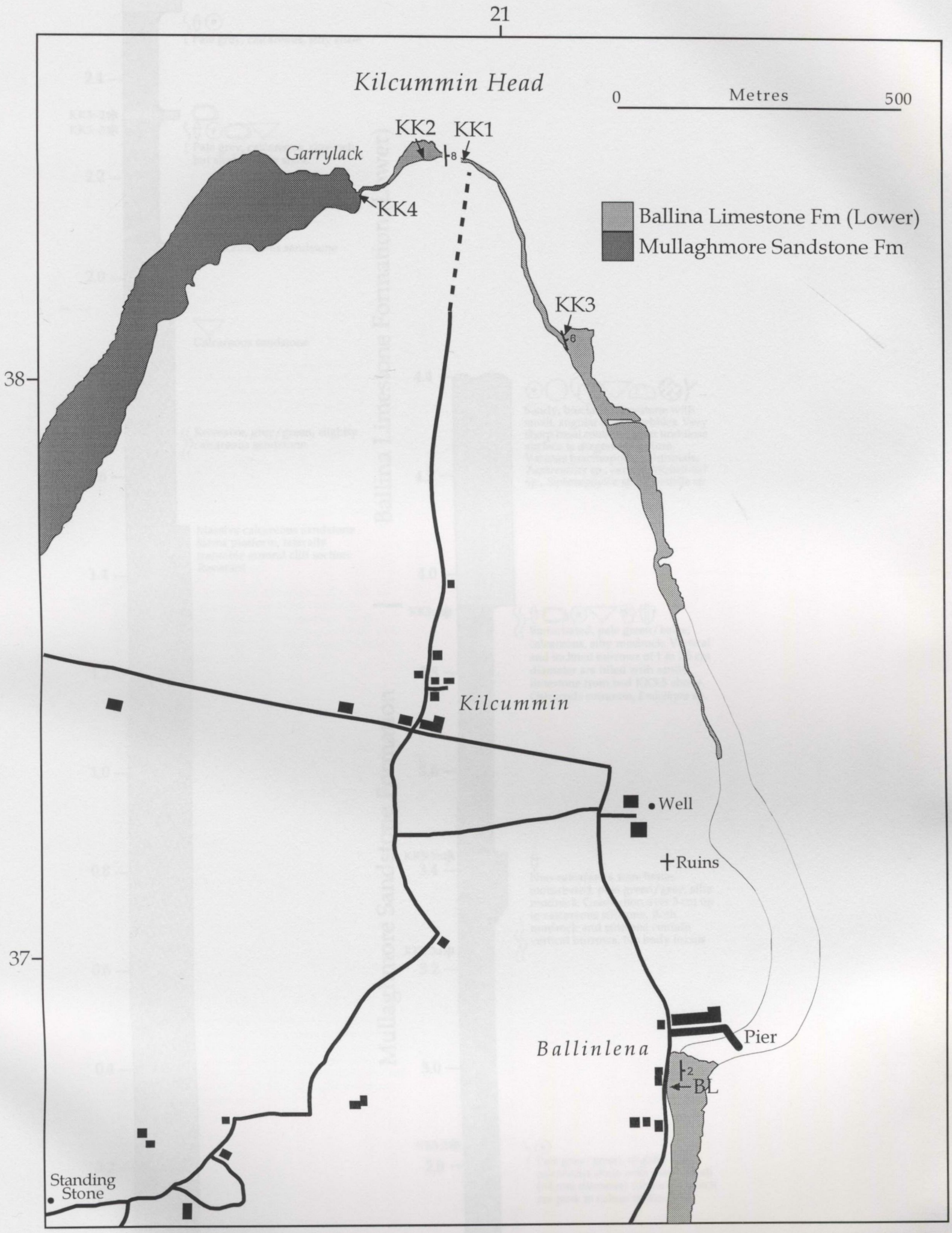


Figure A.5. Locality map for Kilcummin Head and Ballinlena Pier, County Mayo.

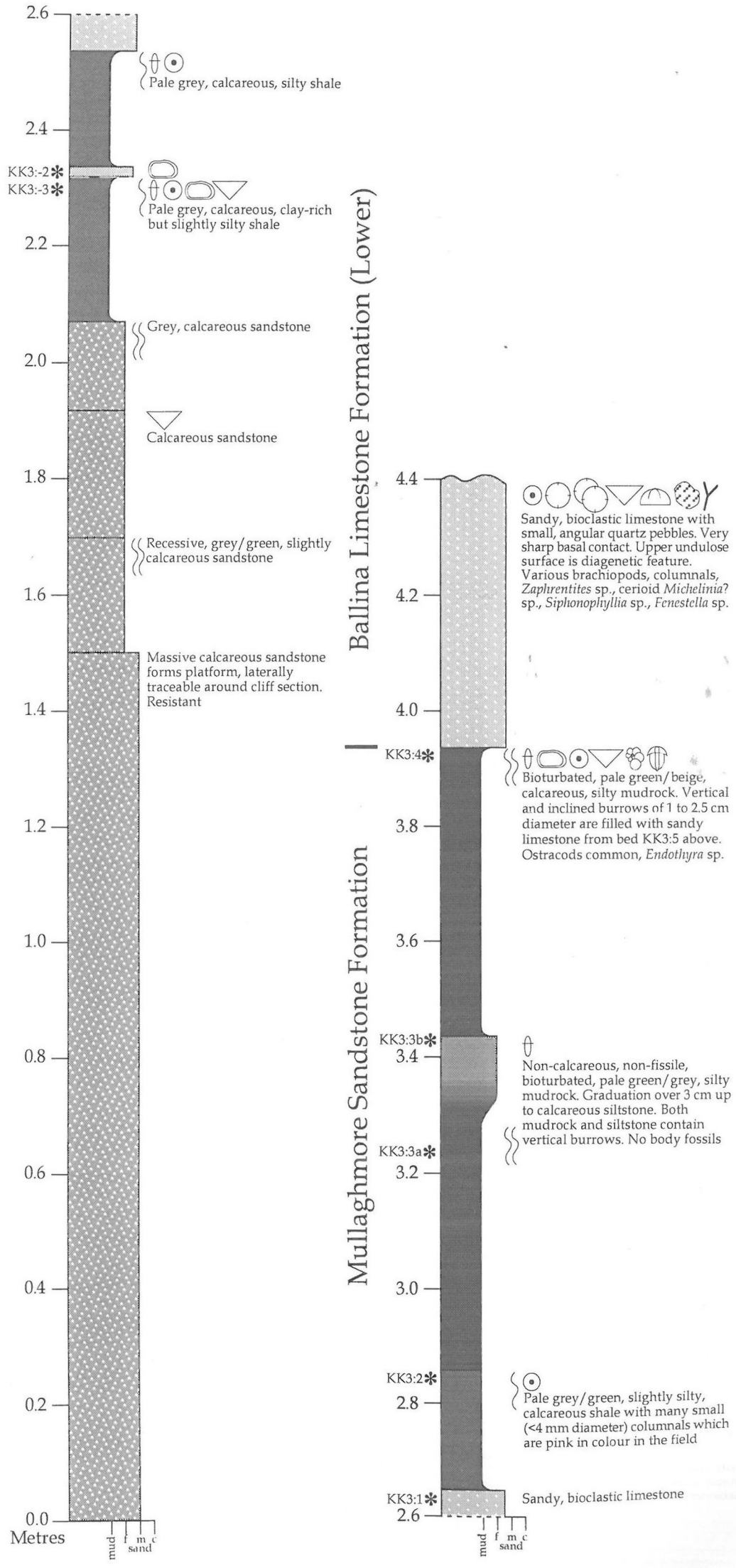


Figure A.6. Stratigraphical log of Locality 3 at Kilcummin Head (GR 2112 3800). Log shows beds KK3:-7 to KK3:5 in the Mullaghmore Sandstone Formation and the Ballina Limestone Formation (Lower).

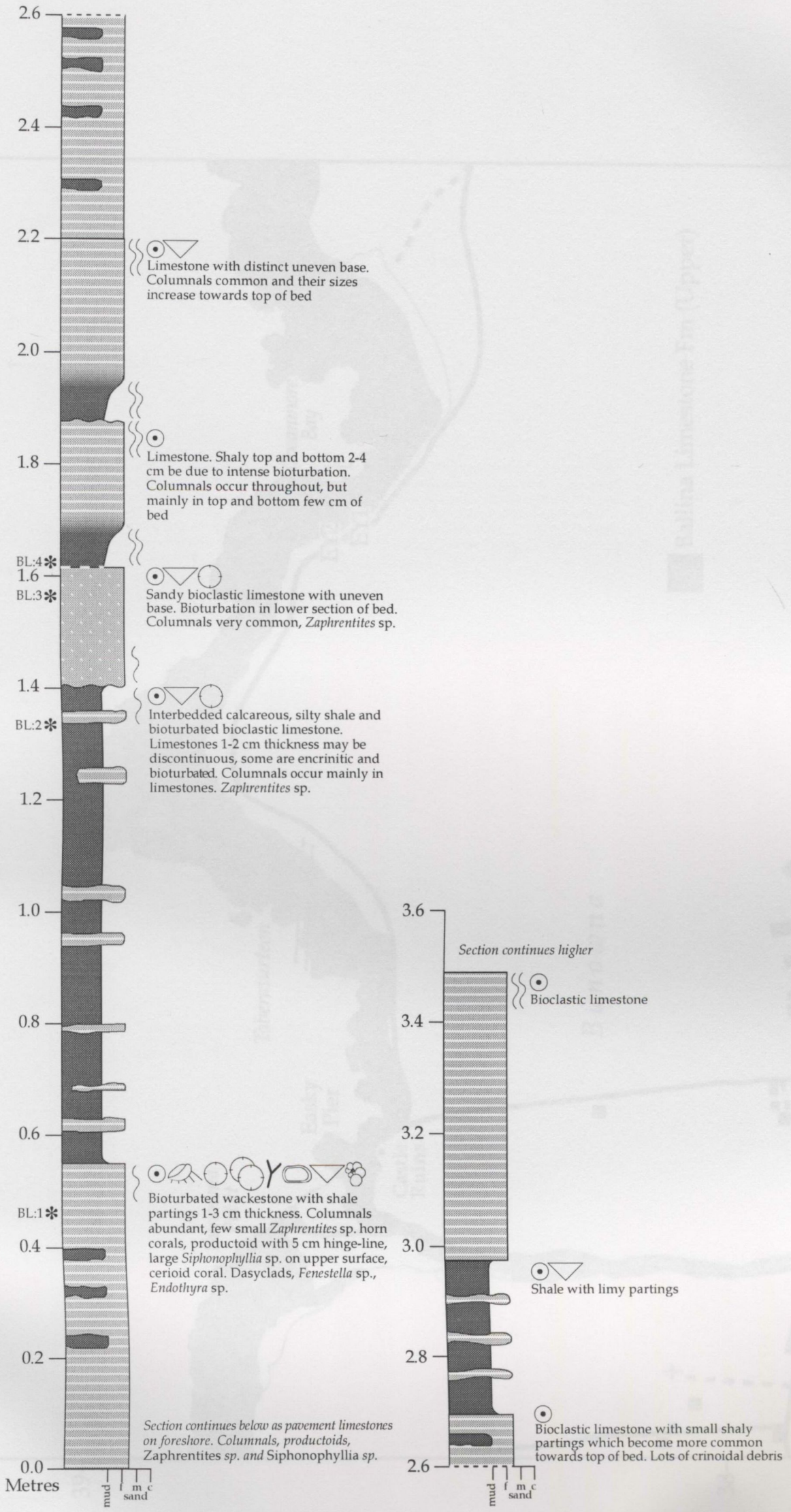


Figure A.7. Stratigraphical log at Ballinlena Pier (GR 2130 3680). Log shows beds BL:1 to BL:8 in the Ballina Limestone Formation (Lower).

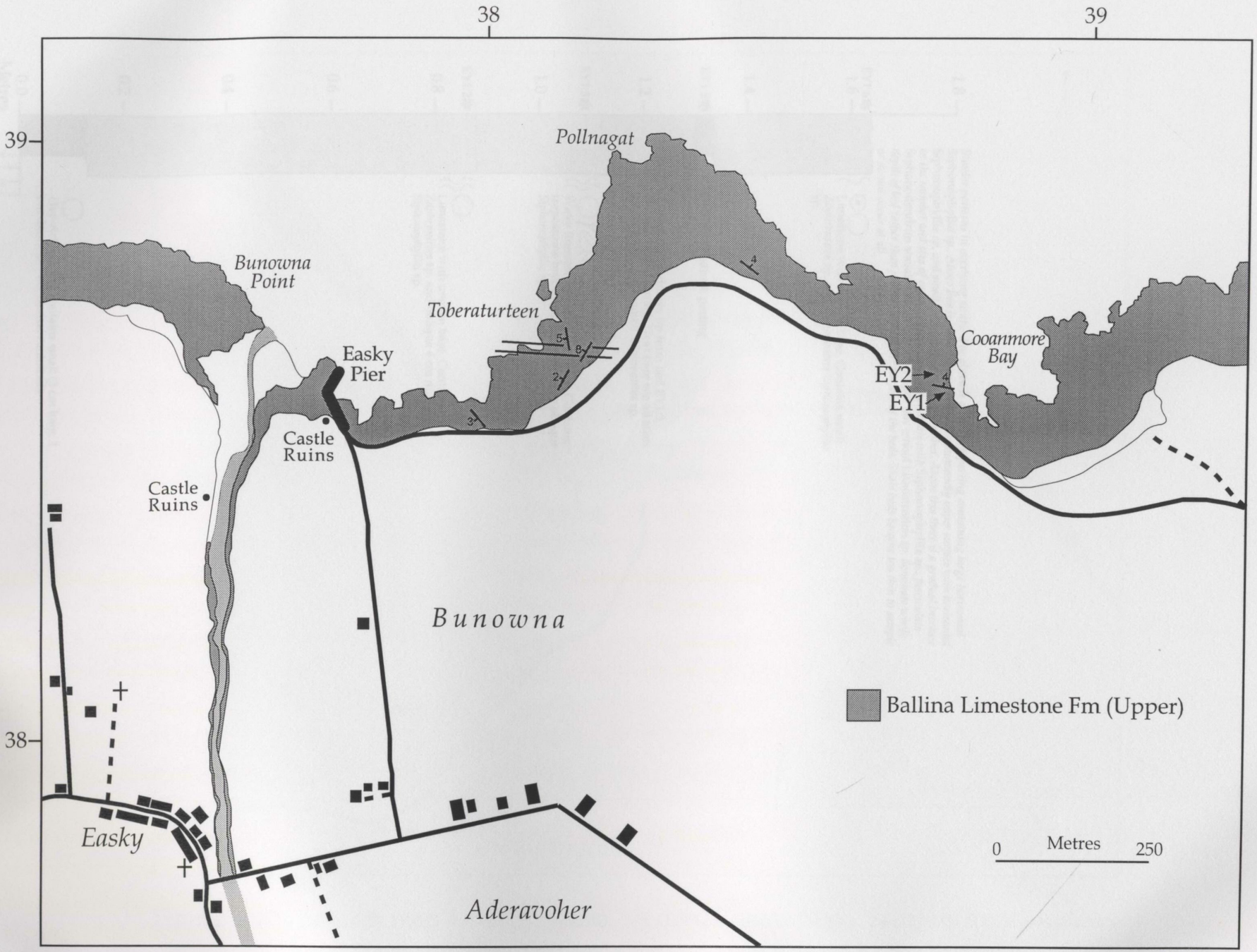


Figure A.8. Locality map for Easky, western County Sligo.

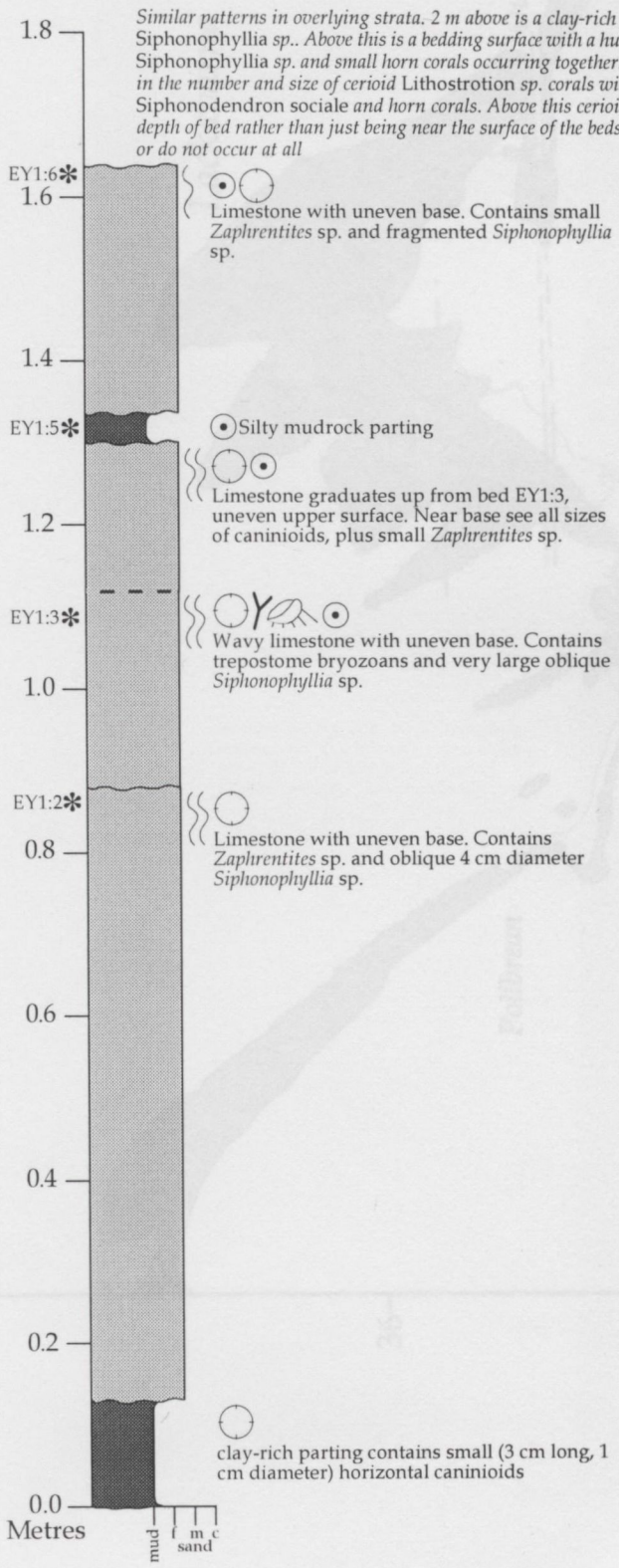


Figure A.9. Stratigraphical log on foreshore at Easky (GR 3876 3857). Log shows beds EY1:1 to EY1:6 in the Ballina Limestone Formation (Upper).

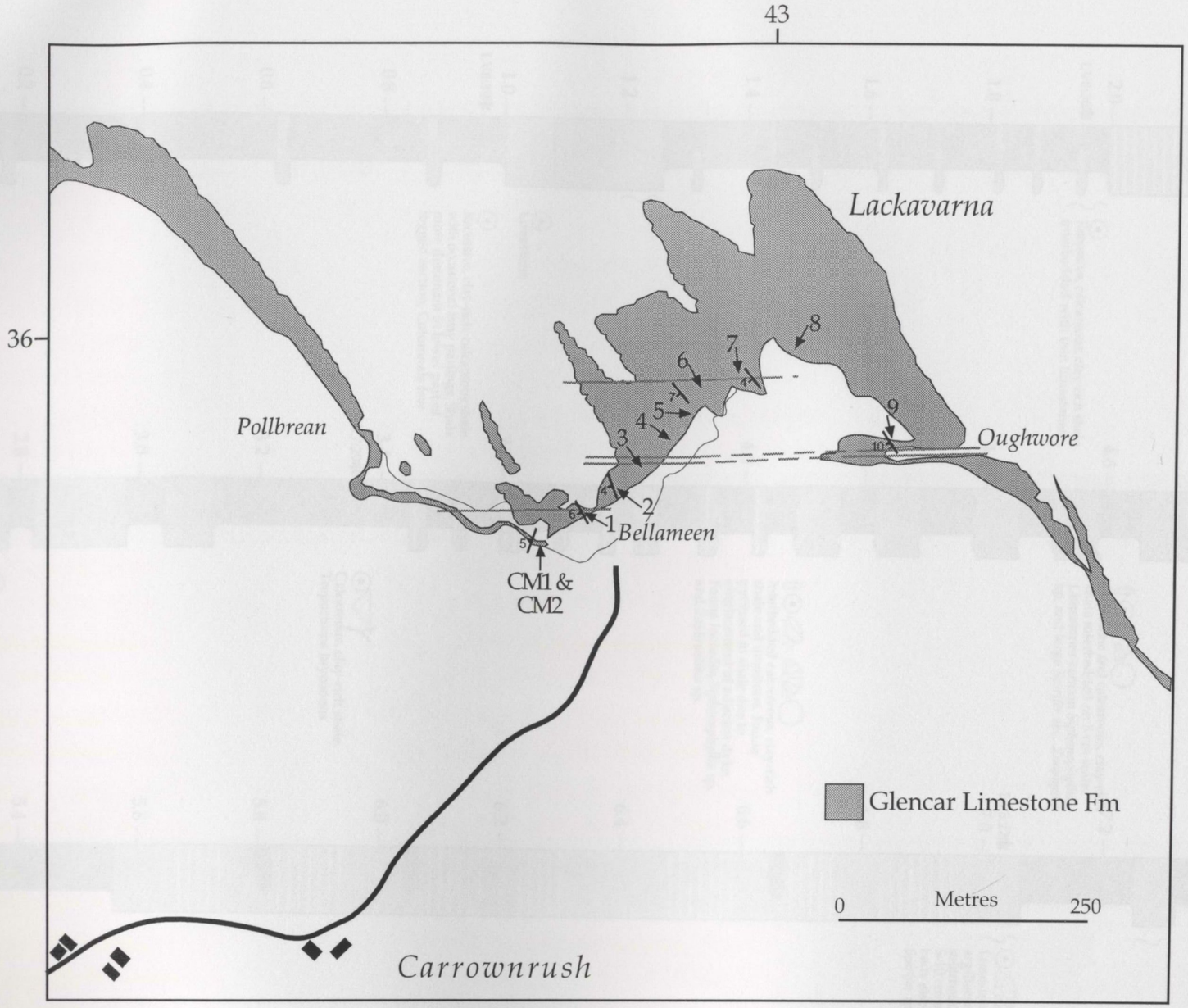


Figure A.10. Locality map for Lackavarna, western County Sligo. Samples from localities 1 to 8 coded LV1:1 to LV8:38 etc.

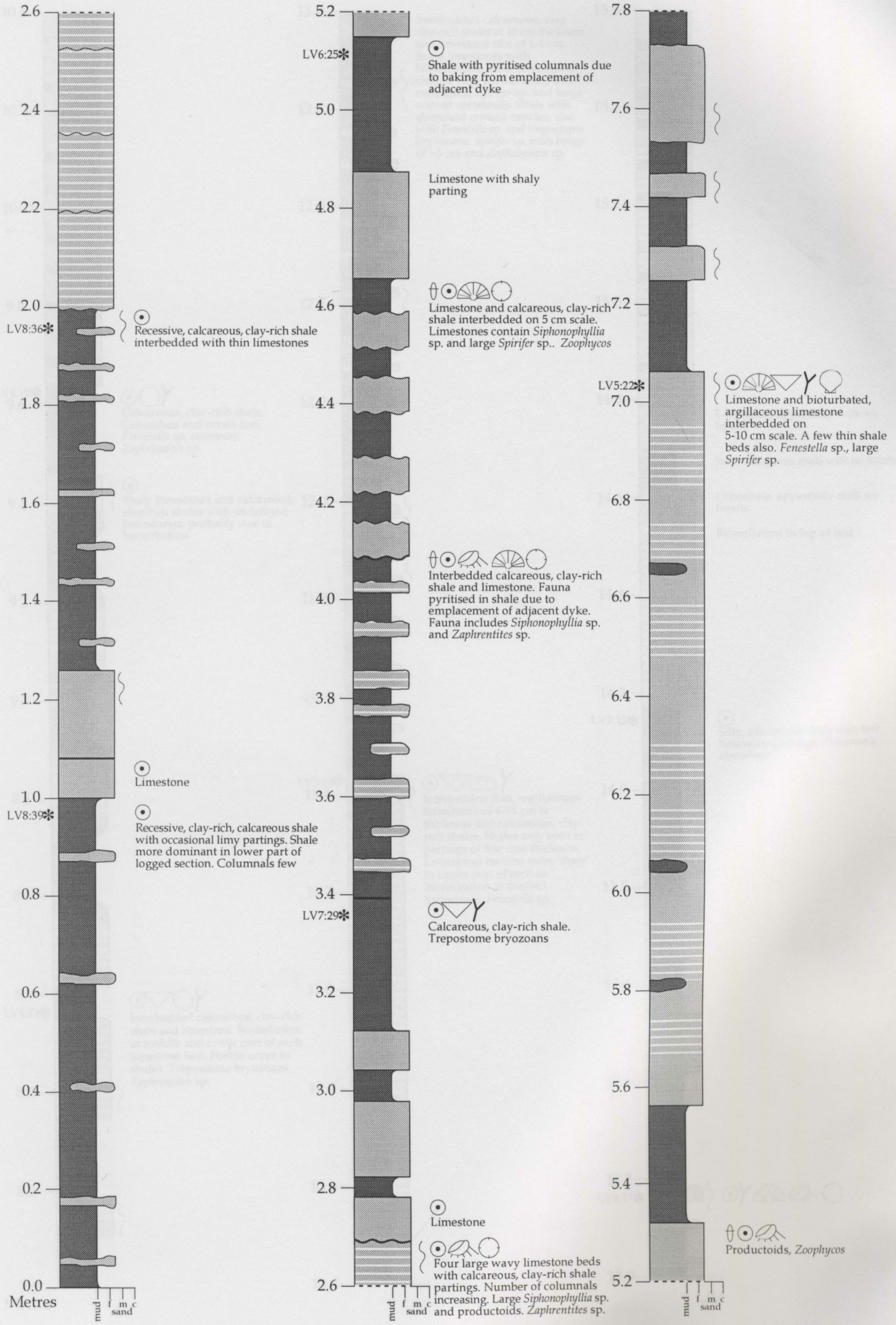


Figure A.11. *a*. Stratigraphical log (lowest section) at Lackavarna (see Appendix B for grid references). Log shows beds LV8:39 to LV4:21 (part of) in the Glencar Limestone Formation.

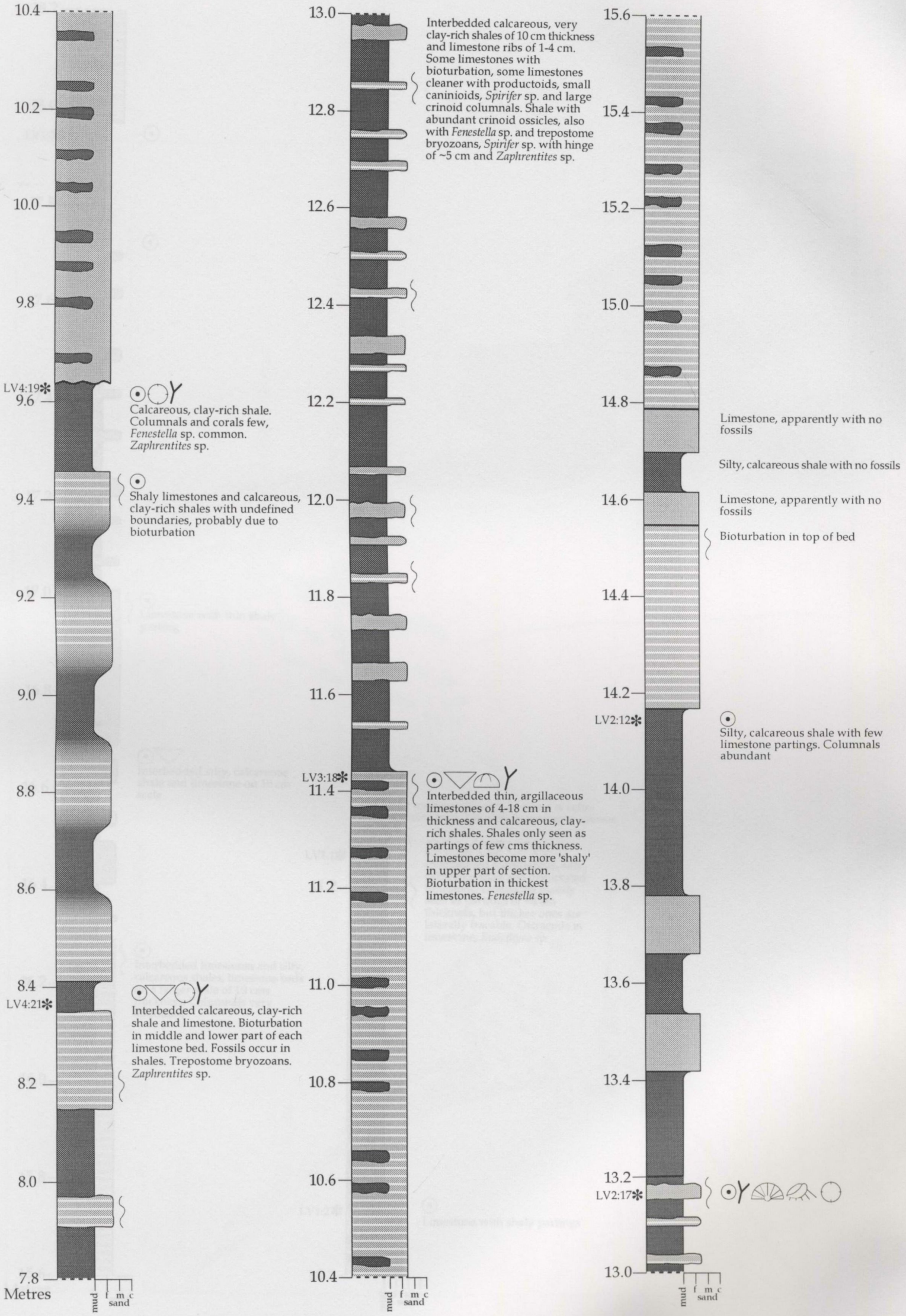


Figure A.11. *b*. Stratigraphical log (middle section) at Lackavarna (see Appendix B for grid references). Log shows beds LV4:21 (part of) to LV1:7 (part of) in the Glencar Limestone Formation.

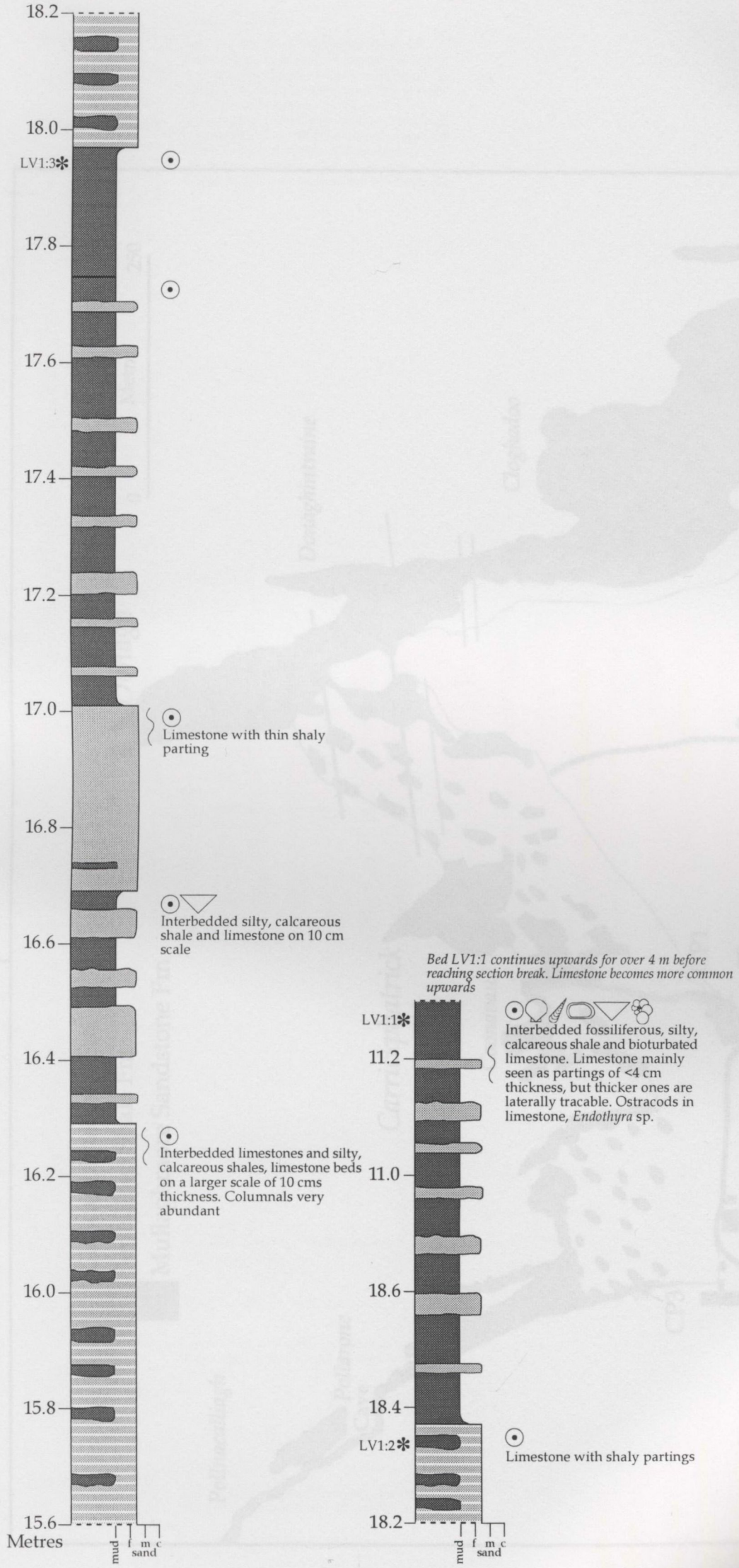


Figure A.11. *c*. Stratigraphical log (highest section) at Lackavarna (see Appendix B for grid references). Log shows beds LV1:7 (part of) to LV1:1 in the Glencar Limestone Formation.

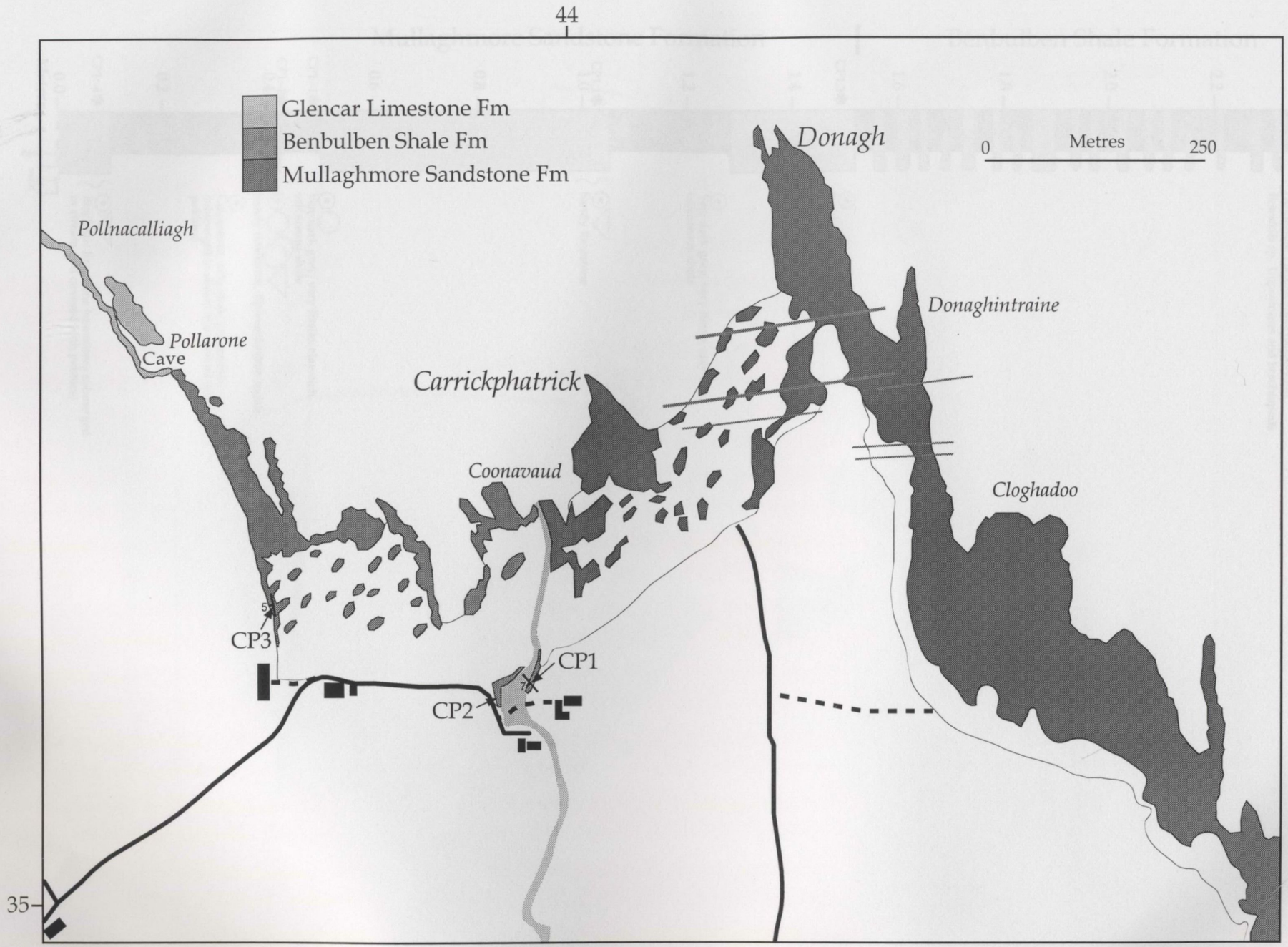


Figure A.12. Locality map for Carrickphatric, western County Sligo.

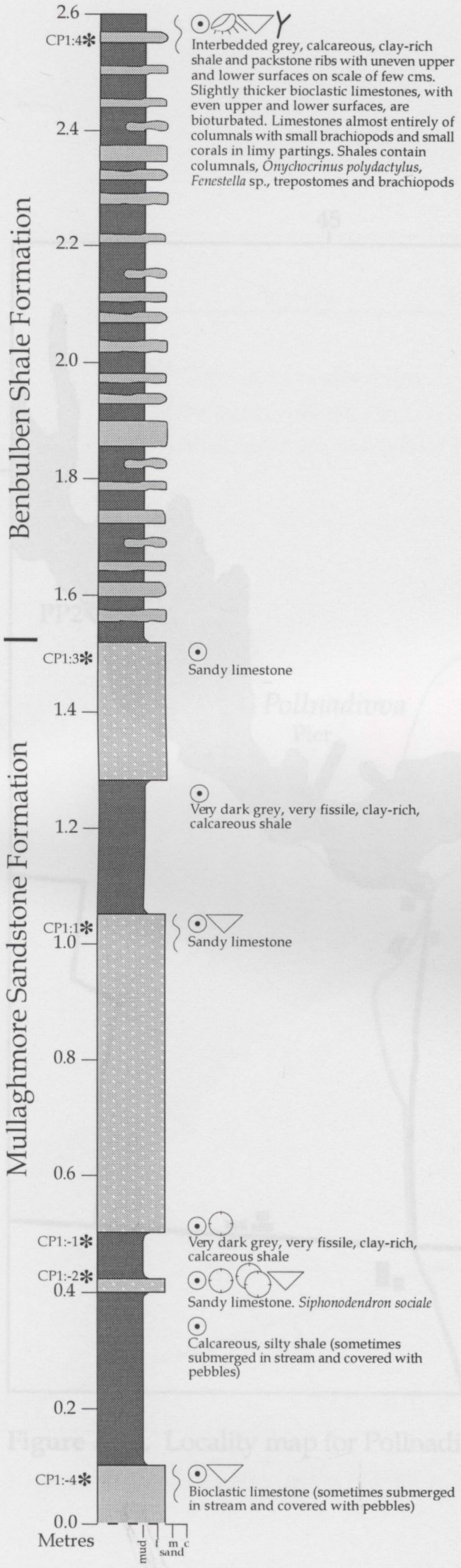


Figure A.13. Stratigraphical log of Locality CP1 at Carrickphatric on the eastern side of the stream (GR 4395 3513). Log shows beds CP1:-4 to CP1:3, the uppermost beds of the Mullaghmore Sandstone Formation, and bed CP1:4, the lowest bed of the Benbulben Shale Formation.

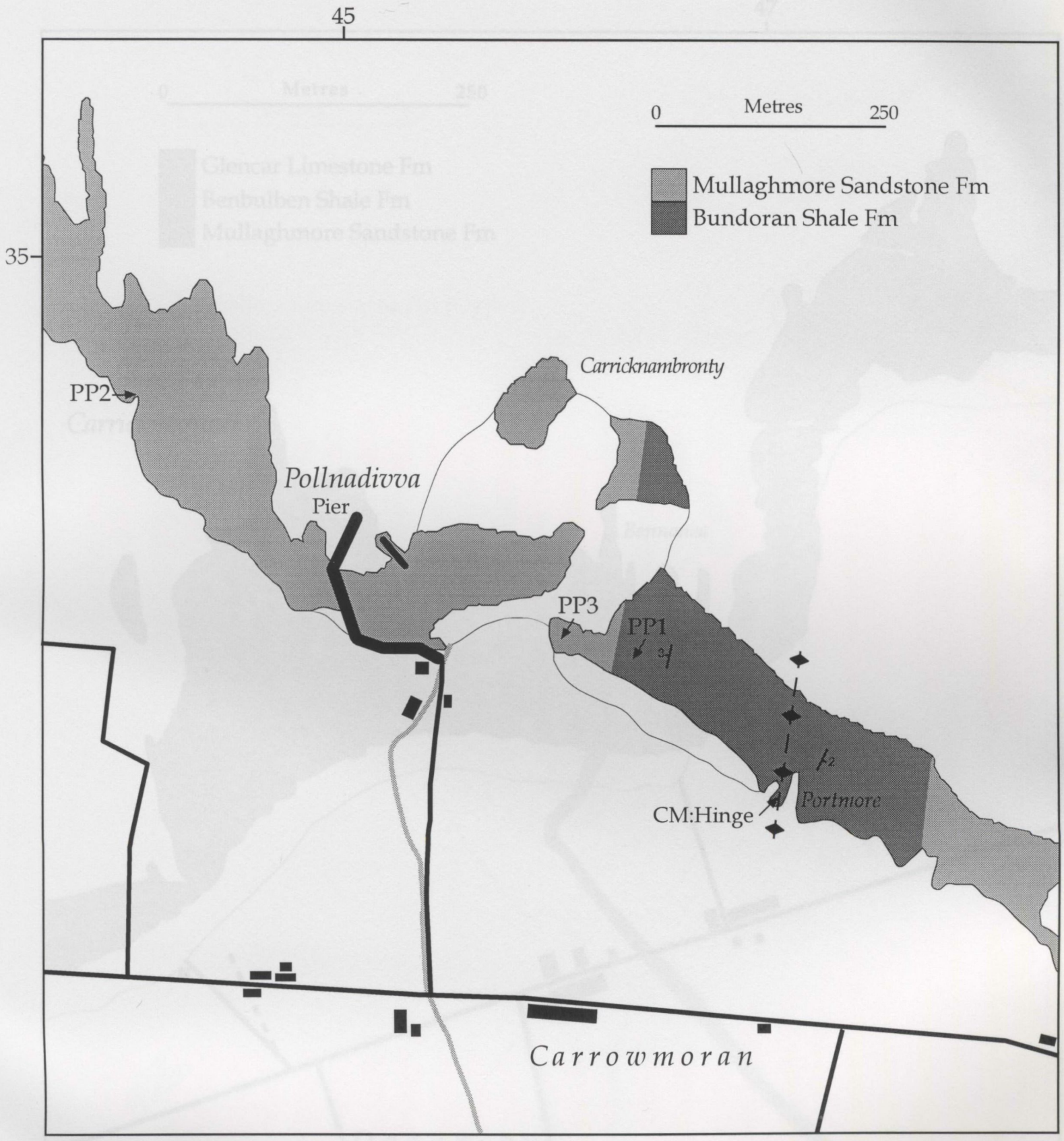


Figure A.14. Locality map for Pollnadivva Pier, western County Sligo.

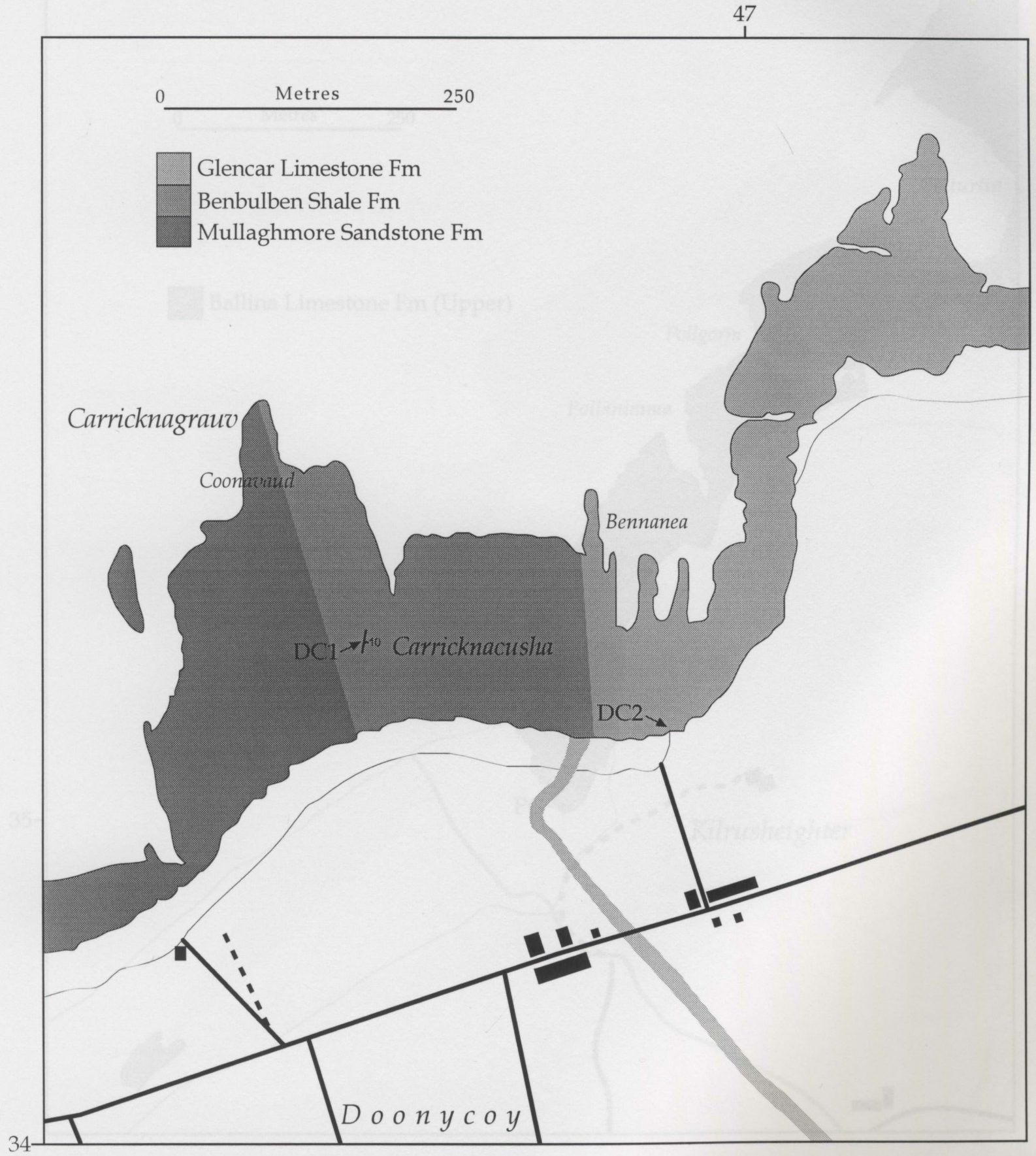


Figure A.15. Locality map for Doonycoy, western County Sligo.

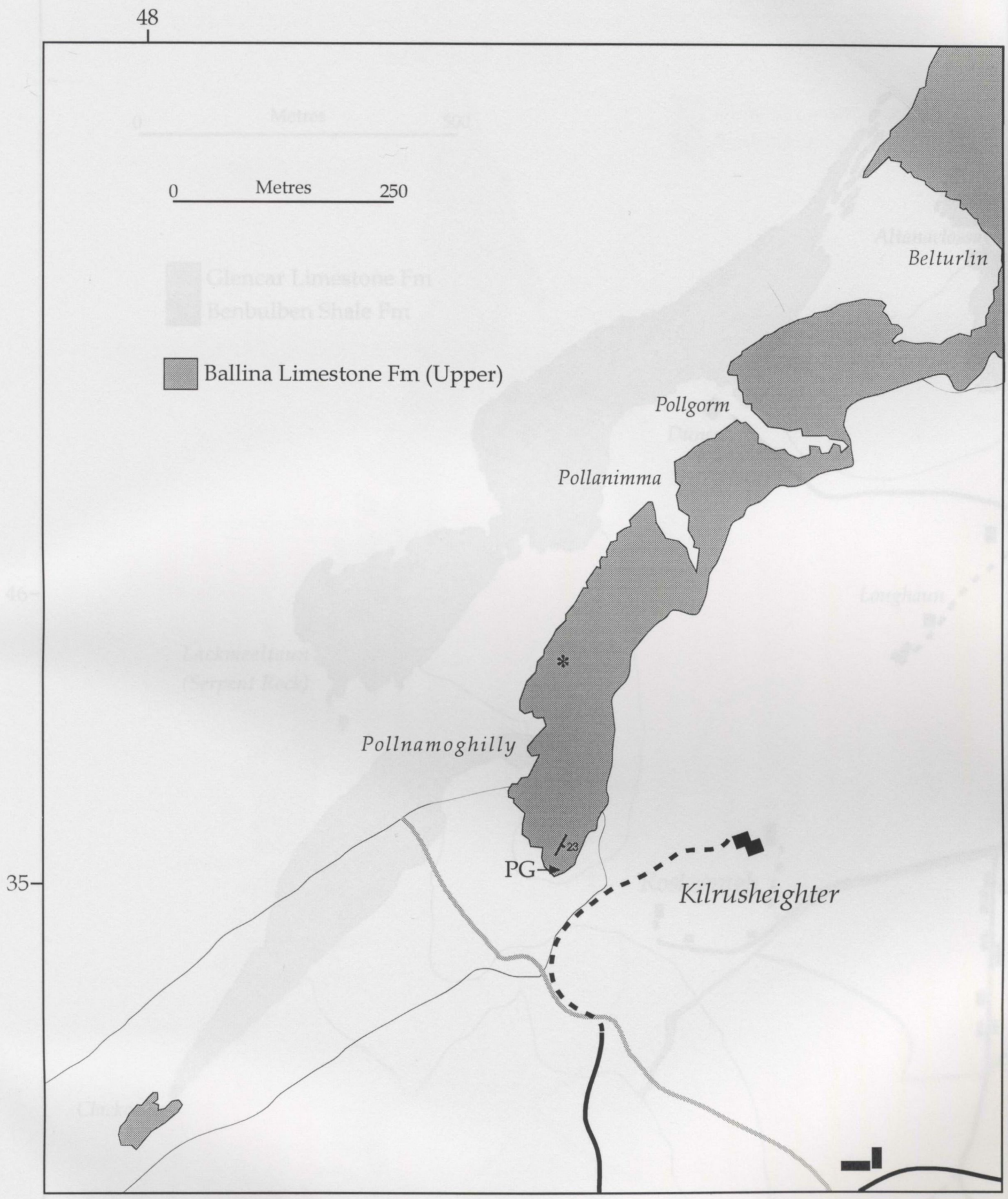


Figure A.16. Locality map for Pollnamoghilly (southwest of Aughris Head), western County Sligo.

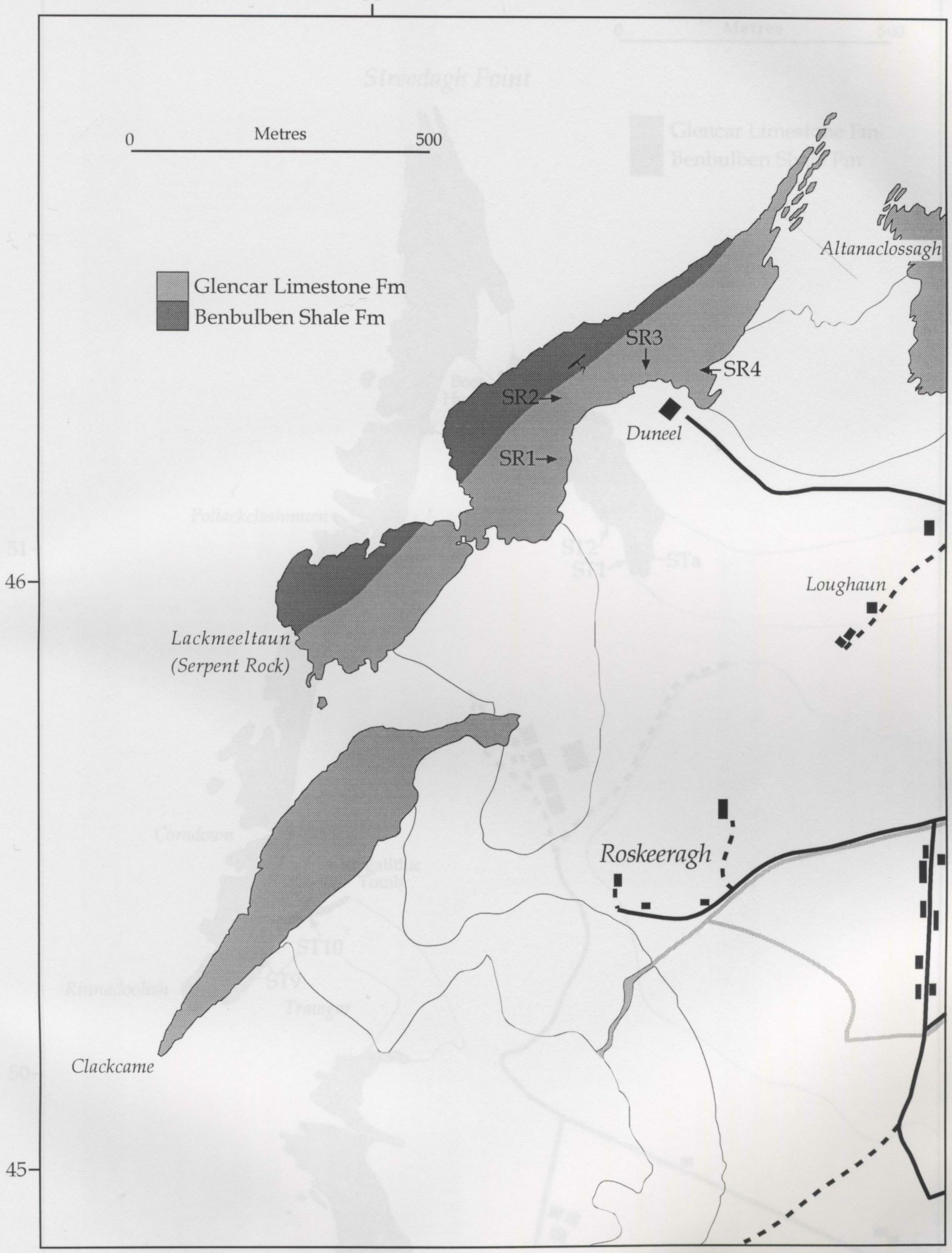


Figure A.17. Locality map for Serpent Rock (west of Ballyconnell) County Sligo.

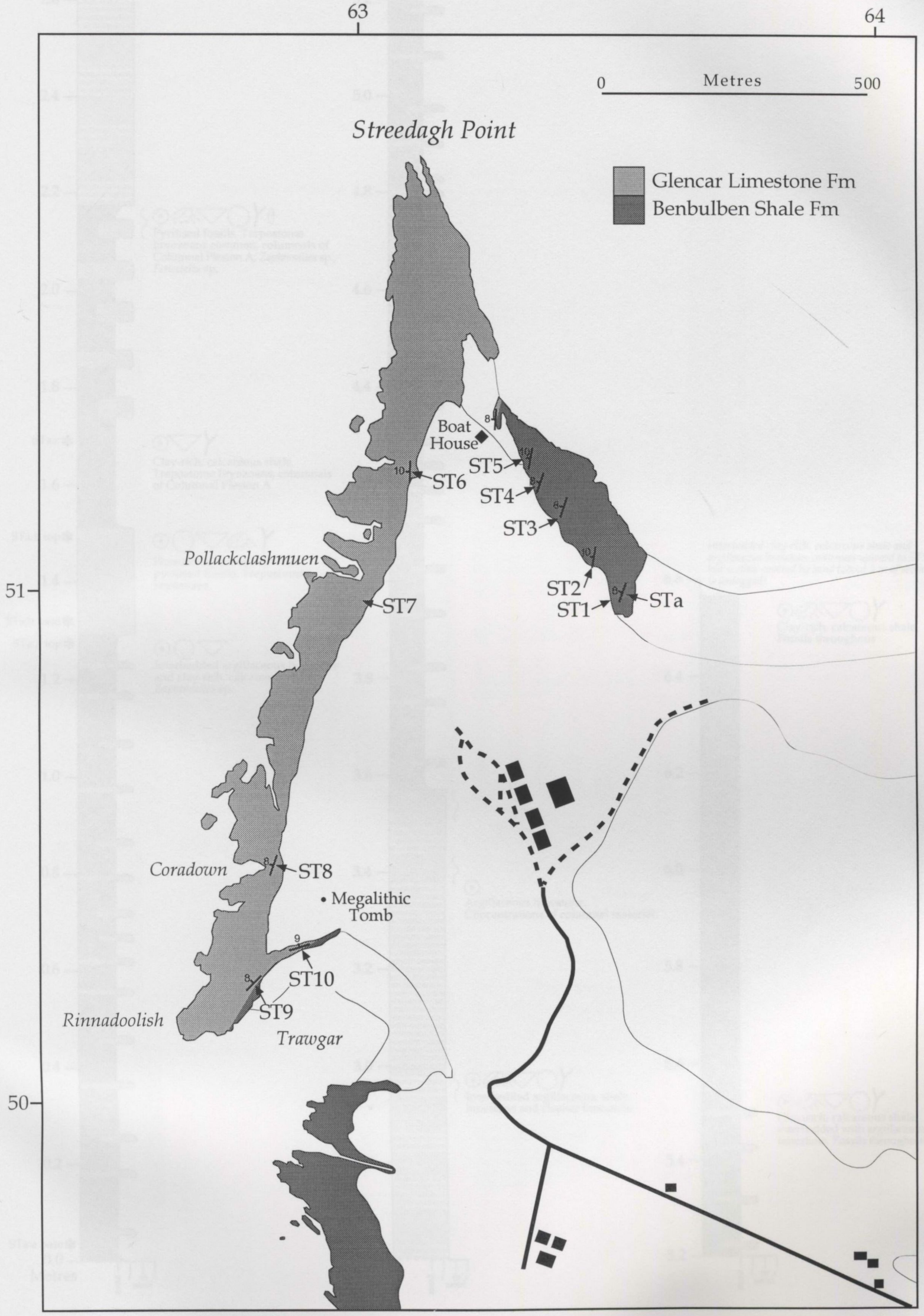


Figure A.18. Locality map for Streedagh Point, County Sligo.

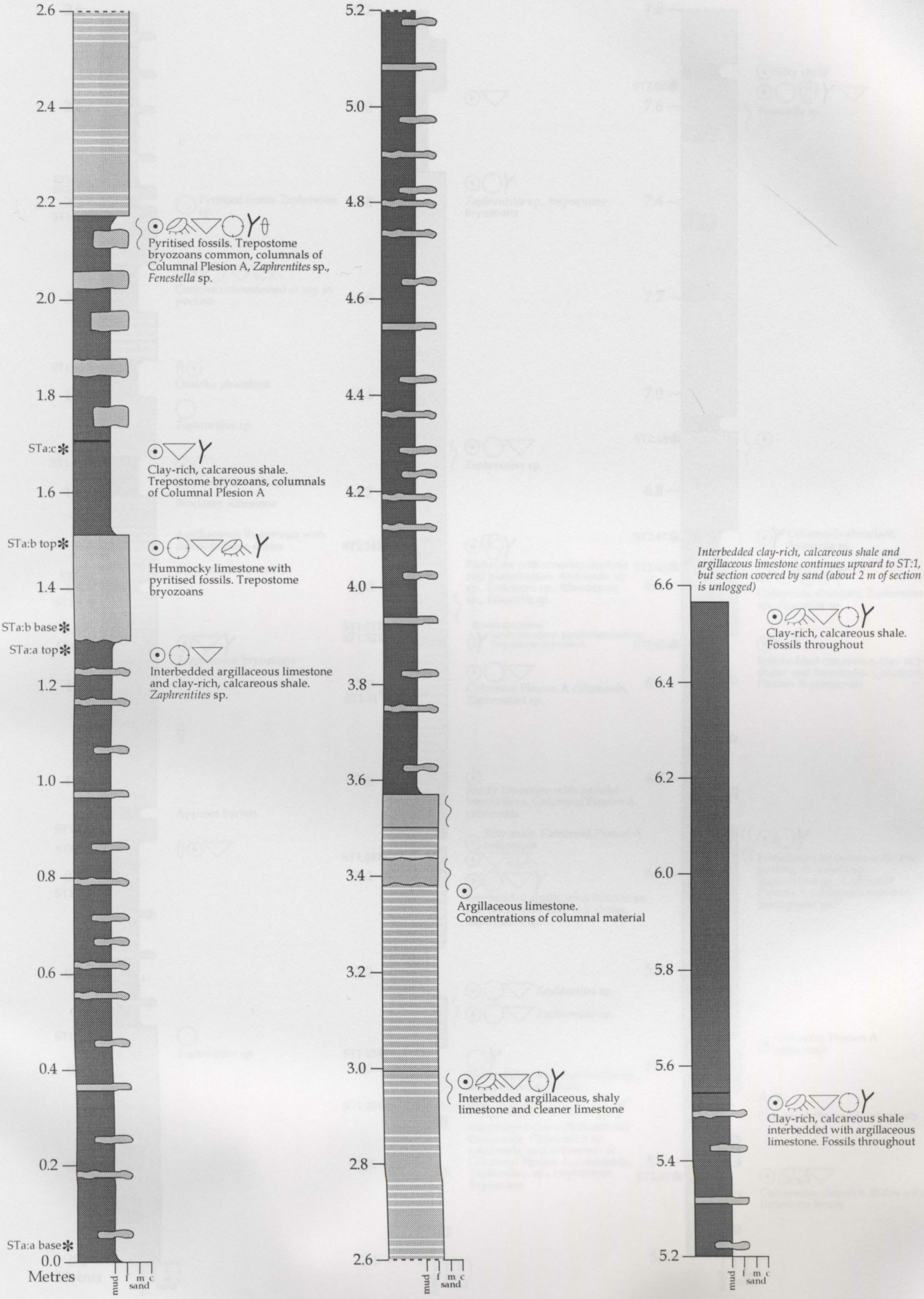


Figure A.19. Stratigraphical log (lowest section, on beach) at Streedagh (GR 6352 5098). Log shows beds STa:a to STa:k in the Benbulben Shale Formation.

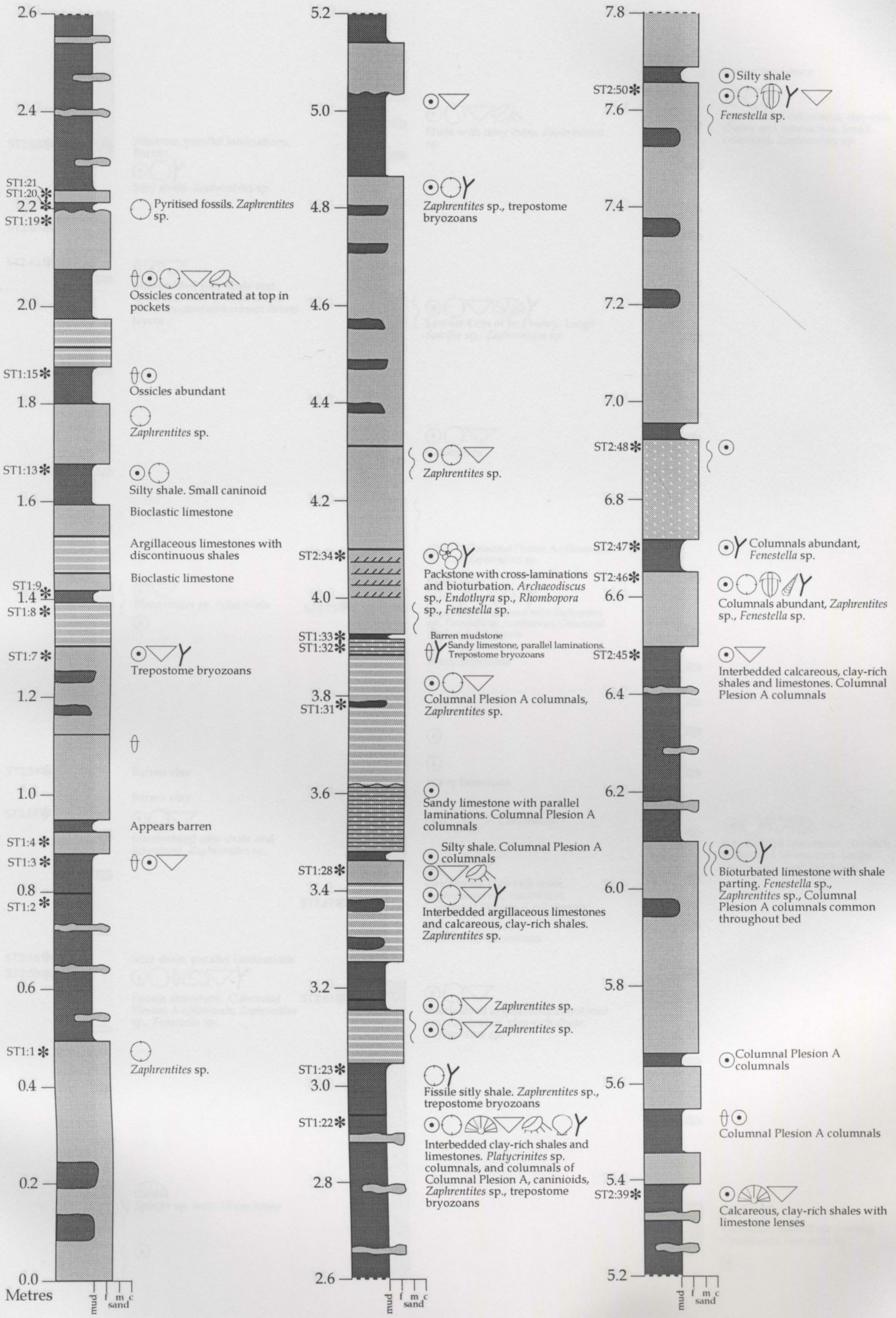


Figure A.20. *a*. Stratigraphical log (lowest section) at Streedagh (see Appendix B for grid references). Log shows beds ST1:1 to ST2:52 (part of) in the Benbulben Shale Formation.

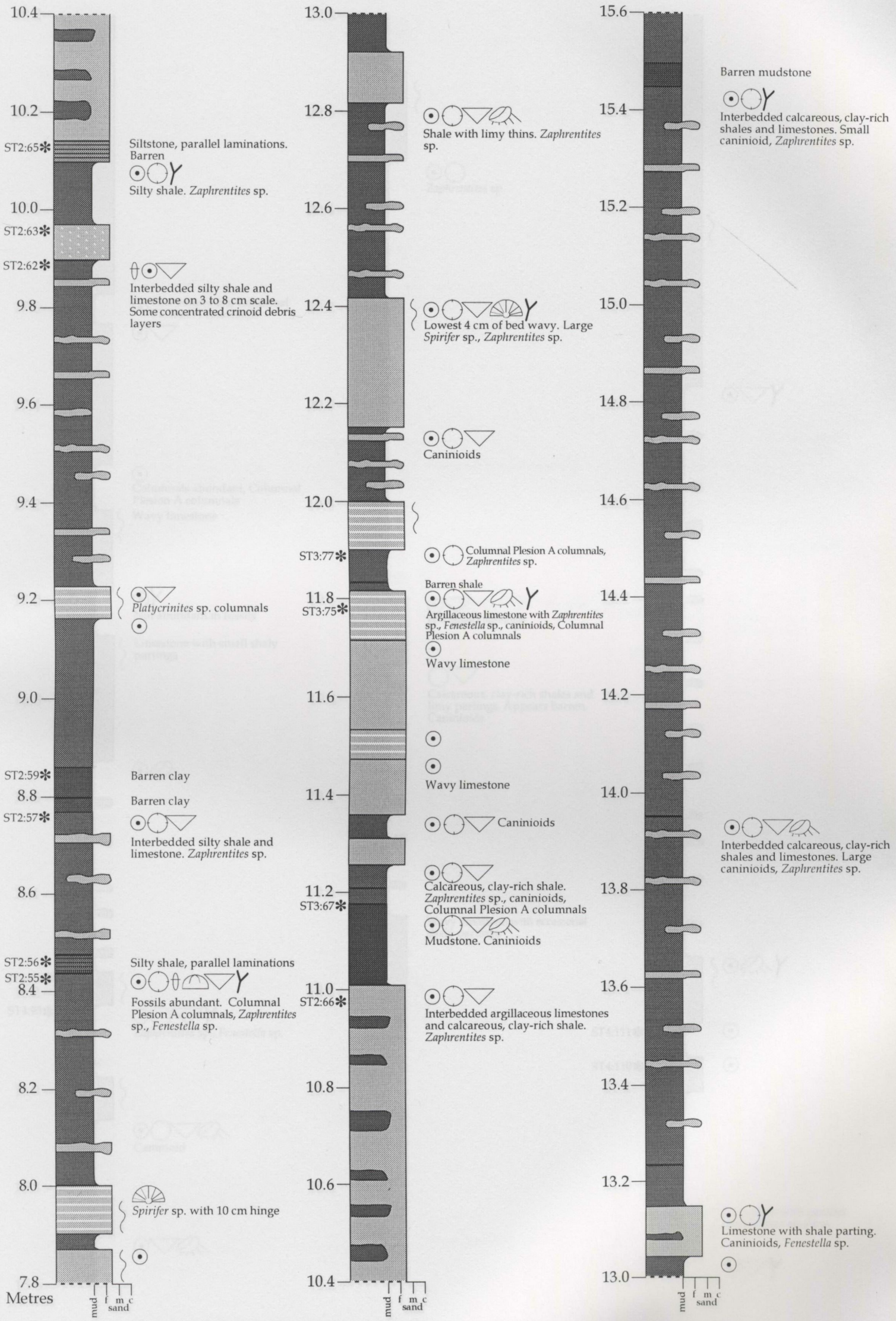


Figure A.20. *b*. Stratigraphical log at Streedagh (see Appendix B for grid references). Log shows beds ST2:52 (part of) to ST4:89 (part of) in the Benbulben Shale Formation.

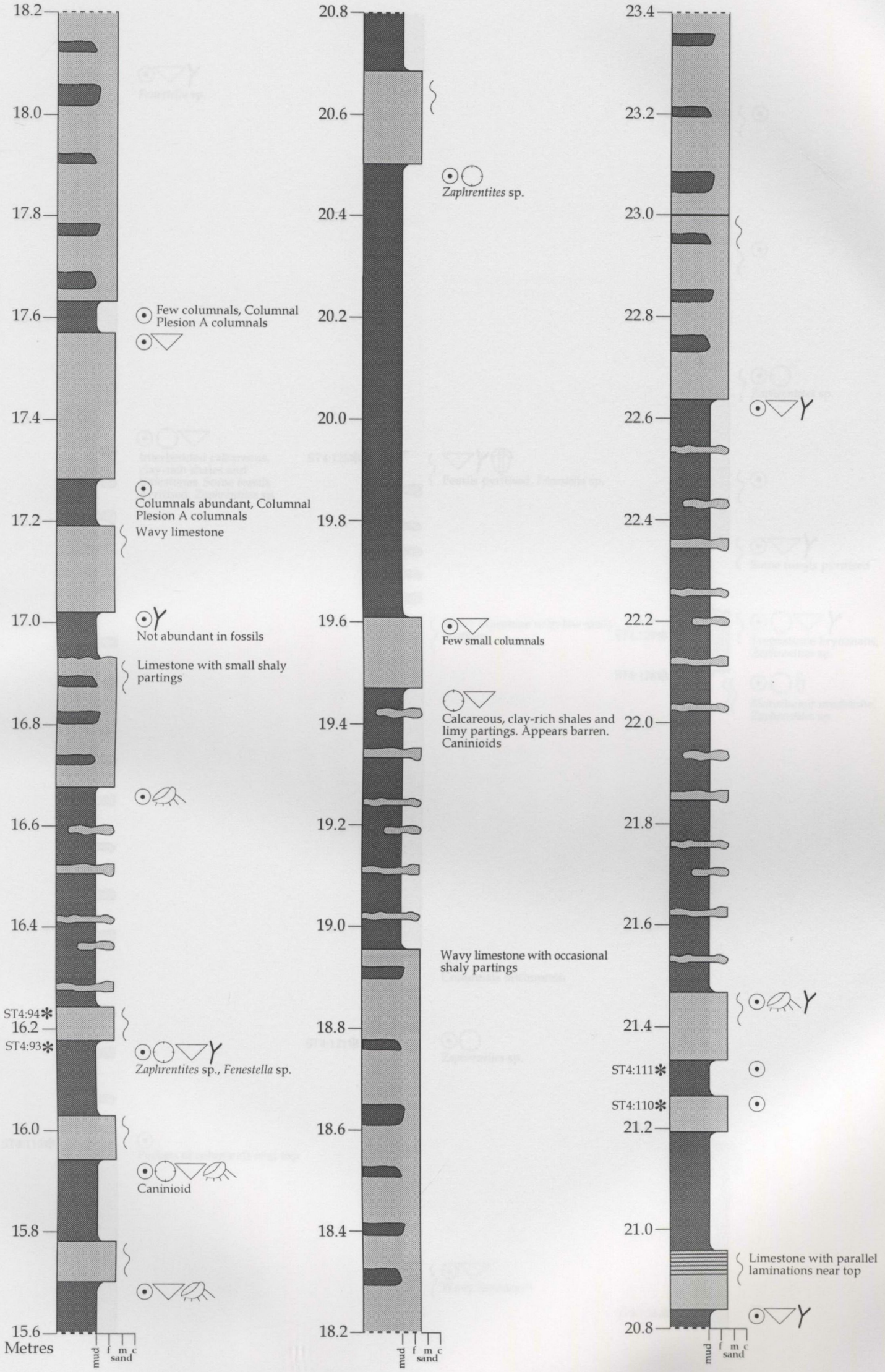


Figure A.20. *c*. Stratigraphical log at Streedagh (see Appendix B for grid references). Log shows beds ST4:89 (part of) to ST4:115 (part of) in the Benbulben Shale Formation.

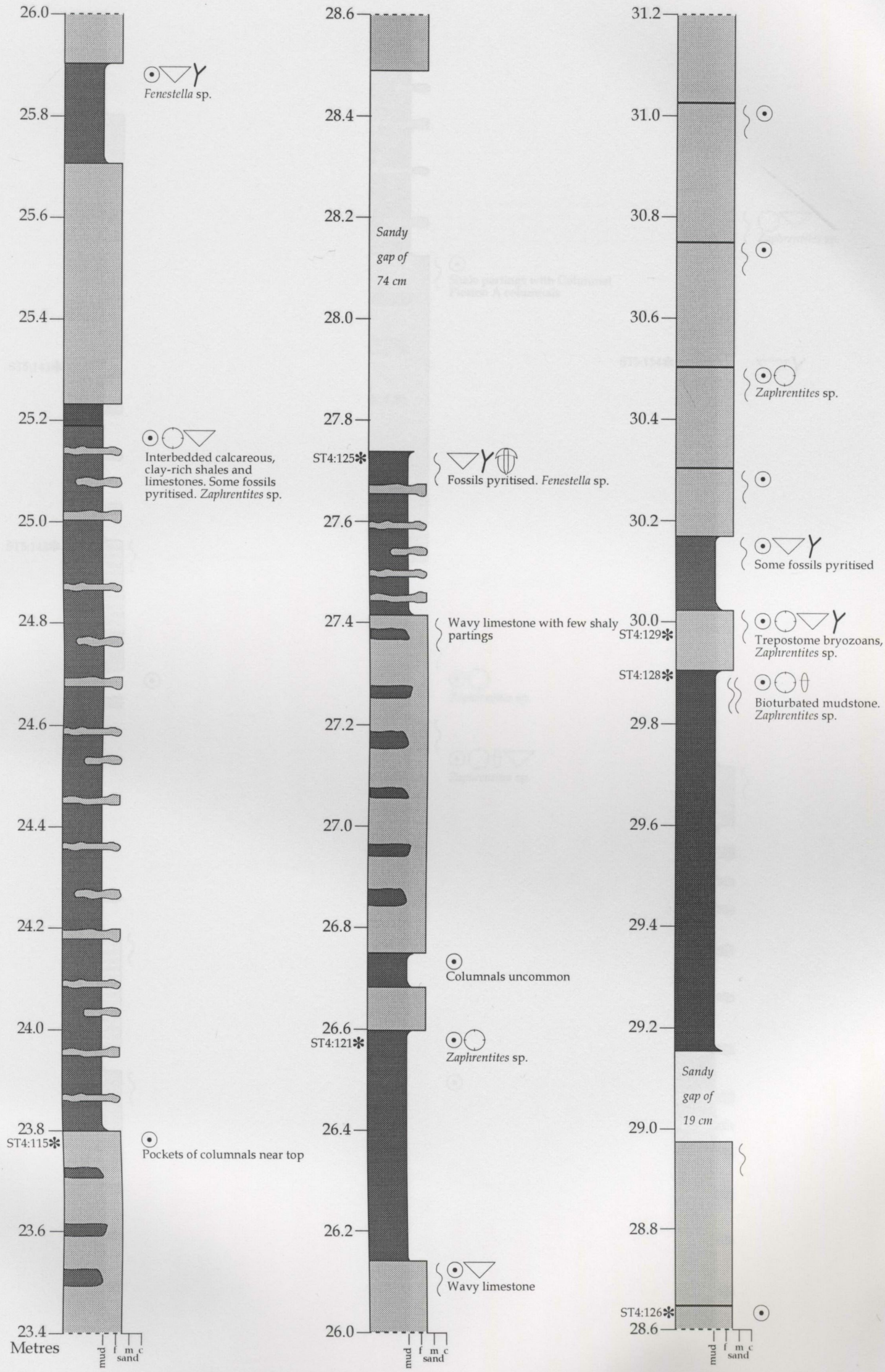


Figure A.20. *d.* Stratigraphical log at Streedagh (see Appendix B for grid references). Log shows beds ST4:115 (part of) to ST5:135 (part of) in the Benbulben Shale Formation.

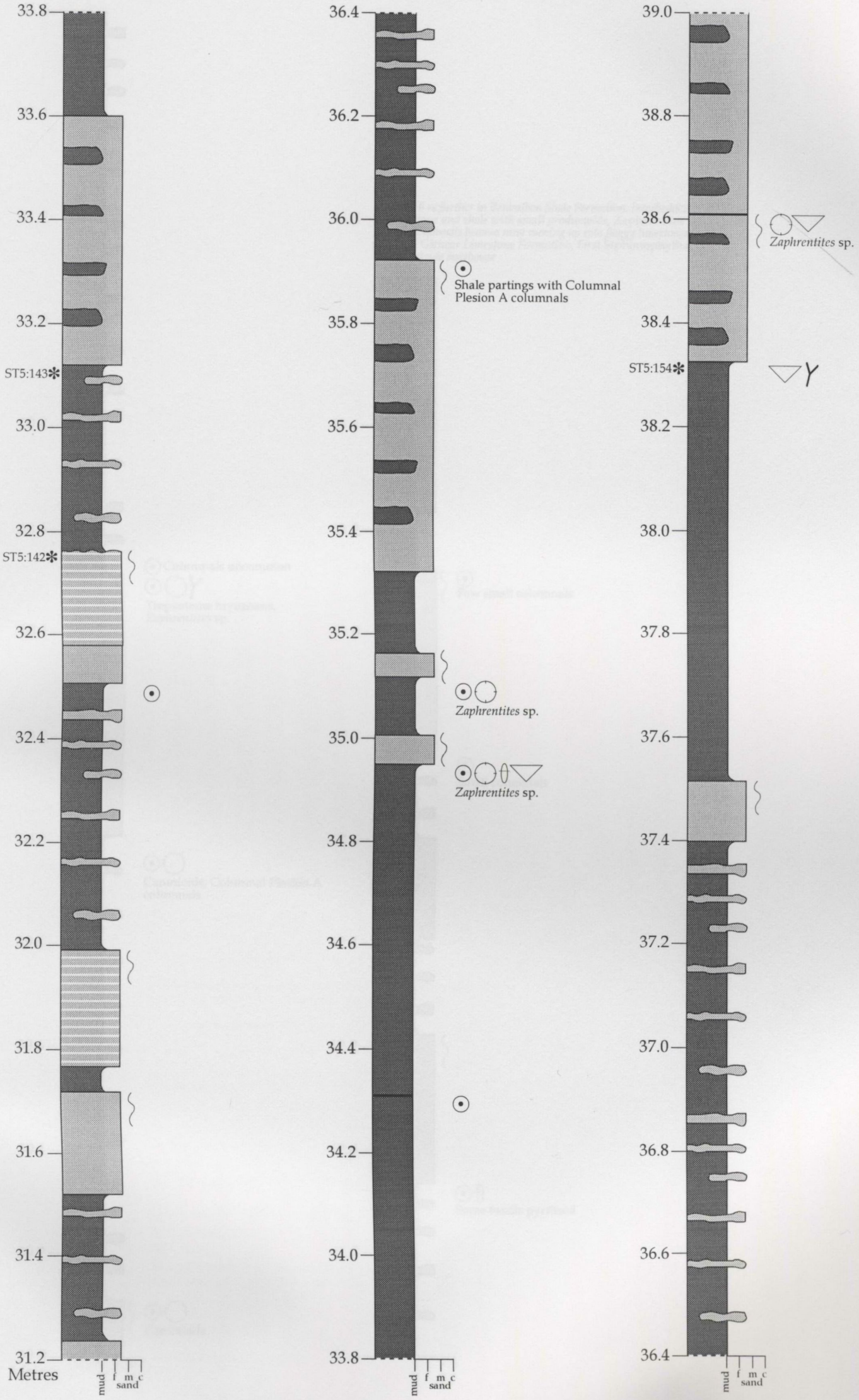


Figure A.20. *e*. Stratigraphical log at Streedagh (see Appendix B for grid references). Log shows beds ST5:135 (part of) to ST5:156 (part of) in the Benbulben Shale Formation.

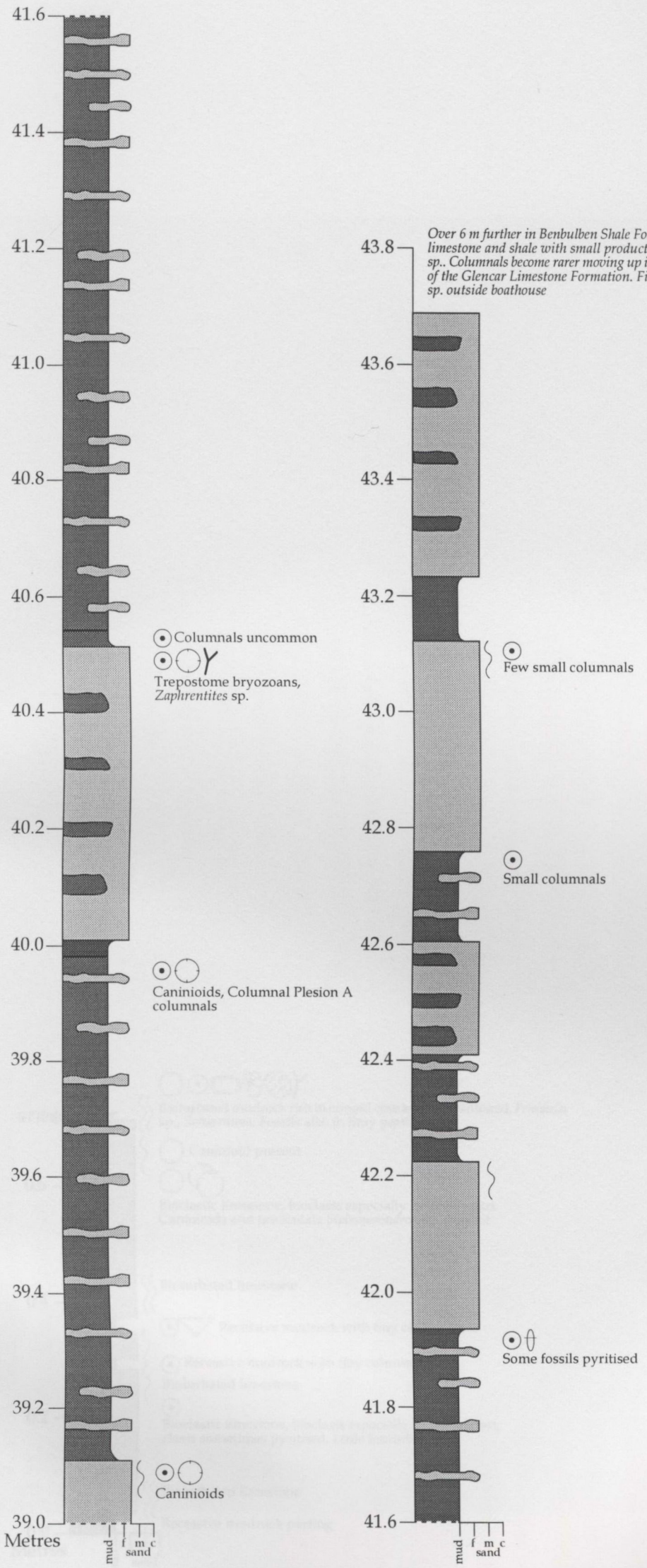


Figure A.20. *f.* Stratigraphical log at Streedagh (see Appendix B for grid references). Log shows beds ST5:156 (part of) to ST5:168 (part of) in the Benbulben Shale Formation.

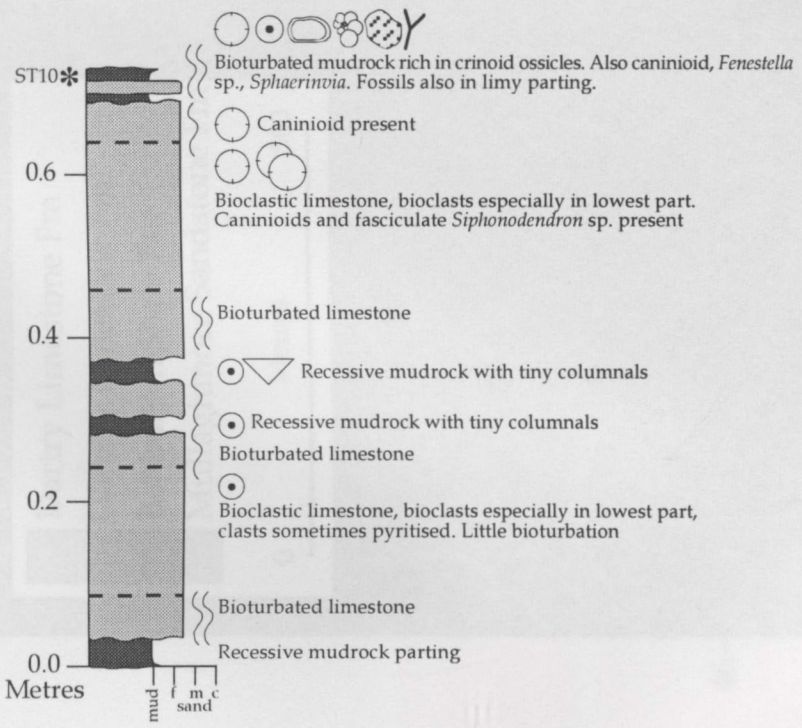


Figure A.21. Stratigraphical log at locality ST10 (GR 6290 5030), Streedagh Point. Log shows beds belonging to the lowest part of the Glencar Limestone Formation.

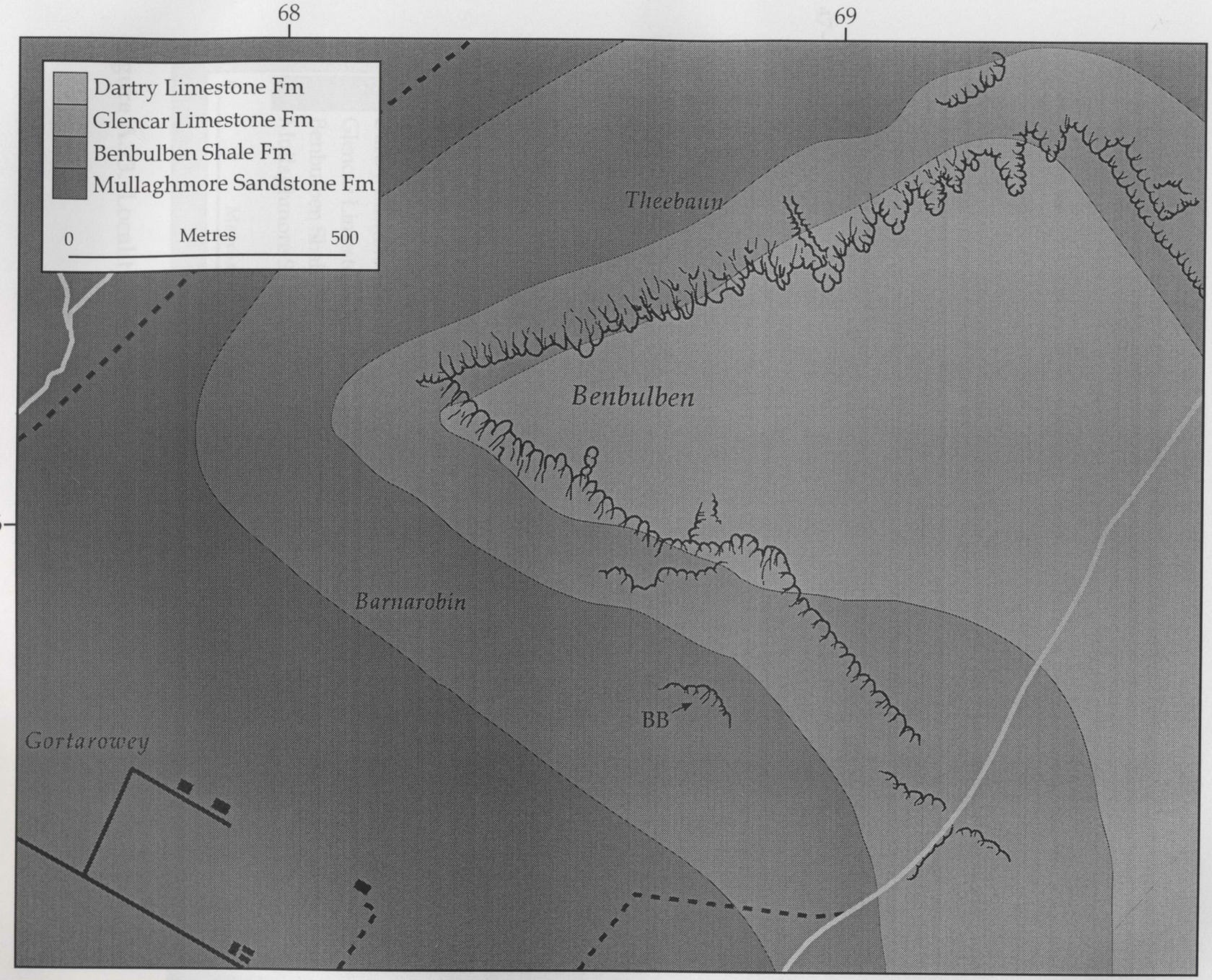


Figure A.22. Locality map for Benbulben Mountain, County Sligo.

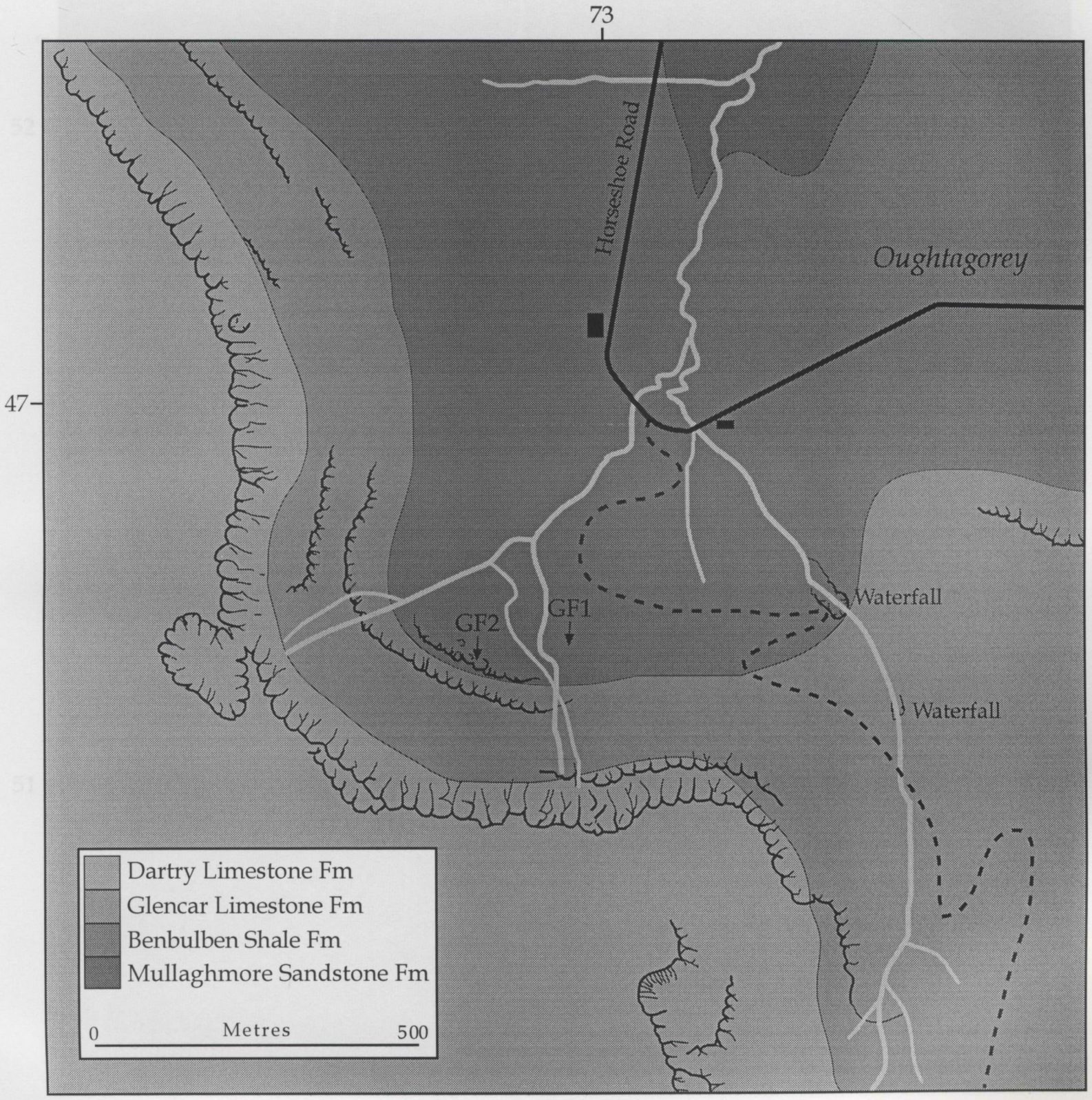


Figure A.23. Locality map for Gleniff, County Sligo.

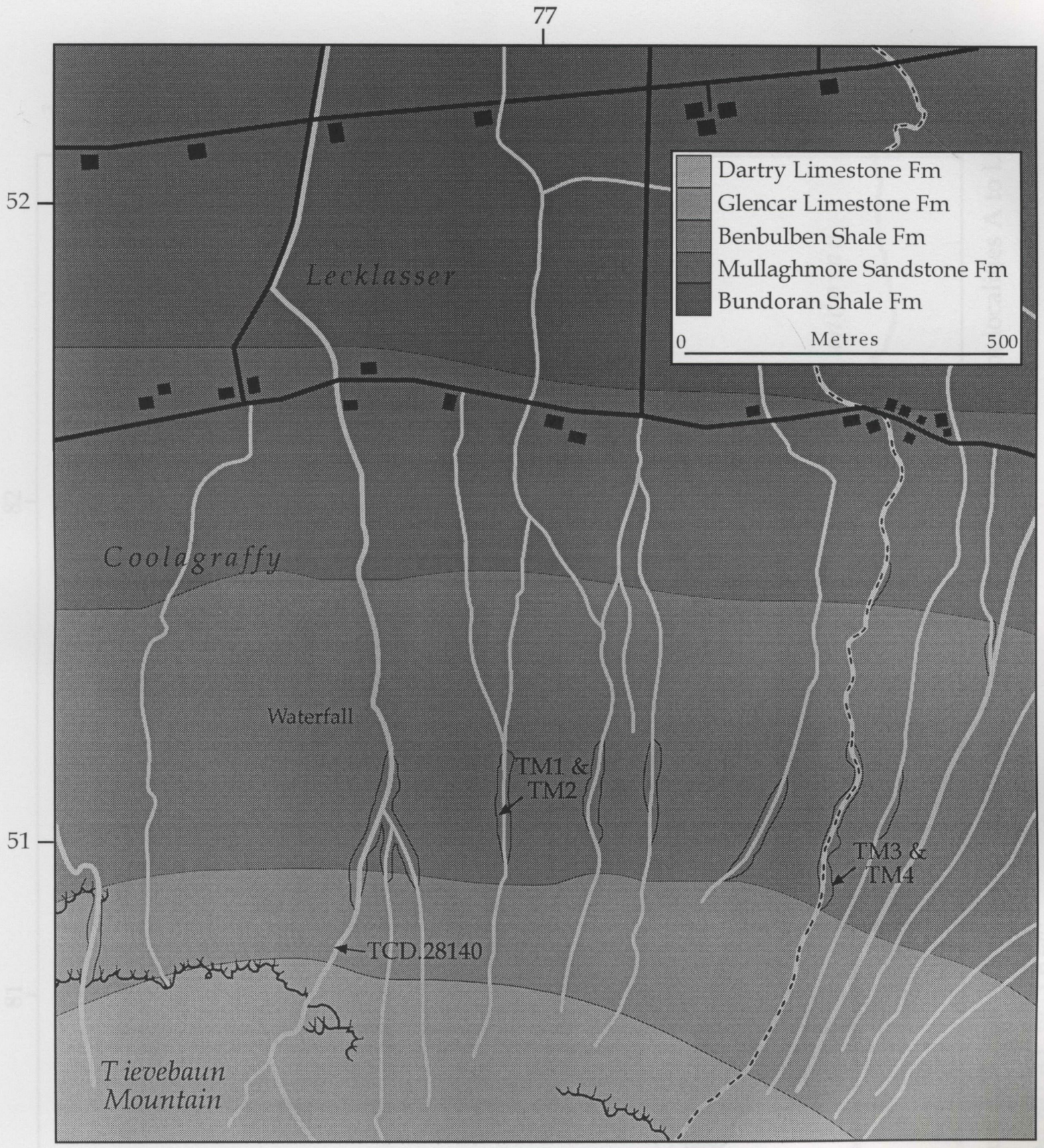


Figure A.24. Locality map for Tievebaun Mountain, Counties Sligo and Leitrim.

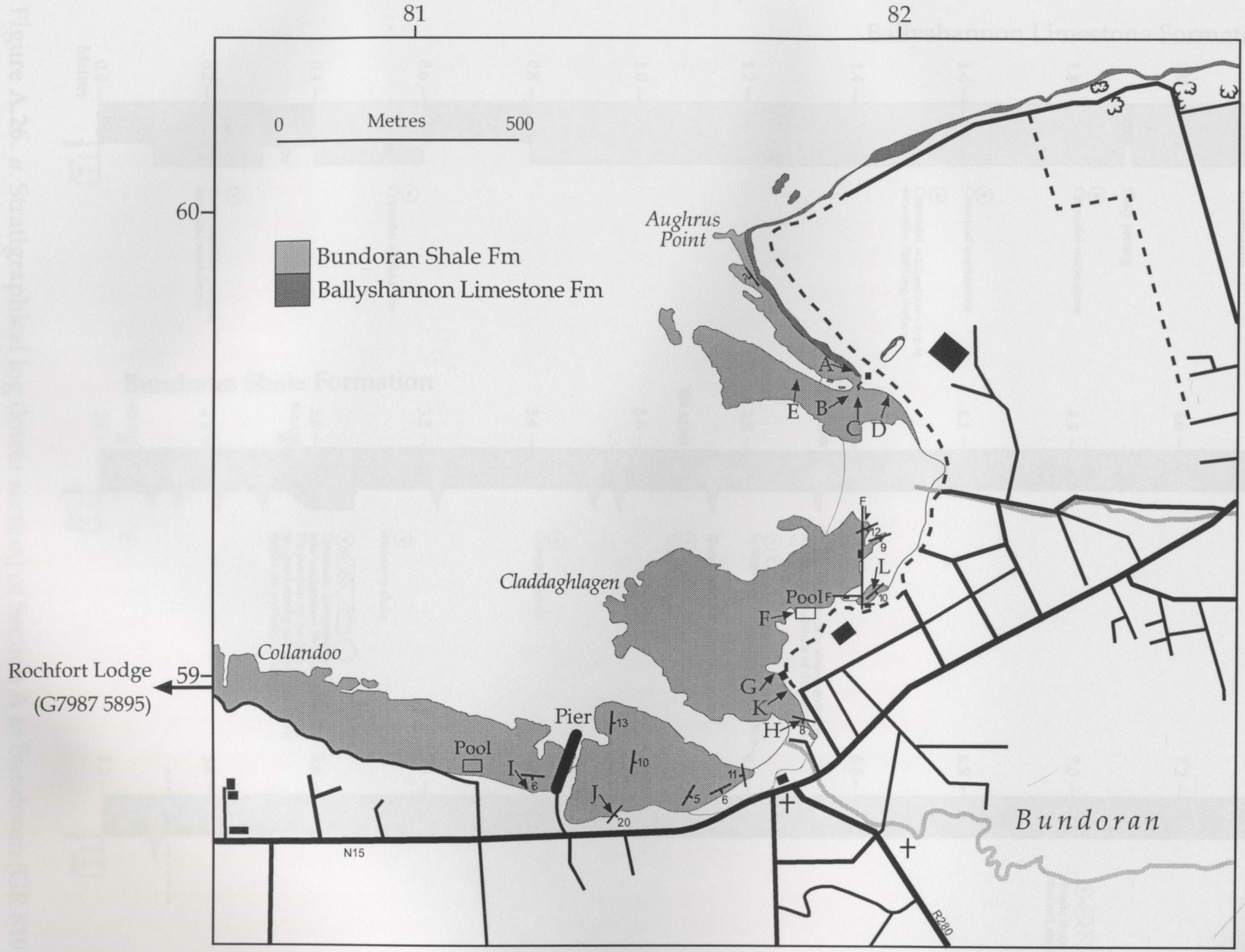


Figure A.25. Locality map for Bundoran, County Donegal. Samples from localities A to L coded BD:A1, BD:L6 etc.

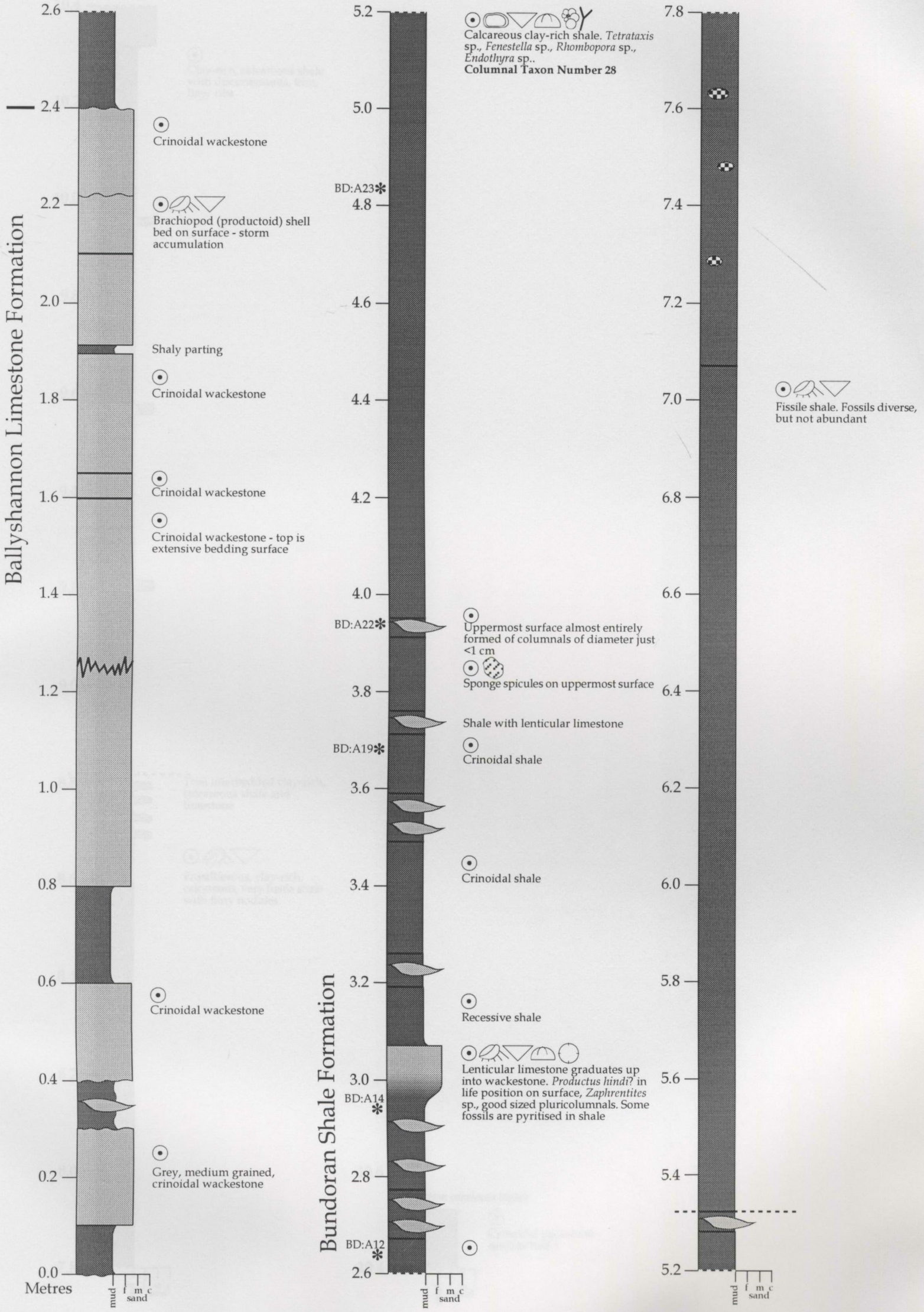


Figure A.26. *a*. Stratigraphical log (lower section) of Section A at Bundoran (GR 8191 5965). Log shows beds BD:A1 to BD:A26 (part of) in the uppermost Ballyshannon Limestone Formation and lowest Bundoran Shale Formation.

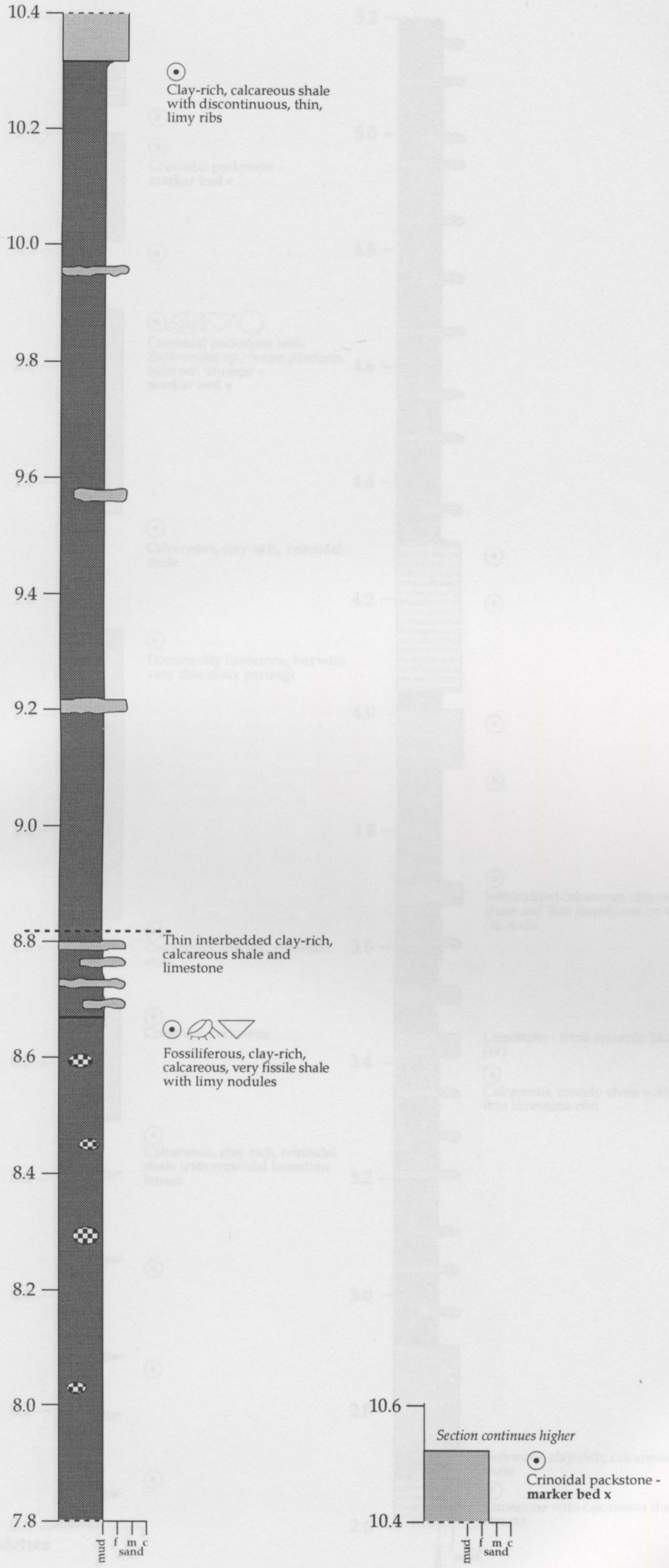


Figure A.26. *b*. Stratigraphical log (upper section) of Section A at Bundoran (GR 8191 5965). Log shows beds BD:A26 (part of) to BD:A29 in the lowest Bundoran Shale Formation.

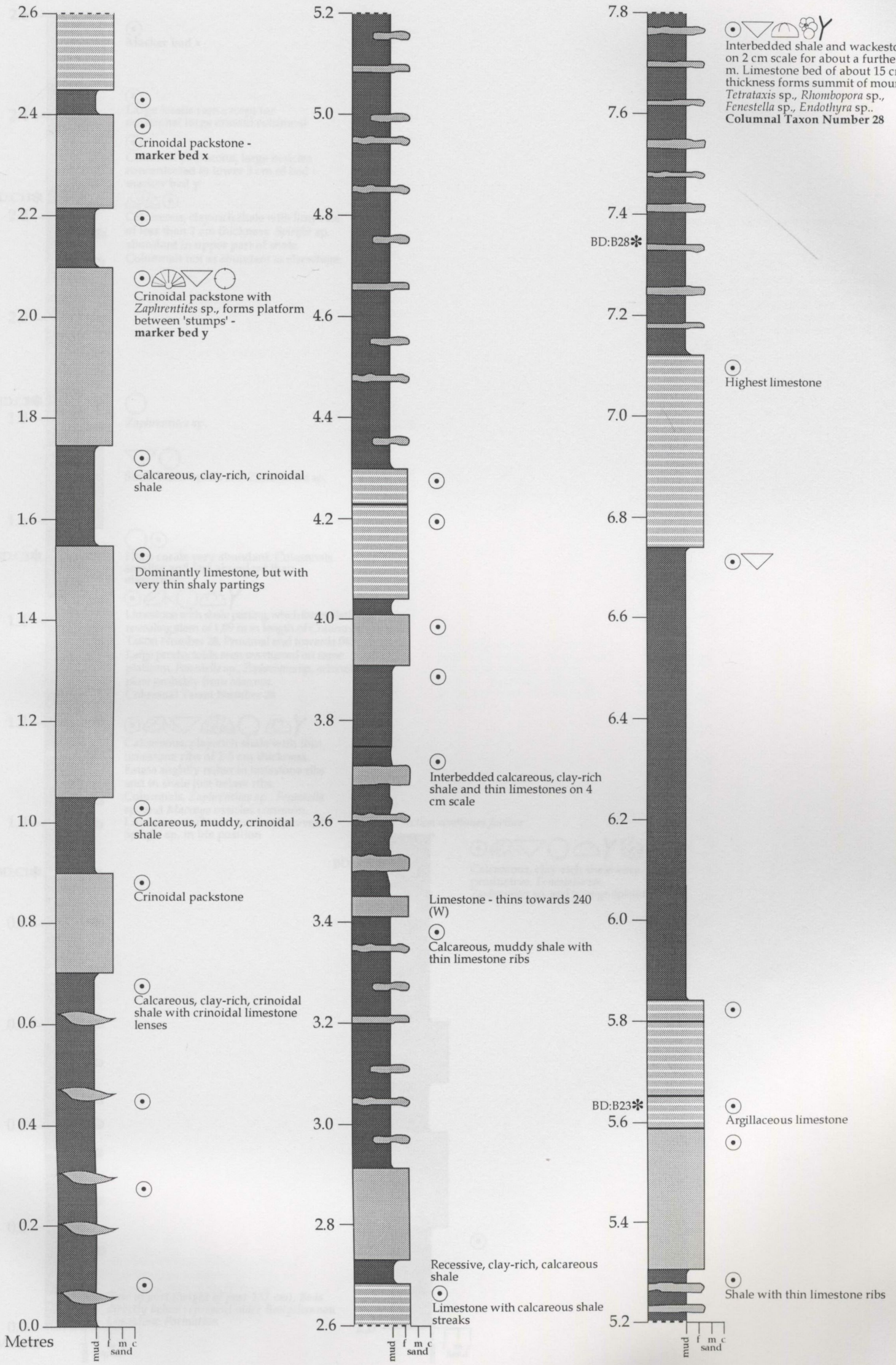


Figure A.27. Stratigraphical log of Section B at Bundoran (GR 8191 5959). Log shows beds BD:B1 to BD:B28 (part of) in the lowest Bundoran Shale Formation.

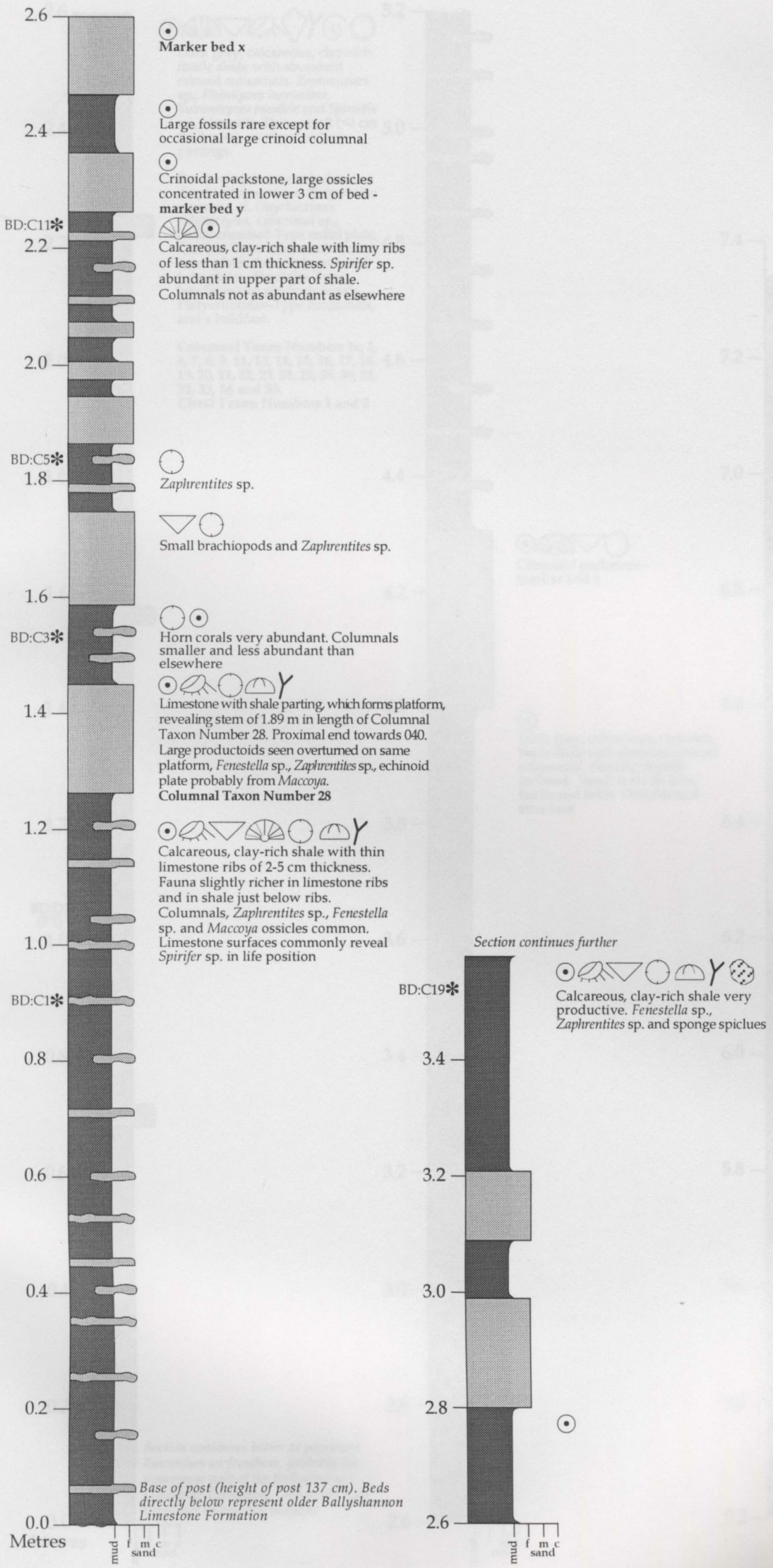


Figure A.28. Stratigraphical log of Section C at Bundoran (GR 8193 5958). Log shows beds BD:C1 to BD:C19 in the lowest Bundoran Shale Formation.

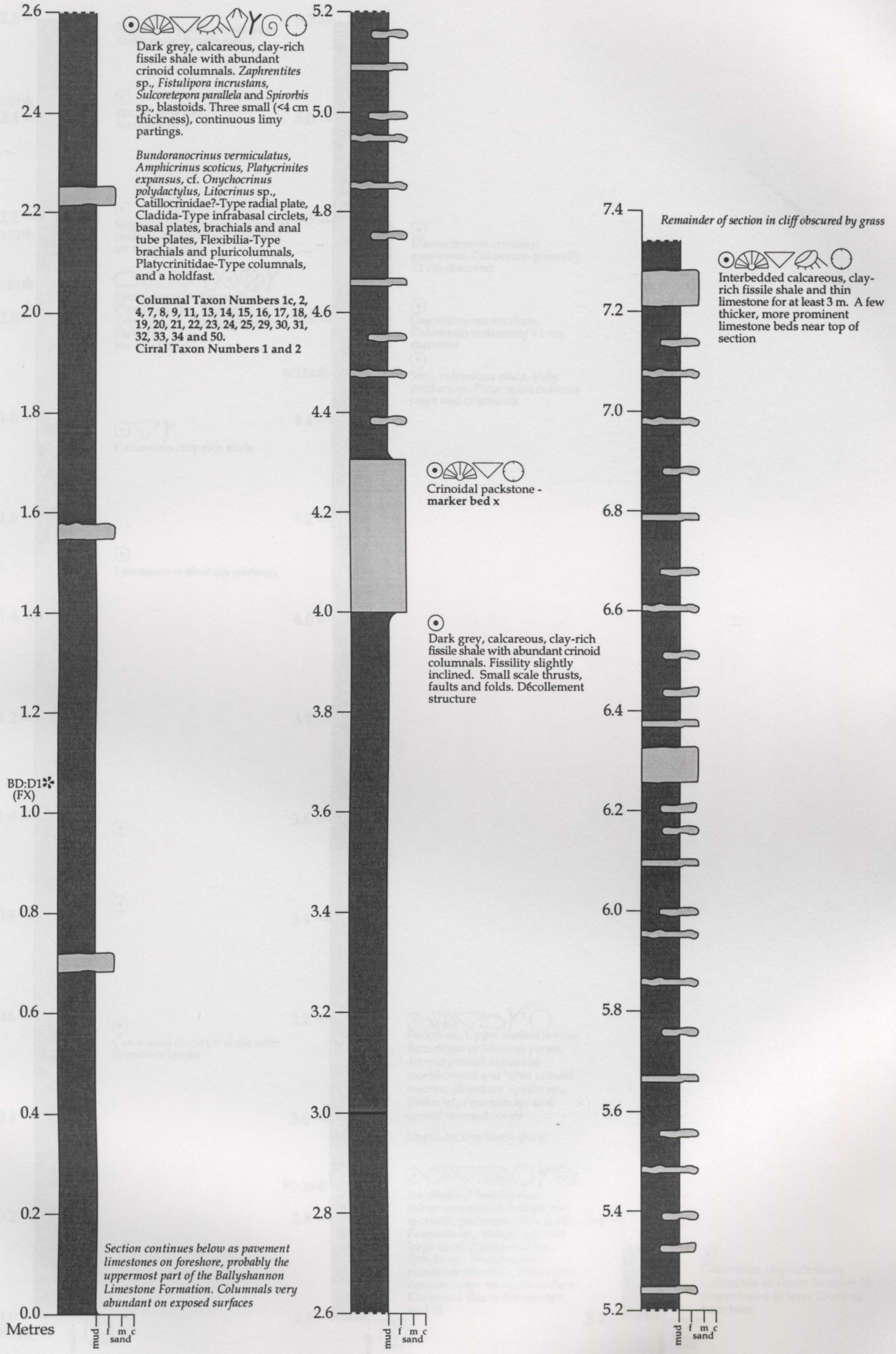


Figure A.29. Stratigraphical log of Section D at Bundoran (GR 8199 5958). Log shows beds BD:D1 (FX) to BD:D4 in the lower Bundoran Shale Formation.

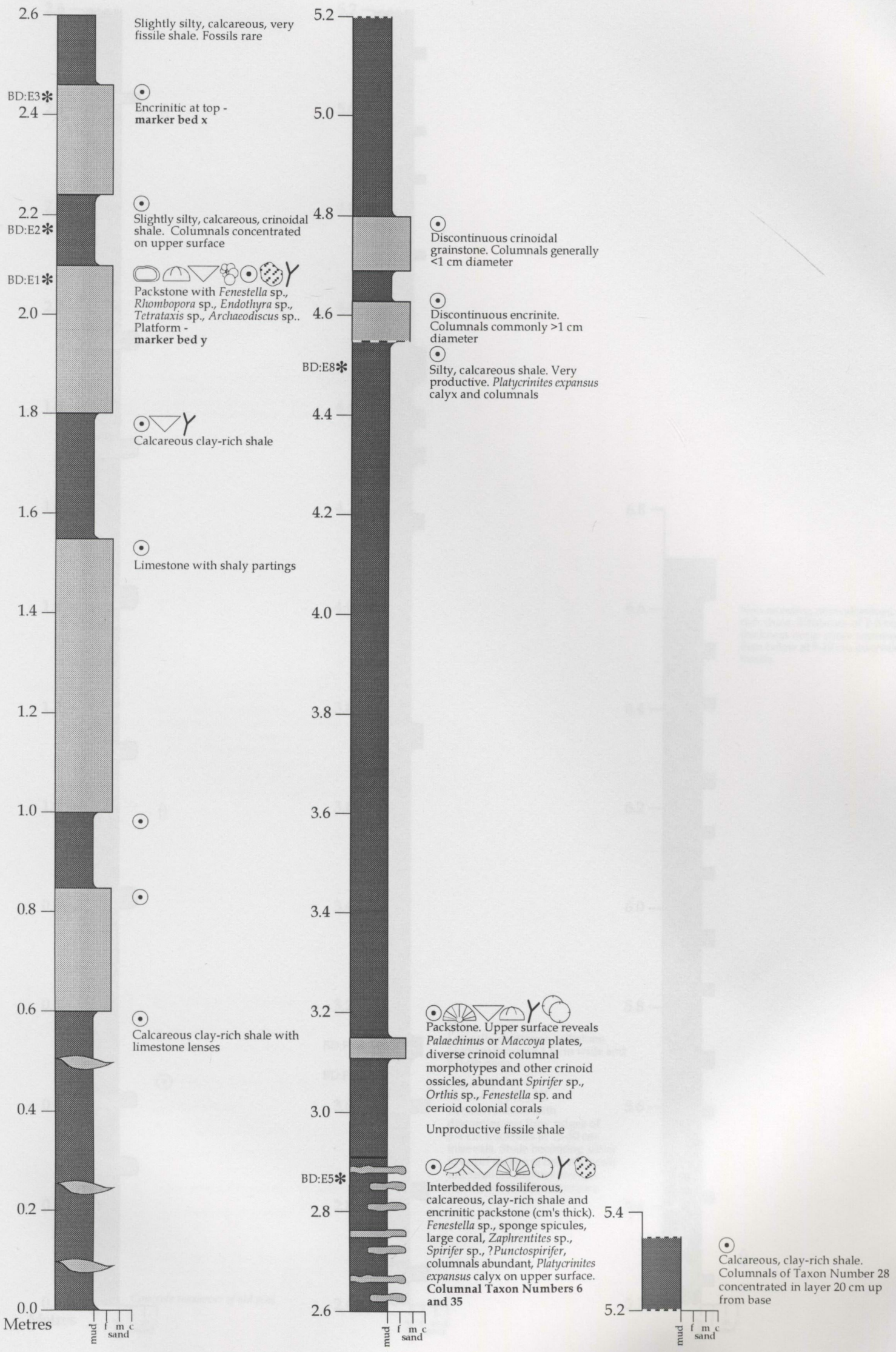


Figure A.30. Stratigraphical log of Section E at Bundoran (GR 8181 5963). Log shows beds BD:E-5 to BD:E12 (part of) in the lower Bundoran Shale Formation.

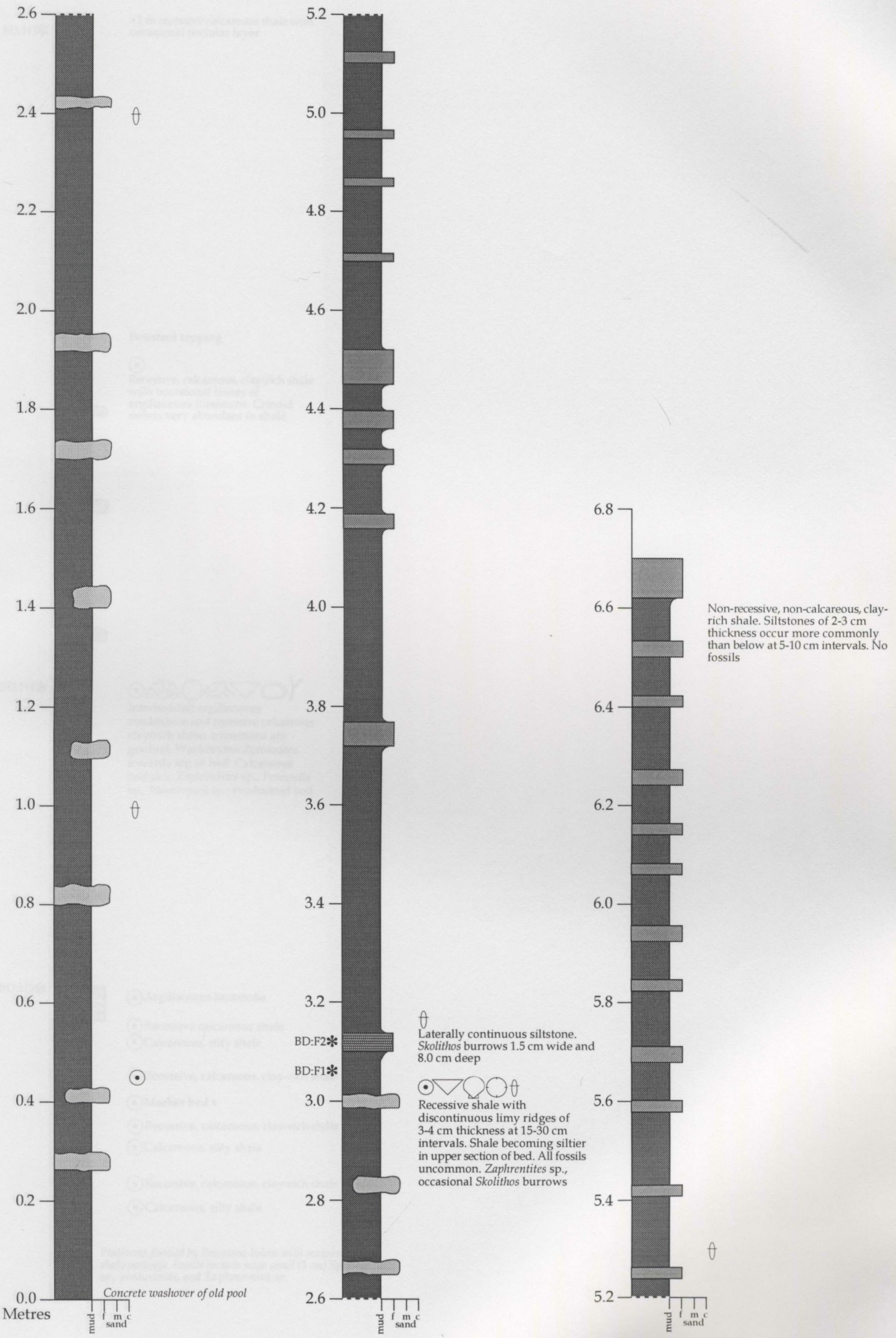


Figure A.31. Stratigraphical log of Section F at Bundoran (GR 8180 5913). Log shows beds BD:F1 to BD:F14 in the middle part of the Bundoran Shale Formation.

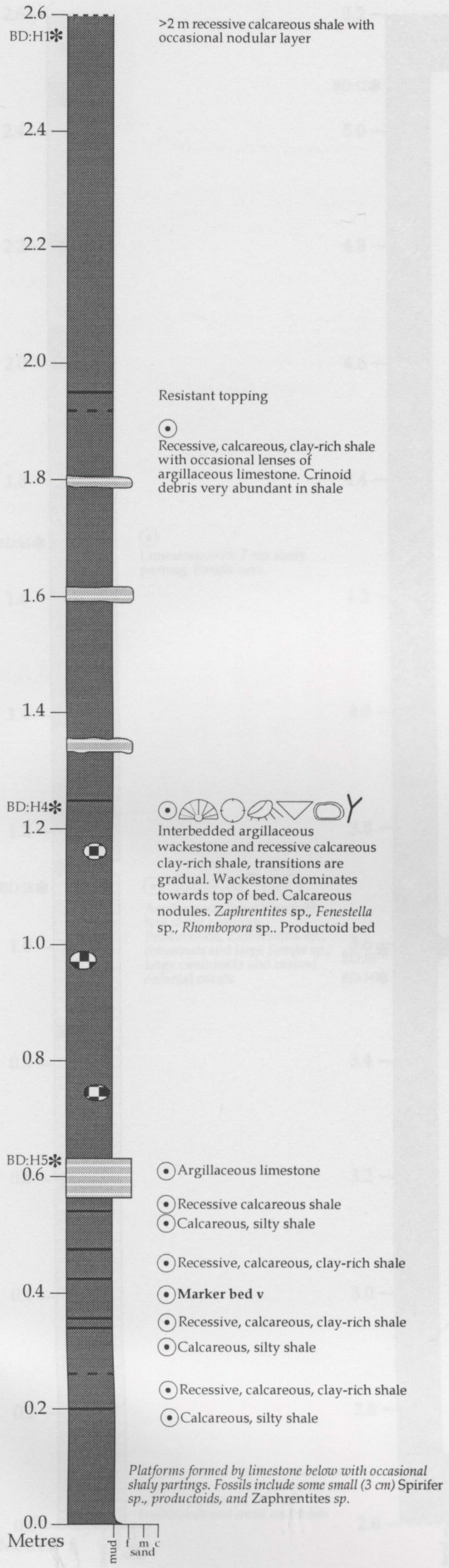


Figure A.32. Stratigraphical log of Section H at Bundoran (GR 8180 5895). Log shows beds BD:H13 to BD:H1 in the middle part of the Bundoran Shale Formation.

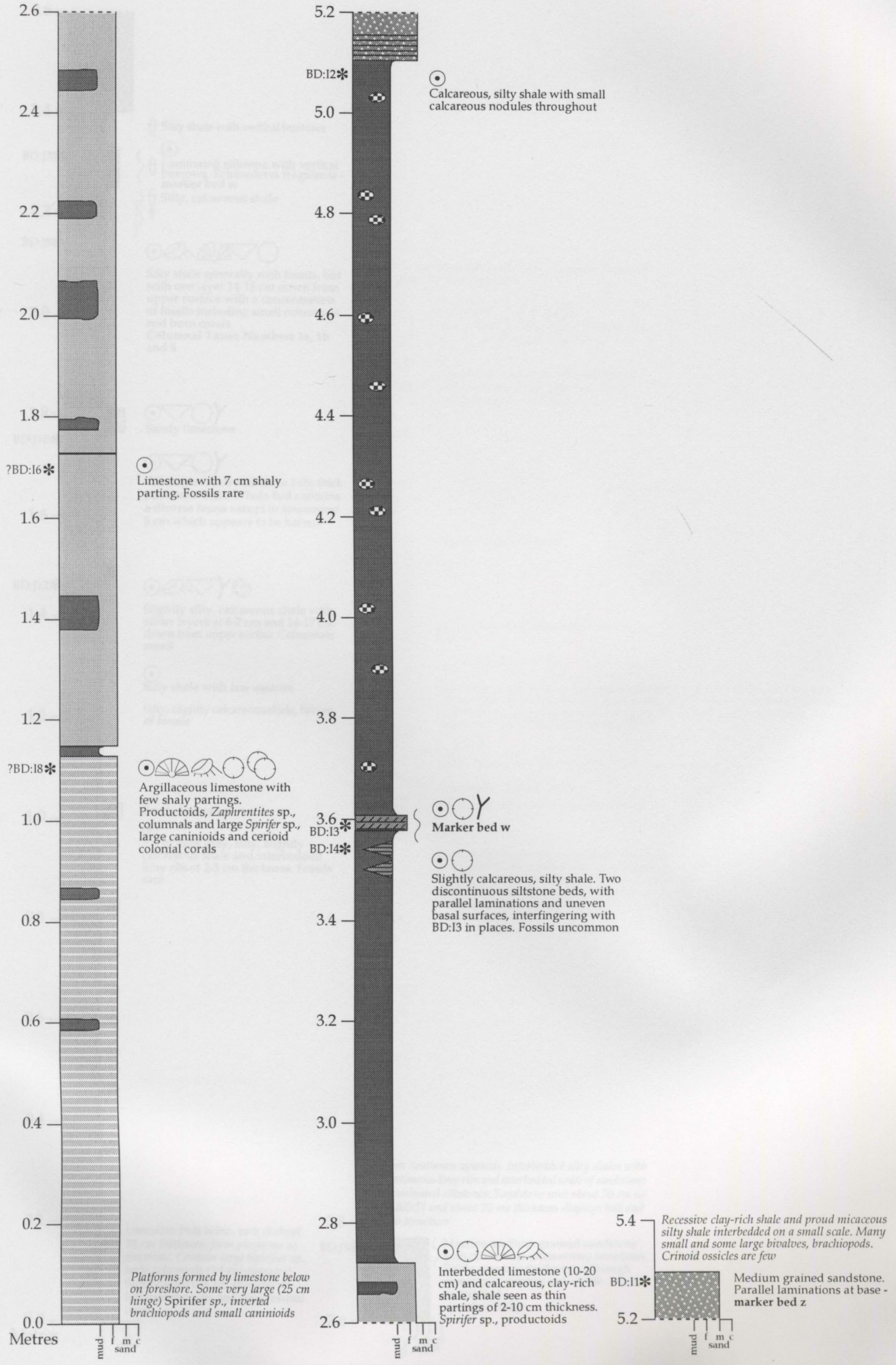


Figure A.33. Stratigraphical log of Section I at Bundoran (GR 8124 5880). Log shows beds BD:I8 to BD:I1 in the upper part of the Bundoran Shale Formation.

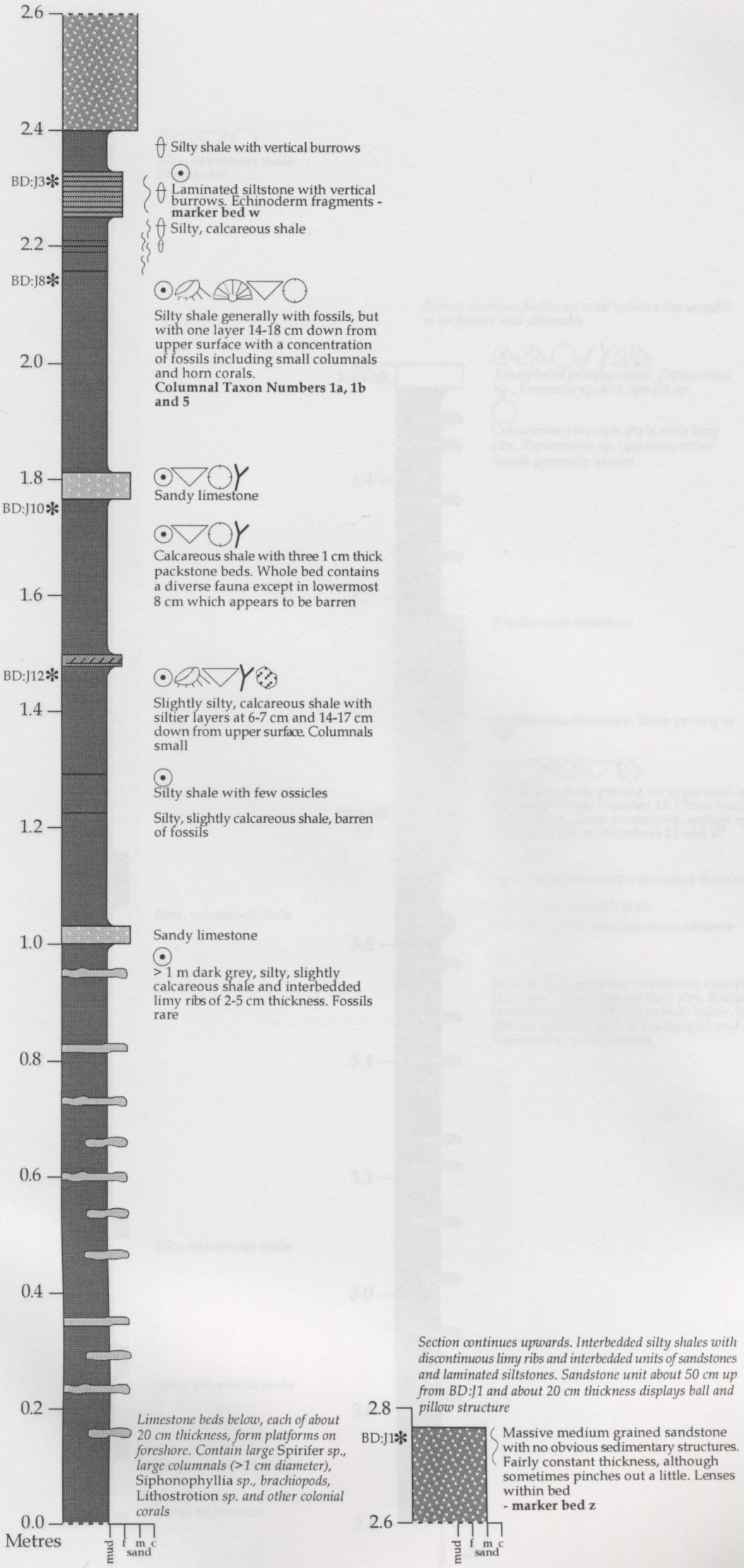


Figure A.34. Stratigraphical log of Section J at Bundoran (GR 8141 5875). Log shows beds BD:J16 to BD:J1 in the upper part of the Bundoran Shale Formation.

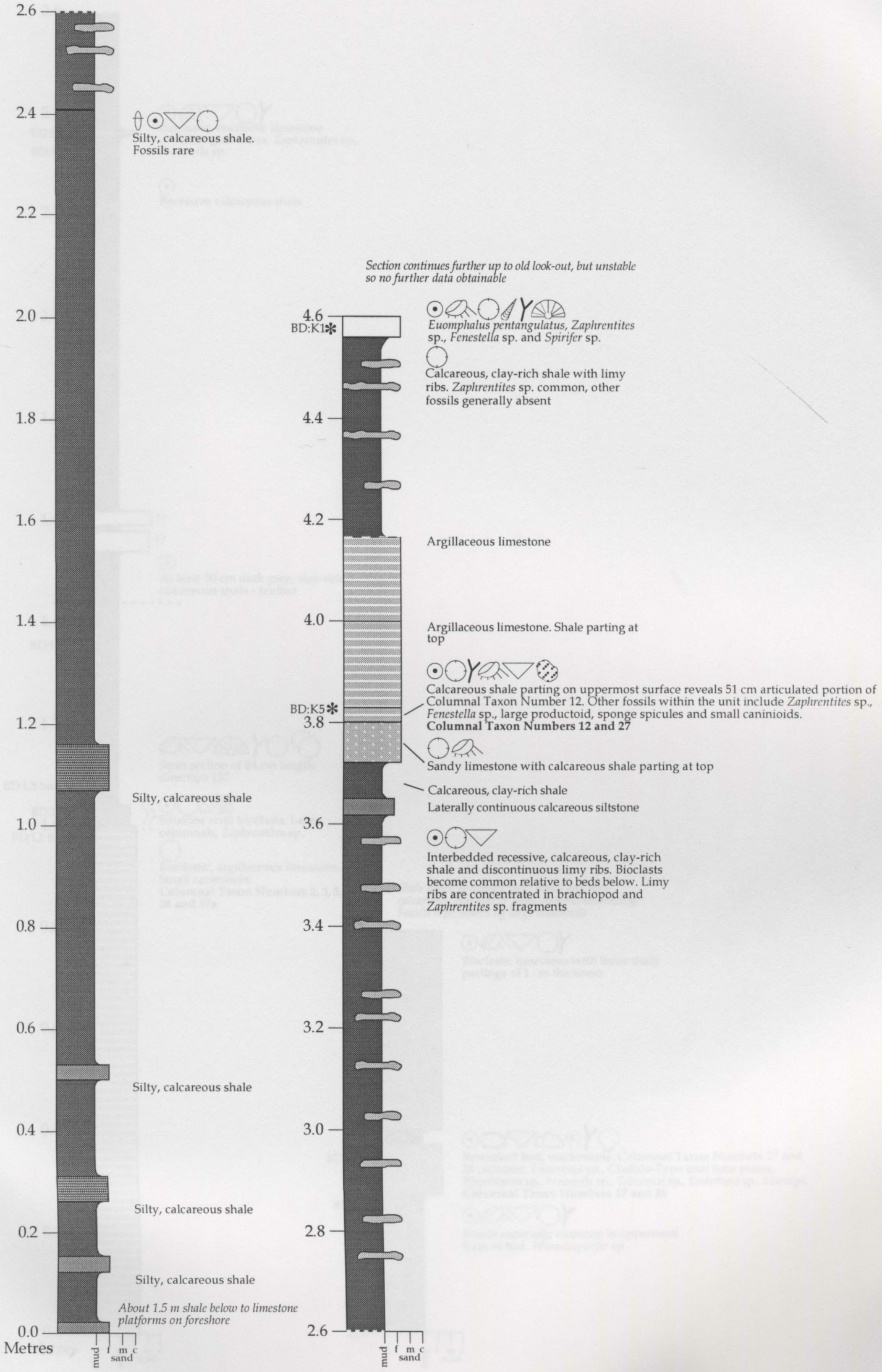


Figure A.35. Stratigraphical log of Section K at Bundoran (GR 8179 5898). Log shows beds BD:K19 to BD:K1 in the middle part of the Bundoran Shale Formation.

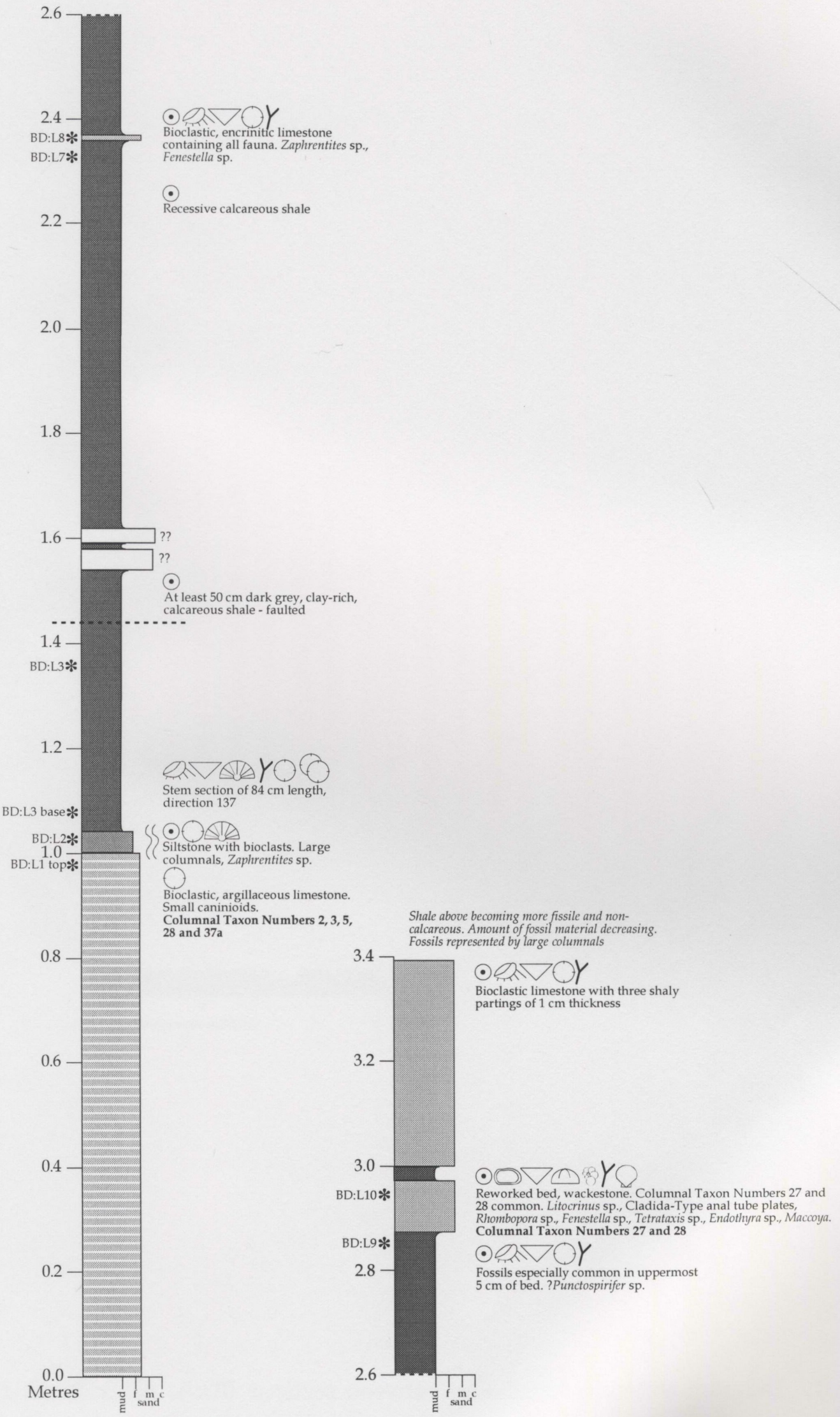
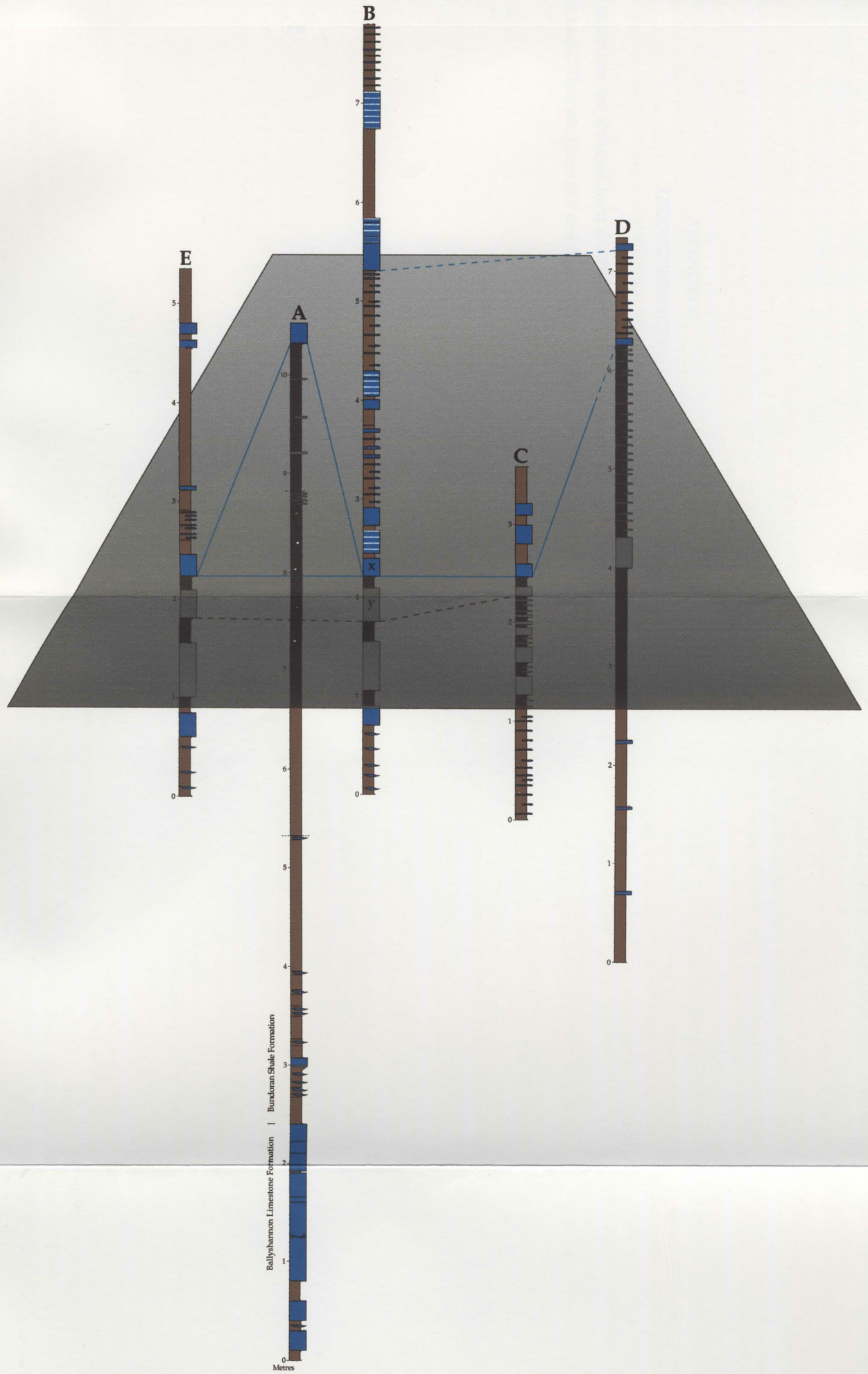


Figure A.36. Stratigraphical log of Section L at Bundoran (GR 8197 5919). Log shows beds BD:L1 to BD:L12 in the lower to middle part of the Bundoran Shale Formation.

Figure A.37. Diagram showing correlation between sections BD:A, BD:B, BD:C, BD:D and BD:E at Bundoran. Two limestone units, marker beds x and y, are used as index horizons where laterally traceable.


B
D
E
A
C
x
y
Ballyshannon Limestone Formation
Burdoran Shale Formation
Metres

APPENDIX B

GRID REFERENCES

All grid references are obtained from the 1913 Ordnance Survey of Ireland 1:25,000 (4 cm/1 km) maps. They are given as 8 or 6 digits and are prefixed GR in the main text.

Locality	*Sample prefix*	*Grid ref.*	*Stratigraphical unit(s)*
Downpatrick Head	DP1	1231 4273	Downpatrick Fm
	DP2	1265 4291	Moyny Lst Fm
	DP3a	1277 4282	Moyny Lst Fm
	DP3b	1284 4280	Moyny Lst Fm
Kilcummin Head	KK1	2094 3835	Ballina Lst Fm (Lower)
	KK2	2086 3834	Ballina Lst Fm (Lower)
	KK3	2112 3800	Ballina Lst Fm (Lower)
	KK4	2068 3826	Ballina Lst Fm (Lower)
Ballinlena Pier	BL	2130 3680	Ballina Lst Fm (Lower)
Easky	EY1	3876 3857	Ballina Lst Fm (Upper)
	EY2	3875 3862	Ballina Lst Fm (Upper)
Lackavarna	CM1 & CM2	4271 3578	Glencar Lst Fm
	LV1	4279 3581	Glencar Lst Fm
	LV2	4285 3583	Glencar Lst Fm
	LV3	4287 3587	Glencar Lst Fm
	LV4	4290 3589	Glencar Lst Fm
	LV5	4291 3591	Glencar Lst Fm
	LV6	4293 3594	Glencar Lst Fm
	LV7	4295 3597	Glencar Lst Fm
	LV8	4302 3598	Glencar Lst Fm
	LV9	4311 3590	Glencar Lst Fm
Carrickphatrick	CP1	4395 3513	Mullaghmore Sst Fm/Benbulben Sh Fm
	CP2	4393 3512	Benbulben Sh Fm
	CP3	4366 3522	Benbulben Sh Fm
Pollnadivva Pier	PP1	4532 3455	Bundoran Sh Fm
	PP2	4480 3485	Mullaghmore Sst Fm
	PP3	4524 3457	Mullaghmore Sst Fm
Carrowmoran	CM:Hinge	4547 3439	Bundoran Sh Fm/Mullaghmore Sst Fm
Doonycoy	DC1	4670 3441	Benbulben Sh Fm
	DC2	4692 3431	Glencar Lst Fm
Kilrusheighter	PG	4835 3503	Ballina Lst Fm (Upper)
Serpent Rock	SR1	5630 4617	Glencar Lst Fm
	SR2	5630 4627	Glencar Lst Fm
	SR3	5645 4633	Glencar Lst Fm
	SR4	5653 4633	Glencar Lst Fm
Streedagh	STa	6352 5098	Benbulben Sh Fm
	ST1	6350 5099	Benbulben Sh Fm
	ST2	6345 5105	Benbulben Sh Fm
	ST3	6338 5115	Benbulben Sh Fm
	ST4	6335 5121	Benbulben Sh Fm
	ST5	6331 5126	Benbulben Sh Fm
	ST6	6311 5123	Glencar Lst Fm
	ST7	6300 5096	Glencar Lst Fm
	ST8	6284 5045	Glencar Lst Fm
	ST9	6281 5023	Benbulben Sh Fm
	ST10	6290 5030	Benbulben Sh Fm
Benbulben	BB	6865 4570	Benbulben Sh Fm
Gleniff	GF1	7296 4663	Benbulben Sh Fm
	GF2	7282 4661	?Benbulben Sh Fm/Glencar Lst Fm
Tievebaun	TM1 & TM2	7694 5105	Benbulben Sh Fm
	TM3 & TM4	7745 5092	Benbulben Sh Fm

Locality	*Sample prefix*	*Grid ref.*	*Stratigraphical unit(s)*
Rochfort Lodge	RL	7987 5895	Bundoran Sh Fm
Bundoran	BD:A	8191 5965	Bundoran Sh Fm
	BD:B	8191 5959	Bundoran Sh Fm
	BD:C	8193 5958	Bundoran Sh Fm
	BD:D	8199 5958	Bundoran Sh Fm
	FX (Flexible Shale)	819 595	Bundoran Sh Fm
	BD:E	8181 5963	Bundoran Sh Fm
	BD:F	8180 5913	Bundoran Sh Fm
	BD:G	8176 5901	Bundoran Sh Fm
	BD:H	8180 5895	Bundoran Sh Fm
	BD:I	8124 5880	Bundoran Sh Fm
	BD:J	8141 5875	Bundoran Sh Fm
	BD:K	8179 5898	Bundoran Sh Fm
	BD:L	8197 5919	Bundoran Sh Fm
	Long stem	8193 5957	Bundoran Sh Fm

APPENDIX C

CURATION OF SAMPLES

Crinoid specimens have been deposited in the Geological Museum, Trinity College Dublin. Although the collector's sample numbers are given in some cases, all specimens have been allocated five digit TCD specimen numbers, e.g. TCD.53046. These are listed along with identification (sometimes with cavity slide position), the horizon and the locality from which the sample was taken in the following appendix. Some crinoidal specimens have been allocated TCD specimen numbers even though they are not figured.

Small specimens are located in numbered cavity slides. Larger specimens are deposited in labelled plastic boxes. Where T, 1, 2 etc. are written in the boxes the morphotype specimens corresponding to those numbers of the columnal type are adhered to the box in their relevant positions, *i.e.* T=type, 1=V1 (variation 1), 2=V2, etc.. When a and b are used these are also written in the box.

Sorted residues which are not figured have also been allocated TCD specimen numbers as have thin sections.

Some sorted residues and bulk samples have not been allocated TCD specimen numbers, but they are labelled and are deposited in boxes in the cellar of the Geology Department, Trinity College Dublin.

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
28140	*Phanocrinus* cf. *calyx* (M'Coy, 1849) ?Glencar Limestone Fm (Asbian) Tievebaun Mountain, Co. Sligo (GR 7668 5082)	-	
28141	*Phanocrinus* cf. *calyx* (M'Coy, 1849) ?Glencar Limestone Fm (Asbian) Meenaphuill, near Glencar Lough (GR 7520 4224)	-	
35950	*Bundoranocrinus vermiculatus* gen. et sp. nov. Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35951	*Amphicrinus scoticus* Springer *in* Wright, 1914 Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35952	*Amphicrinus scoticus* Springer *in* Wright, 1914 Bundoran Shale Fm (?FX) (Arundian) Bundoran, Co. Donegal (approx. GR 819 595)	-	
35953	*Amphicrinus scoticus* Springer *in* Wright, 1914 Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35954	Columnal Taxon Number 38 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	38.V4-BB	
35955	*Onychocrinus polydactylus* (M'Coy, 1844) Benbulben Shale Fm (CP1:4) (Holkerian) Carrickphatrick, western Co. Sligo, (GR 4395 3513)	-	
35956	*Litocrinus* sp. (micro) (- in 'Litocrinus sp. 1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35957	*Platycrinites expansus* (M'Coy), 1844 Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35958	*Platycrinites expansus* (M'Coy), 1844 Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35959	cf. *Onychocrinus polydactylus* (M'Coy, 1844) Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35960	gen. et sp. indet. Flexibilia-Type pluricolumnal Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35961	*Bundoranocrinus vermiculatus* gen. et sp. nov. Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
35962	gen. et sp. indet. Platycrinitidae-Type Columnal 1 Bundoran Shale Fm (BD:B28) (Arundian) Bundoran, Co. Donegal (GR 8191 5959)	PC1-B28	
35963	gen. et sp. indet. Platycrinitidae-Type Columnal 2 Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	PC2-BB	
35964	Columnal Taxon Number 1a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1a.T-BB	
35965	Columnal Taxon Number 1a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1a.V1-BB	
35966	Columnal Taxon Number 1a gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	1a.V2-J8	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
35967	Columnal Taxon Number 1a gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	1a.V3-J8	
35968	Columnal Taxon Number 1a gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	1a.V4-J8	
35969	Columnal Taxon Number 1a gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	1a.V5-J12	
35970	Columnal Taxon Number 1b gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	1b.T-J8	
35971	Columnal Taxon Number 1c gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	1c.T-D1	
35972	Columnal Taxon Number 1d gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1d.T-BB	
35973	Columnal Taxon Number 1d gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1d.V1-BB	
35974	Columnal Taxon Number 1d gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1d.V2-BB	
35975	Columnal Taxon Number 1d gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	1d.V3-BB	
35976	Columnal Taxon Number 2 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	2.T-L1	
35977	Columnal Taxon Number 2 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	2.V1-D1	
35978	Columnal Taxon Number 2 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	2.V2-D1	
35979	Columnal Taxon Number 3 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	3.T-L1	
35980	Columnal Taxon Number 3 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	3.V1-L1	
35981	Columnal Taxon Number 3 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	3.V2-L1	
35982	Columnal Taxon Number 4 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	4.T-D1	
35983	Columnal Taxon Number 5 gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	5.T-J8	
35984	Columnal Taxon Number 5 gp. nov. Bundoran Shale Fm (BD:J8) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	5.V1-J8	
35985	Columnal Taxon Number 5 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	5.V2-L1	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
35986	Columnal Taxon Number 6 gp. nov. Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	6.T-E5	
35987	Columnal Taxon Number 7 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	7.T-D1	
35988	Columnal Taxon Number 8 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	8.T-D1	
35989	Columnal Taxon Number 9 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	9.T-D1	
35990	Columnal Taxon Number 9 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	9.V1-D1	
35991	Columnal Taxon Number 9 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	9.V2-D1	
35992	Columnal Taxon Number 10 gp. nov. Bundoran Shale Fm (BD:G) (Arundian) Bundoran, Co. Donegal (GR 8176 5901)	10.T-G	
35993	Columnal Taxon Number 11 gp. nov. Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	11.T-D1	
35994	Columnal Taxon Number 12 gp. nov. Bundoran Shale Fm (BD:K5) (Arundian) Bundoran, Co. Donegal (GR 8179 5898)	12.K5a	
35995	Columnal Taxon Number 12 gp. nov. Bundoran Shale Fm (BD:K5) (Arundian) Bundoran, Co. Donegal (GR 8179 5898)	12.K5b	
35996	Columnal Taxon Number 13 gp. nov. (micro) (- in 'Columnals A:13') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	13.T-D1	
35997	Columnal Taxon Number 14 gp. nov. (micro) (- in 'Columnals A:14') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	14.T-D1	
35998	Columnal Taxon Number 15 gp. nov. (micro) (- in 'Columnals B:15') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	15.T-D1	
35999	Columnal Taxon Number 16 gp. nov. (micro) (- in 'Columnals B:16') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	16.T-FX	
53000	Columnal Taxon Number 17 gp. nov. (micro) (- in 'Columnals B:17') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	17.T-FX	
53001	Columnal Taxon Number 18 gp. nov. (micro) (- in 'Columnals B:18') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	18.T-FX	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53002	Columnal Taxon Number 19 gp. nov. (micro) (- in 'Columnals C:19') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	19.T-FX	
53003	Columnal Taxon Number 20 gp. nov. (micro) (- in 'Columnals C:20') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	20.T-FX	
53004	Columnal Taxon Number 21 gp. nov. (micro) (- in 'Columnals C:21') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	21.T-D1	
53005	Columnal Taxon Number 22 gp. nov. (micro) (- in 'Columnals C:22') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	22.T-D1	
53006	Columnal Taxon Number 23 gp. nov. (micro) (- in 'Columnals D:23') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	23.T-D1	
53007	Columnal Taxon Number 24 gp. nov. (micro) (- in 'Columnals D:24') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	24.T-D1	
53008	Columnal Taxon Number 25 gp. nov. (micro) (- in 'Columnals D:25') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	25.T-D1	
53009	Columnal Taxon Number 26 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	26.T-BB	
53010	Columnal Taxon Number 27 gp. nov. Bundoran Shale Fm (BD:K5) (Arundian) Bundoran, Co. Donegal (GR 8179 5898)	27.T-K5	
53011	Columnal Taxon Number 28 gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	28.T-L1	
53012	Columnal Taxon Number 28 gp. nov. Bundoran Shale Fm (BD:A23) (Arundian) Bundoran, Co. Donegal (GR 8191 5965)	28.V1-A23	
53013a 53013b	Columnal Taxon Number 28 gp. nov. Bundoran Shale Fm (BD:B28) (Arundian) Bundoran, Co. Donegal (GR 8191 5959)	28.V2-B28 part and counterpart	
53014	Columnal Taxon Number 29 gp. nov. (micro) (- in 'Columnals D:29.T') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	29.T-D1	
53015	Columnal Taxon Number 29 gp. nov. (micro) (- in 'Columnals E:29.V1') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	29.V1-D1	
53016	Columnal Taxon Number 30 gp. nov. (micro) (- in 'Columnals E:30.T') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	30.T-D1	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53017	Columnal Taxon Number 30 gp. nov. (micro) (- in 'Columnals F:30.V1') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	30.V1-D1	
53018	Columnal Taxon Number 31 gp. nov. (micro) (- in 'Columnals E:31') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	31.T-D1	
53019	Columnal Taxon Number 32 gp. nov. (micro) (- in 'Columnals E:32') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	32.T-D1	
53020	Columnal Taxon Number 33 gp. nov. (micro) (- in 'Columnals F:33') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	33.T-D1	
53021	Columnal Taxon Number 34 gp. nov. (micro) (- in 'Columnals F:34') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	34.T-D1	
53022	Columnal Taxon Number 35 gp. nov. Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	35.T-E2	
53023	Columnal Taxon Number 35 gp. nov. Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	35.V1-E2	
53024	Columnal Taxon Number 35 gp. nov. Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	35.V2-E2	
53025	Columnal Taxon Number 35 gp. nov. Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	35.V3-E2	
53026	Columnal Taxon Number 36 gp. nov. Benbulben Shale Fm (CP3a) (Holkerian) Carrickphatrick, western Co. Sligo, (GR 4366 3522)	36.T-CP3a	
53027	Columnal Taxon Number 37a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	37a.T-BB	
53028	Columnal Taxon Number 37a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	37a.V1-BB	
53029	Columnal Taxon Number 37a gp. nov. Bundoran Shale Fm (BD:L1) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	37a.V2-L1	
53030	Columnal Taxon Number 37b gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	37b.T-BB	
53031	Columnal Taxon Number 37b gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	37b.V1-BB	
53032	Columnal Taxon Number 38 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	38.T-BB	
53033	Columnal Taxon Number 38 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	38.V1-BB	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53034	Columnal Taxon Number 38 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	38.V2-BB	
53035	Columnal Taxon Number 38 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	38.V3-BB	
53037	Columnal Taxon Number 39 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	39.T-BB	
53038	Columnal Taxon Number 39 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	39.V1-BB	
53039	Columnal Taxon Number 39 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	39.V2-BB	
53040	Columnal Taxon Number 39 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	39.V3-BB	
53041	Columnal Taxon Number 40 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	40.T-BB	
53042	Columnal Taxon Number 41 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	41.T-BB	
53043	Columnal Taxon Number 42a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	42a.T-BB	
53044	Columnal Taxon Number 42a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	42a.V1-BB	
53045	Columnal Taxon Number 42b gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	42b.T-BB	
53046	Columnal Taxon Number 43 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	43.T-BB	
53047	Columnal Taxon Number 44 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	44.T-BB	
53048	Columnal Taxon Number 44 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	44.V1-BB	
53049	Columnal Taxon Number 45 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	45.T-BB	
53050	Columnal Taxon Number 46a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	46a.T-BB	
53051	Columnal Taxon Number 46b gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	46b.T-BB	
53052	Columnal Taxon Number 47 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	47.T-BB	
53053	Columnal Taxon Number 48 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	48.T-BB	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53054	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.T-BB	
53055	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.V1-BB	
53056	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.V2-BB	
53057	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.V3-BB	
53058	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.V4-BB	
53059	Columnal Taxon Number 49 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	49.V5-BB	
53060	Columnal Taxon Number 50 gp. nov. (micro) (- in 'Columnals F:50') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	50.T-D1	
53061	Columnal Taxon Number 51 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	51.T-BB	
53062	Columnal Taxon Number 52a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	52a.T-BB	
53063	Columnal Taxon Number 52a gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	52a.V1-BB	
53064	Columnal Taxon Number 52b gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	52b.T-BB	
53065	Columnal Taxon Number 52c gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	52c.T-BB	
53066	Columnal Taxon Number 53 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	53.T-BB	
53067	Cirral Taxon Number 1 gp. nov. (micro) (- in 'Cirrals A:1') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	CR1.T-D1	
53068	Cirral Taxon Number 2 gp. nov. (micro) (- in 'Cirrals A:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	CR2.T-FX	
53069	Cirral Taxon Number 3 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	CR3.T-BB	
53070	Bored pluricolumnal Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53171	*Amphicrinus scoticus* Springer *in* Wright, 1914 Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53172	gen. et sp. indet. Cladida-Type Infrabasal Circlet 1 (micro) (- in 'Infrabasal circlets A:1') Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53173	gen. et sp. indet. Catillocrinidae?-Type Radial Plate 1 (micro) (- in 'Radials A:1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53174	gen. et sp. indet. Cladida-Type Infrabasal Plate 1 (micro) (- in 'Infrabasals A:1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53175	gen. et sp. indet. Flexibilia-Type Brachial 1 (- in 'Brachials A:1)' Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53176	gen. et sp. indet. Flexibilia-Type Brachial 2 (- in 'Brachials C:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	FXBr2.T	
53177	gen. et sp. indet. Cladida-Type Brachial 1 (- in 'Brachials A:3') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53178	gen. et sp. indet. Cladida-Type Brachial 2 (- in 'Brachials B:4') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53179	gen. et sp. indet. Cladida-Type Brachial 3 (- in 'Brachials A:5') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53180	gen. et sp. indet. Cladida-Type Brachial 4 (- in 'Brachials B:6') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53181	gen. et sp. indet. Cladida-Type Brachial 5 (- in 'Brachials A:7') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53182	gen. et sp. indet. Cladida-Type Brachial 6 (- in 'Brachials C:8') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53183	Holdfast 1, attached to pluricolumnal (- in 'Holdfasts A:1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53184	*Fistulipora incrustans* (Phillips, 1836) encrusting pluricolumnal (- in 'Bryozoans A:1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53185	gen. et sp. indet. Cladida-Type Anal Tube Plate 1 (- in 'Misc. crinoid ossicles 1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53186	Blastoid Lancet Plate (- in 'Other echinoderm ossicles 1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53187	Thin section Bundoran Shale Fm (BD:A23) (Arundian) Bundoran, Co. Donegal (GR 8191 5965)	BD:A23	
53188	Thin section Bundoran Shale Fm (BD:B28) (Arundian) Bundoran, Co. Donegal (GR 8191 5959)	BD:B28a	
53189	Thin section Bundoran Shale Fm (BD:B28) (Arundian) Bundoran, Co. Donegal (GR 8191 5959)	BD:B28b, a	
53190	Thin section Bundoran Shale Fm (BD:B28) (Arundian) Bundoran, Co. Donegal (GR 8191 5959)	BD:B28b, b	
53191	Thin section Bundoran Shale Fm (BD:E5) (Arundian) Bundoran, Co. Donegal (GR 8181 5963)	BD:E1	
53192	Thin section Bundoran Shale Fm (BD:H4) (Arundian) Bundoran, Co. Donegal (GR 8180 5895)	BD:H4	
53193	Thin section Bundoran Shale Fm (BD:I3) (Arundian) Bundoran, Co. Donegal (GR 8124 5880)	BD:I3	
53194	Thin section Bundoran Shale Fm (BD:J1) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	BD:J1	
53195	Thin section Bundoran Shale Fm (BD:J3) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	BD:J3	
53196	Thin section Bundoran Shale Fm (BD:Jup) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	BD:Jup, a	
53197	Thin section Bundoran Shale Fm (BD:Jup) (Arundian) Bundoran, Co. Donegal (GR 8141 5875)	BD:Jup, b	
53198	Thin section Bundoran Shale Fm (BD:L2) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	BD:L2	
53199	Thin section Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	BD:L10, a	
53200	Thin section Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	BD:L10, b	
53201	Thin section Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	BB	
53202	Thin section Benbulben Shale Fm (CP1:4) (Holkerian) Carrickphatrick, western Co. Sligo, (GR 4395 3513)	CP1:4, b	
53203	Thin section Benbulben Shale Fm (ST3:67) (Holkerian) Streedagh Point, Co. Sligo, (GR 6338 5115)	ST3:67	
53204	Thin section Benbulben Shale Fm (ST2:34) (Holkerian) Streedagh Point, Co. Sligo, (GR 6345 5105)	ST34:base, b	
53205	Thin section Benbulben Shale Fm (ST5:128) (Holkerian) Streedagh Point, Co. Sligo, (GR 6331 5126)	ST5:128	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53206	Thin section Benbulben Shale Fm (ST10) (Holkerian) Streedagh Point, Co. Sligo, (GR 6290 5030)	ST10	
53207	Thin section Benbulben Shale Fm, (Holkerian) Streedagh Point, Co. Sligo, (from beach)	ST Lithostrotion	
53208	Thin section Glencar Limestone Fm (LV1:1) (Holkerian) Lackavarna, western Co. Sligo, (GR 4279 3581)	LV1:1	
53209	Thin section Glencar Limestone Fm (CM2) (Holkerian) Lackavarna, western Co. Sligo, (GR 4271 3578)	CM2:a	
53210	Thin section Glencar Limestone Fm (LV3:18) (Holkerian) Lackavarna, western Co. Sligo, (GR 4287 3587)	LV3:18, a	
53211	Thin section Glencar Limestone Fm (SR3) (Holkerian) Serpent Rock, Co. Sligo, (GR 5645 4633)	SERP	
53212	Thin section (coral) Ballina Limestone Formation (Lower) (Asbian) Kilcummin Head, Co. Mayo	Kilcummin coral	
53213	Thin section Ballina Limestone Formation (Lower) (KK3:3b) (Asbian) Kilcummin Head, Co. Mayo, (GR 2112 3800)	KK3b burrow	
53214	Thin section Ballina Limestone Formation (Lower) (KK3:4) (Asbian) Kilcummin Head, Co. Mayo, (GR 2112 3800)	KK3:4, a	
53215	Thin section Ballina Limestone Formation (Lower) (KK3:3) (Asbian) Kilcummin Head, Co. Mayo, (GR 2112 3800)	KK3:3	
53216	Thin section Ballina Limestone Formation (Lower) (BL1) (Asbian) Ballinlena Pier, Co. Mayo, (GR 2130 3680)	BL1	
53217	Thin section Ballina Limestone Formation (Lower) (BL1) (Asbian) Ballinlena Pier, Co. Mayo, (GR 2130 3680)	BL3	
53218	Thin section Moyny Limestone Formation (DP3a:1) (Lower Viséan) Downpatrick Head, Co. Mayo, (GR 1277 4282)	DP3:1	
53219	Thin section Moyny Limestone Formation (DP3a:2e) (Lower Viséan) Downpatrick Head, Co. Mayo, (GR 1277 4282)	DP3:2e	
53220	Thin section Moyny Limestone Formation (DP2:2) (Lower Viséan) Downpatrick Head, Co. Mayo, (GR 1265 4291)	DP2:2	
53221	gen. et sp. indet. Cladida-Type Anal Tube Plate 2 (- in 'Misc. crinoid ossicles 2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53222	Blastoid Lancet Plate, not figured (- in 'Other echinoderm ossicles 2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53223	*Sulcoretepora parallela* (Phillips, 1836) encrusting pluricolumnal (- in 'Bryozoans A:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53224	gen. et sp. indet. Cladida-Type Infrabasal Circlet 2, not figured (micro) (- in 'Infrabasal circlets A:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53225	gen. et sp. indet. Cladida-Type Infrabasal Circlet 3, not figured (micro) (- in 'Infrabasal circlets A:3') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53226	gen. et sp. indet. Cladida-Type Infrabasal Circlet 4, not figured (micro) (- in 'Infrabasal circlets A:4') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53227	gen. et sp. indet. Cladida-Type Infrabasal Plate 2 (micro) (- in 'Infrabasals A:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53228	Radial Plate 1, not figured (micro) (- in 'Radials A:2)' Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53229	Radial Plate 2, not figured (micro) (- in 'Radials A:3') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53230	Radial Plate 3 (micro) (- in 'Radials A:4') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53231	Radial Plate 4, not figured (micro) (- in 'Radials B:1') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53232	Radial Plate 5, not figured (micro) (- in 'Radials B:2') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53233	Ten flexible brachials, not figured (- in 'Flexibilia brachials') Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	-	
53234	Sorted sample of columnals, not figured or described Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53235	Sorted sample of columnals, not figured or described Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53236	Sorted sample of calycal plates, not figured or described Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53237	Sorted sample of brachial plates, not figured or described Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53238	Sorted sample of other fauna, not figured or described Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53239	Sorted sample of columnals, not figured or described Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53240	Sorted crinoidal material (not columnals), not figured or described Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	

TCD No.	Identification (- cavity slide position) Horizon Locality, Grid Reference	Collector No.	Plate and fig. no.
53241	gen. et sp. indet. Cladida-Type Anal Tube Plate 3, not figured (- in 'Misc. crinoid ossicles 3') Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53242	*Maccoya* ambulacral ossicles, (- in 'Other echinoderm ossicles 3') Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53243	Crinoid Thecal Plate 1, not figured (- in 'Misc. crinoid ossicles 4') Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53244	*Maccoya* interambulacral ossicle, not figured (- in 'Other echinoderm ossicles 4') Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53245	Unpicked 60 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53246	Unpicked 120 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53247	Unpicked 60 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53248	Unpicked 120 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53249	Unpicked 120 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53250	Unpicked 120 mesh shale residue Bundoran Shale Fm (BD:D1) (Arundian) Bundoran, Co. Donegal (GR 8199 5958)	-	
53251	Sorted sample of *Litocrinus* sp. thecae, not figured (- in 'Litocrinus sp. 2') Bundoran Shale Fm (BD:L10) (Arundian) Bundoran, Co. Donegal (GR 8197 5919)	-	
53252	gen. et sp. indet. Flexibilia-Type Brachial 2 (- in 'Brachials D:9)' Bundoran Shale Fm (FX) (Arundian) Bundoran, Co. Donegal (GR 819 595)	FXBr2.V1	
53253	Columnal Taxon Number 47 gp. nov. Benbulben Shale Fm (BB) (Holkerian) Barnarobin, Benbulben Mountain, Co. Sligo (GR 6865 4570)	47.V1-BB	

APPENDIX D

MORPHOLOGICAL TABLE

This appendix is a quick reference table showing which columnals (x-axis) have which morphological features (y-axis). It can be found as a loose enclosure in the back of this volume.

APPENDIX E

OSSICLES PRESENT IN SAMPLES

The following appendix is a quick reference table showing which columnals (x-axis) are present in which samples (y-axis).

Bed\Col. no.	Platy.-Type Col. 1	Platy.-Type Col. 2	Flex.-Type Pluricol	1a	1b	1c	1d	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37a	37b	38	39	40	41	42	43	44	45	46a	46b	47	48	49	50	51	52a	52b	52c	53	CR1	CR2	CR3
DP3a:2																																																																					
KK3:-3																																																																										
KK3:2																																																																										
KK3:4																																																																										
BL:2																																																																										
BL:4																																																																										
EY1:5																																																																										
LV8:39																																																																										
LV8:36																																																																										
LV7:29																																																																										
LV6:25																																																																										
LV4:21																																																																										
LV4:19																																																																										
LV2:17																																																																										
LV2:12																																																																										
LV1:3																																																																										
LV1:1																																																																										
CP1:-1																																																																										
CP1:4																																																																										
CP3a																																																																										
CM:Hinge																																																																										
DC1																																																																										
STa:a base																																																																										
STa:a top																																																																										
STa:c																																																																										
ST1:																																																																										
ST2:																																																																										
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BD:A12																																																																										
BD:A14																																																																										
BD:A19																																																																										
BD:A22																																																																										
BD:A23																																																																										
BD:B28																																																																										
BD:C1																																																																										
BD:C3																																																																										
BD:C5																																																																										
BD:C11																																																																										
BD:C19																																																																										
BD:D1																																																																										
BD:FX																																																																										
BD:E2																																																																										
BD:E5																																																																										
BD:E8																																																																										
BD:F1																																																																										
BD:G																																																																										
BD:H4																																																																										
BD:H1																																																																										
BD:I4																																																																										
BD:I2																																																																										
BD:J12																																																																										
BD:J10																																																																										
BD:J8																																																																										
BD:K5																																																																										
BD:L1 top																																																																										
BD:L3 base																																																																										
BD:L3																																																																										
BD:L7																																																																										
BD:L9																																																																										

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APPENDIX F

PROCESSING OF SAMPLES

The following appendix gives a brief description of the specimen and which extraction and cleaning processes it has undergone.

Sample number	*Description*	*Hydrofluoric Acid*	*Hydrogen Peroxide*	*Washed*	*Quaternary-O*
Platycrinitidae Col. 1					
Platycrinitidae Col. 2			30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
Flexible pluricolumnal					
1a.T-BB	pluricolumnal of 10				
1a.V1-BB	single columnal				
1a.V2-J8	pluricolumnal of 3	40-45%: 5 mins			
1a.V3-J8	single columnal				
1a.V4-J8	pluricolumnal of 2				
1a.V5-J12	pluricolumnal of 6				
1b.T-J8	pluricolumnal of 4	40-45%: 5 mins			
1c.T-D1	pluricolumnal of 4		20% vol. until effervescing ceased		boiled 1.5 hours, soaked 1 week
1d.T-BB	pluricolumnal of 7		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
1d.V1-BB	pluricolumnal of 2		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
1d.V2-BB	single columnal		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
1d.V3-BB	pluricolumnal of 2		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
2.T-L1	pluricolumnal of 10	40-45%: 5 mins			
2.V1-D1	single columnal	40-45%: 5 mins			boiled 1.5 hours, soaked 1 week
2.V2-D1	pluricolumnal of 5	40-45%: 5 mins			boiled 1.5 hours, soaked 1 week
3.T-L1	single columnal	40-45%: 6 mins			
3.V1-L1	single columnal	40-45%: 3 mins			
3.V2-L1	pluricolumnal of 4				
4.T-D1	pluricolumnal of 4	40-45%: 9 mins			boiled 1.5 hours, soaked 1 week
5.T-J8	pluricolumnal of 8				
5.V1-J8	pluricolumnal of 6	40-45%: 5 mins			
5.V2-L1	pluricolumnal of 4	40-45%: 4 mins			
6.T-E5	pluricolumnal of ?4	40-45%: 3 mins			
7.T-D1	single columnal	40-45%: 3 mins			boiled 1.5 hours, soaked 1 week
8.T-D1	pluricolumnal of 5	40-45%: 4 mins			boiled 1.5 hours, soaked 1 week
9.T-D1	pluricolumnal of 11	40-45%: 5 mins			boiled 1.5 hours, soaked 1 week
9.V1-D1	pluricolumnal of 8	40-45%: 9 mins			boiled 1.5 hours, soaked 1 week
9.V2-D1	pluricolumnal of 7	40-45%: 5 mins			boiled 1.5 hours, soaked 1 week
10.T-G	pluricolumnal of 7	40-45%: 6 mins			
11.T-D1	pluricolumnal of 3	40-45%: 5 mins			boiled 1.5 hours, soaked 1 week

Sample number	*Description*	*Hydrofluoric Acid*	*Hydrogen Peroxide*	*Washed*	*Quaternary-O*
12.K5a	pluricolumnal of 29	40-45%: 5 mins			
12.K5b	pluricolumnal of 32	40-45%: 5 mins			
13.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
14.T-D1	single columnal	3.6%: 1 week			
15.T-D1	single columnal	3.6%: 1 week			
16.T-FX	pluricolumnal of 3				
17.T-FX	pluricolumnal of 2				
18.T-FX	single columnal				
19.T-FX	single columnal				
20.T-FX	pluricolumnal of 2				
21.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
22.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
23.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
24.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
25.T-D1	pluricolumnal of 2	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
26.T-BB	pluricolumnal of 16			scrubbed toothbrush/water	
27.T-K5	single columnal				
28.T-L1	pluricolumnal of 13	40-45%: 3 mins			
28.V1-A23	pluricolumnal of 6				
28.V2-B28	pluricolumnal of 11				
29.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
29.V1-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
30.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
30.V1-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
31.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
32.T-D1	pluricolumnal of 3	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
33.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
34.T-D1	single columnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
35.T-E2	pluricolumnal of 4	40-45%: 9.5 mins			
35.V1-E2	pluricolumnal of 6	40-45%: 9.5 mins			
35.V2-E2	pluricolumnal of 2	40-45%: 9.5 mins			
35.V3-E2	pluricolumnal of 2	40-45%: 9.5 mins			
36.T-CP3a	single columnal				

Sample number	*Description*	*Hydrofluoric Acid*	*Hydrogen Peroxide*	*Washed*	*Quaternary-O*
37a.T-BB	pluricolumnal of 4				
37a.V1-BB	single columnal				
37a.V2-L1	single columnal				
37b.T-BB	pluricolumnal of 2	40-45%: 3 mins			
37b.V1-BB	pluricolumnal of 3		30% vol.: 5 mins	scrubbed toothbrush/detergent	
38.T-BB	pluricolumnal of 2	40-45%: 3 mins			
38.V1-BB	pluricolumnal of 4		30% vol.: 5 mins	scrubbed toothbrush/detergent	
38.V2-BB	pluricolumnal of 6		30% vol.: 5 mins	scrubbed toothbrush/detergent	
38.V3-BB	single columnal	40-45%: 3 mins			
38.V4-BB	pluricolumnal of 112			scrubbed toothbrush/Jif: weak HCl overnight	
39.T-BB	pluricolumnal of 3				
39.V1-BB	pluricolumnal of 5	40-45%: 3 mins			
39.V2-BB	single columnal	40-45%: 3 mins			
39.V3-BB	single columnal	40-45%: 3 mins			
40.T-BB	pluricolumnal of 5		30% vol.: 5 mins	scrubbed toothbrush/detergent	
41.T-BB	single columnal				
42a.T-BB	pluricolumnal of 10	40-45%: 6 mins		scrubbed toothbrush/water	
42a.V1-BB	pluricolumnal of 12	40-45%: 6 mins		scrubbed toothbrush/water	
42b.T-BB	pluricolumnal of 14	40-45%: 6 mins		scrubbed toothbrush/water	
43.T-BB	single columnal				
44.T-BB	pluricolumnal of 10				
44.V1-BB	single columnal				
45.T-BB	pluricolumnal of 2	40-45%: 4 mins			
46a.T-BB	pluricolumnal of 2	40-45%: 6 mins			
46b.T-BB	pluricolumnal of 6	40-45%: 6 mins			
47.T-BB	pluricolumnal of 6				
47.V1-BB	pluricolumnal of 3				
48.T-BB	pluricolumnal of 12		30% vol.: 5 mins	scrubbed toothbrush/detergent	
49.T-BB	single columnal		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
49.V1-BB	pluricolumnal of 5		30% vol. until effervescing ceased	scrubbed toothbrush/detergent	
49.V2-BB	pluricolumnal of 5				
49.V3-BB	pluricolumnal of 3				
49.V4-BB	pluricolumnal of 5				

Sample number	*Description*	*Hydrofluoric Acid*	*Hydrogen Peroxide*	*Washed*	*Quaternary-O*
49.V5-BB	pluricolumnal of 2				
50.T-D1	pluricolumnal of 2	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
51.T-BB	single columnal		30% vol.: 5 mins	scrubbed toothbrush/detergent	
52a.T-BB	pluricolumnal of 2		30% vol.: 5 mins	scrubbed toothbrush/detergent	
52a.V1-BB	pluricolumnal of 3	40-45%: 9 mins			
52b.T-BB	pluricolumnal of 4			scrubbed toothbrush/detergent	
52c.T-BB	pluricolumnal of 4		30% vol.: 5 mins	scrubbed toothbrush/detergent	
53.T-BB	single columnal	40-45%: 4 mins			
CR1.T-D1	single cirral	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
CR2.T-FX	pluricirral of 3				
CR3.T-BB	pluricirral of 7				
35995	*Onychocrinus polydactylus*			scrubbed toothbrush/detergent; picked/needle	
53070	bored pluricolumnal	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
53172	infrabasal circlet	3.6%: 1 week			boiled 1.5 hours, soaked 1 week
53234	residue; columnals	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53235	30 mesh residue; columnals				boiled 1.5 hours, soaked 1 week
53236	30 mesh residue; calycal plates				boiled 1.5 hours, soaked 1 week
53237	30 mesh residue; brachials				boiled 1.5 hours, soaked 1 week
53238	30 mesh residue; other fauna				boiled 1.5 hours, soaked 1 week
53239	30 mesh residue; columnals				boiled 1.5 hours, soaked 1 week
53240	30 mesh ossicle residue; not columnals	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53241	cladid anal tube plate	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53242	*Maccoya* ambulacral ossicles	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53243	crinoid thecal plate	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53244	*Maccoya* interambulacral ossicle	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week
53245	unpicked shale residue (60 mesh)				boiled 1.5 hours, soaked 1 week
53246	unpicked shale residue (120 mesh)				boiled 1.5 hours, soaked 1 week
53247	unpicked shale residue (60 mesh)				boiled 2 hours, soaked 40 hours
53248	unpicked shale residue (120 mesh)				boiled 2 hours, soaked 40 hours
53249	unpicked shale residue (120 mesh)				boiled 1.5 hours, soaked 22 hours
53250	unpicked shale residue (120 mesh)				boiled 1.5 hours, soaked 1 week
53251	*Litocrinus* sp. from 30 mesh residue	3.6%: 1 weekend			boiled 1.5 hours, soaked 1 week

PLATES

PLATE 1

(see Section 2.4.2.)

Field photograph of section at Aughrus Point, Bundoran (Arundian), Co. Donegal, showing the lowest beds of the Bundoran Shale Formation (type section). Photographs fit together, the lower one adjoining the right of the upper one. Section shows Localities BD:A to BD:E. Thick shales of Locality BD:D just to right of steps on lower photograph.

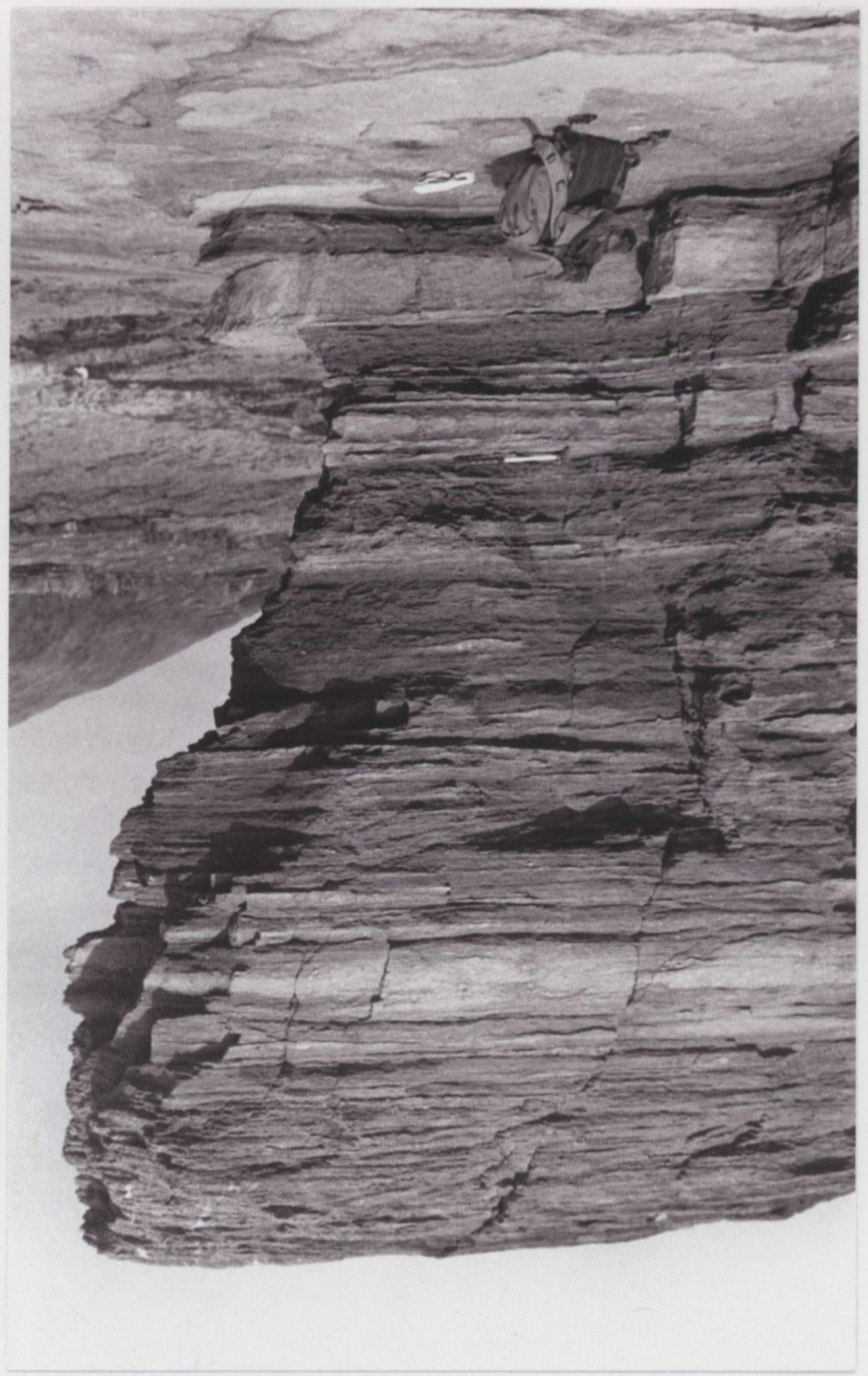




PLATE 2

(see Section 2.4.2.)

Figs a-b. Locality BD:E, just above the base of the Bundoran Shale Formation (type section) at Aughrus Point, Bundoran (Arundian), Co. Donegal. a, field photograph of section, section comprises interbedded calcareous, clay-rich shale and bioclastic limestone (rucksack for scale). b, Bed BD:E9, 7 cm thick encrinite (chisel = 15 cm).



a



b

PLATE 3

(see Section 2.4.2.)

Fig. a. Crinoidal (mostly stem) debris at Locality BD:E (see previous plate).

Fig. b. Crinoidal debris (mostly stem) on surface of Bed BD:L10 (Locality BD:L) in the lower to middle part of the Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal.



a



b

PLATE 4

(see Section 2.4.2.)

Figs a-b. Locality BD:B, just above the base of the Bundoran Shale Formation at Aughrus Point, Bundoran (Arundian), Co. Donegal. a, productoid brachiopods overturned from their life positions on surface of limestone. b, siliceous sponge root tufts in life position on surface of shale.



a



b

PLATE 5

(see Sections 6.3. and 2.4.2.)

Fig. a. Stem section of comprised of columnals of Columnal Taxon Number 12. Preserved portion measures 51 cm in length, but the external mould impression gives a total length of 91 cm. Found on Bed BD:K5, a calcareous shale parting, in the middle part of the Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal.

Fig. b. *Zaphrentites* sp., solitary corals dominate surface of shale platform at Locality BD:H, in the middle part of the Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal.



a



b

PLATE 6

(see Section 2.4.2.)

Fig. a. Field photograph of section at Locality BD:F, in the middle part of the Bundoran Shale Formation at Bundoran (Arundian), Co. Donegal. Section comprises calcareous clay-rich shales with subordinate limestones.

Fig. b. Small caninioid (right) and large *Delpinea* sp. (left) on limestone platforms below Bed BD:I8 at Locality BD:I, in the upper part of the Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal.



a



b

PLATE 7

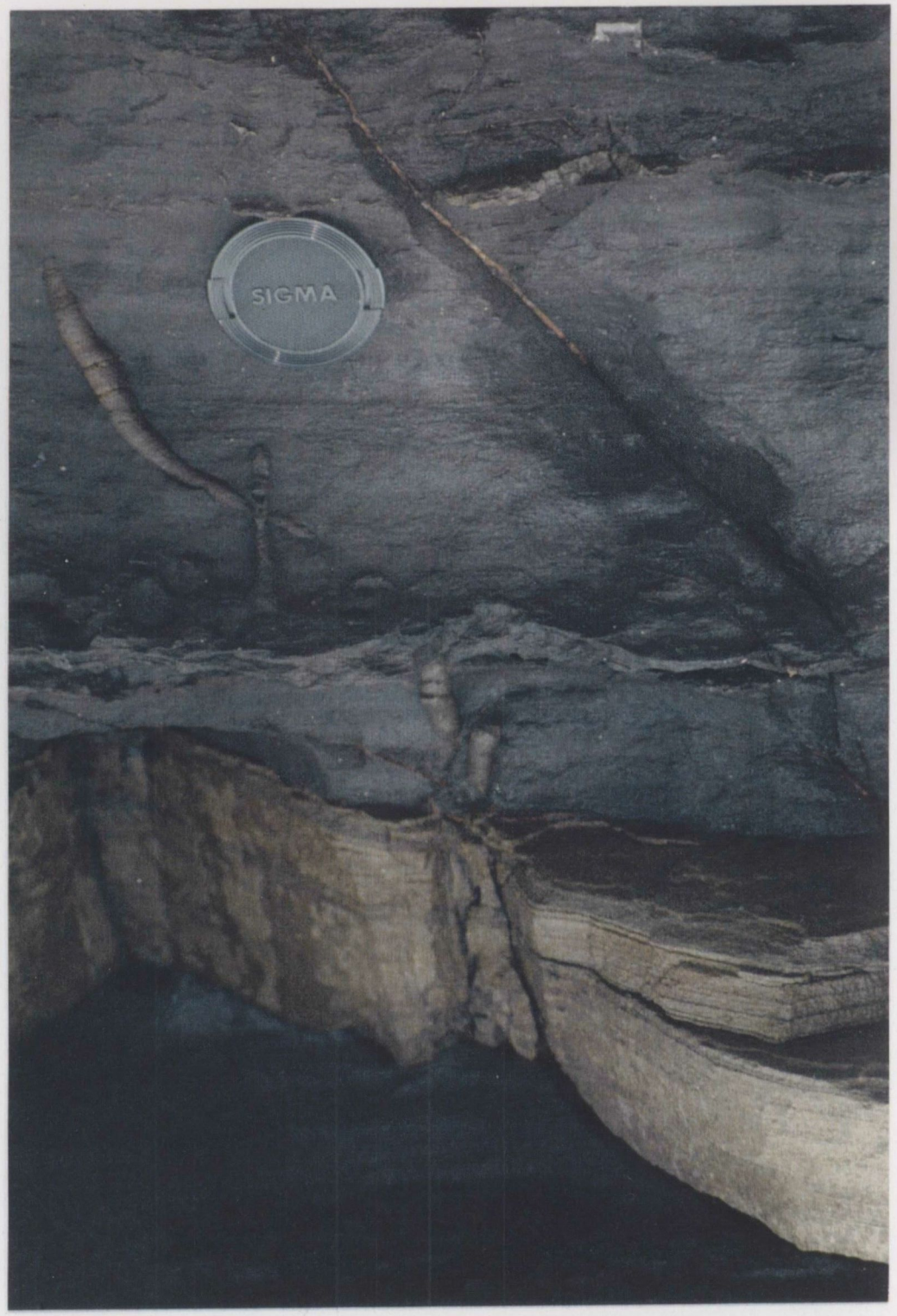
(see Section 2.4.2.)

Fig. a. Field photograph of section at Locality BD:J, in the upper part of the Bundoran Shale Formation at Bundoran (Arundian), Co. Donegal. Section comprises silty shales, thin siltstone beds and a few massive sandstone beds.

Fig. b. Burrows from Bed BD:J3 (Locality BD:J), a laminated siltstone, into silty shale beds below.



a



b

PLATE 8

(see Section 2.4.4.)

Field photograph of Benbulben Mountain, east of Barnarobin, Co. Sligo. Mountain slope shows the Benbulben Shale Formation overlain by the Glencar Limestone Formation and the Dartry Limestone Formation at the top. Outcrop in foreground on right is Locality BB in the Benbulben Shale Formation (Holkerian).



PLATE 9

(see Section 2.4.4.)

Figs a-b. Locality BB in the Benbulben Shale Formation (Holkerian), east of Barnarobin, Benbulben Mountain, Co. Sligo. a, field photograph of outcrop, section comprises dark grey, clay-rich, calcareous shales and argillaceous limestones (about 8 m of section shown in photograph). b, the soft shales form scree on the sheep tracks, columnals are easy to collect.



a



b

PLATE 10

(see Section 2.4.4.)

Figs a-b. Benbulben Shale Formation (Holkerian) at Carrickphatrick, Co. Sligo. a, Locality CP3; cliff of about 9 m in height, section comprises mainly clay-rich shales with some thin limy ribs. b, Locality CP1, stream section revealing the contact between the Mullaghmore Sandstone Formation and the younger Benbulben Shale Formation.



a



b

PLATE 11

(see Section 2.4.4.)

Field photograph of lowermost lithological section (Benbulben Shale Formation) at Streedagh Point, Co. Sligo (Locality STa). Section comprises calcareous, clay-rich shales and argillaceous limestones interbedded on a 10 cm scale (rucksack for scale).



PLATE 12

(see Section 5.2.3.)

Longitudinal section (slightly warped) through a pluricolumnal of an unknown crinoid columnal type. The stereom microstructure is galleried. Notice larger size of pores in outer section where crenularium is situated. Smaller pore sizes occur in areola and claustrum.

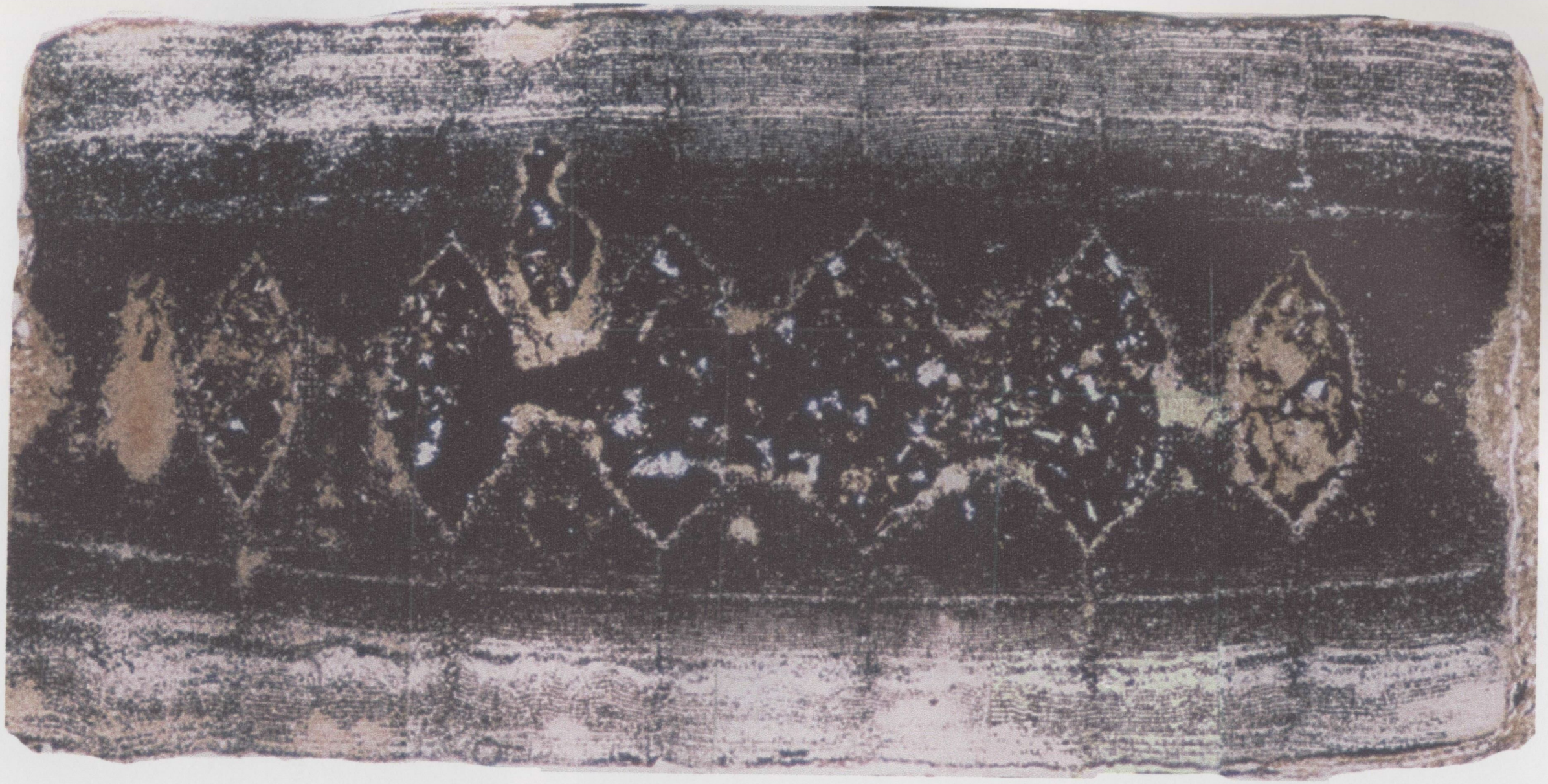


PLATE 13

(see Section 6.2.)

Figs a-b. *Platycrinites expansus* (M'Coy), 1844; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. a, TCD.35957, aboral view of calyx with axillary primibrachial *1* on two arms. b, TCD.35958, aboral view of calyx. On both specimens note wide tripartite basal sutures.

Fig. c. *Amphicrinus scoticus* Springer *in* Wright, 1914; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35951, aboral view of calyx with most proximal columnals of stem, rays are splayed, *CD* interray with enlarged basal and anal X (at 10:30 on photograph).

Figs d-f. *Phanocrinus* cf. *calyx* (M'Coy, 1849). d-e, TCD.28140, ?Glencar Limestone Formation (Asbian), Tievebaun Mountain, Co. Sligo; d, aboral view of calyx. e, adoral view of calyx, distal radial facets plenary with transverse ridge; *A* radial lacking. f, TCD.28141, ?Glencar Limestone Formation (Asbian), Glencar Lough, Co. Leitrim; lateral view of calyx, arms and most proximal portion of stem. The *B*, *A* and *E* rays are seen in this figure.

(all scale bars = 1cm)



a



d

e





b

c



f



PLATE 14

(see Section 6.2.)

Figs a-b. *Litocrinus* sp.; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35956; a, lateral view of calyx showing arm articular facets at distal end of high radials; cracks on specimen removed from plate using Adobe® Photoshop®. b, adoral view of calyx, domed orals lacking anal notch.

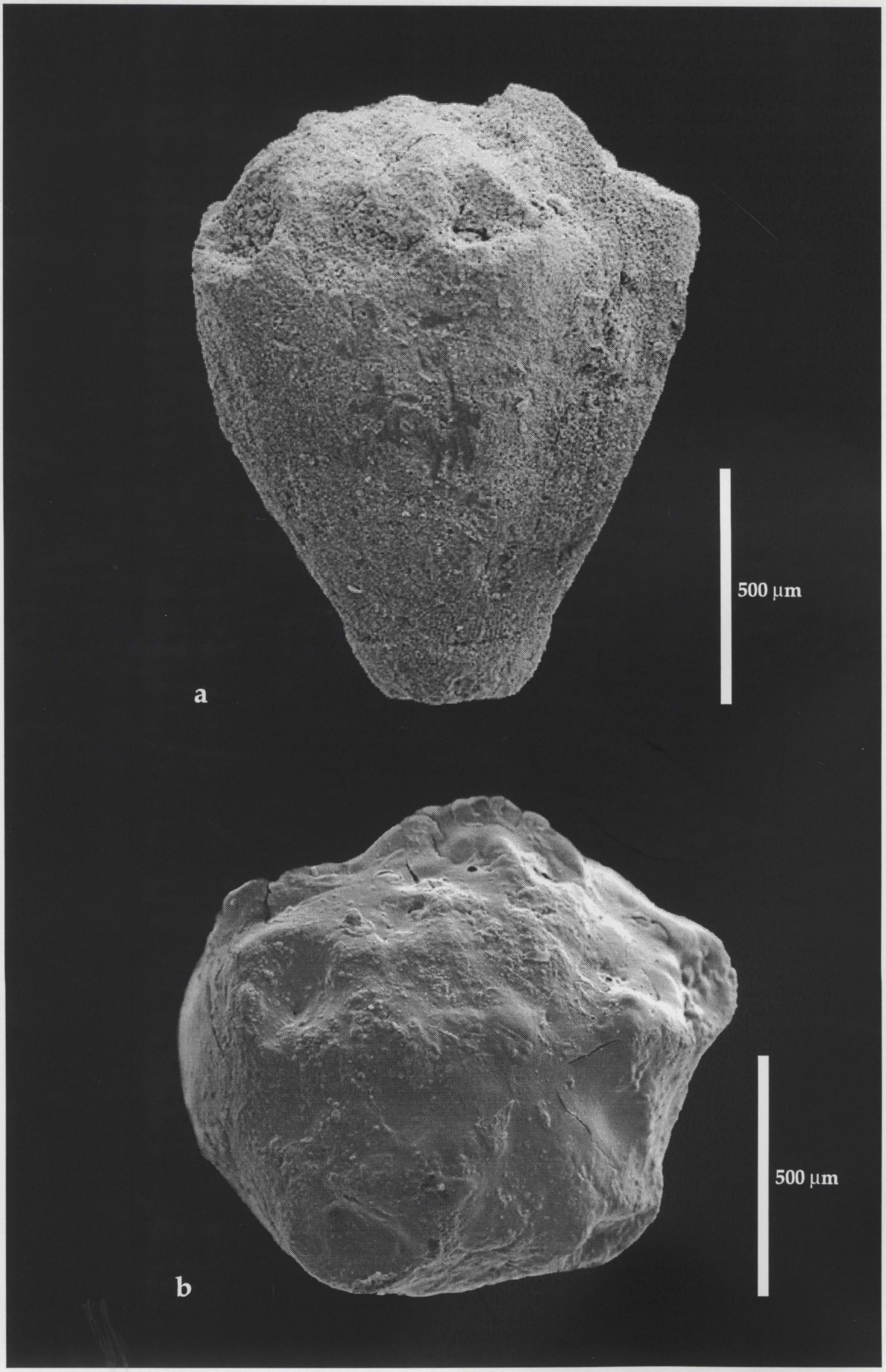

a
500 µm
b
500 µm

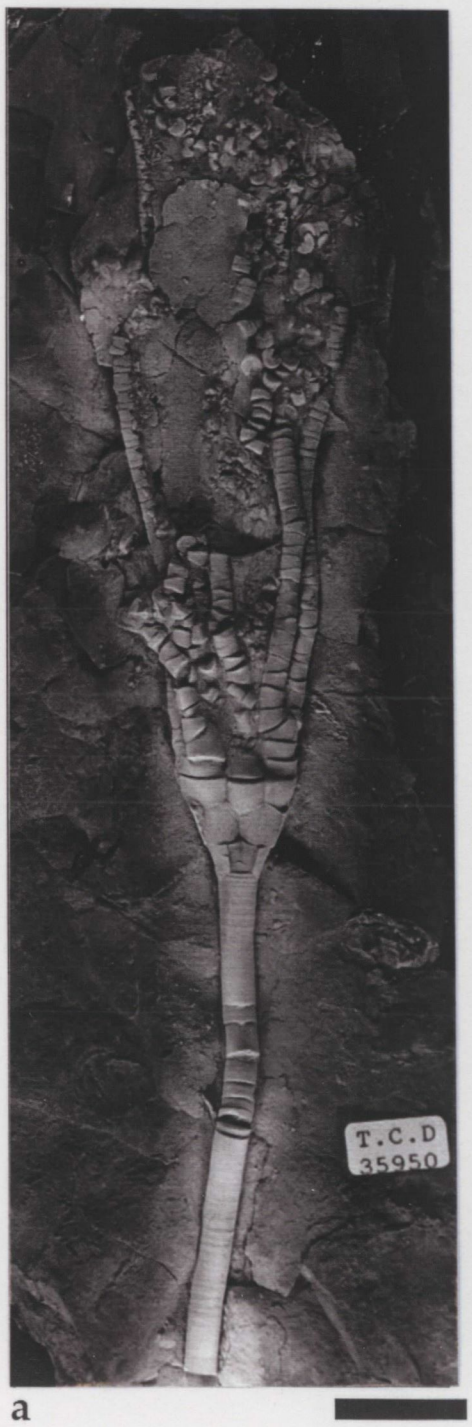
PLATE 15

(see Section 6.2.)

Figs a-d. *Bundoranocrinus vermiculatus* gen. et sp. nov. (holotype); Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35950; a, lateral anterior view of calyx and part of stem. b, detail of stem. c, detail of calyx and proximal arms of *B*, *A* and *E* rays. d, detail of distal arms with some dissociated brachials; note vermiculate ornamentation.

Figs e-f. *Bundoranocrinus vermiculatus* gen. et sp. nov. (paratype); Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35961; e, lateral posterior view of calyx showing *DE*, *CD* and *BC* basals; *CD* basal higher than others and heptagonal. f, lateral anterior view of calyx showing *AB* and *EA* basals; note vermiculate ornamentation.

(fig. a scale bar = 2 cm; figs b-f scale bars = 1 cm)



a



b



c



e

d





f

PLATE 16

(see Section 6.2.)

Figs a-c. *Amphicrinus scoticus* Springer *in* Wright, 1914; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35953; a, aboral view of laterally compressed calyx. b-c, lateral view of calyx. The *A*, *B* and *C* rays are seen in this figure.

(all scale bars = 1cm)



a



b



c

PLATE 17

(see Section 6.2.)

Figs a-c. *Amphicrinus scoticus* Springer *in* Wright, 1914; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. a-b, TCD.35952; a, aboral view of laterally compressed calyx. b, lateral view of calyx, D, E and A rays visible in this plate. c, TCD.53171; aboral view of calyx with splayed arms; infrabasal circlet seen as small, central pentagon; basal:basal sutures clearly seen inside outline of stem impression, which has a pentalobate lumen and peripheral crenularium.

Figs d-e. *Onychocrinus polydactylus* (M'Coy, 1844); Benbulben Shale Formation (Holkerian), Carrickphatrick, Co. Sligo. TCD.35955; d, lateral view of calyx, *A*, *B* and *C* rays visible in this plate. e, aboral view of laterally compressed calyx; note finely tuberculate ornamentation. Bryozoan fragment = *Tabulipora howsii* (Nicholson, 1881).

Fig. f. cf. *Onychocrinus polydactylus* (M'Coy, 1844); Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35959; aboral view of basal circlet surrounding proximal stem; *CD* basal lacking; note finely tuberculate ornamentation.

(all scale bars = 1cm)



a



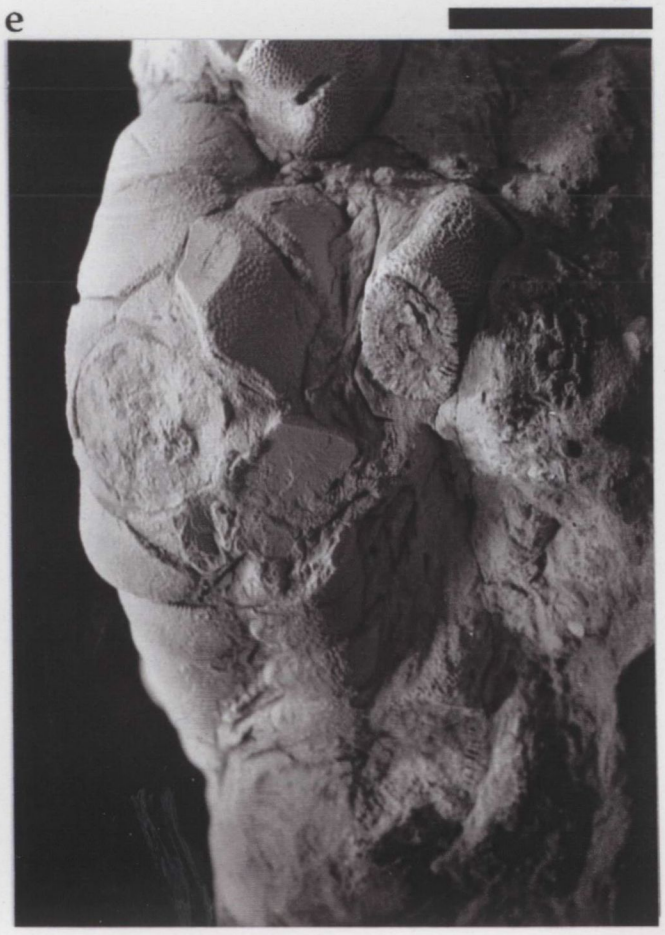
b



c



f



e



d

PLATE 18

(see Section 6.3.)

Figs a-b. gen. et sp. indet. Platycrinitidae-Type Columnal 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen PC1-B28 (TCD.35962); a, synarthrial articular facet, fulcral ridge coincident with longest facetal diagonal, may 'fan out' at either end; opposing articular facets at 90°. b, oblique lateral view, latus concave.


a
2 mm
b
2 mm

PLATE 19

(see Section 6.3.)

Figs a-b. gen. et sp. indet. Platycrinitidae-Type Columnal 2; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen PC2-BB (TCD.35963); a, synarthrial articular facet, fulcral ridge coincident with longest facetal diagonal, vermiculate and comprising two parallel ridges, short, peripheral crenulae at either end; opposing articular facets at 71°. b, oblique lateral view, weakly convex latus, ornamentation of few large tubercles.

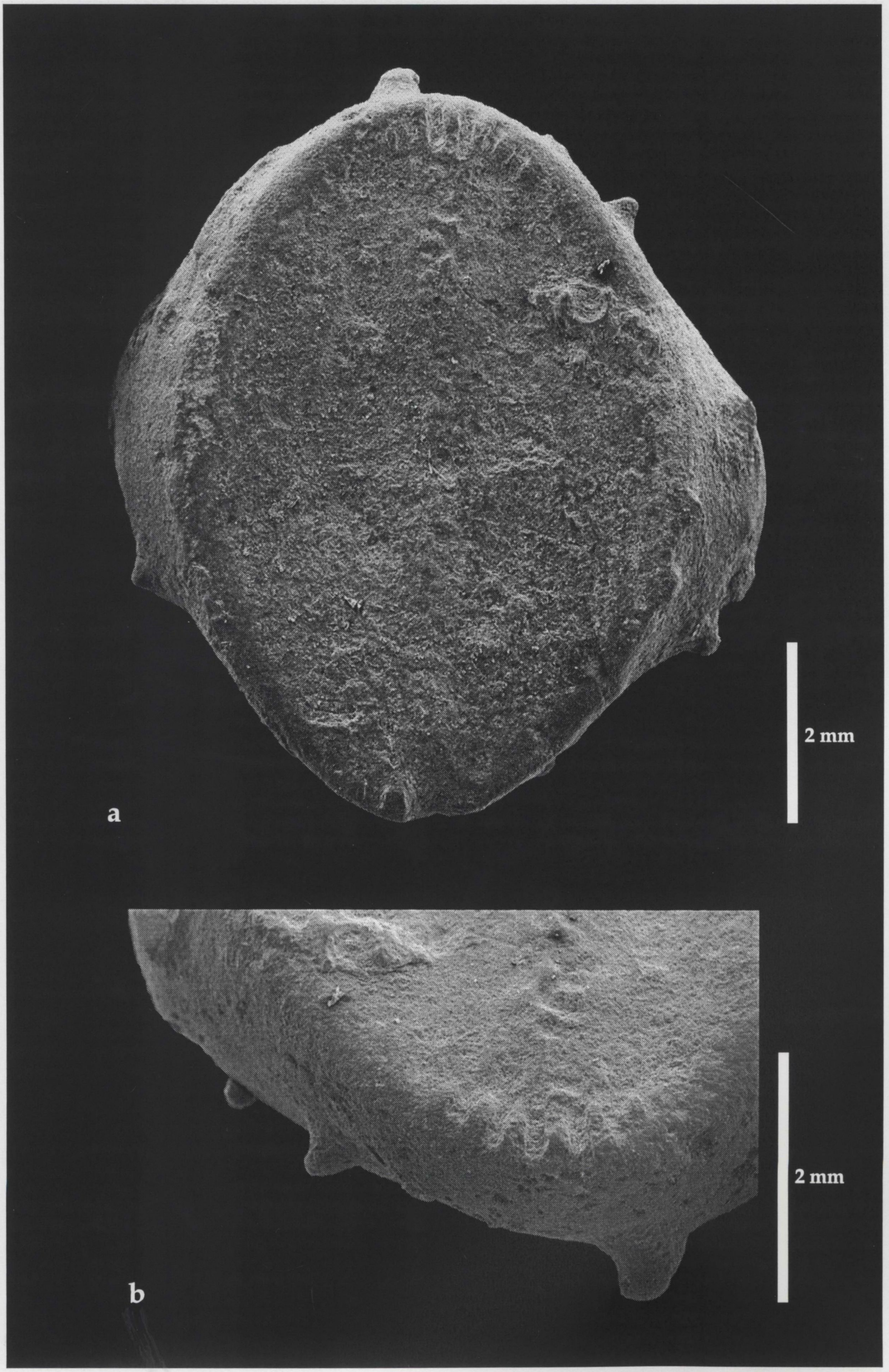

2 mm
a
2 mm
b

PLATE 20

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 1a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 1a.V1-BB (TCD.35965); a, symplectial articular facet; four cirrus-related structures on latus at 72° from each other. b, oblique lateral view of latus with cirrus socket bearing two cirri.

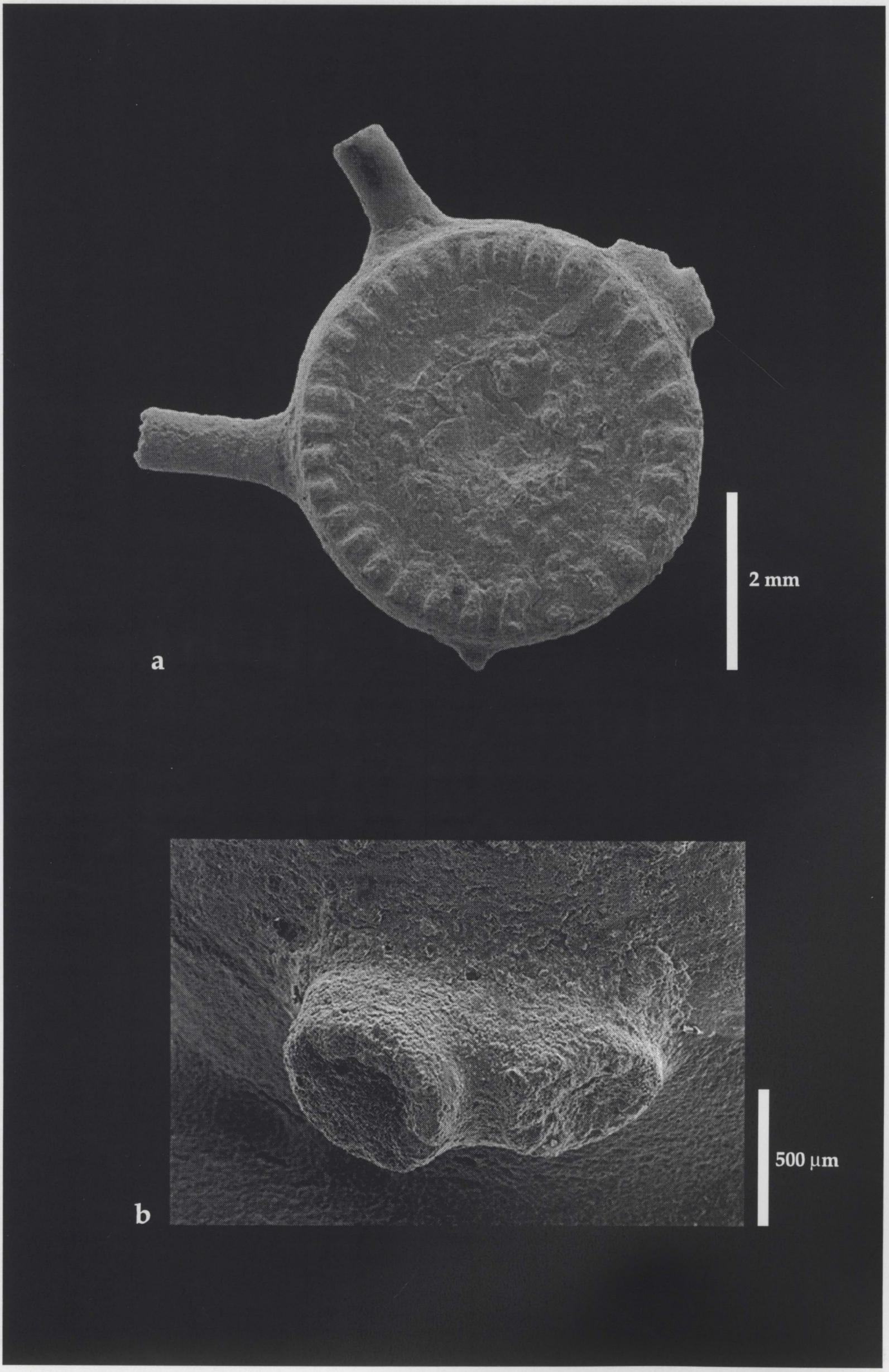

a
2 mm
b
500 μm

PLATE 21

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 1a; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 1a.V2-J8 (TCD.35966); a, symplectial articular facet (diagenetically compressed), pentalobate lumen with rounded angles. b, lateral view of deformed pluricolumnal, latus moderately convex.


a
2 mm
b
2 mm

PLATE 22

(see Section 6.3.)

Figs a-c. Columnal Taxon Number 1a; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 1a.V2-J8 (TCD.35966); galleried stereom microstructure of a, perilumen, b, areola and c, crenularium. Pore sizes largest and bars narrowest in perilumen.

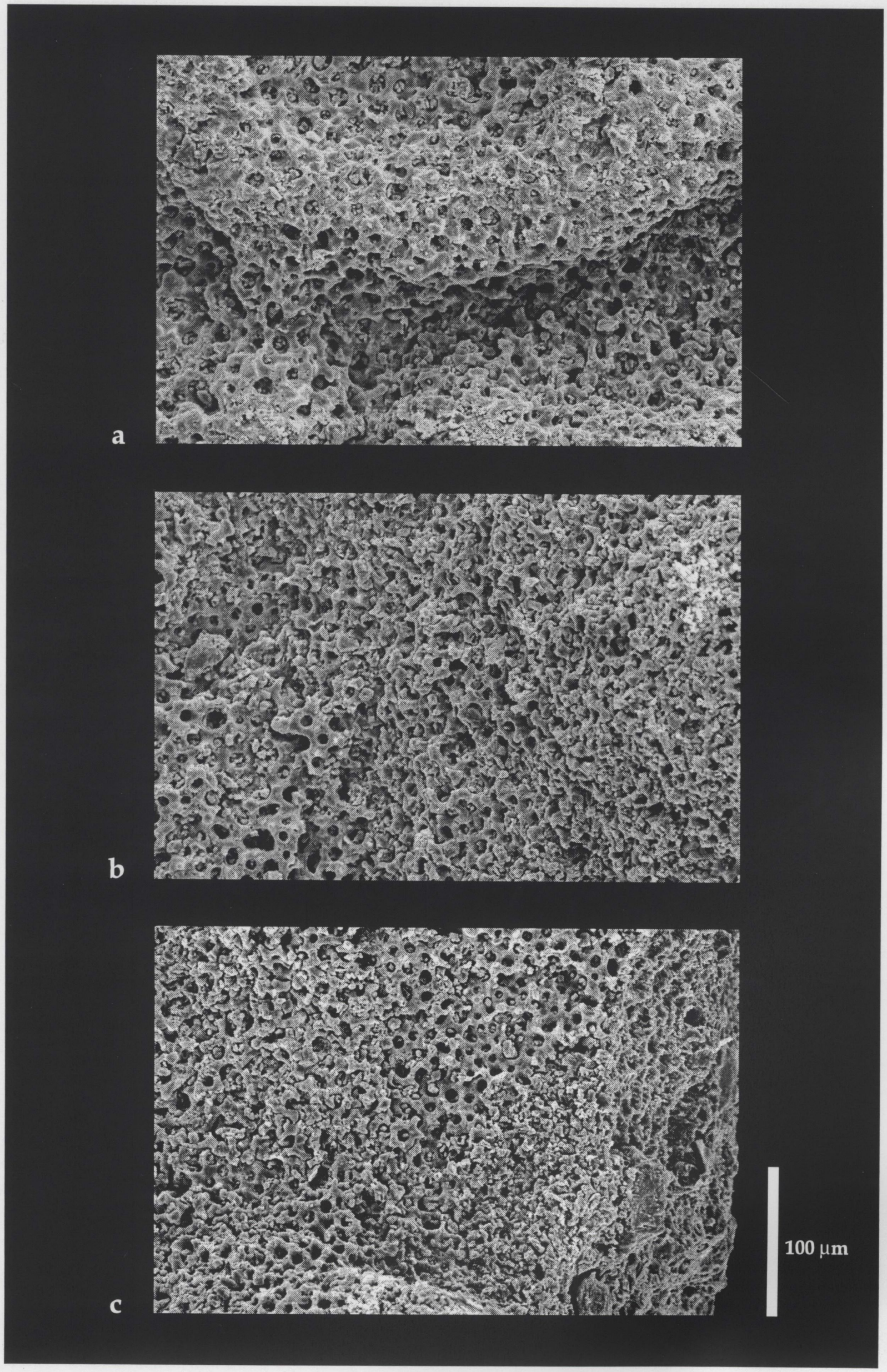

a
b
c
100 μm

PLATE 23

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 1b; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 1b.T-J8 (TCD.35970); a, symplectial articular facet (diagenetically compressed), pentalobate lumen with truncated angles. b, lateral view of pluricolumnal; latus straight with cirrus-related structures.


a
2 mm
b
2 mm

PLATE 24

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 1c; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 1c.T-D1 (TCD.35971); a, symplectial articular facet (diagenetically compressed), pentasteroidal lumen with rounded angles. b, lateral view of pluricolumnal; latus angled equatorially; cirrus-related structures.

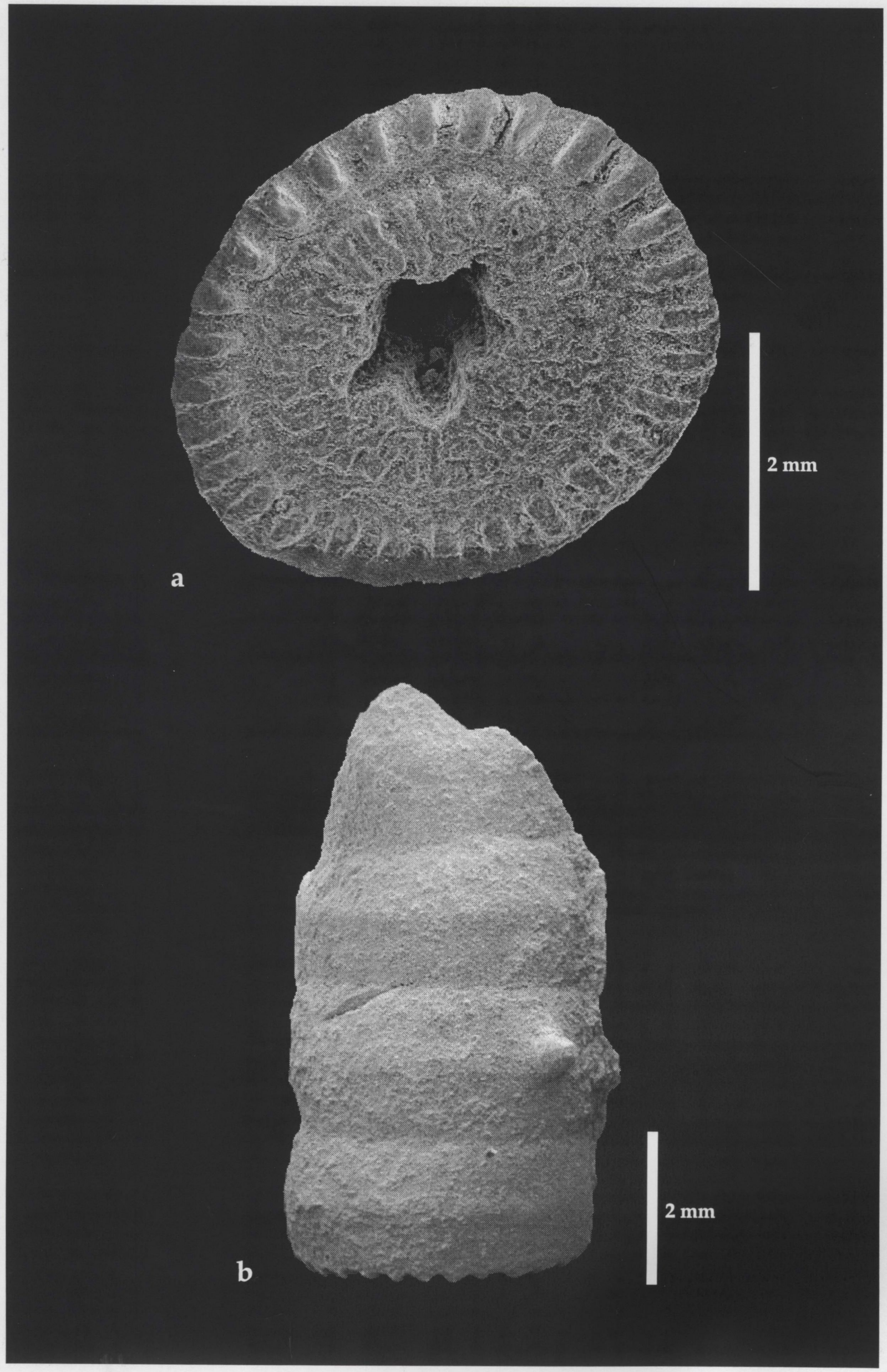

a
2 mm
b
2 mm

PLATE 25

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 1d; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 1d.V1-BB (TCD.35973); a, symplectial articular facet, pentalobate lumen with rounded angles. b, oblique lateral view of latus, linear tuberculate ornamentation.

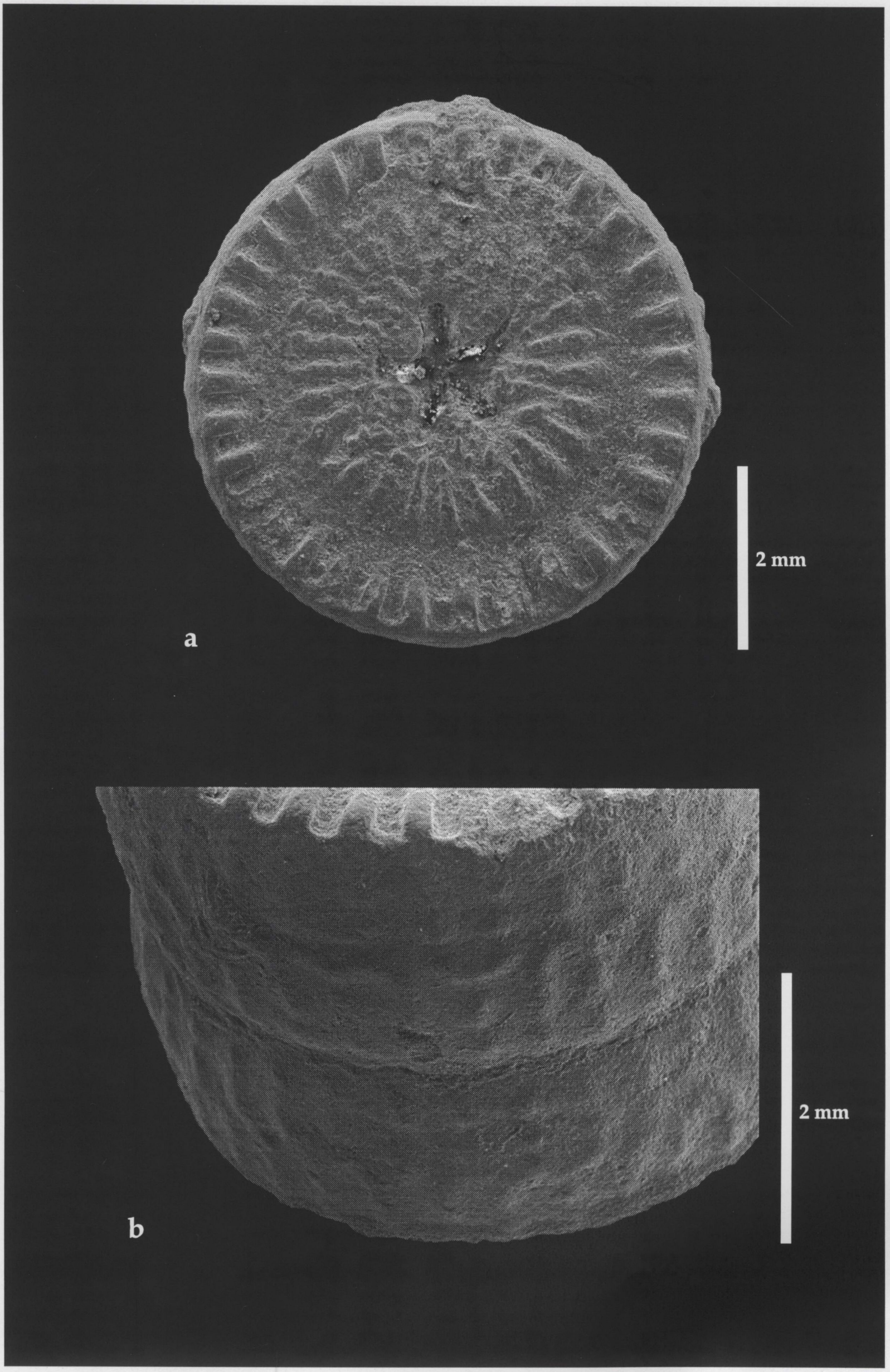

a
2 mm
b
2 mm

PLATE 26

(see Section 6.3.)

Columnal Taxon Number 1d; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 1d.V3-BB (TCD.35975); symplectial articular facet.


2 mm

PLATE 27

(see Sections 3.4.2.2. and 6.3.)

Figs a-b. Columnal Taxon Number 1a, specimen 1a.V2-J8 (TCD.35966).

Figs c-d. Columnal Taxon Number 1b, specimen 1b.T-J8 (TCD.35970).

Figs e-f. Columnal Taxon Number 1c, specimen 1c.T-D1 (TCD.35971).

Figs a, c and e (left) show the outline of the compressed columnals as they were found. Figs b, d and f (right) show the corrected circular outline of the columnals. Manipulation carried out in Adobe® Photoshop®.


a
b
c
d
e
f

PLATE 28

(see Sections 6.3. and 6.6.4.)

Figs a-b. Columnal Taxon Number 1a. a, specimen 1a.T-BB (TCD.35964), Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo; lateral view of pluricolumnal, latus moderately convex, cirrus-related structures not exactly aligned longitudinally. b, specimen 1a.V5-J12 (TCD.35969), Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal; lateral view of pluricolumnal.

Figs c-d. Columnal Taxon Number 12; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. c, specimen 12-K5b (TCD.35995), and d, specimen 12-K5a (TCD.35994); both lateral views of pluricolumnal from coiled stem.

Fig. e. Specimen TCD.53070; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Swollen pluricolumnal with hole; probably caused by epizoic *Phosphannulus*.

Figs f-h. gen. et sp. indet. Flexibilia-Type Pluricolumnal; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. TCD.35960; f, view of most proximal articular facet, symplectial articulation with narrow, peripheral crenularium. g, view of distal articular facet, crenularium wider that on f; vermiculate perilumen on both facets. h, view of convex latus, raised side, columnal peripheries corrugated.

(figs a-d scale bars = 1 cm; figs e-h scale bars = 0.5 cm)

a



b



c



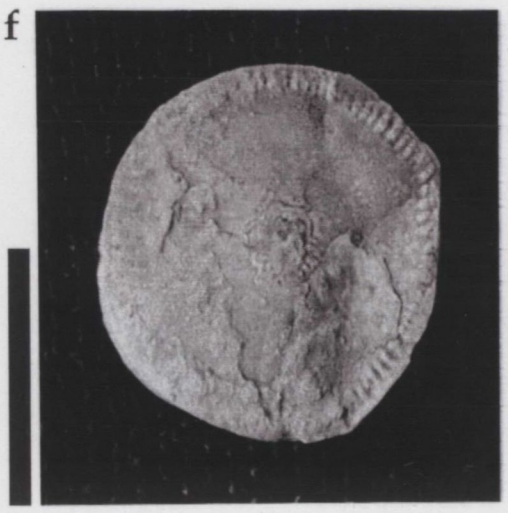
d



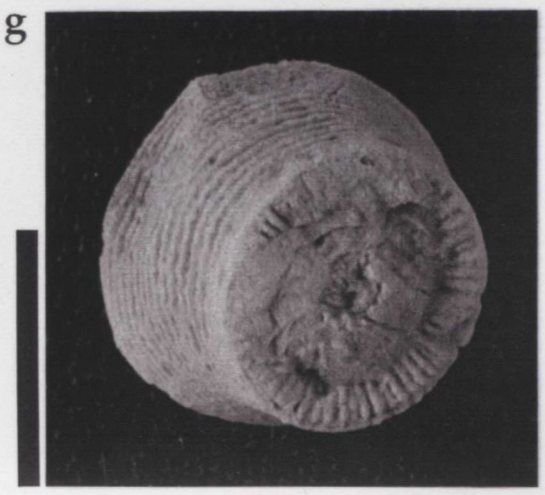
e



f



g



h



PLATE 29

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 2.T1-L1 (TCD.35976); a, symplectial articular facet, some broken away. b, cirrus socket circular and concave.

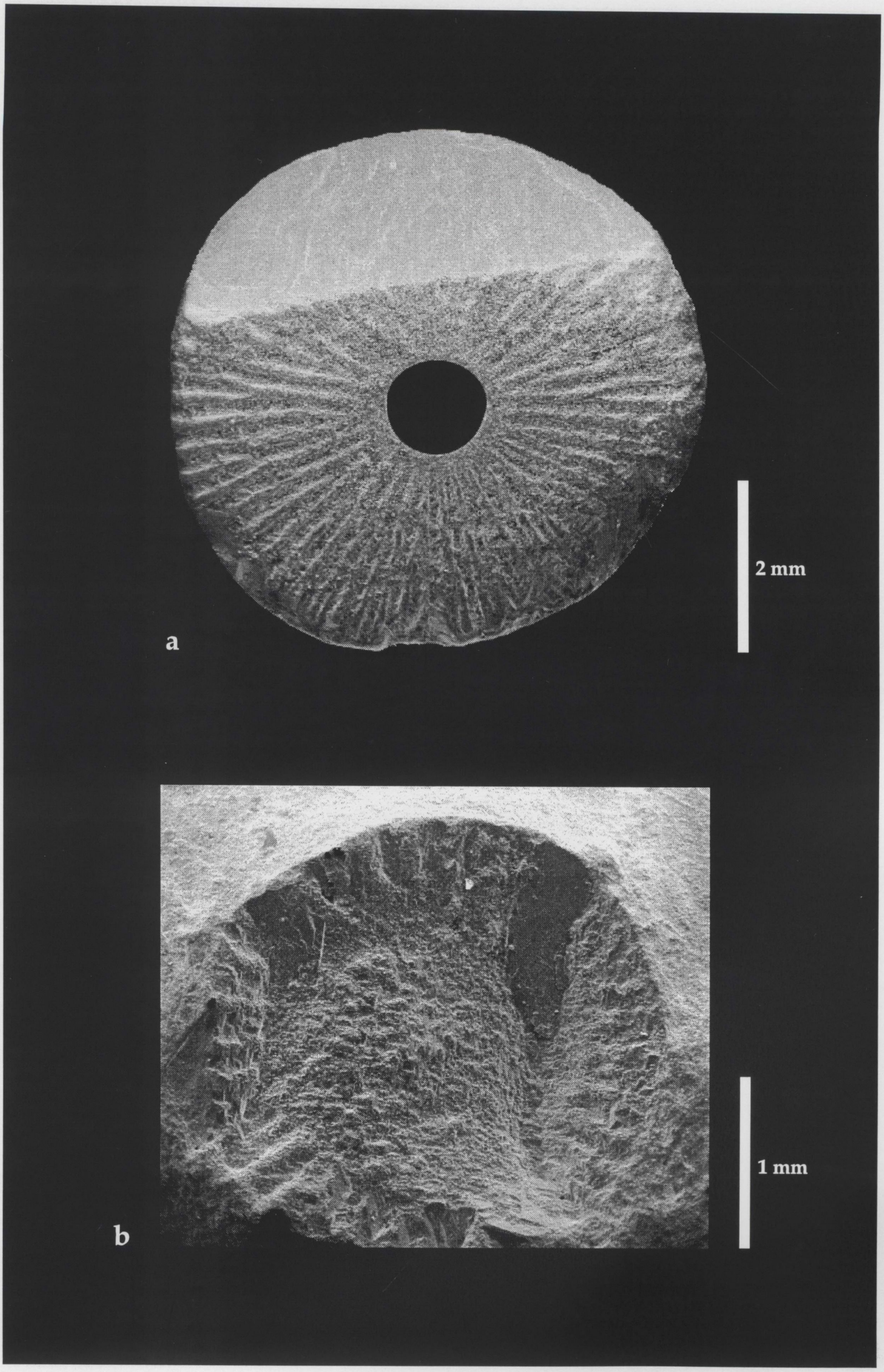

a
2 mm
b
1 mm

PLATE 30

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 2.V1-D1 (TCD.35977); a, symplectial articular facet, fractured and repaired. b, lateral view.

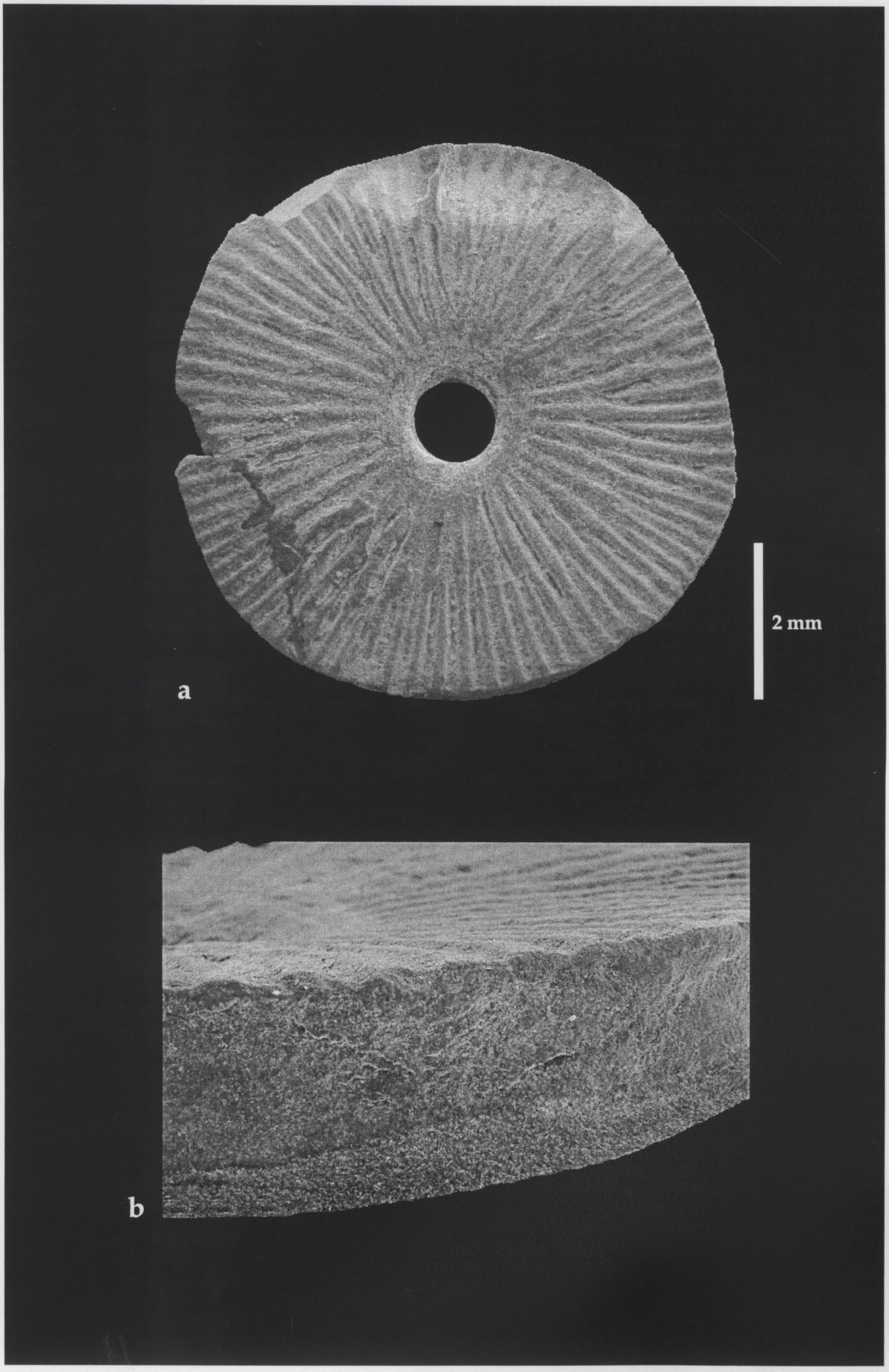

2 mm
a
b

PLATE 31

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 3; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 3.V1-L1 (TCD.35980); a, symplectial articular facet. b, lateral view showing details of tuberculate ornamentation. .

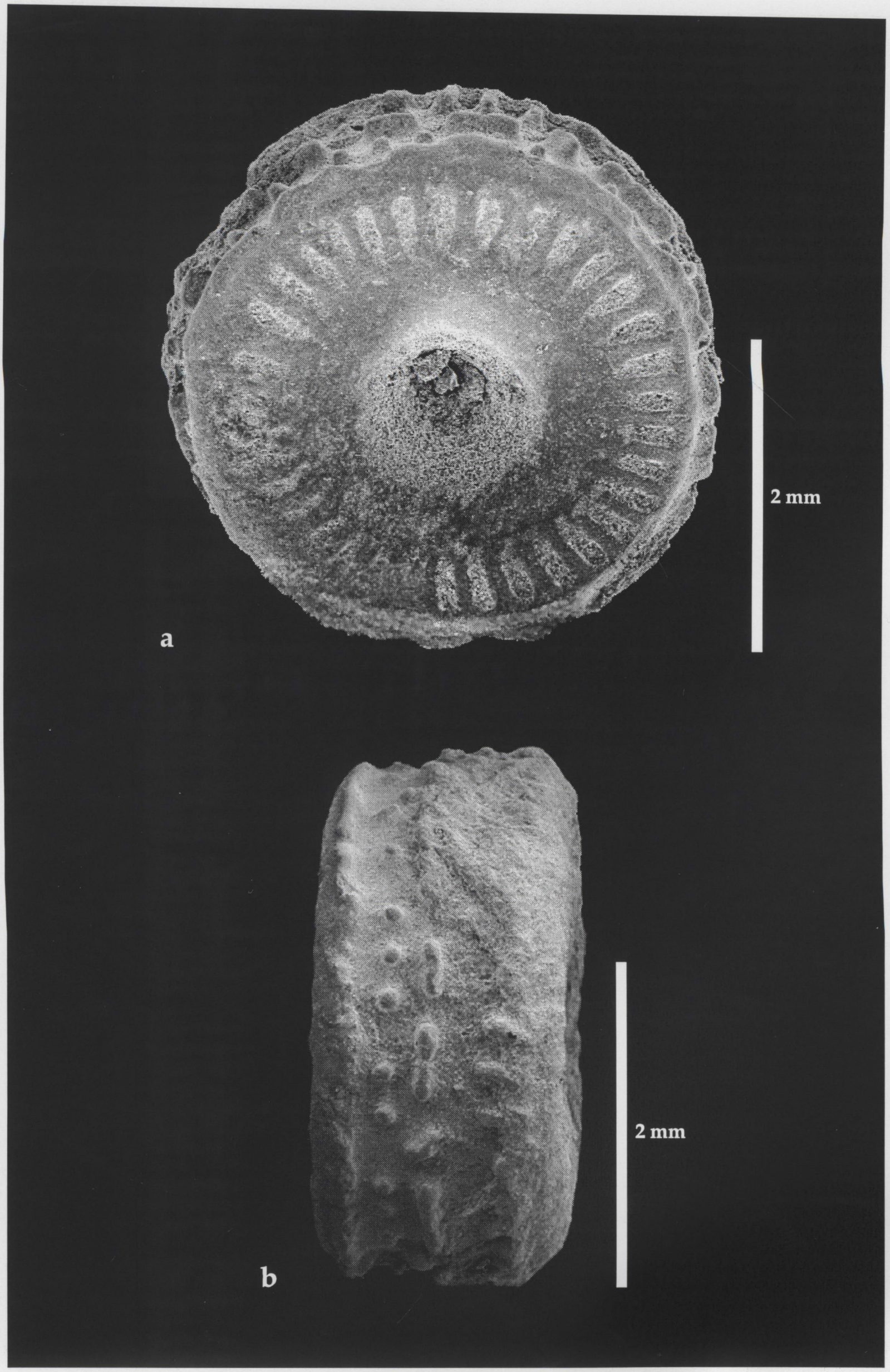

2 mm
a
2 mm
b

PLATE 32

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 4; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 4.T-D1 (TCD.35982); a, symplectial articular facet. b, oblique lateral view showing details of crenulae and relief of facetal morphological features.

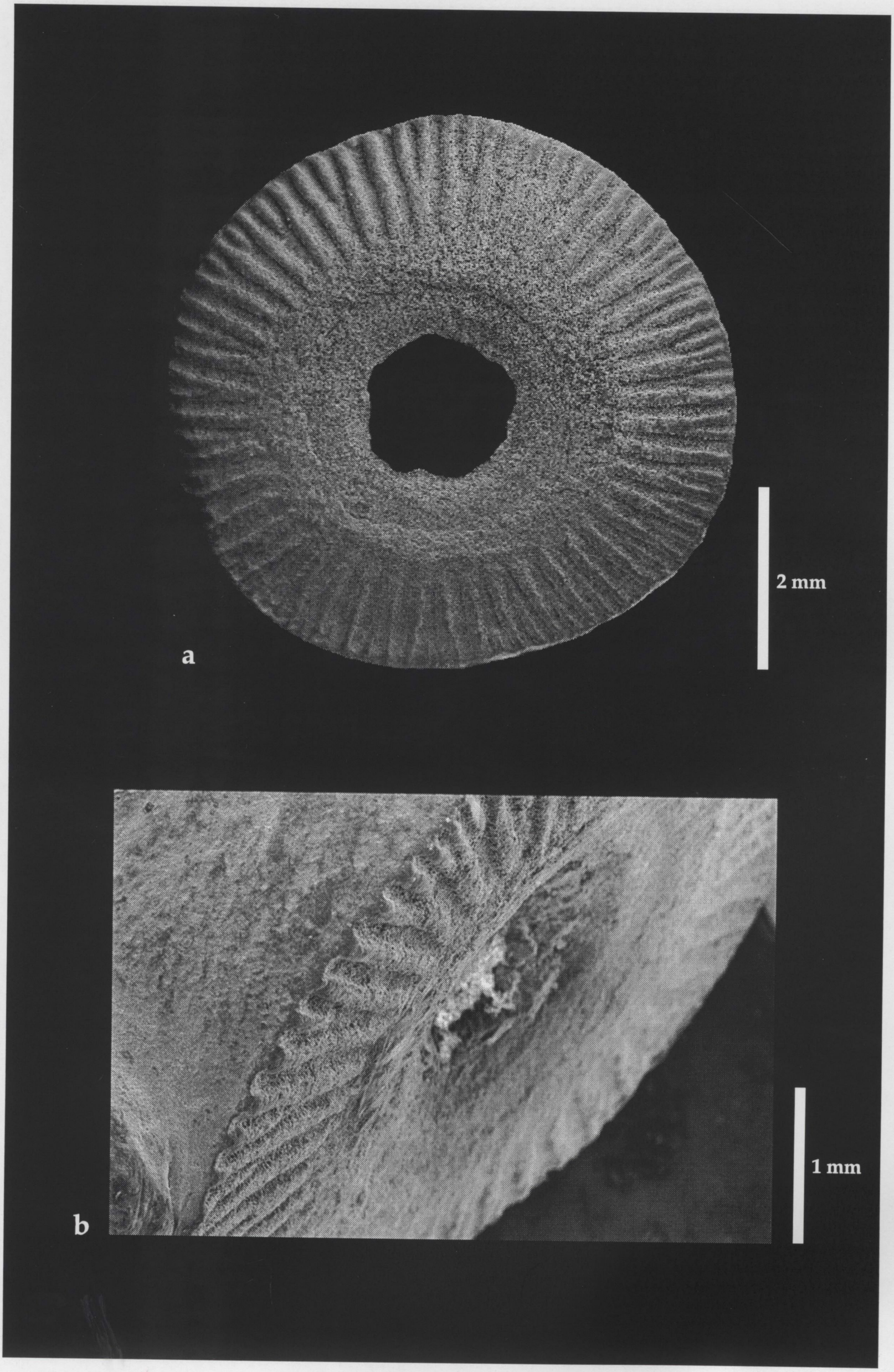

2 mm
a
1 mm
b

PLATE 33

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 4; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 4.T-D1 (TCD.35982); stereom microstructure of crenularium. On fig. b density changes near intercalated crenulae.


a
200 μm
b
200 μm

PLATE 34

(see Section 6.3.)

Figs a-c. Columnal Taxon Number 4; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 4.T-D1 (TCD.35982); a, detail of articular facet of zygocirral. b, oblique lateral view of depressed cirrus socket. c, detail of irregular crenulate suture.

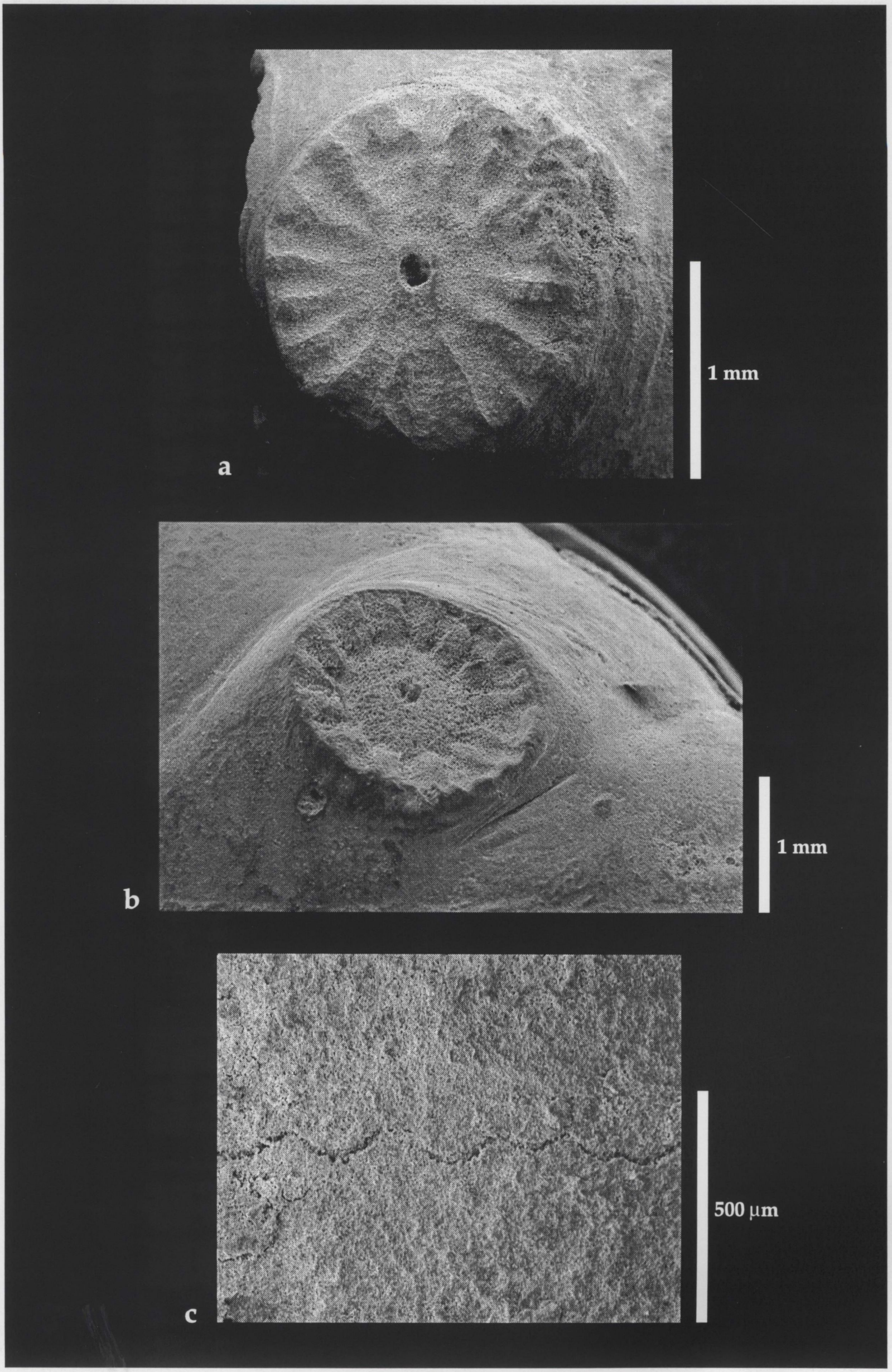
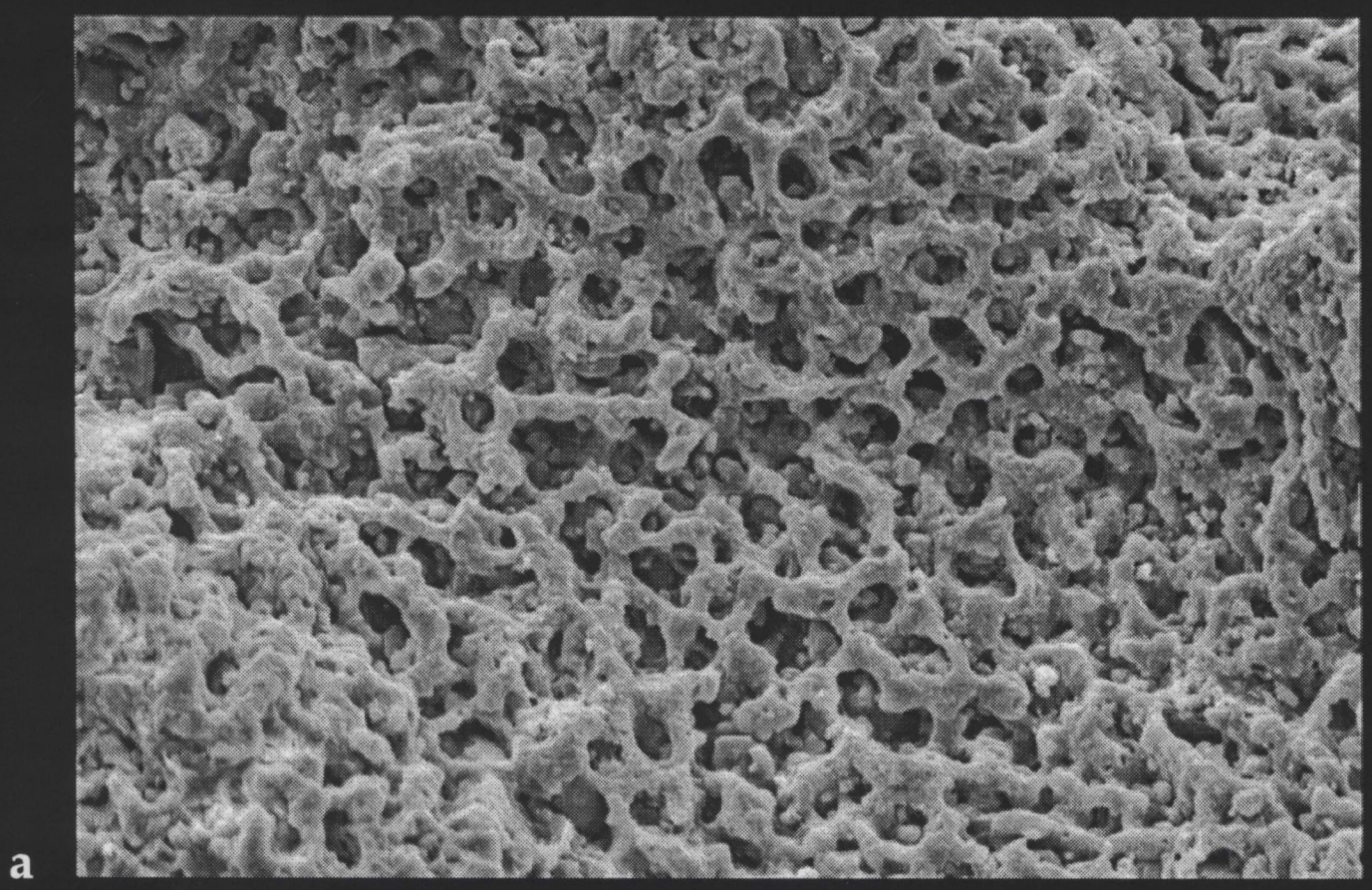

a
1 mm
b
1 mm
c
500 μm

PLATE 35

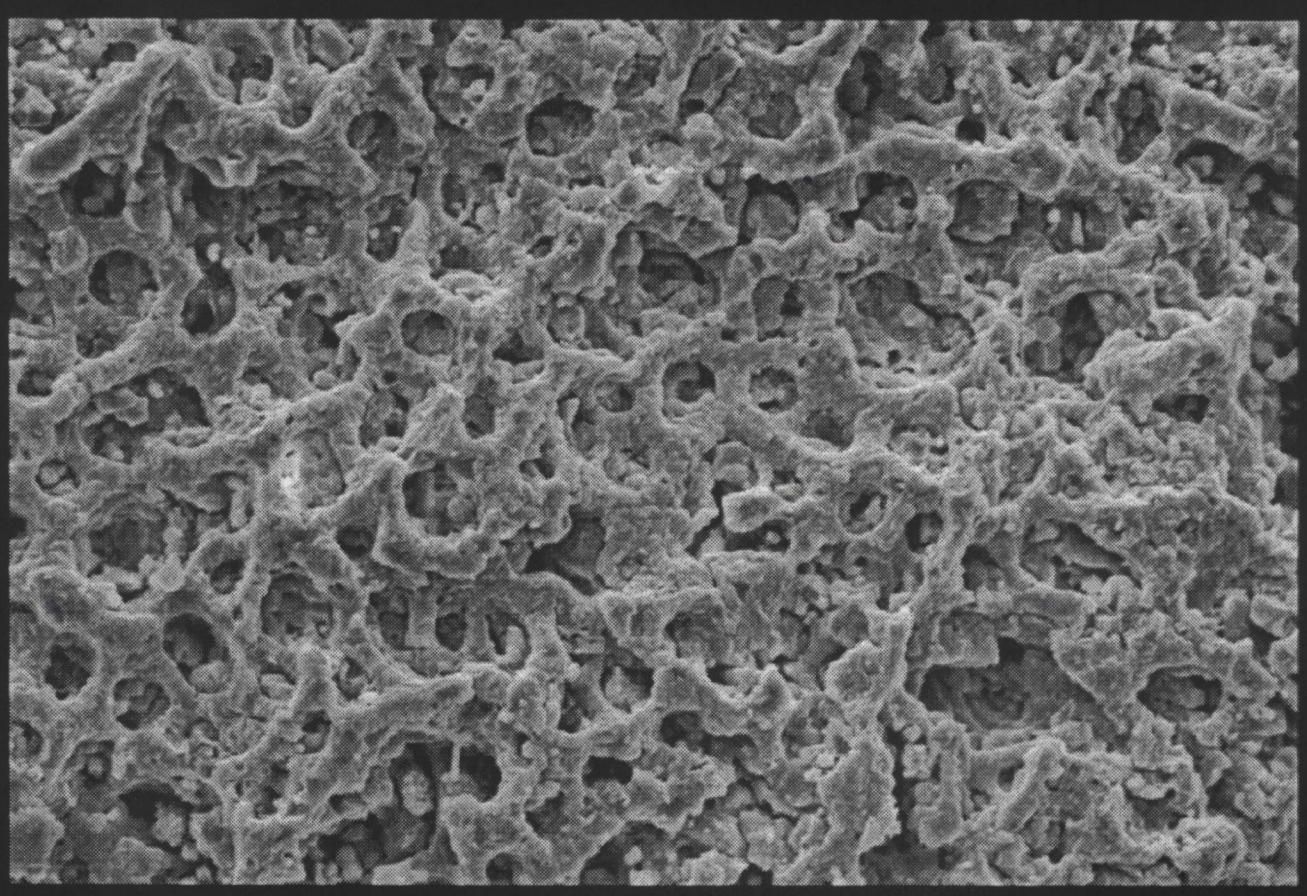
(see Section 6.3.)

Figs a-b. Columnal Taxon Number 4; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 4.T-D1 (TCD.35982); stereom microstructure on cirrus socket, a, crenularium, and b, areola.



a

100 μm



b

100 μm

PLATE 36

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 5; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 5.T-J8 (TCD.35983); a, pentagonal symplectial articular facet. b, lateral view of pluricolumnal.


a
2mm
b
2mm

PLATE 37

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 5; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 5.T-J8 (TCD.35983); a, close-up detail of tubercles. b, latus tuberculate ornamentation.

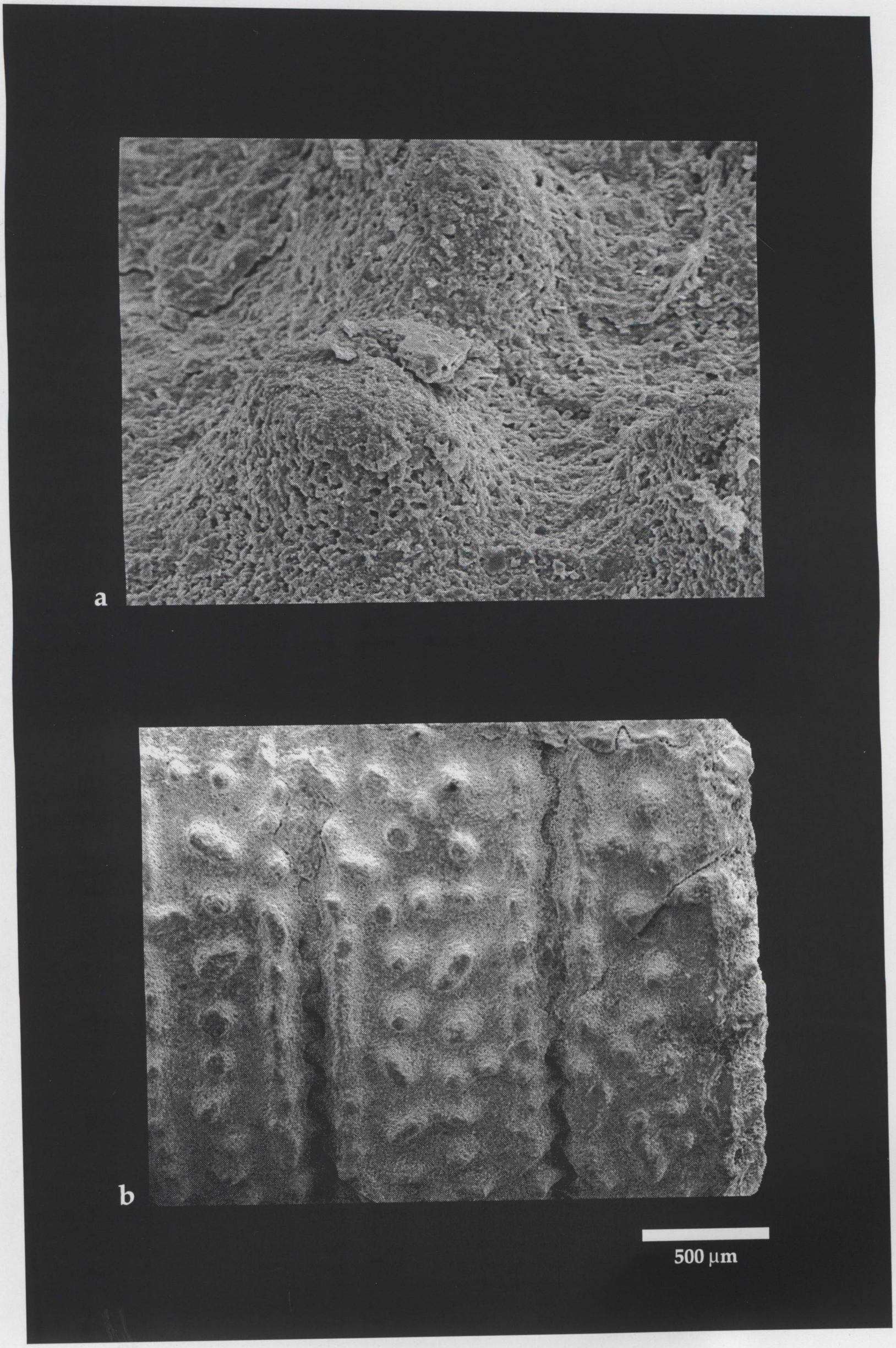
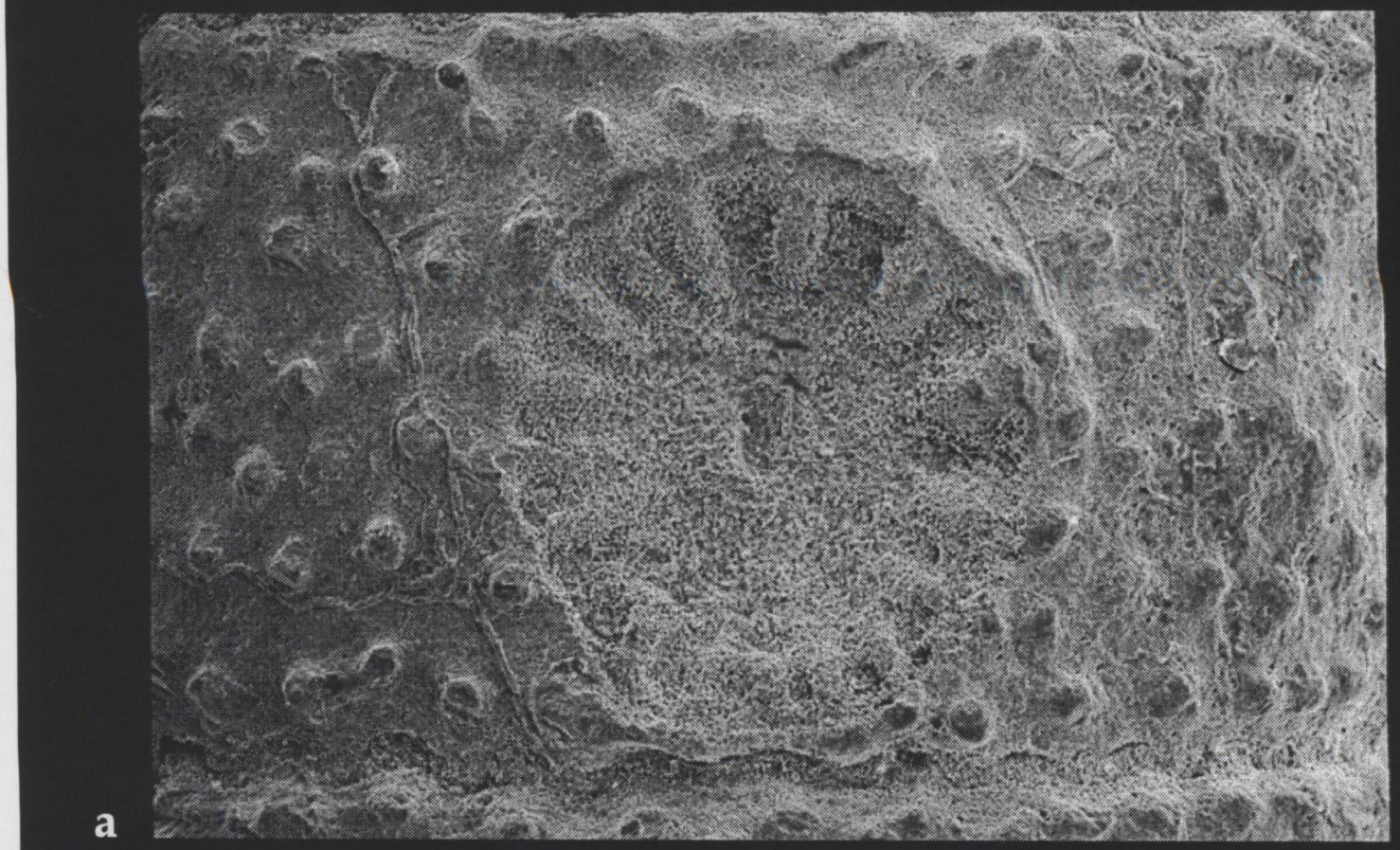

a
b
500 µm

PLATE 38

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 5; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. a, specimen 5.V1-J8 (TCD.35984); detail of cirrus socket. b, specimen 5.V2-L1 (TCD.35985); lateral view of pluricolumnal.


a
1 mm

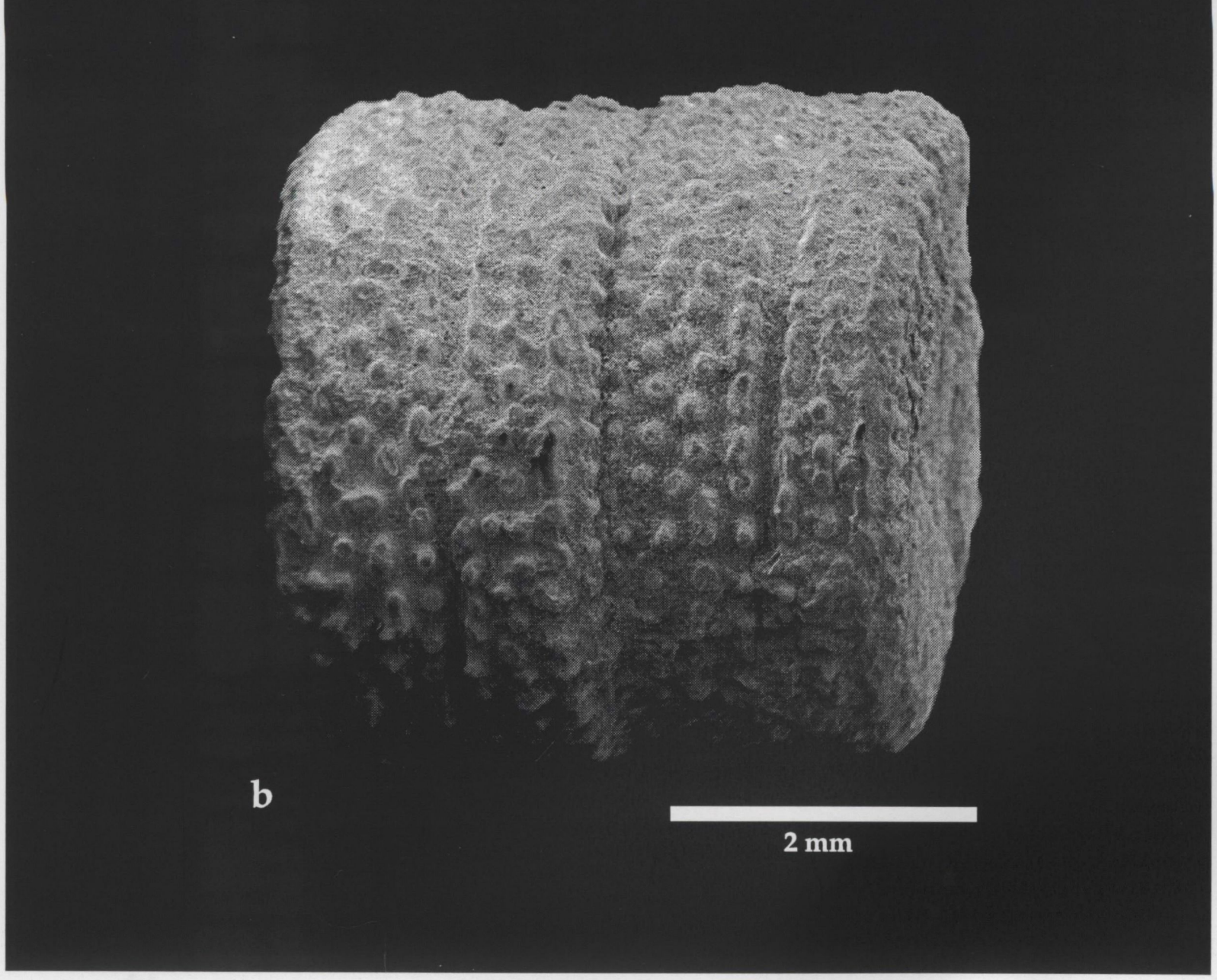
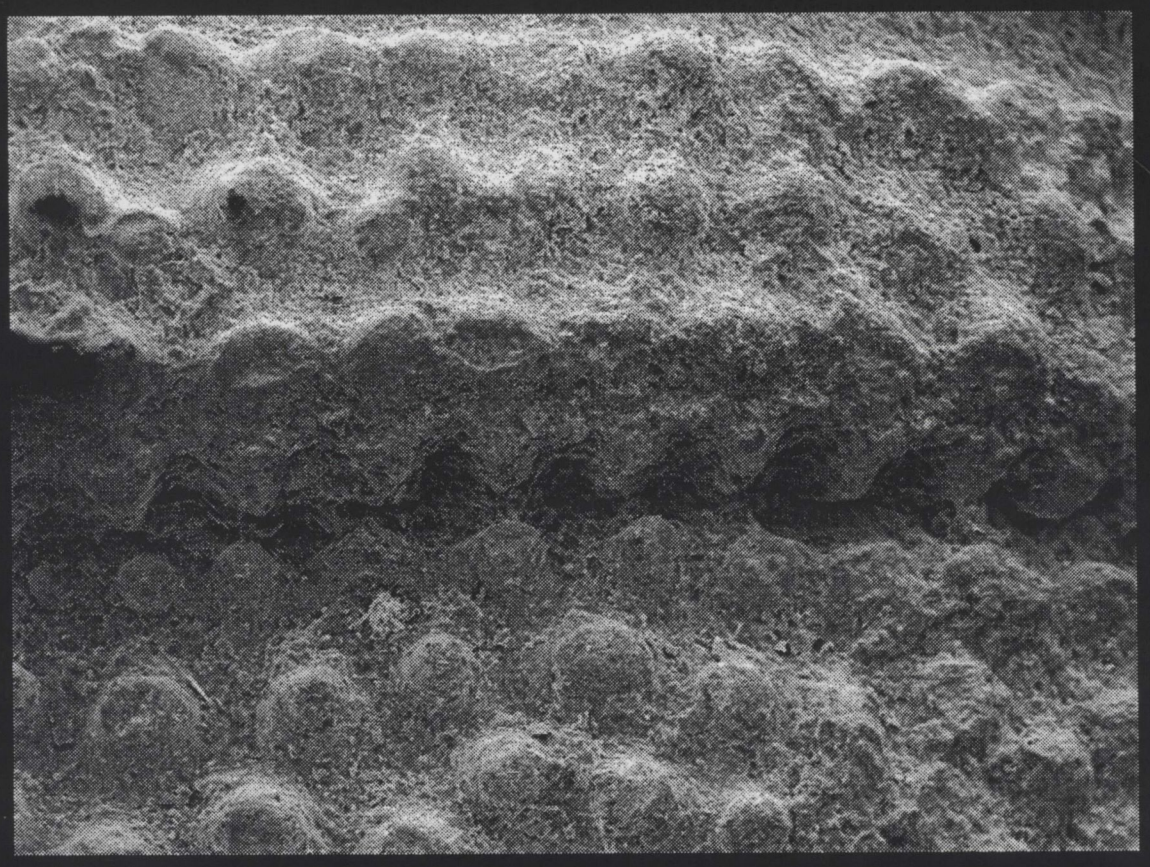

b
2 mm

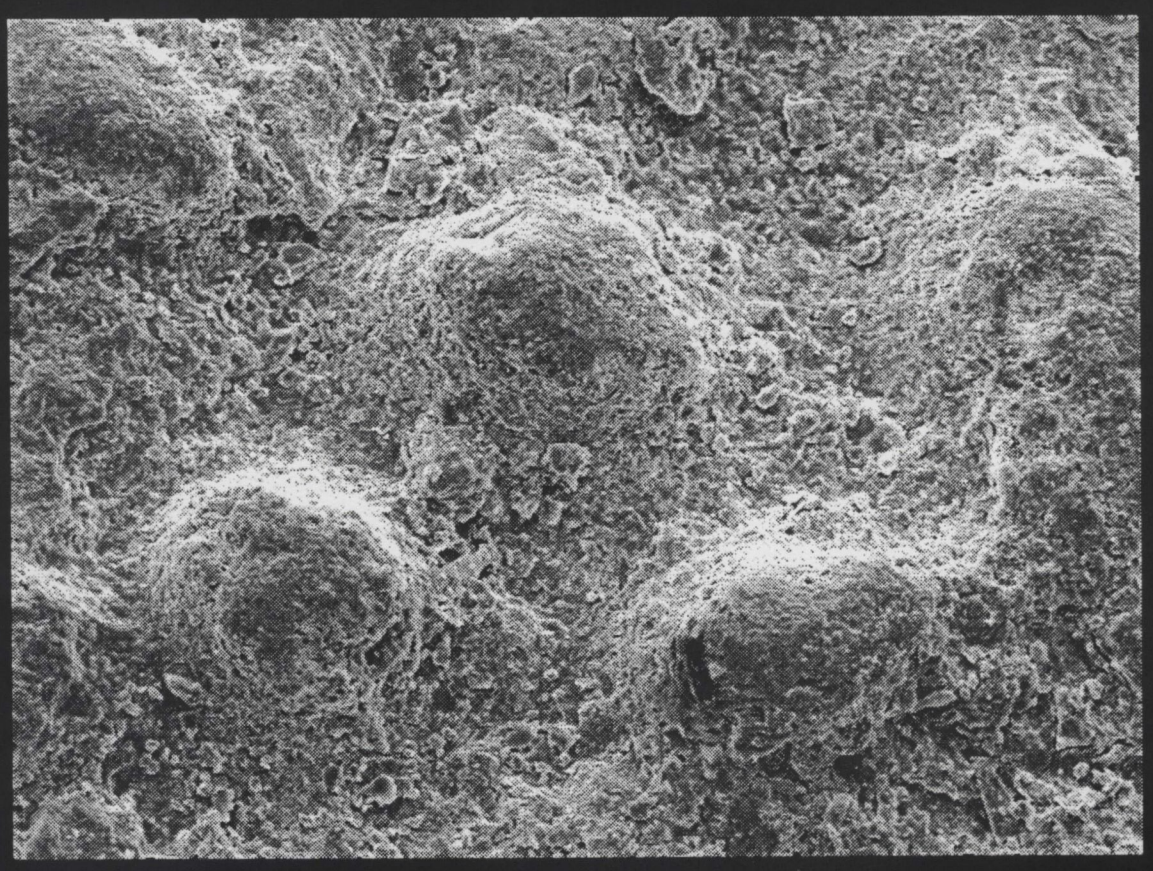
PLATE 39

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 5; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 5.V2-L1 (TCD.35985); a, detail of latus tuberculate ornamentation and crenulae relief. b, close-up detail of tubercles.



a



b

PLATE 40

(see Section 6.3.)

Fig. a. Columnal Taxon Number 6; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 6.T-E5 (TCD.35986); symplectial articular facet.

Fig. b. Columnal Taxon Number 7; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 7.T-D1 (TCD.35987); symplectial articular facet.

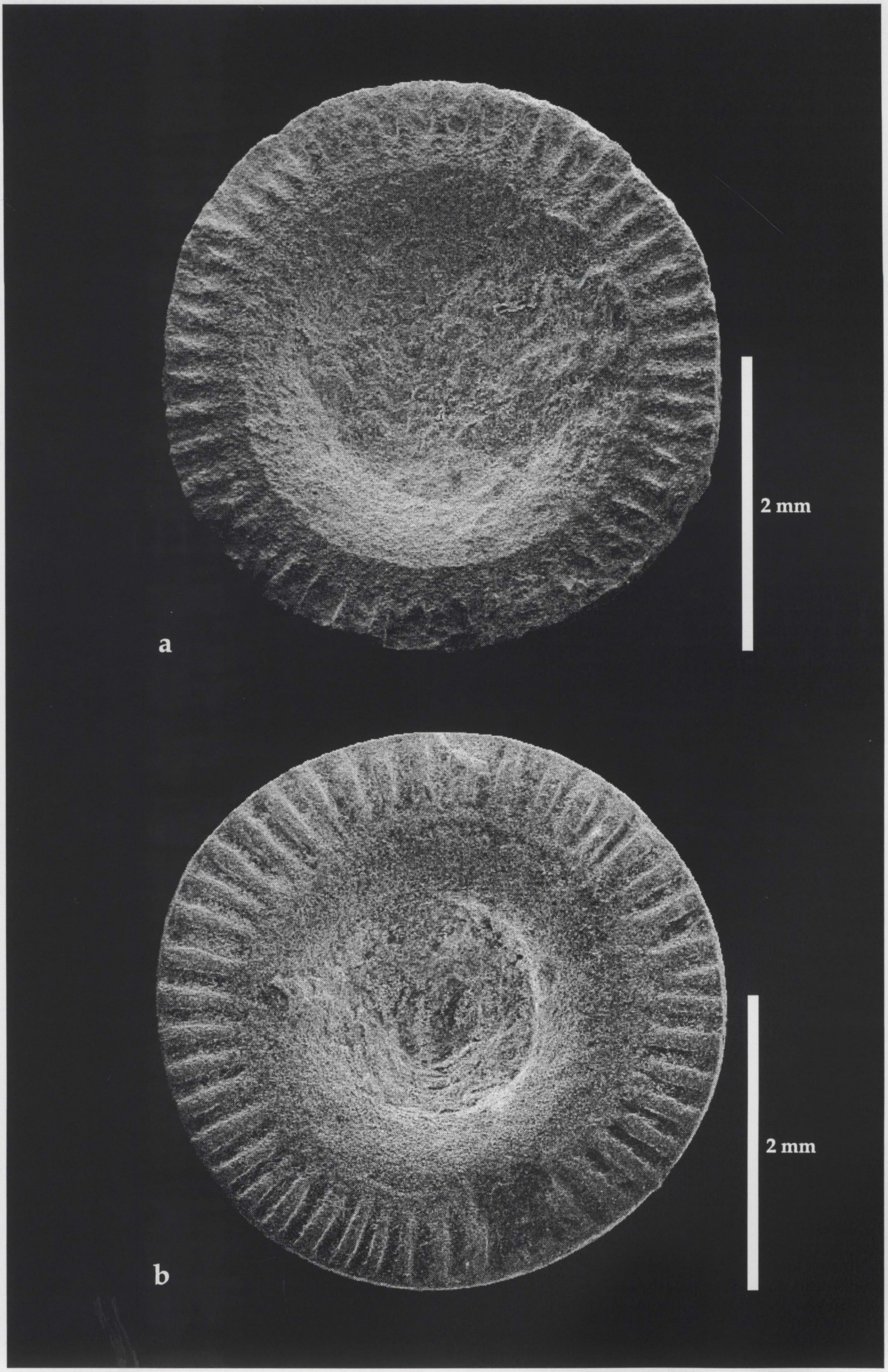

a
2 mm
b
2 mm

PLATE 41

(see Section 6.3.)

Figs a-c. Columnal Taxon Number 8; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 8.T-D1 (TCD.35988); a, symplectial articular facet. b, lateral view of pluricolumnal. c, detail of latus tuberculate ornamentation.

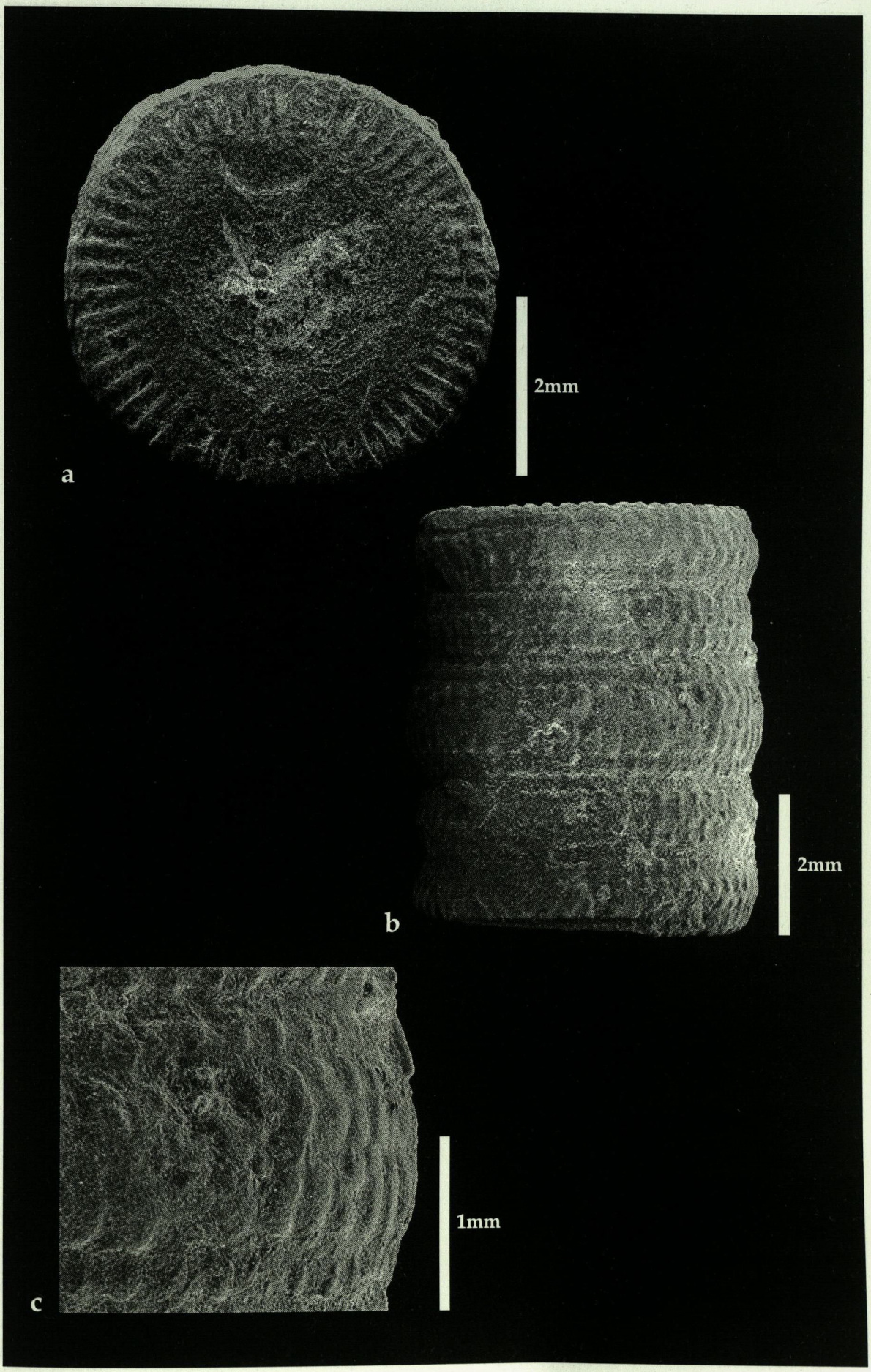
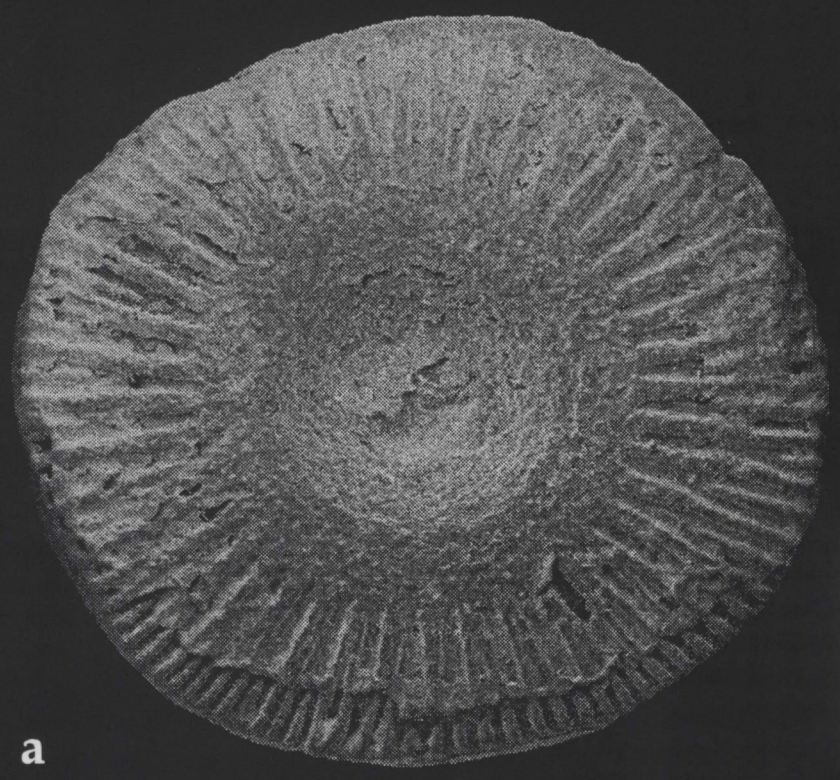

2mm
a
2mm
b
1mm
c

PLATE 42

(see Section 6.3.)

Figs a-c. Columnal Taxon Number 9; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 9.T-D1 (TCD.35989); a, symplectial articular facet. b, detail of crenulate suture. c, cirrus socket with central 'pore'.



a

2mm



b

500 µm



c

1mm

PLATE 43

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 9; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 9.V1-D1 (TCD.35990); a, symplectial articular facet. b, detail of crenularium.

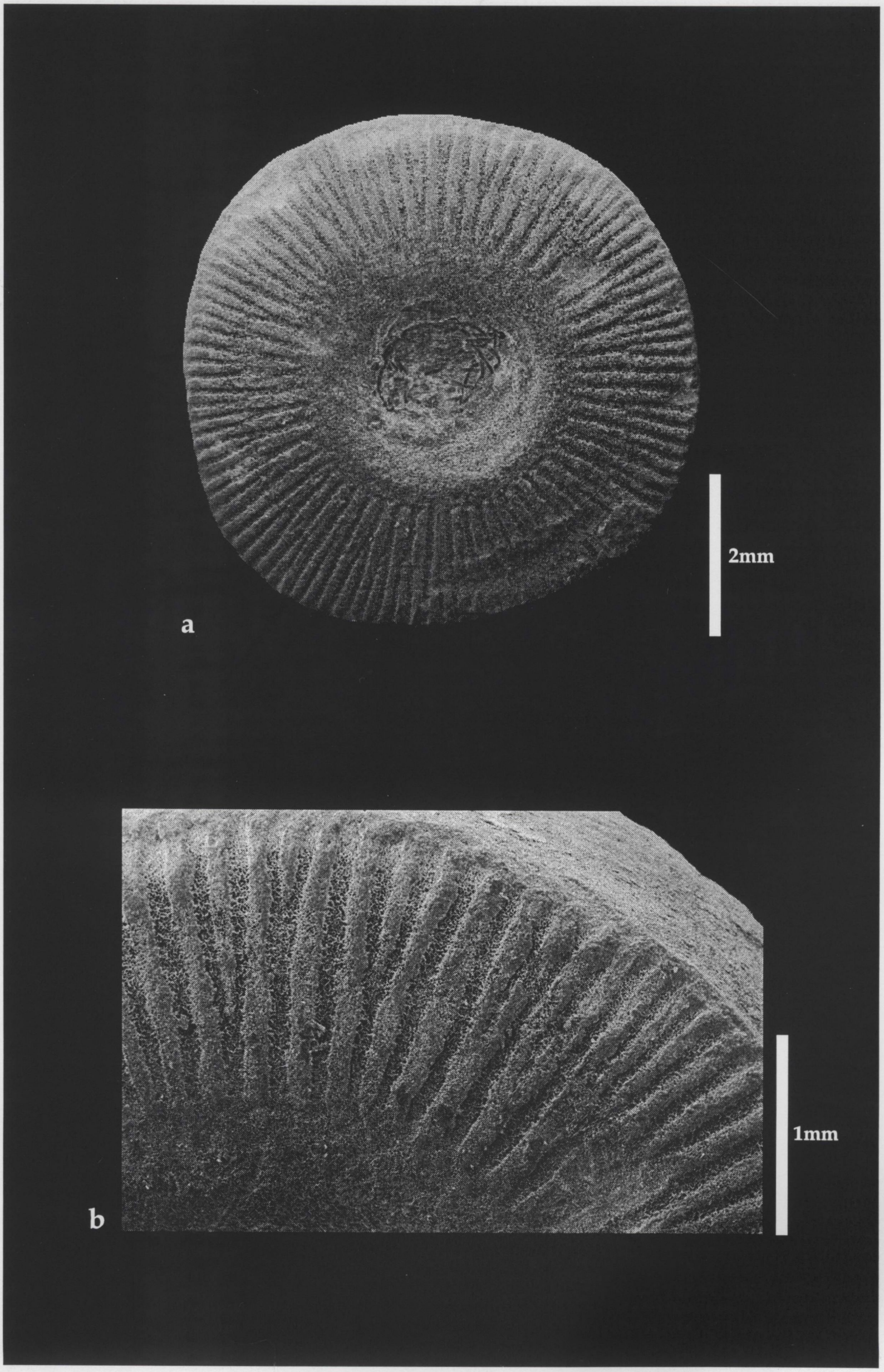

a
2mm
b
1mm

PLATE 44

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 10; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 10.T-G (TCD.35992); a, symplectial articular facet. b, lateral view of pluricolumnal; finely tuberculate ornamentation and small abortive cirri (pluricolumnal is straight; distortion in Plate due to large working distance in SEM).

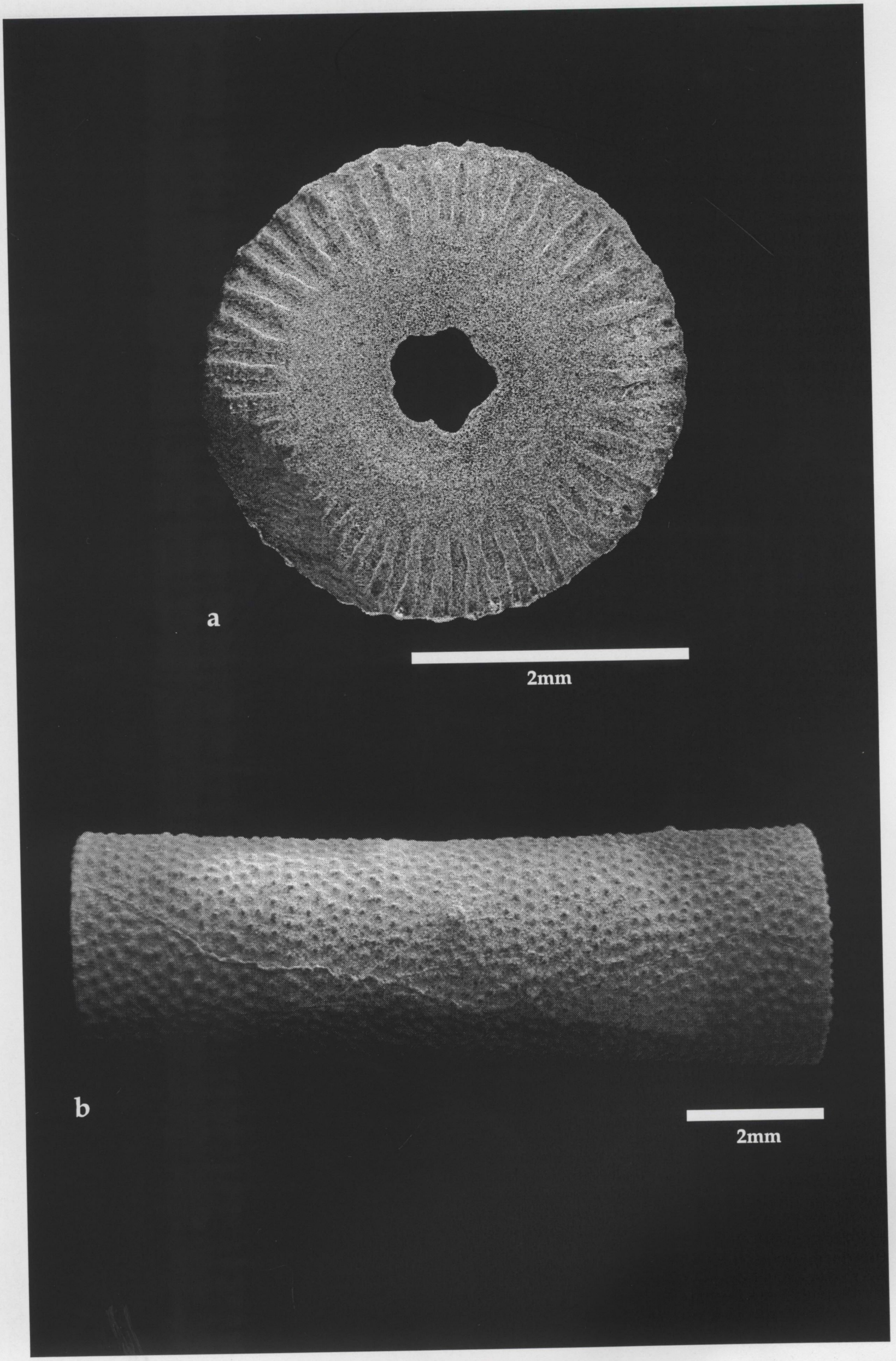
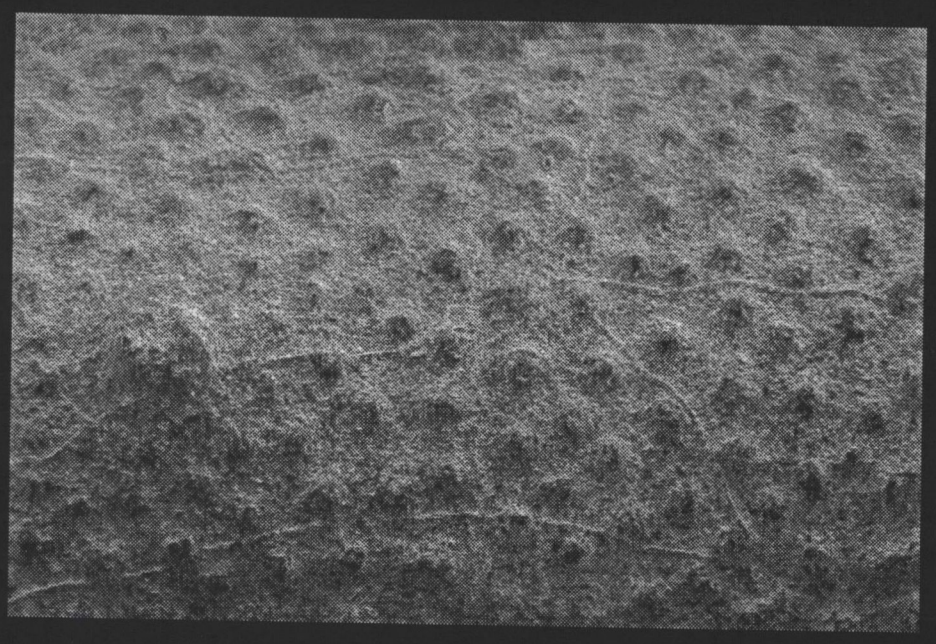

a
2mm
b
2mm

PLATE 45

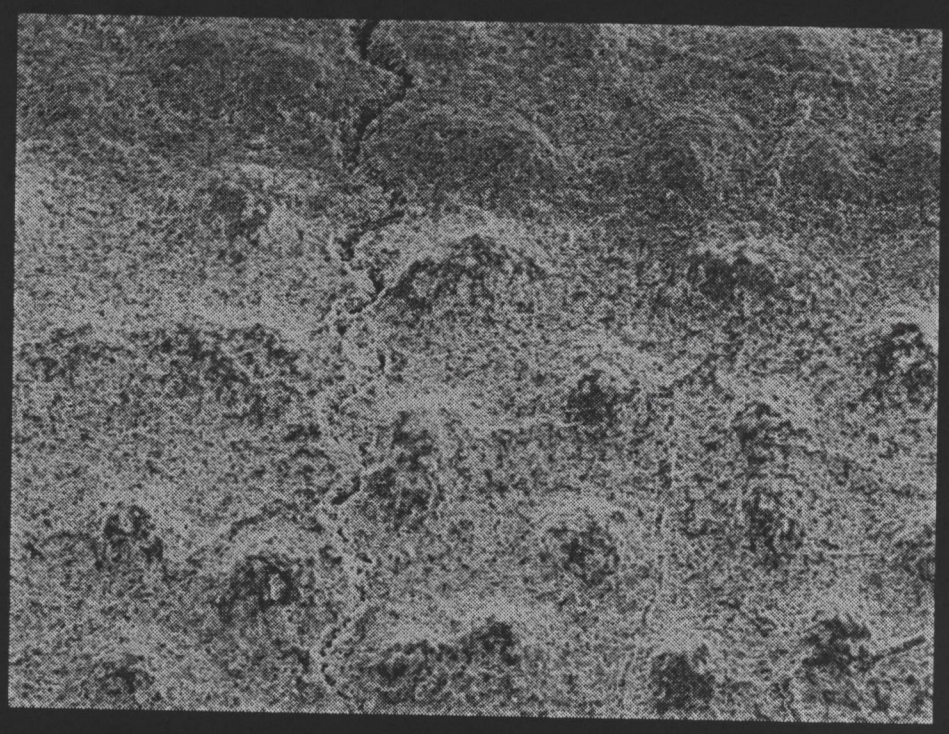
(see Section 6.3.)

Figs a-c. Columnal Taxon Number 10; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 10.T-G (TCD.35992); a and b, detail of tuberculate ornamentation and crenulate suture. c, stereom of crenularium.

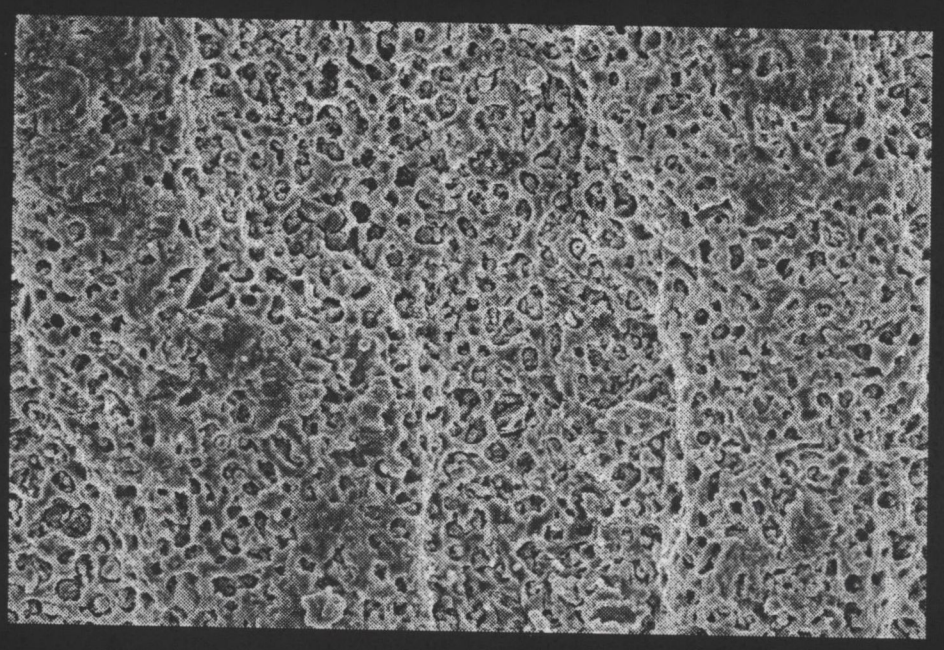


a

1mm



b



c

100 μm

PLATE 46

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 11; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 11.T-D1 (TCD.35993); a, symplectial articular facet, crenulae with bulbous inner terminations, claustrum in three parts. b, lateral view of pluricolumnal, columnals displaced.

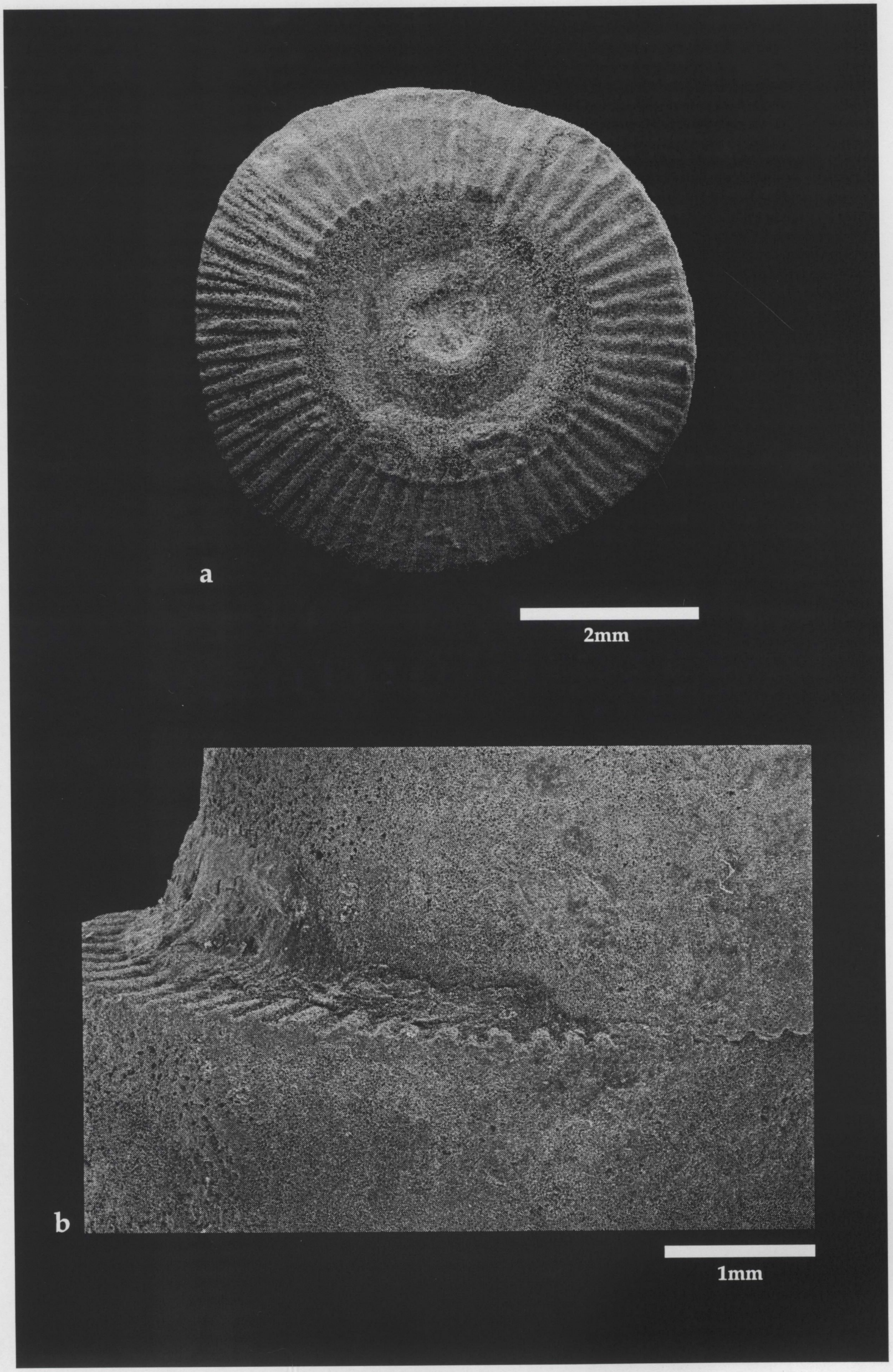
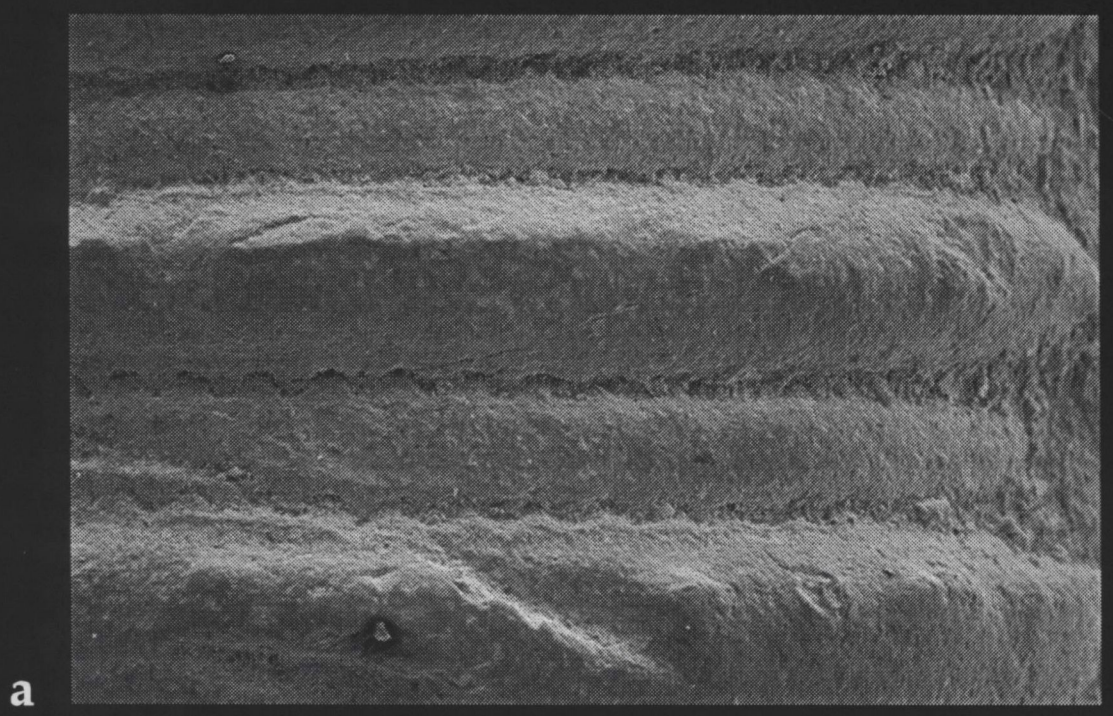

a
2mm
b
1mm

PLATE 47

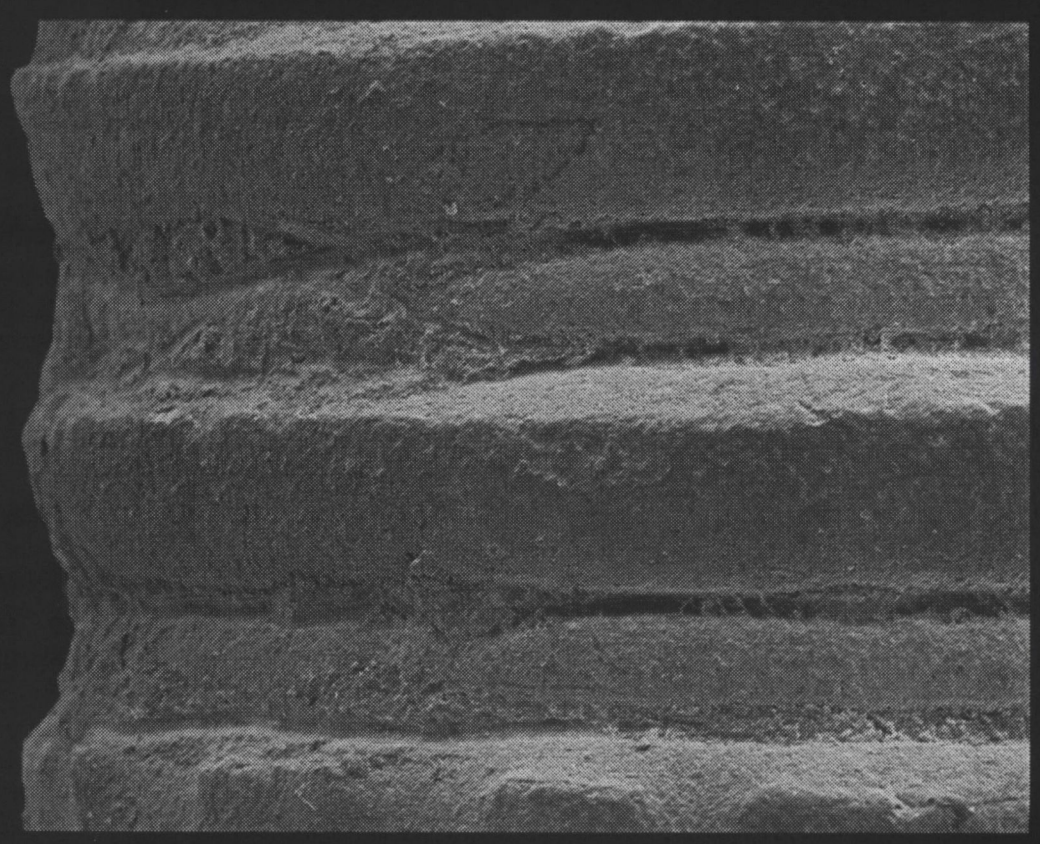
(see Section 6.3.)

Figs a-b. Columnal Taxon Number 12; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 12-K5b (TCD.35995); a and b, lateral views of pluricolumnal. Note crenulate suture, seen in a, and asymmetrically angulated nodals and priminternodals.



a

2 mm



b

2 mm

PLATE 48

(see Section 6.3.)

Fig. a. Columnal Taxon Number 13; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 13.T-D1 (TCD.35996); symplectial articular facet, randomly sized protuberances from latus; cracks on specimen removed from plate using Adobe® Photoshop®.

Fig. b. Columnal Taxon Number 14; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 14.T-D1 (TCD.35997); symplectial articular facet.

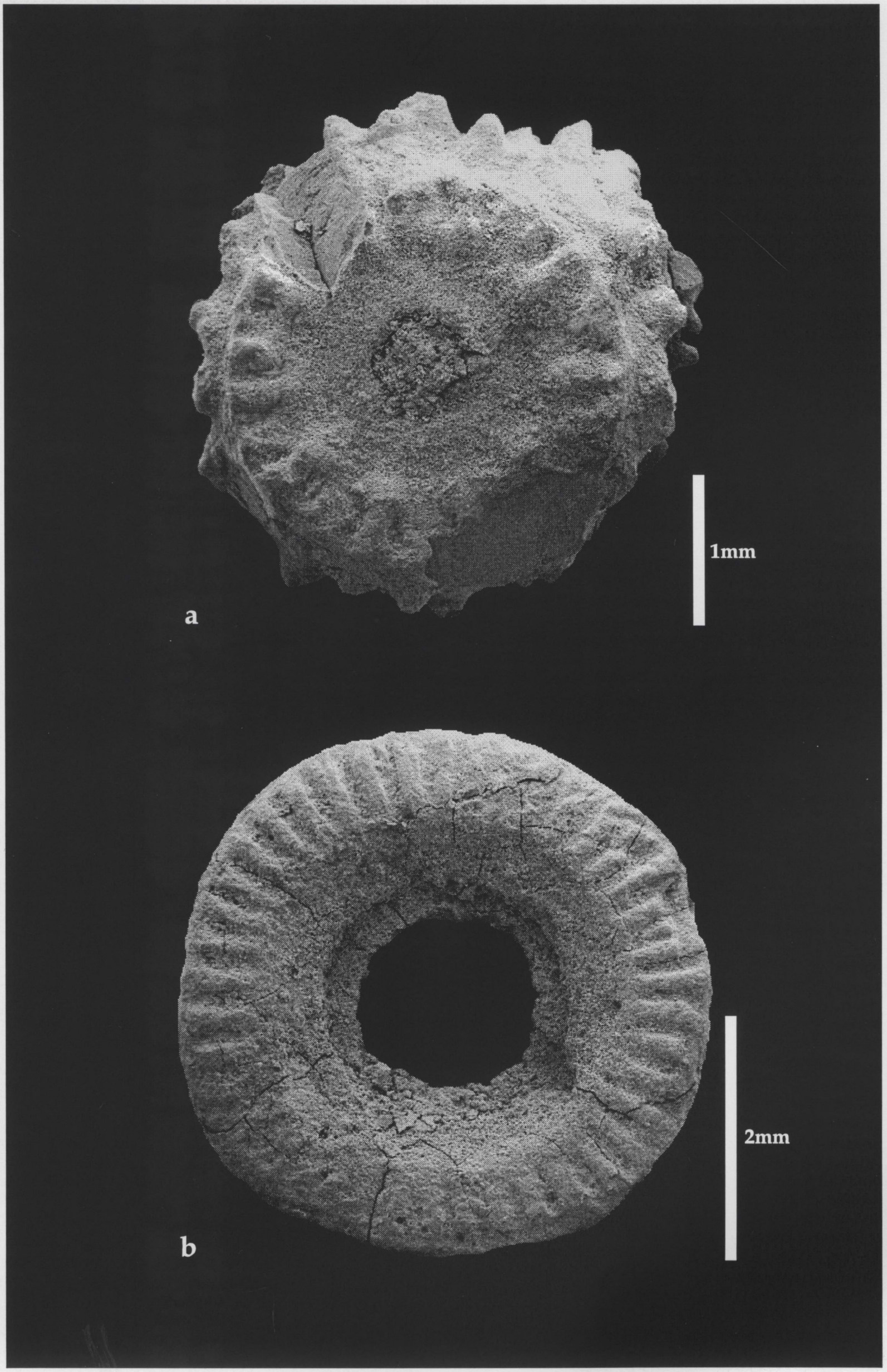

a
1mm
b
2mm

PLATE 49

(see Section 6.3.)

Fig. a. Columnal Taxon Number 15; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 15.T-D1 (TCD.35998); symplectial articular facet.

Fig. b. Columnal Taxon Number 18; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 18.T-FX (TCD.53001); synostosial articular facet, gently concave areola.


500 µm
a
1mm
b

PLATE 50

(see Section 6.3.)

Fig. a. Columnal Taxon Number 16; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 16.T-FX (TCD.35999); lateral view of pluricolumnal, moniliform columnals, ridges and grooves adjacent to crenulate suture.

Fig. b. Columnal Taxon Number 17; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 17.T-FX (TCD.53000); lateral view of pluricolumnal, latera with longitudinal striations and low equatorial flanges. Columnal on left has cirrus socket.

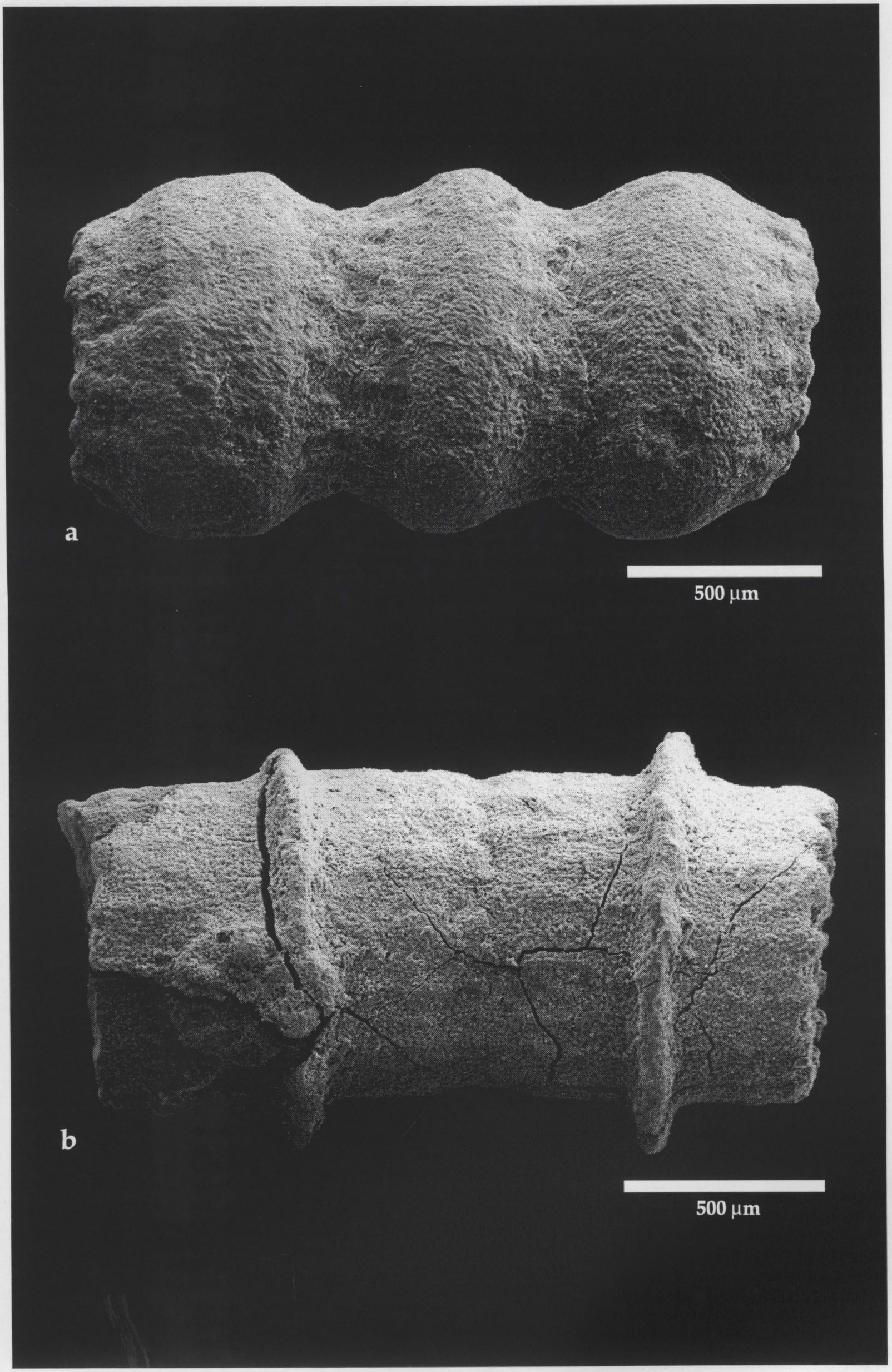

a
500 μm
b
500 μm

PLATE 51

(see Section 6.3.)

Fig. a. Columnal Taxon Number 19; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 19.T-FX (TCD.53002); symplectial articular facet, latus has equatorial flange.

Fig. b. Columnal Taxon Number 20; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 20.T-FX (TCD.53003); pentagonal symplectial articular facets, larger columnal has epifacet.


500 µm
a
500 µm
b

PLATE 52

(see Section 6.3.)

Fig. a. Columnal Taxon Number 21; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 21.T-D1 (TCD.53004); symplectial articular facet, some larger pores in stereom of areola.

Fig. b. Columnal Taxon Number 24; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 24.T-D1 (TCD.53007); lateral view of columnal showing longitudinally aligned tubercles.

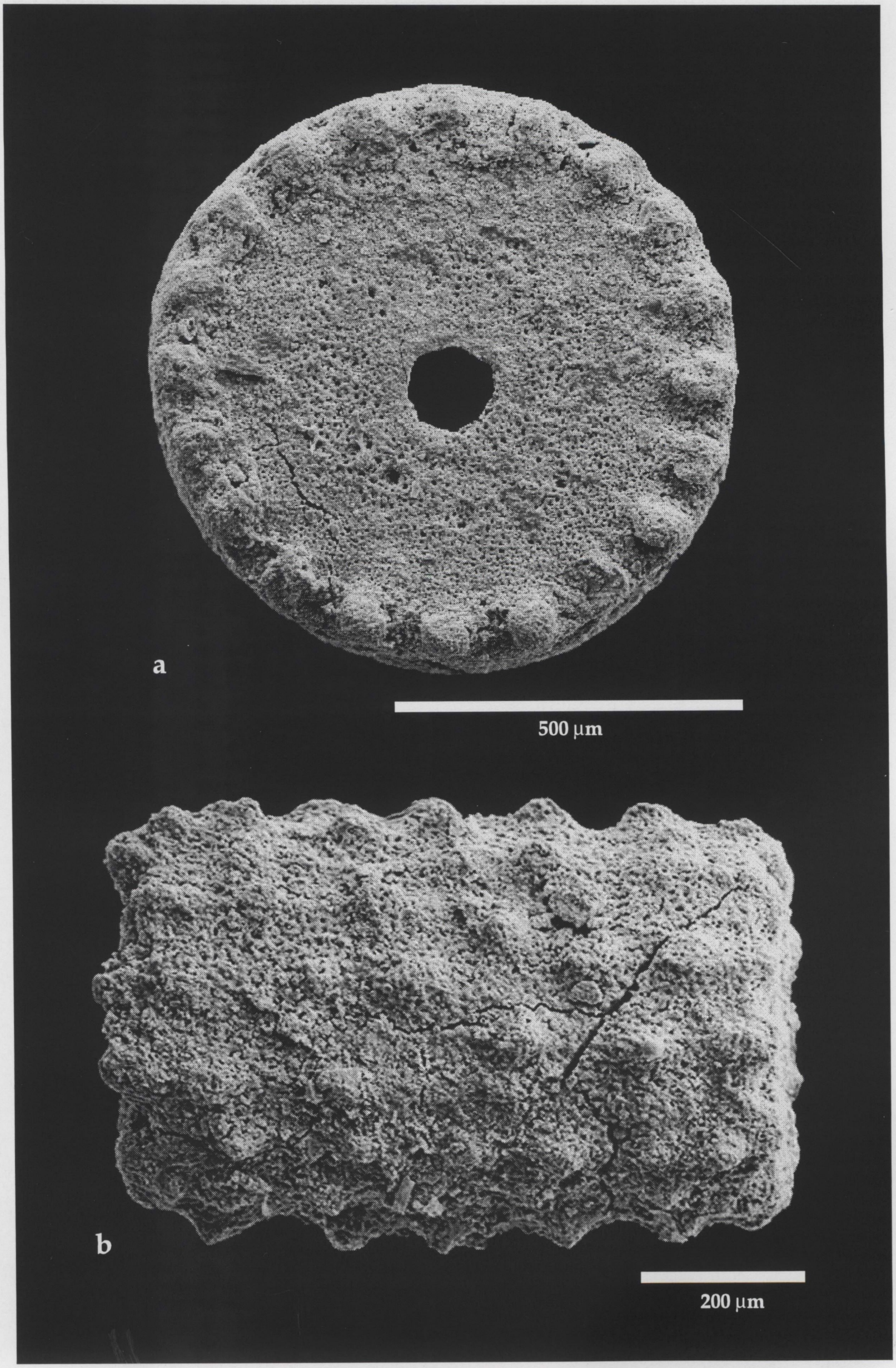

a
500 µm
b
200 µm

PLATE 53

(see Section 6.3.)

Figs a-b Columnal Taxon Number 22; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 22.T-D1 (TCD.53005); a, symplectial articular facet, cirrus socket on latus has greater relief on one side. b, detail of regularly galleried stereom

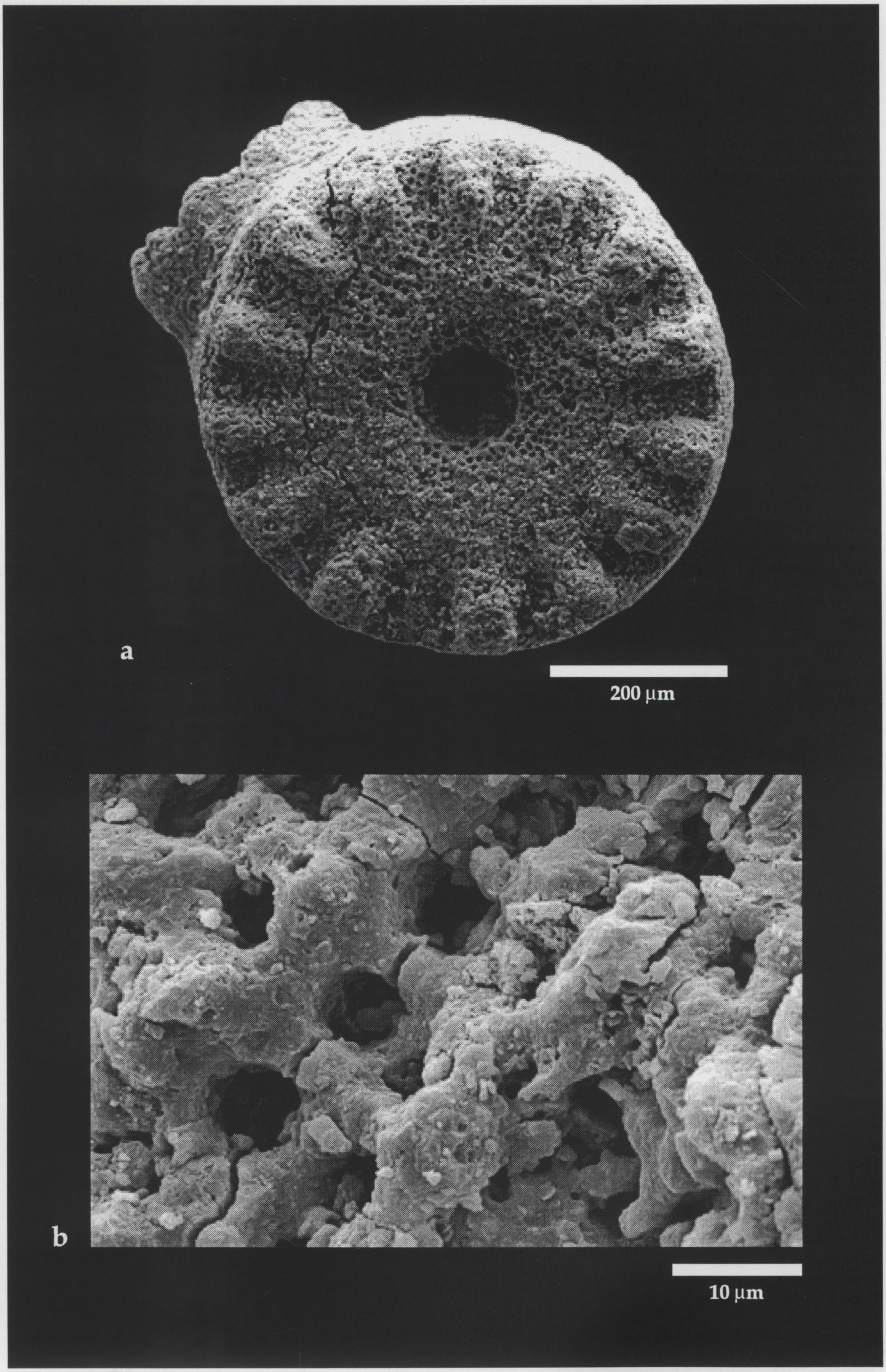

a
200 μm
b
10 μm

PLATE 54

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 23; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 23.T-D1 (TCD.53006); a, symplectial articular facet. b, lateral view of columnal showing high, rounded equatorial ridge.

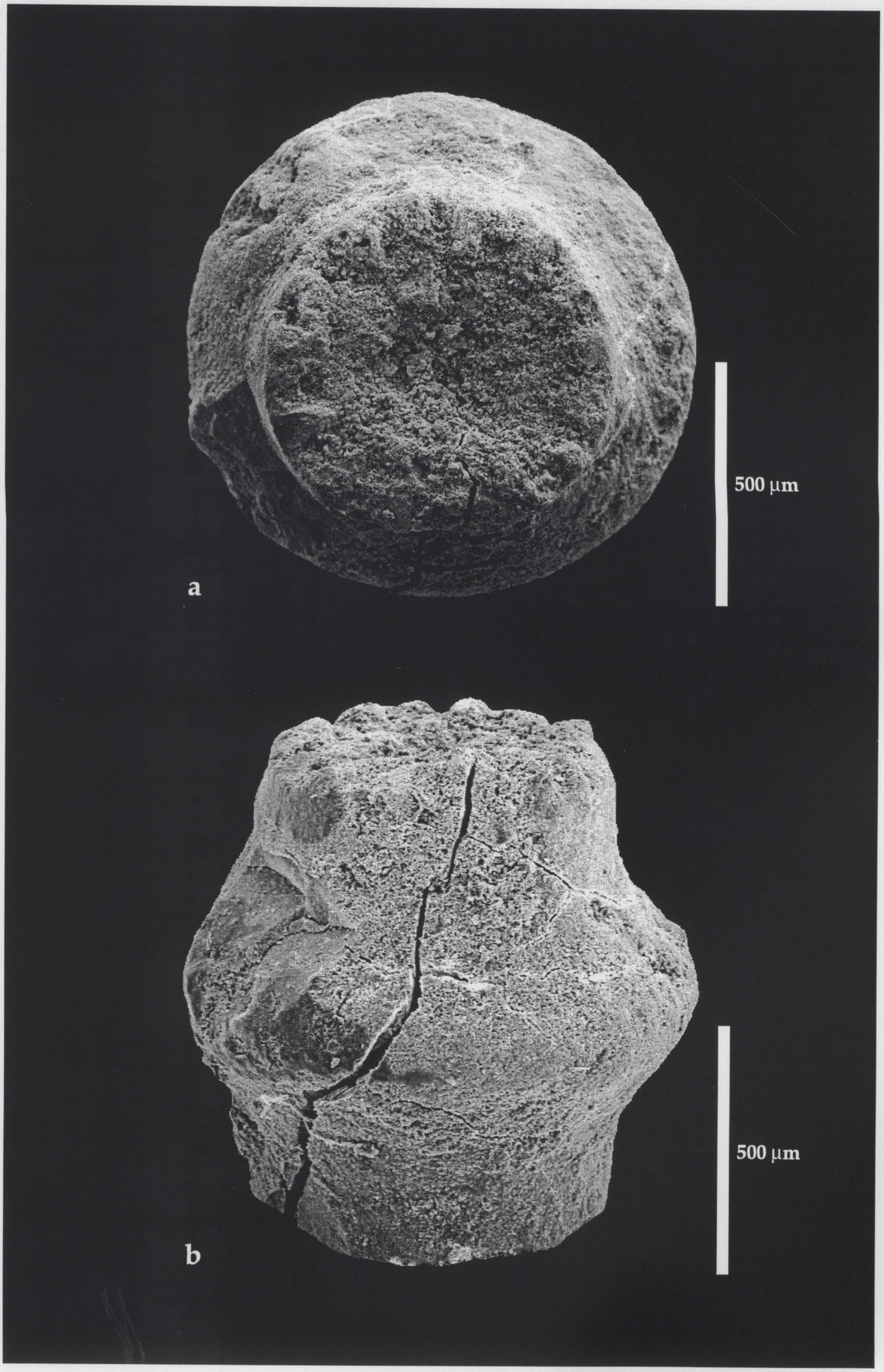

500 µm
a
500 µm
b

PLATE 55

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 25; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 25.T-D1 (TCD.53008); a, symplectial articular facet. b, lateral view of pluricolumnal, high cirrus sockets.

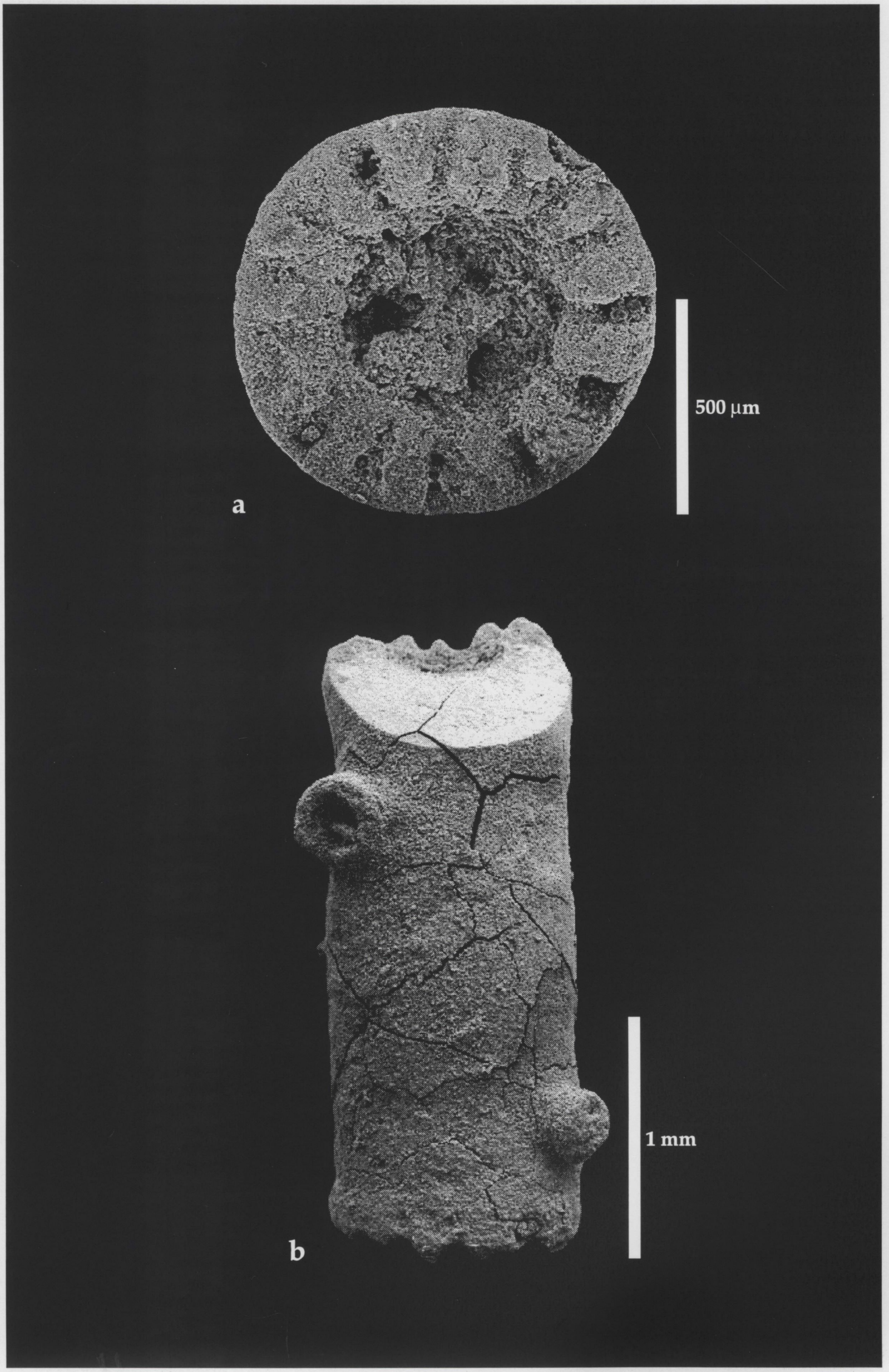

500 μm
a
1 mm
b

PLATE 56

(see Section 6.3.)

Fig. a. Columnal Taxon Number 26; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 26.T-BB (TCD.53009); symplectial articular facet.

Fig. b. Columnal Taxon Number 47; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 47.T-BB (TCD.53052); symplectial articular facet.

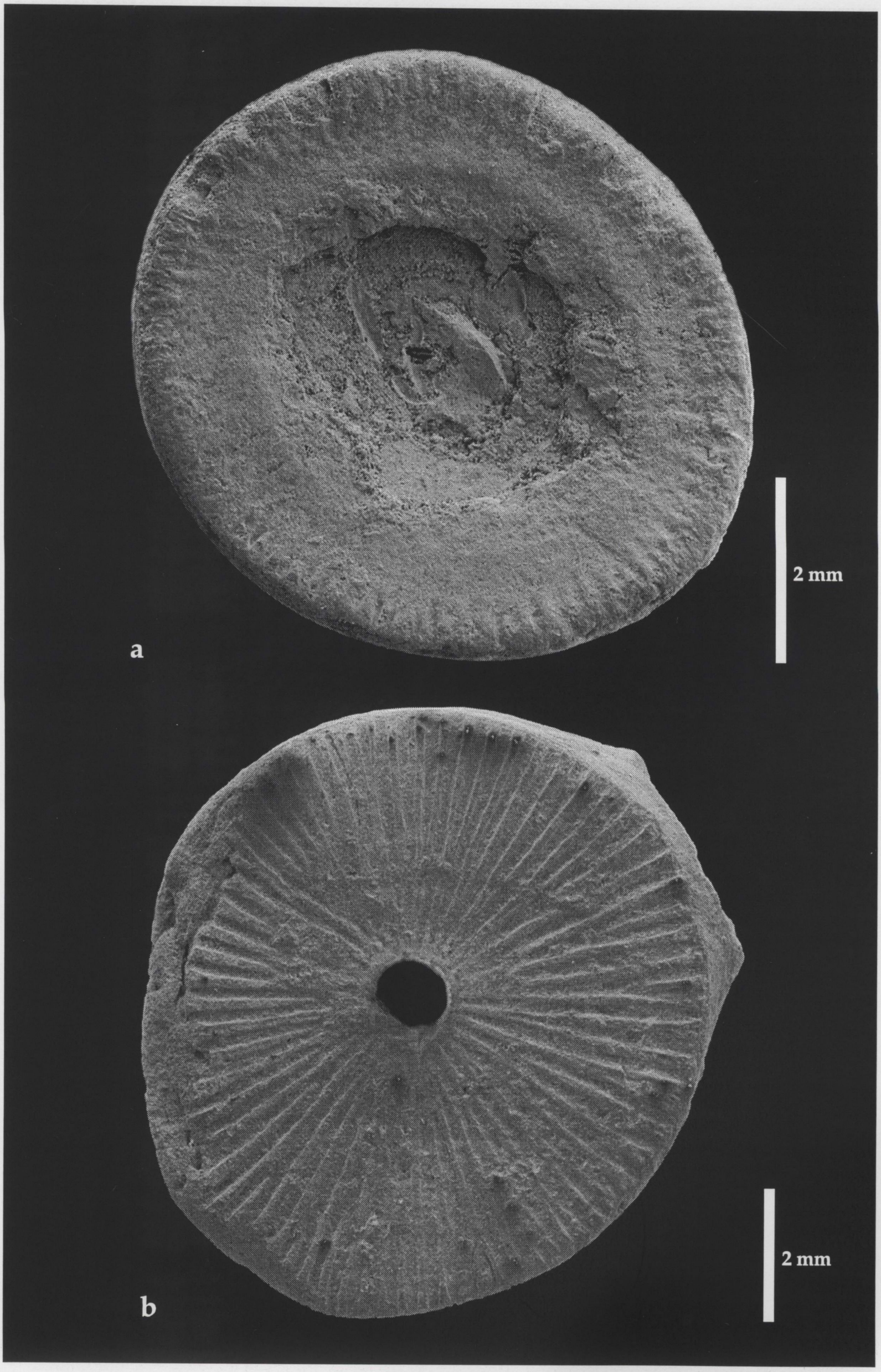

a
2 mm
b
2 mm

PLATE 57

(see Sections 6.3.)

Fig. a. Columnal Taxon Number 27; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 27.T-K5 (TCD.53010); symplectial articular facet.

Fig. b. Columnal Taxon Number 36; Benbulben Shale Formation (Holkerian), Carrickphatrick, Co. Sligo. Specimen 36.T-CP3a (TCD.53026); symplectial articular facet.

Figs c-d. Columnal Taxon Number 28; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. c, specimen 28.V1-A23 (TCD.53012). d, specimen 28.T-L1 (TCD.53011). Symplectial articular facetal views, crenularium in two parts with many crenulae.

Figs e-f. Columnal Taxon Number 38; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 38.V4-BB (TCD.35954); long pluricolumnal portion of stem. f, close up of e.

(figs a, c-f scale bars = 1 cm; fig. b scale bar = 0.5 cm)

a



b



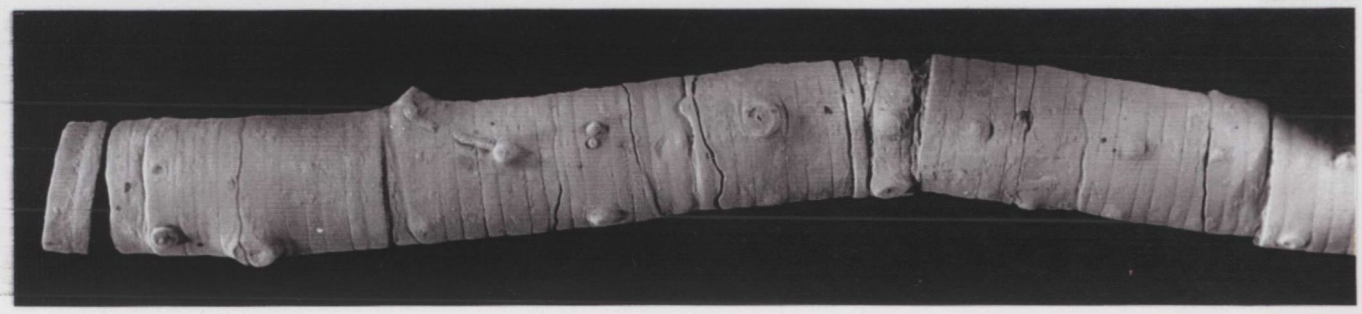
c



d



e



f



PLATE 58

(see Section 6.3.)

Figs a-b. Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Field photographs of stems composed of Columnal Taxon Number 28; a, entire lengths of preserved stems (longest = 1.89 m), attachment structure (radicular cirri) at left of picture. b, close up of the two stems.



a



b

PLATE 59

(see Section 6.3.)

Figs a-b. Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Field photographs of radicular cirri of long (1.89 m) stem composed of Columnal Taxon Number 28.



a



b

PLATE 60

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 29; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. a, specimen 29.T-D1 (TCD.53014); pentagonal symplectial articular facet, some larger pores in stereom of areola. b, specimen 29.V1-D1 (TCD.53015); pentagonal symplectial articular facet, some larger pores in stereom of areola.

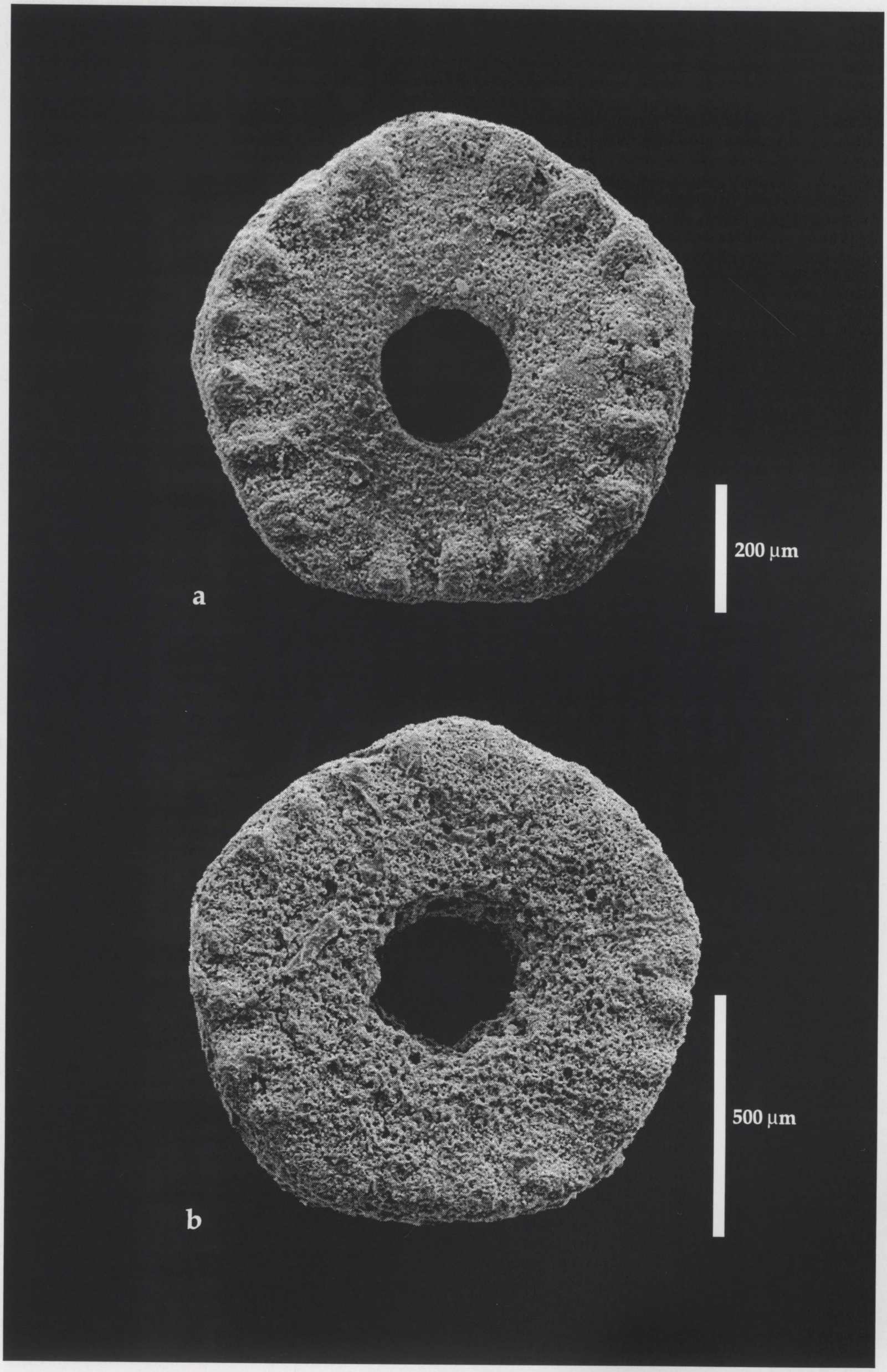

a
200 μm
b
500 μm

PLATE 61

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 30; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 30.T-D1 (TCD.53016); pentagonal symplectial articular facet, some larger pores in stereom of areola. b, detail of galleried stereom microstructure.

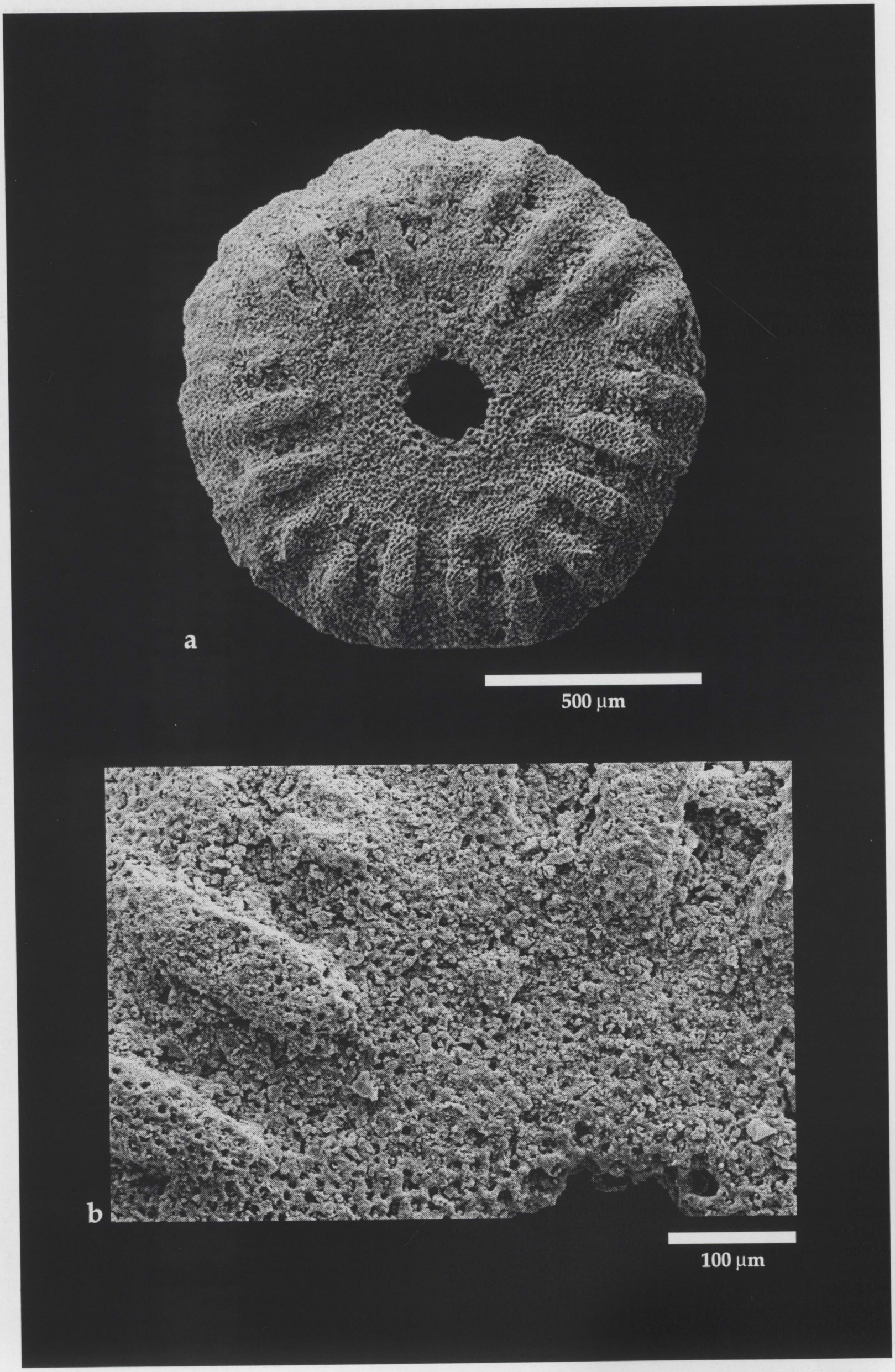

a
500 µm
b
100 µm

PLATE 62

(see Section 6.3.)

Fig. a. Columnal Taxon Number 30; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 30.V1-D1 (TCD.53017); pentagonal symplectial articular facet.

Fig. b. Columnal Taxon Number 31; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 31.T-D1 (TCD.53018); pentagonal symplectial articular facet.

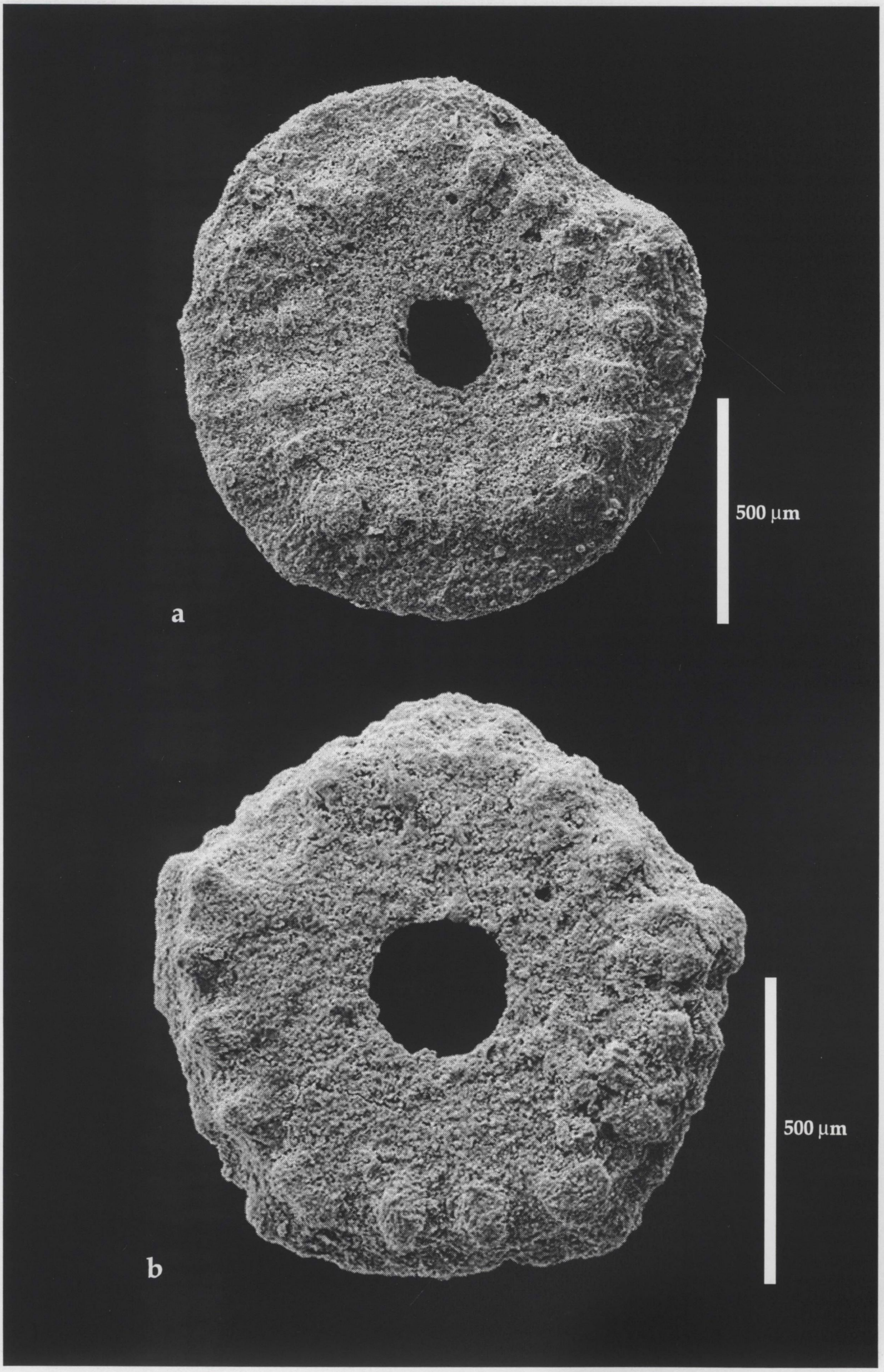

a
500 µm
b
500 µm

PLATE 63

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 32; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 32.T-D1 (TCD.53019); a, symplectial articular facet. b, lateral view of pluricolumnal, cirrus socket on middle columnal.


200 µm
a
1 mm
b

PLATE 64

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 33; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 33.T-D1 (TCD.53020); a, symplectial articular facet, latus with very large cirrus socket; lowest 1 cm of plate constructed using Adobe® Photoshop®. b, detail of galleried crenularium stereom microstructure.

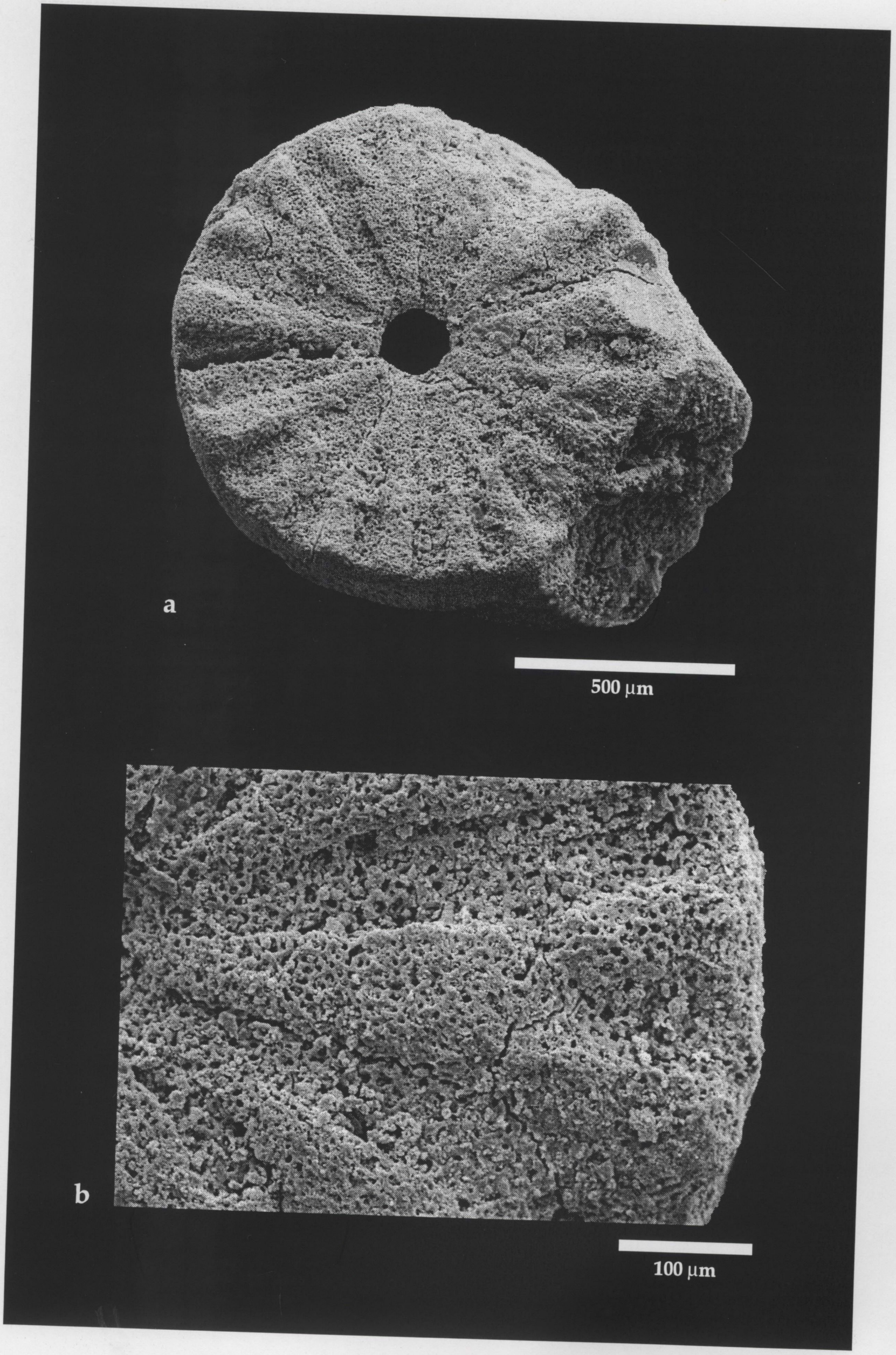

a
500 μm
b
100 μm

PLATE 65

(see Section 6.3.)

Fig. a. Columnal Taxon Number 34; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 34.T-D1 (TCD.53021); oblique view of symplectial articular facet, bulbous crenulae and high, narrow perilumen.

Fig. b. Columnal Taxon Number 35; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 35.T-E2 (TCD.53022); symplectial articular facet.

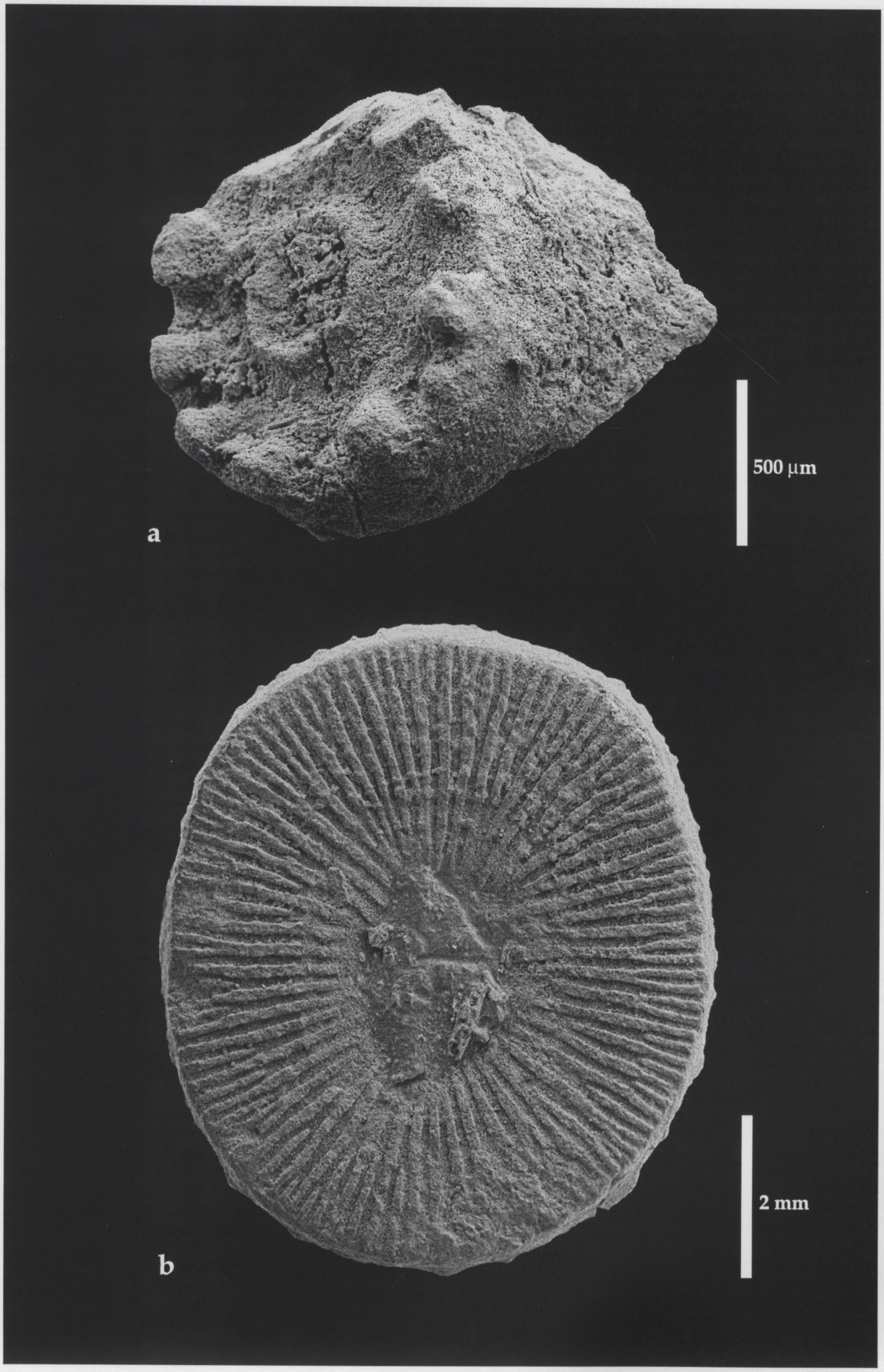

a
500 μm
b
2 mm

PLATE 66

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 35; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 35.T-E2 (TCD.53022); a, details of latus, ornamentation of fine tubercles. b, detail of stereom microstructure of crenularium.

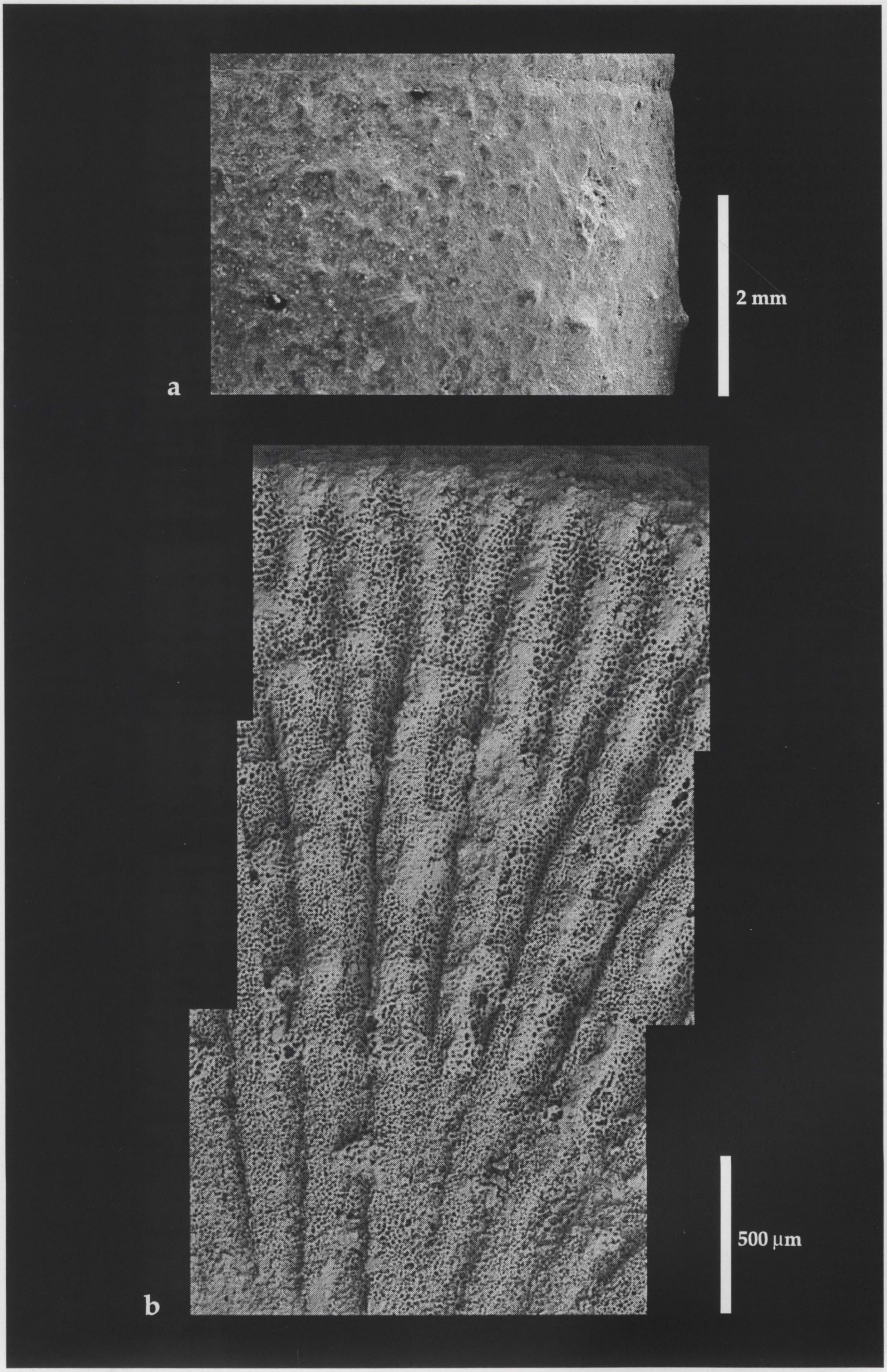

a
2 mm
b
500 μm

PLATE 67

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 37a. a, Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo, specimen 37a.T-BB (TCD.53027); symplectial articular facet. b, Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal, specimen 37a.V2-L1 (TCD.53027); symplectial articular facet.


a
2 mm
b
2 mm

PLATE 68

(see Section 6.3.)

Fig. a. Columnal Taxon Number 37b; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 37b.T-BB (TCD.53030); symplectial articular facet.

Fig. b. Columnal Taxon Number 38; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 38.T-BB (TCD.53032); symplectial articular facet.

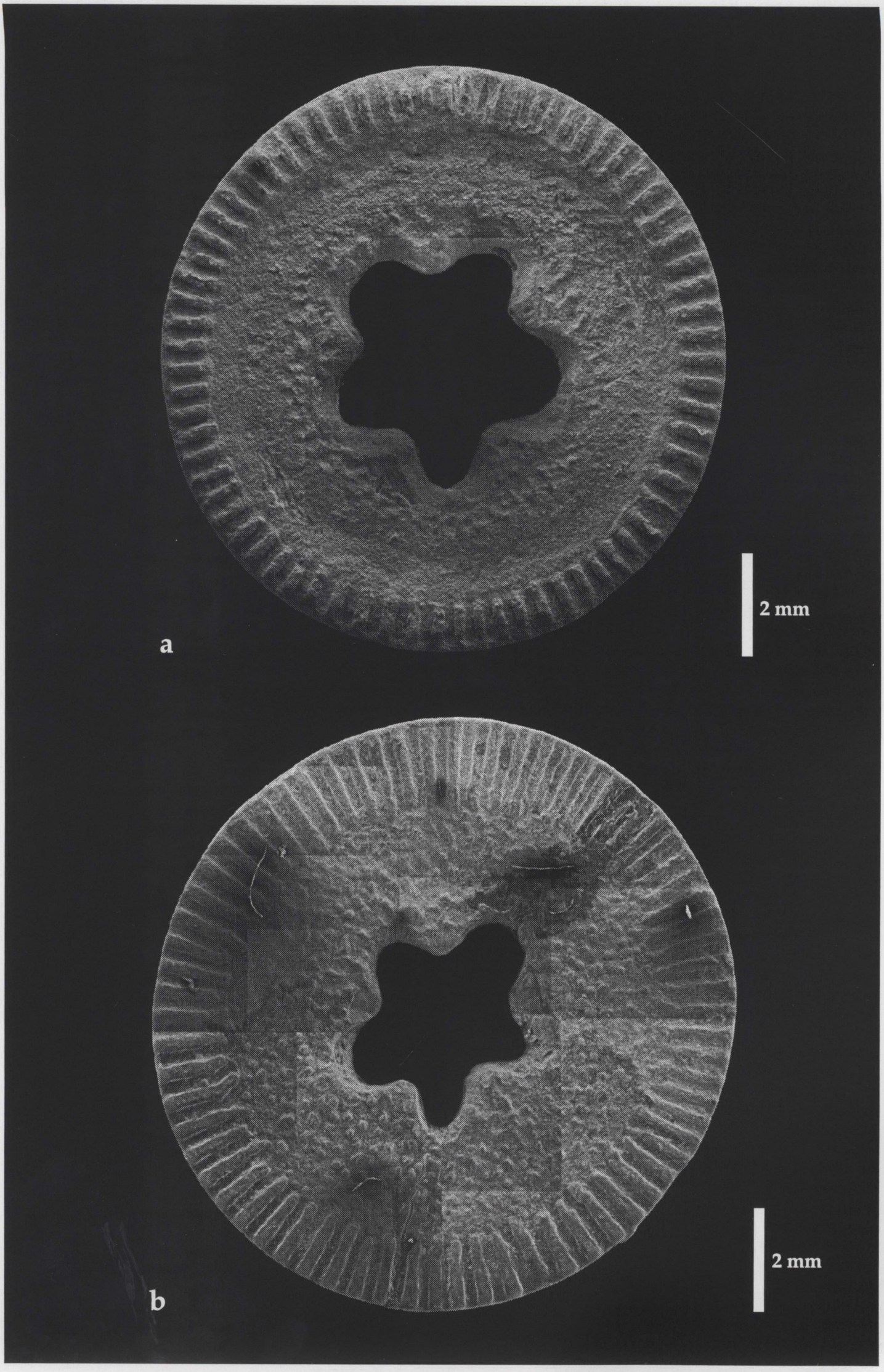

a
2 mm
b
2 mm

PLATE 69

(see Section 6.3.)

Figs a-b. Photographs showing specimen 38.V4-BB (TCD.35954) in the outcrop face in calcareous, clay-rich shale in the Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Notice stem lacks several columnals in photograph a that are present at the distal end in photograph b. Total length of section is 23.04 cm (finger for scale).



a



b

PLATE 70

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 39; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 39.T-BB (TCD.53037); a, symplectial articular facet, areola and lumen eccentric, five cirrus-related structures on latus positioned at 72° from each other. b, oblique lateral view of pluricolumnal, zygocirral attached to cirrus socket.

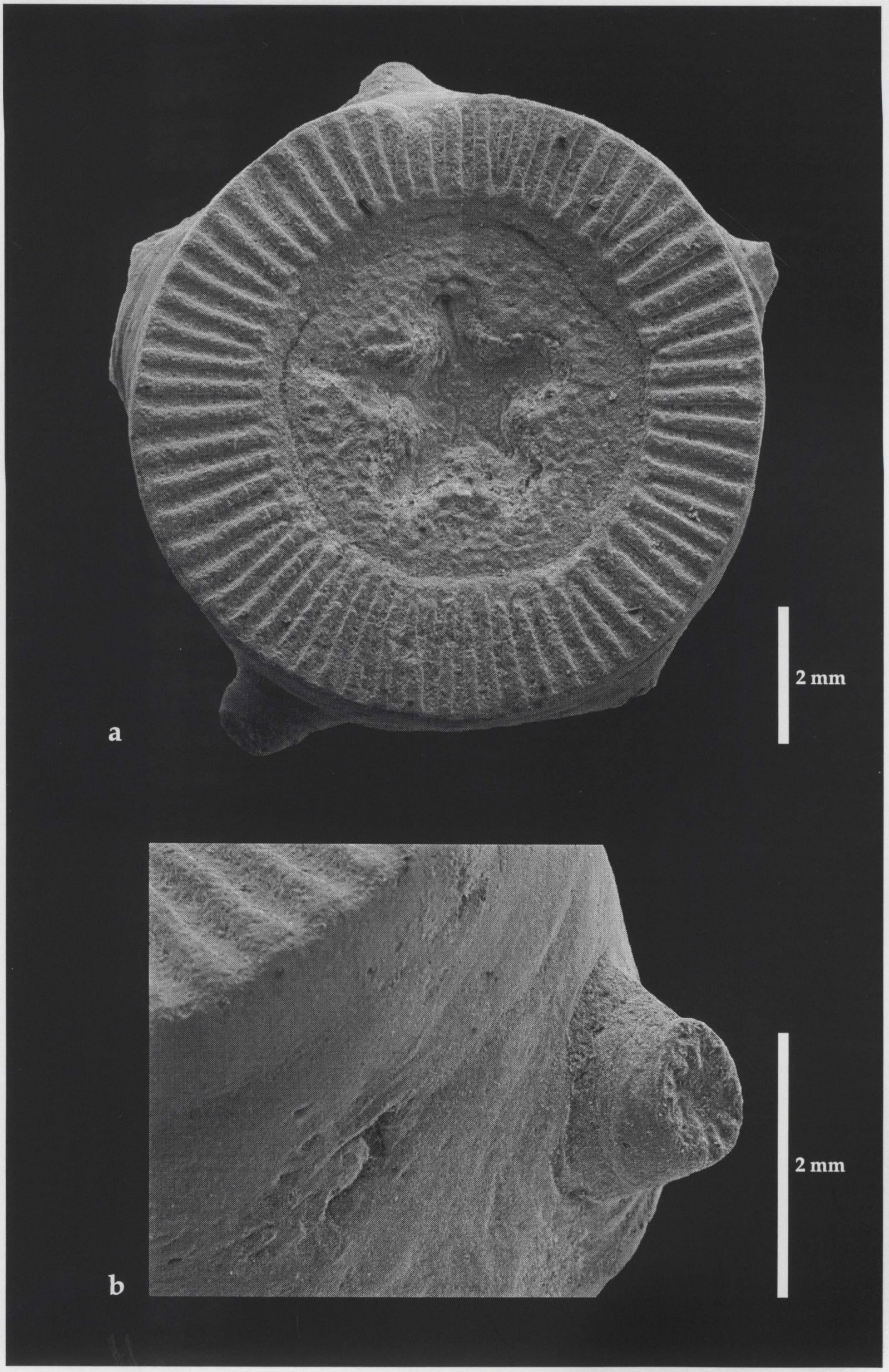

a
2 mm
b
2 mm

PLATE 71

(see Section 6.3.)

Fig. a. Columnal Taxon Number 40; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 40.T-BB (TCD.53041); symplectial articular facet.

Fig. b. Columnal Taxon Number 41; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 41.T-BB (TCD.53042); ovate symplectial articular facet, dilobate lumen.

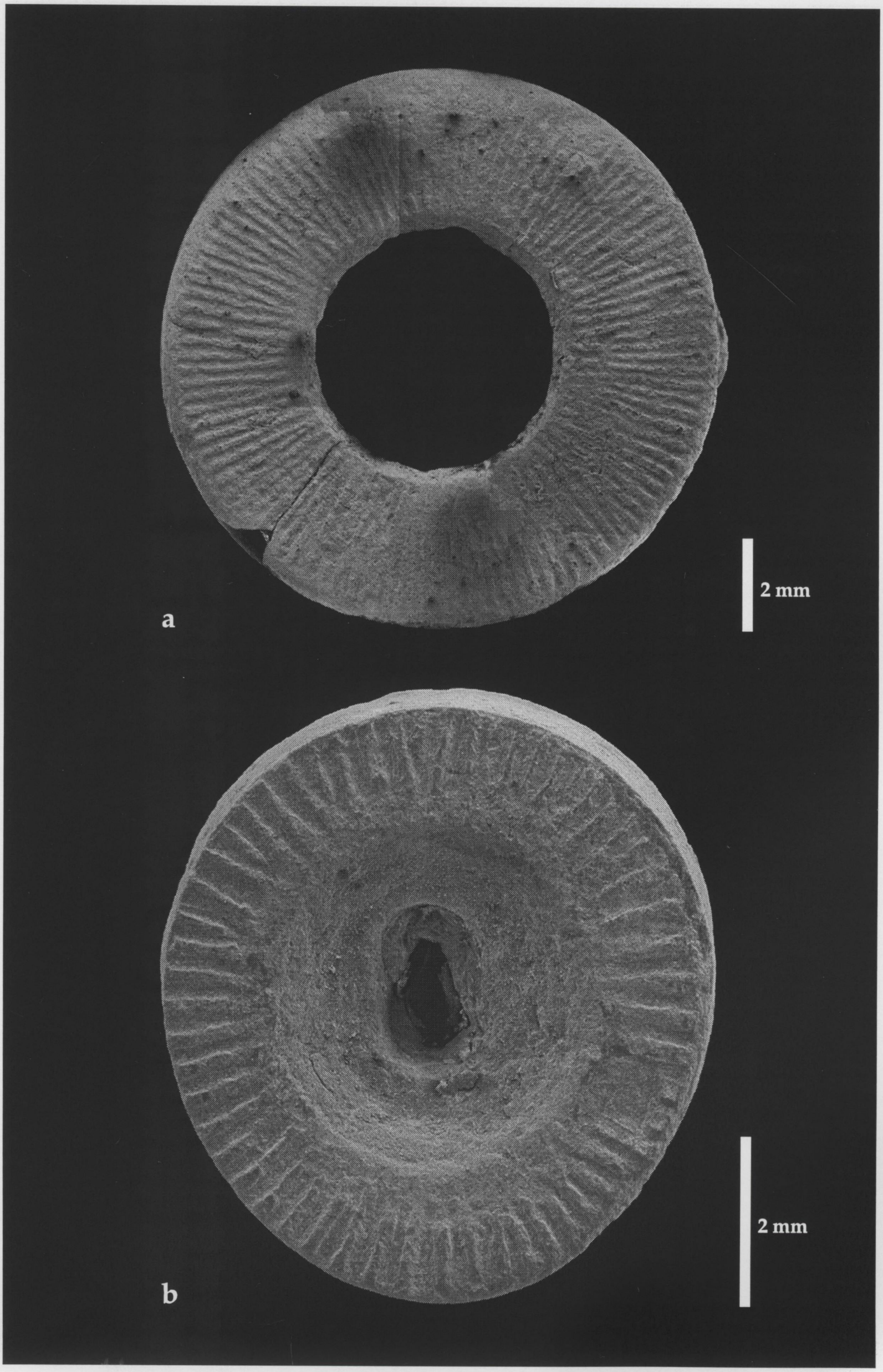

a
2 mm
b
2 mm

PLATE 72

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 42a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 42a.T-BB (TCD.53043); a, lateral view of pluricolumnal with cirrus-related structures. b, regularly galleried stereom microstructure of columnal (area broken away from latus on highest nodal in a).

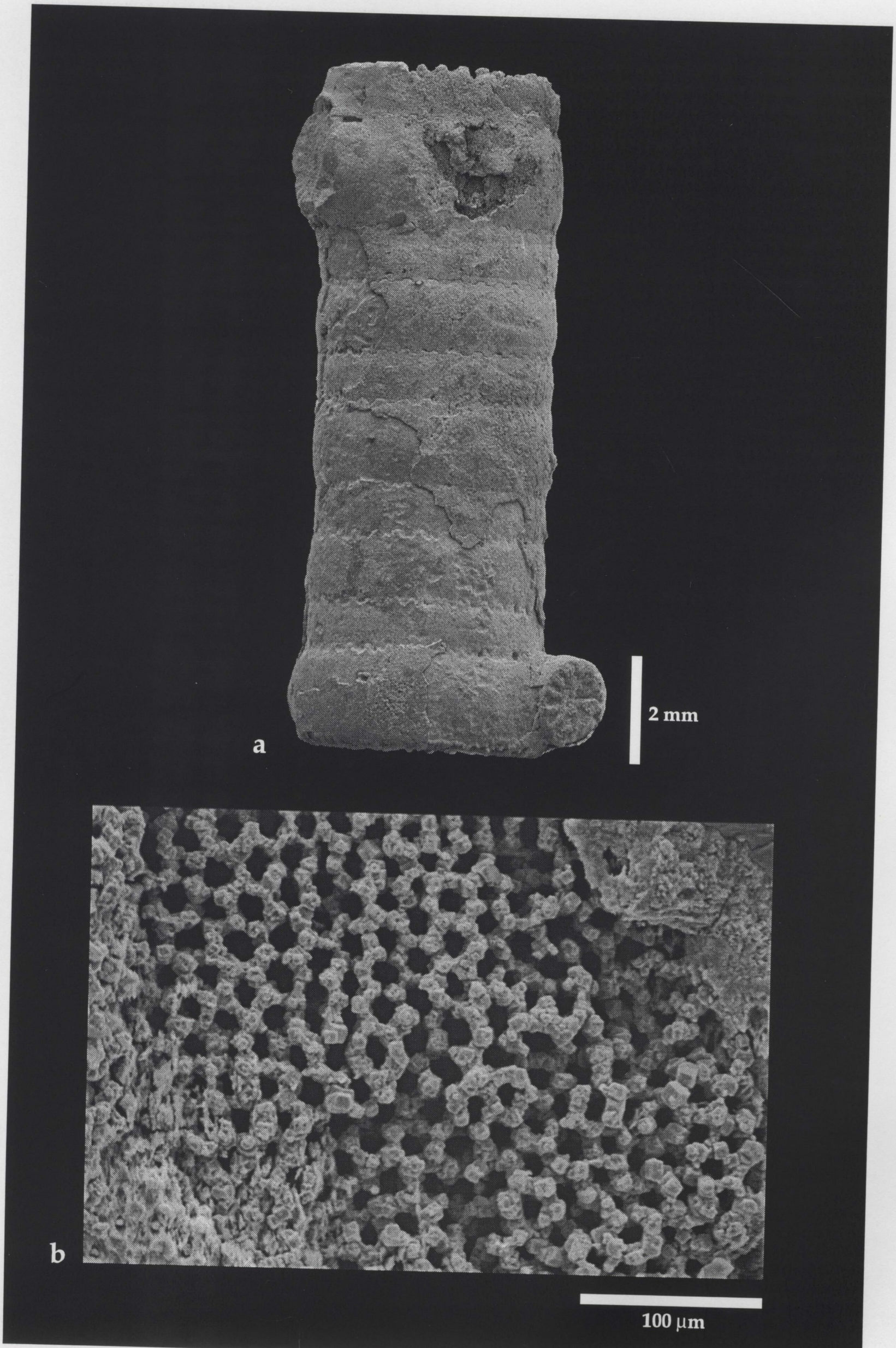

a
2 mm
b
100 μm

PLATE 73

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 42a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 42a.T-BB (TCD.53043); a, oblique lateral view of uneven symplectial articular facet. b, detail of curious bifurcation of crenulae on crenularium.

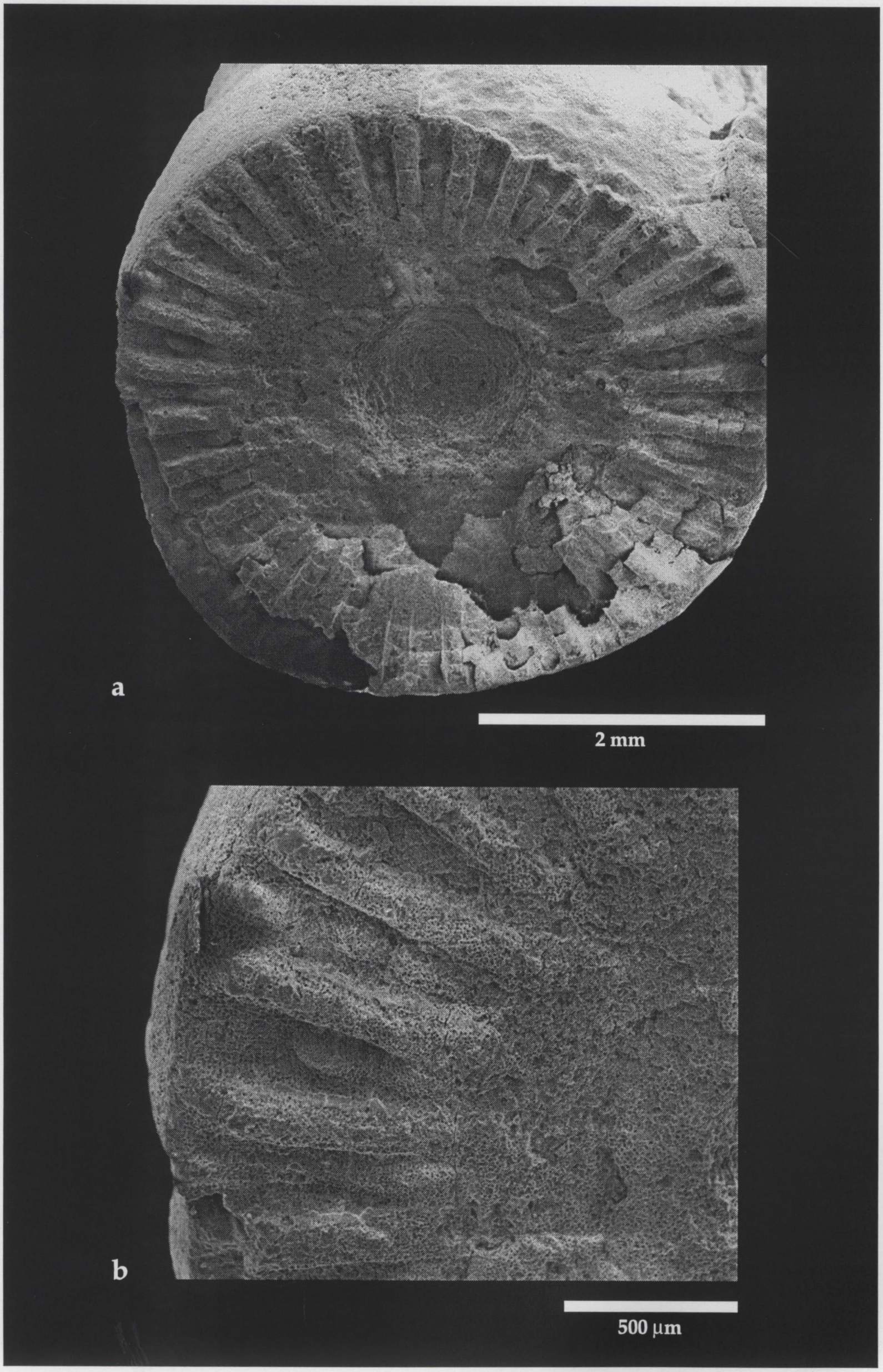

a
2 mm
b
500 µm

PLATE 74

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 42a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 42a.V1-BB (TCD.53044); a, oblique lateral view of symplectial articular facet. b, lateral view of part of pluricolumnal; convex latus, irregular crenulate suture, zygocirral attached to cirrus socket.

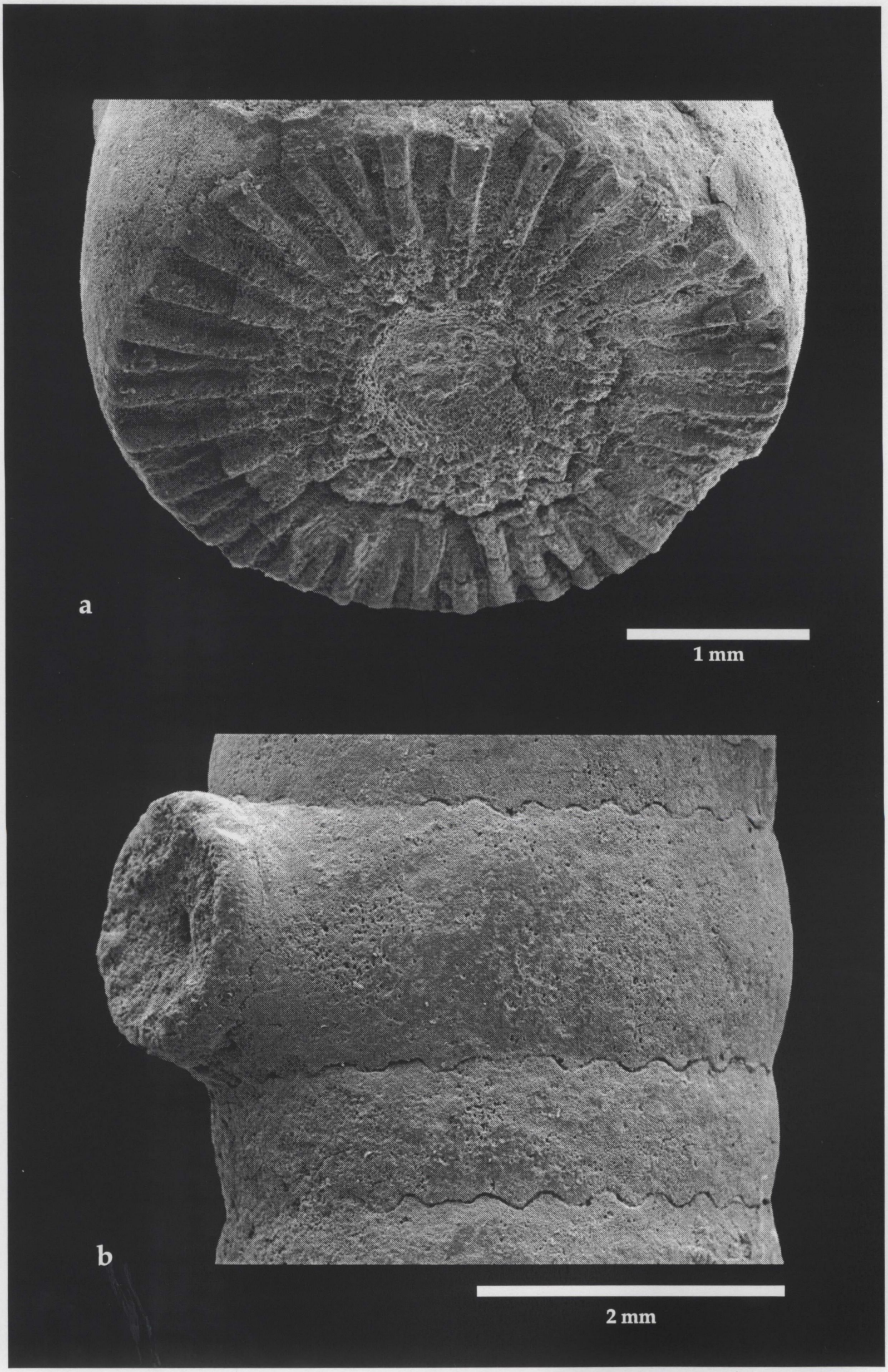

a
1 mm
b
2 mm

PLATE 75

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 42a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 42a.V1-BB (TCD.53044); a, cirrus socket with dilobate lumen. b, detail of galleried stereom microstructure of cirrus socket.


a
1 mm

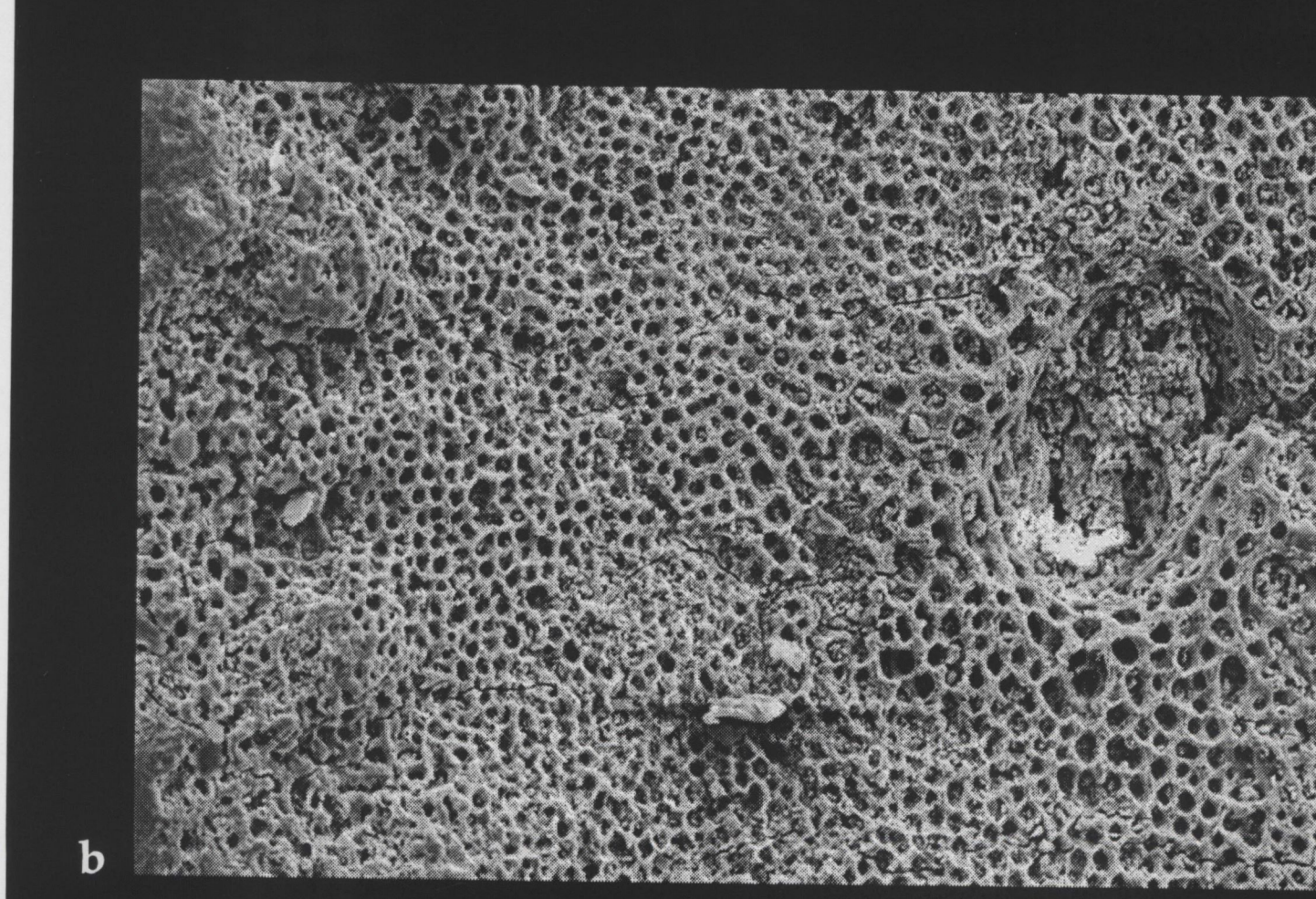

b
200 μm

PLATE 76

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 42b; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 42b.T-BB (TCD.53045); a, lateral view of pluricolumnal with cirrus socket. b, oblique view of articular facet; curious trifurcating culmina.


2 mm
a
500 µm
b

PLATE 77

(see Section 6.3.)

Fig. a. Columnal Taxon Number 43; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 43.T-BB (TCD.53046); symplectial articular facet of nodal with two cirrus sockets at 144° from each other.

Fig. b. Columnal Taxon Number 44; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 44.V1-BB (TCD.53048); symplectial articular facet.

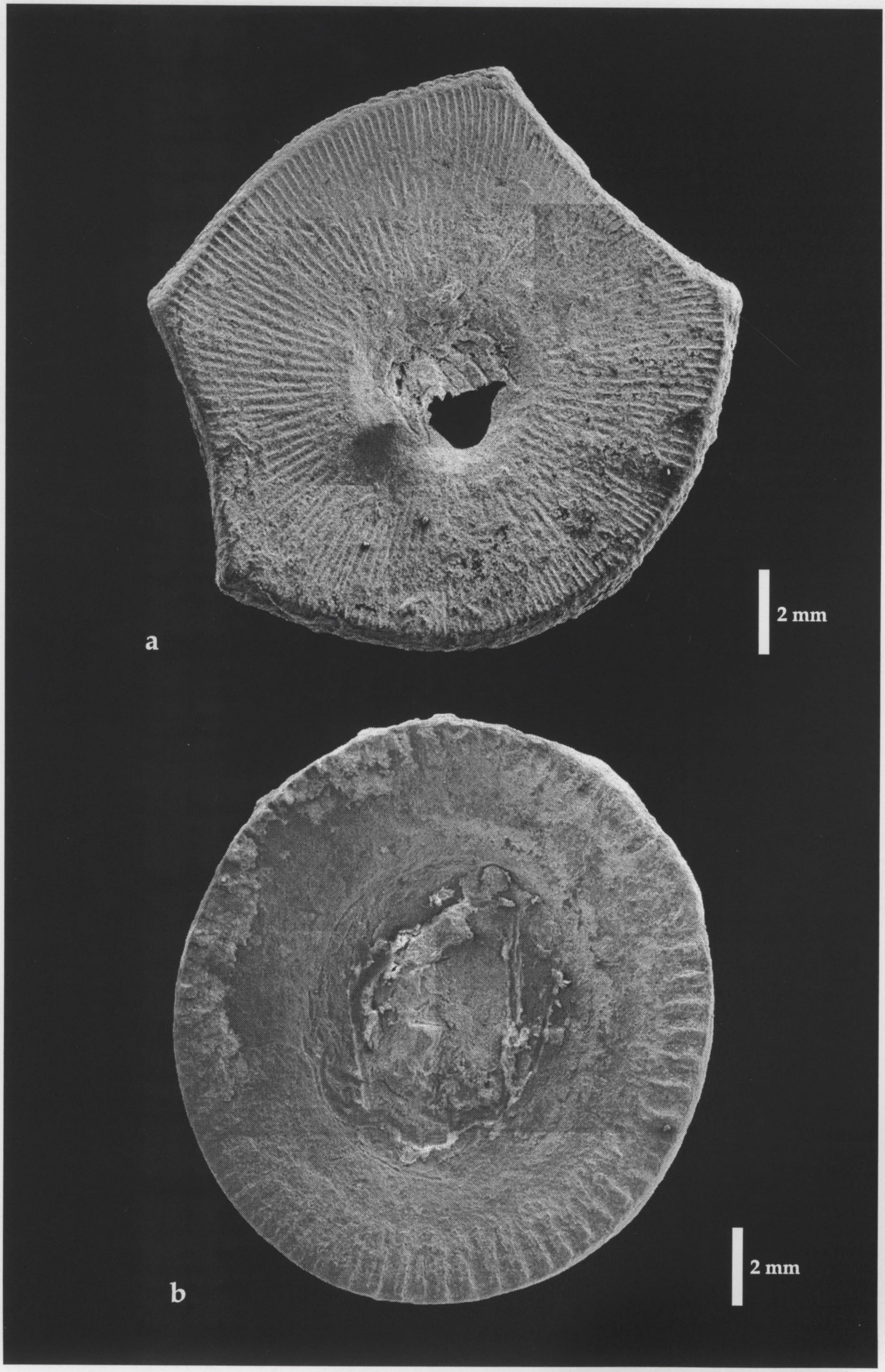

a
2 mm
b
2 mm

PLATE 78

(see Section 6.3.)

Fig. a. Columnal Taxon Number 45; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 45.T-BB (TCD.53049); pentagonal symplectial articular facet.

Fig. b. Columnal Taxon Number 46b; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 46b.T-BB (TCD.53051); oblique view of symplectial articular facet.

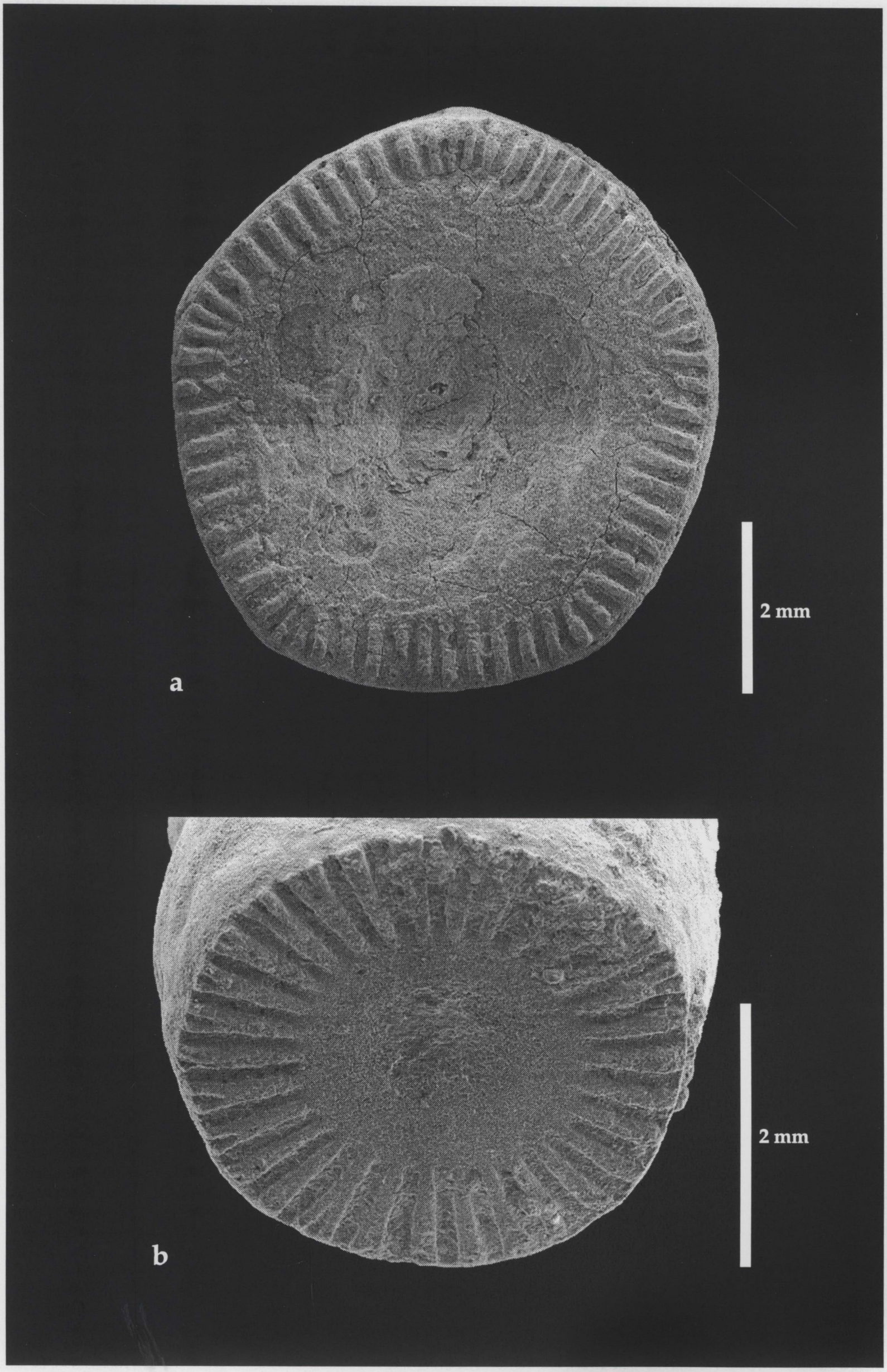

a
2 mm
b
2 mm

PLATE 79

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 45; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 45.T-BB (TCD.53049); regularly galleried stereom microstructure of a, crenularium, and b, areola.

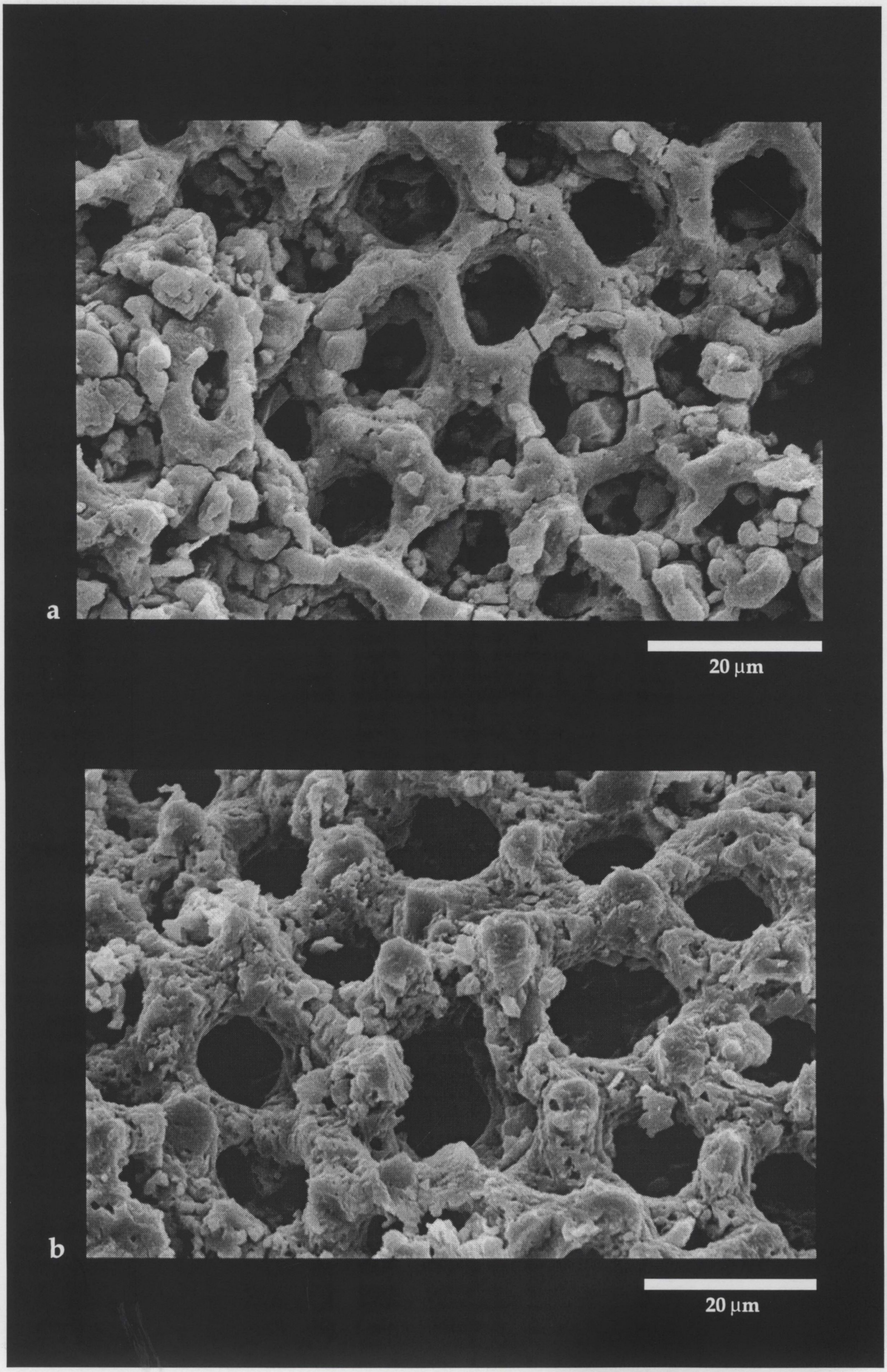

a
20 μm
b
20 μm

PLATE 80

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 46a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 46a.T-BB (TCD.53050); a, symplectial articular facet. b, oblique lateral view of pluricolumnal, moniliform columnals.


a
2 mm
b
1 mm

PLATE 81

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 46a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 46a.T-BB (TCD.53050); a, galleried stereom microstructure of crenularium. b, stereom microstructure of crenularium, areola and claustrum. Stereom less dense in claustrum.

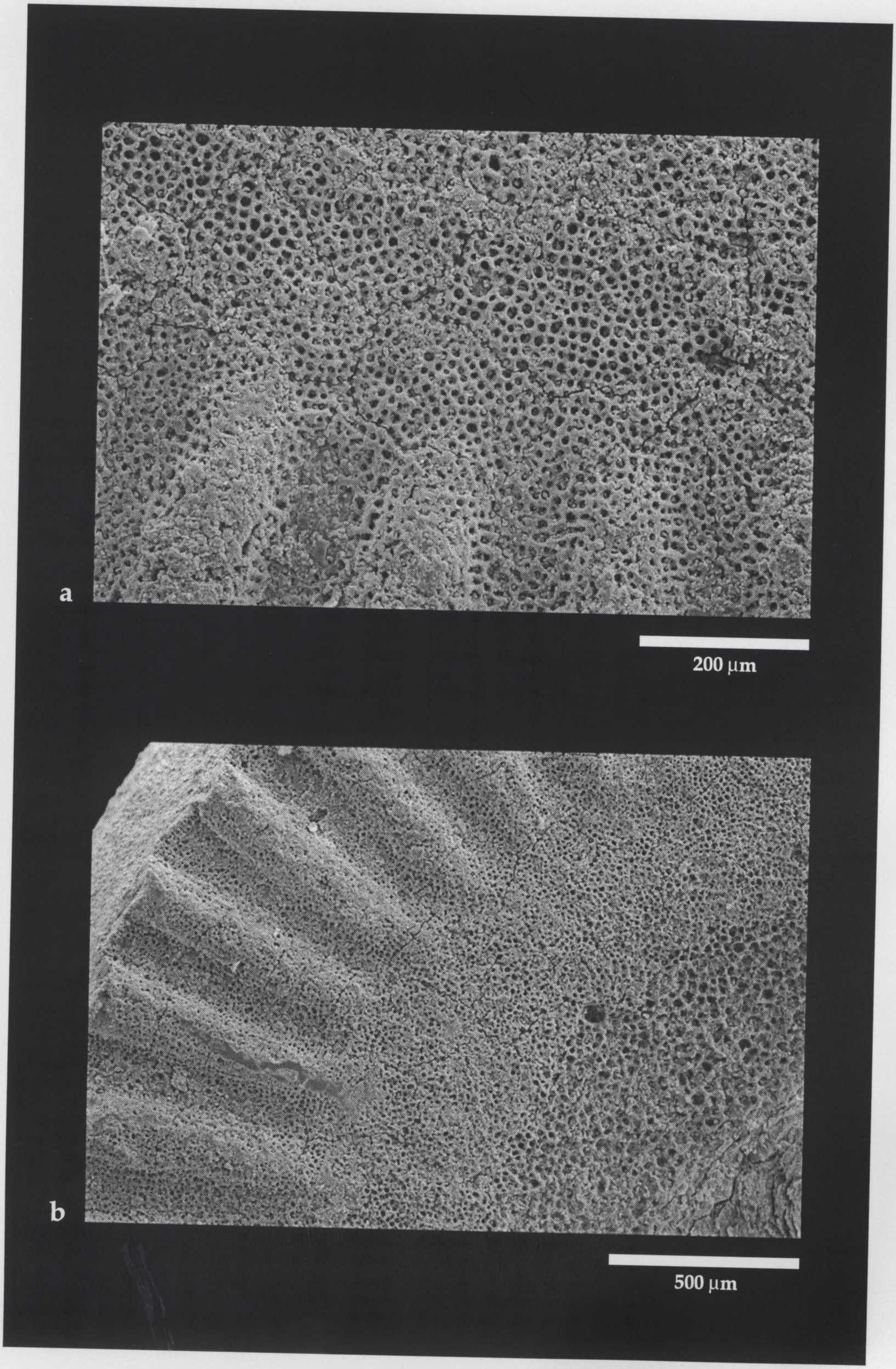

a
200 μm
b
500 μm

PLATE 82

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 48; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 48.T-BB (TCD.53053); a, lateral view of pluricolumnal, latus angulated with equatorial ridge of tubercles. b, oblique view of symplectial articular facet.

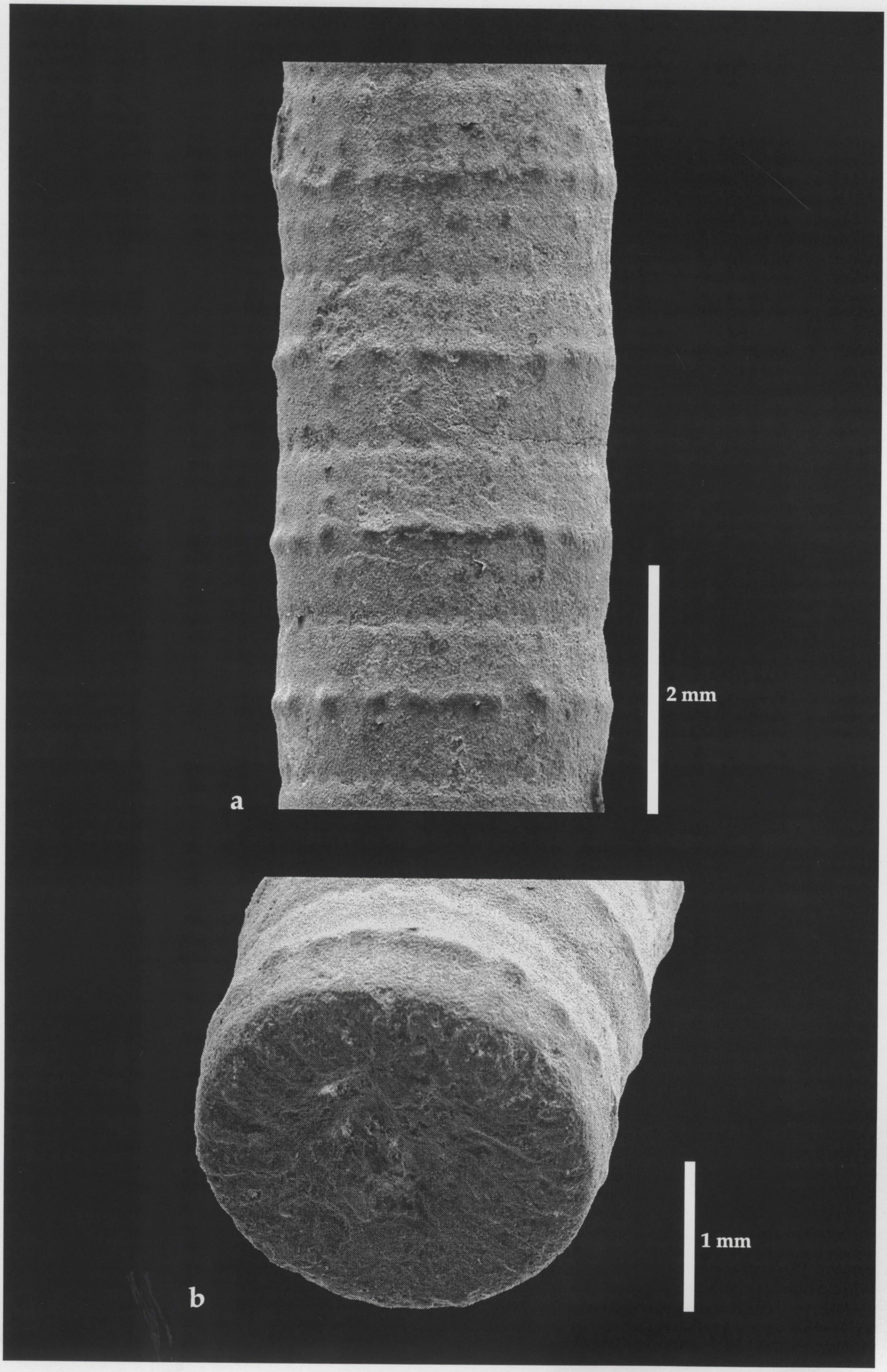

2 mm
a
1 mm
b

PLATE 83

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 49; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 49.T-BB (TCD.53054); a, symplectial articular facet. b, oblique lateral view of tuberculate latus.

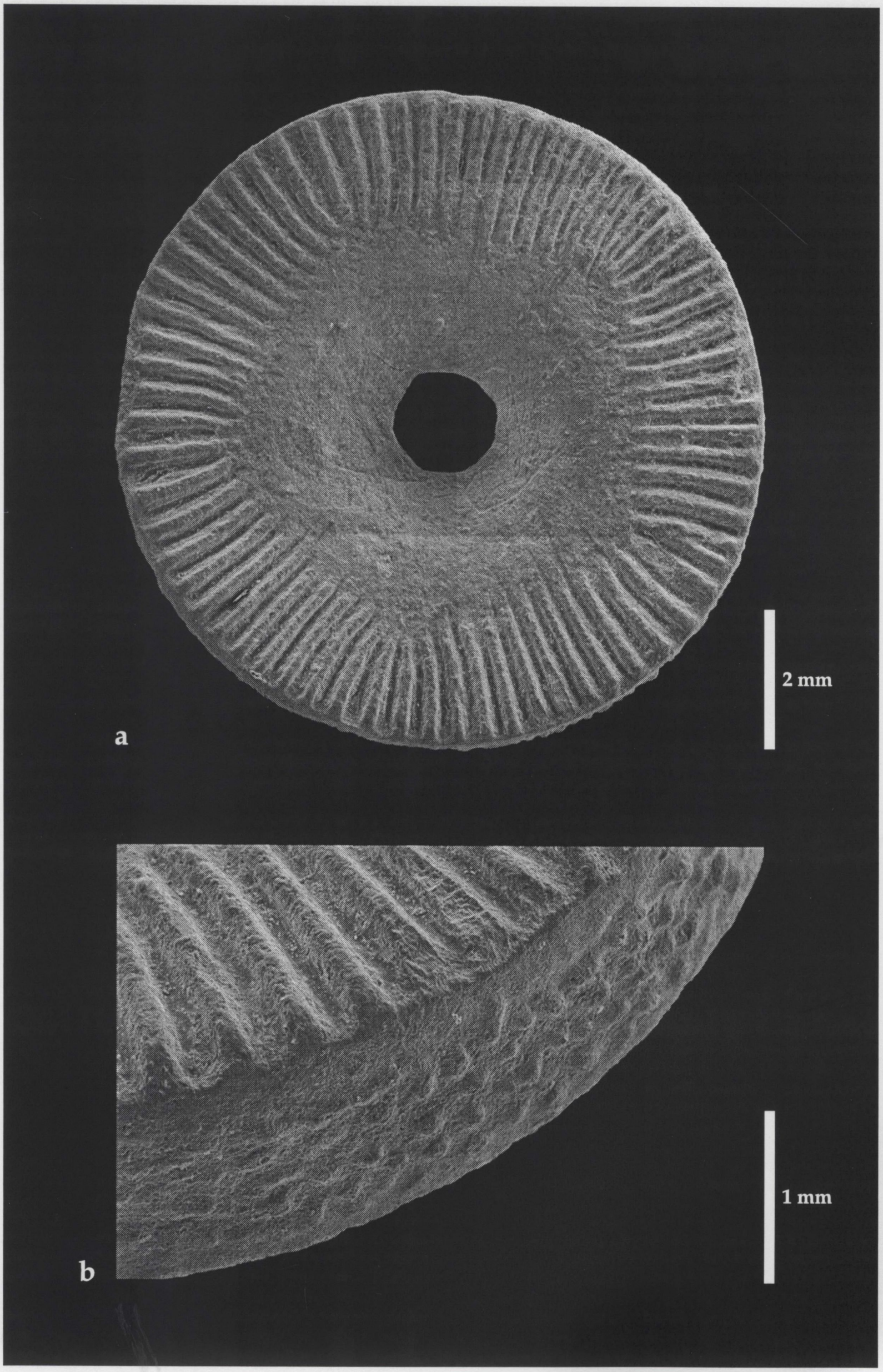

a
2 mm
b
1 mm

PLATE 84

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 50; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen 50.T-D1 (TCD.53060); a, symplectial articular facet. b, detail of galleried stereom microstructure.

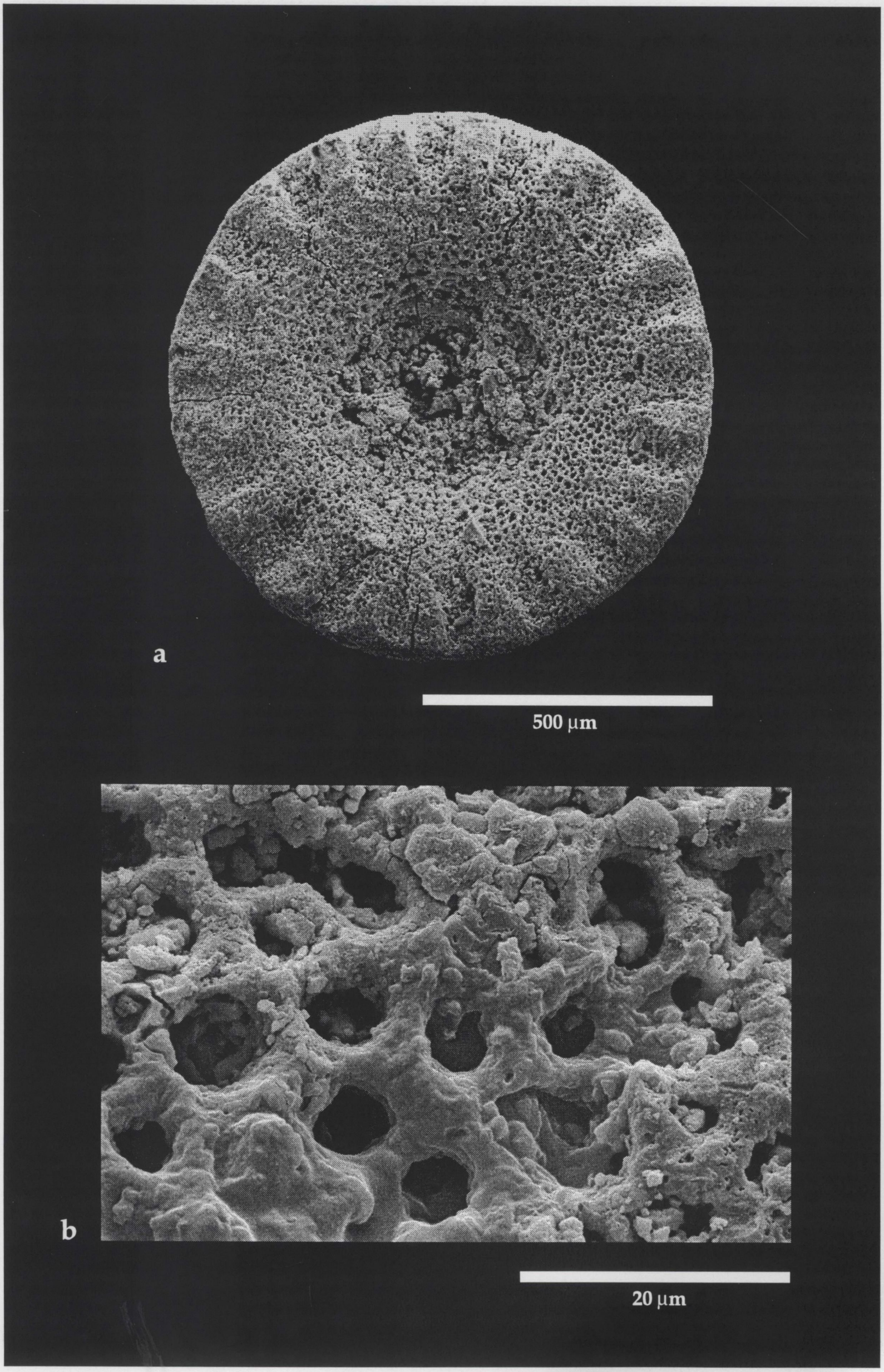

a
500 μm
b
20 μm

PLATE 85

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 51; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 51.T-BB (TCD.53061); a, ovate symplectial articular facet. b, oblique lateral view of latus with equatorial bifurcating row of tubercles.

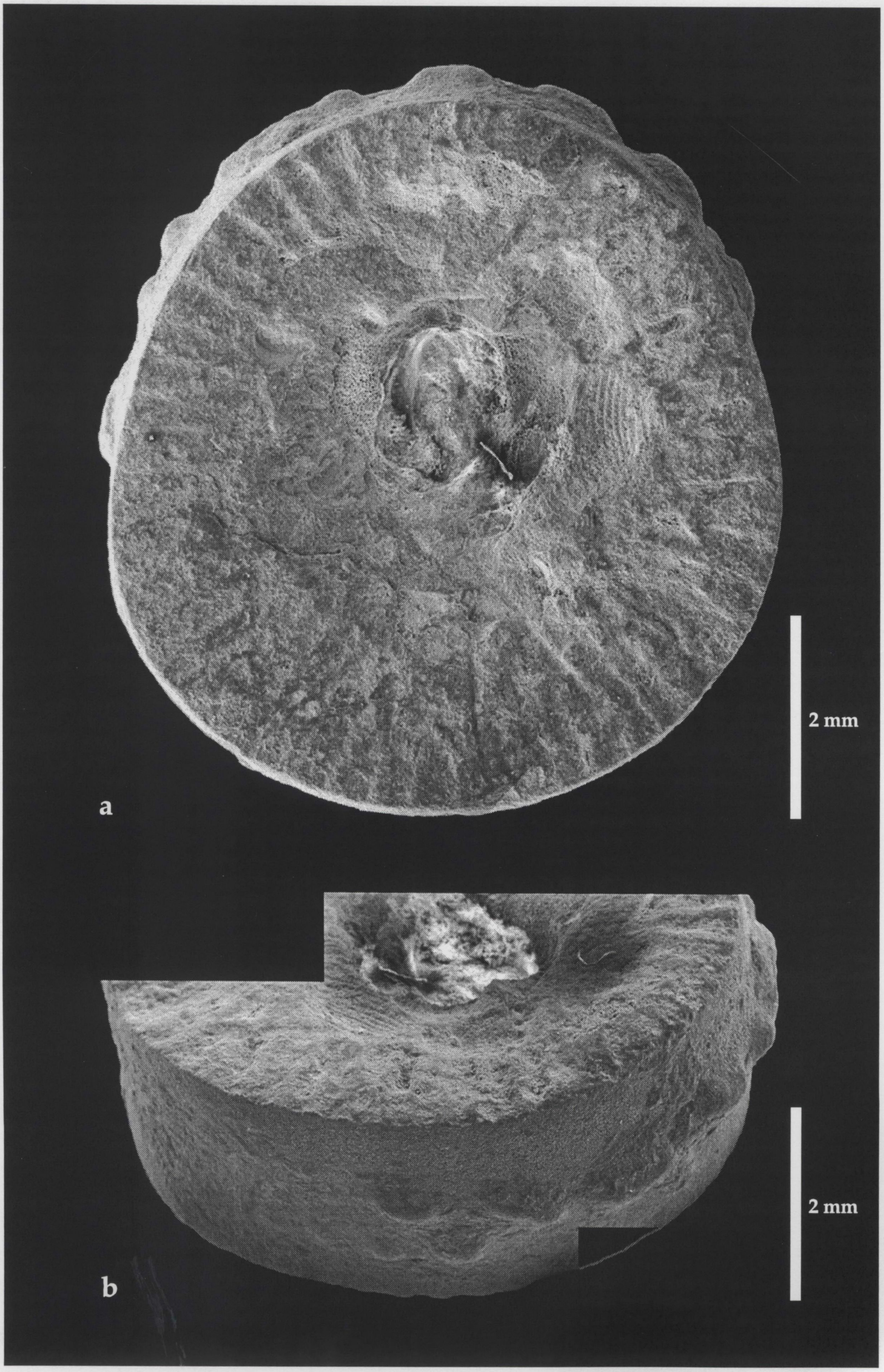

2 mm
a
2 mm
b

PLATE 86

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 52a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 52a.T-BB (TCD.53062); a, ovate symplectial articular facet. b, oblique lateral view of latus with two equatorial rows.

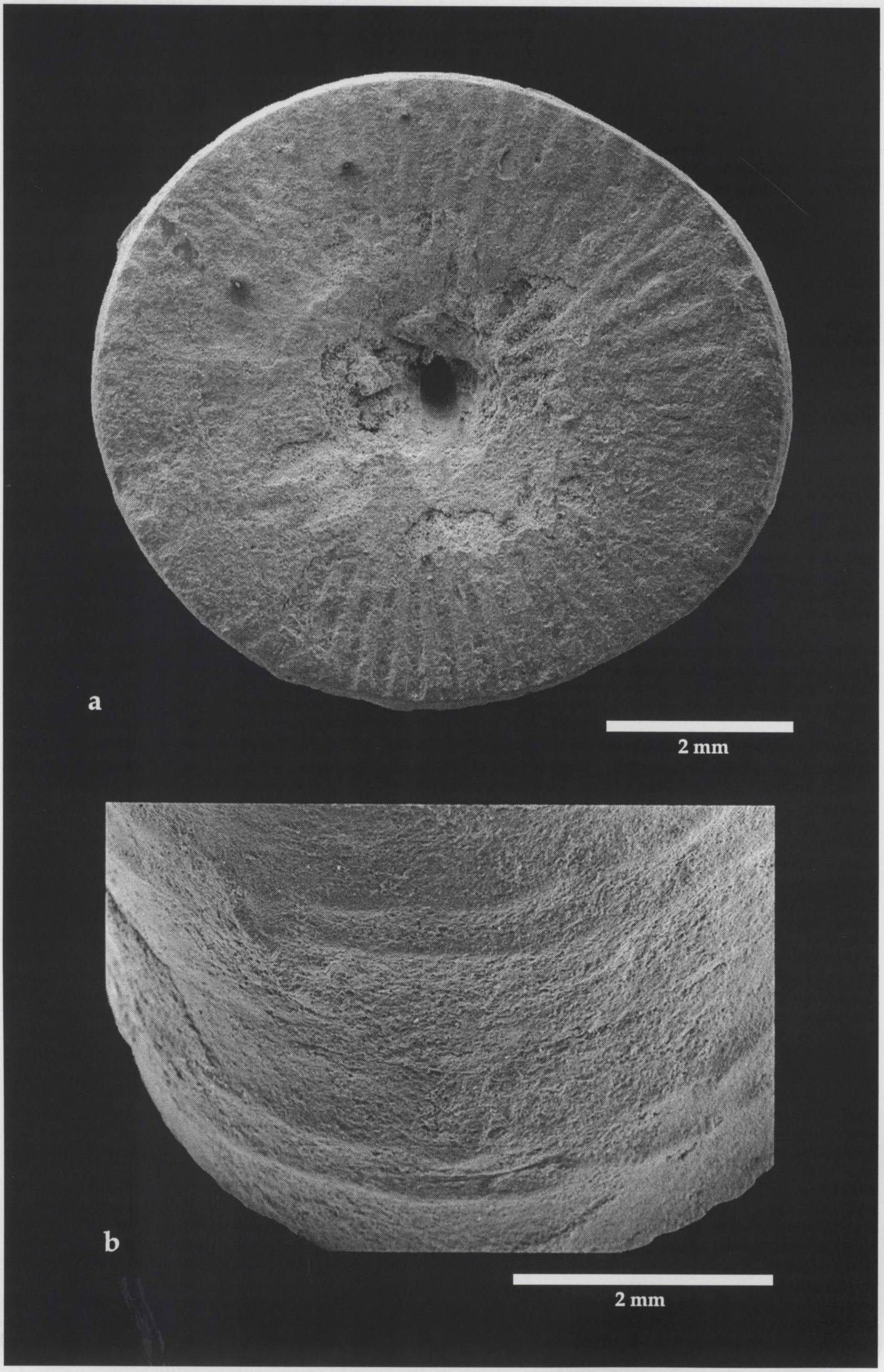

a
2 mm
b
2 mm

PLATE 87

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 52a; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 52a.V1-BB (TCD.53063); a, oblique view of part of symplectial articular facet. b, lateral view of latus with bifurcating equatorial row.

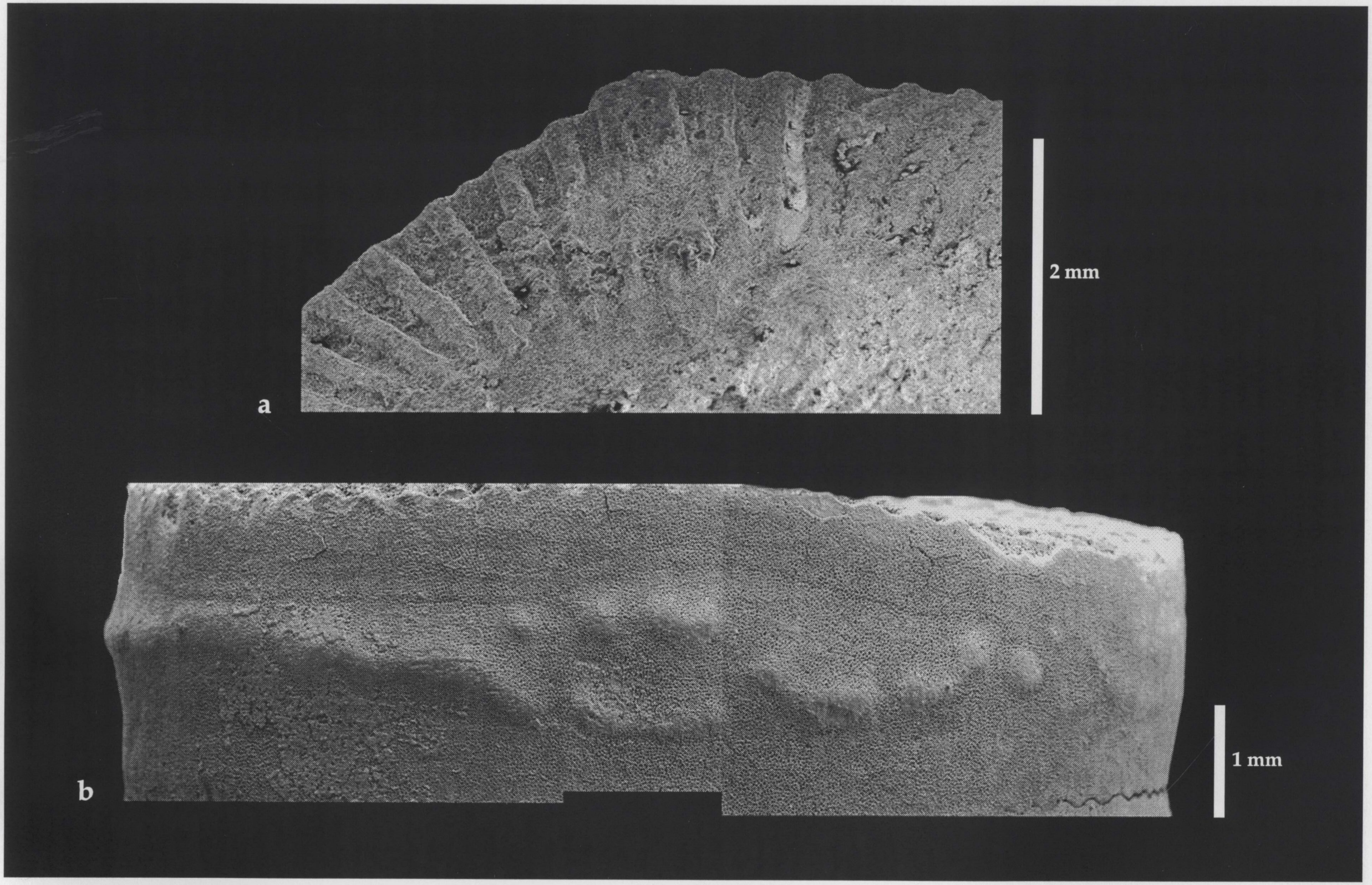

a
2 mm
b
1 mm

PLATE 88

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 52b; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 52b.T-BB (TCD.53064); a, ovate symplectial articular facet with dilobate lumen. b, oblique lateral view of latus with equatorial ridge.

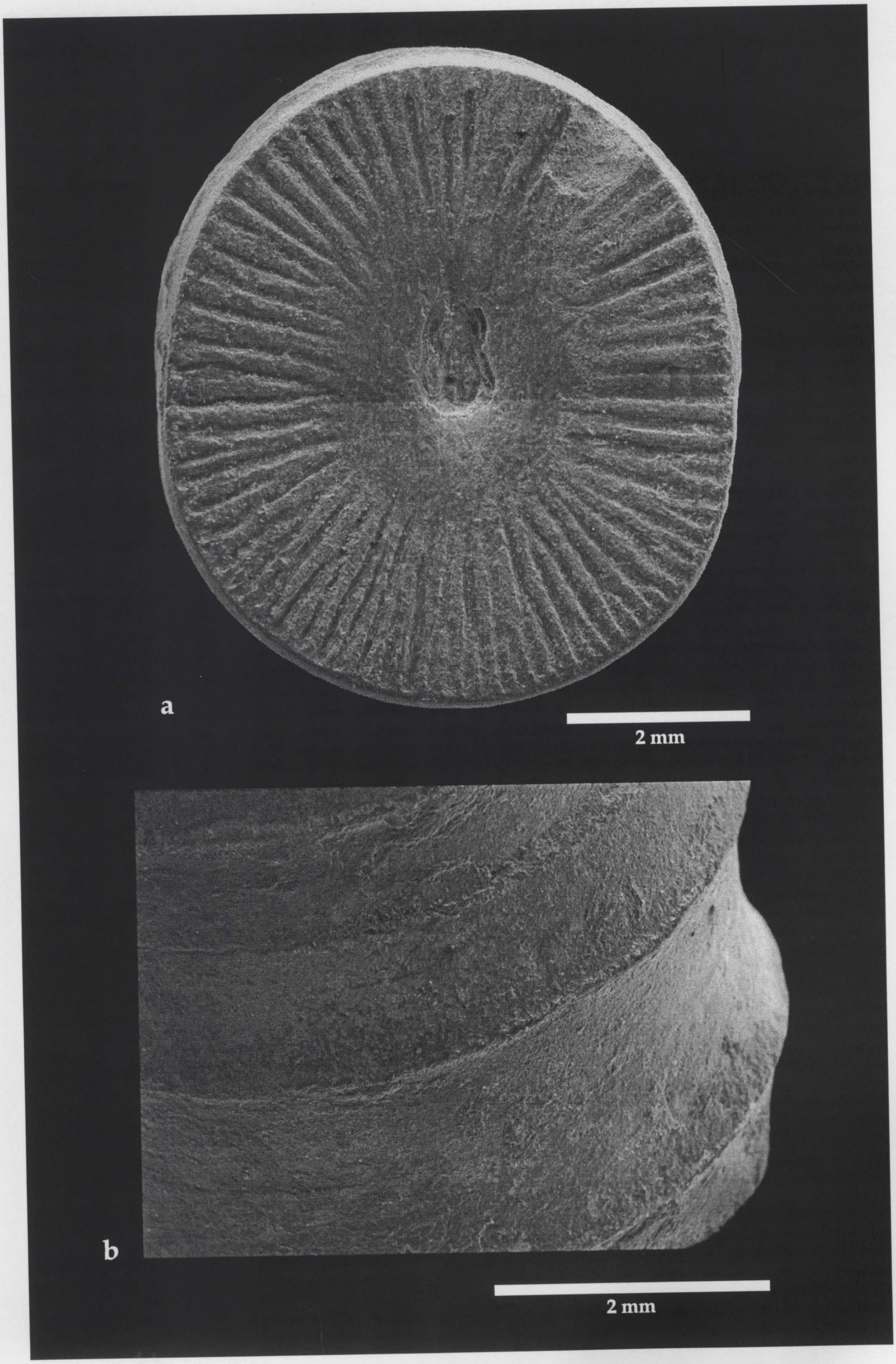

a
2 mm
b
2 mm

PLATE 89

(see Section 6.3.)

Figs a-b. Columnal Taxon Number 52c; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 52b.T-BB (TCD.53065); a, ovate symplectial articular facet. b, oblique lateral view of latus with discontinuous tuberculate ridge.


a
2 mm
b
1 mm

PLATE 90

(see Sections 6.3. and 6.5.5.)

Fig. a. Columnal Taxon Number 53; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen 53.T-BB (TCD.53066); symplectial articular facet with four cirrus sockets on latus at 45° from each other.

Fig. b. Holdfast 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53183; hand-like holdfast attached to another pluricolumnal.


2 mm
a
1 mm
b

PLATE 91

(see Section 6.4.)

Fig. a. Cirral Taxon Number 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen CR1.T-D1 (TCD.53067); symplectial articular facet.

Fig. b. Cirral Taxon Number 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen CR2-T-FX (TCD.53068); lateral view of pluricirral with 'spinelet' protrusions.

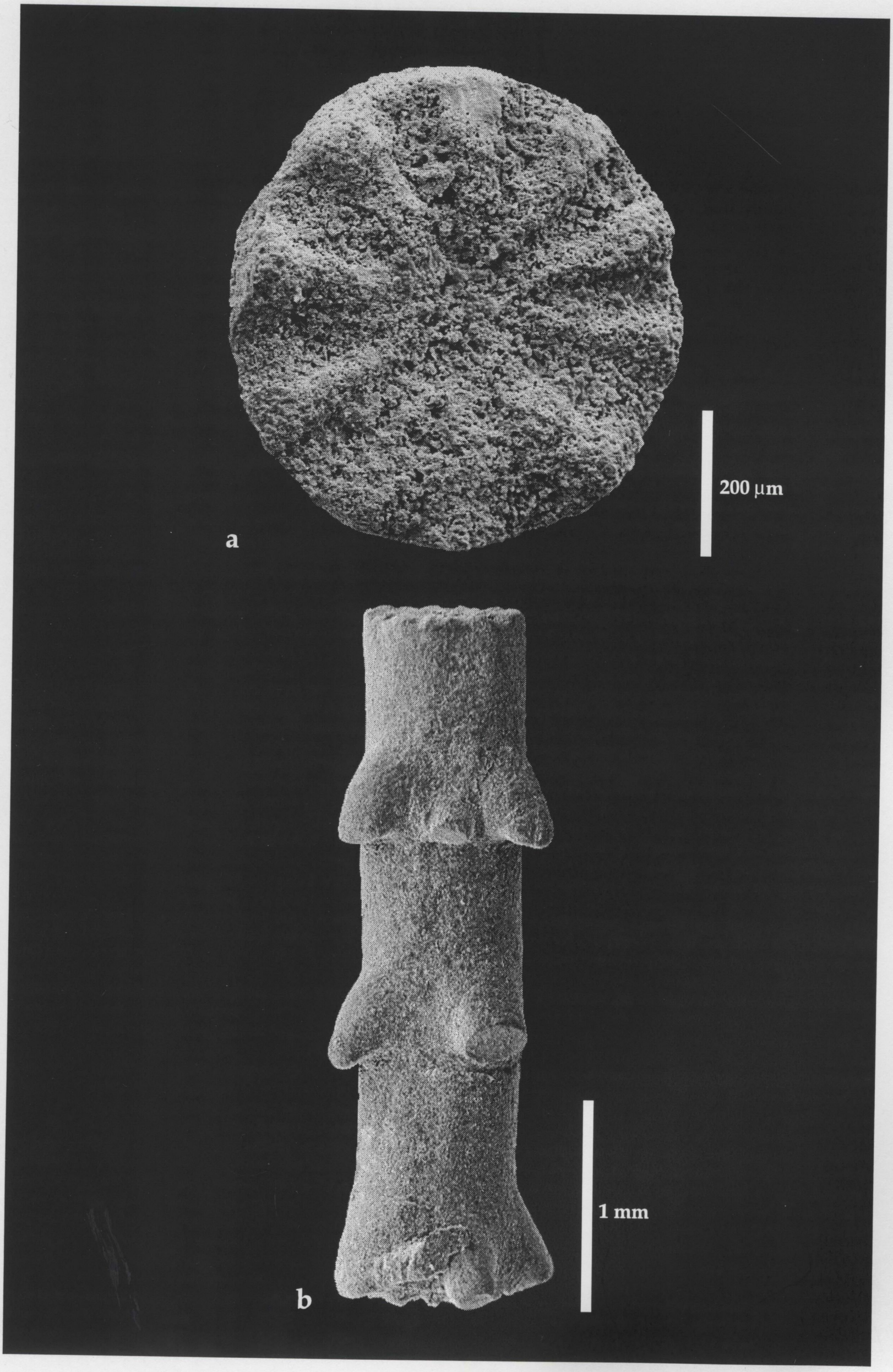

200 µm
a
1 mm
b

PLATE 92

(see Section 6.4.)

Figs a-b. Cirral Taxon Number 3; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. Specimen CR3.T-BB (TCD.53069); a, lateral view of cirral flaring out on one side only. b, oblique lateral view of pluricirral, straight side with peg and socket joint.

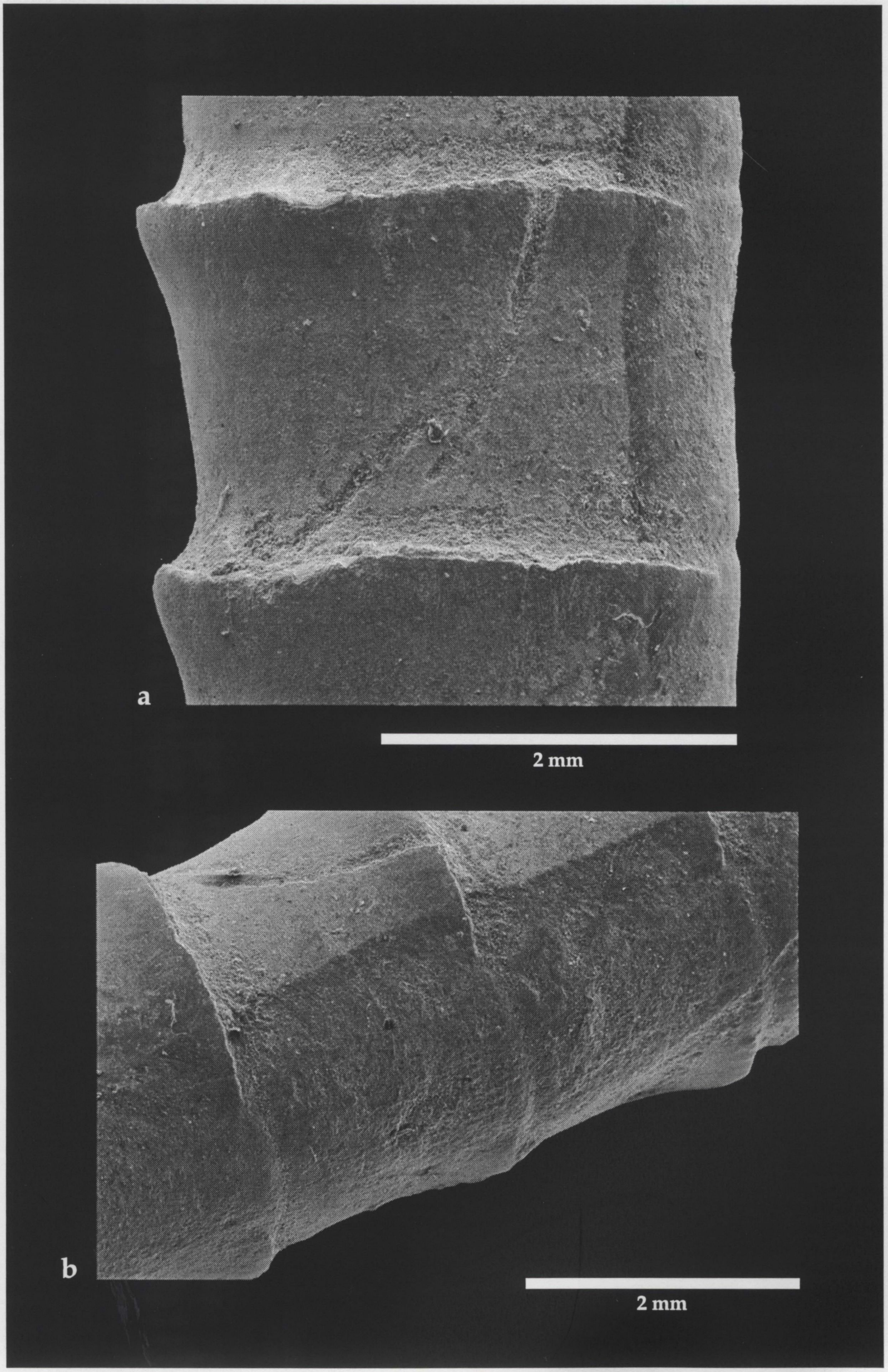

a
2 mm
b
2 mm

PLATE 93

(see Sections 6.5.4. and 6.5.1.)

Fig. a. gen. et sp. indet. Cladida-Type Infrabasal Circlet 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53172; aboral view of infrabasal circlet with stem outline.

Fig. b. gen. et sp. indet. Cladida-Type Infrabasal Plate 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53174; external lateral view.


500 µm
a
1 mm
b

PLATE 94

(see Section 6.5.1.)

Figs a-b. gen. et sp. indet. Cladida-Type Infrabasal Plate 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53227; a, external lateral view. b, external oblique basal view, crenulae for attachment of symplectially articulating stem.


a
1 mm
b
500 µm

PLATE 95

(see Section 6.5.2.)

Figs a-b. gen. et sp. indet. Catillocrinidae?-Type Radial Plate 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53173; a, internal view of plate. b, view of distal, multifaceted articular facet.

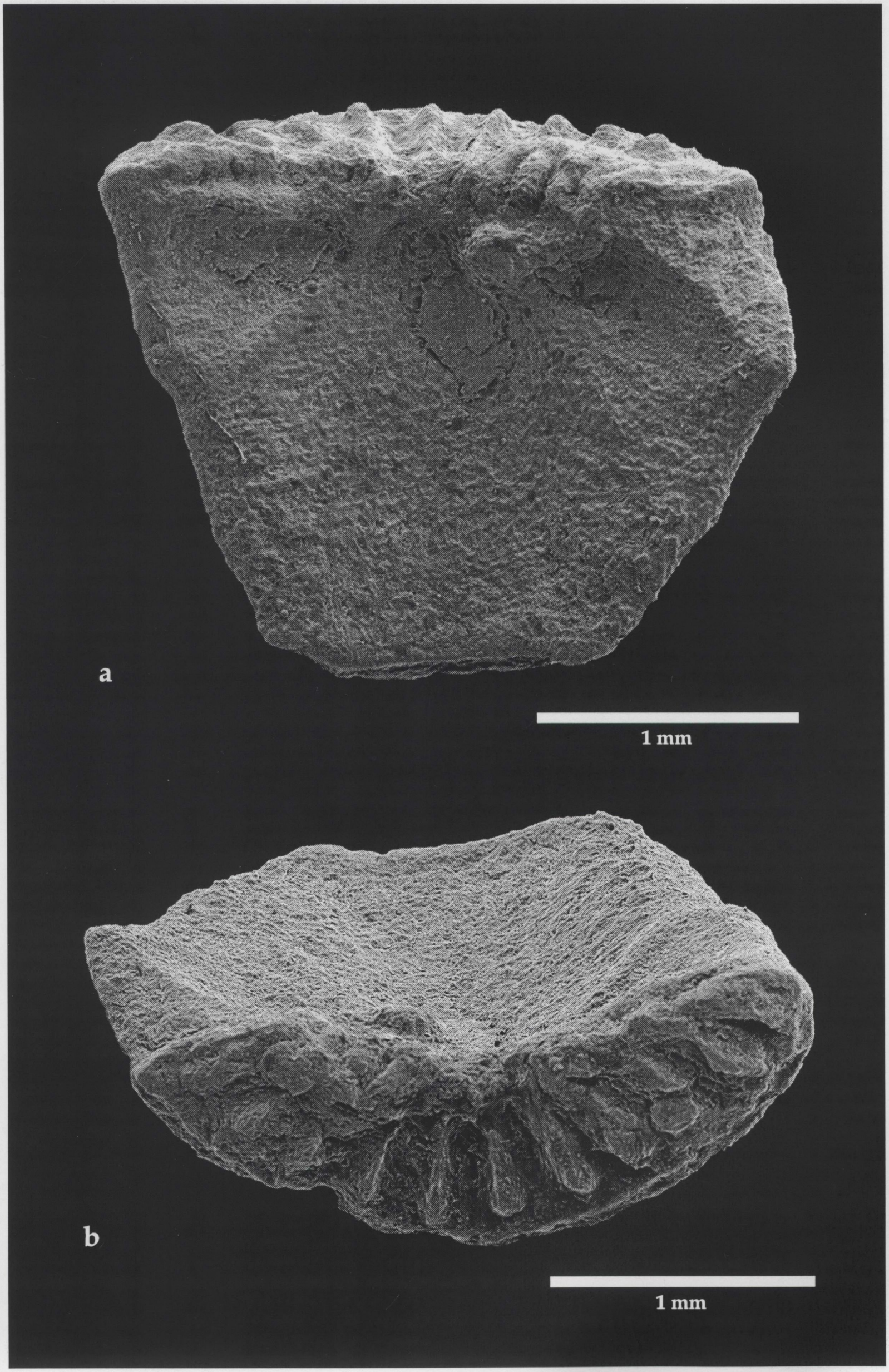

a
1 mm
b
1 mm

PLATE 96

(see Section 6.5.2.)

Figs a-b. Radial Plate 3; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53230; a, external view of plate, verrucate ornamentation. b, view of distal articular facet.

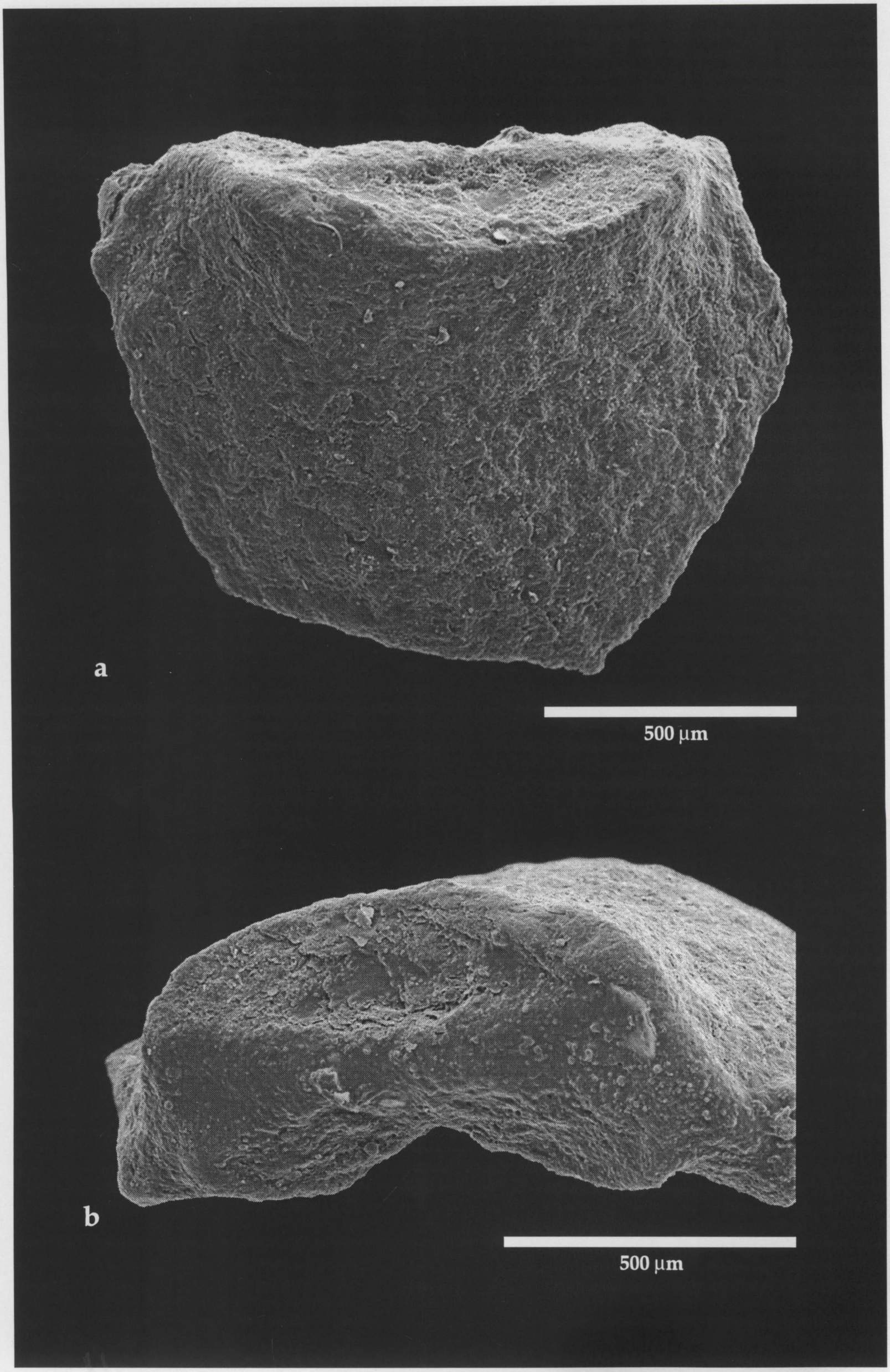

a
500 µm
b
500 µm

PLATE 97

(see Section 6.5.3.)

Figs a-c. gen. et sp. indet. Cladida-Type Brachial 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53177; a and c, facetal views. b, aboral lateral view.

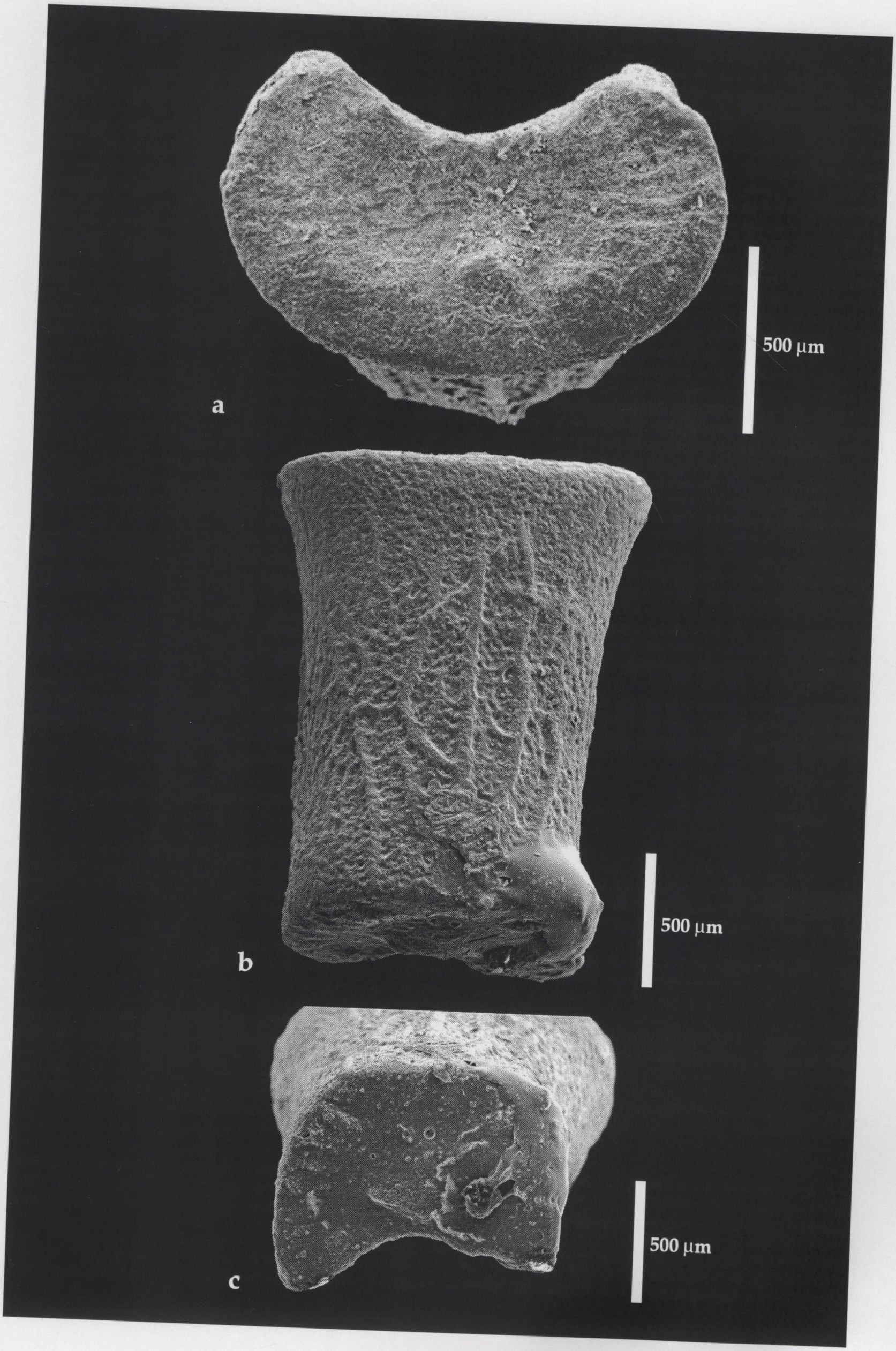

a
500 µm
b
500 µm
c
500 µm

PLATE 98

(see Section 6.5.3.)

Figs a-c. gen. et sp. indet. Cladida-Type Brachial 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53178; a, oblique lateral-facetal view. b, adoral view. c, facetal view.

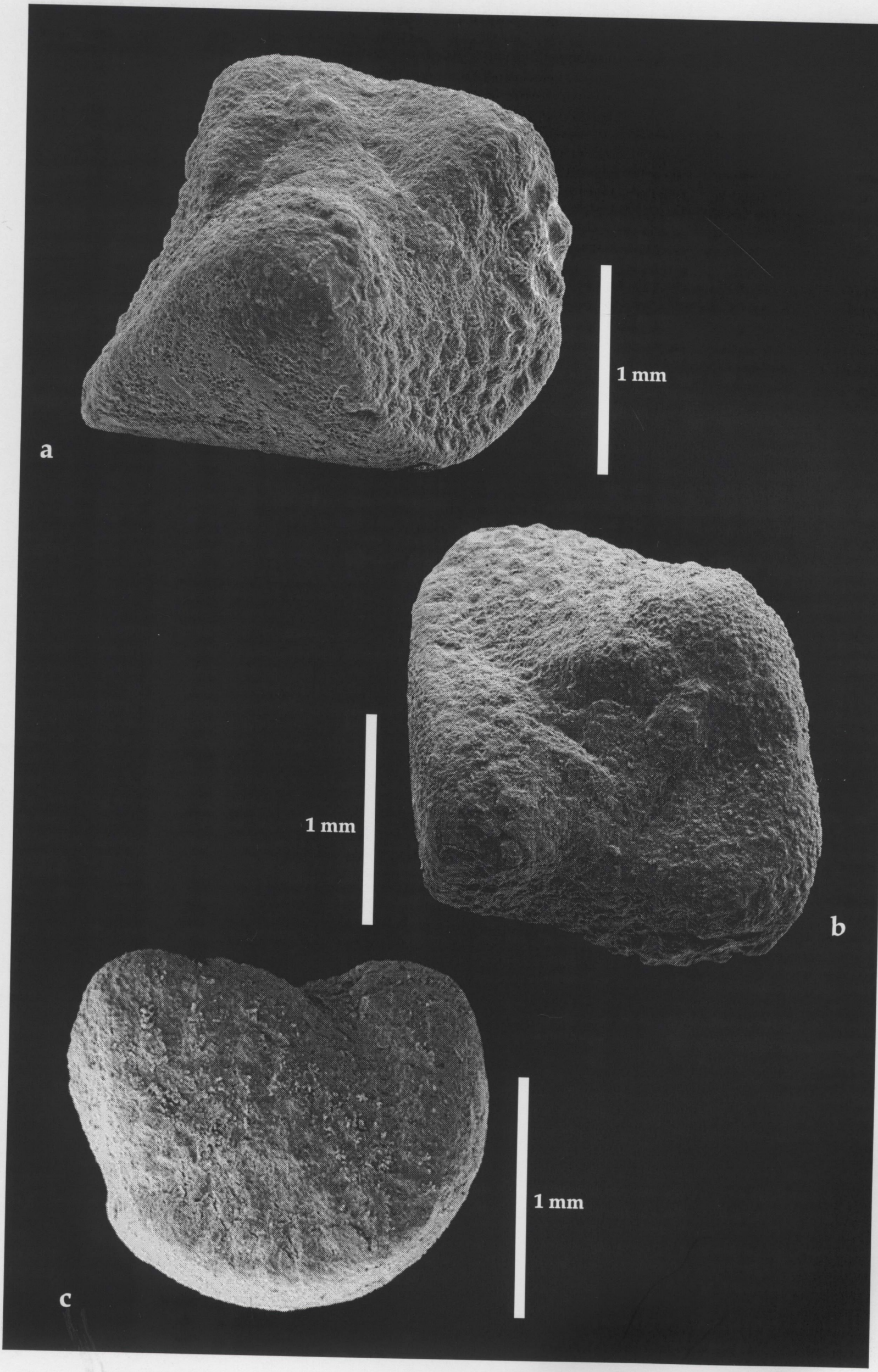

a
1 mm
1 mm
b
1 mm
c

PLATE 99

(see Section 6.5.3.)

Figs a-b. gen. et sp. indet. Cladida-Type Brachial 3; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53179; a, articular facet. b, adoral view.

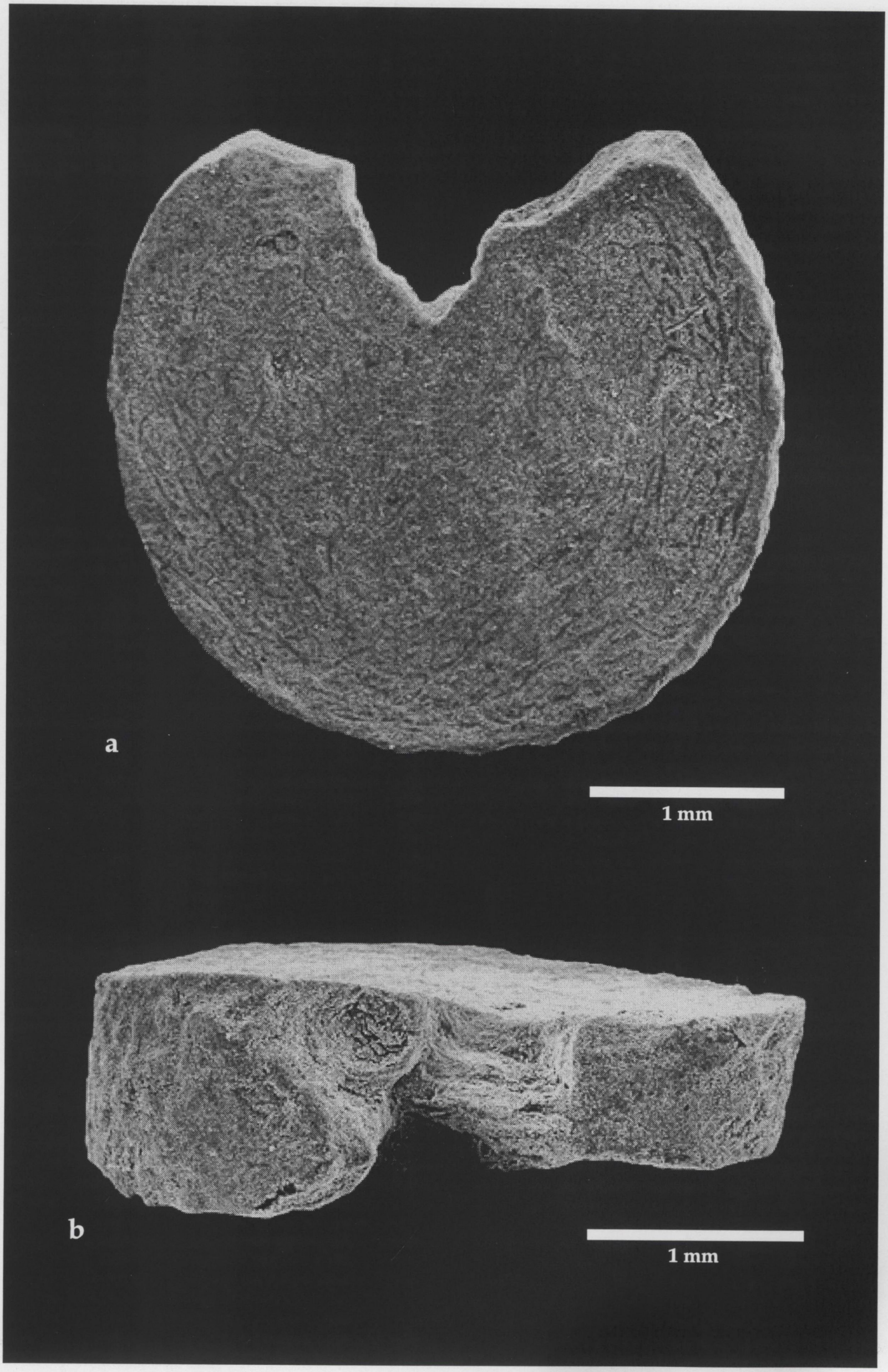

a
1 mm
b
1 mm

PLATE 100

(see Section 6.5.3.)

Figs a-c. gen. et sp. indet. Cladida-Type Brachial 4; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53180; a, aboral view, tuberculate ornamentation. b, adoral view, pinnule socket in top right. c, facetal view of non-pinnulate (proximal) end.


a
1 mm
b
1 mm
c
1 mm

PLATE 101

(see Section 6.5.3.)

Fig. a. gen. et sp. indet. Cladida-Type Brachial 5; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53181; adoral view of axillary brachial.

Fig. b. gen. et sp. indet. Cladida-Type Brachial 6; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53182; adoral view, pinnule socket in upper left.


500 µm
a
1 mm
b

PLATE 102

(see Section 6.5.3.)

Figs a-b. gen. et sp. indet. Cladida-Type Brachial 6; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53182; a, distal articular facet, muscular articulation. b, proximal articular facet, symplectial articulation.

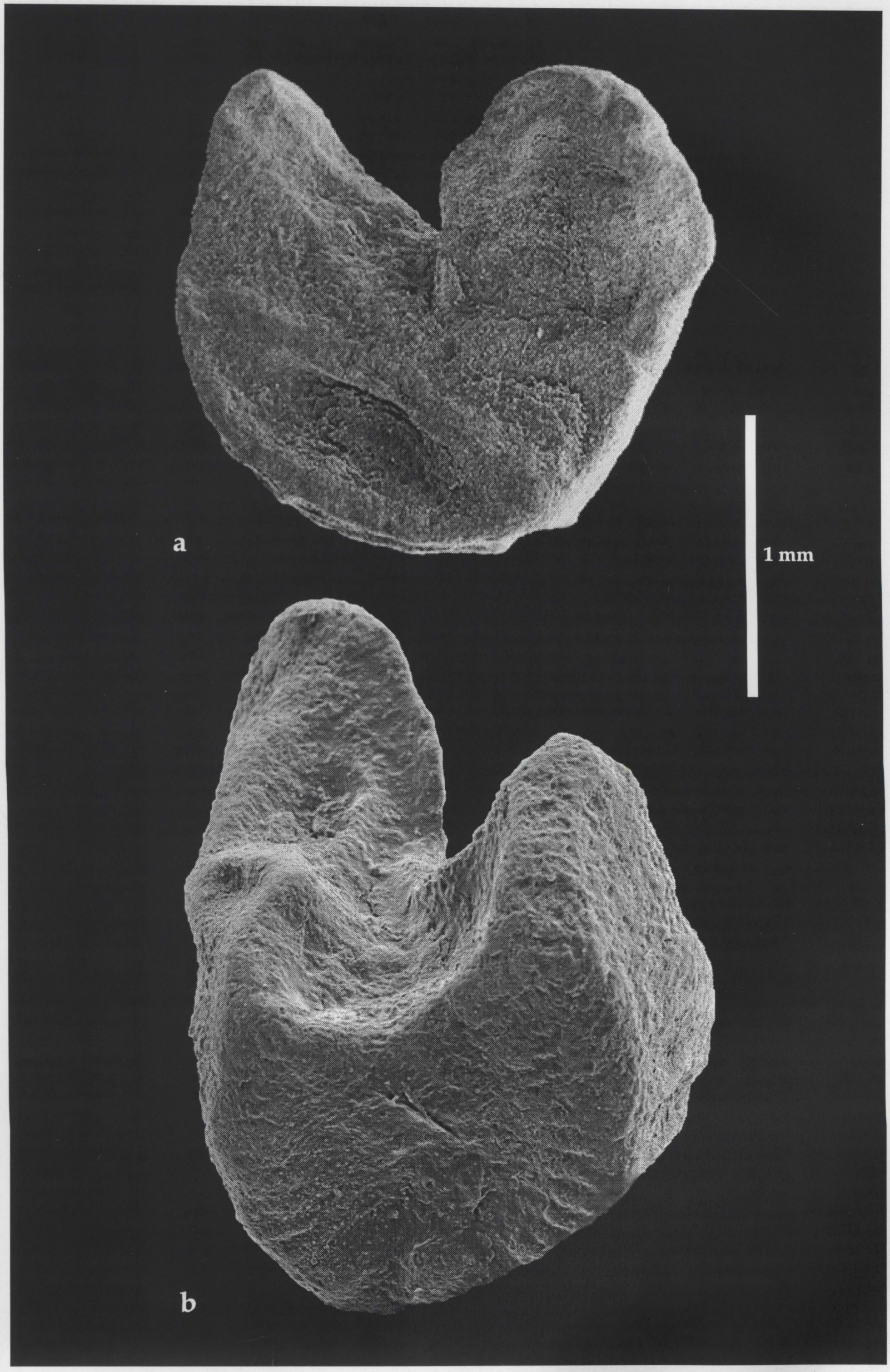

a
1 mm
b

PLATE 103

(see Section 6.5.3.)

Figs a-b. gen. et sp. indet. Flexibilia-Type Brachial 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53175; a, proximal articular facet. b, distal articular facet.


a
1 mm
b

PLATE 104

(see Section 6.5.3.)

Figs a-b. gen. et sp. indet. Flexibilia-Type Brachial 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen FXBr2.T (TCD.53176); a, proximal articular facet. b, distal articular facet.


a
1 mm
b

PLATE 105

(see Section 6.5.3.)

Figs a-b. gen. et sp. indet. Flexibilia-Type Brachial 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen FXBr2.V1 (TCD.53252); a, proximal articular facet. b, aboral lateral view showing lip and socket.


a
1 mm
b

PLATE 106

(see Section 6.5.6.)

Fig. a. gen. et sp. indet. Cladida-Type Anal Tube Plate 1; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53185; aboral view.

Fig. b. gen. et sp. indet. Cladida- Type Anal Tube Plate 2; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53221; adoral view.

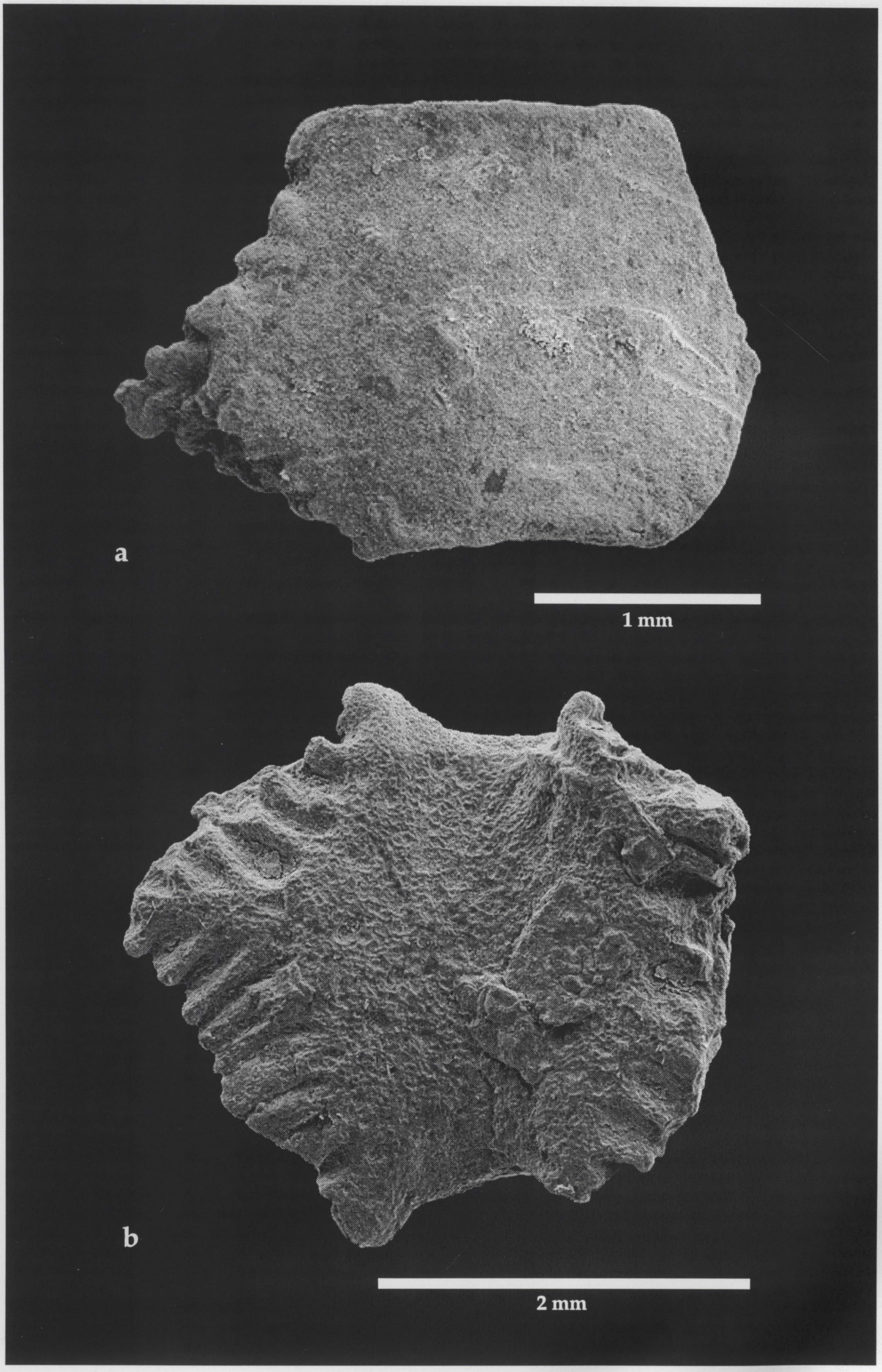

a
1 mm
b
2 mm

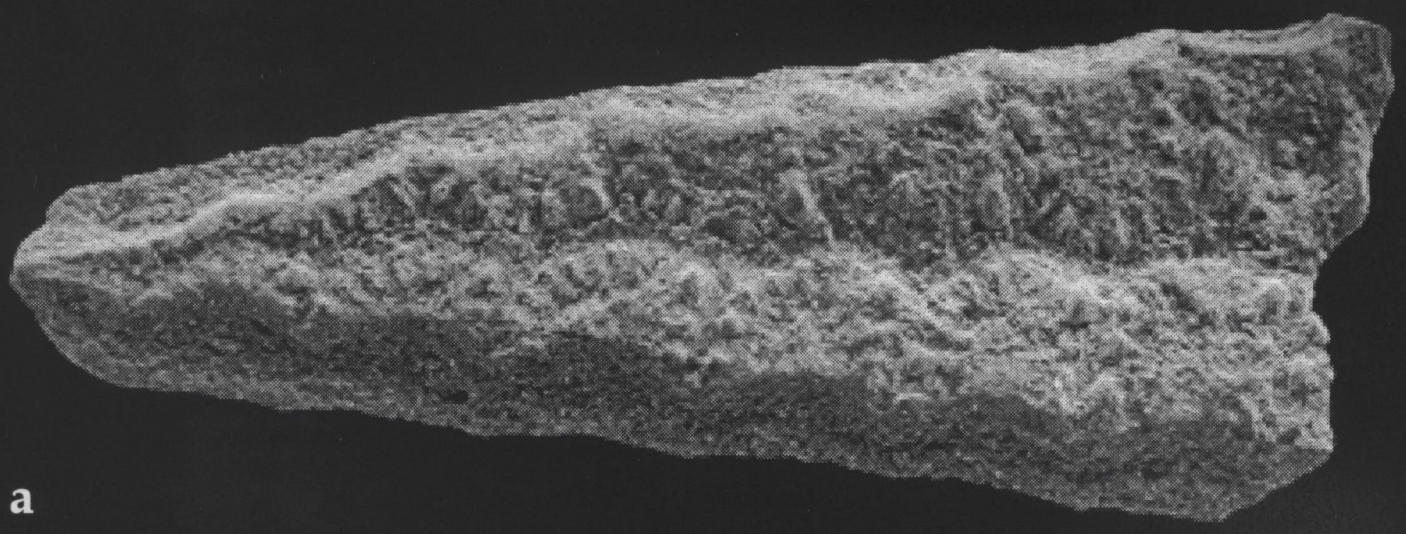
PLATE 107

(see Sections 6.6.2. and 6.3.)

Fig. a. Blastoid lancet plate; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53186.

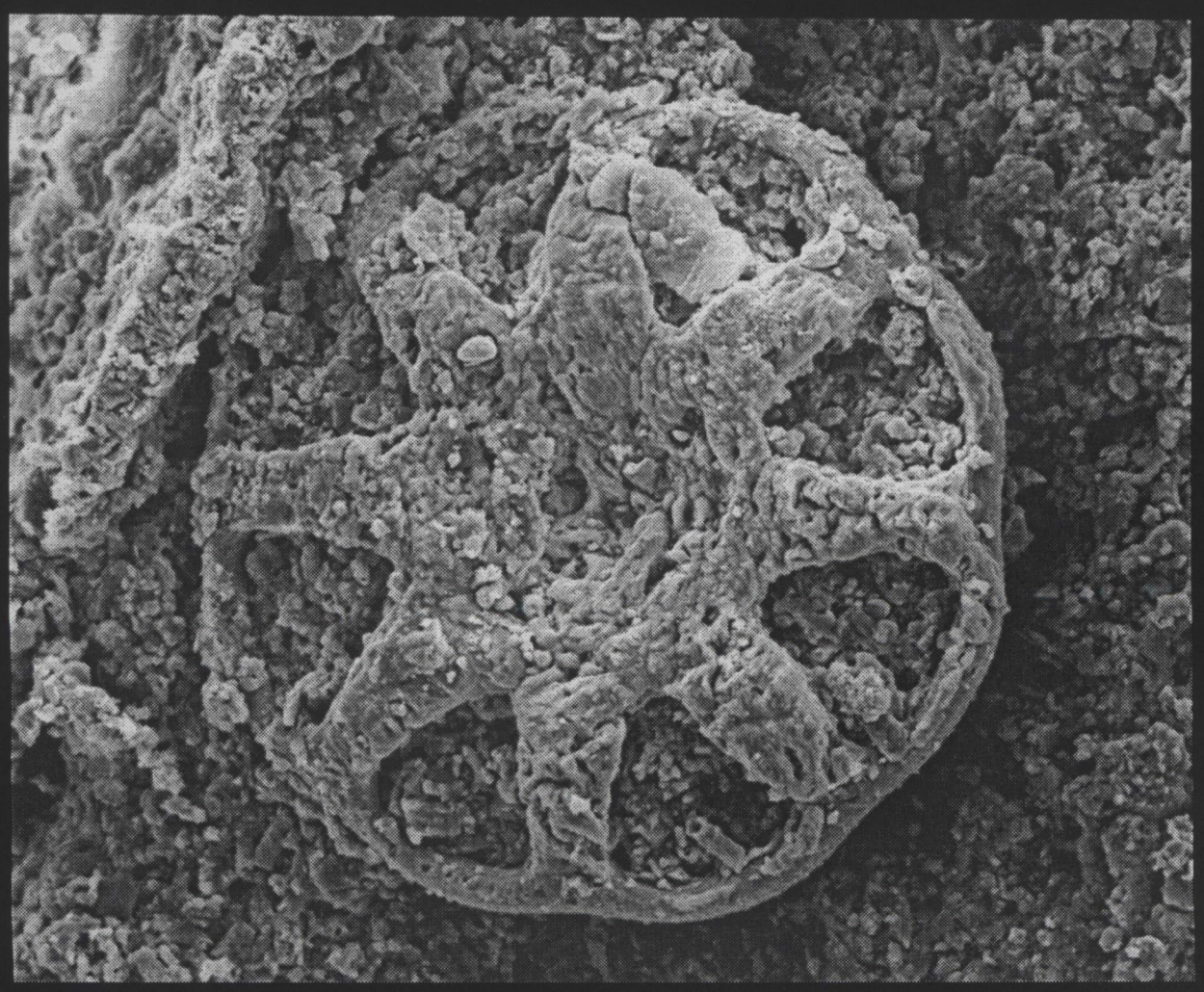
Fig. b. Holothurian wheel-like spicule; Benbulben Shale Formation (Holkerian), Benbulben Mountain, Co. Sligo. On specimen 53.T-BB (TCD.53066).

a



1 mm

b



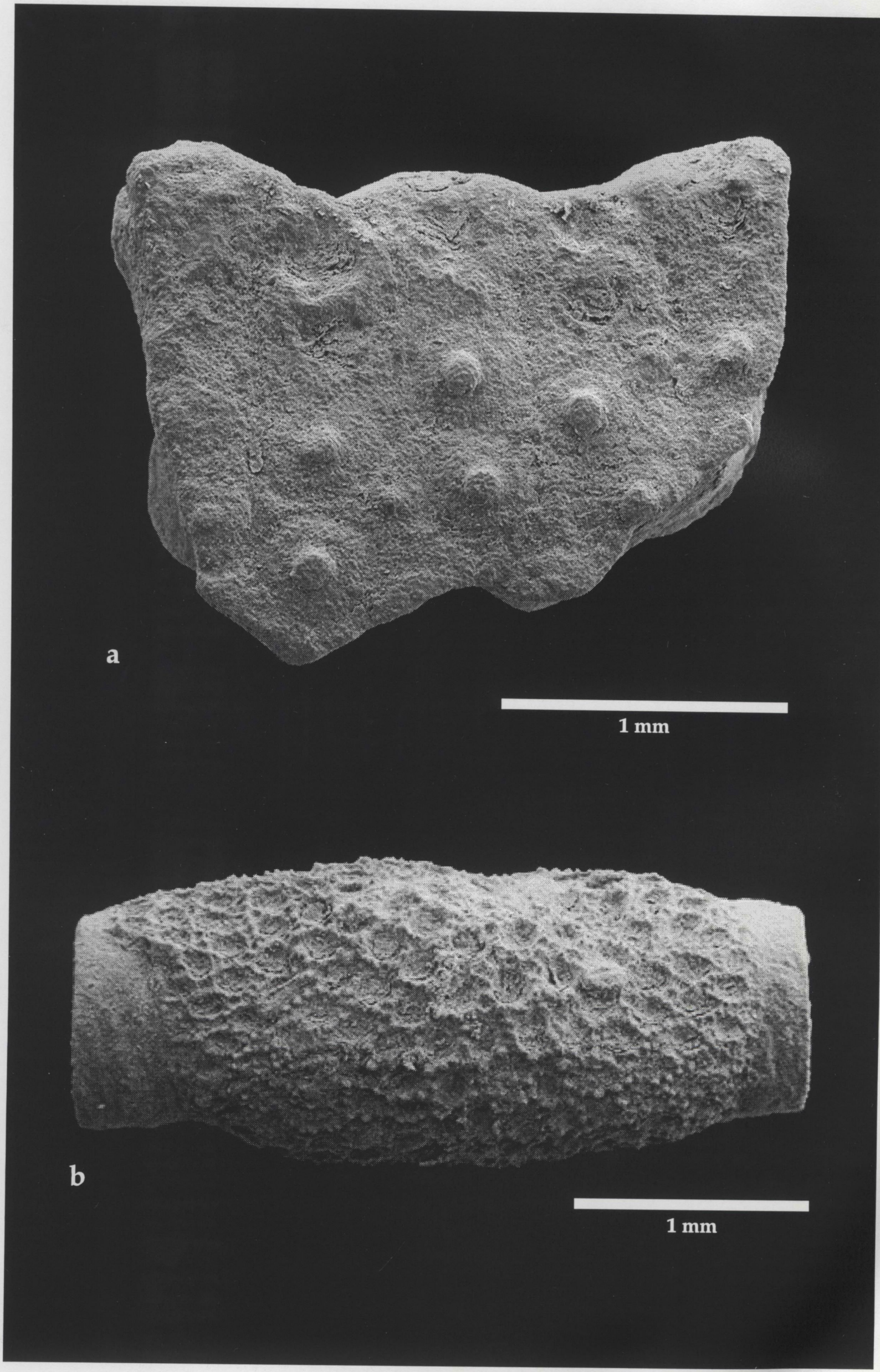
200 μm

PLATE 108

(see Sections 6.6.3. and 6.6.1.)

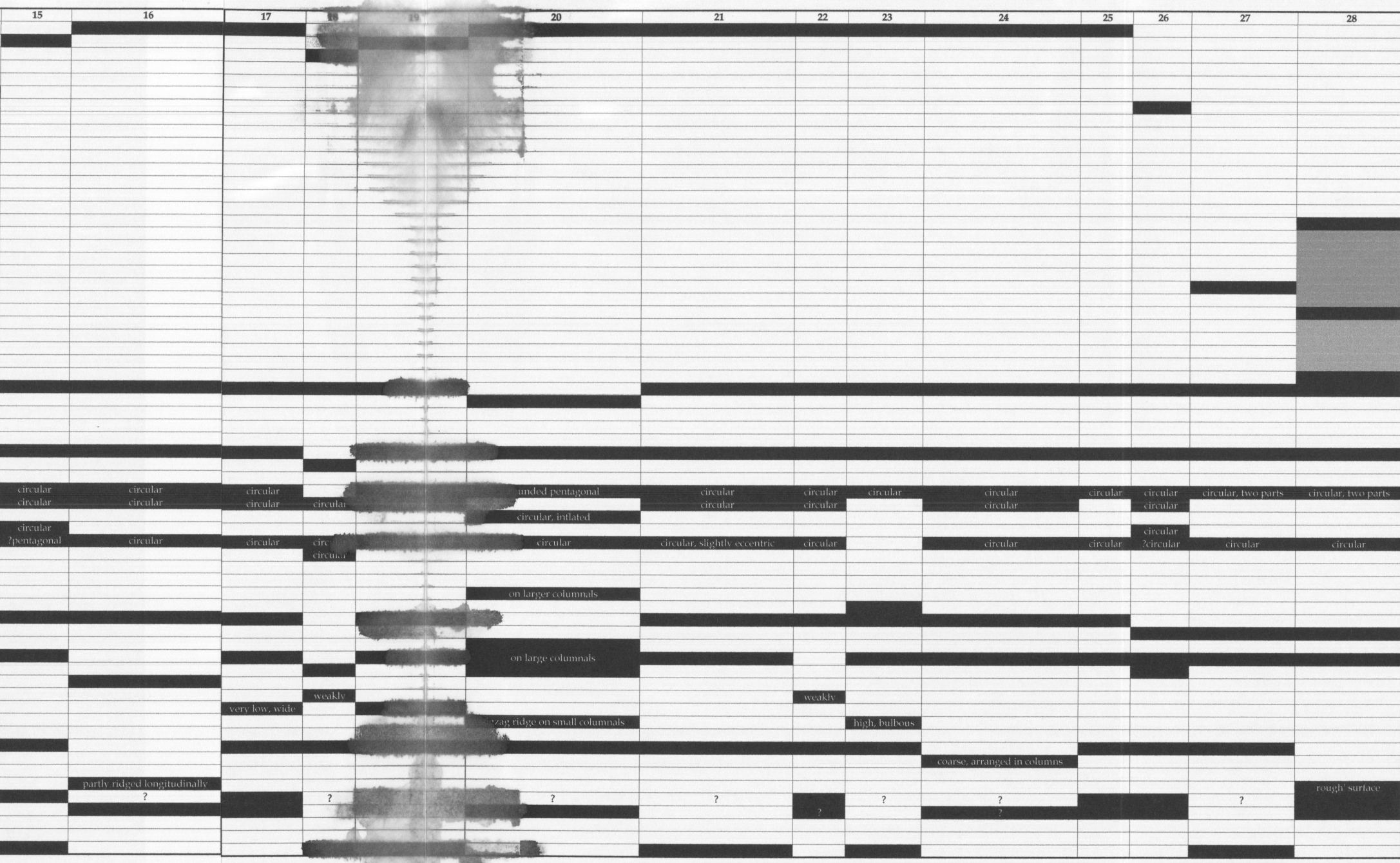
Fig. a. *Maccoya* ambulacral ossicles; Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53242.

Fig. b. *Fistulipora incrustans* (Phillips, 1836); Bundoran Shale Formation (Arundian), Bundoran, Co. Donegal. Specimen TCD.53184; bryozoan encrusting pluricolumnal.

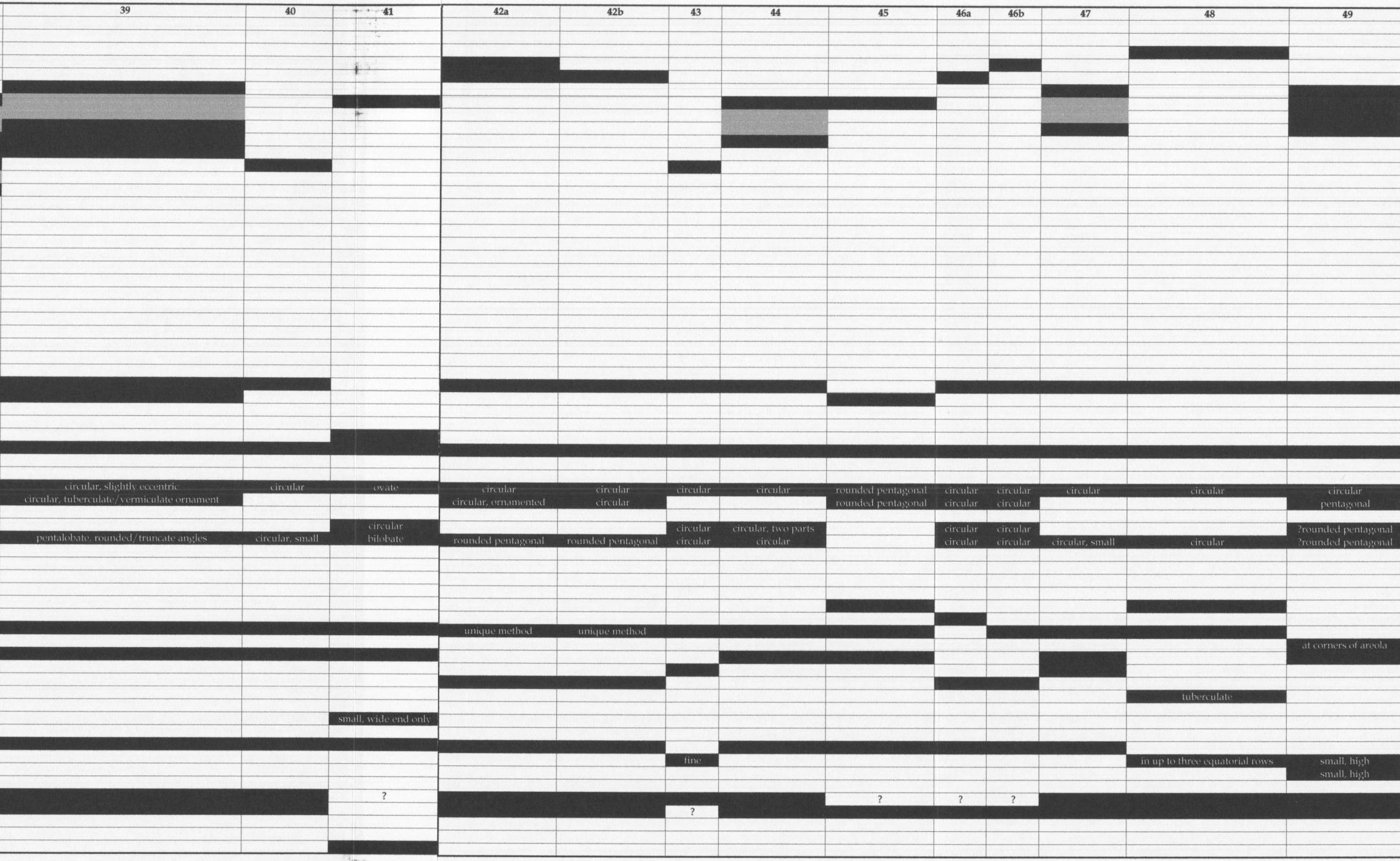

a
1 mm
b
1 mm

	Columnal Type number	Platycrinitidae-Type Columnal 1	Platycrinitidae-Type Columnal 2	Flexible-Type Pluricolumnal	1a	1b
Facetal diameters	<1 mm					
	1 - <2 mm					
	2 - <3 mm					
	3 - <4 mm					
	4 - <5 mm				■	■
	5 - <6 mm			■	■	
	6 - <7 mm	■	■	■	■	
	7 - <8 mm			■		
	8 - <9 mm					
	9 - <10 mm					
	10 - <11 mm					
	11 - <12 mm					
	12 - <13 mm					
	13 - <14 mm					
	14 - <15 mm					
	15 - <16 mm					
	16 - <17 mm					
	17 - <18 mm					
	18 - <19 mm					
	19 - <20 mm					
	20 - <21 mm					
	21 - <22 mm					
	22 - <23 mm					
	23 - <24 mm					
	24 - <25 mm					
	25 - <26 mm					
	26 - <27 mm					
	27 - <28 mm					
Column outline	Circular			■	■	■
	Rounded pentagonal					
	Pentagonal					
	Elliptical	rounded	rounded diamond			
	Ovate					
Articulation	Symplectial			■	■	■
	Synostosial					
	Synarthrial	■	■			
Facetal features	Crenularium			circular, peripheral, narrow	circular	circular
	Areola			circular	circular	circular
	Perilumen			circular, crenula-like ornament	circular, vermiculate	circular, vermiculate
	Claustrum					
	Lumen	■	■	circular	pentalobate, pointed to rounded angles	pentalobate, truncated angles
	Peripheral rim	■	■			
	Bifascial fields	moderately depressed	■			
	Fulcral ridge	at 90°, rounded summit	at 71°, vermiculate summit, crenulae at ends			
	Epifacet	■	■			
	(Remainder) unknown					
Crenulae	Simple only			■	■	■
	Complex					
	Complex corners					
Latus outline	Straight					■
	Weakly convex		■	■		
	Strongly convex				■	
	Angulated					weakly
	Equatorial flange					
	Equatorial ridge					
	Concave	■				
Latus ornament	None (smooth)	■		■	■	■
	Tuberculate		■			
	Merging tubercles					
	Other					
Cirriferous	Yes	?	■		■	■
Column form	Heteromorphic	■	■		■	■
	Homeomorphic					
	Xenomorphic	?	?	?		
	Unknown					

1c	1d	2	3	4	5	6	7	8	9	10	11	12	13	14
			■										■	
	■				■	■	■			■				
■	■		■		■			■						
	■		■								■			■
		■		■					■					
		■							■			■		
■	■	■	■	■		■	■	■	■	■	■	■	■	■
					■									
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
circular	circular	circular	circular	circular	pentagonal	circular	circular	circular	circular	circular	circular, eccentric	circular	circular	circular
circular	circular	circular	circular	circular	pentagonal			circular	circular	circular			circular	
circular, vermiculate	circular, vermiculate											?		
		circular	circular	circular, two parts		circular	circular	circular	circular	circular	circular, three parts			circular, two parts
pentasteroidal	pentalobate, rounded angles	circular	circular	circular	?circular	circular	circular	?circular	circular	rounded pentagonal	circular		circular	circular
												■		
■	■		■			■		■				?	■	■
		■		■			■		■	■	■	?		
		■		■	■									
	■	■	■		■				■	■	■			■
	■			■		■	■						■	
								■						
weakly												strongly, assymetrical, pitted apex		
														narrow, on central 33%
■		■		■		■	■		■		■	■		■
	in columns		■		■			■		fine				
			■		■			■						
			■		■								elongate protuberances	
■	■	■	■	■	■	?	■	?	■	■	?			?
■	■	■	■	■	■			■	■	■	■	■		
						?								
						■								
							■						■	■



29	30	31	32	33	[illegible]	35	36	37a	37b	38
rounded pentagonal	rounded pentagonal	pentagonal	[illegible]	[illegible]	ircular	circular, two parts	circular	circular	circular	circular, slightly eccentric
rounded pentagonal	rounded pentagonal	pentagonal	[illegible]	[illegible]	circular		circular	circular	circular	circular, tubercles/pitted ornament
					circular			pentalobate, crenula-like ornament	pentagonal, crenula-like ornament	
							tetragonal			
circular	circular	pentagonal	[illegible]	[illegible]	ular		tetralobate	pentalobate, pointed angles	pentalobate	pentalobate, round to truncate angles
	strongly, uneven apex					very weakly				
		narrow, rounded								
								weakly		
finely, few						small, low, discontinuous				
									fine 'pimples' in central 33%	
?	?	?	[illegible]	[illegible]	?	?	?	?	?	
						?				



39	40	41	42a	42b	43	44	45	46a	46b	47	48	49
circular, slightly eccentric	circular	ovate	circular	circular	circular	circular	rounded pentagonal	circular	circular	circular	circular	circular
circular, tuberculate/vermiculate ornament			circular, ornamented	circular			rounded pentagonal	circular	circular			pentagonal
		circular			circular	circular, two parts		circular	circular			?rounded pentagonal
pentalobate, rounded/truncate angles	circular, small	bilobate	rounded pentagonal	rounded pentagonal	circular	circular		circular	circular	circular, small	circular	?rounded pentagonal
			unique method	unique method								
												at corners of areola
											tuberculate	
		small, wide end only										
					fine						in up to three equatorial rows	small, high
												small, high
		?					?	?	?			
					?							

