

Late Ordovician bryozoa from Ringerike, Norway

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Fifteen species of bryozoa have been identified from etage 5b at Ullertangen, Ringerike district, Norway. Six new species are described: viz. *Enallopora osloensis*, *Stictopora parvula*, *Dicranopora minuta*, *Sceptropora estoniensis*, *Trematopora ullernensis*, and *Eridotrypa norvegica*. The bryozoan assemblage is similar to that of the Porkuni beds of Estonia, but differs from contemporaneous Ordovician faunas of southern and central Sweden.

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This paper comprises a description of the bryozoan fauna from etage 5b (late Ordovician) of Ringerike, southern Norway. Bryozoa form an important part of the rock in this area where they are common both as species and individuals, though they have been much neglected in previous studies. A few preliminary identifications were made by Kiær in his papers on etage 5 of Ringerike (1897, 1902), but these are not reliable.

Material

The material described here was mainly collected by the author in 1978, and some additional material was supplied by N. M. Hanken (1977). All specimens are from the exposure at Ullertangen in Ringerike. The beds exposed at this locality consist of thickly bedded calcareous sandstones, which are very rich in fossils. Locally the rock is reef-like in character with concentrations of corals and stromatoporoids, and also rich in brachiopods and bryozoans. The fauna was investigated by Kiær (1897), who listed numerous fossils.

Bryozoa are conspicuous even with the naked eye, and the presence of large bryozoa was noted by Kiær, who mentioned the occurrence of 'monticuliporids', obviously a reference to the large trepostomes which are the most conspicuous of the forms at this locality.

The calcareous sandstones were deposited in a shallow water environment, as clearly indicated by the presence of fossil groups such as tabulate and rugose corals, and stromatoporoids. This is further indicated by the mechanical sorting of

the sediment particles, with fine sediments lacking and the fossils affected by mechanical abrasion. In addition the presence of small reefs in the formation also indicates a shallow environment.

Apart from Kiær, studies of the fossils of etage 5b have been undertaken by Spjeldnæs (1961) and Neuman (1969) who dealt with the rugose corals, Henningsmoen (1954) who described the ostracodes, Strand (1934) the cephalopodes, and Størmer (1930) the trilobites.

The 5b beds in the Ringerike – Oslo Region form the uppermost part of the Ordovician. These beds are contemporaneous with the *Dalmanitina* beds (Tommarp Formation) of central and southern Sweden, which are known in older Swedish literature as the 'Brachiopod shale' (Thorslund 1935, Troedsson 1921, among others). The Upper part of the Boda Limestone is also contemporaneous with etage 5b, as are the Porkuni Beds of Estonia. In addition, the drift boulders at Öjle myr on Gotland have the same stratigraphical age. Recently, rocks of the same type as the Öjle myr boulders have been identified from cores in the south part of Estonia (Oraspöld 1975). The Öjle myr beds here represent the highest part of the Porkuni Stage in southern Estonia.

The present bryozoa have all been studied exclusively in thin sections. The calcareous sandstone is very hard and contains little clay material, and for this reason it is impossible to obtain complete bryozoan zoaria from the rock.

All type material is deposited at Paleozoologiska sektionen, Naturhistoriska riksmuseet, Stockholm, with a set of paratypes in Paleontologisk museum, Oslo.

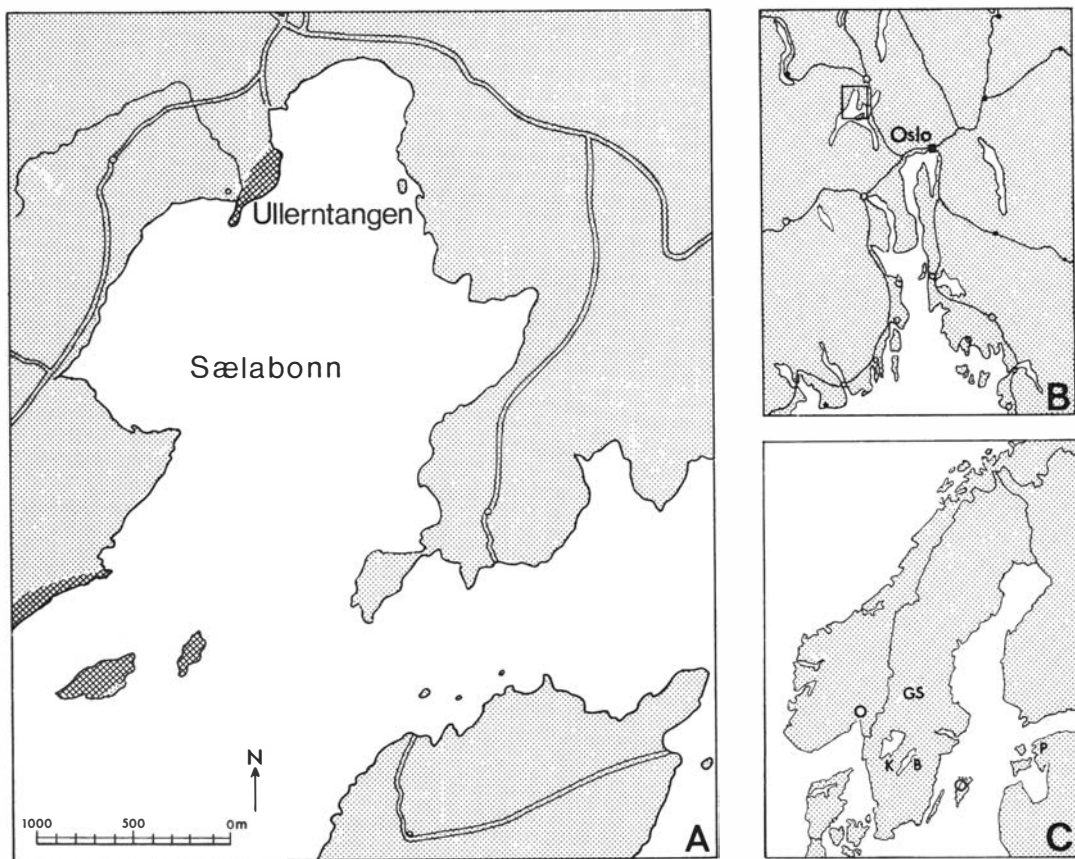


Fig. 1. A. The distribution of the 5b sedimentary rocks (hatched areas) at Ullerntangen, Ringerike, Norway. B. Location of the investigated area. C. Location of discussed localities in Baltoscandia: O = Oslo, G = Gulleråsen, S = Solberga, K = Kinnekulle, B = Borenhult, Ö = Öjle myr, and P = Porkuni.

Discussion of the fauna

Hirnantian bryozoa from Balto-Scandia and nearby areas have been studied by only a few workers, and there are few published papers. The Öjle myr fauna was discussed by Wiman (1901) and has been revised by Spjeldnæs (MS). Bryozoan faunas of this age from Sweden have been investigated by myself (Brood 1978, 1980). Estonian material has been investigated and briefly discussed by Männil (1958, 1962). From the eastern part of North-America there are contemporaneous bryozoan faunas from the Anticosti Island, as discussed by Billings (1866), Bassler (1928), and Ross (1961). Two British trepostome species have been described by McNamara (1978).

Kiepura (1962) described bryozoans from drift boulders in Poland. Some of these boulders

contain material from the uppermost Ordovician which can be compared with the faunas from the Öjle myr boulders and from the Porkuni Beds of Estonia.

Fifteen species of bryozoa have been identified from etage 5b at Ullerntangen. The fauna is dominated by *Trematopora ullernensis* n.sp., *Eridotrypa norvegica* n.sp., *Metadictya borkholmiensis* (Wiman), and *Enallopora osloensis* n. sp., Species such as *Clathropora baltica* Männil, *Metadictya* sp. A., *Sceptropora estoniensis* n.sp., and *Monticulipora schmalenseeii* Brood are also common, though they never dominate. Several of the species at Ullerntangen, such as *T. ullernensis* and *E. norvegica*, are known only from this locality (Table 1) but others occur also elsewhere.

The Ullerntangen fauna shows similarities to

Table 1. Distribution of the Late Ordovician bryozoa of Ullerntangen in Baltoscandia.

Species/Locality	Ullerntangen	Borenhult	Kinneulle	Gulleråsen	Solberga	Ölje myr	Porkuni	Boda Limestone
<i>Chasmatoporella tenella</i> (Eichwald)	x	x			x	x	x	x
<i>Enallopora osloensis</i> Brood	x						x	
<i>Clathropora baltica</i> Männil	x						x	
<i>Stictopora parvula</i> n.sp.	x					x	x	x
<i>Dicranopora minuta</i> n.sp.	x						x	x
<i>Metadictya borkholmiensis</i> (Wiman)	x				x	x	x	x
<i>Sceptropora estoniensis</i> n.sp.	x						x	
<i>Nematopora sublineata</i> Männil	x	x	x	x	x	x	x	x
<i>Trematopora borenhultensis</i> Brood	x	x	x	x				
<i>Trematopora ullernensis</i> n.sp.	x							
<i>Hallopora solbergiensis</i> Brood	x	x	x	x	x	x	x	x
<i>Hallopora dalmani</i> Brood	x	x						
<i>Monticulipora schmalenseii</i> Brood	x			x				
<i>Eridotrypa norvegica</i> n.sp.	x							
<i>Orbignyella bodaensis</i> Brood	x			x				

that of the Porkuni Beds of Estonia (Wiman 1901, Bassler 1911). Species such as *S. estonica*, *M. borkholmiensis*, *C. baltica*, and *P. osloensis* occur commonly at both localities. There are also similarities in facies between the Porkuni Beds and the 5b of Ringerike, with the presence of reefs in both areas and the occurrence of similar species of brachiopods (V. Jaanusson pers. comm. 1979), and ostracodes (Henningsmoen 1954).

A comparison of the Ullerntangen fauna and that of central Sweden shows obvious differences. The faunas of Borenhult in Östergötland, Kinnekulle in Västergötland, and Jältjärn in Dalarna have been investigated by the present author (Brood 1978, 1980). Though these faunas are also derived from shallow water environments (Brood 1978) they have almost nothing in common with the Ringerike fauna. The Swedish faunas are dominated by species such as *Chasmatoporella tenella* (Eichwald), *Clathropora bifurcata* (Brood), *Hallopora solbergiensis* Brood, and *Radiotrypa gothica* Brood which do not occur at all in the Ringerike fauna or are very rare there, whereas the common elements of the Ringerike fauna are completely missing in Sweden. These differences in faunal composition are difficult to explain, but they are obviously due to

ecological differences. Such differences occur also among other fossil groups such as brachiopods and trilobites (V. Jaanusson, pers. comm. 1979).

The Boda Limestone of Dalarna also contains a rich bryozoan fauna (Jaanusson 1978). The carbonate mounds which form the Boda Limestone (and also the Kullberg Limestone) have from time to time been referred to as reefs in the literature (Neuman 1969, Thorslund 1960). However, these massive limestones have little in common with typical reef limestones (Jaanusson 1979), and though it is far from clear how they have been formed, it is certain that they were deposited under different ecological conditions than true reef limestones. It would therefore be expected that the fauna of the Boda Limestone would show clear differences from both the Ringerike-Porkuni fauna and the faunas from central Sweden, and this is confirmed by a preliminary investigation of the bryozoans of the Boda Limestone. The Boda Limestone fauna is dominated by *Chasmatoporella* species, *Trepostomes* (*Hallopora* spp.), and bifoliate cryptostomes (*Stictopora* spp., *Metadictya borkholmiensis*). Several of the common bryozoan species of the Boda Limestone are new and not yet described.

Abbreviations

The following abbreviations are used in the present paper.

Rm	Naturhistoriska riksmuseet, Paleozoologiska sektionen, Stockholm
PMO	Paleontologisk museum, Oslo
O.R.	Observed range
\bar{x}	arithmetical mean
V	coefficient of variation
s	standard variation
<i>l.az.ap.</i>	length of autozooeical aperture
<i>w.az.ap.</i>	width of autozooeical aperture
<i>d.az.</i>	depth of autozooeicum
<i>w.mp.</i>	width of mesopore
N	number of measured objects

Systematic descriptions***Dicranopora minuta* n.sp.**

Fig. 2

Holotype – RM 23892, illustrated in Fig. 2, C.

Paratypes – RM 23964, 23963. PMO 106.303, 106.312, 106.316.

Type horizon and locality. – The 5b limestone at Ullerntangen.

Derivation of name. – *Minute* (Latin) = small, referring to its small dimensions.

Distribution. – This species is known both from Ullerntangen and from the Boda Limestone in Dalarna, Sweden.

Diagnosis. – A small species of *Dicranopora* with well developed acanthopores.

Description. – The colony is small with dichotomously branching stems which are approximately 0.5 mm thick and 2 mm wide. The autozooeia are arranged in 5–9 longitudinal lines. The autozooeical apertures are oval, and between them there are several acanthopores rods.

The proximal parts of the autozooeia are parallel with the stem and their distal ends curve sharply outwards. The depth of the exozone is approximately 0.1 mm. The exozone is generally 0.1–0.2 mm thick. The superior hemiseptum is prominent, but short. Inferior hemiseptum and diaphragms are lacking.

The acanthopore rods between the autozooeical lines are well developed and approximately 0.015 mm thick. Sometimes the autozooeical aperture is penetrated by many small acanthopore rods which are approximately 0.004 mm thick.

The exozone is made of massive laminated calcite penetrated by the acanthopore rods. Vesicular tissue is lacking in the inner part of the exozone.

The mesotheca is thick (approximately 0.025 mm). The median tubuli are closely spaced and approximately 0.005 mm thick.

Dimensions. – Holotype and paratypes. N = 40.

	O.R.	\bar{x}	V	s
<i>l.az.ap.</i>	0.108–0.210	0.164	21.28	0.0349
<i>w.az.ap.</i>	0.069–0.090	0.079	5.41	0.0043
<i>d.az.</i>	0.065–0.108	0.082	17.78	0.0146

Remarks. – An undescribed species of this genus has been reported from the Porkuni beds in Estonia by Männil (1962), and it may be conspecific with the new species described here.

Several species occur in the Upper Ordovician (Cincinnatian) of North America (Ulrich 1882, Bassler 1928 among others). Generally these are much older than the present material but two species are recorded from contemporaneous levels on Anticosti (Bassler 1928). *Dicranopora fragilis* (Billings) differs in being larger than *D. minuta*.

***Stictopora parvula* n.sp.**

Fig. 5.

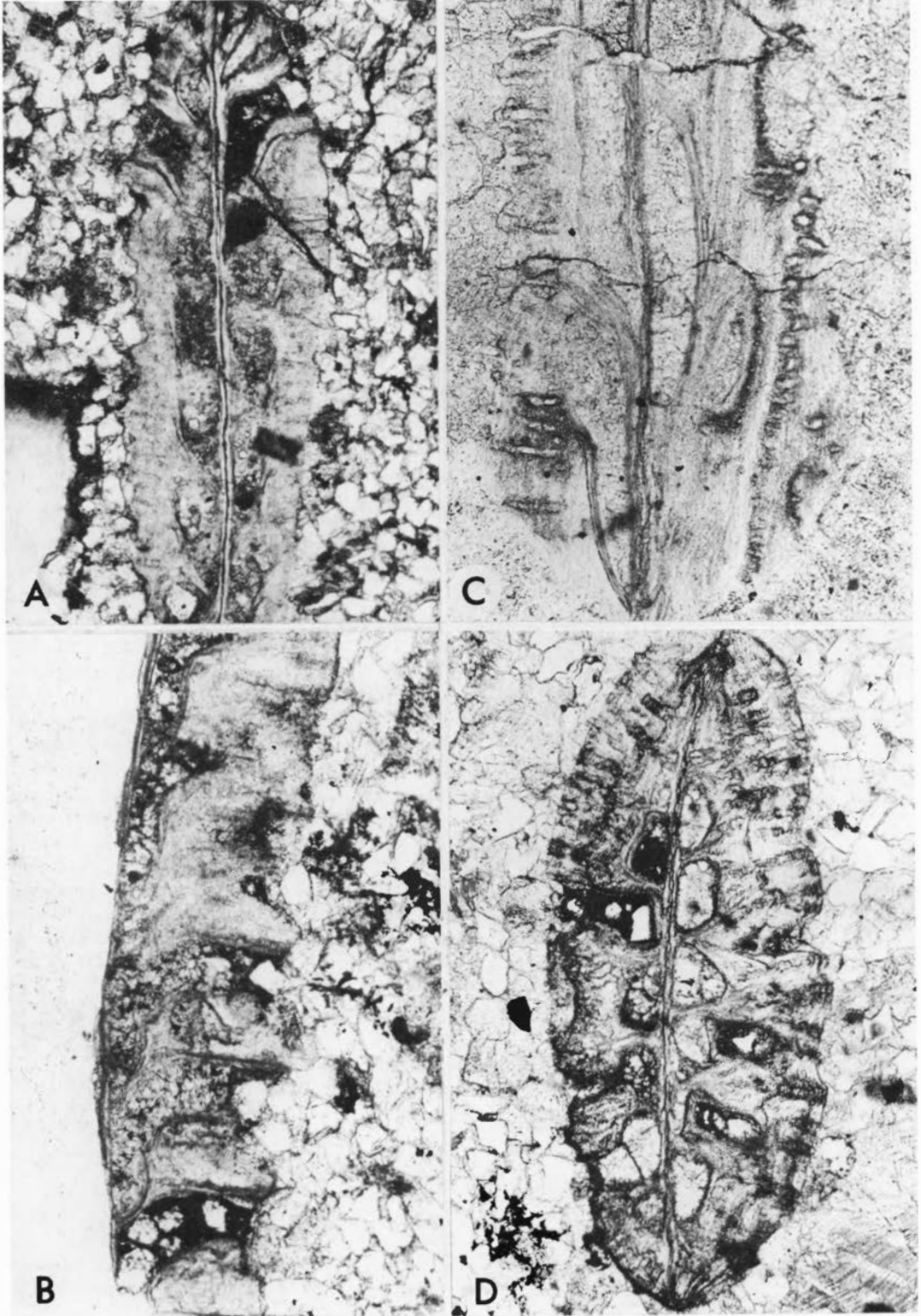
Holotype. – RM 23913, illustrated in Fig. 5, B.

Paratypes. – RM 23888–23891, 23928. PMO 106.304, 106.309.

Type horizon and locality. – The 5b limestone at Ullerntangen.

Derivation of name. – *Parvula* (Latin) = small, referring to its small dimension.

Fig. 2. *Dicranopora minuta* n.sp. A – Oblique transverse section. Paratype. RM 23964. $\times 60$. B – Longitudinal section through stem. Paratype. RM 23863. $\times 80$. C – Longitudinal section through stem showing large acanthopore rods and small acanthopore rods around rim of aperture. RM 23965. $\times 80$. D – Oblique transverse section through stem. Holotype. RM 23892. $\times 80$. A, B, D, from Ullerntangen. C from Porkuni, Estonia.



Distribution. – This species is known from Ullerntangen, the Porkuni beds of Estonia and from drift boulders at Õjle myr.

Diagnosis. – A *Stictopora* with small dimensions and a thin zoarium.

Description. – The zoarium is small, consisting of thin stems with comparatively sharp margins. The stems are 1–3 mm wide and 0.5–1.0 mm thick. The autozooeical apertures are ovate. There are approximately 3 to 10 zooeical ranges per branch, and approximately 6 zooeical ranges per 1 mm.

In deep tangential sections the autozooeica are almost rectangular in outline, with thin zooeical walls. They are approximately 0.1 mm wide.

The mesotheca is approximately 0.025 mm thick, with 0.015 mm thick median tubuli. The proximal part of the autozooeica is approximately 0.2 mm deep; each proximal part is short with a well developed superior hemiseptum. Diaphragms and vesicular tissue at the base of the exozone are generally absent. The acanthopore rods are approximately 0.010 mm thick and present along the zooeical boundaries.

A few irregularly placed acanthopores are also present between the zooeical boundaries. The exozone is relatively thick.

Dimensions. – Holotype and paratypes. N = 35.

	O.R.	\bar{x}	V	s
<i>l.az.ap.</i>	0.140–0.178	0.160	5.58	0.0089
<i>w.az.ap.</i>	0.070–0.092	0.081	5.74	0.0081

Remarks. – This species is characterized by its small zooeical dimensions and its well developed superior hemiseptum. It differs from an undescribed *Stictopora* species from the Boda Limestone and Porkuni beds in its much smaller dimensions and in the absence of an inferior hemiseptum. *S. parvula* differs from *Rhinidictya markhensis* Nekhoroshev from the Upper Ordovician of Siberia in having a well developed superior hemiseptum and larger dimensions, and from *R. bifurcata* Nekhoroshev from the Upper Ordovician of Siberia in having higher autozooeica which turn more rapidly outwards.

Sceptropora estoniensis n.sp.

(Fig. 3)

□ 1911 *Sceptropora facula* Ulrich, Bassler: 153, fig. 74.

□ 1962 *Sceptropora facula* Ulrich, Kiepara: 401, pl. X, fig. 1–3.

Holotype. – RM 23861, illustrated in Fig. 3A.

Paratype. – RM 23866, 23869–23873. PMO 106.305, 106.306.

Type horizon and locality. – Porkuni Beds at Porkuni, Estonia.

Distribution. – *S. estoniensis* is common in the Porkuni Beds and in etage 5b at Ringerike.

Diagnosis. – A *Sceptropora* species with small autozooeica.

Derivation of name. – The species is named after Estonia.

Description. – The zoarium consists of several club-shaped segments, which are one to three mm long. The lower part of the segment is cylindrical and 0.20–0.30 mm thick. The upper part is approximately 1 to 2 mm wide. The upper central socket is 0.7–1.0 mm wide and slightly depressed.

The apertures of the autozooeica open in longitudinal lines on the upper parts of the stems. There are 5–10 autozooeica in each line. The autozooeical apertures are small and oval in outline. Between the autozooeical lines is a series of protruding acanthopore spines. The central core of the acanthopores is approximately 10 μ thick.

The lower part of each segment is free from autozooeical apertures and covered with densely placed, longitudinal lines of acanthopore spines.

The autozooeica originate from the centre of the stem, they turn outwards immediately at an angle of approximately 45°. At approximately half its length the autozooeicum bends horizontally and the autozooeical aperture opens normal to the stem surface. Below the socket at the top of the stem there are several short zooeica which lack apertures. Diaphragms within the autozooeica are generally lacking.

Transverse sections show interzooeical walls radiating from the centre of the stem in a crescent shaped arrangement.

Dimensions. Holotype and paratypes. N = 30.

	O.R.	\bar{x}	V	s
<i>w.az.ap.</i>	0.048–0.073	0.061	10.91	0.0066

Remarks. – This species closely resembles *S. facula* Ulrich from the Richmondian in central North America, as noted by Bassler (1911), who considered the two forms to be identical. However, *S. estoniensis* differs in having more robust stems and smaller autozooeica.

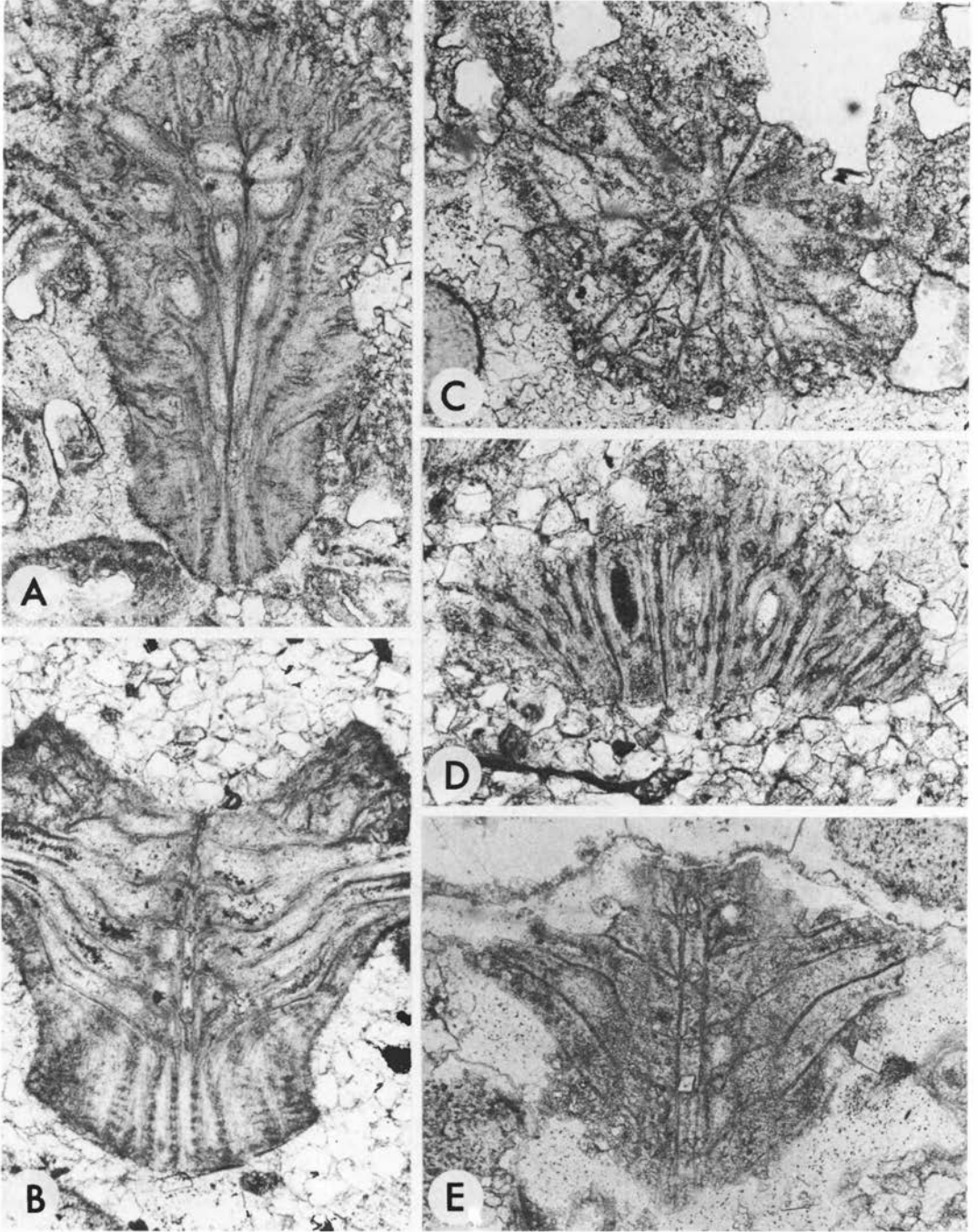


Fig. 3. *Sceptropora estoniensis* n.sp. A – Oblique longitudinal section through heavily calcified stem segment. Holotype. RM 23861. $\times 150$. B – Longitudinal section through heavily calcified stem segment. RM 23871. $\times 150$. C – Transverse section of weakly calcified stem. Paratype. RM 23871. $\times 190$. D – Tangential section through exozone showing laminar calcite penetrated by acanthopore rods. RM 23881. $\times 60$. E – Longitudinal section through weakly calcified stem. Paratype. RM 23870. $\times 190$. Specimens A, C, and E from Porkuni Beds at Porkuni, Estonia. B and D from Ullerntangen, Ringerike.

Kiepura (1962) has described three species of *Sceptropora* from drift boulders in Poland. These boulders contain an Upper Ordovician fauna. The species identified as *S. facula* by Kiepura agrees well with the present species and is here considered to be conspecific. Kiepura's two other species *S. florida* Kiepura and *S. spinosa* Kiepura are based on a small material, which is not so well preserved, and the variation among these two species is not sufficiently well known. *S. spinosa* differs in having spinose segments and *S. florida* in having fewer but larger ridges along the stems and more widely spaced autozoecial apertures.

Enallopora osloensis n.sp.

(Fig. 4).

Holotype. – RM 23852, illustrated in Fig. 4D.

Paratypes. – RM 23850–23851, 23854–23858. PMO 106.307, 106.308.

Type horizon and locality. – The calcareous sandstone at Ullerntangen, Ringerike, etage 5b.

Diagnosis. – A robust *Enallopora* with large autozoecia and prominent zoarial calcification.

Derivation of name. – Named after Oslo, the capital of Norway.

Distribution. – *P. osloensis* is common in etage 5b at Ullerntangen, and rare in the Porkuni Beds of Estonia.

Description. – The zoarium consists of dichotomously branching cylindrical stems, which are approximately 1 mm thick. There are generally no dissepiments between the stems. The autozoecial apertures open irregularly on the frontal side of the stems. The stem surface is almost smooth.

The endozone is approximately 0.5–0.6 mm wide and consists of 10–20 zooecia. The budding of new autozoecia takes place from the centre of the stem. The proximal part of the autozoecium runs parallel with the stem and turns outwards and forward at its distal end. The autozoecium opens obliquely to the stem surface, with the aperture generally circular, but sometimes it may be slightly oval in outline. The autozoecium is generally without diaphragms, but one or two may occasionally occur.

The exozone is generally thick and consists of

laminar calcite. Two types of acanthopores occur. Small acanthopores penetrate the whole exozone, and these are approximately 5 μm . There are also a few large acanthopores, which are 15–20 μm thick and are most common between the autozoecial apertures on the frontal side of the stem, but some are also present on the back side.

The interzoecial walls are made of laminar and granular calcite. The middle granular layer becomes prominent near the exozone and can be up to 10 μm thick.

Dimensions. – Holotype and paratypes. N = 35.

	O.R.	\bar{x}	V	s
<i>w.az.ap.</i>	0.103–0.125	0.116	5.81	0.0067

Remarks. – *E. osloensis* differs from *E. oilensis* (Wiman) in having larger autozoecia, thicker stems, and more autozoecia within the stems.

Trematopora ullernensis n.sp.

(Fig. 7)

Holotype. – RM 23881, illustrated in Fig. 7D.

Paratypes: RM 23877–23880. PMO 106.309, 106.323.

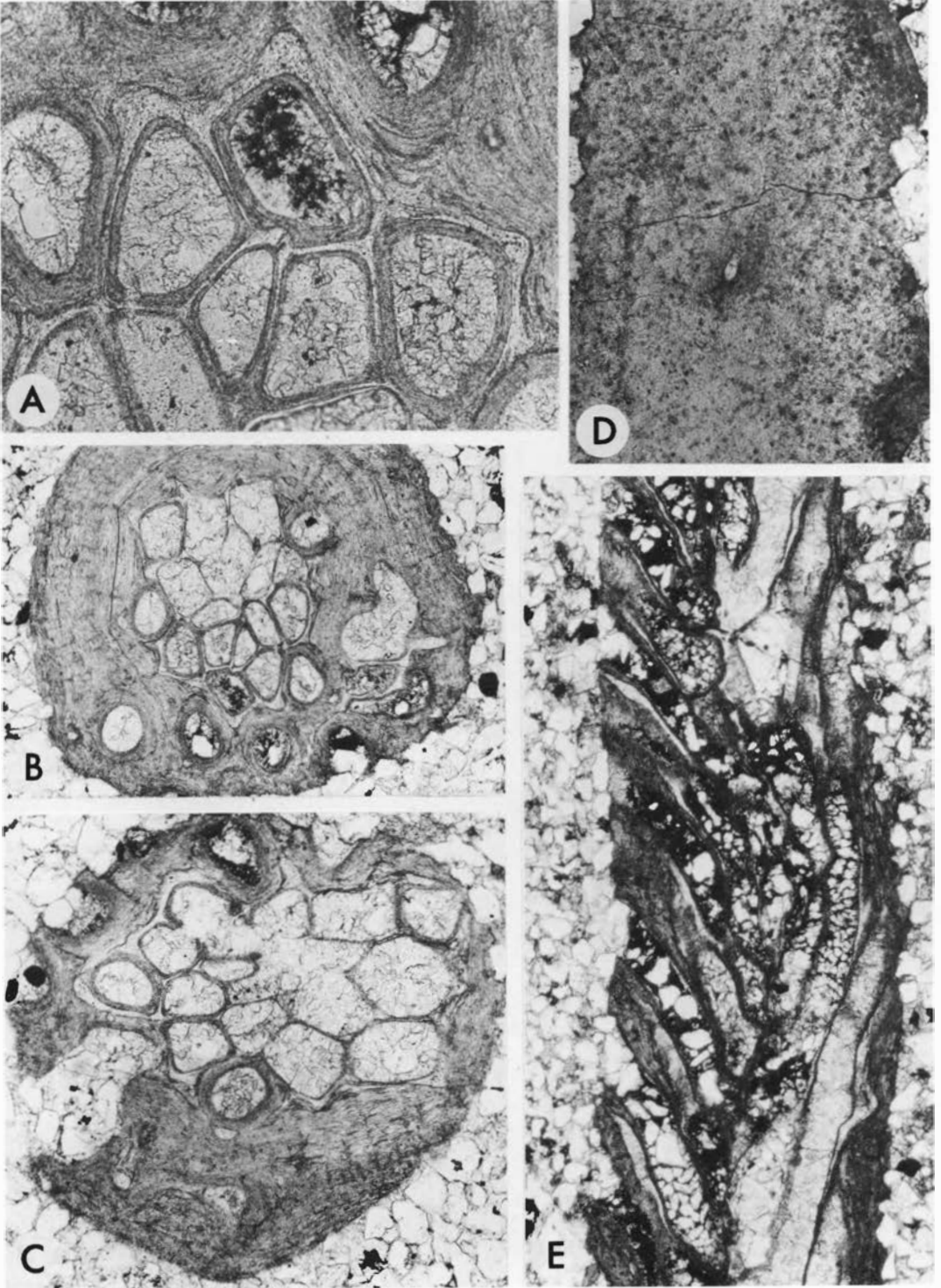
Material. – More than twenty thin sections from Ullerntangen.

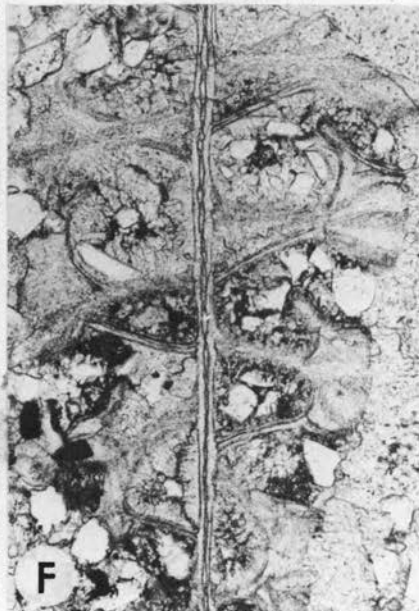
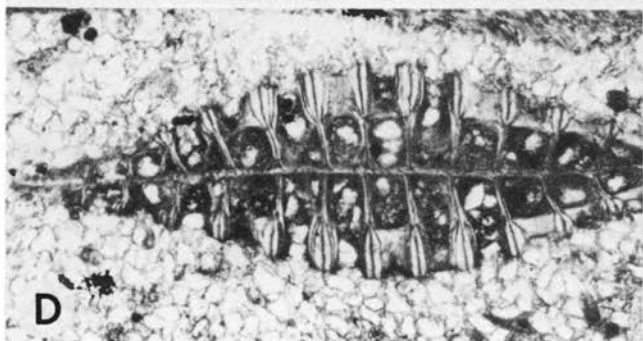
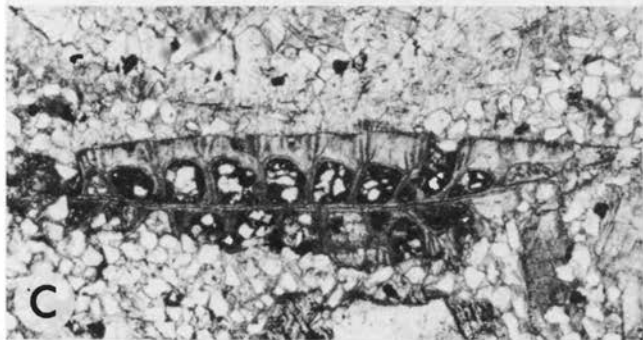
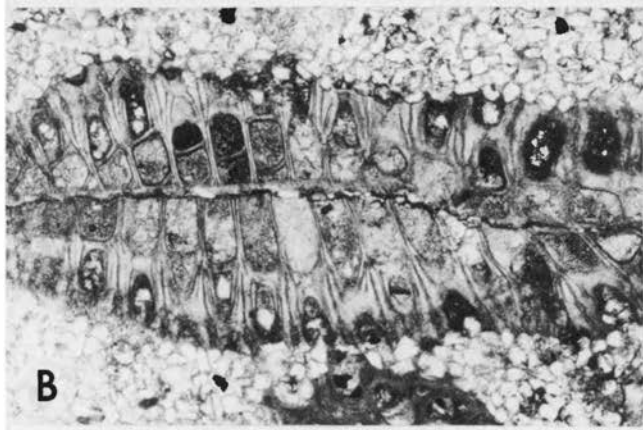
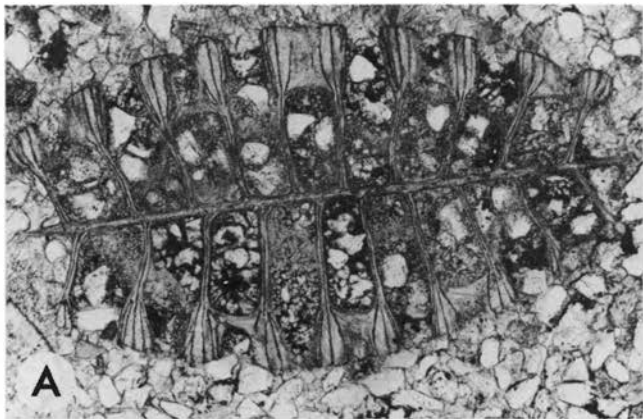
Type horizon and locality. – The calcareous sandstone at Ullerntangen, Ringerike, etage 5b.

Diagnosis. – A large *Trematopora* with heavy calcification, large autozoecia, and large acanthopores.

Derivation of name. – Named after Ullern, the type locality.

Fig. 4. Enallopora osloensis n.sp. A – Transverse section through part of endozone and interior of exozone showing granular layer in the middle of the interzoecial wall and laminated calcite of exozone and zooecial walls. Note the thickening of the granular layer at the point where the acanthopore rods begin. Paratype. RM 23851. $\times 140$. B – Transverse section of stem showing middle of endozone and exozone with laminar calcite penetrated by acanthopore rods. Paratype. RM 23851a. $\times 50$. C – Transverse section showing endo- and exozone. RM 23851b. Paratype. $\times 80$. D – Tangential section through exozone of back side of stem showing laminar calcite penetrated by acanthopore rods of different sizes. Holotype. RM 23852. $\times 80$. E – Longitudinal section of stem showing autozoecia. Paratype. RM 23854. $\times 45$. All specimens from Ullerntangen, Ringerike.





Distribution. – *T. ullernensis* is common at Ullerntangen and rare in the Porkuni Beds of Estonia.

Description. – The zoarium consists of cylindrical, thick stems which are approximately 3 mm wide. The autozoecia open irregularly all around the stem, with oval apertures surrounded by several stout acanthopores.

In longitudinal section the endozone is 0.9–1.1 mm wide. The budding of new zoecia takes place from the centre of the stem. The proximal part of the autozoecium is polygonal and the middle part is crescent-shaped in transverse section. The exozone is thick, approximately 1 mm. The distal end of the autozoecium may contain one or two diaphragms.

The mesopores are numerous and contain several thick diaphragms which are densely grouped so that the exozone consists almost of a compact layer of calcite. The exozone is penetrated by several thick acanthopores approximately 50μ thick.

Longitudinal sections show comparatively short autozoecia budded from the stem centre. They run almost parallel to the stem for some distance and then turn sharply outwards in the exozone. The autozoecia open transversely towards the stem surface. The diaphragms within the autozoecia are few.

Deep tangential sections show autozoecia with oval cross-section. The autozoecial outlines are indented by one to four acanthopores. Shallow tangential sections show autozoecial outlines which are more circular, but the apertures are still indented by the acanthopores.

Dimensions. – Holotype and paratypes. N = 40

	O.R.	\bar{x}	V	s	N
<i>w.az.ap.</i>	0.175–0.250	0.210	10.10	0.0212	48

Remarks. – *T. ullernensis* has much greater dimensions than *T. borenhultensis*. It has some

similarities with *Dittopora colliculata* but lacks the hemi-phragms and has smaller autozoecial dimensions and thinner stems.

Eridotrypa norvegica n.sp.

(Fig. 6).

Holotype. – RM 23971, illustrated in Fig. 6C.

Paratypes. – RM 23967–69, 23977, 23979. PMO 106.310, 106.311, 106.319.

Type locality and horizon. – The 5 b limestone at Ullerntangen.

Derivation of name. – Named after Norway.

Diagnosis. – An *Eridotrypa* species with large dimensions, prominent calcification, and mesopores with many diaphragms.

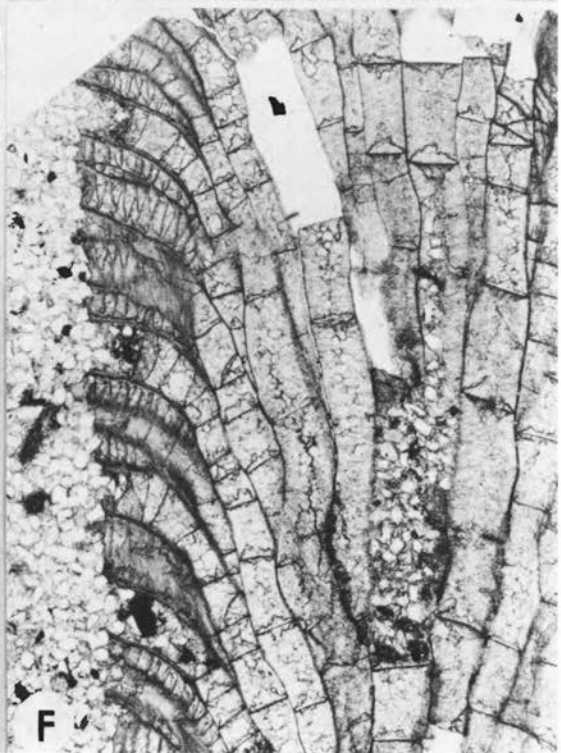
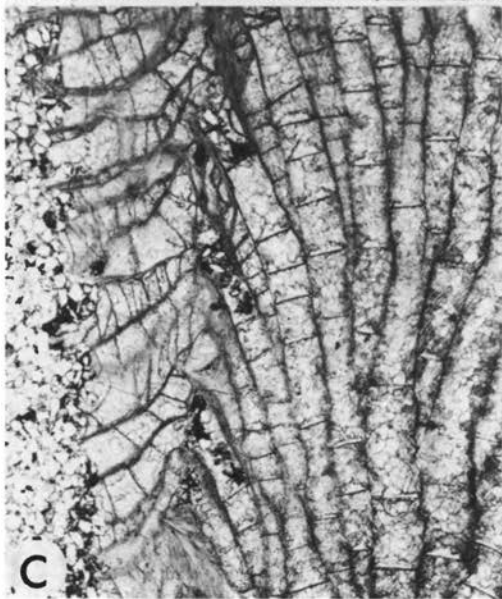
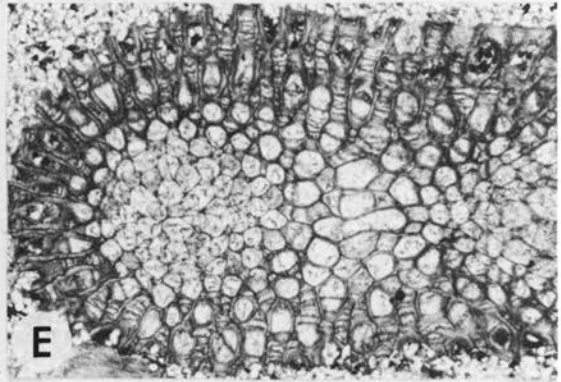
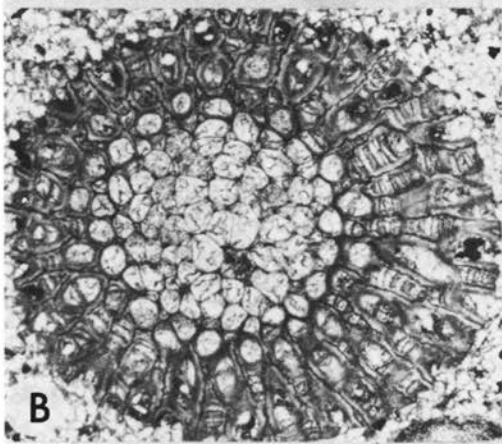
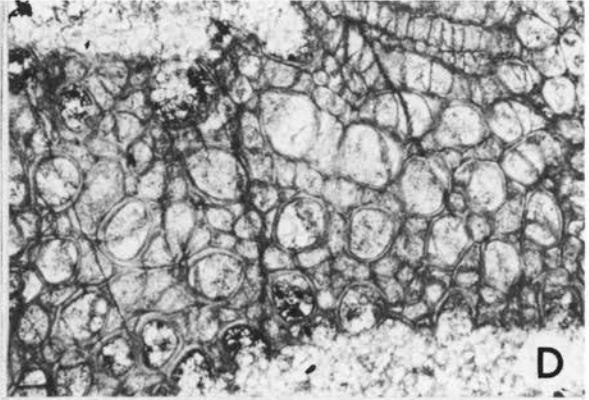
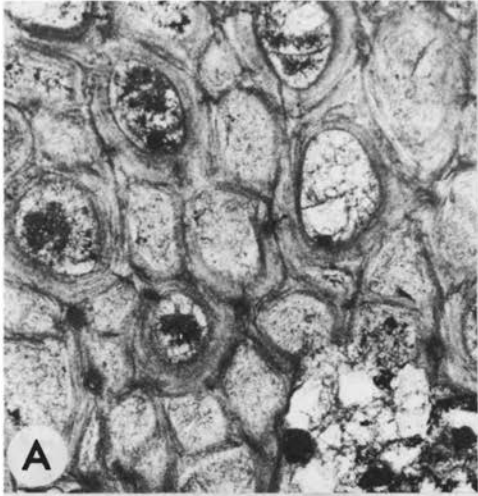
Description. – The zoarium is ramose with circular cross-sections. The width of the stems is approximately 2–4 mm. The aperture of the autozoecia is oval or circular. Calcification is generally prominent in the exozone. The mesopores are several more times common than the autozoecia, and they are much smaller and polygonal or circular in outline.

Tangential sections show oval autozoecia surrounded by polygonal mesopores. A few small acanthopores are present in the exozone. The acanthopore rods are approximately 0.010 mm thick.

Transverse section shows an endozone which is approximately 1.2–1.5 mm wide. The centre is occupied by a bundle of 10–20 polygonal tubes from which the autozoecia are budded. The interzoecial walls of the endozone are thin, approximately 5μ . They thicken in the exozone where they are up to 0.2 mm.

Longitudinal sections show the long central bundles which contain diaphragms, spaced at intervals of 0.5 mm. The autozoecia bud from the central bundle of tubes and bend gently outwards, opening obliquely towards the stem surface. The autozoecia contain numerous diaphragms in the distal part of the endozone and the exozone. They are spaced at approximately 0.1–0.2 mm. Mesopores are common and contain numerous, thick diaphragms and cystiphragms. They are spaced at intervals of approximately 0.05 mm. Acanthopores are few and can sometimes reach down into the endozone.

Fig. 5. Stictopora parvula n.sp. A – Transverse section of stem. Paratype. RM 23890. $\times 60$. B – Transverse section of stem. Holotype. RM 23913. $\times 30$. C – Oblique section of stem. Paratype. RM 23851. $\times 40$. D – Transverse section of stem. Paratype. RM 23899. $\times 40$. E – Oblique section showing autozoecia with superior hemiseptum in upper right. Paratype. RM 23851. $\times 90$. F – Oblique transverse section showing autozoecia with superior hemiseptum. Paratype. RM 23928. $\times 75$. All specimens from Ullerntangen, Ringerike.



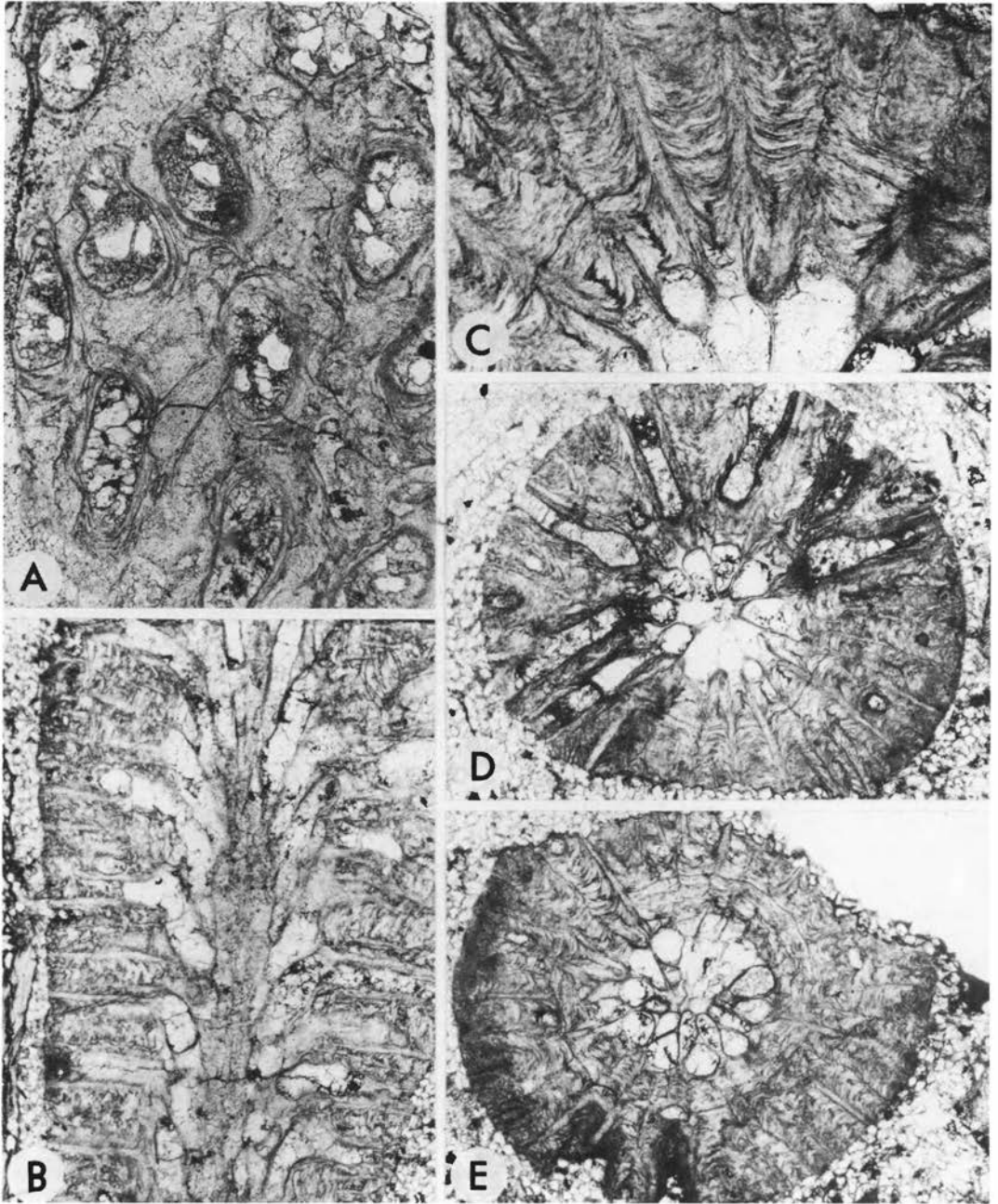


Fig. 6. *Eridotrypa norvegica* n. sp. A - Tangential section showing autozoecia, mesopores and acanthopores. Paratype. RM 23969. $\times 75$. B - Transverse section of stem. Paratype. RM 23967. $\times 25$. C - Longitudinal section of stem with overgrowth. Holotype. RM 23971. $\times 25$. D - Tangential section of stem showing autozoecia and mesopores. Paratype. RM 23977. $\times 30$. E - Transverse section of bifurcating stem. Paratype. RM 23968. $\times 20$. F - Longitudinal section of stem. Paratype. RM 23979. $\times 25$. All specimens from Ullerntangen.

Fig. 7. *Trematopora ullernensis* n.sp. A - Tangential section through exozone showing autozoecial apertures surrounded by acanthopore rods. Paratype. RM 23882. $\times 65$. B - Longitudinal section of stem showing autozoecial shape. Paratype. RM 23880. $\times 25$. C - Transverse section of exozone showing acanthopore rods and strongly calcified mesopores. Holotype. RM 23881. $\times 65$. D - Transverse section of stem showing arrangement of autozoecia. Holotype. RM 23881. $\times 25$. E - Transverse section of stem. Paratype. RM 23878. $\times 25$. All specimens from Ullerntangen, Ringerike.

Dimensions. – Holotype and paratypes. N = 35.

	O.R.	\bar{x}	V	s
<i>w.az.ap.</i>	0.168–0.210	0.185	7.01	0.0130
<i>W.mp.</i>	0.068–0.108	0.080	17.65	0.0142

Remarks. – This species differs from the contemporaneous *Eridotrypa suecica* Brood from Borenhult in having much larger autozoecial dimensions, more mesopores, and a more pronounced calcification. It is known only from Ullerntangen.

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