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Some Carboniferous — Permian organisms from the coral-bearing strata of Spitsbergen

ABSTRACT: The paper presents descriptions and illustrations of *Anthracoporella spectabilis* Pia (Dasycladaceae) and *Palaeoaplisina laminaeformis* Krotov (Hydrozoa) from the Treskelodden Formation (Lower Permian, Sakmarian) of the Hornsund area (Treskelen, Urnetoppen), and *Chaetetes arcticus* sp. n. (Demospongiae) from the „Wordiekammen Limestone" (Permo — Carboniferous) of the Isfjorden area of the southern and central part of Spitsbergen. *A. spectabilis* and *P. laminaeformis* common in the Hornsund area are also known from the northern Ural Mts. and Timan.

K e y w o r d s: Arctic, Spitsbergen, Permo Carboniferous, palaeontology (algae, sponges, hydrozoans).

Introduction

The aim of the present paper is to discuss the results of investigations of three interesting organisms: *Anthracoporella spectabilis* Pia (Chlorophycophyta, Dasycladaceae), *Chaetetes arcticus* sp. n. (Demospongiae) and *Palaeoaplisina laminaeformis* Krotov (Hydrozoa). They are accompanying the rich fauna of tabulates and rugose corals in the Permo — Carboniferous deposits of the western part of Spitsbergen.

Chaetetes arcticus sp. n. has been found in the Permo—Carboniferous „Wordiekammeen Limestone" of the Isfjorden area (Inner Isfjorden, Windodden). *Anthracoporella spectabilis* Pia and *Palaeoaplisina laminaeformis* Krotov are derived from the deposits of the Treskelodden Formation (Upper Treskelodden Beds) of the Lower Permian (Sakmarian) in the Hornsund area (Treskelen, Hyrnefjellet, Urnetoppen) of the southern part of Spitsbergen (Fig. 1; *see also* Nowiński 1991 *in press*).

The investigated material (about 30 specimens), together with a rich collection of tabulates (over 200 colonies — *see* Nowiński 1982, 1991 *in press*) has been collected by the present author during the Polish Palaeontological

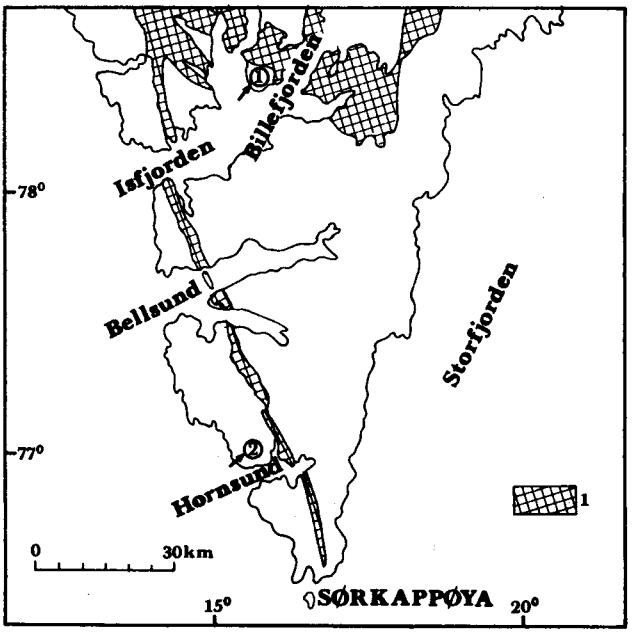

Fig. 1. Location of sections (south-west Spitsbergen) where the investigated material has been collected. 2 — Hornsund area, 1 — Isfjorden (Windodden), 1. Permo—Carboniferous marine deposits.

Expedition to Spitsbergen in 1974, led by Professors G. Biernat and K. Birkenmajer.

86 thin sections and numerous peels have been done for the purpose of the study.

The present work was done in the Institute of Paleobiology of the Polish Academy of Sciences, Warsaw, abbreviated as ZPAL, where the collection is housed.

Acknowledgements. — I am indebted to Professors Ewa Roniewicz and Józef Kaźmierczak (both from the Institute of Paleobiology, Polish Academy of Sciences, Warsaw) for the review of the manuscript and valuable comments. Thin- and polished-sections have been prepared by Mrs Mirosława Nowińska and Mrs Danuta Kościelska, while drawings by Mrs Danuta Sławik; Mr Marian Dziewiński and Mr Wojciech Skarżyński have taken photographs. I would like to express my thanks to all these persons.

Palaeogeographical remarks

Extent, lithological description and discussion of the age of the Treskelodden Formation and „Wordiekammen Limestone" in the western part of Spitsbergen, as well as the analysis of fossil assemblages were presented by the

present author elsewhere (Nowiński 1982, 1991 — *in press*; *see also* Birkenmajer 1964, Birkenmajer and Fedorowski 1980, Cutbill and Challinor 1965, Czarniecki 1969, Fedorowski 1982, Forbes *et. al.* 1958, Heritsch 1939, Padget 1954, Siedlecka 1968, Stel and Worsley 1984).

The Permo—Carboniferous Treskelodden Beds and „Wordiekammen Limestone" contain, beside abundant tabulates and solitary and colonial ruguse corals (Holtedahl 1913, Heritsch 1939, Fedorowski 1965, 1967) very numerous brachiopods (Gobbet 1964, Czarniecki 1969) and crinoids (stems). Less common are bryozoans (among them *Coscinium cyclops* Keyserling), gastropods (Karczewski 1982), bivalves and foraminifers (Liszka 1964).

Contrary to the highly endemic assemblage of tabulates and rugose corals, the described here *Palaeoaplisina*, and especially *Anthracoporella*, display wide geographical distribution during the Permo — Carboniferous time, *i.e.* they occur in the whole south and southwestern part of Europe as well as in the north and south Asia.

Anthracoporella spectabilis (especially common in the V Coral Horizon on Urnetoppen) and *Palaeoaplisina laminaeformis* (especially common in the IV Coral Horizon on Treskelen), as well as *Coscinium cyclops* Keyserling (*see* Pl. 2, Fig. 1a-b) are also known from coeval deposits from the northern Ural Mts and Timan, thus indicating marine connection between both areas during the Lower Permian. This conclusion is also supported by similarities of other bryozoans (mainly from the V Coral Horizon on Hyrnefjellet) and tabulates, as well as rugose corals from the considered areas.

Systematic palaeontology

Phyllum **Chlorophycophyta**
Class **Chlorophyceae**
Order **Dasycladales** Pascher, 1931
Family **Dasycladaceae** Kutzing, 1843
Genus *Anthracoporella* Pia, 1920

Type species: *Anthracoporella spectabilis* Pia, 1920

Diagnosis: Thallus cylindrical, branches dichotomous, pierced by numerous and narrow canals (primary branches), often branching dichotomously (secondary branches). Canal openings visible on the outer and inner surfaces of thallus as small pores. Sporangia unknown.

Remarks. — The following 10 species of this genus (ranging in age from Silurian to Upper Jurassic) have been described so far: *Anthracoporella spectabilis* Pia, *A.* cf. *spectabilis* Racz, *A. fragillisima* Maslov, *A. kasachiensis* Maslov, *A. magnipora* Endo, *A. menchikoffi* Chanton, *A. macrurii* Elliot, *A. uralensis* Chuvasov, *A. vicina* Kochansky et Herak, and *A. torinensis* Endo.

Occurrence. — Silurian: USSR (Kazakhstan); Upper Carboniferous: Spain, Greece, USSR (Donetsk Basin); Upper Carboniferous through Lower Permian: Austria (Carnic Alps), Yugoslavia, USSR (Ural), Iran, Turkey, Japan, Spitsbergen (Hornsund), USA (Texas, New Mexico, Missouri); Permian: USSR (Kazakhstan), Iraq, Afghanistan, Oman, Thailand, Cambodgia, Madagascar; Upper Jurassic: Japan.

Anthracoporella spectabilis Pia, 1920

(Pl. 1, Figs 1a—c, 2; Pl. 2, Figs 2—3)

1920. *Anthracoporella spectabilis* Pia; Pia, p. 15—18, Pl. 1, Figs 7—11.
1972. *Anthracoporella spectabilis* Pia; Homann, p. 189—191, Pl. 3, Fig. 23 (*cum syn.*)
1974. *Anthracoporella spectabilis* Pia; Chuvasov, p. 20, Pl. 6, Figs 1—6.
1978. *Anthracoporella spectabilis* Pia; Kulik, p. 191, Pl. 4, Figs 1—6.
1980. *Anthracoporella spectabilis* Pia; Flügel and Flügel — Kahler, p. 123—124, Pl. 7, Fig. 7.
1980. *Anthracoporella spectabilis* Pia; Vachard, p. 345—348, Pl. 5, Figs 2—4; Pl. 7, Fig. 3; Pl. 23, Figs. 6—8.

Diagnosis. — Thalli cylindrical, rarely branching, 1.0 to 10.0 in diameter, usually between 3.0—6.5 mm. Thallus wall 0.10 to 0.80 mm thick, pierced by straight, commonly dichotomously branched canals, which are perpendicular or slightly oblique to the thallus surface. Wall pores round, 0.01 to 0.07 mm in diameter. Pore centers usually 0.01 to 0.09 mm apart.

Material. — Very numerous and well preserved thalli, which have been found in six samples (concentrations): ZPAL V. XIX/1—6 from Treskelen and Urnetoppen. 1. Treskelen: No. 1 in the IVb Coral Horizon, Creek IV. 2. Urnetoppen: Nos 2—6 in the V Coral Horizon.

Description. — Nonsegmented, cylindrical or slightly ellipsoidal thalli, sometimes slightly curved and with rare branches; strongly differentiated in size. They occur in the rock in the rich discrete accumulations, numbering hundreds of specimens. Usually thalli show no orientation, only rarely their longer axes are more or less parallel to the surface of the bed. The length of thalli varies from 7.0 to 20.0 mm, their interior is infilled with a rock matrix or calcite spar. In the interior of some larger thalli 1 to 4 smaller thalli have been found. Thalli are round in transverse section with an outer diameter between 1.0 to 7.5 mm, usually 3.0 to 6.3 mm, sometimes slightly ellipsoidal measuring 1.8—4.0 × 3.0—7.5 mm. Inner diameter of thalli varies between 0.8 and 6.8 mm, usually 1.7 and 4.5 mm. Wall thickness in particular thallus relatively stable, shows, however, important differences among different specimens. It is usually 0.1—0.15 in small thalli, up to 0.25—1.0 mm (most common 0.4—0.7 mm) in large thalli. Thallus wall pierced by very numerous, small canals oriented perpendicularly or slightly obliquely in relation to the wall surfaces (outer and inner). Their length is equal with the thickness of wall. Both, in transverse and longitudinal sections, these canals are straight or slightly arch-like curved, commonly dichotomously branched at a low angle, and sometimes funnel-like expanded when approaching outer and inner thallus surfaces. No primary or secondary branches can be distinguished, despite a relatively good state of preservation. Canal openings are visible as round or slightly oval pores (side openings) on the thallus surfaces, measuring about 0.046—0.052 in diameter. The diameter of pores is equal with the diameter of canals, or a little higher when funnel-like expansions of canals are present near the surface. In tangential section thallus displays dense, grid-like structure, where pore centers are up to 0.050 mm apart. No sporangia have been found.

Remarks. — *Anthracoporella spectabilis* shows high intraspecific variability (*see* Table 1). The investigated thalli from the Permo—Carboniferous of the Hornsund area are the most similar to the specimens from the Lower Permian of Carnic Alps (Trogkofel Limestone) described by Flügel and Flügel-Kahler (1980). Similarities concern the size and diameter of thalli, thickness of wall and the distance between pore centers. The specimens from Spitsbergen differ only from the alpine forms in a slightly larger diameter of pores and in the presence of small thalli inside large one.

The thalli from Spitsbergen are larger and show more narrow range of pores diameter than the holotype (*see* Pia 1920).

Occurrence. — Lower Carboniferous through Lower Permian: Greece, USSR (Ural), Japan (Kitakami Mts, Monshu Mts); Upper Carboniferous: Spain (Asturia); Upper Carboniferous through Lower Permian: Austria (Carnic Alps), Yugoslavia (Slovenia, Karawanken), Spitsbergen

Table 1

Dimensions (*in* mm) of *Anthracoporella spectabilis* Pia

Author (locality) age	L	D	d	s	p	l
Pia 1920 Carnic Alps, Upper Carboniferous	-	1.3 - 5.8	0.6 -3.5	-	-	-
Kochansky and Herak 1960 Yugoslavia, U. Carboniferous – L. Permian	-	1.0 - 4.6	0.5 -3.7	0.16 - 0.80	0.04 - 0.07	-
Flügel 1966 Alps, Lower Permian	3.5 - 6.4	-	-	0.25 - 0.70	0.048 - 0.072	0.05 -0.06
Racz 1966 Spain, Upper Carboniferous	-	1.5 - 2.25	0.88 - 1.55	0.185 - 0.410	0.035 - 0.040	-
Elliot 1968 Oman, Permian	5.0 - 6.0	-	-	-	ca 0.040	-
Homann 1972 Alps, Lower Permian	max. 14.96	1.0 - 10.23	0.45 - 9.13	0.134 - 1.150	0.028 - 0.1	0.014 - 0.09
Chuvashov 1974 USSR (Ural), Lower Permian	0.9 - 3.75	-	-	0.425 - 0.575	0.02 - 0.045	0.01 - 0.022
Vachard 1976 France, Carboniferous	max. 2.0	1.65 - 2.0	0.95 - 1.10	0.34 - 0.45	0.04 - 0.05	0.01 - 0.02
Vachard 1980 Afghanistsan, Permian	max. 4.9	0.8 - 1.9	0.48 - 1.10	0.12 - 0.68	00.2 - 0.05	0.02 - 0.06
Flügel and Flügel-Kahler 1980 Carnic Alps, Lower Permian	max. 20.0	max. 6.0	-	ca 0.60	0.04 - 0.05	max. 0.05
Nowiński (*this paper*) Spitsbergen, Permo-Carboniferous	7.0 - 20.0	1.0 - 7.5 (3.0 - 6.3)	0.8 - 6.8 (1.7 - 4.5)	0.1 - 1.0	0.046 - 0.052	max. 0.050

L – lenght of thallus, D – outer diameter of thallus, d – inner diameter of thallus, s – thrickness of thallus wall, p – diameter of pores, l – distance between centres of pores

(Hornsund area); Pennsylvanian through Wolfcampian: USA (Texas); Lower Permian Turkey (Ankara region), Iran, Cambodia; Middle through Upper Permian: Madagascar; Permian: Iraq, Afghanistan, Thailand, Oman.

Phyllum **Spongia**
Class **Demospongiae**
Subclass **Sclerospongiae**
Order **Chaetetida** Okulitsch, 1936

Remarks. — Until recently chaetetids have been included into Anthozoa, mainly to the Tabulata (basing on the presence of pseudoseptal processes and diaphragms, which were regarded as structures analogous to septal spines and tabules of Tabulata), or even Hydrozoa (*i.e.* Sokolov 1950, 1955, 1962; Stasińska 1958; Nowiński 1975; Hill 1981).

The recent investigations of chaetetid skeletal structure (*i.e.* Kaźmierczak 1979; Reitner and Engesler 1987) have shown the presence of spicules typical for sponges, or traces of such spicules (pseudomorphoses) in a skeletal tissue of some Paleozoic and Mesozoic members of this order (*Acanthochaetetes, Atrochaetetes, Boswelia, Chaetetopsis, Hispidoptera, Ptychochaetetes*). Carbonate or pyritic pseudomorphoses after siliceous spicules (monaxons) have been observed in *Ptychochaetetes* Koechlin 1947 from the Kimmeridgian of Spain (Termier and Termier 1976) and in *Atrochaetetes* Cuif at Fischer 1974 from the Upper Triassic of Italy (Dieci *et al.* 1977). Kaźmierczak (1979) described siliceous spicules (monaxons) in *Chaetetopsis favrei* (Deninger 1906) from the Barremian of Crimea. Pseudomorphoses after spicules in a skeleton of Paleozoic chaetetids of the genus Boswelia have been noted by Gray (1981). Hartman and Goreau (1972), comparing the extant sclerosponge *Ceratoporella nicholsoni* (Hickinson 1911) with various chaetetids, have proved important analogies in the structure of their skeletons.

Thus, the investigations by Hartman and Goreau (1972), Kaźmierczak (1979) and Gray (1981) indicate that both, Paleozoic and Mesozoic chaetetids, should be included into subclass Sclerospongiae.

Family **Chaetetidae** Milne—Edwards et Haime, 1850
(=? **Varioparietidae** Schorf—Steiner, 1963)
Subfamily **Chaetetinae** Milne—Edwars et Haime, 1850
Genus *Chaetetes* Fischer von Waldheim, 1837

Type species: *Chaetetes cylindraceus* Fischer von Waldheim *in* Eichwald, 1929.

Remarks. — So far, only two chaetetid species (*Chaetetes radians* Fischer von Waldheim and *Ch. svalbardensis* Heritsch) have been known from the central part of the western Spitsbergen. They occur in the Permo—Carboniferous deposits (Passage beds, „Wordiekammen Limestone", Lower Brachiopod Cherts) of the Isfjorden and Belsund areas (Heritsch 1939, Forbes *et al.* 1958).

Chaetetes arcticus sp. n.
(Figs 2A, B; Pl. 3, Fig. 1a—d

Holotype: Specimen ZPAL V. XIX/7; Figs 2A, B; Pl. 3, Fig. 1a—d.

Type horizon: *Spirifer* limestone horizon, Lower Permian (Upper Kungurian).

Type locality: Isfjorden, Windodden.

Derivation of the name: *arcticus* — occurring in Arctica.

Diagnosis. — Basal skeleton spherical, about 150 mm in diameter. Tubes very long,

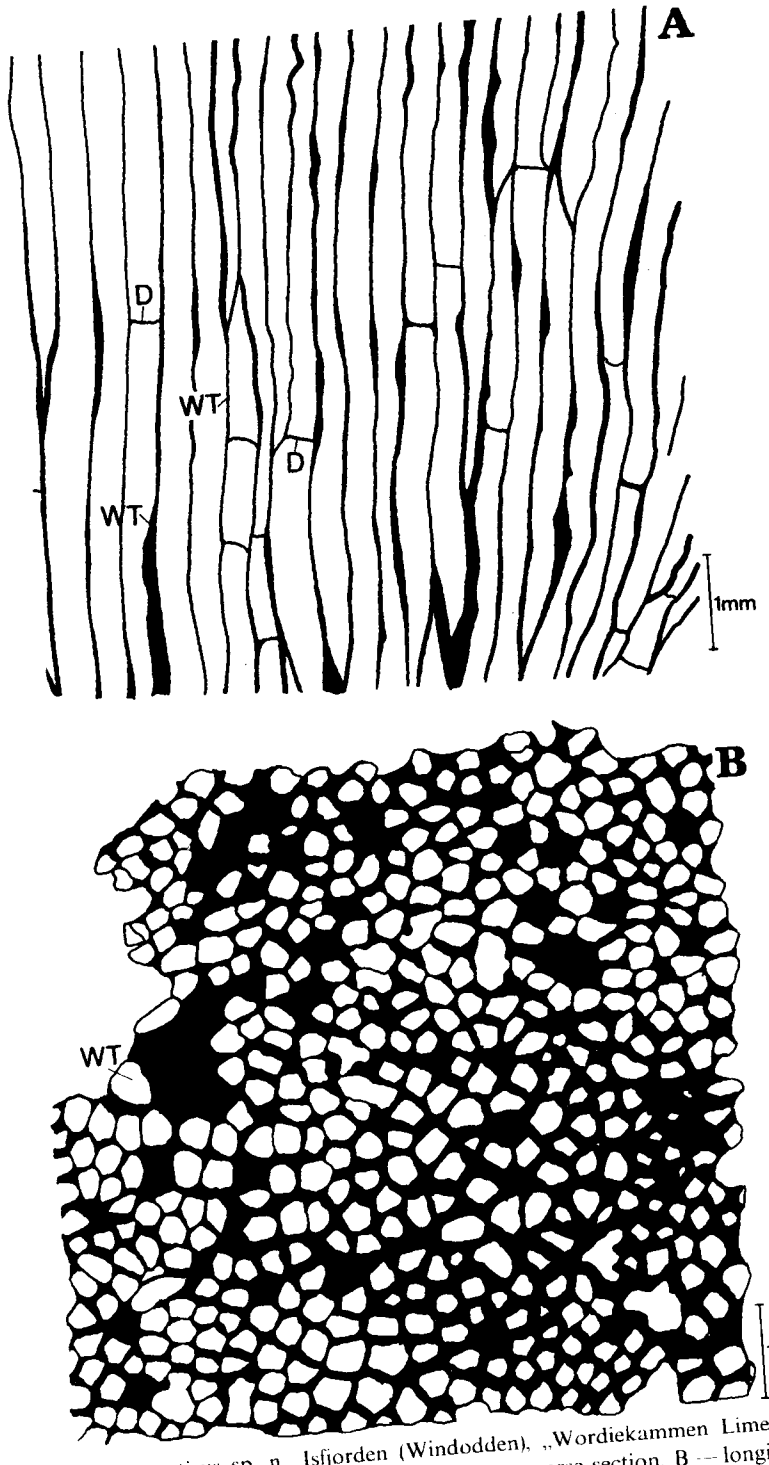

Fig. 2. *Chaetetes arcticus* sp. n., Isfjorden (Windodden), „Wordiekammen Limestone" (Spirifer limestone horizon). ZPAL V. XIX/7, holotype; A — transverse section, B — longitudinal section; ×10. D — diaphragm, WT — tube wall.

prismatic, multiangular in transverse section, with diameter between 0.30 and 0.55 mm, commonly 0.35 to 0.45. Tube walls smooth, 0.02 to 0.04 mm thick. Diaphragms extremely rare, straight or concave, thin and horizontal. They are distributed randomly and 10.0 to 12.0 mm apart, locally more densely spaced (3—5 tabulae) 1.0—1.2 mm apart. Pseudoseptal spines absent.

Material. — One complete, very well preserved specimen from Inner Isfjorden (ZPAL V. XIX/7) from Spirifer limestone horizon. 8 transverse and longitudinal thin sections have been made.

Description. — Large, massive, nearly regular sphere of the basal skeleton has diameter about 150 mm. Tubes very long (up to several cm), strongly prismatic, tightly packed, slightly curved, straight on a short (about 20 mm) distance, radially disposed. They are more or less regularly multiangular in transverse section (penta- to hexagonal) with sharply delimited angles. Diameter of tubes differentiated, from 0.30 to 0.55 mm, usually between 0.35 to 0.45 mm. Inner shape clearly multiangular. Tube walls smooth, straight and very thin (0.02—0.04 mm). Diaphragms extremely rare, very thin (approaching wall thickness), straight or menisc-like concave, horizontal. They are randomly distributed, both in particular tubes and whole basal skeleton, 10.0-12.0 mm apart. Sometimes diaphragms are locally more densely spaced in groups (2 to 5) and 1.0 to 1.2 mm apart. Pseudoseptal spines absent.

Remarks. — *Chaetetes arcticus* sp. n. is most similar to *Ch. subcapillaris* Sokolov from the Lower Carboniferous (Visean) of Voronez (Sokolov 1950). The similarities are in pattern and tube wall thickness, as well as in extremely rare and thin diaphragms. The new species differs from *Ch. subcapillaris* in having slightly larger diameter and more differentiated transverse sections of the tubes which are strongly prismatic, and in the absence of pseudoseptal processes as well as in a larger size of the spherical basal skeleton.

It differs also from the similar (in relation to the form of the basal skeleton and the absence of pseudoseptal processes) *Ch. raritabulatus* Lee *et* Chu from the Middle Carboniferous of China (Lee, Chen and Chu 1930) in having larger diameter of more thin tube wall and in nearly total absence of diaphragms. From similar *Ch. capilllaris* (Phillips) from the Carboniferous of Ireland (Phillips 1836; Mc Coy 1844), *Chaetetes arcticus* sp. n. differs in a little larger diameter of tubes, rare diaphragms and the total absence of pseudoseptal processes.

It differs also from *Ch. tabulicarens* Sokolov, from the Lower Carboniferous (Upper Visean) of the Moscow Basin (Sokolov 1950), which also have no diaphragms, in much smaller diameter and thinner tube walls, and in the total absence of pseudoseptal processes.

Occurrence. — Lower Permian: Spitsbergen (inner Isfjorden).

Phyllum **Coelenterata**
Class **Hydrozoa**
Subclass **Hydroidea**
Order **Sphaeractinida** Waagen et Wentzel, 1887
Family **Sphaeractinidae** Waagen et Wentzel, 1887
Genus *Palaeoaplisina* Krotov, 1888 (=*Mezenia* Stuckenberg, 1895; =*Uralotimania* Riabinin, 1913)

Type species: *Palaeoaplisina laminaefromis* Krotov, 1888.

Diagnosis. — Wide and long skeletal laminae 2.0—7.0 mm thick, scrolled in wide-cone tubes or totally irregularly curved, commonly parallel and placed very near each other. Upper surface of laminae covered with small and large (up to 5.0 mm high) hemispherical and conical processes as well as with numerous pores (openings of intralaminar canals). Basal surface homogeneous, without pores.

Remarks. — The genus *Palaeoaplisina* has been erected by Krotov (1888) and included into so called „horny sponges" — Ceraospongiae. According to him, the structures described from the Upper Carboniferous of the western slopes of the Ural Mts and Timan, displayed important similarities with the Recent horny — *Aplisina aerophoba* Nardo. Other very similar skeletal structures, from the Upper Carboniferous and Permian of the Ural and Timan, were described by Stuckenberg (1895) under the name *Mezenia* (*Mezenia roseni* Stuckenberg) and associated with Hydrozoa.

Under the name *Uralotimania* (*U. reticulata* Riabinin), Yakovlev and Riabinin (1913) described, from the Upper Carboniferous of the Ural and Timan, the structures very similar to *Palaeoaplisina* and *Mezenia*, and included them also into Hydrozoa (order Tubulariae).

Later investigations by Riabinin (1955) have shown that all these earlier described skeletons (*Palaeoaplisina*, *Mezenia* and *Uralotimania*) are conspecific and belong to *Palaeoaplisina* Krotov, which represents hydroids.

The characteristics of the genus is given in Krotov (1888), Riabinin (1913, 1955) and Tchudinova (1962).

Occurrence. — Upper Carboniferous through Lower Permian: USSR (Ural, Timan); Lower Permian: Spitsbergen.

Palaeoaplisina laminaeformis Krotov, 1888

(Fig. 3; Pl. 4, Figs 1a—c, 2)

1888. *Palaeoaplisina laminaeformis* Krotov; Krotov, p. 20—26.
1955. *Palaeoaplisina laminaefromis* Krotov; Riabinin, p. 331—337, Pl. 2, Figs 1, 3—5.
1962. *Palaeoaplisina laminaeformis* Krotov; Tchudinova, p. 151—152, Pl. 2, Figs 2—7.

Diagnosis. — Skeletal laminae 1.0—5.5 mm thick, usually between 2.5 and 4.5 mm, commonly arranged in composite layers including several laminae, each lamina 0.1—0.4 mm apart or even touching one another, sometimes scrolled in irregular tubes 15—25 mm in diameter (or 1—28 × 18—35 mm in transverse section). Processes very numerous, mound-like, hemispaherical or club-like 1.3—3.5 mm in diameter and 0.5—3.5 mm high, sometimes conical and 4.0—5.0 mm high. Pores and canals 0.05 to 0.20 mm in diameter. Chambers diameter about 0.4—1.0 mm.

Material. — Large fragments of nine well preserved colonies from Treskelen (IV Coral Horizon, Creek II) — ZPAL V. XIX/8—14, 16, 17; one fragment of a colony from Urnetoppen (V Coral Horizon) — ZPAL V. XIX/15.

Description. — Colonies as wide as long, in the form of more or less irregulary curved laminae with largely varying thickness (from 1.0 to 5.5 mm, usually 2.5—4.5 mm). Particular laminae commonly parallel, forming pseudolayers of 2 to 4—5 laminae. Inside pseudolayers particular laminae touch each other (basal — lower surface of the upper laminae touch the upper surface of the lower laminae — the surface with processes), or randomly spaced 0.1 to 4.0 mm apart. In rare cases (2 colonies) laminae can touch each other with basal surfaces. Sometimes, particular laminae are scrolled in irregular tubes with folded walls and 15—25 mm in diameter, or 1—28 × 18—35 mm in transverse section. In such cases the outer surface of laminae (surface with processes) is always the inner surface of a tube, while the basal surface is an outer tube surface. The upper surface of laminae and processes is covered with numerous, small nodes. Processes of the upper surface numerous (locally very numerous), from low to high and mound—like, hemispherical, finger-like, sometimes club-like; in transverse section (parallel to the lamina surface). They are rounded or oval, 1.3—3.5 mm in diameter and 0.5—3.5 mm high. Only rarely conical processes occur, which are 2.0 to 3.5 mm wide at a base and 4.0 to 5.0 mm high. These processes occur exclusively on any upper surface of skeletal laminae. The basal surface is smooth, without nodes and processes. Inner part of laminae contains numerous, strongly branched (in various directions) and connected canals. In horizontal plane (parallel to a lamina surface), these chambers

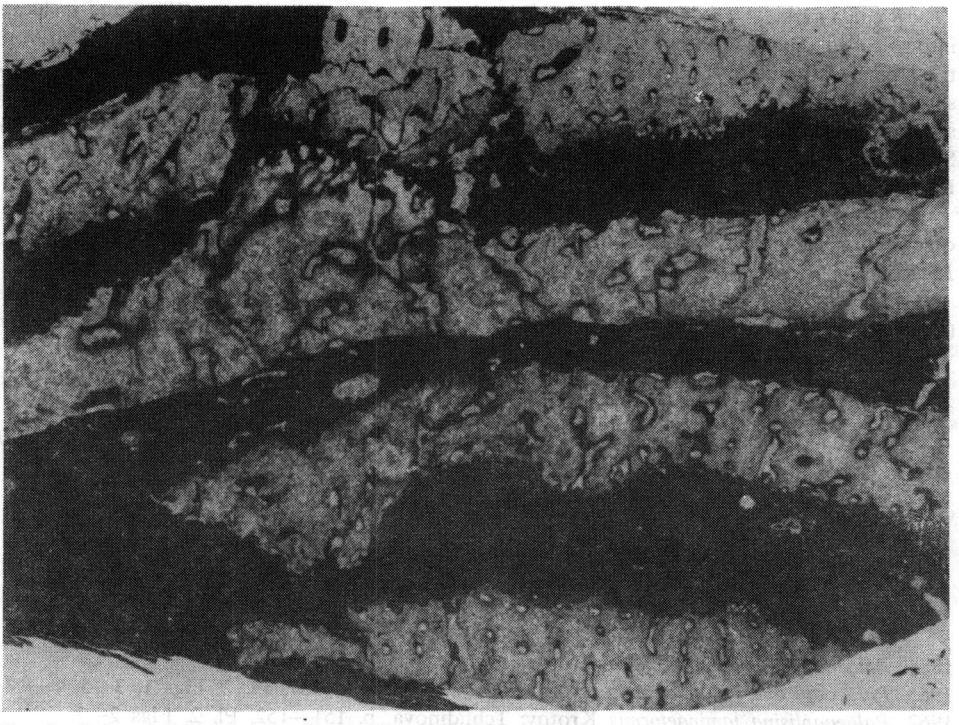

Fig. 3. *Palaeoaplisina laminaeformis* Krotov, 1888. Transverse sections (perpendicular to the surface) through 4 superimposed colonies, × 5; ZPAL V. XIX/15; Urnetoppen, V Coral Horizon.

are strongly tubular-like elongated and parallel to each other. Maximum diameter of their chambers is about 0.4—0.5 mm, only exceptionally up to 1.0 mm. The chambers are connected with the outer (only upper) surface of lamina by intralaminar canals, and next by pores between nodes. Canal and pore diameters are similar and equal to 0.05—0.10 mm, sometimes 0.20 mm. Similar internal structure (chambers, canals and pores) exists also inside of processes on the upper surface of laminae. Whole internal space of laminae, between chambers and canals, is infilled with carbonate skeletal tissue. Its structure cannot be observed due to a high degree of recrystallization.

Remarks. — Colonies from Treskelen and Urnetoppen differs from the specimens described earlier from the Upper Carboniferous and Lower Permian of the Ural and Timan (Krotov 1888; Riabinin 1955) only in slightly thinner skeletal laminae and in a low number of low conical processes on the upper surface of a colony.

Occurrence. — Upper Carboniferous through Lower Permian: North Ural, Timan; Lower Permian: Spitsbergen (Hornsund area).

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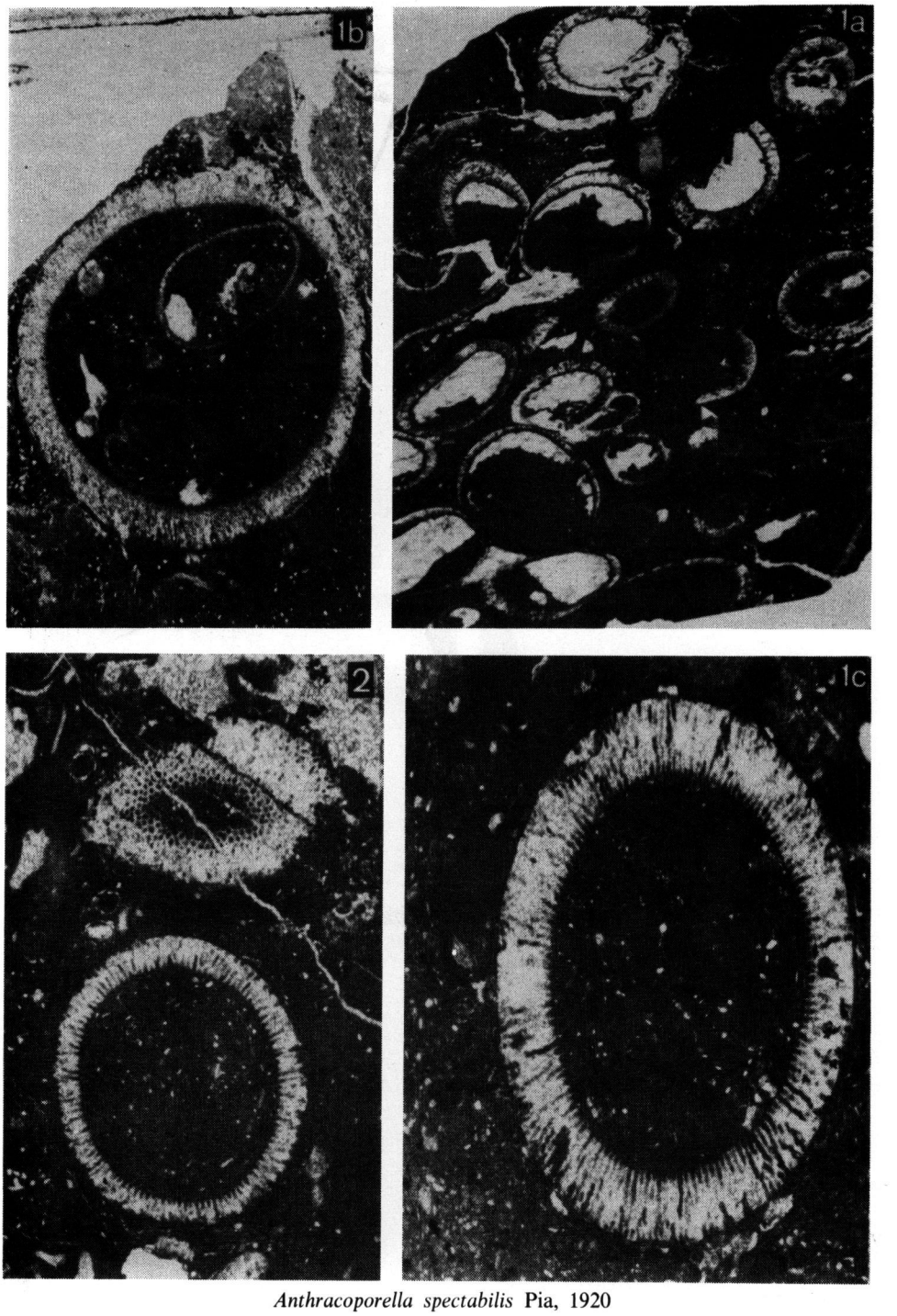
Streszczenie

W pracy opisano i zilustrowano trzy interesujące organizmy: *Anthracoporella spectabilis* Pia, 1920 (Dasycladaceae), *Chaetetes arcticus* sp. n. (Demospongiae) i *Palaeoaplisina laminaeformis* Krotov, 1888 (Hydrozoa), towarzyszące koralowcom Tabulata (Nowiński 1982, 1991 *in press*), rugozom (Fedorowski 1965, 1967) i innej faunie w osadach permo-karbonu zachodniej części Spitsbergenu (fig. 1).

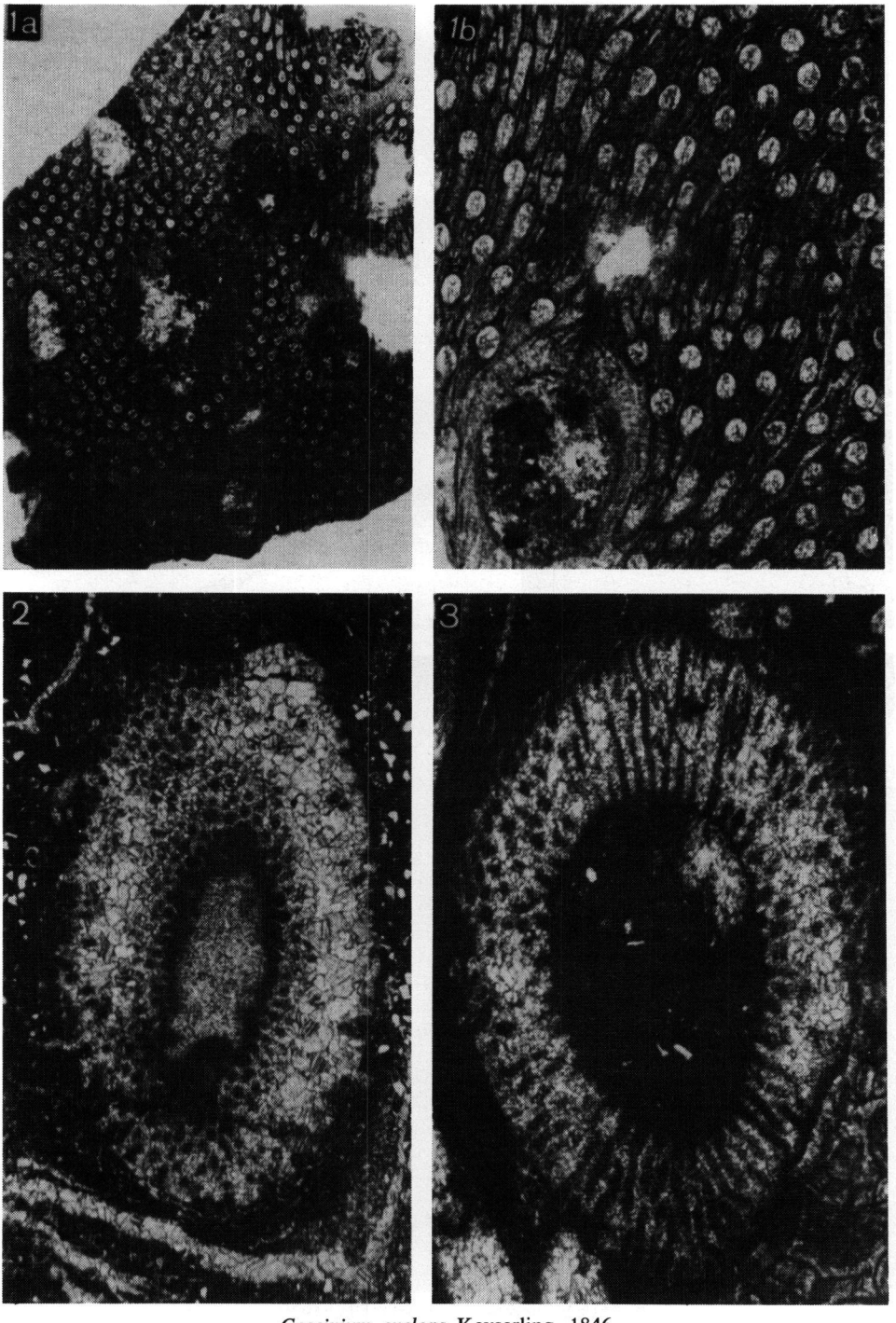
Chaetetes arcticus sp. n. (fig. 2; pl. 3, fig. 1a—d) pochodzi z permo-karbońskich osadów „Wordiekammen Limestone" obszaru Isfjorden (Windodden). *Anthracoporella spectabilis* (table 1; pl. 1, fig. 1a—c; pl. 2, fig. 2—3) i *Palaeoaplisina laminaeformis* (fig. 3; pl. 4, fig. 1a—c, 2) — występują liczne w dolno-permskiej formacji Treskelodden (Upper Treskelodden Beds) rejonu Hornsundu (Treskelen, Hyrnfjellet, Urnetoppen).

Palaeoaplisina laminaeformis, a szczególnie *Anthracoporella spectabilis* miały duże rozprzestrzenienie paleogeograficzne w permokarbonie, obejmujące południową i południowo-zachodnią Europę oraz północną i południową Azję. Odpowiedniki spitsbergeńskie tych gatunków są większe i lepiej wykształcone od europejskich i azjatyckich. Gatunki te wraz z towarzyszącymi im licznymi fragmentami kolonii mszywiołów, głównie *Coscinium cyclops* Keyserling, 1846 (pl. 2, fig. 1a—b) wykazują — podobnie jak Tabulata i Rugosa tego obszaru — wyraźne powiązania z równowiekowymi zespołami antrakoporel, paleoaplizin i koscinium Północnego Uralu i Timanu.



Anthracoporella spectabilis Pia, 1920

1a — Transverse and oblique sections of cyllindrical thalli, × 5; b — transverse section of cyllindrycal, thin-walled thallus; smaller thalli of the same species visible inside, × 8; c — transverse section of the thallus showing canals, some of them dichotomously branched, × 18; ZPAL V. XIX/3; Urnetoppen, V Coral Horizon; 2 — Transverse section of thin-walled thallus (below) and tangential section of terminal part of a thallus, numerous pores visible × 14; ZPAL V. XIX/1; Treskelen, IV Coral Horizon, Creek IV.

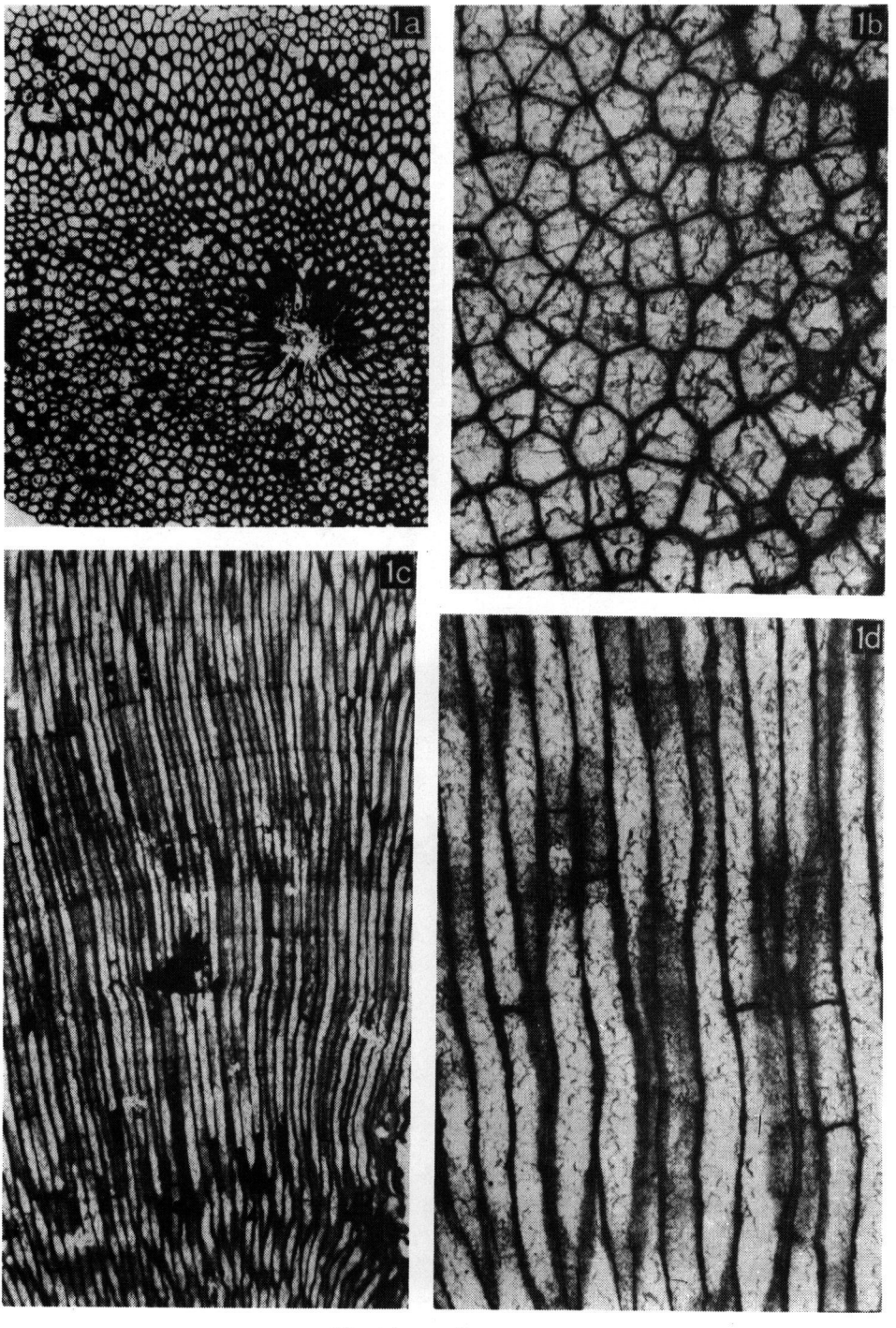


Coscinium cyclops Keyserling, 1846

1a — Transverse section of a colony, × 6; b — oblique section of a colony fragment, aperture with lunnarium visible, × 16; ZPAL V. XIX/18; Hyrnefjellet, Va Coral Horizon.

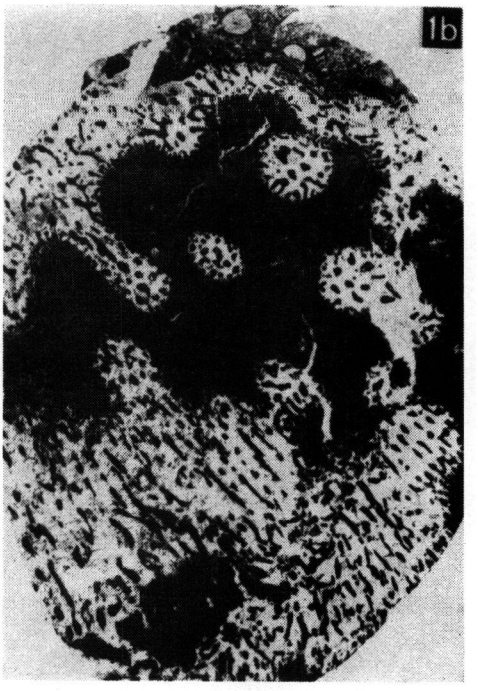
Anthracoporella spectabilis Pia, 1920

2 — Tangential section of a terminal part of dichotomously branching thick-walled thallus, × 30; ZPAL V. XIX/1; Treskelen, IV Coral Horizon, Creek IV; 3 — Transverse section of a small, thick-walled thallus showing canals and wall pores, × 32; ZPAL V. XIX/4; Urnetoppen, V Coral Horizon.



Chaetetes arcticus sp. n.

1a — Transverse section, × 5; b — transverse section of a colony fragment showing thin-walled prismatic tubes, × 22; c — longitudinal section, × 5; d — longitudinal section of a colony showing rarely spaced diaphragms, × 15; holotype, ZPAL V. XIX/7; Isfjorden (Inner Isfjorden, Windodden), „Wordiekammen Limestone" (*Spirifer* limestone horizon).



Palaeoaplisina laminaeformis Krotov, 1888

1a — Various sections of three different colonies, × 3; b — horizontal section (parallel to the surface of the colony) and sections of finger-like processes, × 3; c — transverse sections (perpendicular to the surface) of the colony showing strongly developed finger-like processes, × 5; ZPAL V. XIX/10; Treskelen, IVc Coral Horizon, Creek II; 2 — Oblique section of fragments of two colonies which are nearly touching with their basal laminae, × 3; ZPAL V. XIX/8; Treskelen, IVc Coral Horizon, Creek II.