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SILICEOUS SPONGES FROM THE UPPER CRETACEOUS OF POLAND
PART I. TETRAXONIA

Abstract.— Sixty two species of sponges, belonging to the Tetraxonia, of this number, 19 new ones: *Brochodora latiramea* n.sp., *Pachypoterion biedai* n.sp., *Homalodora skrainivensis* n.sp., *H. polonica* n.sp., *H. brachiramosa* n.sp., *Heterostinia phytiformis* n.sp., *Heloraphinia chordata* n.sp., *Phymatella irregularis* n.sp., *Thecosiphonia gracilis* n.sp., *Kozłowskispongia bulbosa* n.gen., n.sp., *Phyllodermia magna* n.sp., *Ph. pulchra* n.sp., *Eustrobilus extraneus* n.sp., *Ragadinia foraminifera* n.sp., *Plinthosella elegans* n.sp., *Acrochordonia regularis* n.sp. and *A. bifurcata* n.sp. are described and one new genus, *Kozłowskispongia* n.gen., is erected. The species investigated belong to Tetractinellida (2 species), Tetracladina (32 species), Megaccladina (16 species) and Dicranocladina (7 species). In most species, the morphology of the body, the structure of the skeleton and the morphology of the megascleres have been studied. In many of them, the microscleres have been found.

INTRODUCTION

In Poland, sponges belong to little-investigated fossil animals. First mentions on the sponges of the Upper Cretaceous of Poland are in works by Roemer (1841, 1864, 1870), Leonhard (1897), Zittel (1878), Zejszner and Zaręczny (1894) and they concern only their age and occurrence. Różycki (1938), Barczyk (1956) and Krażewski (1958) give only lists of identified genera of sponges. So far, only two more extensive papers have been devoted to the investigation of fossil sponges, occurring in Poland. Siemiradzki (1913) described Jurassic sponges and Bieda (1933 — sponges from the Senonian of the vicinities of Cracow.

In 1957, on Professor Roman Kozłowski's initiative and under his guidance, I started studies on sponges from the Upper Cretaceous of Poland. This paper makes up part I of a monograph of the siliceous sponges from the Upper Cretaceous of Poland and comprises the order Tetraxonia. In part II, representatives of the Monaxonia and Triaxonia will be described.

Between 1958 and 1961, I collected the materials, now under study, from the Campanian and Maastrichtian outcrops of the Cracow Highland and the Nida Basin. In addition, a certain number of specimens, coming from these same regions, have been supplied by the Museum of the Earth (Muzeum Ziemi) in Warsaw.

I would like to express my deep gratitude to Professor R. Kozłowski for constant care of my studies and for many valuable advices. My thanks are also due to Professor F. Bieda (Department of Palaeozoology of the Mining and Metallurgy Academy in Cracow) and Professor J. Gołąb (Chair of Hydrogeology of the Warsaw University) for reading my manuscript and their valuable critical remarks, to Professor K. Pożaryska (Institute of Palaeozoology of the Polish Academy of Sciences) for checking the chapter on the stratigraphy of the Cretaceous, to Dr W. Szymańska and Dr H. Osmólska (Institute of Palaeozoology of the Polish Academy of Sciences) for reading the manuscript, as well as to Dr H. Nestler (University of Greifswald) for looking through my collection and for an ensuing discussion.

The laboratory work has been carried out at the Palaeontological Laboratory of the Chair of Geology of the Łódź University. The lithological analyses and the sections of sponges have been made by Mr. J. Ziomek (Geographical Institute of the Łódź University), the sections of some spicules — by Miss M. Witkowska and the photographs of sponges — by Miss M. Czarnocka (both from the Institute of Palaeozoology of the Polish Academy of Sciences) and, in part, by Mr. Lotar Jędrasik (Łódź University), the photographs of the skeletal network and of the microscleres — by Miss L. Łuszczewska (Chair of Palaeontology of the Warsaw University). The English translation have been made by Mr. J. Dłutek. To all these persons I wish to express my sincerest gratitude.

Figures have been drawn by means of the Abbé apparatus, measurements of specimens have been taken by the slide gauge, and of spicules — by the micrometer.

The collection described is housed at the Palaeontological Laboratory of the Łódź University for which the abbreviation *Z. Pal. UŁ Sp.II/...* is used.

MATERIAL AND METHODS

The majority of the sponges investigated are silicified. In some cases, a secondary swelling of spicules or destruction of microstructures have been caused by the silification process. The calcification of the skeleton, which occurs frequently, is also an unfavourable preservation condition. In most specimens, the stem is broken off or the oscular part is destroyed;

relatively only few specimens are completely preserved. The parenchymal skeleton remained intact mostly in the superficial layer of the walls or around the canals. Voids, left by the dissolved spicules, accurately depicting their shape, are found in many specimens. It was only in some specimens that the megascleres could be isolated and their morphology and manner of connection was investigated in detail. The presence of many microscleres was stated in the genera *Geodia* and *Propachastrella*, in all representatives of the family Discodermiidae, as well as in many Megacladina and in *Pachynion scriptum*.

About 45 species of the Monaxonia and Triaxonia will be described in part II of the present work.

The greatest differentiation among the investigated Tetraxonia is displayed by the Tetracladina, represented by 32 species. Most species of this group are, however, represented by a small number of individuals. *Callopegma ficoideum* Hinde, *Plinthosella squamosa* Zittel and *Ragadinia rimosa* (Roemer) belong to the most numerous. The Megacladina are represented by the following genera: *Heterostinia* Zittel (3 species), *Brochodora* Schram. (3 species), *Homalodora* Schram. (8 species), as well as *Pachycothon* Schram. Some Megacladina have a very well-preserved dermal skeleton.

CHARACTERISTICS OF OUTCROPS IN WHICH SPONGES WERE COLLECTED

The sponges, described in the present paper, were mostly collected from the Campanian and Maastrichtian marls in the outcrops, situated in the north-western confines of the Nida Basin and in the Cracow Highland (Table 1).

Bonarka, south of Cracow.—The layer from which sponges were collected is situated in the central part of the southern wall of an abandoned quarry. The stratigraphy of the Bonarka deposits has recently been discussed by Panow (1934), Aleksandrowicz (1954) and Barczyk (1956). The occurrence of the Turonian, Santonian and Campanian sediments has been ascertained by the latter author. The siliceous "opoka" and the gray marl, outcropped in the upper part of the southern slope, belong to the Lower Campanian. Many calcareous sponges, belonging to the *Porosphaera globularis* (Phillips) and siliceous sponges, belonging to the Lithistida and Triaxonia, have been collected from the siliceous "opoka".

Witkowice.—A natural outcrop of limestones is situated in the northern end of the village Witkowice, north of Cracow, in the steep slope of the left bank of the Białucha (Prądnik) brook. In the lower part of the section, there are abraded Rauracian limestones, underlying a calcareous conglomerate, assigned by Panow (1934) to the Middle Cenomanian,

as well as gray loamy marls of the Senonian which pass upwards into white marls with cherts. The occurrence of *Actinomax quadratus*, identified by Bukowy (1956) in both the gray and white marls, indicates the Lower Campanian. The sponges, occurring in marls, described by Bieda (1933) and in the present paper, belong mostly to the Megacladina and Triaxonia.

The Miechów Highland. — A white-gray clayey marl with many rusty spots, attributed by Krach (1947) to the Senonian, outcrops in the Kocie Doly gorge, situated 1 km. each of the Miechów railroad station. Since these marls contain, according to F. Huss' determination (personal communication) the foraminifers: *Stensioina gracilis* Brotzen, *Stensioina pommerana* Brotzen which are index species for the Upper Campanian and Lower Maastrichtian, as well as *Globotruncana globigerinoides* Brotzen, common in the Campanian and Maastrichtian (although met with as early as in the Turonian) they must be assigned to the Campanian. In the present paper, the Upper Campanian age has been accepted for these beds. I succeeded in collecting there a rich fauna of sponges.

Within the limits of the Lelów Threshold three larger assemblages of sponges have been found in the localities Skrajniwa, Zbyszycze and Pniaki.

Skrajniwa. — Numerous sponges are found in the tilled soil near a cuesta at Skrajniwa. According to Różycki (1936), these sponges derived from both the Albian and Lower Campanian. The material, described in the present paper was collected on the slope of the cuesta close to its uppermost part. The section here reproduced (Fig. 1), after Różycki, presents the geological structure of that area. According to Różycki, the middle part of the Lower Campanian overlays the Turonian, developed as glauconite limestones with *Echinoconus subrotundus*. The Lower Campanian is developed in the form of white marls or bright-gray slates par-

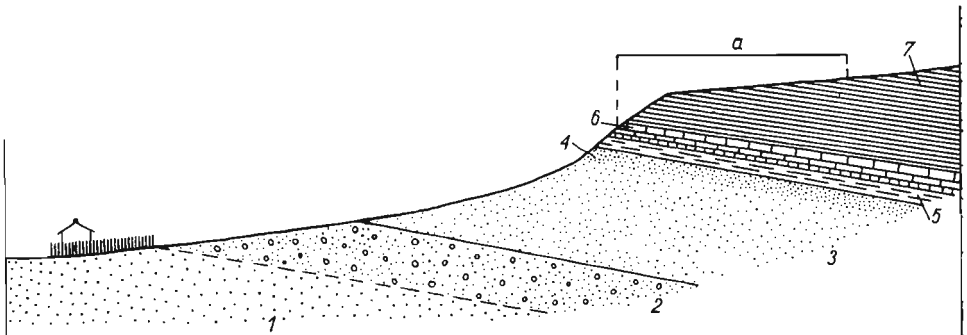


Fig. 1. — A section of the chalk cuesta south of the village Skrajniwa: 1 Albian, 2 Cenomanian, 3—6 Lower Turonian, 7 marls with *Actinocamax quadratus* and *Ofiaster pilula*, a numerous sponges.
Scale 1 : 1 600 (after Różycki, 1938)

tially glauconitic in character and containing 32.3 per cent of calcium carbonate, 55.7 per cent of clayey parts and 12 per cent of residua.

A rich assemblage of sponges, represented by 16 genera and 35 species, mostly of the Lithistida, has been supplied by the Campanian of Skrajniwa. Few belemnites, echinids and calcareous sponges, belonging to *Porosphaera globularis* (Phillips) make up the accompanying fauna.

Zbyczyce.—North of the Biała Lelowska river and Zbyczyce village, at the top of a hill (265 m. a.s.l.), there are a few outcrops in which the following two layers may be distinguished: a) a subsoil layer of weathered marls about 0.5—0.7 m. thick and b) a layer of marly, thick-plated limestones which here and there, are split in a slatelike, almost horizontal layers. At the bottom of this layer, the macrofauna is very poor. In the upper part, the rock is fairly friable, bright-gray, even almost white in colour and contains 45.4 per cent of calcium carbonate, 34.6 per cent of clayey components and 20 per cent of the residue with many spicules. Strongly silicified sponges are distributed in layers. Near the surface, at a depth of 0.40—0.50 m., the sponge assemblage is predominated by slender Rhizocladina of the genus *Scytalia*, while, at a depth of 1 m., flat, thin-walled sponges of the genus *Verruculina* predominate in the underlying layer. A rich material, collected at Zbyczyce, is represented by 47 species, belonging to 31 genera of which 20 genera and 29 species, assigned to the Tetraxonia, are described in the present paper.

According to Różycki (1938), the layers at Zbyczyce are of the Senonian age and the fauna, found in this locality, allows one to attribute them to the middle part of the Lower Campanian.

Pniaki.—This locality is situated west of the Lelów-Szczekociny highroad, between the Paulinka and Turzyn settlements. A large outcrop of marls has been found in the upper part of a cuesta slope and, in part, on the cuesta height. The width of the outcrop exceeds 200 m. and the height of the walls amounts to 1-8 m. In this outcrop, the layers of marls dip 5° to the east. In the south-west cross section of the wall, there are the following layers (from the top): a) 1 m. of marly rubble, white in colour, stained with limonite stripes without sponges, and b) underlying thick-plated, gray, marly limestones, non-uniform in colour, interbedded with more clayey layers and, in the sampling place, having a general thickness of 3 m. The compact rock contains 48.5 per cent of calcium carbonate, 25 per cent of clayey parts and 26 per cent of residua. The intercalations of clayey marls contain 39.2 per cent of calcium carbonate, 39.8 per cent of clayey parts and 21 per cent of residual parts. The assemblages of sponges, belonging to the Rhizocladina and Megacladina are found in them. The sponges occur mostly in marls that make up the intercalations. Here and there, two, three or even four marly banks, situated at different heights and separated from each other by compact marly limestones, occur in the wall but they do not form conti-

nuous horizons. The upper bed, marked by "A", is situated 1—2 m. below the surface. It contains abundant Rhizocladina, mostly of the genus *Scytalia*, thin-walled *Verruculina reussi* (M'Coy, 1848), as well as some representatives of Megacladina. In underlying beds, designated "B" and "C", which are disposed 1.5—2.0 m. below the surface, the Rhizocladina are also and even more abundantly represented, the genera *Seliscothon* and *Scytalia* being predominant. Thin branches of the Rhizocladina penetrate the compact limestone, overlaying the marly beds. According to Różycki (1938), the marls of Pniaki correspond to the middle part of the Lower Campanian.

GEOGRAPHICAL AND STRATIGRAPHIC DISTRIBUTION OF THE DESCRIBED SPONGES

Abundant assemblages of sponges have been found at Bonarka and Witkowice near Cracow in the Cracow Highland, as well as within the limits of the Lelów Threshold (Pniaki, Zbyszce and Skrajniwa) where banks are formed by the sponges, belonging to the Lithistida. Both the preservation of the investigated specimens and their disposition in the rock, seem to indicate that they correspond to a tanatocoenose of different sponges which lived in these places at the same time.

The composition of sponge assemblages in particular localities is presented in a diagram, shown in Fig. 2.

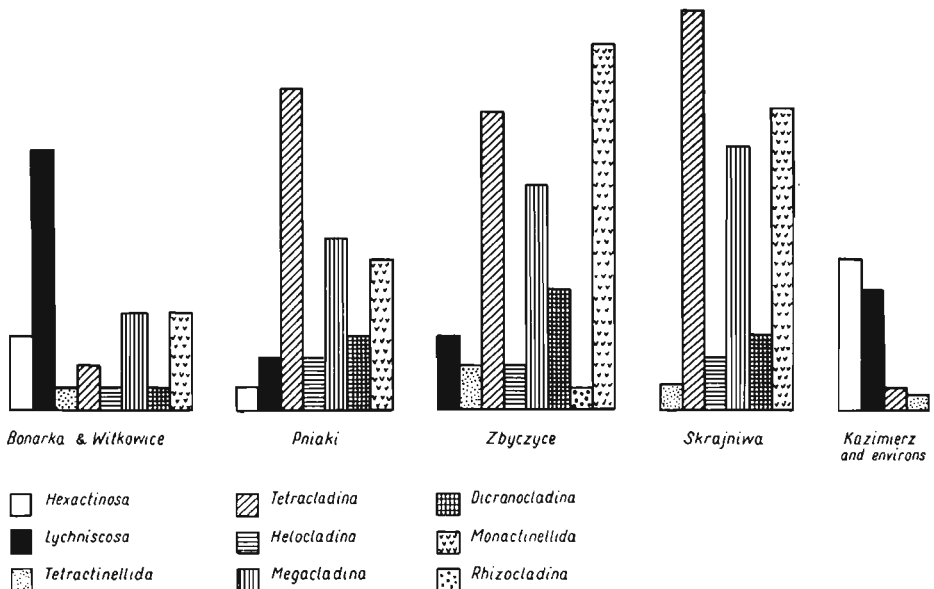


Fig. 2. — Relative abundance of different groups of sponges in Upper Cretaceous of southern Poland. 1 square = 2 species.

At Bonarka and Witkowice, *Ventriculites radiatus* Mantell abundantly occurs in the Lower Campanian. At Skrajniwa, the most common are the *Homalodora*, represented by 8 species, of this number, three endemic ones, *Scytalia*, represented by 3 species of which *S. radiformis* (Phillips) (153 specimens) is the most abundant and *Callopegma*, represented by 2 species, of which *C. acaule* Zittel (13 specimens) is the most abundant. The genera *Seliscothon* (2 species) and *Scytalia* (2 species) predominate at Pniaki, while *Verruculina* Zittel (2 species) and *Brochodora ramusculus* Schram. (about 70 fragments of branches) — at Zbyczyce.

The assemblages investigated give evidence that, on the territory of Poland, as well as of Germany, an intensive development of sponges of the Lithistida, particularly of the Megacladina and Tetracladina, took place in the Lower Campanian, whereas a distinct decrease in the number of all groups is recorded in the Upper Campanian.

From the comparison of the genera of Tetralithistida of Poland and other European countries it results, that the Polish assemblage is most similar to that of Germany.

The presence of many species, common for Poland and Northwest Germany, makes probable the supposition that, in the Campanian, the sea of Southern Poland was directly connected with the Hanover Basin. Both in Poland and Germany, the species, *Brochodora roemeri* Hinde, *Callopegma acaule* Zittel and *Ragadinia rimosa* (Roemer) are marked by a great abundance of specimens, occurring in the Lower Campanian. The following species have the widest stratigraphic range in the Upper Cretaceous: *Propachastrella primaeva* (Zittel), *Aulaxinia sulcifera* (Roemer), *Siphonia tulipa* Zittel and *S. pyriformis* Goldfuss, *Eustrobilus callosus* Schram., *Plinthosella squamosa* Zittel, *Brochodora roemeri* Hinde and *Pachynion scriptum* (Roemer) (Table 1). The genera, *Jerea*, *Siphonia*, *Ragadinia* and *Isoraphinia* and only three species (*Siphonia tulipa* Zittel, *S. pyriformis* Goldfuss and *Ragadinia rimosa* Roemer) are common to the Upper Cretaceous of Poland and the U.S.S.R. It should be emphasized that the genera and species, mentioned above were, in the Campanian, widely distributed in both Eastern and Western Europe.

REMARKS ON TAXONOMY

Different criteria are applied by different authors to the taxonomy of fossil sponges. One of the oldest is Zittel's taxonomy in which the greatest importance is ascribed to the morphology of megascleres. The same taxonomic basis has been used by Moret (1925, 1958). In his studies, devoted mainly to siliceous sponges, Schrammen (1910—1937) assumed

the correctness of zoologists', and particularly Schultze's view, concerning a great taxonomic importance of microscleres. On the basis of this view, Schrammen (1910) accepted such suborders, erected by zoologists, as *Sigmatophora* Sollas, *Astrophora* Lendenfeld, *Euastrora* Lendenfeld and *Sterrastroza* Lendenfeld. However, Schrammen's classification cannot be applied to the full to the fossil sponges which, in general, are devoid of microscleres. In part 3 of his monograph, Schrammen (1924) introduced many changes to the Lithistida and, more than once, reclassified the species he investigated between 1903 and 1912, erecting several monotypical families. Schrammen's classification has been simplified in relation to part one of his monograph (1910) by Lagneau-Hérenger (1955, 1962) who adapted it to fossil sponges.

In Laubenfels' (1955) work, forms similar in the external aspect and in the structure of the water system, although different in the structure of the parenchymal and dermal skeletons, are sometimes assigned to the same family of the Lithistida, for instance, the genus *Jerea* with smooth, and the genus *Acrochordonia* with coarse, lumpy tetraclores are assigned by him to the family Jereidae.

On the basis of morphological investigations, based on a fairly well-preserved material from Poland, I conclude that the lower ranking taxonomic units, that is families, genera and species, should be based on such features as, the character of megascleres, morphology of the desma surface, type of zygome and zygoze, size of desmas, spicular composition of the skeleton, structure of the water system and, finally, the general habitus of sponges, as well as, sometimes, their dimensions.

According to Lagneau-Hérenger (1962), the dimensions of particular morphological elements as spicules, pores and canals are of a secondary importance, while the aspect of spicules, the manner of the pore distribution and the development of theca are the main taxonomic characters.

This view arouses certain doubts. First of all, determining megascleres as small, middle-sized or large is insufficient. Their dimensions should be given in millimetres. This also applies to the dimensions of some other elements as ostia, postica, or to the thickness of walls (in the Rhizocladina) which are characteristic of particular species.

In our investigations, attention has also been paid to the occurrence of microscleres preserved in many genera between the parenchymal and dermal megascleres and presumably pertaining to them. On the basis of their presence, closer relationships have been stated between some genera and families.

The taxonomy, prepared by Lagneau-Hérenger (1962), has mainly been applied to the present study with the following minor changes and complements:

STRATIGRAPHIC AND GEOGRAPHICAL DISTRIBUTION OF THE TETRAONIA

No.	Species	Aptian	Albian	Cenomanian	Turonian	Emscherian	Santonian	Lower Campanian	Upper Campanian	Senonian	Lower Maastrichtian	Upper Maastrichtian
I. Tetractinellida												
1	<i>Geodia</i> sp.	—	—	—	—	—	—	Zb	—	—	—	—
2	<i>Propachastrella primaeva</i> (Zittel)	—	—	F	NWG	—	—	Wi, Sk, Zb, NWG	—	E, F, C	—	—
II. Tetralithistida												
A. Tetracladina												
3	<i>Phymatella bulbosa</i> Zittel	—	—	—	—	—	—	Zb, Pn, NWG	NWG	NWG	R	—
4	<i>Ph. irregularis</i> n. sp.	—	—	—	—	—	—	Zb	—	—	Gn	—
5	<i>Myrmeciophytum verrucosum</i> (Roemer)	—	—	—	—	—	—	Zb, NWG	—	—	—	—
6	<i>Thecosiphonia gracilis</i> n. sp.	—	—	—	—	—	—	Zb	—	—	—	—
7	<i>Aulaxinia sulcifera</i> (Roemer)	S	—	—	—	F	F	NWG, F	NWG, F	E	R, Gn, Prz, G	NWG
8	<i>A. fallax</i> Schrammen	—	—	—	—	—	—	NWG	—	—	R, Gn	—
9	<i>A. ventricosa</i> Schrammen	S	—	—	—	—	—	Sk	NWG	—	—	—
10	<i>Callopegma acaule</i> Zittel	—	—	—	—	—	—	Pn, Zb, Sk, NWG	NWG	—	R	—
11	<i>C. ficoideum</i> Hinde	—	—	—	—	—	—	Pn, Zb, Sk	—	E	—	—
12	<i>Turonia variabilis</i> Michelin	—	—	—	—	—	—	Pn, NWG	NWG	F	—	—
13	<i>T. aff. variabilis</i> Michelin	—	—	—	—	—	—	—	Mi	—	Pw	Ja
14	<i>Kozlowskispongia bulbosa</i> n. gen., n. sp.	—	—	—	—	—	—	—	Mi	—	—	—
15	<i>Jerea pyriformis</i> Lamouroux	—	—	NWG	NWG	—	—	Sk, Pn	—	F, E	—	—
16	<i>Siphonia tulipa</i> Zittel	—	—	F	—	—	—	Sk	—	F, E	—	—
17	<i>S. pyriformis</i> Goldfuss	S	S, E	E, F, O	F	—	—	Sk	F	SF, U	—	—
18	<i>S. ficus</i> Goldfuss	—	—	C, E	F	—	—	Sk, F, NWG	F	C, F	—	—
19	<i>S. tubulosa</i> (Roemer)	—	—	—	NWG	SF	—	Sk, Zb	—	NWG	—	—
20	<i>Discodermia cf. galloprovincialis</i> Moret	—	—	—	—	—	F	Sk, Zb	—	—	—	—
21	<i>Phylodermia magna</i> n. sp.	—	—	—	—	—	—	Sk	—	—	—	—
22	<i>Ph. pulchra</i> n. sp.	—	—	—	—	—	—	Sk	—	—	—	—
23	<i>Ph. costata brevicostata</i> Lamouroux	—	—	—	—	—	—	Sk	—	E, F	—	—
24	<i>Eustrobilus callosus</i> Schrammen	S	—	—	—	SF	—	Wi, Zb, Pn, Sk, NWG	NWG	—	—	—
25	<i>E. extraneus</i> n. sp.	—	—	—	—	—	—	Pn	—	—	—	—
26	<i>Ragadinia rimosa</i> (Roemer)	—	—	—	—	—	F	Zb, Bo, Sk, Pn, NWG	Mi, NWG	C, E	—	—
27	<i>R. foraminifera</i> n. sp.	—	—	—	—	—	—	Zb, Sk	—	—	—	—
28	<i>Astrocladia subramosa</i> (Roemer)	—	—	—	—	—	F	NWG	NWG	—	—	Prz
29	<i>Prokaliapsis clavata</i> (Hinde)	—	—	—	—	F	—	Zb, Pn, NWG	NWG	E	—	—
30	<i>Pr. arborescens</i> (Michelin)*	—	—	—	—	—	—	Pn	—	—	—	—
31	<i>Cycloclasma compressa</i> (Hinde)	—	—	F, G	—	—	—	Sk, NWG	Mi, Zb, NWG	F, E	—	—
32	<i>Plinthosella squamosa</i> Zittel	—	—	W, F	C, NWG	F	—	Zb, NWG	Mi, NWG	Sz, E	Prz, Mu, R	Gn
33	<i>Pl. elegans</i> n. sp.	—	—	—	—	—	—	Pn	—	—	—	—
34	<i>Plinthosella</i> sp.	—	—	—	—	—	—	Sk	—	—	—	—
B. Helocladina												
35	<i>Heloraphinia chordata</i> n. sp.	—	—	—	—	—	—	Pn	—	—	—	—
36	<i>Inodia elisabethae</i> Moret	—	—	F	—	—	—	—	—	—	Prz	—
37	<i>Inodia</i> sp.	—	—	—	—	—	—	—	Mi	—	—	—
38	<i>Carterella cf. cylindrica</i> (Gümbel)	—	—	SG	—	—	—	Sk, Zb	—	—	—	—
39	<i>Pachycothon giganteus</i> Schrammen	—	—	—	SG	SF	—	Bo, Sk, Pn, Zb	—	SG	—	—
C. Megacladina												
40	<i>Brochodora roemeri</i> (Hinde)	S	—	—	SG	—	F	Bo, Sk, Zb, Po, NWG	NWG	F, E	—	—
41	<i>Br. ramusculus</i> Schrammen	—	—	—	—	—	—	Zb, Pn, Bo, Wi, NWG	NWG	SF, E	—	—
42	<i>Br. latiramea</i> n. sp.	—	—	—	—	—	—	Zb	—	—	—	—
43	<i>Pachypoterion biedai</i> n. sp.	—	—	—	—	—	—	Pn	—	—	—	—
44	<i>Homalodora ramosa</i> Mantell	—	—	F, C	—	—	—	Sk, NWG	NWG	F, E	—	—
45	<i>H. tuberosa</i> Schrammen	—	—	—	—	—	—	Sk, NWG	NWG	—	—	—
46	<i>H. plana</i> Schrammen	—	—	—	—	—	—	Sk, Zb, NWG	NWG	—	—	—
47	<i>H. pusilla</i> Schrammen	—	—	—	—	—	—	Sk, NWG	—	—	—	—
48	<i>H. ficus</i> Schrammen	—	—	—	—	—	—	Sk, NWG	NWG	—	—	—
49	<i>H. skrainivensis</i> n. sp.	—	—	—	—	—	—	Sk	—	—	—	—
50	<i>H. polonica</i> n. sp.	—	—	—	—	—	—	Sk, Pn	—	—	—	—
51	<i>H. breviformis</i> n. sp.	—	—	—	—	—	—	Sk, Pn	—	—	—	—
52	<i>Heterostinia obliqua</i> (Bennet)	S	—	F, S	—	—	F	Bo, Zb, Pn, Sk, NWG	NWG	E	—	—
53	<i>Het. conica</i> (Schrammen)	—	—	—	—	—	—	Zb	NWG	—	—	—
54	<i>Het. phytoniformis</i> n. sp.	—	—	—	—	—	—	Sk, Zb	—	—	—	—
55	<i>Propleroma campanica</i> n. sp.	—	—	—	—	—	—	Zb	—	—	—	—
D. Dicranocladina												
56	<i>Aerochordonia cf. ramosa</i> Schrammen	—	—	—	—	—	F	Zb, NWG	—	—	—	—
57	<i>Acr. bifurcata</i> n. sp.	—	—	—	—	—	—	Zb	—	—	—	—
58	<i>Acr. regularis</i> n. sp.	—	—	—	—	—	—	Pn	Mi	—	—	—
59	<i>Pachynion scriptum</i> (Roemer)	S	—	—	G	—	—	Wi, Pn, Sk, NWG	NWG	F	—	—
60	<i>Phalangium scytaliforme</i> Schrammen	—	—	—	—	F	—	Sk, Po, Zb	NWG	—	—	—
61	<i>Ph. ramosum</i> Moret	—	—	—	—	—	F	Sk, Po, Zb	—	—	—	—
62	<i>Ph. tubulifera</i> Moret	—	—	—	—	—	—	Pn, Zb	—	F	—	—

* France: Cretaceous on the secondary bed in Miocene.

- Legend: C — Czechoslovakia
 E — England
 F — France
 SF — Southern France
 G — Germany
 NWG — North-western Germany
 SG — Southern Germany
 R — Rügen Island, Germany
 S — Spain
 U — U.S.S.R.
- Poland:
 Bo — Bonarka
 Gn — Gnatowice
 Ja — Janowiec
 Ka — Kazimierz
 Mi — Miechów
 Mu — Muniakowice
 O — Opole
 Pn — Pniaki
- Po — Podgaj
 Prz — Przesławice
 Pw — Piotrawin
 Sk — Skrajniwa
 Sz — Szczepanowice
 W — Wolbrom
 Wi — Witkowice
 Zb — Zbyszycze

1. The presence of sterrasters has been stated in all the genera investigated belonging to the family Discodermiidae. This not only supplements and extends the diagnosis of this family, but also indicates its, and Tetracladina's relationship to the family Geodiidae of the order Tetractinellida (Choristida).
2. Lagneau-Hérenger considers the skeleton of the genera *Ragadinia* and *Phymaplectia* to be built of "grands tetracloves verruqués", identical with those in *Plinthosella*. It is mostly for this reason that the genus *Ragadinia* is assigned by this author to the Plinthosellidae. In addition, she justifies this assignment by the fact that the phyllotriaenes in *Ragadinia* resemble, to a greater extent, the discotriaenes and are similar to the dermal plates of *Plinthosella squamosa*.

In all the species examined of the genus *Ragadinia*, the lumpiness of the desmas is fine as in the genera of the Discodermiidae, whereas, in Plinthosellidae and Acrochordonia, the desmas have coarse lumps. Dermal plates in *Plinthosella* are acrepidal, while the phyllotriaenes in *Ragadinia*, however strongly differentiated, have the rhabdomes and cladomes whose structure is clearly derived from triaenes. Furthermore, the presence in situ of many sterrasters, found in all examined specimens and species of the genus *Ragadinia*, allow one to assign this genus to the Discodermiidae.

3. According to Lagneau-Hérenger, in the Tetraxonia, except for the Dicranocladina, the dichotriaenes occur together with the smooth parenchymal megascleres, while the phyllotriaenes — with the lumpy megascleres.

On the basis of the investigation of the spiculation in *Phyllodermia magna* n.sp. (p. 55), in *P. kempkei* Wagner (1963, p. 188) and in *Ragadinia galloprovincionalis* Moret (Hérenger, 1942 a), it has been proven that, next to the dermal phyllotriaenes, like those occurring on the entire sponge, also dermal dichotriaenes may be present within the limits of the stem. Such forms should, however, be considered as young ones and not as separate species.

4. A different character of dermal desmas in the representatives of Tetracladina which have oblong, prominent ribs allowed us to state that, next to the *Hallirhoa costata* with dichotriaenes, there exists a homeomorphic form of *Phyllodermia costata* n.sp. which has dermal phyllotriaenes. Consequently, this species has been assigned to the Discodermiidae and *Hallirhoa costata* with dichotriaenes has been left within the Phymatellidae.
5. The taxonomic position of the suborder Helocladina Lagneau-Hérenger is so far an unsolved problem. A doubt whether or not its

desmas belong to tetraaxial ones is caused by the shape of heloclones. Dermal orthodichotriaenes, found in the genera *Carterella* and *Pachycothon* which contain typical parenchymal heloclones, allows one to assign the suborder Helocladina to the Tetraxonia and a firm connection by the zygoe and a formation into a network seems to indicate that they belong to the Tetralithistida.

6. Moret (1925) assigned his genus *Inodia* to the Megacladina of the family Dorydermidae. In the investigated *Inodia* sp., heloclones, situated near the outer surface, are similar — in their manner of connection and their morphology — to megaclones. On the other hand, in *I. elisabethae* Moret, a presence of megascleres, morphologically similar to heloclones which occur in *Heloraphinia* of the family Isoraphiniidae, has been stated in the internal part of the parenchymal skeleton. Considering the phenomenon of the spicule modification in the skeleton of the external part and the similarity of the *Inodia* spicules to heloclones, the genus *Inodia* has been transferred from the Dorydermidae to the Isoraphiniidae, assigned, after Schrammen, to the Helomorina.
7. The morphology of the water system is a character, common for the subfamilies Doryderminae and Homalodorinae Schrammen. Genera, belonging to these subfamilies, differ from each other not only in the type megaclones, but also in their arrangement in the network, in the type of dermal spicules, in the presence or absence of the bundles of comitalia, in the structure and distribution of ostia, as well as in the type of microscleres.

The differences, mentioned above, fully justify the advancement of the subfamilies in question to the level of families Dorydermidae, with its typical genus *Doryderma* Zittel, and Homalodoridae, with the genus *Homalodora* Schrammen.

In the present paper, the genera *Doryderma*, *Brochodora* and *Pachypoterion* with the microscleres which are only of the microxea type, as well as microrhabds and single microcalthrops, have been assigned to the family Dorydermidae. The genus *Pachypoterion*, attributed by many investigators to the Heterostiniidae and, in Poland, represented by *P. biedai* n.sp., has a stripe-like system of megaclones surrounding the prosopyles, pleuralia having a long rhabdome, numerous microxeas and microrhabds as in *Brochodora*. For these reasons, the genus *Pachypoterion* has been excluded from the Heterostiniidae and assigned to the Brochodoridae, while the genera *Homalodora* and *Amphiplectella* which, in addition to microxeas and microstrongyles, have sphaerasters and single sterrasters, have been included in the family Homalodoridae.

SYSTEMATIC DESCRIPTIONS

Class **Demospongia** Sollas, 1875Order **Tetraxonia** Schultze, 1877Suborder **Tetractinellida** Marshall, 1888, emend. Moret, 1925Family **Geodiidae** Gray, 1867Genus **Geodia** Lamarck, 1815(Type species: *Geodia gibberosa* Lamarck, 1815)

According to Lendenfeld (1903, p. 105), this genus is characterized by the presence of the triaene type megascleres and their derivatives. Different in length, they occur in association with the sterraster type microscleres. In the taxonomy of Recent sponges, the following characters are taken into account: body shape, morphology of the water system, composition and dimensions of particular skeleton elements.

The fossil species attributed hesitatingly to this genus, *Geodia? clavata*, *G.? coronata* and *G.? wrighti*, erected by Hinde (1883) and *G. gigantea*, *G. communis* and *G. gracilis*, erected by Počta, were based only on isolated spicules which occur in the Cretaceous sediments. All of them should be considered indeterminate species.

Geodia sp.

(Pl. I, Figs. 1 a-c, 2; Text-fig. 3)

Material. — Three specimens, preserved only in fragments (Sp. II/729, A, B, C), but having a very well visible skeleton, consisting of naturally arranged spicules. Each specimen is differently shaped which, in part, is related with a different degree of secondary deformation. Specimen A is shaped like a flat, elongated plate; specimen B, irregularly conical, with a part of the central cavity preserved; specimen C makes up a shapeless fragment. The outer surface of specimens A and B is flat; pores and canals invisible.

Description. — Dermal skeleton is built of concentrated amphioxea about 0.3 mm. long and of orthodichotriaenes with their cladomes pointing towards the outer surface. Clads (in specimen B) arcuate; cladome 0.15 to 0.21 mm. in span. In specimen A, ellipsoidal or reniform sterrasters 0.09—0.195 mm. long and 0.09—0.15 mm. wide are scattered in great abundance between megascleres. Their surface is slightly rough.

Parenchymal skeleton consists of megascleres, obliquely disposed and grouped in numerous, large bundles. Dimensions and composition of megascleres are different. Amphioxeas to 5 mm. long and 0.03 to 0.21 mm. thick predominate among them. Protriaenes and prodichotriaenes are marked by a long, to 2.5 mm., rhabdome and very short, pointed clads 0.15 mm. long. In most protriaenes, cladome is broken off. Thread-like, straight amphioxeas are situated between solid megascleres.

Comparison. — Specimens investigated are, in their spiculation, similar to the representatives of the families Stellettidae Sollas and Geodiidae Gray. In the morphology of parenchymal megascleres, they are most similar to *Stolleya ornatissima* Schram. (Schrammen, 1910, p. 51). According to Sollas (1888, p. 183) and Lendenfeld (1903, p. 33),



Fig. 3. — *Geodia* sp., Lower Campanian, Zbyczyce; megascleres of the parenchymal skeleton, a prodichotriaenes, b protriaenes, c amphioxeas and oxeas, d dermal orthodichotriaenes (Z. Pal. UŁ Sp. II/729B); $\times 16$.

the Recent genera, assigned to the Stellettidae, have microscleres of the euaster, spiraster or amphiaster type but never of the sterraster type, while in the Geodiidae, there are only the sterraster type microscleres. The presence of sterrasters in the specimens investigated, as well as the predominance of amphioxeas, allow one to attribute them to the Geodiidae. The lack of mesotriaenes and parenchymal anatriaenes excludes the possibility of the specimens under study being congeneric with *Geodiopsis* Schrammen, while the character of megascleres and the presence of sterrasters allow one to assign them to the genus *Geodia* Lamarck.

The Polish specimens differ from Recent species of the genus *Geodia* in the arrangement and dimensions of spicules. They resemble to the greatest extent *G. ramodigitata* Carter (1880, p. 133) from which they differ, however, in the lack of anatriaenes and strongylasters.

Occurrence. — Poland: Zbyczyce, marls of the Lower Campanian.

Family *Pachastrellidae* Sollas, 1886, emend. Schrammen, 1910Genus *Propachastrella* Schrammen, 1910(Type species: *Pachastrella primaeva* Zittel, 1878)*Propachastrella primaeva* (Zittel, 1878)

(Pl. II, Figs. 1—2 a, b; Text-fig. 4)

1877—78. *Pachastrella primaeva* Zittel; K. Zittel, Beiträge zur Systematik..., p. 7, Pl. 1, Fig. 4.1933. *Propachastrella primaeva* (Zittel); F. Bieda, Gąbki..., p. 24.

Material. — Eight fragments of walls and one almost complete specimen with very well-preserved original system of megascleres.

Dimensions (in mm.):

	Height	Thickness of wall
Largest fragment (Sp. II/1422)	50	8

Description. — Fragments irregular in shape; one specimen (Pl. II, Fig. 1) cup-shaped and with a broad stem, marked off by a contraction. Pores indistinct. Water canals short and tortuous, poorly preserved, sometimes, forming oval cavities 0.5 mm. in diameter.

Dermal skeleton consists of small orthodichotriaenes, loosely disposed and apt to fall out during preparation; cladomes 0.35 to 1.2 mm. in size.

Parenchymal skeleton contains chelothrops with a variable morphology. Principal type of spicules derives from calthrop. Chelothrops are

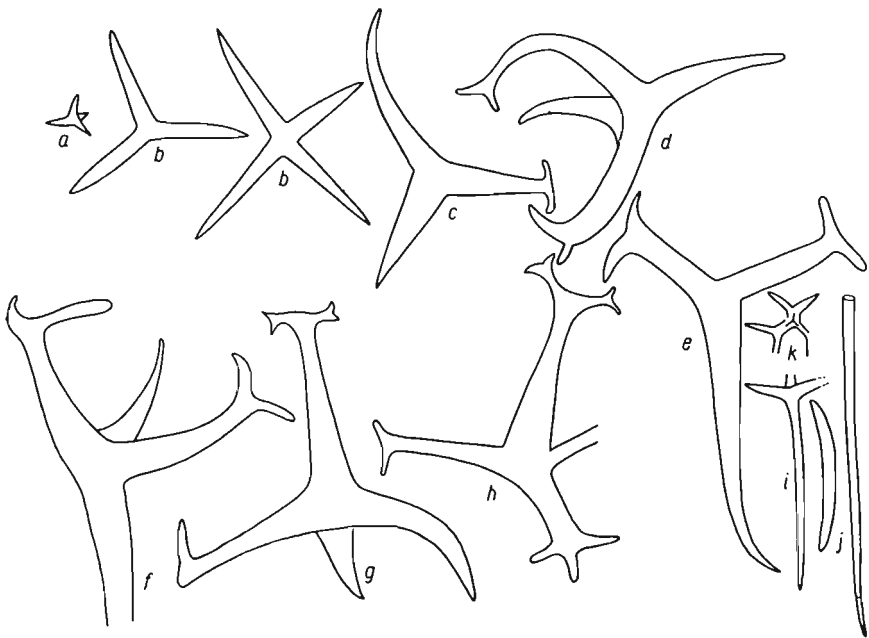


Fig. 4. *Propachastrella primaeva* (Zittel), Lower Campanian, Zbyczyce, successive development stages of megascleres: a microcalthrop, $\times 70$; b calthrops, $\times 20$; c—h chelothrops, $\times 20$; i comitalia and triaene, $\times 12$; j amphioxeas, k dermal orthodichotriaenes, $\times 12$ (Z. Pal. UŁ Sp. II/700).

either slightly hooked on each other or overlap each other with their rays. The variation of megascleres is observed in their size, shape, length and termination of rays. Beside solid chelothrops 0.15 mm. thick in the middle of a spicule, small calthrops with 0.1 mm. long rays occur in the spaces of the meshwork. The ontogenetic development of chelothrops progressed from a small calthrop, through an irregular elongation and bending of rays and transformations in their ends, up to solid chelothrops. The length of rays in a chelothrop varies from 0.9 to 2 mm.; usually, it has one longer and pointed or split clad. Many amphioxeas and oxeas differ in length and thickness (from 0.5 to 3.0 mm.), single orthodichotriaenes with rhabdome to 1.5 mm. long and cladome 0.75 mm. in span, as well as few triaenes are disposed between chelothrops.

The microxea type of microscleres 0.024 mm. long and microstrongyles 0.012 mm. in size are abundantly scattered among megascleres. Microcalthrops and sterrasters are also met with.

Comparison. — *Propachastrella primaeva* (Zittel) differs from the representatives of the genus *Pachastrella*, both Recent and fossil, mostly in the morphology of megascleres. In *Pachastrella plana* Hinde (1883, p. 27), parenchymal megascleres are calthrops with rounded rays which are almost straight and differ from each other only in length. On the other hand, according to Schrammen (1924, p. 45), in large forms of *Propachastrella primaeva*, triaenes and not chelothrops predominate in their parenchymal skeletons. In Polish specimens, it is the other way around; the variation is shown in the Table 2.

Table 2

Variation of characters in *Propachastrella primaeva* (Zittel) from Germany and Poland

Country and age	Shape	Size	Chelothrop rays (in mm.)		Dermal dichotriaenes, cladome diameter
			longest	shortest	
North-western Germany, Turonian	flat	of a child's fist	1.2	0.05	no data available
Germany, Upper Campanian	flat	0.5 sq. m.	solid and big	solid and big	0.8 mm.
Poland, Lower Campanian	cup-like	height = = 50 mm.	2.0	0.9 and in calthrop, 0.1	0.35–1.2 mm.

According to Lendenfeld (1903, p. 71), the Recent representatives of the family Pachastrellidae contain microxeas, euasters and spirasters.

Occurrence. — Poland: Lower Campanian marls of Witkowice, Skrajniwa and Zbyczyce. Single megascleres, identical with those in

P. primaeva have been found in the Cenomanian and Senonian of France and in North-western Germany, here they are known from the Turonian of the *Scaphiten geinitzi* zone.

Suborder **Tetralithistida** Lagneau-Hérenger, 1962

Superfamily **Tetracladina** Zittel, 1878

Family **Phymatellidae** Schrammen, 1910

Genus *Phymatella* Zittel, 1878

(Type species: *Eudea intumescens* Roemer, 1864)

Phymatella bulbosa Zittel, 1878

(Pl. III, Fig. 7; Text-fig. 5)

1878. *Phymatella bulbosa* Zittel; K. Zittel, Studien..., p. 74, Pl. 2, Fig. 1.
 1910. *Phymatella bulbosa* Zittel; A. Schrammen, Die Kieselspongien..., p. 75, Pl. 3, Fig. 2; Pl. 4, Fig. 8.
 1925. *Phymatella bulbosa* Zittel; L. Moret, Contribution..., p. 148, Pl. 13.

Material. — One complete, partially silicified, specimen with well-preserved spicules on outer surface.

Dimension (in mm.):

	Length	Max. thickness
Specimen Sp. II/1020	45	38

Description. — Bulbous in shape. Upper pole uneven, lower conical, short, obtuse, without stem; few irregular swellings and depressions occur on lateral surfaces. Oscula (about ten) ca. 3 mm. in diameter are disposed at different heights, surrounded by somewhat obscure, radial canals 1—1.5 mm. wide. Small canals, 0.6—0.75 mm. long and bounded by skeletal bands, meander between the swellings and depressions.

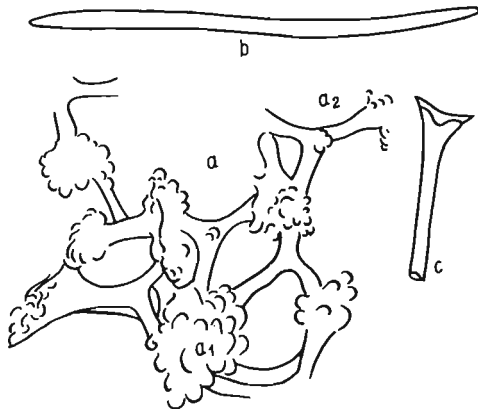


Fig. 5. — *Phymatella bulbosa* Zittel, Lower Campanian, Pniaki; a parenchymal network, a_1 zygose, a_2 tetraclone, b monaxon, c orthodichotriaene (Z. Pal. UŁ Sp. II/1020); $\times 36$.

Inhalant pores irregular in outline and 0.21—0.6 mm. in diameter. General central cavity lacking.

Dermal skeleton, preserved at the lower pole, forms a layer, fairly strongly transformed. Dependent cortex, on the upper part of the sponge, consists of the clone bands and lumpy processes on the zygome. Cortical bands, 0.35—0.9 mm. wide, have desmas which are either modified as a result of the ramification, or straight and elongated. Apical clad absent or strongly shortened.

Parenchymal skeleton compact, consisting of smooth tetracles whose clones vary in length from 0.35 to 0.45 mm. Zygomes, strongly tattered and lumpy, are situated 0.15—0.20 mm. from the middle of spicule. Zygoses spherical; comitalia in the form of long-shafted protriaenes and oxeas.

Comparison. — The type of spicules, clones, arranged in bands, the manner of connecting them with each other and the irregularly built network justify, according to Moret's (1925, p. 143) definition, the assignment of the specimen under study to the genus *Phymatella* Zittel. In its shape and general morphology, our specimen is, to a greatest extent, similar to the *P. bulbosa* Zittel specimen, described by Schrammen (*l.c.*, 1910, Pl. 3, Fig. 2). According to this author, the exhalant cavities in *P. bulbosa* from the Campanian of Germany constitute sinuses, of the central cavity. However, Schrammen's description and illustrations are inadequate. He does not mention the existence of lateral oscula, distinctly visible in his illustration. The irregular shape of our specimen similar to that of *P. bulbosa* from Germany makes up a basis for assigning it to this species. The lack of the general central cavity in the Polish specimen and substituting it by exhalant cavities indicate its similarity to *P. irregularis* n.sp., described below.

Occurrence. — Poland: Pniaki, Lower Campanian marls; Germany: Lower Senonian, Lower and Upper Campanian and, on Rügen Island, Maastrichtian.

Phymatella irregularis n.sp.

(Pl. III, Figs. 5, 6; Text-fig. 6)

Holotypus: Pl. III, Fig. 5 (Z. Pal. UŁ Sp. II/31).

Stratum typicum: Lower Maastrichtian, marl.

Locus typicus: Gnatowice.

Derivatio nominis: *irregularis* — Lat. *irregularis* = irregular, on account of its irregular shape.

Diagnosis. — Irregular sponge, without stem and central cavity. Peculiar bundles of oxeas and triaenes occur in the parenchymal network and inside the canals.

Material. — Two specimens, one from the Lower Campanian of Skrajniwa, silicified and containing voids, left by tetracles, and another

from the lower Maastrichtian of Gnatowice, containing a very well-preserved parenchymal and cortical network.

Dimensions (in mm.):

	Height	Thickness
Specimen Sp. II/1525	43	50
Specimen Sp. II/31	32	60 × 38

Description. — Asymmetric sponge, irregularly subspherical, with uneven surface; upper pole convex, lower uneven with traces of very short basal processes broken off. Central cavity lacking; ostia and inhalant canals invisible; exhalant system consisting of cavities and short tubular canals 0.45–0.6 mm. in diameter, wider than the meshwork spaces.

Dermal skeleton is built of independent cortex, consisting of crowded and entangled flat rhizoidal elements and orthodichotriaenes with a cladome ca. 0.2 mm. in span. This cortex covers the entire basal surface, whereas, in the upper part of the sponge, it is invisible.

Parenchymal skeleton forms a rather loose network consisting of smooth, here and there, slightly spiny tetracloones; zygome strongly ramified. Clone length uneven, varying from 0.15 to 0.45 mm. In the



Fig. 6. — *Phymatella irregularis* n.sp., Lower Maastrichtian, Gnatowice; a parenchymal tetracloones, b zygome, c rhizoidal elements from cortex, d dermal orthodichotriaene (Z. Pal. UŁ Sp. II/31); × 25.

network, desmas are sometimes arranged in rows; zygoes spherical or oval, 2–2.5 mm. in diameter, each formed by ca. 9 zygoes combined together; clones in zygoes are radially disposed; arrangement of clones and shape of zygoes give the parenchymal network an aspect, characteristic of the genus *Phymatella* Zittel. Comitalia, occurring in bundles, in the form of long and very thin monaxons and triaenes, arranged along canals.

Comparison. — The species of the genus *Phymatella* Zittel, so far described, have a deep and wide central cavity. The species, described above, differs from the remaining ones in the absence of the central cavity. Both in its shape and a poorly developed exhalant system (Moret, 1925) it is similar to the oviform specimens of *Ph. bulbosa* from the Senonian of France. It differs, however, in the lack of the central cavity

and the presence of the spicule bundles in canals. According to Moret, the spongocoel of *Ph. bulbosa* from the Senonian of Saint-Cyr is irregular and 4 mm. in diameter, that is the smallest diameter as compared with other species of this genus. In its external aspect, *Ph. irregularis* n.sp. resembles *Jerea excavata* "forme *globosa*" Lagneau-Hérenger (1961, Pl. 131), from which, however, it differs substantially in the morphology of the desma network and in the system of exhalant canals. These characters also differentiate the specimens under study from other species of the genus *Phymatella* and justify the erection of a new species.

The presence of the bundles of the monaxon spicules in the canals of *Ph. irregularis* n.sp. makes this species similar to the genus *Brochodora* Schrammen, especially to *B. ramosa* (order Megacladina).

Occurrence. — Poland: Gnatowice, Lower Maastrichtian marl, and Zbyczyce, Lower Campanian.

Genus *Myrmeciophytum* Schrammen, 1910
(Type species: *Stellispongia verrucosum* Roemer, 1864)

This monotypic genus has been assigned by Schrammen (1910) to the Tetracladinidae and by Laubenfels (1955) — on the basis of star-like concentrated postica — to the Astrocladidae Schrammen. The morphology of tetracloes, their size and manner of connection makes *Myrmeciophytum* more similar to the representatives of the family Phymatellidae than to the genus *Astrocladia* Zittel, 1878. On the basis of the structure of the parenchymal and dermal spicules, I have assigned *Myrmeciophytum* Schrammen to the family Phymatellidae. The stratigraphic range of *Myrmeciophytum* is limited to the Lower Campanian.

Myrmeciophytum verrucosum (Roemer, 1864)
(Pl. III, Fig. 1; Text-fig. 7)

1864. *Stellispongia verrucosa* Roemer; A. F. Roemer, Die Spongitarien..., p. 50, Pl. 17, Fig. 5.
1910. *Myrmeciophytum verrucosum* (Roemer); A. Schrammen, Die Kieselspongien..., p. 81, Pl. 4, Fig. 1, Text-Pl. 4, fig. 3.
1919. *Myrmeciophytum verrucosum* (Roemer); Ph. D. O'Connell, The Schrammen collection..., p. 150.

Material. — Two well-preserved fragments. Skeleton distinctly visible, dermal dichotriaenes not numerous.

Dimensions (in mm.):

	Height	Diameter
Specimen Sp. II/1471a	35	12
Specimen Sp. II/1471b	80	18

Description. — Sponge cylindrical in shape, tapering towards the upper pole. Conical protuberances ca. 1—2 mm. high and 3—7 mm. distant from each other occur on the lateral surface; in the top part — lacking. Water system indistinct except for the pores. Canals narrower than the meshes of the skeletal network. Postica fine, star-like, disposed on the protuberances. A characteristic aspect is given to the sponge by this arrangement. There are two types of postica: either 6—8 of them, oval and, sometimes, elongated, to 2.5×1 mm. in size, or radially disposed around the central, round posticum, 1.25—1.5 mm. in diameter. Ostia ca. 1—2 mm. in diameter, are irregularly scattered between the protuberances, the distances between them amounting to 2—5 mm. Apophyses short, tubular, radially disposed near the surface and indistinct inside the wall.



Fig. 7. — *Myrmeciophytum verrucosum* (Roemer), Lower Campanian, Zbyczyce; a parenchymal tetraclones, b a fragment of a dermal dichotriaene with clones broken off, c amphioxea, d a flattened monacrepid element (Z. Pal. UŁ Sp. II/1471); $\times 62$.

The only traces of the dermal skeleton preserved are, large prodichotriaenes with the cladome span to 0.18 mm. and with rhabdome 0.018 mm. thick, as well as ortodichotriaenes with the cladome span of 0.24 mm. Numerous, scattered microxeas are observed in the parenchymal network.

Parenchymal skeleton forms a loose network consisting of smooth tetraclones with slightly ramified zygone. Clones 0.18—0.3 mm. long and 0.06 mm. thick; zygomies, surrounding postica are strongly tattered; zygomies globular, small and — within limits of the groups of postica — forming longer or shorter septa between canals. Numerous oxeas different in length and amphioxeas, as well as single monaxons, occur on the surface of the sponge and in the meshes of the parenchymal network.

Comparison. — The specimens investigated differ from *M. verrucosum* from Germany (whose diameter amounts to 20—25 mm.) in their smaller thickness and in the distribution of pores. In German specimens, ostia, 0.5—2 mm. in diameter, are disposed 0.5—2 mm. apart, while in our specimens, these distances amount to 2—5 mm. In its externals,

M. verrucosum is similar to *Astrocladia subramosa* and *Prokaliapsis danubica* Wagner (1963, p. 195), from which, however, it differs fundamentally in the structure of skeleton having no swellings on clones.

Occurrence. — Poland: Zbyczyce, Lower Campanian; North-western Germany: Misburg and Oberg, Lower Campanian.

Genus *Thecosiphonia* Zittel, 1878

(Type species: *Limnorea nobilis* Roemer, 1864)

Thecosiphonia gracilis n.sp.

(Pl. IX, Fig. 2; Text-fig. 8)

Holotypus: Pl. IX, Fig. 2 (Z. Pal. UŁ Sp. II/1565).

Stratum typicum: Lower Campanian, clayey marl.

Locus typicus: Zbyczyce.

Derivatio nominis: *gracilis* — Lat. *gracilis* = slim, after fine shape of the stipe.

Diagnosis. — A bushy *Thecosiphonia* with fine stipes, irregularly divided and covered with cortex. Parenchymal tetracloves finer and smaller than in *T. ramosa* Schrammen.

Material. — One, fairly well-preserved, silicified specimen.

Dimensions (in mm.):

Specimen (Sp. II/1565)	Height	Thickness of stipes
	over 80	3—15

Description. — A bundle-like group of long stipes. Single stipes irregular in shape, different in thickness and length, irregularly ramified. Lower part of bundle consisting of 5, upper — of 20 stipes. Top parts fragile, conical, not many of them preserved. Surface of stipes flat and smooth. Aporhyse grooves long, winding, 0.6—0.75 mm. in diameter. Postica and ostia invisible.

Dermal skeleton forms a compact layer, covering the surface of stipes and consisting of very fragile rhizoidal elements and fragile

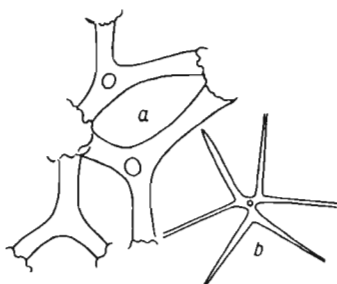


Fig. 8. — *Thecosiphonia gracilis* n.sp., Lower Campanian, Zbyczyce; a arrangement of tetracloves in the parenchymal network, b dermal dichotriaenes (Z. Pal. UŁ Sp. II/1565); $\times 38.2$.

ortodichotriaenes with cladome 0.6 mm. in span. In the lower part of the bundle it forms a common theca.

Parenchymal skeleton in the form of a dense network, consisting of smooth, fairly fragile and regular tetracloes 0.12 to 0.18 mm. long. Zygomes slightly ramified. In the network, oval meshes 0.75 mm. in diameter are isolated through which aporhyses run. Widely scattered oxeas occur in canals.

Comparison. — Single spicules of this species are, to the greatest extent, similar to the desmas of *Thecosiphonia postumus* Schrammen from Germany and to *T. nobilis* Moret from France. Their tetracloes differ however, from those, figured by Schrammen (1910, Pl. 4, Figs. 4 and 5) and Moret (1925, Fig. 62-2), in a general aspect and in longer rays. In our specimen, tetracloes are finer, have thinner and longer clones than the tetracloes of other species of the genus *Thecosiphonia*. Similar is the case of the ortodichotriaenes. In the manner of grouping stipes, our specimen resembles *T. ramosa* Schrammen from which, however, it considerably differs in the shape and size of stipes, as well as in the diameter of postica. These differences justify the erection of a new species.

Occurrence. — Poland: Zbyszce, Lower Campanian.

Genus *Aulaxinia* Zittel, 1878

(Type species: *Siphonocoelia sulcifera* Roemer, 1864)

Aulaxinia sulcifera (Roemer, 1864)

(Pl. III, Figs. 2 and 3)

1864. *Siphonocoelia sulcifera* Roemer; A. F. Roemer, Die Spongitarrien..., p. 30, Pl. 11, Fig. 7.
 1961. *Aulaxinia sulcifera* (Roemer); H. Nestler, Spongien..., pp. 24—25, Pl. 4, Figs. 5—8, Messtab. pp. 63—64 (here earlier synonymy).
 1962. *Aulaxinia sulcifera* (Roemer); L. Lagneau-Hérenger, Contribution..., p. 127. Text-Pl. 20, Fig. 3.

Material. — Two almost complete specimens, one of them with well-preserved skeleton (Sp. II/4 and 713).

Dimensions (in mm.):

	Height	Width of apex	Width of base	Max. thickness
Specimen Sp. II/4	50	5	10—12	20

Description. — A cucumber-shaped sponge with the upper pole conical, with a slight depression at the top and, towards the base, somewhat narrowed. On the surface, regular, oblong furrows, 0.6—1 mm. wide, separated by flat ribs 1—2 mm. wide. Both specimens investigated, similar in size, without the central cavity. Two types of oval apertures are distributed all over the surface: larger ones, corresponding to postica

and 0.6—0.75 mm. in diameter, are arranged in rows and situated in furrows; smaller ones, corresponding to ostia and 0.2 to 0.3 mm. in diameter, are distributed on the ribs between the furrows. Aporhyses and postica are equal in width; epirhyses are shorter and narrower than aporhyses.

There is no separate dermal skeleton. It is only on the outer surface that the network is condensed in the form of a layer 1 mm. thick. This is a dependent cortex.

Parenchymal skeleton, fairly dense and compact, consisting of smooth tetracles with a comparatively slightly ramified zygome; clones 0.18—0.24 mm. long; zygome stipes fragile with lumpy terminations; rays of some tetracles fairly elongated, slightly flattened and, within the canals, arcuate.

Comparison. — The specimens investigated are, to the greatest extent, similar to the specimens of *A. sulcifera* from Rügen Island. The lack of the central cavity in Polish specimens makes up an only difference. According to Nestler and Schrammen, the specimens having this cavity, represent the mature stage, while those devoid of it — the young stage. In the light of these views, our specimens would correspond to the young stage. The characters, occurring in both *A. sulcifera* and *A. fallax*, that is, in the lower part, irregular, winding furrows which, running upwards, become, half-way the height of the sponge, parallel and regularly arranged, are displayed by one of the Polish specimens (Z. Pal. UŁ Sp. II/4).

Table 3

Comparison of dimensions (in mm.) of *A. sulcifera* (Roemer) from Germany, Poland, France and Spain

Country and age	Ostia	Length of canals	Diameter of postica and apochetes	Height	Thick-ness	Width	
						of furrows	of ribs
Germany, Rügen Island, Maastrichtian, the smallest specimen	0.1	0.293	1.5—2.0	59	18	—	—
North-western Germany Campanian, forma <i>typica</i> Schram.	0.3—1.0	—	—	100	70	—	—
Poland, Lower Maastrichtian, young stage	0.2—0.3	without zygome 0.18—0.24	0.6—0.75	50	20	0.6—1.0	1—2
France, Emscherian	—	—	—	130	70	—	—
Spain, Aptian	—	—	—	60	40	—	—

Occurrence. — Poland: Przesławice and Gnatowice, Lower Maastrichtian; Germany: Campanian and Maastrichtian; France: Emscherian, Santonian, Campanian; Spain: Can Casayas Castellet, Aptian; Great Britain: Upper Chalk.

Aulaxinia fallax Schrammen, 1910

1910—1912. *Aulaxinia fallax* Schrammen; A. Schrammen, Die Kieselspongien..., p. 78, Pl. 1, Fig. 4.

1961. *Aulaxinia fallax* Schrammen; H. Nestler, Spongien..., p. 26, Pl. 4, Figs. 9, 10; Pl. 5, Figs. 1—3; Messtabel, p. 64.

Material. — Two specimens, one of them without apex, another with a well-preserved skeleton.

Dimensions (in mm.):

Specimen Sp. II/20	Height	Max. width
	over 30	ca. 25

Description. — Oviform sponge with lower pole rounded and turning into a thick, excentrically situated stem. Furrows, 0.6—0.9 mm. in width, run on the outer surface. Epirhyses are 0.2 mm. and aporhyses 0.6 mm. wide. Their trace is difficult to determine. Ostia and postica oval, different in size and irregularly disposed.

Dermal skeleton poorly preserved. Parenchymal skeleton very compact near the surface, with small meshes of the network and consisting of smooth, fairly solid tetracloes; desmas, surrounding canals, have three equal clones 0.15 mm. long, the fourth, elongated, clone reaches 0.21 mm. in length; zygoes slightly ramified.

Comparison. — The specimens investigated probably represent young stages. With regard to the size of tetracloes of the parenchymal skeleton,

Table 4

Comparison of *A. fallax* Schrammen from Germany and Poland (dimensions in mm.)

Country and age	Height	Length of clones	Diameter of			Width of furrows
			ostia	postica	osculum	
Germany, Rügen Island, Maastrichtian	70—95	0.27	0.6 at the top, 0.82 at the base	1.8	15	—
Poland, Lower Maastrichtian, young stage	25—30	0.15—0.21	0.2 (diam. of epi-rhyses)	0.6 (diam. of apo-chetes)	lacking	0.6
Germany, Lower Campanian	—	—	—	1.0—2.0	10—15	—

they are similar to *Astrocladia subramosa* Moret from which they differ in larger dimensions of tetracloves and in their externals, particularly in the arrangement and outline of postica.

Occurrence. — Poland: Gnatowice, Lower Maastrichtian; Germany: Rügen Island, Maastrichtian chalk; North-western Germany, calcareous marl, Lower Campanian.

Aulaxinia ventricosa Schrammen, 1910
(Pl. III, Fig. 4; Pl. XXIV, Fig. 1)

1910. *Aulaxinia ventricosa* Schrammen; A. Schrammen, Die Kieselspongien..., p. 79, Pl. 1, Fig. 5.

1962. *Aulaxinia ventricosa* Schrammen; L. Lagneau-Hérenger, Contribution..., p. 128.

Material. — One complete, calcified specimen. Skeletal network partially preserved.

Dimensions (in mm.):

	Height	Max. thickness	Thickness of the base
Specimen Sp. II/1296	135	87	35

Description. — Conical sponge, narrowing down and turning into a stem. Central cavity deep, reaching down as far as the lower pole; walls thick, pierced by canals. Aporhyses in the lower part straight, around osculum winding and, in the walls running obliquely; ostia and postica oval, irregularly scattered.

Dermal skeleton invisible.

Parenchymal skeleton similarly built as that in *A. sulcifera*. Clones 0.09—0.15 mm. long.

Comparison. — Polish specimen is very similar in its size and morphology to the specimens from the Upper Campanian of North-western Germany, described by Schrammen. It differs from *A. sulcifera*, *A. fallax* and *A. ventricosa* in its irregular and poorly visible furrows and disarranged pores. It results from the comparison of the dimensions

Table 5

Comparison of dimensions (in mm.) of *A. ventricosa* Schrammen from Germany, Poland and Spain

Country and age	Size		Length of clones	Diameter of		
	height	width		ostia	postica	osculum
North-western Germany, Upper Campanian	100	70	—	0.2—1.0	—	0.5—1.5
Poland, Lower Campanian	135	87	0.09—0.15	0.3	0.75—0.9	35×10
Spain, Aptian	60	50	—	—	—	10

of desmas of different species of the genus *Aulaxinia* that the smallest tetracloones are those in *A. ventricosa* from Poland.

Occurrence. — Poland: Skrajniwa, Lower Campanian; North-western Germany: Misburg, Upper Campanian; Spain: Mas de Artis and Can Casayas, Aptian.

Genus *Callopegma* Zittel, 1878

(Type species *Callopegma acaule* Zittel, 1878)

Callopegma acaule Zittel, 1878

(Pl. I, Fig. 5; Text-fig. 9)

1878. *Callopegma acaule* Zittel; K. Zittel, Studien..., II, p. 139, Pl. 2, Fig. 6; Pl. 8, Fig. 5 (1878b).

1961. *Callopegma acaule* Zittel; H. Nestler, Spongien..., pp. 18—19, Pl. 2, Fig. 8; Messtabel. p. 63 (earlier synonymy).

Material. — Thirteen fairly well-preserved specimens.

Dimensions (in mm.):

	Height	Max. thickness
Largest specimen (Sp. II/1015)	40	35
Smallest specimen (Sp. II/832)	19	19

Description. — Spherical, hemispherical or bowl-shaped sponges; upper pole obliquely flattened or concave; lower pole rounded or obtusely conical, without processes and traces of the attachment place. Central cavity shallow, variable in width, with internal margins furrowed by irregular canals. Ostia small, scarcely visible, irregularly distributed below the place of maximum thickness and, in the upper part, invisible. Canals not isolated. Probably, they were narrower than the meshes of the skeletal network.



Fig. 9. — *Callopegma acaule* Zittel, Lower Campanian, Pniaki; a parenchymal tetracloones combined into a network, b zygose, c broken off clone (Z. Pal. UŁ Sp.II/1290); $\times 50$.

Parenchymal skeleton fairly loose, consisting of smooth tetracles with clones 0.3 mm. long and 0.03 mm. thick; zygomes tattered, zygoses spherical. Numerous oxeas and amphioxeas scattered all over the outer surface of walls. Probably, they belong to the dermal skeleton. The occurrence of fairly numerous elliptical sterrasters mostly 0.02 mm. in diameter in the meshes of the network has been stated on the surface of three specimens. The manner of their arrangement allows one to assume that they belonged to the investigated specimens.

Table 6
Variation of *Callopegma acaule* Zittel

Size and age of specimens from the Campanian of Poland	Shape	Paragaster	Length of clones (in mm.)
Smallest specimen (Sp. II/832)	spherical	lacking	0.18–0.3
Middle-sized specimen (Sp. II/70/5)	hemispherical	small	0.15–0.21
Largest specimen (Sp. II/1610)	bowl-shaped	shallow	ca 0.3

Table 7
Comparison of dimensions (in mm.) of *Callopegma acaule* Zittel from Poland and Germany

Country and age	Size		Length of clones	Ostia	Postica	Paragaster
	Height	Thickness				
Germany, Rügen Island, Maastrichtian (according to Nestler, 1961)	100	100	0.21–0.675, at the base, 0.35	lacking	1.0	bowl-shaped
North-western Germany (according to Schrammen, 1910): Lower Campanian	20–30	50–60	no data available	present only at the bottom	3–5	bowl-shaped
Upper Campanian	100	thick	as above	as above	as above	as above
Poland, Lower Campanian	19–45	19–35	0.3	small	—	as above

Variation is mainly found in the shape, size of the sponge and development of the central cavity. Comparing the investigated specimens with each other, one may distinguish certain groups of forms different with regard to their ontogenetic age.

Callopegma ficoideum Hinde, 1883
(Pl. I, Figs. 3 and 4)

1883. *Callopegma ficoideum* Hinde; J. G. Hinde, Catalog..., pp. 61–62, Pl. 11, Fig. 4.

Material. — Twenty nine silicified specimens; desmas embedded in chalcedony.

Dimensions (in mm.):

	Height	Thickness	Thickness of stem
Spherical specimens	30—42	18—30	3—4
Pear-shaped specimen (Sp. II/1014)	20—32	28—32	3—4

Description. — Spherical or pear-shaped sponges with fragile stems; in pear-shaped ones, the upper pole slightly flattened with a small depression in the middle. Outer surface flat, pierced by irregularly distributed pores. Large postica (1—2 mm. in diameter), substituting osculum, are situated mostly in the upper part of the sponge and connected with the subdermal exhalant cavities which contain, on their bottom, 2—4 apopyles each. The majority of ostia, ca. 0.5 mm. in diameter, occur in the lower part of the sponge. Central cavity not individualized. Wide cavities, varying in size and shape, are situated inside walls. Epirhyses scarcely distinguishable from aporhyses.

Dermal skeleton consisting of cortex and ortodichotriaenes; in the region of the upper pole and in the basal part, on the stem, cortex forms a (secondarily calcified) layer 0.15 mm. thick in which rhizoidal elements are visible; fragile ortodichotriaenes with clads 0.45 mm. long are embedded between them.

Parenchymal skeleton compact. Particular desmas and their arrangement display the clone lengths varying between 0.15 and 0.3 mm.; the rays of some desmas are elongated and reach 0.33 mm.; within the range of canals, tetracloes are disposed in rows and their clones are parallel to each other; zygoes strongly ramified; zygoes form lumps which do not display any compact structure; numerous scattered oxeas and amphioxeas and, very often, elliptical sterrasters 0.15—0.24 mm in diameter, occur on the surface of the sponge.

Comparison. — The specimens investigated differ from those of this same species from England, described by Hinde (1883) in the distribution of their canals. In English specimens, aporhyses, 1.8 mm. in diameter, opening at the top of the sponge, are wider than lateral canals (0.8 mm. wide). Aporhyses and epirhyses have not been separately analyzed by Hinde who has only settled the dimensions of canals. Writing "lateral", he probably meant "inhalant" and, writing "vertical", he meant "exhalant". Postica are grouped, in the investigated specimens, rather in the upper part of the sponge and not exactly at its top as Hinde ascertains. On the other hand, in the lower part, there are only ostia. It seems that this character might be considered a diagnostic one for the subspecies which, however, in this paper, is not distinguished on account of the scarcity of the material available. The investigated specimens of *C. fico-*

ideum differ from *C. acaule* in the presence of stem and absence of central cavity, as well as in the structure of the multioscular water system.

Two specimens (Sp. II/1236 and 1234) are pierced clean through by a tubular canal, 5 and 7 mm. in diameter, disposed obliquely to the body axis. This canal — of unknown origin — is similar to that, recorded in calcareous sponges of the genus *Porosphaera globularis* (Phillips) (Hurcewicz, 1960).

Occurrence. — Poland: Skrajniwa, Pniaki, Zbyszce, Lower Campanian, marl; England: Croydon, Guildford, Surrey, Upper Chalk.

Genus *Turonia* Michelin, 1847

(Type species: *Turonia variabilis* Michelin, 1847)

Turonia variabilis Michelin, 1847

(Pl. VIII, Figs. 1 a, b)

1847. *Turonia variabilis* Michelin; H. Michelin, Iconographie..., p. 125, Pl. 35, Fig. 8 (*vide* Schrammen, 1910).

1925. *Turonia variabilis* Michelin; L. Moret, Contribution . . . , p. 152, Pl. 12, Fig. 10 (here earlier synonymy).

Material. — One complete specimen with its sides covered with a continuous layer of a compact cortex. Dermal and parenchymal skeletons well-preserved; marginalia strongly damaged.

Dimensions (in mm.):

	Length	Cross section in place of max. circumference	Diameter of stem roots
Specimen (Sp. II/381)	60	50 x 40	2

Description. — Sponge conical, in cross section oval. Upper pole strongly convex with irregular protuberances; lower pole, making up an apex of the cone, provided with short roots. Lateral surface transversely corrugated. The width of folds varying from 1.5 to 5 mm. Ostia invisible, postica not preserved. The aporhyses outlets clearly visible and irregularly scattered between the protuberances of the upper part. Central cavity lacking. Aporhyses are not continuous in trace, they are tortuous and extending near the margins of the cavities.

Cortical skeleton covers the entire sponge. Next to very small ortodichotriaenes with a 0.06 mm. cladome there are many large ortodichotriaenes with a 0.75 mm. cladome. The thickness of the cortical layer at the base amounts to ca. 0.18 mm., while that of fragments, preserved at the top — to ca. 0.3 mm. Rhizoidal skeletal elements very fine and numerous, arranged in layers. Ends of two basal roots rounded and fully covered with cortex. Strongly modified triaenes, with their cladome pointed downwards, are vertically embedded in two broken off roots

under cortex. The remains of broken off marginalia are visible at the top around exhalant canals.

Parenchymal skeleton compact, consisting of fairly thick and smooth tetracles with almost equal clones. The length of clone varies in particular desmas within limits of 0.15 and 0.27 mm. Zygomeres short, tattered, extended; zygoes compact, flattened. Fairly numerous sterrasters ellipsoidal to spherical in shape and 0.12—0.24 mm. in diameter, as well as many microamphioxes, microstrongyles and a few microscleres of the style and torne type have been washed out from the sediment which fills up the meshes of network on the upper pole.

Comparison. — Morphology of the parenchymal and cortical skeletons is characteristic of the genus *Turonia* Michelin. The investigated specimens do not differ from those of *T. variabilis* from the Senonian of France.

Occurrence. — Poland: Pniaki, Lower Campanian marl; France: Senonian of the Paris Basin; Germany: Lower and Upper Campanian.

Turonia aff. *variabilis* Michelin, 1847

(Pl. VIII, Fig. 2; text-fig. 10)

Material. — Four almost complete specimens without apical parts and two fragments.

Dimensions (in mm.):

	Height	Thickness
Smallest specimen (Sp. II/127)	10	45 × 50
Largest specimen (Sp. II/28)	40	110—120

Description. — Bowl-like forms, provided with a short stem or many short, blunt processes, concentrically arranged. On the lower, uneven side, there are growth zones, marked by distinct swellings. Upper part, mostly poorly preserved, convex and either with processes or smooth and concave. Central cavity lacking. Ostia invisible; aporhyses short, tortuous and tubular, 0.6—1.0 mm. in diameter, considerably narrower than the meshes of the skeletal network.

Dermal skeleton consisting of cortical, densely entangled, flat, rhizoidal elements and ortodichotriaenes. The thickness of the cortical layer comes to ca. 0.2—0.3 mm. Dermal orthodichotriaenes are larger than parenchymal ones; their clades are ca. 0.45 mm. long. Cortex compact and preserved only on the lower side where it forms a fairly thick layer.

Parenchymal skeleton not very dense and firm with irregular meshes, formed of tetracles with clones varying in length within limits of 0.2 and 0.45 mm. The terminal part of clones spiny, mostly dichotomously divided into shorter or longer stipes. Zygomeres ramified, zygoes fairly loose, perforated. Usually, three zygomeres are connected together

in a zygome. Comitalia embedded in the network meshes make up dichotriaenes with clads and rhabdome 0.15 mm. long; there are also numerous amphioxeas variable in length, very thin oxeas and single protriaenes.



Fig. 10. — *Turonia* aff. *variabilis* Michelin, Upper Maastrichtian, Janowiec; a parenchymal tetrachlaenae, b rhizoidal elements from the cortex, c dermal orthodichotriaenes; comitalia, d prototriaenes, e amphioxeas and oxeas (Z. Pal. UŁ Sp. II/62); $\times 35$.

Variation. — Differences in size, shape and arrangement of basal processes and swellings are displayed by particular specimens with a similar structure of skeleton.

Comparison. — Polish specimens are very similar to those of *T. variabilis* from Germany, figured by Schrammen (1910, Pl. 3, Figs. 8 and 9). They differ from some of them in the lack of mammillary or digital swellings on the upper surface. The fragments of the parenchymal network, preserved in the upper part of our specimens may only testify to the presence of protuberances and not processes. The presence of dichotriaenes which, in the canals of some specimens, form a transverse partition is a character, never mentioned by former authors, but which may be a specific one.

Occurrence. — Poland: the Upper Campanian marl in the Miechów Highland; the Lower Maastrichtian, horizon "t" at Piotrawin on the Vistula River.

Genus *Kozłowskispongia* n.gen.

(Type species: *Kozłowskispongia bulbosa* n.sp.)

Derivatio nominis: *Kozłowskispongia* — in honour of Professor Roman Kozłowski.

Diagnosis. — Sponges, consisting of empty, bulbous protuberances, developed as a result of undulation of a plate. Water system poorly developed; central cavity lacking; ostia and postica different in size. Skeletal network not very close, formed by smooth tetrachlaenae. Dermal

skeleton covers protuberances with a continuous layer. Dermal ortodichotriaenes fairly large.

Comparison. — *Kozlowskispongia* is a monotypic genus, resembling some species of *Polyjerea* Fromentel. It differs, however, from this genus in the morphology of the water system and in the manner of its general growth. The species of *Polyjerea* are composed by solid individuals coalescent one to another by their surfaces or by the superficial zone. In *Polyjerea*, each individual has its separate water-exhalant system. In *Kozlowskispongia*, on the contrary—the system of protuberances is morphologically indivisible; these protuberances are not independent like separate individuals. The presence of smooth parenchymal tetracles and dermal ortodichotriaenes allow one to assign *Kozlowskispongia* n.gen. to the family Phymatellidae Schrammen in the vicinity of the genus *Jerea* Lamouroux whose single desmas are similar in form.

Kozlowskispongia bulbosa n.sp.

(Pl. II, Fig. 3; Pl. VII, Figs. 1 a, b)

Holotypus: Pl. VII, Figs. 1 a, b (Z. Pal. UŁ. Sp. II/93/94).

Stratum typicum: Upper Campanian, clayey marl facies.

Locus typicus: Kocie Doły, near Miechów railway station.

Derivatio nominis: *bulbosa* — Lat. *bulbosus* = bulbous.

Diagnosis. — An assemblage of hemispherical empty protuberances, developing from an undulated plate. Water canal short, piercing the wall almost clean through and situated alternately. Postica clearly outlined, uniformly distributed all over the entire surface. Dermal ortodichotriaenes large, parenchymal tetracles smooth, zygone ramified.

Material. — Four, partially calcified or limonitized, specimens; isolated tetracles well-preserved; single dermal ortodichotriaenes.

Description. — Formless sponges, consisting of bulbous protuberances directed either upwards or downwards; upper ones hemispherical, 15—20 mm. high, lower ones varying in height from 10 to 22 mm. and 20 mm. in diameter. Wall thickness amounts to 3 mm. Funnel-like cavities are disposed between protuberances. Exhalant pores 0.3—0.45 mm. in diameter best-preserved on apexes of hemispherical protuberances and fairly widely scattered. Canals and postica equal in width; ostia considerably smaller than postica and indistinctly outlined on the surface.

Dermal skeleton consisting of relatively large ortodichotriaenes with a cladome 0.5 mm. in span.

Parenchymal skeleton not very compact, consisting of fairly irregular, smooth tetraxones; zygoes strongly tattered; zygoes large, oval, perforated; clones varying in length, dichotomously divided near the middle of spicules at various distances. Length of spicules varying between 0.15 and 0.45 mm. and, frequently, smaller than that of the zygone "actines".

Occurrence. — Poland: Miechów, Upper Campanian.

Genus *Jerea* Lamouroux, 1821(Type species: *Jerea pyriformis* Lamouroux, 1821)*Jerea pyriformis* Lamouroux, 1821

(Pl. IV, Figs. 1—3)

1878. *Jerea pyriformis* Lamouroux; K. Zittel, Studien . . . , p. 145.1958. *Jerea pyriformis* Lamouroux; S. Defretin-Lefranc, Contribution . . . , p. 103, Pl. 16, Figs. 5—6 (earlier synonymy).1963. *Jerea pyriformis* Lamouroux; W. Wagner, Die Schwammfauna . . . , p. 177.

Material. — Three almost complete, probably young individuals, silicified and with partially preserved skeleton.

Dimensions (in mm.):

	Height	Max. thickness	Thickness of apex	Thickness of stem
Smallest specimen (Sp. II/382)	35	16	8	.6
Medium specimen (Sp. II/1624)	44	23	10	10
Largest specimen (Sp. II/373)	65	40	10—15	20

Description. — Macelike or fusiform shape, slender, sometimes, irregular; upper pole rounded, slightly concave or flat; lower pole narrowed and passing into a fairly thick and short stem. Outer surface flat, after destruction of the cortex, slightly furrowed; furrows, 0.6 mm. wide, in the upper part of the body elongated and in the lower part, sometimes, radially disposed. Central cavity lacking. Aporhyse diameter larger than the meshes of the parenchymal network, that is 0.75—0.90 mm. Postica, concentrated on the apex, rounded and 0.45—0.75 mm. wide; sometimes, slightly elongated, measuring 1.5×0.45 mm. around the apex margin. Ostia fine, on the cortex, invisible; prosopyles, uncovered after the destruction of the cortex, are 0.25—0.3 mm. in diameter.

Dermal skeleton, covering the entire sponge, consists of the independent cortex, built of acrepidal, rhizoidal, serrated platelike elements, arranged in a tilelike manner and of ortodichotriaenes with a cladome 0.3 mm. in span. After the destruction of the cortex, subdermal inhalant cavities and short epirhyses are uncovered.

Parenchymal skeleton compact, consisting of tetracloves with short, smooth, split clones; zygomeres relatively slightly ramified and spiny; clones 0.15—0.03 mm. long and about 0.06 mm. thick; owing to the ratio of the thickness to the length of clones, tetracloves look solid. Canal meshes are distinctly visible in the network. A few sterrasters, which need not necessarily be part of this sponge, have been found on the surface of one (Sp. II/382) specimen.

Variation is observed in the size and shape of the body. One of the specimens (Pl. IV, Fig. 1) is elongated and without a bulgy swelling characteristic of *J. pyriformis*. In general, it is similar to *Jerea clavata*

Moret but it is considerably smaller and has smaller postica (0.75 and 1.5×0.45 mm. and not 2 mm. like in *J. clavata* from France). Its spiculation and water system are identical with those in *J. pyriformis*.

Comparison. — Polish specimens are considerably smaller than *J. pyriformis* from France, described by Moret (1925) and Defretin-Lefranc (1958—1960). According to the authors, mentioned above, the tetracles of *J. pyriformis* are "large" (dimensions are not given), while in Polish specimen from the Lower Campanian, they are rather middle-sized, their clones reaching 0.15 and, sometimes, only 0.03 mm. *J. pyriformis* resembles *J. clavata* which, however, differs in its elongated shape, solidity of the exhalant system and thickness of stem. Specimens which, in the present paper, are assigned to *J. pyriformis*, are undoubtedly young individuals. In two cases (specimens Sp. II/1623 and 1624), 2—3 mm. high processes, corresponding to the earliest stages of budding individuals, have been found on the lateral wall. The structure of the apex of these buds is similar to that of the apex of the mother sponge, that is they are porous, furrowed, their postica are 0.45 mm. in diameter and clones are 0.09 mm. long.

Occurrence. — Poland: Pniaki, Skrajniwa, Lower Campanian; France: Senonian; North-western Germany: Cenomanian and Lower Turonian; England: Vaches Noires, Craie.

Genus *Siphonia* Parkinson, 1822, emend. Zittel, 1878

(Type species: *Siphonia koenigi* Mantell, 1822)

Two groups of species, the group of *S. pyriformis* Goldfuss and the group of *S. koenigi* Mantell are distinguished within this genus by Moret (1925). According to Moret (1925), Defretin-Lefranc (1958—1960) and Lagneau-Hérenger (1962), the first group is strongly differentiated. They ascertain that the forms, assigned by former authors to *S. incrassata*, *S. micropora*, *S. ficus*, *S. tulipa*, *S. tubulosa* and *S. coronata*, are only intraspecific varieties of one, broadly understood, species of *S. pyriformis*. However, on the basis of the investigation of the abundant material of sponges of this group from the Lower Campanian of the Nida Basin, I am inclined to retain the majority of the species, erected by former authors. Characters in which these species differ from each other are given in Table 8.

Siphonia tulipa Zittel, 1878

(Pl. IV, Fig. 4)

1878. *Siphonia tulipa* Zittel; K. Zittel, Studien . . . , p. 145, Pl. 9, Fig. 5.

1883. *Siphonia tulipa* Zittel; J. G. Hinde, Catalogue . . . , p. 64, Pl. 13, fig. 2.

1962. *Siphonia tulipa* Zittel; L. Lagneau-Hérenger, Contribution . . . , p. 133, Text-Pl. 20, Fig. 8.

Table 8

Comparison of *Siphonia tulipa*, *S. pyriformis*, *S. ficus* and *S. tubulosa* (dimensions in mm.)

Name	Shape	Stem	Ostia	Postica	Osculum	Clones
<i>Siphonia tulipa</i>	oval	distinct	0.45–0.6	—	5–10	0.1–0.2
<i>S. pyriformis</i>	spherical	no stem	0.5	1.0	8	0.09–0.3
<i>S. ficus</i>	pyriform	thick	0.5	variable in size, 0.5–1.0 × 1.5–3.0	10–18	—
<i>S. tubulosa</i>	oviform-cylindrical	short, thick, ramified	0.5–3.0	2–3	variable in width	0.25–0.3

Material. — Sixteen silicified specimens, of this number, two with a well-preserved skeleton.

Description. — Body oval or spherical in shape with rounded top part; a distinct stem visible on the lower pole; many oval ostia ca 0.45–0.6 mm. in diameter irregularly scattered all over the surface. Central cavity situated in the middle, in some specimens, tubular 5–10 mm. in diameter and ca. 15 mm. deep, in others, shallow and in the form of a depression with mildly rounded margins furrowed by aporhyses 0.8–1.0 mm. in diameter; postica are visible on the walls and on the bottom of the cavity.

Parenchymal skeleton consisting of smooth tetrachlores with 0.1–1.2 mm. long clones; zygomeres short, tattered; zygomeres in the form of small nodes. Dermal spicules have not been recorded.

Ontogenetic variation of *S. tulipa* concerns the size of particular individuals and structure of their water system. Now and then, some of

Table 9

Comparison of characters of *Siphonia tulipa* from Spain, England and Poland (dimensions in mm.)

Country and age	Shape of specimen	Length	Width	Diameter	Length of clones	Thickness of clones	Diameter of	
							ostia	osculum
Spain, Aptian (acc. to Lagneau-Hérenger, 1962)	tulip-like	—	—	10	—	—	0.1	3
England, Upper Green Sand	tulip-like	21–105	13–46	—	0.135	0.052	—	—
Poland, Lower Campanian	oval, spherical	25–40	22–40	2–4 (of stem)	0.1–0.2	—	0.45–0.6	0.5–10

them have the central cavity and their ostia, uniform in diameter, are regularly scattered. In other specimens, in addition to the cavity and ostia, there are accessory inhalant cavities, probably subdermal, loosely distributed all over the surface. Eight spherical specimens, mounted on a slender stem, without the paragaster but with many postica, have also been assigned in the present paper to *S. tulipa*. Since their parenchymal skeleton has identical structure with that of specimens provided with the central cavity, they probably represent a young stage of *S. tulipa*.

Occurrence. — Poland: Skrajniwa, Lower Campanian marl; France: Senonian of the Paris Basin and Cenomanian of Pas de Calais; England: Blackdown, Warminster, Upper Green Sand.

Siphonia pyriformis Goldfuss, 1833

(Pl. IV, Fig. 5)

1833. *Siphonia pyriformis* Goldfuss; A. Goldfuss, *Petrefacta* . . . , p. 16, Pl. 6, Fig. 7A.
 1958. *Siphonia pyriformis* forma *tulipa*; S. Defretin-Lefranc, *Contribution* . . . , p. 108, Pl. 18, Fig. 1; Text-fig. 9.
 1962. *Siphonia pyriformis* forma *tulipa*; L. Lagneau-Hérenger, *Contribution* . . . , p. 132 (earlier synonymy).

Material. — Five silicified specimens with spicules embedded in chalcedony.

Description. — Sponges globular in shape, 24×35 mm. in cross section, without either a stem, or any trace of the attachment place; osculum, 8 mm. in diameter, is situated on the upper pole; central cavity tubular, 23 mm. deep; postica, 1 mm. in diameter, verticillately disposed on the paragaster wall; ostia, 0.5 mm. in cross section, densely distributed all over the surface and, through short canals, connected with subdermal cavities.

Parenchymal skeleton consisting of tetrachones with uneven clads 0.09—0.3 mm. long; in different specimens, the lengths of clads are different.

Comparison. — An ovoid specimen without a stem (50 mm. long and 40 mm. thick) and having a rudimentary rib-like protuberances is assigned by Defretin-Lefranc (1958—60) to *S. pyriformis* forma *tulipa*. On the other hand, specimens with a well-developed stem and with furrows around the osculum are assigned to this species by Moret (1925). Polish specimens differ from both Moret's specimens, in the lack of stem and globular shape, and from those, described by Defretin-Lefranc, in the lack of furrows and ribs, in a smaller osculum (8 and not 12 mm.) and in narrower ostia (0.5 and not 0.7—1.0 mm.). With regard to morphology, our specimens of *S. pyriformis* are, to the greatest extent,

similar to *S. tulipa*. The lack of a stem in the former, different shape and character of tetracles, are features which differ these two species from each other. To *S. pyriformis*, I assign globular sponges, without a stem and with tetracles whose clones are uneven in length and, to *S. tulipa* — the ovoid ones, mounted on a separate stem more or less thick and long and with regular tetracles whose clones are almost equal in length. The specimens from the Aptian of Spain, described by Lagneau-Hérenger (1962), slightly differ, mostly in size, from our specimens. According to Defretin-Lefranc, the specimen of *S. pyriformis* from the Cenomanian (zone of *Chlamys asper*) with riblike protuberances makes up a transition to the genus *Hallirhoa* Lamouroux.

Occurrence. — Poland: Opole, Cenomanian, Skrajniwa, Lower Campanian; Spain: Can Casanyas, Aptian and Albian; England: Blockdown and Warminster, Albian and, more abundant, in Cenomanian; France: Pas de Calais, Cenomanian (zone of *Chlamys asper*), Paris Basin, Turonian, vicinities of Nice, Senonian, and Charantes, Campanian.

Siphonia ficus Goldfuss, 1833
(Pl. IV, Fig. 6)

1833. *Siphonia ficus* Goldfuss; A. Goldfuss, *Petrefacta...*, p. 221, Pl. 65, Fig. 14.
1925. *Siphonia pyriformis* forma *ficus*; L. Moret, *Contribution...*, p. 167, Fig. 65.
1943. *Siphonia pyriformis* forma *ficus*; J. Lachasse, *Contribution...*, pp. 43—66.

Material. — Three silicified specimens with a stem only preserved and without spiculation.

Description. — Sponge pyriform, slightly tapering downwards and passing into a fairly thick stem; osculum 10—18 mm. in diameter, oval, with sharp margins, more or less elevated, sometimes, deflated, surrounded by radiate furrows different in length and width; ostia 0.5 mm. in diameter, regularly scattered all over the surface; central cavity conical, reaching almost as far as the stem, cavity bottom rounded, walls 8—15 mm. thick. On the wall of the paragaster, postica elliptical, 0.5×1.0 mm. to 1.5×3.0 mm. in diameter, regularly verticillate and disposed in vertical rows.

Comparison. — *S. ficus* is very similar to *S. tulipa* but has a differently shaped central cavity, a different oscular margin and a different manner of the development of stem.

Occurrence. — Poland: Skrajniwa, Lower Campanian; Czechoslovakia: Cenomanian and Senonian; France: Turonian of the Paris Basin, Senonian of the vicinities of Nice, Lower Campanian of Menregue; England: Dover, Cenomanian; North-western Germany: Sudmerberg, Glentorf, Lower Campanian.

Siphonia tubulosa (Roemer, 1841)

(Pl. V, Figs. 1 and 2; Pl. VI, Figs. 1 and 2; Text-fig. 11)

1841. *Scyphia tubulosa* Roemer; A. F. Roemer, Die Versteinerungen..., p. 8, Pl. 3, Fig. 10.
 1889. *Siphonia ovalis* Griepenkerl; A. F. Roemer, *ibid.*, p. 20, Pl. 3, Figs. 3 a—b.
 1910—1912. *Siphonia tubulosa* (Roemer); A. Schrammen, Die Kiesel-spongien..., p. 93, Pl. 2, Figs. 6—8.
 1925. *Siphonia pyriformis* Goldfuss forma *tubulosa* (Roemer); L. Moret, Contribution..., p. 168, Pl. 12, Figs. 3.

Dimensions (in mm.):

	Height	Thickness	Thickness of base	Thickness of stem roots
Smallest specimen (Sp. II/257b)	80	60	28	—
Medium specimen (Sp. II/257a)	120	90	20	—
Largest specimen (Sp. II/386)	190	100×75	70×50	10—19

The dimensions, specified above, pertain to fragments which approximately make up a half of the sponge. Their real size was, therefore, twice as much.

Description. — A single sponge, large, ovoid-cylindrical in shape, much bigger in height than in width; lower pole gradually narrowing and passing into one or two short, solid stems; outer surface flat, strongly porous; ostia oval, variable in size, irregularly and rather densely distributed at 1—4 mm. intervals; in different specimens, diameter of ostia varies from 0.5 to 3 mm.; ostia mostly wider in the upper part of

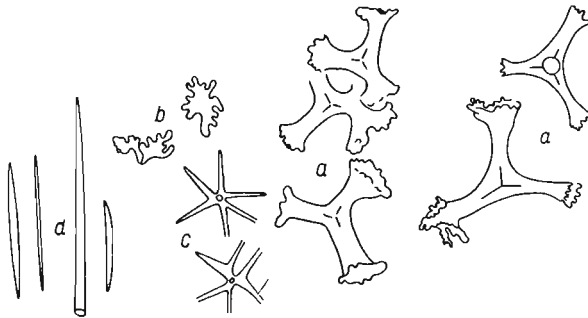


Fig. 11. — *Siphonia tubulosa* (Roemer), Lower Campanian, Zbyczyce; a parenchymal tetrachlores, b rhizoidal cortical elements, c dermal ortodichotriaenes, d comitalia of amphioxea (Z. Pal. UŁ Sp. II/386); × 30.

the sponge than in the lower. Water system well-developed; central cavity large, tubular, tapering downwards, in different specimens variable in depth and in diameter (sometimes 15 to 12 × 50 mm.); walls 20—40 mm. thick, pierced by tubular canals 1.5—2 mm. in diameter; exhalant system complex in structure; in the upper part of the sponge,

aporhyses are situated near the sponge axis and, in the walls, they run obliquely upwards at an angle of almost 45° . Postica 2—3 mm. wide, situated on the paragastral surface and arranged in irregular rows; sometimes, in addition to aporhyses, there are irregularly shaped large cavities, called by Reid (1963, p. 220), "cavedials", 10—12 mm. wide; the bottom of the central cavity variable, rounded or tetramerous with a protuberance in the middle; epirhyses short, equal in width, formed by the combination of a few prosodial canals.

Dermal skeleton consisting of fragile ortodichotriaenes with a cladome diameter of 36 mm. and with clads relatively thin as compared with the parenchymal tetraclones; rhizoidal dermal plates also are visible.

Parenchymal skeleton dense and compact, consisting of fairly solid, smooth desmas; clones relatively short, at the ends mostly dichotomically ramified; clone length fluctuates between 0.25 and 0.3 mm. and thickness amounts to 0.06 mm.; zygomes averagely tattered and not very widely open. Large canal meshes distinctly visible in the network; on the surface, the network forms bands which surround the pores; comitalia, abundantly occurring in the network meshes and in canals, consist of thin amphioxeas varying in length and of microscleres. Large, ca. 15 mm. long, amphioxeas, arranged longitudinally on the surface of the paragaster. Numerous microxeas, varying in length, and microstrongyles ca. 0.16 mm. long are also present.

Table 10

Comparison of the representatives of *Siphonia tubulosa* (Roemer) from Poland, Germany and France (dimensions in mm.)

Country and age	Height of specimen	Thickness of specimen	Diameter of				Length of clones
			central cavity	ostium	posticum	ortodichotriaene	
Poland, Lower Campanian	160—380	120—200	15 to 12×50	0.5—3.0	2—3	0.36	0.25—0.3
North-western Germany, Campanian (acc. to Schrammen, 1910)	to 500	250	10—30	0.5—1.5	1—2	—	—
France, Emscherian (acc. to Moret, 1925)	70	35	8—10	—	—	—	—
Germany (acc. to Gripenkerl, 1888—1889)	110—120	70	20	—	—	—	—

Comparison. — It results from Schrammen's (1910, p. 93), Moret's (1925, p. 168) and Wagner's (1963, p. 178) descriptions that *S. tubulosa* is characterized by a variable size and diameter of the elements of the water system. This is depicted by Table 10.

Occurrence. — Poland: Skrajniwa and Zbyczyce, Lower Campanian; Germany: Turonian and Senonian; France: vicinities of Nice and Villen-trois, Emscherian.

Family **Discodermiidae** Schrammen, 1910

The genera, assigned to the family Discodermiidae are characterized by the presence of parenchymal desmas, mainly those with fine lumps with a slight admixture of smooth ones, as well as of dermal phyllo-triaenes of variable morphology which are differently transformed up to the discotriaenes. Sometimes, small, dermal dichotriaenes may also occur as is the case in *Ragadinia galloprovincialis* Lagneau-Hérenger, *Pseudojerea kempei* Wagner and *Phylloderma magna* n.sp. Our statement that microscleres of the sterraster type occur in all investigated specimens, belonging to the Discodermiidae, allows one to supplement the diagnosis of this family and, at the same time, it confirms the assignment of fossil species to the Discodermiidae.

Genus *Discodermia* Bocage, 1869

(Type species: *Discodermia polydiscus* Bocage, 1869)

On the basis of the morphology of tetracrepid parenchymal and dermal desmas, as well as microscleres such as, microamphioxeas and microrhabds, shaped like short cylinders or eggs, this genus has been assigned by Lendenfeld (1903) to the Theonellidae Lendenfeld. According to Schrammen (1924, p. 48), the genus *Discodermia*, as understood by zoologists, is an artificial group of a few Recent heterogeneous tetracladine sponges. Lendenfeld (1903) assigned to *Discodermia* 10 species, containing parenchymal desmas with dermal discotriaenes and with small microscleres similar to amphioxeas and "oviform or cylindrical" microrhabds (*l.c.*, p. 128).

In the investigated specimens of *D. galloprovincialis* from the Lower Campanian of Poland, the presence has been stated of only sterrasters, without microxeas. In conformity with Lendenfeld's view, Schrammen and Moret believe that microxeas and microstrongyles are known only in Recent *Discodermia*. On the other hand, Defretin-Lefranc (1958—1960), Lachasse (1943) and Lagneau-Hérenger (1962) do not mention this subject. The excluding of the genus *Discodermia* from the family Theonellidae, done by Schrammen (1910) on the basis of megascleres and

erecting a separate family Discodermiidae is confirmed in the light of the present study.

Occurrence. — From the Cretaceous up to the present-day times.

Discodermia cf. *galloprovincialis* Moret, 1925

1925. *Discodermia galloprovincialis* Moret; L. Moret, Contribution..., p. 177, Pl. 6. Fig. 1; Pl. 7, Fig. 3; Pl. 15, Figs. 1—2; Text-fig. 69—1.

Material. — Three silicified specimens with skeletons embedded in chalcedony.

Dimensions (in mm.):

	Height of colony	Height of individual	Thickness of individual
Specimen Sp. II/285	50	ca. 30	35—40

Description. — An assemblage of indistinctly marked off, almost globular individuals with a common base. Upper pole rounded; on the apex of some individuals (probably, young ones), postica form a conical prominence. Lower pole blunt, short, with 12 mm. thick and about 10 mm. long processes. Outer surface smooth, after the destruction of cortex — rough, covered with short canals and pores. Water system in the specimens investigated differently developed. Some of them have a wide and deep — to 12 mm. (Sp. II/284) — central cavity with numerous postica on the walls, some others — probably young ones — have no paragaster which is replaced by a bundle of aporphyses. In all specimens, the inhalant system is invisible.

Dermal skeleton formed of two types of phyllotriaenes, those, flattened, situated in the inferior part of the cortex and those, cut out, with narrow clones, disposed in the outer part of cortex.

Parenchymal skeleton dense, consisting of tetracloes with a strongly ramified zygome. Inside the walls, desmas are mostly smooth, while near the surface — lumpy. Some tetracloes, situated on the surface, have a reduced apical ray; zygoes form a lacelike twist. Numerous elliptical sterrasters with their diameters varying within limits from 0.006×0.009 mm. to 0.015×0.024 mm. (specimen Sp. II/285) and globular ones 0.018 mm. in diameter are situated in the meshes of the parenchymal network. Their number is variable.

Comparison. — The colonial specimens from France, consisting of 2—22 individuals, have a narrow and deep central cavity, whereas our specimens from the Lower Campanian have a shallow and broad central cavity which, sometimes, may be replaced by aporphyses. Ostia, $\frac{1}{3}$ mm. in diameter and 1 mm. distant from each other, are visible on the specimens of *D. galloprovincialis* from France. Polish and French specimens are similar to each other in size and shape. According to

Moret, in the forms from the Santonian of Saint-Cyr, where *D. gallo-provincialis* is very common, the surface of phyllotriaenes is lumpy which has never been recorded in Polish specimens. In view of the differences mentioned above, the conspecificity of the specimens described in this paper with the species, erected by Moret is not certain.

Occurrence. — Poland: Skrajniwa and Zbyczyce, Lower Campanian marl; France: Saint-Cyr, Santonian.

Genus *Phyllodermia* Schrammen, 1924

(Type species: *Discodermia antiqua* Schrammen, 1901)

Phyllodermia magna n.sp.

(Pl. XI, Figs. 1 a, b; Text-fig. 12)

Holotypus: Pl. XI, Figs. 1 a, b (Z. Pal. UŁ Sp. II/1295).

Stratum typicum: Lower Campanian marl.

Locus typicus: Skrajniwa near Koniecpol.

Derivatio nominis: *magna* — Lat. *magnus* = great.

Diagnosis. — This is a solid *Phyllodermia*, with an irregular upper pole, having a few concavities in which postica are irregularly crowded. Ostia on the cortex invisible; dermal phyllotriaenes deeply cut out; parenchymal tetracloones in the form of fine lumps; numerous sterrasters varying in size.

Material. — One complete specimen, silicified inside and with a preserved spiculation on the surface.

Description. — Sponge shaped like an irregular mace, mounted on a distinctly isolated stem; upper pole irregular, with protuberances and concavities varying in size and depth, the latter reaching 15—20 mm. Lower part conical, its surface flat. Aporhyses with 1 mm. lumen are revealed in the transverse section of the stem. In the upper part, tubular grooves, tortuous and variable in length, are visible on the surface of the swelling. Prosopyles on lateral walls just below the cortex are irregular and ca. 0.15 mm. in diameter. Irregular postica are crowding the concavities, in the top part.



Fig. 12. — *Phyllodermia magna* n.sp., Lower Campanian, Skrajniwa; a parenchymal tetracloones, b a modified desma on the sponge surface, c dermal phyllotriaenes, d microstrongyles (Z. Pal. UŁ Sp. II/1295); $\times 35$.

Dermal skeleton, consisting of deeply cut out phyllotriaenes with a 0.45 mm. cladome span, of rhizoidal elements, as well as of elongated and modified clones of the main skeleton. Dermalia form a cortex, consisting of phyllotriaenes and, within limits of the stem, also of dichotriaenes.

Parenchymal skeleton built of almost smooth or lumpy tetracloes, the latter having fairly small, globular lumps, loosely distributed on clones or, less frequently, on zygomes. Tetracloes smooth, less abundant. Loosely scattered microstrongyles 0.021 mm. long are situated in the network. Numerous globular sterrasters, 0.018 and 0.024 mm. in diameter and with a slightly rough surface, are visible on the bleached out surface of the specimen. The smallest globular sterraster is 0.009 mm. in diameter. More abundant are the elliptical ones whose dimensions are from 0.018×0.012 mm. to 0.024×0.022 mm.

Comparison. — The tetracloes and phyllotriaenes of a type, characteristic of the genus *Phyllodermia* Schrammen, have been figured by Lagneau-Hérenger (1962, Pl. 21, Fig. 1 b). The solidity, the different structure of the top part and the arrangement of postica are a diagnostic character, differentiating our species from other ones of this genus.

Occurrence. — Poland: Skrajniwa, Lower Campanian.

Phyllodermia pulchra n.sp.

(Pl. XII, Fig. 2, Text-fig. 13)

Holotypus: Pl. XII, Fig. 2 (Z. Pal. UŁ Sp. II/391).

Stratum typicum: Lower Campanian marl.

Locus typicus: Skrajniwa.

Derivatio nominis: *pulchra* — Lat. *pulcher* = beautiful.

Diagnosis. — Sponges irregularly conical with differently developed lateral walls, one of them being convex, the other — flattened, and extended in a fan-wise manner; central cavity lacking; cortex consisting of sharp-edged, cut out phyllotriaenes; tetracloes lumpy; sterrasters present.

Material. — Three complete, silicified specimens with desmas embedded in chalcedony.

Dimensions (in mm.):

	Length	Maximum thickness	Thickness of stem
Specimen Sp. II/395	50 — 55	34 — 37	8 — 15

Description. — Shape irregular, resembling a pear, mounted on a short, averagely thick stem; upper pole fairly wide and rounded. On one side, the sponge is convex, on the other flattened, extended in

a fan-wise manner and with slightly flanged and rounded margins. Oval prosopyles 0.75 mm. in diameter are visible under the destroyed cortex on a rounded wall. Ostia on the cortex scarcely visible, equalling 0.03 mm.; they are situated between the phyllostriaene clones. In this wall,



Fig. 13. — *Phyllostria pulchra* n.sp., Lower Campanian, Skrajniwa; a parenchymal tetracclone, b dermal phyllostriaene (Z. Pal. UŁ Sp. II/391); $\times 40$.

epirhyses run obliquely upwards. Tortuous, anastomosing grooves, corresponding to subcortical aporhyses, are visible on the upper margins of the fanlike wall. Their width is equal to that of prosopyles.

Dermal skeleton forms a compact silicified crust, built of phyllostriaenes with fine, deeply cut out and sharp-edged clads whose cladome is ca. 0.5 mm. in span.

Parenchymal skeleton, distinctly visible in the inner part of the sponge, consists of lumpy tetracclones. Inside the sponge, there are only the cavities, left over by dissolved desmas. Globular sterrasters not numerous, their diameter amounting to 0.009 mm., whereas elliptical ones with cross sections, 0.009×0.012 , 0.012×0.015 and 0.015×0.021 mm. are more abundant.

Comparison. — *Ph. pulchra* n.sp. differs from other representatives of the genus *Phyllostria* in its spiculation and water system. Its general morphology corresponds to the diagnosis, given by Schrammen (1924, p. 48). A different shape of the body and the morphology of the walls differ it, however, from the described species of this genus and provide a basis for erecting a new species.

Occurrence. — Poland: Skrajniwa, Lower Campanian.

Phyllostria costata (Hinde) subsp. *brevicostata* (Michelin, 1847)
(Pl. X, Fig. 1)

1821. *Hallirhoa costata* Lamouroux; J. Lamouroux, Exposition méthodique..., p. 72, Pl. 78, Fig. 1 (*vide* L. Moret, 1925, p. 171).
1878. *Hallirhoa costata* Lamouroux; F. A. Quenstedt, Petrefactenkunde..., vol. 5, p. 426, Pl. 135, Fig. 14 (*vide* L. Moret, 1925, p. 171).
1878. *Hallirhoa costata* Lamouroux; K. Zittel, Studien..., p. 143.
1883. *Siphonia* (*Hallirhoa*) *costata* (Lamouroux); J. G. Hinde, Catalogue..., p. 67, Pl. 14, Figs. 1 a—e.
1883. *Siphonia* (*Hallirhoa*) *costata* forma *brevicostata* Michelin; J. G. Hinde, *Ibid.*, p. 68.
1925. *Siphonia* (*Hallirhoa*) *costata* forma *brevicostata* Michelin; L. Moret, Contribution..., p. 171, Fig. 66.

Material. — Two silicified specimens with a well-preserved morphology of walls and of water system. Spiculation poorly visible but the outlines of peculiar desmas are preserved.

Dimensions (in mm.):

	Diameter (minus ribs)	Max. thick- ness of ribs	Height of ribs
Specimen Sp. II/1200	40	8 — 12	13 — 17

Description. — In transverse section, this sponge is irregularly quadrilateral with strongly protruding longitudinal ribs, asymmetrically distributed. These ribs are formed at different heights in relation to the lower pole. Their distances, widths and heights are not equal. Edges of ribs are flattened and extended in a raillike manner. Upper pole flatly truncated and with rounded margins, lower conically rounded, with no trace of a stem. Central cavity tubular, 7—12 mm. in diameter, centrally situated and reaching as far as the base. Osculum round in outline, equal to the paragaster diameter. Water system complex, well-developed. Epirhyses tubular, ca. 1 mm. in diameter, running obliquely upwards between ribs. In the walls they join the aporhyses. The wall between ribs is 10—20 mm. thick. The traces of aporhyses in ribs and walls are different. Four to five aporhyses parallel to the central cavity are visible in the transverse section of a rib, while, in the walls, aporhyses run nearly perpendicularly to the paragaster surface and are wider than those in ribs. Prosopyles are oval in outline and ca. 0.5 mm. in diameter; ostia, 0.1 mm. in diameter, are visible on the cortex.

Dermal skeleton, covering the entire sponge, consists of phyllotriaenes with narrow clones and of rhizoidally cut out elements.

Parenchymal skeleton is, to a considerable extent, destroyed. Only lumpy tetracloes, similar to those in other genera of the Discodermiidae, are preserved.

Comparison. — Specimens from Poland differ from those from England in the lack of a long stem, in a smaller number of ribs and in a different shape of their edges. Specimens of *H. costata* described by Hinde had 6—7 ribs with rounded ridges. Specimens, similar to Polish ones, without stem, were called by Hinde, *Hallirhoa costata* forma *brevicostata*. Specimens with both slightly and strongly protruding ribs also occur in France. One of the specimens, described by Defretin-Lefranc (1958, p. 109) as *Hallirhoa costata*, has distinct riblike processes only at its base. Near the osculum they are scarcely outlined. Tetracloes of our specimens are different from that, mentioned by Defretin-Lefranc. In Polish and English specimens, tetracloes are lumpy, while in French ones (visible in a transparent chalcedony), they are large and smooth. This difference indicates that, despite the shape similarity, they should be assigned to two different genera.

Sponges with ribs and a deep paragaster, having a tetraxon skeleton, have so far been identified as *Siphonia* (*Hallirhoa*) *costata*. Attention has been drawn by Hinde to the lumpy tetraxones present in this species. On the other hand, Moret (1925, p. 172) ascertains that dermal dichotriaenes occur in *Siphonia* (*Hallirhoa*) *sexplicata* Roemer but he does not mention them, describing the species *costata*. Lumpy parenchymal tetraxones with dermal phyllotriaenes, the same as in all Discodermiidae, whose presence was discovered in my specimens, allow one to state that, despite a similar shape, the specimens investigated do not represent the genus *Siphonia* (*Hallirhoa*) Lamouroux (1821) but the genus *Phyllodermia* Schrammen (1924), while *S.* (*Hallirhoa*) *sexplicata* Roemer, described by Moret (1925, p. 172) must be considered a species, typical of the genus *Hallirhoa* Lamx. of the Phymatellidae.

Occurrence. — Poland: Skrajniwa, Lower Campanian marl; England: Wiltshire and Norfolk, Upper Green Sand; France: Maine et Loire, Senonian.

Genus *Eustrobilus* Schrammen, 1910

(Type species: *Eustrobilus callosus* Schrammen, 1910)

Eustrobilus callosus Schrammen, 1910

(Pl. X, Figs. 2—3 a, b; Text-fig. 14)

1933. *Eustrobilus callosus* Schrammen; F. Bieda, Gąbki..., p. 19 (here earlier synonymy).

1962. *Eustrobilus callosus* Schrammen; L. Lagneau-Hérenger, Contribution..., p. 144.

Material. — Six complete specimens with the internal part silicified and, in some fragments, with well-preserved cortex; one of the specimens consists of two individuals concrescent with their sides.

Dimensions (in mm.):

	Height	Max. thickness	Diameter of apex	Thickness of base
Smallest specimen (Sp. II/1613)	43	30	15	8
Medium specimen (Sp. II/1534)	55	43×30	30	11
Largest specimen (Sp. II/724)	130	75×50	35×55	20×60

Description. — Sponge in the form of a bilaterally flattened mace, mounted on a short, thick base. Upper part rounded with more or less distinctly outlined triangular or oval top plane which is arcuate and obliquely situated. Lower part, elliptical in cross section, makes up a solid stem from below concave and on the sides provided with short rootlike processes. Outer surface uneven, rough. Osculum situated in the middle of the apical plane. Central cavity 6×15 mm. wide and more than 45 mm. deep; aporhyses tortuous and anastomosing like canals, uncovered on top of the sponge. The majority of postica destroyed, the

preserved ones are oval ca. 1 mm. in diameter; apopyles on the paragaster wall arranged in regular rows; prosopyles, confusedly scattered under cortex, are 0.3 mm. in diameter. Ostia, 0.06 mm. in diameter, scarcely visible on the cortex, are situated between phyllotriaenes; epirhyses invisible.

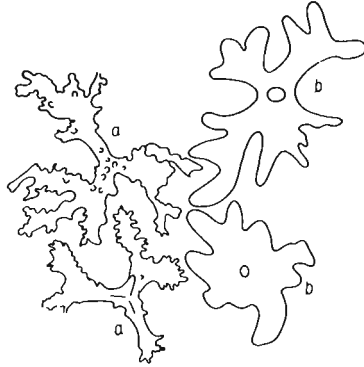


Fig. 14. — *Eustrobilus callosus* Schrammen, Lower Campanian, Zbyczyce; a parenchymal tetrachloes from the superficial zone of the sponge, b dermal phyllotriaenes (Z. Pal. UŁ Sp. 11/726); $\times 35$.

Dermal skeleton covers the entire sponge and forms an independent cortex, consisting of flat rhizoidal elements and phyllotriaenes, densely arranged in layers. Some phyllotriaenes are more flattened and have a lesser number of distinct clones, other ones have narrow and twisted rays. Near the surface, numerous sterrasters are visible, embedded in marl, surrounding them; elliptical sterrasters 0.009×0.012 , 0.015×0.018 and 0.015×0.021 mm. thick are still more abundant, while single globular ones, 0.012 mm. in diameter, are met with very rarely. Less frequently, elliptical sterrasters are also preserved in prosopyles.

Parenchymal skeleton consists of tetrachloes, densely covered with rodlike lumps. In addition, there are megarhizoclones. Elongated desmas occur in canals. Internal skeletal network, dense and compact, containing tetrachloes with a more regular structure, fairly large and solid and with the clone ends more lumpy and dichotomous; clones variable in length (0.15 to 0.3 mm.) and thickness (0.06 to 0.09 mm.); clones of desmas connected through a slightly ramified zygone; zygoes small, lumpy, somewhat wider than the clone thickness. In the basal part, the lumps of desmas are more loosely distributed. In some tetrachloes the apical ray is reduced. In the basal part of the sponge, numerous microxeas 0.03—0.045 mm. long and sterrasters occur in the skeleton.

Variation is displayed in the size. Some specimens are large (to 130 mm.), some other — medium and pear-shaped. The specimen, consisting of two concrescent individuals (Pl. X, Fig. 3a) is covered with

a common cortex; each of these individuals has a separate, excentrically disposed osculum and their aporphyses uncovered on the top are 0.75—1.2 mm. in diameter; central cavity single, narrow and more than 20 mm. deep.

Table 11

Comparison of characters of *Eustrobilus callosus* Schrammen from Germany, Poland, France and Spain

Country and age	Height (mm.)	Diameter of osculum (mm.)	Ostia	Postica	Tetraclones	Dermal phyllo-triaenes
Germany, Campanian (acc. to Schrammen, 1910)	50—120	10—15	1	1	fairly large, lumpy	present
Poland, Lower Campanian	43—130	6×15 variable	prosopyles 0.3 ostia 0.06	1	clones 0.15—0.3 long	present
France, Emscherian (acc. to Moret, 1925)	55	5—7	—	—	large, lumpy	present
Spain, Aptian (acc. to Lagneau-Hérenge, 1962)	70	15	—	—	—	—

Occurrence. — Poland: Witkowice near Cracow and, within limits of the Lelów Threshold, Zbyczyce, Pniaki, Skrajniwa, Lower Campanian marls; Spain: Mes de Artis and Can Casanyas Castellet, Aptian; North-western Germany, Lower and Upper Campanian; France: vicinities of Nice. Emscherian.

Eustrobilus extraneus n.sp.

(Pl. IX; Figs. 1 a—c; Text-fig. 15)

Holotypus: Pl. IX, Figs. 1 a—c (Z. Pal. UŁ Sp. II/1617).

Stratum typicum: Lower Campanian, clayey marl facies.

Locus typicus: Pniaki, hamlet quarry near Lelów.

Derivatio nominis: *extraneus* — Lat. *extraneus* = strange.

Diagnosis. — Sponge, approaching in shape a deformed mace with processes. The two sides are different, one is smooth, the other uneven. Paragaster tubular, deep; water canals tortuous and running obliquely.

Material. — One complete, very well-preserved specimen.

Description. — Sponge asymmetrical in shape; stem short, irregular, cylindrical; upper part, on one side smooth, triangular in outline with rounded apexes and, on the other, uneven, convex along the axis. Upper pole and lateral protuberances are similar to each other in shape and thickness; osculum, 6 mm. in diameter, oval, excentrically situated on

the apex, having sharp margins and surrounded by radial furrows. Below osculum, two wide (12—15 mm.) processes, probably the remains of the bases of broken off individuals occur on the convex side. Outer surface smooth, covered with cortex. Central cavity tubular, with diameter identical with that of osculum and passing only through the extended part of the sponge. Aporphyses with a stem about 0.75 mm. in diameter. At the apex, the canal diameter amounts to 0.6—0.75 mm. Epirhyses short and tortuous, varying in length, irregularly distributed.

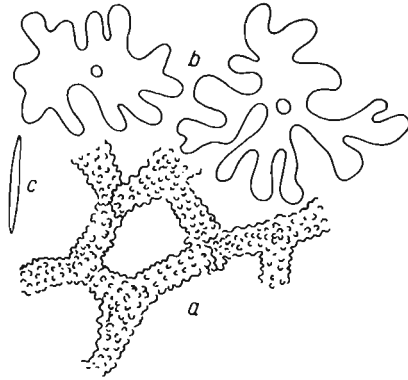


Fig. 15. — *Eustrobilus extraneus* n.sp., Lower Campanian, Pniaki; *a* a fragment of the parenchymal network consisting of lumpy tetracles, *b* dermal phyllotriaenes, *c* amphioxeas (Z. Pal. UŁ Sp. II/1617); $\times 46$.

Dermal skeleton, covering the entire sponge, consists of phyllotriaenes with a short rhabdome and arranged in layers. Cladomes deeply cut out and 1.5—2 mm. in span.

Parenchymal skeleton is built of fragile and fine-lumped tetracles. Lumps are irregularly scattered all over the surface of a tetracle. On the flattened side of the sponge, tetracles are still finer; some of their clones are ramified with invisible terminations. Zygomes rather small, hooklike. Length of clones varies within limits of 0.15 and 0.24 mm. and their thickness amounts to 0.06 mm. On the outer surface of the sponge, tetracles are almost flat; the apical ray is either reduced, or considerably shortened. Fairly numerous oxeas, variable in length and, sometimes, also sterrasters occur in canals and pores. Elliptical sterrasters, 0.018×0.021 and 0.018×0.024 mm. in diameter, as well as, less frequently, globular ones, 0.0125 mm. in diameter, occur under cortex.

Comparison. — In the structure of its parenchymal skeleton, *E. extraneus* n.sp. is, to the greatest extent, similar to *E. callosus* Schrammen from which it fundamentally differs, however, in shape, in structure of the cortical skeleton and in the arrangement of exhalant canals. Its phyllotriaenes are, to a greater extent, cut out than those in *E. callosus*. Aporphyses run obliquely in relation to the paragaster and not horizontally

as is the case in *E. callosus*. According to Schrammen (1910, p. 103), Moret (1925, p. 186) and Bieda (1933, p. 19), specimens of *E. callosus* may be cylindrical or pear-shaped, while our specimen is spade-macelike in shape, that is, different than other species of this genus.

Occurrence. — Poland: Pniaki, Lower Campanian.

Genus *Ragadinia* Zittel, 1878

(Type species: *Cupulospongia rimosa* Roemer, 1864)

The taxonomic position of the genus *Ragadinia* has not so far been clear. Schrammen (1920—1924), Moret (1925), Bieda (1933) and Defretin-Lefranc (1958) assign it to the Discodermiidae, while Lagneau-Hérengeger — to the Plinthosellidae. In the latter author's opinion, the lumpiness of desmas makes them more similar to the Plinthosellidae than to the Discodermiidae. In all specimens of this genus, here investigated, such desmas have a morphology of the Discodermiidae type and dermal spicules are differentiated from dichotriaenes, through phyllotriaenes almost up to discotriaenes. These are not plates, as is the case in *Plinthosella* Zittel. Numerous sterrasters occur in all the species investigated which also allows one to attribute this genus to the Discodermiidae and not to the Plinthosellidae.

Occurrence. — Cenomanian through Campanian.

Ragadinia rimosa (Roemer, 1864)

(Pl. XIII; Figs. 1 a, b; Text-fig. 16)

1864. *Cupulospongia rimosa* (Roemer); A. F. Roemer, Spongitarien . . . , p. 51, Pl. 17, Fig. 8.
 1933. *Ragadinia rimosa* (Roemer); F. Bieda, Gąbki . . . , p. 18 (here earlier synonymy).
 1958. *Ragadinia rimosa* (Roemer); S. Defretin-Lefranc, Contribution . . . , p. 113, Pl. 19, Fig. 1; Text-fig. 35.
 1963. *Ragadinia rimosa* (Roemer); W. Wagner, Die Schwammfauna . . . , p. 100.

Material. — Thirty six differently sized, silicified or calcified fragments. Thirteen of them well-preserved. Spiculation very well-visible.

Dimensions (in mm.):

	Height	Width	Thickness of walls
Smallest specimen (Sp. II/1204)	23	13	4
Medium specimen (Sp. II/829)	70	60	11
Largest specimen (Sp. II/829A)	100	118	13

Description. — Sponge shaped like an asymmetrically bent plate with or without a stem. Stem blunt, bunglike in shape, sometimes flattened and coiled up in the form of a roll. Upper margin rounded. Wall surface non-uniform. On the inner side, which is concave after the de-

struction of cortex, conical protuberances and, less frequently, depressions with radially diverging furrows are recorded in some specimens; in others, this surface is flat and covered with tortuous grooves. Outer side convex, mostly covered with canals which are disposed in a fanwise-radial manner. Aporhyses tortuous, anastomosing, about 0.5 mm. in diameter, wider in marginal parts (0.75 mm.) and, to a greater extent, crowding the outer surface of the sponge. Postica are variously arranged, either they are contracted in the center of starlike grooves, or situated in slight depressions, or on top of protuberances. Prosopyles, 0.3—0.6 mm. in diameter, are irregularly scattered or situated on the bottom of canals. Tortuous canals without any definite arrangement run inside the walls.

Dermal skeleton forms a thin layer, covering the entire surface and consisting of phyllostriaenes and sharp-edged, cut out, very fine, rhizo-

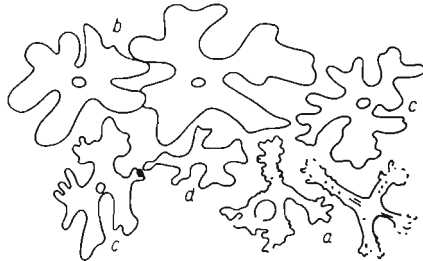


Fig. 16. — *Ragadinia rimosa* (Roemer), Lower Campanian, Bonarka; a parenchymal tetracclones, b dermal phyllostriaenes of the exhalant surface, c dermal phyllostriaenes of the inhalant surface d dermal rhizoidal elements (Z. Pal. UŁ Sp. II/1612); $\times 40$.

idal elements. Phyllostriaenes of both surfaces are not identical: on the outer surface, they are fine, strongly cut out and with a cladome 0.5 mm. in span, on the inner — solid, more flattened, similar to discotriaenes and with a cladome reaching 0.65 mm. In all specimens, numerous oval sterrasters, variable in size and with diameters fluctuating between 0.009×0.012 and 0.021×0.030 mm. occur on the surface below the cortex, elliptical ones being more abundant and globular, 0.0045 to 0.009 mm. in diameter, less so. Sterraster surface is rough.

Parenchymal skeleton makes up a close, fairly dense network, consisting of fine-lumped or almost smooth tetracclones with a fairly ramified zygome. Near the surface, tetracclones are more lumpy than within the network; sometimes, smooth tetracclones predominate inside the wall. The length of clones varies from 0.1 to 0.3 mm. Wider meshes, encircling tubular canals are distinctly visible in the network. Comitelia are numerous. These are amphioxees different in length. Microscleres of the sterraster type occur by ones on the surface of the network, surrounding canals.

Variation is displayed in the size of individuals, their shape, thickness of plate, relief of surface and manner of fastening to the substratum. In *R. rimosa* from the "opoka" facies at Bonarka, sterrasters are smaller than in the specimens of this species from the Lower Campanian of the marly facies. Specimens, representing successive stages of growth, occur in the Lower Campanian marls at Zbyczyce. The characters of *R. rimosa* from Poland, cited below, indicate ontogenetic variation.

Table 12

Variation of characters in *Ragadinia rimosa* (Roemer) from Poland (dimensions in mm).

Specimens Z.Pal.UŁ Sp. II	Specimen measurements			Spicule measurements		
	height	width	thickness of wall	length of clones	phyllotriasenes	
					inner surface	outer surface
828	23	13	4	0.09—0.15	—	—
1215	30	20	5	ca. 0.21	—	0.36
1057	62	38	8	0.18—0.21	0.36	—
827	72	—	10	0.21—0.30	0.45	0.50

Comparison. — The specimens of *R. rimosa* from "opoka" of Bonarka are thin, fragile and mostly radially furrowed, their wall thickness varying from 4 to 8 mm., while those from clayey marls of the Lower Campanian of Zbyczyce are more solid, their wall thickness amounts to 8—13 mm. and surface is irregularly furrowed. More or less the same differences have been found in this species, coming from the Lower and Upper Campanian sediments, by Schrammen (1910) who maintains that the specimens of *R. rimosa* from *Bel. mucronata* zone of North-western Germany have thicker walls with wider grooves on both sides than the specimens of this species from *Actinocamax quadratus* zone of Germany. Specimens from the Lower Campanian of Poland differ from the West-European ones in their shape; specimens of *R. rimosa* from Hanover are shaped like an ear, a bowl or a cup, while those from the Santonian of Northern France — like a funnel or a cup. Polish specimens mostly resemble a flatly spread or tubularly folded leaf with an asymmetrically indented side. Some of our specimens are identical in size with those of the Cenomanian of France.

Occurrence. — Poland: Zbyczyce, Bonarka, Miechów, Skrajniwa and Pniaki, Lower and Upper Campanian. In Germany, England, France and Czechoslovakia, *R. rimosa* occurs from the Cenomanian to the Senonian inclusively. In Cenomanian, this species occurs rarely. More frequently, it may be met with in the Senonian, especially in the Santonian of Southern France. In particular, it is richly represented in the Campanian of Germany.

Ragadinia foraminifera n.sp.
(Pl. XII, Figs. 1 a—c, Text-fig. 17)

Holotypus: Pl. XII, Figs. 1 a—c (Z. Pal. UŁ Sp. II/1466).

Stratum typicum: Lower Campanian, clayey marl.

Locus typicus: Zbyczyce, a quarry in the forest.

Derivatio nominis: Lat. *foramen* — after foramina, occurring on the outer surface.

Diagnosis. — Sponge fanlike in shape with undulated margins; loosely distributed thimble-shaped exhalant cavities occur on the inner surface. Irregular processes are observed on the outer wall.

Material. — Three specimens of which one only (holotype) is complete.

Dimensions of holotype (in mm.):

	Height	Thickness of base	Max. width of wall	Diameter of stem
Specimen Sp. II/1466	95	25	60 (top) 10-12 (base)	30 × 14

Description. — Sponge fan-shaped, mounted on a short, thick stem limited by a necklike contraction; upper part of the sponge and its margin unevenly wavy; oval, thimblelike cavities to 5 mm. deep and 2—4 mm. wide, loosely and irregularly distributed, occur on the internal, concave surface. In addition to folds, two irregular processes, one of them hook-shaped and turned upwards, are situated on the external side of the holotype. The surface is almost smooth, slightly and irregularly furrowed. Radially disposed furrows are visible around some orifices.

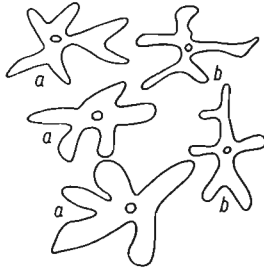


Fig. 17. — *Ragadinia foraminifera* n.sp., Lower Campanian, Zbyczyce; dermal phyllostriaenes: a of the exhalant surface, b of the inhalant surface (Z. Pal. UŁ Sp. II/1466); × 35.

Pores invisible. Very fine and short, tortuous and anastomosing canals are revealed in the transverse section of the wall. The demarcation of the inhalant and exhalant systems is indistinct.

Dermal skeleton forms cortex whose phyllostriaenes are more cut out than those in *R. rimosa* but, like in the latter species, with surfaces different from each other. There occur numerous elliptical sterrasters with dimensions varying from 0.012×0.015 to $0.012 \times 0.015 \times 0.033$ mm.

Parenchymal skeleton, uncovered in a few places, is built of fine-lumped tetracles, identical with those in *R. rimosa*.

Comparison. — The specimens investigated approach *R. rimosa* from which they differ, however, in their undulated margins and walls, as well as in the presence of cavities on the external wall. Like in *R. rimosa*, the surfaces are not furrowed. The specimens of *R. rimosa* forma *elongata* Schrammen also have macelike processes but they are situated on the margins and not on the lateral surface. Specimens of *R. foraminifera* n.sp. are larger in height than in width; their surfaces are also, except for the cavities, smooth and pores invisible. The species *R. doederleini* Schrammen, slightly similar in its body shape, has distinctly outlined pores, surrounded with canals and the ratio of the height to the width amounts, in the largest specimen from Germany (Oberg), to 1 : 2.5.

Occurrence. — Poland: Zbyszce and Skrajniwa, Lower Campanian.

Family **Astrocladiidae** Schrammen, 1910

Genus *Astrocladia* Zittel, 1878

(Type species: *Astrocladia ramosa* Michelin, 1847)

Astrocladia subramosa (Roemer, 1864)

1864. *Astrospongia subramosa* Roemer; A. F. Roemer, Spongitarien . . . , p. 54, Pl. 19, Fig. 3.
 1963. *Astrocladia subramosa* (Roemer); W. Wagner, Die Schwammfauna . . . , p. 186 (here earlier synonymy).

Material. — One stipe with very well-preserved postica and a network of tetracles.

Description. — This is a fragment of a cylindrical stipe 23 mm. long and 8 mm. thick. Outer surface even; upper pole rounded, lower — lacking; ostia round, 0.15—0.25 mm. in diameter, numerous and irregularly scattered; postica 0.3—0.4 mm. wide, irregularly disposed in the apical part and radially — in the lower part of the stipe. Canals tubular, not very long, wider than the meshes of the skeletal network. Parenchymal skeleton dense and compact, with irregular meshes of the network, consisting of very fine and small tetracles; the desmaclones ca. 0.06 mm. long and smooth; tattered zygomes form elongated, fairly solid zygoses owing to which the network looks relatively compact.

Comparison. — The tetracles of the specimen investigated correspond to those in *A. subramosa* from North-western Germany; the radial arrangement of postica also testifies to this conspecificity. In *A. lerouxia* Moret and *A. induta* Schrammen, postica are irregularly scattered while in *A. nitida* Schrammen they form rows.

Occurrence. — Poland: Przesławice, marly sediments of the Maastrichtian on the Proszowice Plateau. Germany: Oberg and Gelntorf, marly

limestone and glauconitic sandstone of the Lower Campanian, as well as the Upper Campanian marls at Misburg. France: vicinities of Saint-Cyr, Santonian.

Family **Phymaraphiniidae** Schrammen, 1910

Genus *Prokaliapsis* Schrammen, 1901

(Type species: *Rhagadina clavata* Hinde, 1883)

Prokaliapsis clavata (Hinde, 1883)

(Pl. XXIII, Figs. 2—4, Text-fig. 18)

1883. *Rhagadina clavata* Hinde; J. G. Hinde, Catalogue . . . , p. 84, Pl. 19, Fig. 4 a—c.

1901. *Prokaliapsis cylindrica* (Hinde); A. Schrammen, Neue Kieselschwämme . . . , p. 8, Pl. 1, Fig. 5; Pl. 4—1.

1910—1912. *Prokaliapsis clavata* (Hinde); A. Schrammen, Die Kieselspongien . . . , p. 108, Pl. 8, Figs 9—12, Text-Pl. 6—1.

1925. *Prokaliapsis clavata* (Hinde); L. Moret, Contribution . . . , p. 193, Fig. 72—2.

Material. — Five specimens with the preserved cortex; parenchymal skeleton visible near the surface; water system poorly preserved.

Description. — Sponges cylindrical, straight or slightly bent, mostly with a lateral process; upper pole conical with a small cavity at the top, surrounded by fine furrows. Outer surface covered with cortex, smooth, after the destruction of cortex, either porous, or slightly furrowed longitudinally. Canal system indistinct; subcortical inhalant pores, 0.3—0.6 mm. in diameter, loosely and irregularly distributed; postica grouped on the apex.

Dermal skeleton forms a thin layer, consisting of phyllotriaenes with fine, narrow and deeply cut out tetracles, protruding over the outer

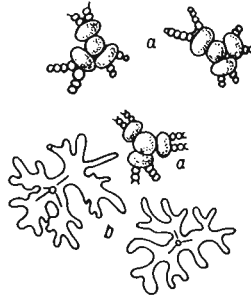


Fig. 18. — *Prokaliapsis clavata* (Hinde), Lower Campanian, Zbyczyce; a parenchymal tetracles, b dermal phyllotriaenes (Z. Pal. UŁ Sp. II/876); $\times 35$.

surface; cladome span variable from 0.3 to 0.6 mm.

Parenchymal skeleton compact, consisting of tetracles which, on their rays, have a globular swelling, occurring close to the surface of the central part of desma; apical clone transformed into a small ball with fine ornamentation; the remaining section of clones behind the globular swelling consists of lumps, arranged in rows; this part of clones is either single or forked; zygomeres slightly ramified; clone length varies

from 0.15 to 0.3 mm. The arrangement of zygoses is stellate. Amphioxeas, varying in length, occur as comitalia. The smallest specimen investigated has, as compared with the remaining ones, almost capillary desmas, its swellings and lumpiness being scarcely perceptible.

Comparison. — Polish specimens of the investigated species are smaller than the West-European ones and differ from them in shape and in the lack of the central cavity.

Occurrence. — Poland: Zbyszce and Pniaki, clayey marl of the Lower Campanian. Germany: Campanian. France: Emscherian of the vicinities of Nice. England: Wiltshire, Upper Chalk.

Prokaliapsis arborescens (Michelin, 1840)

(Pl. XXIII, Fig. 1, Text-fig. 19)

1840—1847. *Jerea arborecens* Michelin; H. Michelin, *Iconographie...*, pp. 136—137, Pl. 42, Figs. 2 a—b (*vide* L. Moret, 1925).

1925. *Prokaltapsis arborescens* (Michelin); L. Moret, *Contribution...*, p. 194; Pl. 7, Fig. 5; Pl. 12, Fig. 15; Pl. 14, Fig. 12; Text-fig. 72

Material. — Two almost completely silicified specimens with a preserved morphology of the surface and spiculation, as well as a cylindrical fragment of (probably) a stem.

Dimensions (in mm.):

	Length	Diameter of upper part	Diameter of stem
Specimen Sp. II/1625	60	20 × 20	10
Specimen Sp. II/1626	40	45 × 30	10
Specimen Sp. II/1604	65	—	8

Description. — Sponges funnell-shaped, with walls 5 mm. thick, mounted on a thin stem; funnell margin rounded. On the cortex, ostia are 0.06 mm. in diameter and, under the cortex the prosopyles vary from 0.45 to 0.6 mm. Epirhyses short, running towards subdermal cavedia which are variable in size. In a cross section, 10 aporhyses, visible in the stem, are 0.75—1.2 mm. in diameter.

Dermal skeleton consisting of phyllostriaenes, arranged in layers; on the inner surface, phyllostriaenes are large, fairly thick, with sharply cut out margins and their cladome is 0.45 to 0.6 mm. in diameter, while on the outer surface, they are finer, thinner, with narrower clones and their cladome span varying within limits of 0.45 and 1.0 mm.

Parenchymal skeleton, in the marginal part of the funnel, consists of non-uniform desmas: on the outer side, tetracclone rays are short, 0.09—0.1 mm., and ramifying just behind the swelling, while, on the

inner side, corresponding to the wall of the paragaster, clones are longer, equalling 0.15 mm. In these desmas, the swelling is smaller and the part of the clone behind the swelling consists of small globes. Zygomes are slightly ramified with hooklike terminations; their apical ray on both surfaces is transformed into a tubercle. Megarhizoclones and oxeas also

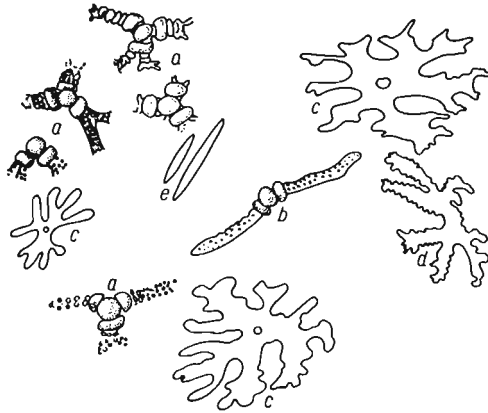


Fig. 19. — *Prokaliapsis arborescens* (Michelin), Lower Campanian, Pniaki; *a* parenchymal tetracloones, *b* a modified desma on the outer surface, *c* dermal phyllo-triaenes, *d* parenchymal megarhizoclone, *e* oxeas (Z. Pal. UŁ Sp. II/1625); $\times 35$.

are present in the network. Numerous sterrasters whose pertinence to *P. arborescens* is not, however, certain, have been etched out from the rock in which specimens are embedded.

Comparison. — *P. arborescens* has some characters common with *P. clavata*. Like in *P. clavata*, the apical ray of its desmas is globular and not pointed, as it has been observed by Moret in French specimens. The shape of the body, furrowing of the surface and the trace of canals are identical with those in typical specimens of *P. arborescens* (Michelin). Generally speaking, Polish specimens are very close to those, described by Moret from France.

Occurrence. — Poland: Pniaki, Lower Campanian marl; France: on the secondary chalk bed at Montrichard and in the lumachelle of Miocene of de Pauvrely.

Genus *Cycloclema* Schrammen, 1910—1912
(Type species: *Rhagadinia compressa* Hinde, 1883)
Cycloclema compressa (Hinde, 1883)
(Pl. XXI, Figs. 1 and 2, Text-fig. 20)

1883. *Rhagadinia compressa* Hinde; J. G. Hinde, Catalogue..., p. 82, Pl. 19.

1958. *Cycloclema compressa* (Hinde); S. Defretin-Lefranc, Contribution..., p. 115, Pl. 19, Figs. 2—3, Text-fig. 37.

Material. — Four specimens with calcified skeletons and two silicified ones; canals hidden by sediment. Desmas well visible. Dermal skeleton preserved in fragments only.

Dimensions (in mm.):

	Height	Diameter of upper part	Diameter of stem
Smaller specimen Sp. II/826	40	30	9
Larger specimen Sp. II/86	35	67	10

Description. — Sponges funnellike or earlike in shape. Opening angle of the funnel is larger than its height; lower pole terminating in a stem; funnel margin slightly flanged and rounded, about 8 mm. thick. Wall surface flat or slightly furrowed. Ostia oval, 0.75 to 1.5 mm. in diameter (specimen Sp. II/1297), are situated at considerable distances from each other. The depression of the funnel corresponds to the central cavity.

Dermal skeleton forms a not very thick layer, consisting of flattened and fairly deeply cut out phyllotriaenes. This skeleton covered the stem and funnellike part from the outside. Solid amphioxeas, mostly broken, are obliquely embedded in the meshes of the network.

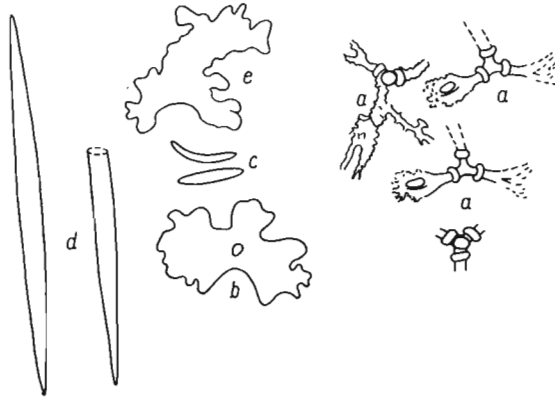


Fig. 20. — *Cycloclema compressa* (Hinde), Upper Campanian, Miechów; a parenchymal tetraclones, b dermal phyllotriaenes, c amphioxeas, d large amphioxeas, e rhizoidal elements (Z. Pal. UŁ Sp. II/86/58); $\times 25$.

Parenchymal skeleton, uncovered in the stem, not very compact, consisting of tetraclones with an annular swelling near their middle. Clones varying in length from 0.15 to 0.45 mm. Zygoes dichotomously ramified. Tetraclones without the zygoe on one of the rays and terminating in lumps or spines may be also found in the network. Zygoes formless and reticulate. Parenchymal skeleton of the funnellike part forms a fairly loose network with oval meshes 0.6—1.2 mm. wide.

On the outer sides, zygomes are arranged in bands. In the lower part of the sponge, these bands are shorter, variable in trace and mostly disposed across the stem where they mark off the furrows. In the upper part, particularly on the rounded margins of the funnel, the bands are longer and the direction of their arrangement is parallel to the height. No furrows are recorded on the internal side of the funnel. In one specimen, well-preserved apical clones are transformed into a tubercle, protruding on the outside. In this specimen, tetracloves have, in some places, smooth rays, devoid of rings.

Comparison. — The specimens of *C. compressa* investigated differ from the West-European ones in a more shapely form. According to Moret (1925), *C. compressa* from Central France are more slender.

Table 13

Dimensions (in mm.) of the specimens of *C. compressa* from the Upper Cretaceous of Europe

Country and age	Height	Width	Thickness of walls	Diameter		Tetra-clones	Zygomes
				of ostia	of postica		
France, Ardennes, Cenomanian	90	70	25	0.6–1.2	1.0	fairly solid	slightly ramified
Germany, Campanian	100	100	8–12	1.0–1.5	smaller than ostia	large	—
France, on the secondary bed	45–110	40	7	0.5	large	large	—

C. compressa displays a similarity to *Prokaliapsis arborescens*, shown in its funnellike shape and in its dermal skeleton, consisting of phyllotriaenes. The morphology of tetracloves makes up a fundamental difference. In *C. compressa*, the swelling on clones is annular, slightly withdrawn from the spicule center and the rays are longer, while in *Prokaliapsis* this swelling is globular, ornamented, situated close to the center and mounted on short clones. In *C. compressa*, investigated during our studies, like in the specimens, described by Hinde (1883) from England the presence was stated of phyllotriaenes which were not observed by Schrammen (1910–1912) and Moret (1925) in specimens from Germany and France.

Occurrence. — Poland: Skrajniwa, Lower Campanian and Miechów, Upper Campanian; France: Upper Cretaceous and the Miocene shellstone on the secondary bed, Marlemont in the Ardennes, Cenomanian; Germany: Lower and Upper Campanian; England: Oare, Huish Wiltshire, Upper Chalk.

Family **Plinthosellidae** Schrammen, 1910Genus *Plinthosella* Zittel, 1878(Type species: *Plinthosella squamosa* Zittel, 1878)*Plinthosella squamosa* Zittel, 1878

1878. *Plinthosella squamosa* Zittel; K. Zittel, Studien..., p. 89, Pl. 2, Fig. 10; Pl. 10, Fig. 5, Part 2; Beiträge..., p. 581.
1961. *Plinthosella squamosa* Zittel; H. Nestler, Spongien..., p. 23, Pl. 3, Figs. 4—7; Pl. 4, Figs. 1—4.
1961. *Plinthosella squamosa* Zittel; M. Koltun, Spikuly kremnevych..., p. 66.

Material. — Twenty eight not very well-preserved specimens.

Dimensions (in mm.):

	Diameter
Smallest specimen (Sp. II/297)	10 × 8 × 3
Largest specimen (Sp. II/280)	28 × 19
Cenomanian specimen (Sp. II/283)	to 55 × 25 × 40

Description. — Sponges globular-oviform or lenticular in shape. In globular forms, poles are not differentiated, in hemiglobular, sometimes, the upper pole is shaped like a conical protuberance. Surface smooth. Central cavity lacking. Ostia and postica not marked off. Canals indistinct.

Dermal skeleton built of peculiar acrepidal plates, arranged like tiles. These plates, variable in outline, are mostly quadrangular. Sometimes, they cover the entire surface, in other cases — only the lower part of the sponge where they are arranged in layers.

Parenchymal skeleton, in general poorly preserved, consisting of tetramyrmeclones with their rays to 0.36 mm. long and 0.06—0.12 mm. thick. Apical ray reduced; zygomes terminating in a hooklike form. Central part of desma covered with lumps, larger than those on clones, where they are arranged in regular verticils.

Comparison. — Our specimens do not differ from those, described from Germany and France.

Occurrence. — Poland: Wolbrom, Cenomanian; Komorowo, Miechów, Przesławice, Muniakowice, Zbyczyce, Szczepanowice and Gnatowice — Campanian; France: Emscherian and Cenomanian; Germany: Weissenberg, Turonian, Lower and Upper Campanian, Rügen Island, Maastrichtian; South of England: Wiltshire, Upper Chalk.

Plinthosella elegans n.sp.

(Pl. XIII, Figs. 2 a—c; Text-fig. 21)

Holotypus: Pl. XIII, Figs. 2 a—c (Z. Pal. UŁ Sp. II/1013).

Stratum typicum: Lower Campanian, clayey marl facies.

Locus typicus: Pniaki, hamlet quarry.

Derivatio nominis: *elegans* — Lat. *elegans* = ornamental, after its ornamental spicules.

Diagnosis. — *Plinthosella* in the form of an inverted cone with a convex, uneven apical surface. Lower part with small processes. Lumps in tetramyrmeclones regularly arranged in rows. Dermal plates present only on lateral walls.

Material. — Three silicified specimens with a well-preserved structure of the skeleton; the fourth specimen calcified, embedded in marl.

Dimensions (in mm.):

	Length	Diameter of	
		apex	stem
Smallest specimen (Sp. II/1294)	13	17	3
Medium specimen (Sp. II/1202)	25	22 × 28	3
Largest specimen, holotype (Sp. II/1013)	12	35	4

Description. — Sponge shaped like an inverted cone with a wide apical part. Upper surface convex, uneven, oval in outline, with a roller-like, oblong protuberance in the middle. Lower pole conical, terminating in a blunt, short stem. Lateral surface somewhat undulated longitudinally, with small, irregularly distributed processes. Central cavity lacking. Ostia not marked off; postica 1.2—1.5 mm. wide, grouped on the upper pole and situated in small cavities, radially surrounded by grooves.

Dermal skeleton, covering the lateral surface, consists of acrepidal plates and modified superficial desmas. Plates mostly rounded, arranged in a tegular manner, in the basal part elongated and, in the upper part, oval. In addition to plates, numerous vermiform, elongated desmas

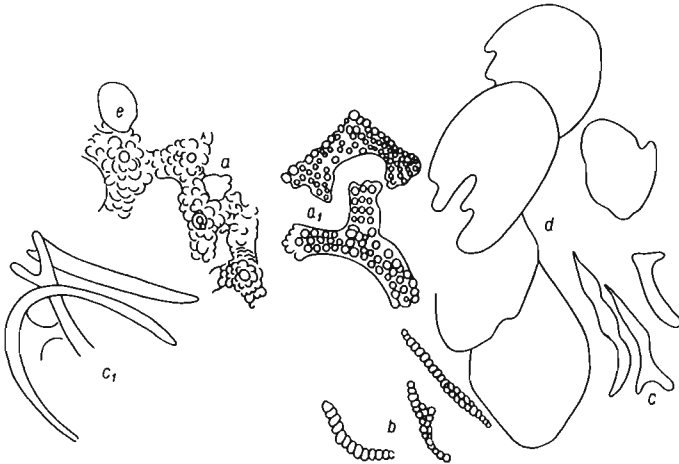


Fig. 21. — *Plinthosella elegans* n.sp., Lower Campanian, Pniaki; a parenchymal tetraclones, a₁ parenchymal tetraclones — schematic drawing, b vermiform lumpy cortical megascleres, c cortical megascleres, modified, smooth, c₁ megascleres situated close to processes, d acrepidal dermal plates, e parenchymal network meshes (Z. Pal. UŁ Sp. II/1013); × 30.

with either smooth or lumpy surface, occur in cortex; some of them ramify; globular lumps are arranged on them in regular rows. Protruding lateral processes are formed of the bundles of fine, elongated megascleres which — in their shape — approach monaxons. These spicules, close to processes, are transformed into vermiform, irregular, smooth desmas which — in their shape — resemble flattened tetracles. The length of vermiform desmas fluctuates from 0.12 to 0.13 mm. They make up part of the dependent cortex.

Parenchymal skeleton, fully uncovered on the apex, consists of large tetramyrmeclones. On the upper pole, these desmas have the apical ray shortened and protruding on the outside. The remaining clones are 0.15 mm. thick and 0.3—0.4 mm. long. Zygoses are invisible. Large marginal monaxons stuck around postica. Numerous, fine oxeas are situated in the apex canals.

Comparison. — *P. elegans* n.sp. differs from *P. squamosa* mainly in the structure of its cortical skeleton and in a slightly different body shape. The new species approaches *P. acanthodes* Defretin-Lefranc from which it differs, however, in the shape of plates, in the presence of vermiform desmas and monaxonic spicules in cortex, as well as in the regular arrangement of lumps on the surface of desmas. The new species differs from *P. squamosa* Zittel in the arrangement of lumps which, in *P. squamosa* are verticillate and, in *P. elegans*, are disposed in rows on clones.

Occurrence. — Poland: Pniaki, Lower Campanian.

Plinthosella sp.

(Pl. XII, Fig. 3, Text-fig. 22)

Material. — One specimen, almost complete, except for stem and cortex which are lacking. Desmas distinctly visible.

Dimensions (in mm.):

	Height	Diameter
Specimen Sp. II/457	15	35

Descriptions. — Sponge platelike in shape. Upper pole slightly concave with small prominences. A trace of a very thin stem, excentrically situated on the lower, somewhat convex, pole. Wall surface flat, without any traces of dermal plates, except for the stem within which they are slightly discernible. In the specimen investigated, the water system is better-developed than in *P. squamosa* Zittel and rather similar to that in *P. elegans* n.sp. Tortuous canals run from the stem towards the margins.

Parenchymal skeleton consisting of tetracles similar to spicules of *P. elegans* n.sp. Numerous monaxons, different in length and thickness,

stick in the meshes of the network. Canal meshes are individualized in the network. Aporhyses, short, 0.5—0.75 mm. in diameter.

Comparison.—Two distinct characters, the shape and the well-developed exhalant system, imply that the sponge in questions may

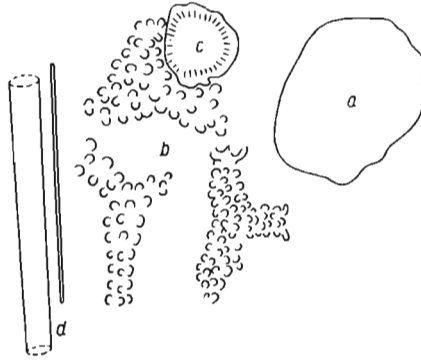


Fig. 22. — *Plinthosella* sp., Lower Campanian, Pniaki; *a* acrepidal dermal plate, *b* parenchymal tetramyrmeclones, *c* pinacid, *d* broken off monaxons variable in size (Z. Pal. UŁ Sp. II/457); $\times 30$.

represent a new species. It may well be, however, that this is only a gerontic stage of *P. elegans*. Scarcity of material does not allow one for a more accurate determination.

Occurrence.—Poland: Skrajniwa, Lower Campanian marl.

Superfamily **Helocladina** Lagneau-Hérengrer, 1962

(= **Helomorina** Schrammen, 1910)

Family **Isoraphiniidae** Schrammen, 1937

Genus *Heloraphinia* Schrammen, 1937

(Type species: *Heloraphinia arborescens* Schrammen, 1937)

Heloraphinia chordata n.sp.

(Pl. XXII, Fig. 9, Text-fig. 23)

Holotypus: Pl. XXII, Fig. 9 (Z. Pal. UŁ Sp. II/1563).

Stratum typicum: Lower Campanian, clayey marl.

Locus typicus: Pniaki near Lelów.

Derivatio nominis: *chordata* — Lat. *chorda* = cord, on account of cordlike, elongated desmas.

Diagnosis.—Cylindrical *Heloraphinia*, variable in size, without the central cavity. Inhalant system indistinct. Heloclones concentrated in irregular elongated strands. Dermal ortodichotriaenes loosely pinned in the parenchymal skeleton.

Material.—Three specimens devoid of the lower pole. Parenchymal skeleton very well-preserved, dermal — only at the upper pole.

Dimensions (in mm.):

	Height	Thickness
Smaller specimen (Sp. II/1585)	over 50	10
Larger specimen, holotype (Sp. II/1563)	over 100	22

Descriptions.—Sponge, shaped like a slightly bent cylinder with either smooth, or irregularly furrowed surface. Deeper furrows occur at both ends of the sponge; these are subdermal aporhyses 0.45–1.0 mm. wide. Ostia and epirhyses invisible. Exhalant canals, better visible in the internal part, are indistinct in outline and meandering between heloclone strands. Postica not numerous, oval, disposed at the apex.



Fig. 23. — *Heloraphinia chordata* n.sp., Lower Campanian, Pniaki; a heloclones surrounding fissural pores, b parenchymal network meshes, c zygose, d dermal dichotriaene (Z. Pal. UŁ Sp. II/990); $\times 40$.

Dermal skeleton is represented only by loose and widely scattered ortodichotriaenes with thick clones and variable cladome span.

Parenchymal skeleton consisting of elongated, twisted and, sometimes, forked heloclones, different in length and densely arranged in elongated strands parallel to each other. These heloclones are shaped like smooth, not twisted sticks to 3 mm. long. Zygomes are slightly flattened, rounded or bluntly terminating and provided with a concave articular surface. Single microscleres of the sterraster type 0.15 mm. in diameter occur between heloclones.

Comparison.—Spicules of the investigated specimens are similar to desmas of *Isoraphinia* Zittel and to ophirhabds of *Ophiraphidites* Schrammen (1910, p. 119, Pl. 7, Fig. 6). According to Moret (1925, p. 129, Fig. 51), in *Isoraphinia*, heloclones are smooth, slightly twisted and forklike at their terminations. In the investigated specimens, heloclones so terminating are visible only in a few places. Most spicules have bluntly terminat-

ing zygomes, smooth and not twisted surface. Spicules of our specimen differ from ophirhabds in being shorter, in a not so strong S-shaped deflection, in thicker zygomes and in the presence of lateral branches. Their arrangement also is different. In the investigated specimen, like in *Isoraphinia*, these spicules are arranged in strands and not densely crowded, like in *Ophiraphidites*. Like in *Isoraphinia*, irregular meshes are formed in the skeleton. Despite the similarity of spicules to those of the genus *Isoraphinia*, I do not assign the investigated specimens to this genus since the latter is characterized by the presence of the central cavity which is absent from my specimens. The assumption that the cylindrical specimens may be fragments of a stem of indeterminate genus is contradicted by the presence of the upper pole with postica, as well as by the fact that heloclones do not display modifications, usually displayed in the structure of the stem skeleton. Our specimens have a form, approaching that of *Heloraphinia arborescens* Schrammen (1937) from the Malm and their heloclones are identical with those in *Heloraphinia* sp. described by Lagneau-Hérenger from the Aptian of Spain (1962, Pl. 25—1). The new species differs from *H. arborescens* Schrammen in its shape, dimensions and a smooth surface without any tubercles.

Occurrence.—Poland: Pniaki, Lower Campanian, clayey marl.

Genus *Inodia* Moret, 1925

(Type species: *Inodia elisabethae* Moret, 1925)

Inodia elisabethae Moret, 1925

1925. *Inodia elisabethae* Moret; L. Moret, Contribution..., p. 127, Pl. 5, Fig. 5, Text-fig. 50.

Material.—Two fragments with very well-preserved spicules.

	Height	Diameter
Specimen Sp. II/47a	18	12 × 8
Specimen Sp. II/47b	42	11 × 8

Description.—Stipes cylindrical in shape, almost uniform in thickness, with poles not preserved; surface flat; pores invisible; prosopyles in the form of fissures, varying in length from 0.3 to 0.5 mm. and in diameter from 0.03 to 0.15 mm. Epirhyses and aporhyses indistinct.

Parenchymal skeleton looks like a bundle consisting of very thin, elongated spicules, varying in length (to 2 mm.), with lateral, irregular offshoots. Some desmas are straight, smooth, without offshoots, others have very short offshoots with flat ends, unilaterally situated over the entire length. Parenchymal network is formed by terminal offshoots overlapping each other and by the adherence of their flat zygome to the epirhabd of the adjoining desma.

Comparison. — The investigated specimens have spicules very similar to those of *Inodia elisabethae*, as well as to the spicules, presented by Zittel as modified tetracles in the stem of *Phymatella tuberosa* (Quenstedt) (Zittel, 1924, Pl. 63, Fig. 65; 1878, II, Pl. 8, Fig. 36). Over the entire length of one of the specimens (ca. 60 mm.), desmas do not display deformations which are usually recorded in the stem skeleton. The conclusion that this is not a stem is confirmed by the specimen Sp. II/138/140, described in the present paper as *Inodia* sp., in which desmas are thicker but their morphology is similar. For this reason, I assign the investigated specimens, although they are incomplete, to *Inodia elisabethae* Moret.

Occurrence. — Poland; Przesławice, Lower Maastrichtian; France: Orne, Cenomanian.

Inodia sp.
(Pl. XXII, Fig. 10)

Material. — Three fragments, without poles, preserved in marl; etched desmas on the surface. Arrangement of canals visible on the transverse section.

Dimensions (in mm.):

	Height	Thickness
Specimen Sp. II/138/140	over 100	30

Description. — Cylindrical sponge, with a flat, longitudinally furrowed surface. Furrows varying in length and 0.75—1.0 mm. wide. Prosopyles oval, 0.15—0.2 mm. in diameter, densely disposed in the desma openings between the furrows. Epirhyses of a size, equal to the width of pores, situated obliquely in relation to aporhyses. In central part of the sponge, aporhyses are tubular, 0.75—1.0 mm. in diameter concentrically arranged.

Parenchymal skeleton consisting of elongated heloclones, bent and hookwise ramified at the ends; some lateral clones have flattened or bowl-like zygomes. In the outer part of the network, heloclones are more solid and less ramified than in the inner part. Length and thickness of desmas and their clones are variable.

Comparison. — Although the arrangement and manner of connecting heloclones in the investigated specimens are identical with those in *Inodia elisabethae* Moret, their shape, more distinctly developed canal system and greater dimensions of ostia and heloclones, seem to indicate a different, probably new species. *Inodia elisabethae* is bushy and has finer stipes, whereas the fragments investigated seem to be rather single,

fairly solid individuals. Any closer determination is, however, made difficult by the scarcity of material.

Occurrence: — Poland: near Miechów, Upper Campanian marl.

Genus *Carterella* Zittel, 1878

(Type species: *Jerea cylindrica* Gümbel, 1878)

Carterella cf. *cylindrica* (Gümbel, 1878)

(Pl. XXII, Fig. 2, Text-fig. 24)

1878. *Carterella cylindrica* (Gümbel); K. Zittel, Studien..., II, pp. 99, 132, Pl. 2, Fig. 7.

1878. *Carterella cylindrica* (Gümbel); K. Zittel, Beiträge..., p. 596.

Material. — Eight fragments without basal parts, with well-preserved skeleton.

Dimensions of fragments (in mm.):

	Height	Thickness
Specimens Sp. II/1427 and Sp. II/454	20-58	4-8

Description. — Branches cylindrical, non-uniform in thickness, sometimes, flattened, narrowing upwards. Prosopyles oval, indistinctly individualized, not numerous, distributed between heloclones. Outer surface of heloclones is flat. Exhalant system consisting either of one canal 3×2.1 mm. in cross section, probably running throughout the entire height of the sponge, or of a few narrower canals. Epirhyses short, radially arranged.

Dermal skeleton is represented only by ortodichotriaenes with a cladome span varying between 0.12 and 0.36 mm. and with arcuate clones.

Parenchymal skeleton consists of very fine heloclones which ramify or have lateral actines with a flattened zygone and which are arranged

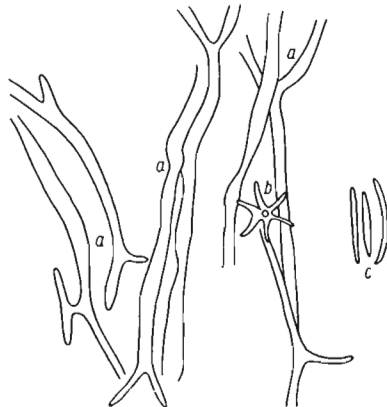


Fig. 24. — *Carterella* cf. *cylindrica* (Gümbel), Lower Campanian, Zbyczyce; a parenchymal heloclones, b dermal orthodichotriaenes, c amphioxeas (Z. Pal. UŁ Sp. II/1427); $\times 35$.

in strands. Usually, two heloclones form a knotty zygose. Length of heloclones varies from 1.5 to 2.1 mm. Numerous oxeas and amphioxeas 0.3—0.45 mm. long are obliquely pinned in the parenchymal network. Numerous microamphioxeas 0.09—0.15 mm. long, microstrongyles 0.15 mm. long and single sterrasters (3 in all) were stuck in the meshes of the network.

A very thin, newly formed twig, 10 mm. long and, at the base, ca. 2 mm. wide runs close to the lateral surface in one of the specimens. No visible change has been observed in the arrangement and structure of heloclones in its closest environment on the skeleton of the mother sponge. On the other hand, in the twig, heloclones are threadlike, without lateral offshoots but with their length approaching that of desmas in the mother individual.

Comparison. — In their externals, the investigated specimens are similar to the representatives of the genera *Inodia* and *Isoraphinia* from which they differ in a fibroidal, and not rodlike, character of heloclones. In the morphology of megascleres, they are to a greater extent, similar to *Carterella cylindrica* in which, according to Zittel, spicules are large and solid. As figured by Zittel (1878, Pl. 2, Fig. 7), the specimens of *C. cylindrica* are macelike-cylindrical, while Polish specimens are cylindrical and their heloclones are smaller.

Occurrence. — Poland: Skrajniwa and Zbyczyce, Lower Campanian; Germany: Kelheim near Ragensbrück, Cenomanian.

Genus *Pachycothon* Schrammen, 1901

(Type species: *Pachycothon giganteum* Schrammen, 1901)

Pachycothon giganteum Schrammen, 1901

(Pl. XXII, Fig. 1, Text-fig. 25)

1901. *Pachycothon giganteum* Schrammen; A. Schrammen, Neue Kieselschwämme..., p. 12, Pl. 3, Fig. 2; Pl. 5, Fig. 3.
 1933. *Pachycothon giganteum* Schrammen; F. Bieda, Gąbki..., pp. 16—17 (here earlier synonymy).

Material. — One almost complete specimen, 29 cylindrical fragments and 8 flat specimens. Skeleton well-preserved.

Dimensions (in mm.):

	Lenght	Diameter of upper part	Thickness of the calix base	Thickness of walls
Complete specimen (Sp. II/811)	100	65	48 × 20	3-18

Description. — Sponge variable in shape, flat, funnellike or earlike; lower pole makes up a thick, long, cylindrical stem, terminating in short (15 mm.), conical processes. Stem thickness varying from 8 to 30 mm.

Wall thickness variable. Surfaces of stem and of walls are different. Elongated, tortuous and anastomosing furrows, varying in length and width (0.24—1.2 mm.) run along the stem, while no such furrows occur on flat specimens and on the upper part of the funnellike ones. Water

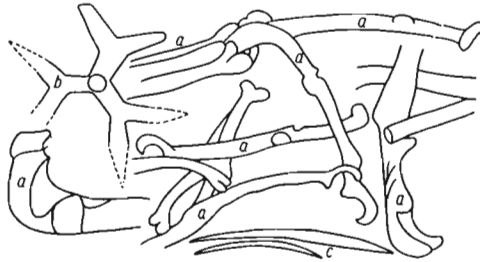


Fig. 25. — *Pachycothion giganteum* Schrammen, Lower Campanian, Zbyszcyce; a heloclones of the parenchymal skeleton, b dermal orthodichotriaenes, c amphioxeas as comitalia (Z. Pal. UŁ Sp. II/1371); $\times 17.5$.

system indistinct. Water canals tortuous, narrower than the meshes of the network. Exhalant pores, preserved in the bottom of the funnellike specimens, are 0.75 and 1.2 mm. in diameter and those on basal processes — 0.1 mm. Epirhyses very thin. Prosopyles considerably narrower than the meshes of the skeletal network and equalling 0.2—0.5 mm.

Dermal skeleton is represented only by ortodichotriaenes with clads 0.36—0.6 mm. long. They occur both on the surface of flat parts and on processes, where they are fairly loosely situated, pinned by ones. Some of them have preserved their axial canals.

Parenchymal skeleton consists of large heloclones, variable in length and width, straight, or, sometimes, bent, smooth but, in some places, having swells and, in the central part, bowllike concavities or articular humps. Terminal zygomeres are bowllike or spadelike in shape. Zygomeres form a thick knot, consisting of a small number of desmas; with microamphioxeas 0.035 mm. long preserved among them. In cylindrical specimens, heloclones are disposed in horizontal strands and, in flat specimens, the network is tangled, looser than in cylindrical ones and consisting of heloclones crossing each other. Meshes of this network are irregular, ca. 1.5 mm. in diameter. On the lower surface, the thickness of heloclones amounts to 0.75 mm., while on the upper one — to ca. 1.0 mm., the length fluctuating from 1.2 to 2.7 mm. Comitalia of the parenchymal network are in the form of prodichotriaenes. The microscleres of the following types have been washed out from the studied specimen: very numerous microamphioxeas, variable in thickness and 0.09—0.2 mm. long; numerous microstrongyles 0.06—0.18 long; microstyles 0.18 mm. long; numerous elliptical sterrasters varying in diameter from 0.12 to 0.27 mm., larger ones being more numerous. Rhaxes, with smooth sur-

face and ca. 0.09 mm. in diameter occurred sporadically; single fine sigmas C-shaped or, sometimes, less bent and one sphearaster, fairly solid and with loose, blunt rays, have also been found.

Comparison. — It has been shown by the investigated specimens that their upper part was finer and hence — in the fossil state, it is mostly preserved in fragments only, while the lower, cylindrical part is solid. The thickness of walls and the height of entire specimens, as well as the skeleton morphology of Polish and West-European specimens of *P. giganteum* are similar. According to Schrammen, *P. giganteum* may reach a surface of 1/3 sq. m. In specimens of *P. giganteum*, described by Schrammen (1910), Moret (1925) and Bieda (1933), the water system was invisible. Some traces of small aporhyses were observed by Moret. The specimens, investigated during our studies, allowed us to state that the water canals in *P. giganteum* are narrower than the meshes of the skeletal network.

Occurrence. — Poland: Bonarka, Skrajniwa, Zbyczyce, Pniaki, Lower Campanian; France: vicinities of Nice, Emscherian; Germany: Turoonian ("Scaphiten Pläner") and Upper Senonian in the north-west part of the country.

Superfamily **Megacladina** Lagneau-Hérenger, 1962

(= **Megamorina** Zittel, 1878)

Family **Dorydermidae** Schrammen, 1924

Genus *Brochodora* Schrammen, 1910, emend.

(Type species: *Brochodora ramusculus* Schrammen, 1910)

The subgenus *Doryderma* (*Brochodora*), erected by Schrammen, has never been accurately enough characterized. Defretin-Lefranc (1958) considers *Brochodora* Schrammen to be a synonym of *Doryderma* Zittel. It results from the analysis of particular species of *Doryderma* and *Brochodora* that single cylindrical, pear-shaped and macelike forms are characteristic of the genus *Doryderma* Zittel, while bushy ones, varying in thickness and length of branches, should be assigned to the genus *Brochodora* Schrammen. In the genus *Brochodora*, the skeletal network is built of short strands, consisting of megaclones. The meshes of the network play the role of the inhalant pores (prosopyles); epirhyses are short, aporhyses tubular and running along the stipes. Single, or grouped in bundles, protriaenes and monaxons, as well as fairly numerous microscleres of the microxea, microrhabd and microdiactine type, are stuck in the meshes of the network and in the water canals. The parenchymal network in *Doryderma* is, according to Zittel (1878), built of very large, smooth megaclones, more or less bent, variable in length and 0.12—0.18 mm. thick, whereas in *Brochodora* megaclones are less than

0.12 mm. thick and their length is more regular, varying from 1.0 to 2.0 mm.

The representatives of the genus *Brochodora* are often found in the Upper Cretaceous sediments of Germany, France, U.S.S.R. and Poland.

Brochodora roemeri Hinde, 1883

(Pl. XIV, Fig. 1, Text-fig. 26)

1864. *Polyjerea dichotoma* (Roemer); A. F. Roemer, Die Spongitarien..., p. 56, Pl. 16, Fig. 1.
 1883. *Doryderma Roemeri* Hinde; J. G. Hinde, Catalogue..., p. 49, Pl. 8, Fig. 3.
 1933. *Doryderma (Brochodora) Roemeri* Hinde; F. Bieda Gąbki..., p. 13 (here earlier synonymy).
 1943. *Doryderma (Brochodora) Roemeri* Hinde; J. Lachasse, Contribution..., pp. 1—42.

Material. — Twenty six partially silicified branches with well-preserved skeletons:

Dimensions (in mm.):

	Thickness of branches	Thickness of stipes	Height of stipes
Smallest specimen (Sp. II/1575)	18	16	40
Medium specimen (Sp. II/1084b)	45	23	45
Largest specimen (Sp. II/737)	18—45	16	40—45

Description. — Branches cylindrical, fairly solid, non-uniform in length, but uniform in diameter, bilaterally flattened, with apical surfaces truncated or rounded. Lateral surface flat, densely covered with oval pores, corresponding to prosopyles and limited by the megaclone strands. Postica, situated on the apex, have a diameter which is equal to aporhyses. Epirhyses short, radially disposed; aporhyses tubular, 1.2—1.8 mm. in diameter, grouped around the branch axis.

Dermal skeleton made up of fine pleuralia, consisting of oxeas, amphioxeas, protriaenes and dichotriaenes. These spicules are either stuck in prosopyles or, few of them, scattered over the surface. Very numerous microaxeas and, less so, microrhabds and microcalthrops are visible together with them.

Parenchymal skeleton, preserved in all specimens, contains thick and solid megaclones. Considerably smaller, flattened and twisted desmas, approaching in shape the typical megaclones, wind around them. The thickness of megaclones amounts to ca. 0.12 mm. and the length — to 1.8 mm. They are arranged in strands, encircling the meshes of the network, 3—4 of them in each strand. Zygomes of megaclones are bowl-like in shape. Network meshes varying in width from 0.6 to 0.75 mm.

Monaxons and protriaenes form large bundles, obliquely disposed in canals. Protriaene cladomes fine. The number of spicules in a bundle varying from a few to over 50. In prosopyles, bundles are larger; filling out the entire canal lumen. Numerous, long, single spicules, both uniaxal and protriaenes with small cladomes, occur in aporhyses.



Fig. 26. — *Brochodora roemeri* (Hinde), Lower Campanian, Zbyczyce; a arrangement of megaclones around prosopyles, b protriaenes (comitalia), c oxeas from water canals (comitalia), d embryonal megaclones, occasionally occurring in the network (Z. Pal. UŁ Sp. II/442); $\times 25$.

Variation of the investigated specimens is displayed in the thickness and length of branches, as well as in the level of the dichotomous division. Longer branches are flattened on apexes and round at the base. Apical terminations display a slight variety: there are truncated, flat or rounded apexes.

Comparison. — Polish specimens of *B. roemeri*, compared with the West-European ones, although approaching the latter in the thickness of branches, have different diameters of pores and canals. In specimens from France, described by Moret (1925), the diameters of epirhyses are smaller (0.5 mm.) than in Polish ones (0.6—0.75 mm.); aporhyses of our forms are 1.2—1.8 mm. and of French ones 1.0—1.5 mm. in diameter. On the other hand, as compared with German ones, our specimens have narrower pores and canals. The widest canals have been found in English specimens, described by Hinde (1883). The diameters of their epirhyses amount to 1.0—1.25 mm. and those of aporhyses — 2.0 mm. Like in West-European specimens, the length of branches in our specimens is not constant. German specimens, 25—40 mm. in diameter, reached to 500 mm in length.

Occurrence. — Poland: Bonarka, Skrajniwa, Zbyczyce, Podgaj, Mydlniki — Lower Campanian, and Podgórze — on the secondary bed; Germany: "Scaphiten Pläner" zone, Lower and Upper Campanian; France: vicinities of Nice — Senonian, and Saint-Cyr — Santonian; Spain: Annot and Castelet, Aptian; England: Wiltshire, Upper Chalk.

Brochodora ramusculus Schrammen, 1910

(Pl. XIV, Fig. 2)

1883. *Doryderma ramosum* (Mantell); J. G. Hinde, Catalogue . . . , p. 48, Pl. 8, Fig. 2A.
 1910. *Brochodora ramusculus* n.sp.; A. Schrammen, Die Kieselspongien . . . , p. 59, Pl. 18, Fig. 6.
 1933. *Doryderma* (*Brochodora*) *ramusculus* Schrammen; F. Bieda, Gąbki..., p. 14, Pl. 3, Fig. 1 (here earlier synonymy).

Material — Seventy five branches, varying in length, from 10 to 65 mm., with a well-preserved spiculation.

Description. — Bushy sponges, with fine, irregularly ramifying branches. Ramification manner variable; sometimes, 2—3 branches at a time occur in the same place. Branch apexes flattened or rounded. Branch thickness varies from 5 to 15 mm., averaging 8 mm. Water system not very distinct; epirhyses radially arranged, aporhyses grouped, in the middle. Ostia not individualized. Prosopyles surrounded by spicule strands. Postica situated on stipe apexes.

Dermal skeleton similar in structure to that in *B. roemeri* Hinde. Very thin protriaenes have long (1 mm.) rhabdomes and short cladomes. The surface of the sponge was probably covered with pleural spicules as amphioxeas and protriaenes, pinned in the network.

Parenchymal skeleton less regular than in *B. roemeri*. Network meshes smaller, almost identical in diameter, from 0.46 to 0.75 mm., averaging 0.6 mm. (specimen Sp. II/875). Megaclone length amounts to about 1 mm. and thickness varies from 0.03 to 0.06 mm., in thicker branches being larger. Bundles of oxeas and long-shafted protriaenes are visible in all stipes.

Comparison. — In the form and structure of the water system *B. ramusculus* is, to a greater extent, similar to *B. roemeri*. Manner of ramification, smaller dimensions of branches and arrangement of megaclones within the network make up fundamental differences between these two species. In *B. ramusculus* the network meshes are encircled by single megaclones, while, in *B. roemeri*, megaclones form small strands around the meshes.

The investigated branches of *B. ramusculus* are shorter than the specimens of this species from North-western Germany and from France. The largest of them, 90—140 mm. long and 15—20 mm. thick, have been described by Moret (1925, p. 122). Since the specimens, described by Hinde (1883, p. 48) from the Upper Chalk of Oare and Wiltshire as *Doryderma ramosum*, differ from *B. ramusculus* Schrammen only in a larger thickness of megaclones, amounting to 0.157 mm. and not 0.03—0.06 mm., I consider them to be conspecific with *B. ramusculus* (cf. synonymy).

According to Schrammen (1910) and Moret (1925), *B. ramusculus*' specimens have a form, similar to that of *Homalodora ramosa* and may be easily confused. Both these species are bushy, with branches approaching each other in size. According to these authors, they differ only in the network which is denser in *Homalodora*. The investigated specimens of both *B. ramusculus* and *H. ramosa* do not display such great a similarity in shape as that, mentioned by Schrammen and Moret since the development manner by ramification is quite different. *Homalodora ramosa* is characterized by a more regular dichotomous arrangement of branches, by the presence of an axial bundle of aporphyses 1.2 mm. in diameter and by the lack of long-shafted protriaenes and oxeas in the network meshes and in canals.

Occurrence. — Poland: Zbyczyce, Pniaki, Bonarka, Pychowice, Witkowice — Lower Campanian marl; Germany: Lower and Upper Campanian; France: vicinities of Nice — Senonian, and Basses Alpes; England: Upper Chalk. In Poland, this species also met with on the secondary bed in the Miocene sediments in the vicinities of Cracow.

Brochodora latiramea n.sp.

(Pl. XIV, Figs. 3 a, b)

Holotypus: Pl. XIV, Figs. 3 a, b (Z. Pal. UŁ Sp. II/888, 889).

Stratum typicum: Lower Campanian, clayey marl sediments.

Locus typicus: Zbyczyce, a quarry on a forest hill.

Derivatio nominis: *latiramea* — Lat. *latus* = broad, *ramus* = branch.

Diagnosis. — Stipes triangular-fanlike in shape, bilaterally flattened. Ramification takes place at one point only. Parenchymal network built of fairly solid megaclones, arranged in a similar manner as in *B. ramusculus* but different in length and in convexity.

Material. — Five branches.

Dimensions (in mm.):

	Height	Thickness of stem	Thickness of apex	Width of apex
Smallest specimen (Sp. II/889)	25	3	10	4
Medium specimen (Sp. II/888)	35	8	15	3
Largest specimen (Sp. II/891)	40	8	18	6

Description. — Sponges with branches cylindrical at the base, flattened and fanwise extended upwards. Outer surface flat, without individualized pores. Prosopyles (= network meshes) 0.45—0.75 mm. in diameter. Exhalant canals not numerous, 0.75—1.0 mm. in diameter; in the lower part of the branch, there are only three of them, situated in its middle. Postica, situated on the apex, are not very distinct.

Parenchymal skeleton consisting of solid megaclones arranged in the network by ones and not in strands. Megaclone length non-uniform, reaching 2 mm., and thickness — ca. 0.12 mm.; they are slightly convex and have 3—4 clones terminating in a concave zygome. Bundles of oxeas and protriaenes with very small cladomes are pinned in the meshes of the network. Near megaclones and zygomes, there occur very numerous microxeas, microrhabds and, less frequently, microactines. Their dimensions vary from 0.012 to 0.036 mm.

Comparison. — *B. latiramea* n.sp. is similar to *B. ramusculus* Schrammen from which it differs, however, in its considerably smaller dimensions, in a different manner of ramification and, mainly, in a fanlike, extended shape of stipes, as well as in a single and not bandlike arrangement of megaclones in the network. *B. roemeri* forma *clavaeformis* has been differentiated by Moret (1925) on the basis of three specimens from Saint-Cyr which differ from the typical *B. roemeri* only in a macelike distended stipe apex. Specimens from Poland differ from *B. roemeri* and *B. ramusculus* to such an extent that they should be considered representatives of another, separate species.

Occurrence. — Poland: Zbyczyce, Lower Campanian marl.

Genus *Pachypoterion* Hinde, 1883

(Type species: *Pachypoterion robustum* Hinde, 1883)

According to Hinde (1883), Schrammen (1910—1924) and Moret (1925), sponges of the genus *Pachypoterion* are single, fairly solid, cuplike or cylindrical, with thick walls, ample central cavity and with a water system individualized with regard to the arrangement and dimensions of pores and canals. Parenchymal megaclones are large and connected by zygoe into a solid network. Dermal dichotriaenes have rhabdomes with a variable length.

Pachypoterion has been assigned by Hinde (1883) to the family Megamorina Zittel (1878). Schrammen (1910) leaves it within this family but in the subfamily Homalodorinae. In 1924, this author erected a new family Dorydermidae in which he included Homalodorinae with *Pachypoterion*. Moret (1925) assigns the genus *Pachypoterion* to the Dorydermidae, while Laubenfels (1955) attributes this genus, as similar to *Nematinion* Hinde, to the Pleromidae Sollas (1888).

In the present paper, it has been stated that in *Pachypoterion biedai* n.sp. and in *P. robustum* Hinde, the megaclone system in the network is bandlike, similar to that in the genus *Doryderma* which justifies the assignment of the genus *Pachypoterion* to the family Dorydermidae (and not to the Pleromidae Sollas) near the genus *Brochodora*.

Occurrence. — Cenomanian through Campanian.

Pachypoterion biedai n.sp.
(Pl. XV, Figs. 1 a—c, Text-fig. 27)

Holotypus: Pl. XV, Figs. 1 a—c (Z. Pal. UŁ Sp. II/1585).

Stratum typicum: Lower Campanian.

Locus typicus: Pniaki, hamlet quarry.

Derivatio nominis: *biedai* — in honour of Professor F. Bieda.

Diagnosis. — Sponge cylindrical, extending upwards in a spadelike manner. Prosopyles arranged in vertical, undulating rows. Central cavity lacking. Pleural skeleton strongly developed.

Material. — Three specimens with broken off poles but with very well-preserved skeleton and water system.

Dimensions (in mm.):

	Height	Thickness of upper part	Diameter of lower part
Smaller specimen (Sp. II/1553)	65	13	11 × 18
Larger specimen (Sp. II/1583)	110	17	11 × 18

Description. — Sponge slim, elongated. Upper part slightly extended in a spadelike manner, lower — clublike. Subpleural prosopyles oval or round, 0.45—1.05 mm. in diameter, densely arranged in undulating vertical rows. Epirhyses perpendicular to the surface, fairly short, straight, radially arranged, about 0.2 mm. in diameter. Exhalant system consisting of apopyles and aporhyses 1.15 mm. in diameter. The latter form an axial bundle along the entire height of the body.

Parenchymal skeleton consisting of slightly convex, formless megalones with fairly long and uneven clones. Epirhabds are S-shaped or vermiform, varying in length to 2 mm. and in thickness from ca. 0.09



Fig. 27. — *Pachypoterion biedai* n.sp., Lower Campanian, Pniaki; a pleural protriaenes and prodichotriaenes, b megalones from the parenchymal networks on the outer surface (Z. Pal. UŁ Sp. II/1585); × 15.

to 0.75 mm. The network of this skeleton is dense and compact with meshes longitudinally disposed and encircled by megaclone strands.

Dermal skeleton is formed of pleuralia which cover the surface with a thick layer. These are protriaenes and prodichotriaenes with a long rhabdome, arranged densely and obliquely in the meshes of the parenchymal network. Cladomes of prodichotriaenes are small and uneven, to 0.18 mm. in span. Rhabdomes variable in thickness and length, some of them are capillary, others — 0.07 mm. thick at the base of the cladome and variable in length, coming to 2.4 mm. The prodichotriaene system of both sides of the sponge is different: some groups of prodichotriaenes are pointed with their cladomes downwards, while others — situated on the convex side — upwards. Numerous microxeas and microrhabds, 0.009—0.039 mm. long, occur on the outer surface near the pleuralia.

Comparison. — The structure of the parenchymal skeleton and the water system in *Pachypoterion biedai* n. sp. are most similar to the structure of these parts in *Pachypoterion robustum* (Hinde, 1883, Pl. IX, Fig. 2, p. 52). According to Hinde, pores in *P. robustum* are arranged regularly in a vertical direction, while, in the investigated species, the vertical rows are slightly undulating. The pore diameter in both species is similar: in English specimens, the inhalant pores are 0.5—0.9 mm. and in *P. biedai* 0.45—1.05 mm. in diameter. There is also a small difference in the thickness of megaclones which, in *P. robustum*, amounts to 0.135 mm. and, in *P. biedai*, to 0.075—0.09 mm. A considerable similarity in the morphology of the skeleton indicates the fact that both these species are undoubtedly congeneric with *Pachypoterion* Hinde. A cylindrical (and not cuplike) shape of the body, a lack of the central cavity and a strongly developed pleural-dermal skeleton, differ this new species from the remaining representatives of this genus.

Occurrence. — Poland: Pniaki, Lower Campanian marl.

Family **Homalodoridae** Schrammen, 1924

Genus *Homalodora* Schrammen, 1910

(Type species: *Spongia ramosa* Mantell, 1822)

Sponges of this genus consist of processes, different in shape and arrangement. A compact skeletal network is formed of megaclones, arranged by ones and not in fibroidal bands. Inhalant pores, distinctly individualized in the network, are irregularly scattered on lateral walls. Central cavity lacking. Ortodichotriaenes and, less frequently, protriaenes occur as dermalia; comitalia are hyelic of the amphioxea and oxea type, different in size. Microscleres of the microxea type, as well as microstrongyles, microrhabds, sphaerasters and single sterrasters are also present.

Homalodora ramosa (Mantell, 1882)
(Pl. XVII, Figs. 1 a, b and 2)

1822. *Spongia ramosa* Mantell; G. A. Mantell, Fossils..., p. 162, Pl. 15, Fig. 1.

1925. *Doryderma (Homalodora) ramosa* (Mantell); L. Moret, Contribution..., p. 123 (here earlier synonymy).

Material. — Sixteen silicified specimens, of this number, 6 very well-preserved.

Dimensions (in mm.):

	Height	Diameter of apex	Thickness	Thickness of branches
Smaller specimen (Sp. II/1072)	90	6	12	25—30
Larger specimen (Sp. II/1069)	95	12	18	36

Description. — Sponges in the form of digitate groups dichotomously divided. These groups have the shape of an inverted pyramid, consisting at the bottom mostly of 4 branches concrescent by their walls and, at the top, of 8 such branches (Sp. II/1069 and 1072). The branch apex usually flattened, with a small cavity. Surface flat, covered with a network with ostia which vary in diameter and are irregularly scattered 1—3 mm. from each other; in the lower parts of branches, ostia, 0.6—0.75 mm. in diameter, are more densely grouped, while, in the upper part, their diameter amounts to 0.45—0.6 mm. Central cavity lacking. Aporhyses tubular, 0.6—1.2 mm. (Sp. II/723) in diameter, longitudinally arranged. Postica oval, with a diameter equal to the width of aporhyses, open at the apex of the branch where their number fluctuates between 17 and 41 (Sp. II/1117).

Dermal skeleton has not been recorded.

Parenchymal skeleton fairly compact, consisting of arcuate megalones 0.5—1.2 mm. long and 0.06—0.12 mm. thick. Number of clones varying from 4 to 9. Zygomes concave, bowl-like. Epirhabds sometimes elongated, twisted and smooth or fine-grained. Network meshes uneven, larger of them, oval in shape, encircling canals. In addition to megalones, there are: single or sometimes fairly numerous oxeas, microxeas, 0.021 mm. long (Sp. II/1117) and situated near the zygomes having more or less pointed ends, microstrongyles variable in length, microrhabds, numerous sphaerasters, 0.03—0.09 mm. in diameter, with a surface with protruding ends of rays, as well as single sterrasters 0.18 mm in diameter.

Variation. — A considerable variation is displayed by the investigated specimens. It results from the division, from the manner of concrescence, as well as from the shape and thickness of branches. In particular specimens of a similar size, the dichotomous division takes place at different heights and, consequently, the length of branches is different.

The individualization of branches may be complete or partial. Some specimens form a compact entirety with walls only undulating and encircling the cavity which imitates the central cavity (Pl. XVII, Fig. 1b); others are conerescent only in some places and divided from each other by fissural spaces.

Comparison. — Specimens of *H. ramosa* from Poland are smaller than those from the *Actinocamax quadratus* zone and *Bel. mucronata* zone of North-western Germany. The length branches in German specimens varies from 50 to 250 mm. and diameter from 10 to 25 mm., their ostia and postica also being wider (ostia, 0.5—1.0 mm. and postica 1.5—2.0 mm.). Specimens from the Cenomanian of France, described by Moret (1925) had few and smaller inhalant pores and a more compact skeleton. According to Moret, ostia in these specimens are very small and postica, numbering only 12—15, only 1 mm. in diameter.

Occurrence. — Poland: Skrajniwa, Lower Campanian; Germany: Lower and Upper Campanian; France: Cenomanian at Sablons and Orne, Senonian at Meaulne; Czechoslovakia: Cenomanian; England: Upper Chalk of Warminster and Wiltshire.

Homalodora tuberosa Schrammen, 1910

(Pl. XVIII, Figs. 2, 3 a—b and 4)

1910—1912. *Homalodora tuberosa* Schrammen; A. Schrammen, Die Kiesel-spongien..., p. 60.

Material. — Fifteen strongly silicified fragments with poorly preserved skeleton.

Dimensions (in mm.):

	Height	Max. thickness	R i b s		
			length	thickness	width
Smallest specimen (Sp. II/1073)	35	40	20	6	5
Medium specimen (Sp. II/1073 B)	52	55	40	18	16
Largest specimen (Sp. II/1073 A)	100	90	45	23	15

Description. — Sponge, shaped like an inverted cone, consisting of short branches, with macelike terminations and conerescent over all their length. Some branches become thicker and display the tendency to ramify, others remain single. Five to six ribs occur in the upper part of a branch. Branch apex flat or, as a result of being encircled by ribs, protruding upwards — concave. Apophyses tubular, over 1 mm. in diameter, densely arranged in the middle. Beside apophyses, there are irregular cavities. Numerous postica, grouped in the middle of the branch apex and, sometimes, also on rib tops, are about 0.75—1.2 mm. in diameter. Ostia 0.6—0.9 mm. in diameter, mostly grouped between ribs.

Parenchymal skeleton preserved only in fragments. Megaclones, visible on the outer surface of the lower part of the sponge (Sp. II/709), with fine-grained rhabds, while those in the upper part mostly smooth, not very long, usually with 4 clones. In the 3-clone megaclones, clones are split. The network of the inner part consists of more elongated megaclones. In one specimen (Sp. II/709), microscleres of the sterraster type have been found, as well as numerous sphaerrasters, microxeas, microstrongyles and microstyles.

Comparison. — Specimens of *H. tuberosa* from Poland are less solid than those, described by Schrammen (1912) from Germany, because their rib thickness varies from 80 to 150 μ m. Their postica are wider, about 0.2 mm. Schrammen stated the presence of large dermal prodichotriaenes, while no such prodichotriaenes were recorded in Polish material. Both in the structure of its water system and in the width of pores and skeleton, *H. tuberosa* most closely resembles *H. ramosa* from which it differs mainly in the shape of branches.

Occurrence. — Poland: Skrajniwa, Lower Campanian; Germany: Misburg and Oberg, Lower and Upper Campanian.

Homalodora plana Schrammen, 1910

(Pl. XIX, Figs. 1—5, Text-fig. 28)

1910—1912. *Homalodora plana* Schrammen; A. Schrammen, *Die Kieselspongien...*, p. 59, Pl. 17, Figs. 3—4.

1924. *Homalodora plana* Schrammen; A. Schrammen, *Ibid.*, III, p. 159, Pl. 6, Fig. 9.

Material. — Twenty seven specimens well-preserved, except for a stem which is mostly broken off. Skeletal network usually distinctly visible. A young bud preserved on one specimen.

Dimensions (in mm.):

	Height	Width	Thickness
Smallest specimen (Sp. II/649)	35	32	16
Medium specimen (Sp. II/1079)	64	55	18
Largest specimen (Sp. II/375)	80	70	32

Description. — Sponge strongly flattened and shaped like an isosceles triangle, turned with its base upwards. Lower pole terminating in a stem gradually passing into the body. Apical surface narrow, horizontal, densely covered with round postica, 0.9—1.35 mm. in diameter. Round ostia, variable in diameter, situated 1.5—2.5 mm. from each other, more densely grouped in the central part of walls than on the margins and on the stem, occur on lateral walls. Diameter of ostia in middle-sized specimens amounts, in the upper part of the wall, to 0.6—0.75 mm. and, in the basal part, to 0.3—0.45 mm. Apophyses tubular, with postica

equal in diameter, run parallel to the surface along the entire height of the sponge. They are limited by the skeletal network and the distance between them amounts to ca. 0.15 mm. Numerous apopyles 0.2—0.3 mm. in diameter. Epirhyses considerably shorter than aporhyses, straight

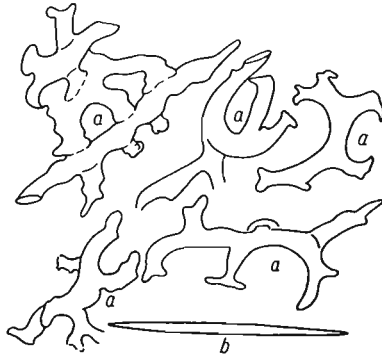


Fig. 28. — *Homalodora plana* Schrammen, Lower Campanian, Zbyszce; a parenchymal megaclones isolated from the sponge surface, b oxeas from water canals. (Z. Pal. UŁ Sp. II/1575); $\times 16$.

tubular, with diameter identical with that of ostia, arranged obliquely towards the bottom part of the sponge. In one specimen (Pl. XIV, Fig. 3) an oblong furrow, deepening upwards and separating a macelike bud, concrescent almost over its entire length with the flat mother individual, runs somewhat above the basal part; it is only its apical part that remains separated. Both in the branch and in the flat mother individual postica are different in diameter. In the branch it amounts to 0.75—1.2 mm. and, in the mother part, to 0.9—1.35 mm. Dimensions of ostia and megaclones on both branches are approximately the same.

Dermal skeleton, preserved in a fragment of one specimen, consists of dichotriaenes.

Parenchymal skeleton makes up a dense network which, particularly around aporhyses and ostia, consists of megaclones varying in length from 0.6 to 0.9 mm. and having 3—4 clones. Epirhabds elongated, about 0.06—0.12 mm. thick. Megaclone system in the network irregular. Single oxeas or bundles of them occur occasionally in postica.

Numerous microscleres of different size such as, microstrongyles, microamphioxeas covered with very fine spines, microrhabds, sterrasters (Sp. II/620) and very numerous sphaerrasters to 0.09 mm. in diameter with ray terminations protruding over the surface, have been washed out of the specimens, preserved in marl.

Variation. — Specimens of *H. plana* from Poland vary in size, thickness of individuals and width of pores. Two fundamental types which, as a result of different body thickness differ in aspect may be separated.

The first type (Pl. XIX, Fig. 3) is represented by individuals 36—80 mm. high with a 15—32 mm. thickness, the second (Pl. XIX, Fig. 1) — by flatter specimens, 55—80 mm. high and only 8—20 mm. thick.

Comparison. — Specimens of this species from Hanover described by Schrammen (1912) approach flat forms from Poland, differing from them only in smaller ostia whose size, in the specimens from Hanover, amounts to 0.5 mm. and, in Polish ones, to 0.6—0.75 mm.

Occurrence. — Poland: Skrajniwa and Zbyczyce, Lower Campanian; Germany: Oberg and Misburg, Upper and Lower Campanian.

Homalodora pusilla Schrammen, 1910

(Pl. XVII, Figs. 3 a, b)

1910—1912. *Homalodora pusilla* Schrammen; A. Schrammen, Die Kieselspongien..., p. 60, Pl. 17, Fig. 5.

Material. — One silicified specimen (Sp. II/379).

Dimensions (in mm.):

	Height	Max. thickness	Diameter of	
			stem	apex
Specimen Sp. II/379	33	32	15	23 × 13

Description. — Macelike sponge, gradually extending from the solid stem. Apex truncated, slightly concave, densely covered with oval postica 1.0—1.5 mm. in diameter. Ostia 0.75 mm. wide, visible in the lower part. Diameters of aporhyses, visible in transverse section through the stem, reach 0.75—1.0 mm.

Comparison. — The investigated specimen differs from the representatives of *H. ficus* Schrammen, to which it is most similar, in a smaller height of the apical section and in a less bulgy outline of the upper part of the body. In addition, this specimen has a slightly concave apical surface. It is similar to the specimen of *H. pusilla*, figured by Schrammen, although it differs from it in a smaller height and thickness.

Occurrence. — Poland: Skrajniwa, Lower Campanian; Germany: Oberg, Lower Campanian.

Homalodora ficus Schrammen, 1910

(Pl. XX, Figs. 2 a, b)

1933. *Doryderma (Homalodora) ficus* Schrammen; F. Bieda, Gąbki..., p. 13, Pl. 1, Figs. 1—2 (here earlier synonymy).

Material. — Four silicified specimens with a poorly preserved skeleton.

Dimensions (in mm.):

	Height	Max. thickness	Thickness of apex	Diameter of stem
Smallest specimen (Sp. II/390A)	33	32	23 × 13	15
Medium specimen (Sp. II/390)	40	40 × 30	—	—
Largest specimen (Sp. II/629)	70	40 × 30	40 × 15	20

Description. — Pyriform sponge, lower pole conical or terminating in a thick stem; upper pole rounded with a flattened apex. In the upper part, beginning with the thickest place, few, tortuous, not very long superficial furrows are visible. Ostia, 0.6—1.0 mm. in diameter, equal in size and uniformly distributed. From 15 to 22 ostia may be counted, in different specimens, on an area of 1 sq. cm. Postica, grouped on the apex, are 1.0—1.5 mm. in diameter. Number of postica, in particular specimens, variable.

Parenchymal network fairly loose, consisting of megacloves, ca. 1.0 mm. long and 0.09 mm. thick, slightly arcuate. Network meshes formless, their size variable depending on the arrangement of spicules. Megaclove system in the network irregular. Four to five elongated megacloves, with epirhabds pointing towards the pore lumen, are situated around the individualized ostia. The epirhabd outline near the ostium variable, slightly undulating. Near the stem (Sp. II/629), epirhabds of megacloves are elongated in conformity with the sponge height. The general plan of the network structure similar to that in *H. plana* Schrammen.

Comparison. — *H. ficus* differs from *H. plana* and *H. ramosa* in its bulgy shape and somewhat wider postica. This species is most similar to *H. pusilla* Schrammen from which it differs in the shape of the upper part. As compared with the specimens of *H. ficus* from North-western Germany, Polish specimens are more solid.

Occurrence. — Poland: Skrajniwa, Lower Campanian; Germany: Lower and Upper Campanian.

Homalodora skrainivensis n.sp.
(Pl. XVIII, Figs. 1 a, b, Text-fig. 29)

Holotypus: Pl. XVIII, Figs. 1 a, b (Z. Pal. UŁ Sp. II/384).

Stratum typicum: Lower Campanian, marl facies.

Locus typicus: Skrajniwa near Koniecpol.

Derivatio nominis: *skrainivensis* — after locality of occurrence, Skrajniwa.

Diagnosis. — *Homalodora* consisting of short, bulbous branches with conical prominences on the upper surface. Stem short, conical. Aporhyses forming bundles. Postica grouped on apexes of prominences. Megacloves smaller than in *H. ramosa* (Mantell).

Material. — Six silicified specimens with well-preserved shape and structure. Skeleton fragments visible on the surface.

Dimensions (in mm.):

	Height	Thickness	Thickness of branches	Diameter of stem
Smaller specimen (Sp. II/385)	50	85	30	8
Larger specimen (Sp. II/384)	ca. 80	85	45	18

Description. — Tripartite sponge with bulbous, irregular branches which are also tripartite. Lower pole makes up a conical stem. Branches are not fully individualized but concretescent by their internal walls. External wall flat, covered with ostia, ca. 0.75 mm. in diameter, which are loosely scattered all over its surface. Upper side of each branch uneven, conically convex or humped. Postica, 1.0—1.35 mm. in diameter, situated on flattened prominences, form oval groups, 8—10 mm. distant from

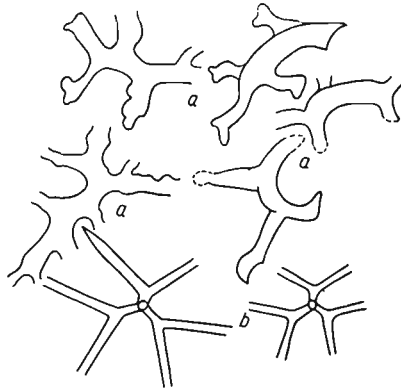


Fig. 29. — *Homalodora skrainivensis* n.sp. Lower Campanian, Skrajniwa; a megaclones from the outer surface of the sponge, b dermal orthodichotriaenes (Z. Pal. UŁ Sp. II/385); $\times 20$.

each other. It may be concluded from the distribution of postica that, following the deflection of branches from the main stem, aporhyses formed arcuate bundles bent outwards. In the stem, postica are ca. 1.0 mm. in diameter (specimen Sp. II/384).

Dermal skeleton, preserved in fragments on the upper surface, consists of ortodichotriaenes with cladomes different in span. Dichotriaene clads are to 0.3 mm. long.

Parenchymal skeleton contains megaclones somewhat smaller than those in other species of this genus; they are provided with 4—6 clones which, sometimes, ramify. Around clones, megaclones are, here and there, arranged in strands. Megaclone length varies from 0.6 to 0.75 mm. (specimen Sp. II/385). Few sphaerrasters, almost uniform in size, 0.06 mm. in diameter, have been washed out.

Comparison.—*H. skrainivensis* n.sp. approaches *H. tuberosa*. In *H. tuberosa*, branches growing up vertically, are macelike in shape and have oblong ribs round about, while, in *H. skrainivensis*, they are shaped like bulbous, arcuate buds sharp-edged in outline. In *H. tuberosa*, aporhyses are grouped in the central part of the sponge and, in *H. skrainivensis*, they form bundles.

Occurrence.—Poland: Skrajniwa, Lower Campanian marl.

Homalodora polonica n.sp.

(Pl. XVI, Figs. 1 a—c, 2; Text-fig. 30)

Holotypus: Pl. XVI, Figs. 1 a—c (Z. Pal. UŁ Sp. II/743).

Stratum typicum: Lower Campanian.

Locus typicus: Pniaki, hamlet quarry.

Derivatio nominis: *polonica*—after the country where it was first identified.

Diagnosis.—Macelike sponge, single or consisting of a few lobes, each macelike in outline. In both the lower and upper part, ostia are different in size. Aporhyses are arranged in bundles.

Material.—Seven specimens from marls. Skeleton partially prepared.

Dimensions (in mm.):

	Height	Max. thickness	Diameter of stem
Smallest specimen (Sp. II/732)	60	25	3—4
Medium specimen (Sp. II/743)	70	ca. 35	8
Largest specimen (Sp. II/1475)	ca. 80	40	12

Description.—Single *Homalodora*, not very high, forming groups and not branching. Shape macelike, beginning with a conical stem, gradually extending upwards. Apex mildly rounded, in the middle flat, densely co-



Fig. 30. — *Homalodora polonica* n.sp. Lower Campanian, Pniaki; a parenchymal network around ostium, b isolated megaclones, c amphioxees (Z. Pal. UŁ Sp. II/743); $\times 25$.

vered with postica. The pore diameter the smallest among representatives of *Homalodora*. Outer surface flat. Ostia variable in size, uniformly distributed, near the stem, 0.3—0.45 mm. in diameter, while in the upper part — 0.5—0.6 mm. Aporhyses tubular, more loosely arranged in the stem than on the apex; concluding from the arrangement of postica, they form dense bundles. Postica varying in diameter from 0.5 to 0.9 mm.

Parenchymal skeleton compact, consisting of small, slightly twisted, megaclones. Megaclones, adjoining ostia, are elongated (to 1.2 mm.), while those, situated between the pores in the network, are shorter and more convex. Very thin protriaenes and oxeas, varying in length, occur in postica on the apex. Several types of microscleres have been washed out from four specimens. These are: numerous microamphioxeas (ca. 0.024 mm. long), microstrongyles (0.012 mm.), still more abundant sphaerasters with protruding end of rays and varying in diameter from 0.03 to 0.15 mm., occasionally met with elliptical sterrasters, 0.021 mm. in diameter and with a rough surface, as well as smooth, bean-shaped rhaxes.

Variations. — One of the specimen consists of two branches which allows one to assume that *H. polonica* represents sponges, forming groups of branches. Three other specimens (Sp. II/743, 744, 1121) display a growth variation, progressing from a single macelike form to that consisting of branches, connected close to the stem.

Comparison. — *H. polonica* n.sp. primarily differs from all other known species of this genus in a different (macelike) shape. Like *H. ramosa* and *H. plana*, the new species has ostia which are different in the lower and in the upper part and its megaclones are most similar to those of *H. ramosa*, except for their epirhabd which is less bent.

Occurrence. — Poland: Pniaki, Lower Campanian.

Homalodora breviramosa n.sp.

(Pl. XX, Fig. 1)

Holotypus: Pl. XX, Fig. 1 (Z. Pal. UŁ Sp. II/1114).

Stratum typicum: Lower Campanian, marly facies.

Locus typicus: Pniaki, hamlet quarry.

Derivatio nominis: *breviramosa* — Lat. *ramosus* = branchy, *brevis* = short, after the shape of branches.

Diagnosis. — *Homalodora* consisting of short, cylindrical, thick branches, irregularly grouped and with flatly truncated apices; ostia oval, variable in size; megaclones with spadelike, strongly elongated zygomes.

Material. — Two silicified specimens with well-preserved shape and, in one of them, also skeleton.

Dimensions (in mm.):

	Height	Thickness	Number of branches	Length of branch	Thickness of branch
Specimen (Sp. II/1114)	55	40	7	12	23 × 9
Specimen (Sp. II/1547)	65	23	3	22	25 × 8

Description. — Sponges consisting of short, cylindrical, sometimes, bilaterally flattened branches uniform in length, ramifying from a thick stem. Number of branches variable; their apexes are flat, densely covered with postica 1.2 mm. in diameter; ostia varying in size, oval, 0.6—0.9 mm. in diameter, more densely grouped within the limits of the stem than on branches. Concluding from the arrangement of postica, visible in the cross section through the stem, aporphyses were tubular and ran vertically.

Parenchymal skeleton forms a not very dense network, consisting of fairly variable megaclones with 3—4 clones and spadelike, strongly elongated zygoses. On the outer surface, megaclones are 1.5 mm. long. Amphioxeas, variable in length, occur as comitalia and pleuralia(?). Single ortodichotriaenes with their rhabdome directed outwards, as well as microxeas may be observed in the meshes of the network.

Comparison. — *H. breviramosa* n.sp. differs from the species of the genus *Homalodora*, described in the present paper, in the shape and irregular grouping of branches, in a different, oval, outline of ostia, as well as in the presence of pleuralia. It is most similar to *H. ramosa* (Mantell), primarily in the manner of ramification, in a considerably smaller length of branches and in a larger diameter of ostia.

Occurrence. — Poland: Skrajniwa and Pniaki, Lower Campanian.

Family **Pleromidae** Sollas, 1888

Genus *Propleroma* Moret, 1925

(Type species: *Propleroma regnardi* Moret, 1925)

Propleroma campanica n.sp.

(Pl. XX, Figs. 3, Text-fig. 31)

Holotypus: Pl. XX, Fig. 3 (Z. Pal. UŁ Sp. II/899).

Stratum typicum: Lower Campanian, clayey marl facies.

Locus typicus: Zbyszycze near Lelów.

Derivatio nominis: *campanica* — after the Campanian stage.

Diagnosis. — Bushy *Propleroma*, consisting of fine branches, conerescent along their walls. Pores invisible, water canals not very distinct. Dermal dichotriaenes arranged by ones.

Material. — Two silicified specimens without basal parts but with a well-preserved shape and skeleton.

Description. — Bushy sponges, consisting of branches, conerescent along their walls in which neither the skeleton, nor water system are

demarcated. Length of investigated branches amounts to ca. 30 mm. and their thickness varies, maximum being 10×7 mm.; fine apices are sharply pointed; surface flat, pores invisible. Water system not very distinct. A centrally situated bundle of exhalant canals, 1 mm. in diameter, is visible in transverse section; inhalant canals short, perpendicular to the surface.



Fig. 31. — *Propleroma campanica* n.sp., Lower Campanian, Zbyszce; a isolated parenchymal megaclones, b megaclones from the network on the outer surface, c amphioxeas variable in length, d dermal dichotriaenes (Z. Pal. UŁ Sp. II/899); $\times 20$.

Dermal skeleton preserved only in the form of dichotriaenes with a cladome span, varying from 0.12 to 0.5 mm., producing no compact cortical skeleton but separately arranged in layers. Maybe, these were pleuralia.

Parenchymal skeleton consisting of megaclones with epirhabds mostly elongated, more or less arcuate, smooth, varying in length from 1.2 to 2.0 mm. and in thickness from 0.03 to 0.12 mm., with clones relatively short and variable in length, sometimes, split and distributed on the inside of the epirhabd; number of clones varies from 2 to 4. On the outer surface, megaclones are, sometimes, flattened; their epirhabd is short and clones are situated near each other. Small amphioxeas, oxeas 2 mm. long and ortodichotriaenes with long rhabdomes are pinned in the meshes of the network. Here and there, the network is condensed and embryonal megaclones, differing only in smaller dimensions and smaller number of their clones, occur in it; they have the form of a small rod with one offshoot which makes up a rudimentary clone. Microxeas and occasionally, elliptical sterrasters, to 0.21 mm. in diameter, have been washed out from the network close to the surface.

Comparison. — *Propleroma campanica* n.sp. differs from *P. regnardi* Moret from France in the lack of pores, in more solid desmas and in the lack of distinctly individualized aporphyses. *P. campanica* n.sp. have dermal spicules and comitalia whose presence in *P. regnardi* has not been mentioned by Moret. Desmas of *P. campanica* n.sp. are more similar to

those of the Recent species *Pleroma turbinatus* Sollas (Moret, 1925, p. 119) of Fiji Islands.

Occurrence. — Poland: Zbyczyce, Lower Campanian.

Family **Heterostiniidae** Schrammen, 1924

Genus *Heterostinia* Zittel, 1878

(Type species: *Polypothechia obliqua* Bennett, 1831)

Heterostinia obliqua (Bennett, 1831)

(Pl. XXI, Figs. 3 a, b; Text-fig. 32)

1831. *Polypothechia obliqua* Bennett; W. Bennett, Catalogue..., Pl. 8, Fig. 1 (*vide* F. Bieda, 1933).

1962. *Heterostinia obliqua* (Bennett); L. Lagneau-Hérenger, Contribution..., p. 161, Text-Pl. 25, Fig. 2.

• *Material.* — Eight almost complete specimens and 37 fragments with a well-visible skeleton.

Dimensions (in mm.):

	Height	Thickness	Diameter of stem	Thickness of wall
Specimen Sp. II/14	90	40	9	6
Specimen Sp. II/1382	110	70	10	8

Description. — Sponge considerably variable in shape: bowllike, funnellike, sometimes, rolled like a leaf, asymmetrical, provided with a stem or a few processes. Wall margins rounded, surface smooth; pores, usual-



Fig. 32. — *Heterostinia obliqua* (Benett), Lower Campanian, Zbyczyce; a arrangement of megacloones in the parenchymal network, b megacloones isolated from the outer surface, c embryonal? desmas, occasionally occurring near parenchymal megacloones, d dermal orthodichotriaenes, e oxeas (Z. Pal. UŁ Sp. II/885); × 22.

ly, not individualized; not very distinct, tortuous, small canals, somewhat more distinctly individualized only in the stem, run in the walls.

Dermal skeleton is represented only by few large ortodichotriaenes pinned in by ones. They are more numerous on the outer than inner side (Sp. II/402, 422 and 883); they also occur on the stem. Cladome span variable but more than 0.6 mm.

Parenchymal skeleton consists of large, thick megaclones with a variable number of clones, different in length and degree of convexity. The three-ray megaclones are predominating but the 2-clone, arcuate and, less frequently, many-clone ones, elongated and vermiculate in shape, may also be met with. The length of megaclones varies from 1.0 to 1.85 mm. and thickness — from 0.12 to 1.135 mm. The external side of the epirhabd is fine-grained. The skeletal network is not identical on both sides: on the external side, it is denser, consisting of shorter and less solid megaclones; on the internal side, it is looser and consisting of large and solid megaclones. Flattened, much smaller and ramified elements occur around megaclones, arranged by ones or in groups. Amphioxeas, variable in length (to 2.0 mm.) occur as comitalia. Microstrongyles and microamphioxeas have been washed out from the outer surface of one specimen (Sp. II/420), while a few euasters, variable in size — from the sediment, filling the spaces between megaclones (specimen Sp. II/1382).

Comparison. — According to Schrammen (1910), in the specimens of this species, described from Spain and from other West-European countries, ostia have a diameter, varying from 0.3 to 0.5 mm. and, according to Lagneau-Hérenger (1912), amounting to 0.5 mm. In one of my better preserved specimens (Sp. II/887), the prosopyles have a diameter of 0.75 mm. In flat specimens from Poland, megaclones are fairly variable, smooth and their clones are longer than those in funnellike specimens. Similar megaclones have been observed by Nestler (1961) in flat form from Rügen Island. The presence of the oxyaster type microscleres and euasters, 30—40 μ in size, has also been stated by this author in *H. obliqua*.

Occurrence. — Poland: Bonarka, Zbyszce, Pniaki, Skrajniwa — Lower Campanian marl; Germany: Oberg and Misburg, Lower and Upper Campanian; France: Cenomanian, Santonian and Senonian of Saint-Cyr, Mont Richard, Gorbio and Paris Basin; Spain: Aptian and Cenomanian; England: Flamborough and Warminster, Upper Chalk.

Heterostinia conica (Schrammen, 1901)

(Pl. XXIV, Figs. 2 a—b; Text-fig. 33)

1901. *Astroderma conica* Schrammen; A. Schrammen, *Neue Kieselschwämme...*, p. 14, Pl. 1, Fig. 9.

Material. — Two specimens with a preserved shape and skeleton.

Dimensions (in mm.):

	Height	Thickness
Specimen Sp. II/1388	over 60	ca 50

Description. — Sponge cylindrical-macelike in shape; lower pole destroyed, upper — rounded. Ostia oval, 0.8—1.2 mm. in diameter, distributed fairly uniformly all over the surface, 2—4 mm. distant from each other. Central cavity lacking. Canals indistinct, poorly individualized from the network. No canals are visible in longitudinal section; it is only in the axial part that a vertical system of desmas is visible; between them, there are small, elongated exhalant cavities, different in size and outline.

Dermal skeleton not preserved. A few dermal ortodichotriaenes, pinned in the network, as well as few, solid protriaenes with a long rhabdome, found in the residue, have only been recorded.

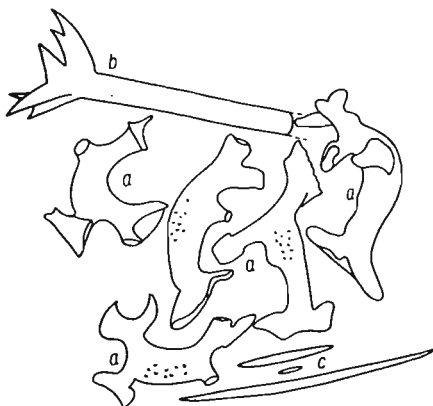


Fig. 33. — *Heterostinia conica* (Schrammen), Lower Campanian, Zbyszce; a isolated parenchymal megalones, b dermal dichotriaenes, c oxeas (comitalia) (Z. Pal UŁ Sp. II/1399); $\times 23$.

Parenchymal skeleton compact, with formless network meshes, consists of relatively short and solid arcuate megalones, similar to those in *H. obliqua*. Clone ends strongly concave and fairly wide. Megalone epirhabd, on the external side, fine-grained. Megalone length equalling 1.2 mm., arc chord 0.75 mm. and thickness ca. 0.185 mm. Many microxeas 0.15—0.18 mm. long and amphioxeas about 1 mm. long may be observed in the network meshes.

Comparison. — The specimens of *H. conica* differ from amblyproct species (as *H. obliqua*, *H. immanis* and *H. depressa*) in their elongated, cylindrical form without the central cavity. In the specimens of *H. conica* from Germany, described by Schrammen (1901) as *Astroderma conica*, pores are smaller than those in Polish specimens. The morphology of the

network and of the water system of the specimens investigated is characteristic of the genus *Heterostinia* and, therefore, *Astroderma conica* Schrammen is referred, in the present paper, to the genus *Heterostinia*.

Occurrence.—Poland: Zbyszce, Lower Campanian, clayey marl facies; Germany: Oberg, *Bel. mucronata* zone.

Heterostinia phytoniformis n.sp.

(Pl. XXI, Fig. 4, Pl. XXIV, Figs. 3 a—b; Text-fig. 34)

Holotypus: Pl. XXI, Fig. 4 (Z. Pal. UŁ Sp. II/No. 590).

Stratum typicum: Lower Campanian.

Locus typicus: Skrajniwa and Zbyszce.

Derivatio nominis: *phytoniformis*—Lat. *phytum* = plant, *forma* = shape, after a plantlike shape.

Diagnosis.—Single *Heterostinia*, solid, elongated, not very wide, slightly bent; walls thick, pores indistinct. Megacloones like those in *H. immanis*.

Material.—Thirteen incomplete, silicified specimens, making up a lower or upper part of sponges. Skeletal network distinctly visible.

Dimensions (in mm.):

	Height	Width
Specimen Sp. II/590	110	40 × 25

Description.—Single sponge, irregular in shape, clublike, longitudinally concave, considerably larger in height than in width, falciform or reniform in transverse section. Walls variable in thickness with different aspects; margins more or less rounded, depending on the manner of inflection. Upper pole either flat, or pointed (specimens Sp. II/591, 592),



Fig. 34. — *Heterostinia phytoniformis* n.sp., Lower Campanian, Skrajniwa; *a* megacloones from the network on the outer surface, *a*₁ parenchymal megacloones, *b* dermal orthodichotriaenes, *c* small spicular elements in the parenchymal network (Z. Pal. UŁ Sp. II/849, 1418); × 23.

lower — not individualized, forms only a slightly extended base. External side smooth or with longitudinal furrows and small rollers. Inhalant canal system radial, epirhyses straight, tubular, slightly narrowing to the inside, to 10 mm. long. Their diameter, near the surface, amounts to 0.5 mm. Aporhyses do not run continuously; below the cortex, they are tortuous and, near the concave surface, more condensed. In the upper part of the sponge, some of them reach 2—3 mm. in width. Postica distinctly visible on the apex, 0.6—0.75 mm. in diameter.

Dermal skeleton, varying in thickness, consists of dichotriaenes with 0.15—0.6 mm. wide cladome and with a long rhabdome. In some specimens, clones are somewhat pointing forwards. Dichotriaenes pinned perpendicularly, by ones or, obliquely, in layers. On the surface of the concave wall, the majority of dichotriaenes protrude over the surface of the sponge.

Parenchymal skeleton, in particular specimens, not very uniform, varies in density and size of meshes. Megaclone thickness variable. In specimens with a rollerlike swelling, resembling a concrescent branch, megaclones are thin (0.09—0.1 mm.), while in bent, reniform specimens, they are thick (0.12—0.18 mm.). Megaclone length is variable and reaches 0.3 mm. In some places, flat, rhizoidal elements 0.2—0.3 mm. long and with very thin processes, occur on the surface. The prepared microscleres represent a few types as, microamphioxeas ca. 0.012—0.027 mm. long, microstrongyles, occasional microstyles and sterrasters variable in diameter, as well as a single oxyaster.

Comparison. — A similar general morphology and structure of the skeleton testifies to the appurtenance of the investigated species to the genus *Heterostinia* Zittel. However, the fundamental type of megaclones in *H. phytiformis* n.sp. is different than the megaclones in *H. obliqua*. The megaclones of the species, described here, are solid and frequently have a greater number of clones only near the surface, whereas, inside the network, they display the similarity to the megaclones of *H. immanis* Schrammen (1910, Pl. 2, Text-fig. 2). The manner of the arrangement of megaclones in the network approaches that in *H. obliqua*. The investigated species differs from others of this genus in the elongated shape, thickness of walls and lack of individualized pores.

Occurrence. — Poland: Skrajniwa and Zbyszce, Lower Campanian.

Superfamily **Dicranocladina** Schrammen, 1937 (= **Corallistidae** Sollas)

Family **Acrochordoniidae** Schrammen, 1901

Genus *Acrochordonia* Schrammen, 1901

(Type species: *Acrochordonia ramosa* Schrammen, 1901)

Acrochordonia cf. *ramosa* Schrammen, 1901

Material. — One complete, fairly well-preserved specimen; dermal skeleton, visible in fragments, was subject to strong silicification.

Dimensions (in mm.):

	Length	Diameter of apex	Thickness of branching	Height of branch	Thickness of branch
Specimen Sp. II/1461	30	19	25	15	12

Description. — Sponge, triangular in longitudinal section, consisting of two concrescent individuals whose apexes are rounded. A common lower pole is short and blunt. Outer surface even, slightly porous. Water canal system indistinct; canals short, tortuous and running irregularly. Central cavity lacking. Ostia, 0.06 mm. in diameter, are loosely and non-uniformly distributed; on the inner side of the individuals, they are more condensed.

Dermal skeleton probably covered the entire surface but, now, is preserved only in fragments; it forms a dependent cortex which was transformed during the fossilization. Fine, dermal ortodichotriaenes with a cladome measuring 0.15 mm. are visible.

Parenchymal skeleton, dense and compact, consisting of mammilliform tetramyrmeclones with clones ca. 0.2 mm. long; apical ray transformed into a tubercle; dicranoclones derivatives of tetramyrmeclones are also recorded; the arrangement of lumps on desmas is variable, sometimes, ringlike and, if such is the case, lumps form 3—4 swellings, situated near each other; lump diameter fluctuates from 0.03 to 0.05 mm., the largest ones being situated on the outer side of the central part of desma where they also occur in the largest number. Zygomes are forked in a hooklike manner.

Comparison. — Comparing with *A. ramosa* from Hanover and from France, Polish specimens are smaller. According to Schrammen (1910), German specimens were 15–40 mm. thick and French ones, as described by Moret (1925), are 40 mm. high and 15 mm. in diameter. The morphology of the basal part of the specimen investigated approaches that in *A. ramosa*, figured by Schrammen (1910, Pl. IV, Fig. 6). The upper part of German specimens is bulbous, and of Polish — cylindrical. They also differ in the number of processes, but are similar in the microstructures of tetraclones. In German specimens, lumps are irregularly scattered and do not form ringlike groups. In addition, Polish specimens differ in not having the central cavity. Like in specimens from Saint-Cyr, described by Moret, their ostia are distributed on one only side of a branch.

Occurrence. — Poland: Zbyczyce, Lower Campanian clayey marl; France: Saint-Cyr, Santonian; Germany: Oberg, Lower Campanian.

Acrochordonia bifurcata n.sp.

(Pl. XX, Figs. 4–5, Text-fig. 35)

Holotypus: Pl. XX, Figs. 4–5 (Z. Pal. UŁ Sp. II/1457).

Stratum typicum: Lower Campanian.

Locus typicus: Zbyczyce, hamlet quarry.

Derivatio nominis: *bifurcata*—Lat. *bifurcatus* = bifurcate, after a dichotomous division of branches.

Material.—Six branches without basal parts, of this number, three calcified and three silicified; parenchymal skeleton distinctly visible; cortical skeleton destroyed to a considerable extent. Canals are not individualized.

Diagnosis.—A bushy *Acrochordonia* with branches, dichotomously divided. Ostia and inhalant pores not individualized, postica, on the branch apex, not very distinct. Water canals narrower than the meshes of the skeletal network.

Dimensions (in mm.):

	Height of branch	Diameter of branches
Smallest specimen (Sp. II/1458)	40	12-15
Largest specimen (Sp. II/1457)	50	12

Description.—Cylindrical branches, dichotomously divided; branch apices rounded; surface even with slightly marked transverse contractions; exhalant pores visible only on apices. Small postica are visible in young branches and only a slight depression—on longer branches. Only single canals preserved; they are shorter and narrower than the network meshes.



Fig. 35. — *Acrochordonia bifurcata* n.sp., Lower Campanian, Zbyczyce, a parenchymal dicranoclones, a₁ tetramyrmeclones, b dermal dichotriaenes, c oxeas (comitalia) (Z. Pal. UŁ Sp. II/1458); × 35.

Parenchymal skeleton compact, consisting of fairly solid tetramyrmeclones; actines of some desmas dichotomously divided; length and thickness of clones variable. External side of desmas covered with lumps variable in height and width. Sometimes, these lumps form a compact bulk or, some of them, are individualized. Internal side of desmas smooth, apical clone is either reduced and replaced by a bundle of lumps, or shortened and bristled up with fine lumps. Desmas are arranged in the

network fairly regularly in a tierlike manner and include lower situated spicules around apical lumps, thus forming a fairly dense network with meshes, varying in size. In addition to tetramyrmeclones, there are dicranoclonal oxeas varying in thickness and length from 0.1 to 0.75 mm., as well as very fine dichotriaenes with their cladome pointed outwards and pinned in the parenchymal network. Thick, solid amphioxeas, probably of a strange origin, are scattered on the surface, while other ones, very thin, corresponding to comitalia are pinned in the network in the form of bundles. Preserved fine dichotriaenes belong to desmal spicules. There are also numerous microxeas with sharply pointed end and 0.018 mm. long.

Comparison. — The new species is most similar to *A. ramosa* Schrammen, both in shape and character of desmas and differs from it in a distinctly displayed tendency to a dichotomous division of branches and in their dimensions. In *A. ramosa*, branches are 15—40 mm. in diameter, while in *A. bifurcata* n.sp. — 10—15 mm. in the thickest place. Another difference consists in the size and arrangement of pores. In *A. ramosa*, pores are grouped in depressions on the internal side of branches which is not observed in *A. bifurcata* n.sp. Besides, the new species is similar to *Pholidocladia dichotoma*, its cortex containing discotriaenes, and parenchymal skeleton has small tetracloones with a ringlike swelling close to the desma center.

Occurrence. — Poland: Zbyszce, Lower Campanian.

Acrochordonia regularis n.sp.

(Pl. XX, Fig. 6, Text-fig. 36)

Holotypus: Pl. XX, Fig. 6 (Z. Pal. UŁ Sp. II/131).

Stratum typicum: Campanian, marly facies.

Locus typicus: Pniaki and Miechów.

Derivatio nominis: *regularis* — after a regular shape of an individual.

Material. — Three well-preserved specimens, one of them complete, except for a lacking stem.

Diagnosis. — *Acrochordonia* with a very regular macelike shape, without the central cavity; exhalant system consisting of numerous, irregular cavities; canals short; tetracloones coarse-lumped and modified into tripods and dicranoclonal; dermal dichotriaenes with a cladome span of 0.5 mm.

Description. — Regular, macelike sponge with mildly rounded apex, narrowing downwards and passing into a stem. Surface even, after destruction of cortex, densely covered with fine, irregular inhalant pores, 0.45—0.75 mm. in diameter, distributed between tetracloones. Prosoduses irregular, almost perpendicular to the surface, short, with diameter,

equalling that of pores. Central cavity lacking. Exhalant cavities varying in size from 3 to 7 mm. Exhalant canals invisible in the part extended in a macelike manner, in the stem, they are tubular in shape and ca. 0.5 mm. in diameter. Few postica, ca. 2 mm. in diameter, are situated on the apex.

Dermal skeleton contains large ortodichotriaenes, preserved only around a supposed bud and on the stem. Clad length amounts to 0.2—0.3 mm., thickness — to 0.03—0.045 mm. and cladome span — to 0.5 mm. Numerous oxeas 0.1-ca. 0.5 mm. long are scattered all over the surface.

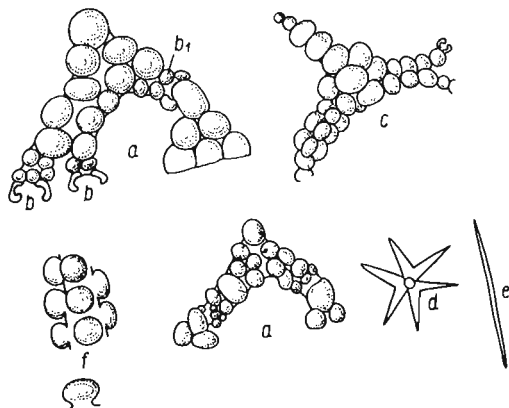


Fig. 36.—*Acrochordonia regularis* n.sp., Lower Campanian, Pniaki. Schematic drawings: a dicranoclones, b zygose, b₁ manner of connecting desmas, c tetramyrmeclones, vertical view, d dermal orthodichotriaenes, e comitalia-oxeas, f morphology of lumps on desmas (Z. Pal. UŁ Sp. II/131); × 25.

Parenchymal skeleton compact, consisting of very densely arranged tetramyrmeclones, closely adhering to each other. Lumps varying in size, are hemispherical in shape and there are 5—6 of them near the apical ray. In the outer part of the body, clones are disposed at an acute angle, while, inside, at an obtuse angle and tetraclones are low. On the lateral surface of some clones, tubercles are arranged in one or several elongated rows. Zygomes are hooklike or lumpy. Lumps on zygomes are finer and irregularly scattered. Derivative desmas are of the tripod and dicranoclone type. Microscleres of the microxea and microstrongyle type, as well as single sterrasters 0.06—0.21 mm. in diameter have been prepared out of the specimen No. 780.

Comparison. — *A. regularis* n.sp. differs from the representatives of the genus *Acrochordonia*, described from France and Germany by Schrammen (1910), Moret (1925) and Defretin-Lefranc (1958), in a very regular shape of the body. It is most similar to *A. ramosa* Schrammen which forms groups of cylindrical or macelike individuals with processes. Besides the shape, it differs from *A. ramosa* in different morphology

of its exhalant system, devoid of paragaster. In *A. regularis*, the widest postica, ca. 2 mm. in diameter, are grouped on the apex and the smallest prosopyles, 0.45—0.75 mm. in diameter, are scattered all over the surface, while, in *A. ramosa*, ostia are irregular, small and postica, 1 mm. in diameter, are grouped in depressions, situated on the inner side of the branches. On the other hand, *A. regularis* n.sp. differs from *A. auricula* Schrammen which is earlike in shape, in the lack of the central cavity and in considerably larger postica. *A. coilorhopalota* Defretin-Lefranc has a large central cavity with osculum, situated below the apex and inhalant pores small and densely arranged. Dermal dichotriaenes in the latter species have a cladome 0.2 mm. in span, while those in *A. regularis* n.sp. — 0.6 mm.

Occurrence. — Poland: Miechów, Upper Campanian, Pniaki, Lower Campanian.

Family **Pachynionidae** Zittel, 1878

Genus *Pachynion* Zittel, 1878

(Type species: *Jerea scripta* Roemer, 1864)

Pachynion scriptum (Roemer, 1864)

(Pl. XXIII, Figs. 6 a—b; Text-fig. 37)

1864. *Jerea scripta* Roemer; A. F. Roemer, Die Spongitarien . . . , p. 34, Pl. 13, Fig. 1.
 1933. *Pachynion scriptum* (Roemer); F. Bieda, Gąbki . . . , pp. 12—13.
 1962. *Pachynion scriptum* (Roemer); L. Lagneau-Hérenger, Contribution . . . , p. 166, Text-Pl. 26, Fig. 3.

Material. — Nine almost complete, well-preserved specimens, without the stem. Cortex and dermal spicules have been destroyed during etching, dichotriaenes remained only at the stem of one specimen.

Dimensions (in mm.):

	Height	Thickness	Diameter of	
			apex	stem
Smallest specimen (Sp. II/1584)	35	18	15	14
Medium specimen (Sp. II/1593)	60	21	ca. 15	15
Largest specimen (Sp. II/1614)	100	38	38 × 25	20

Description. — Specimen, shaped like a narrow mace, slightly tapering downwards with small transverse contractions. Upper pole flat; osculum oval, 6 mm. in diameter, surrounded by 10—13 mm. thick falls. Central cavity flattened, narrow, deep. Aporhyses tortuous, anastomosing and irregularly arranged in walls. In the lower part of the sponge, exhalant system consists of canals and cavities. In the central part of the body, aporhyses, 0.45—0.6 mm. in diameter, are tortuous and their system is perpendicular to the outer wall and paragaster. In the apical part,

near the osculum, aporphyses are elongated around the paragaster and, running obliquely, reach its surface. Inhalant system almost invisible. Prosopyles large, 0.75—1.2 mm. in diameter, irregularly scattered all over the surface, are running to very fine, oval cavities, situated between exhalant canals.



Fig. 37. *Pachynion scriptum* (Roemer), Lower Campanian, Pniaki; a parenchymal dicranoclonal, b parenchymal tetramyrmeclonal, c dermal dichotriaenes, d oxeas (Z. Pal. UŁ Sp. II/1593); $\times 25$.

Dermal skeleton, preserved in the basal part, consists of flattened desmas and dermal dichotriaenes with a cladome span of 0.2 mm. There are also rhizoidal, flat, cut out elements the traces of which are only visible.

Parenchymal skeleton consists of dicranoclonal with clones varying in length from 0.1 to 0.5 mm. Small, globular lumps are loosely distributed on clones. Zygomeres ramified in a clawlike manner. Desmas, connected by zygomeres, sometimes, form skeletal strands, distinctly visible along canals. Parenchymal network dense and compact, with irregular meshes. Single, small dichotriaenes and oxeas, as well as numerous microxeas (specimens Sp. II/1614 and 1593) are visible in the network. Microamphioxeas 0.03—0.06 mm. long and, less frequently, sterrasters with variable dimensions, have been etched out.

Comparison.—Specimens of *P. scriptum* from the vicinities of Witkowice, described by Bieda (1933), differ from our specimens in the arrangement of dicranoclonal on the surface in short fibers. A similar arrangement is visible in the investigated specimens only within the range of canals.

P. scriptum, numerous occurring in Germany, forms groups of more than 7 branches, single individuals being very rarely met with. Specimens, described by Schrammen (1910—1912), differ from our specimens in poorly developed canals and invisible pores. Specimens from the Aptian of Spain, described by Lagneau-Hérenger (1962) have a skeleton, built of large dicranoclonal in which lumps are well-preserved and separated, as well as of megarhizoclonal and small, dermal dichotriaenes, like in specimens, coming from the vicinities of Witkowice. *P. scriptum* from Germany forms groups, having common cortex but separate water

systems. According to Schrammen, particular individuals in such colonies, have their upper part distinctly separated.

P. scriptum resembles *P. cylindricum* Schrammen in the presence of single individuals and in a slender, cylindrical, slightly bent shape but differs in parenchymal desmas which, in *P. cylindricum* Schrammen (1910, p. 68), are larger than in *P. scriptum*. *P. familiare* (Roemer, 1864) considerably differs from *P. scriptum* in the occurrence of individuals, grouped in clusters and concrescent so that their paragaster forms a small orifice.

Investigating the specimens of the genus *Pachynion* from the vicinities of Witkowice, Bieda considers the species *P. scriptum* and *P. cylindricum*, described by Schrammen, to be phenotypical forms of the species *P. scriptum*. The spicule measurements of both these species being unavailable, the supposition, mentioned above, can be neither confirmed, nor denied.

Occurrence. — Poland: Witkowice, Pniaki, Skrajniwa, Lower Campanian; Spain: Aptian sediments; France: Senonian; Germany: in the "Scaphiten Pläner" and "Cuvieri Pläner" horizons and in the Upper and Lower Campanian.

Family **Phrissospongiidae** Lagneau-Hérenger, 1962

Genus *Phalangium* Schrammen, 1910 (= *Iouea* Laubenfels, 1955)

(Type species: *Phalangium cylindratum* Schrammen, 1910)

Phalangium scytaliforme Schrammen, 1910

(Pl. XXIII, Figs. 5 a, b, Text-fig. 38)

1910—1912. *Phalangium scytaliforme* Schrammen; A. Schrammen, Die Kiesel-spon-gien..., p. 70, Pl. 18, Fig. 1; Text-Pl. 3.

1925. *Phalangium scytaliforme* forma *giganteum* Moret; L. Moret, Contribution..., p. 110, Text-fig. 38.

Material. — Twenty specimens, in this number, 14 complete ones, silicified and without the stem; spiculation distinctly visible in different regions of the body.

Dimensions (in mm.):

	Length	Max. width	Width of apex	Width of base	Thickness of wall
Smallest specimen (Sp. II/727)	43	20	18	8	—
Medium specimen (Sp. II/1209)	75	25	—	9	—
Largest specimen (Sp. II/1423)	90	32	ca. 16	12	10

Description. — Sponge shaped like a formless cylinder tapering downwards; lower pole terminating in a short stem which, sometimes, has a globular base; surface uneven, with small processes varying in size;

central cavity narrow and deep, situated in the center; osculum 4 mm. wide; canals narrower than the meshes of the skeletal network.

Dermal skeleton contains ortodichotriaenes with uneven cladomes; clone length varies from 0.06 to 0.2 mm.

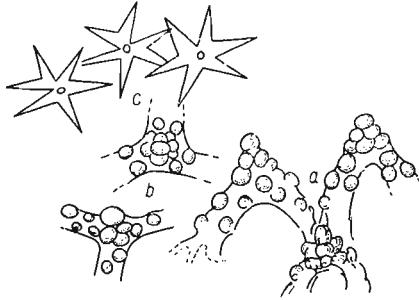


Fig. 38. — *Phalangium scytaliforme* Schrammen, Lower Campanian, Zbyczyce; a arrangement of dicranoclones in the parenchymal network, b fragments of parenchymal tetramyrmeclones, c dermal ortodichotriaenes (Z. Pal. UŁ Sp. II/1423); $\times 25$.

Parenchymal skeleton forms a dense, compact network, consisting of dicranoclones, densely covered with fairly large, globular lumps, distinctly individualized; apical ray, in the form of a small sphere, protrudes over the outer surface among ortodichotriaenes. Dicranoclones variable: regular and stocky, with a variable length and number of rays. Very numerous microxeas, oxeas and, sometimes, protriaenes with a long rhabdome, as well as dichotriaenes occur in the meshes of the network.

On the outer surface of one specimen (Pl. XVII, Fig. 5a), two buds, adhering to the mother individual, occur near the apex. They have a skeleton, consisting of fine discranoclones and of smooth, irregularly elongated fibers. Ortodichotriaenes also occur on their surface. Globular lumps on the dicranoclones of the bud are similar in shape and arrangement to those in the mother individual.

Variation. — In *P. scytaliforme*, the ratio of the body width to height is variable and, in this connection, sometimes, there occur either very bulgy, or more cylindrical specimens, either with rounded, or flattened apices. Ostia have diameters varying from 0.45 to 0.75 mm. Likewise, paragaster diameters varies between 2 and 10 mm. In one specimen (Sp. II/1421), the system of dicranoclones, in lateral walls, is radial, while, near the apex and within the lower part, dicranoclones are pointed with their apical tubercle upwards.

Comparison. — As compared with the specimens from France and Germany, Polish specimens of *Ph. scytaliforme* are the smallest ones. Desmas of our specimens are similar to dicranoclones, figured by Schrammen (1910, Text-Pl. 3, Fig. 2). The greatest similarity occurs

between *Ph. scytaliforme* from Poland and *Ph. cylindratum*. Both these species are similar in shape, size, morphology of the outer surface and in the water system. According to Schrammen, they differ only "durch gracileren Bau" and in the ratio of thickness to height. In *Ph. cylindratum*, this index is expressed by the figures, $1/5$ to $1/4$: 1, while, in *Ph. scytaliforme* — $1/3$: 1. Both these forms seem to represent only different growth stages of the same species. *Ph. scytaliforme* is very similar to *Pachynion scriptum* Roemer. The difference between them is shown in a different development of lumps on desmas. In the genus *Pachynion*, lumps are fine and loosely scattered, whereas, in *Phalangium*, globular, large and similar to those in the representatives of the family Plinthosellidae of the Tetracladina.

Occurrence. — Poland: Skrajniwa, Podgaj, Zbyczyce, Lower Campanian, lithological marl facies; Germany: Misburg, Upper Campanian, France: vicinities of Nice, Emscherian.

Phalangium ramosum Moret, 1925

(Pl. XXII, Figs. 3—7)

1925. *Phalangium ramosum* Moret; L. Moret, Contribution..., p. 109, Pl. 17, Fig. 1.

Material. — Eighty differently sized fragments of branches, mostly silicified; spiculation distinctly visible.

Dimensions (in mm.):

	Height	Thickness of apex	Thickness of the basal part of branch
Smallest branch (Sp. II/825)	30	4	3
Medium branch (Sp. II/1606)	35	5 × 10	3
Largest branch (Sp. II/1435)	55	15	8

Description. — Sponges ramified with cylindrical branches, variable in thickness and length. Surface non-uniform, in some specimens, even, in others, knotty with ringlike swellings; apical part, in the majority of branches, rounded with a small concavity. An axial exhalant canal, 0.1—0.25 mm. in diameter, runs along the main stem; in thicker branches, accessory, verticillate aporhyses are also visible. In thinner branches, ostia and canals are invisible.

Dermal skeleton consists of ortodichotriaenes, distributed in layers. These spicules are pinned in somewhat above the parenchymal network and bound the subdermal cavities (specimen Sp. II/820). Cladome span amounts to 0.3 mm. and clad length in the largest ortodichotriaenes, — to 0.15 mm.

Parenchymal skeleton consists of dicranoclones (specimen Sp. II/813) similar to those in *Ph. scytaliforme* and *Ph. tubulifera*. Fairly numerous

microamphioxeas, microstrongyles, 0.009—0.03 mm. long, rare tornes 0.03 and tylostyles 0.024 mm. long, as well as sterrasters 0.021 mm. in diameter have been etched out of some specimens.

Comparison. — *Ph. ramosum* distinctly differs from other species of the genus *Phalangium* primarily in its irregular development of processes, variable in size, and in a different manner of ramification.

In its externals, this species is very similar to *Thamnospongia glabra* (Hinde, 1883, p. 79) but is different in the internal structure. Both these species may be easily confused with each other since they have dichotriaenes in the cortex and a lumpy parenchymal skeleton. In *Ph. ramosum*, this skeleton consists of dicranoclones, whereas in *Th. glabra* — of lumpy tetracrones. In *Ph. ramosum*, an axial exhalant canal runs along the body and, in the *Th. glabra* branches, these canals, narrower than the network meshes, are in practice, invisible.

Occurrence. — Poland: Skrajniwa, Zbyszce and Podgaj, Lower Campanian; France: very numerous at Saint-Cyr, Santonian.

Phalangium tubulifera Moret, 1925

(Pl. XXII, Fig. 8)

1925. *Phalangium tubulifera* Moret; L. Moret, Contribution..., p. 112.

Material. — Seven calcified specimens with the skeleton morphology preserved.

Dimensions (in mm.):

	Height	Thickness	Diameter of base
Smaller specimen (Sp. II/477)	30	15	8 × 4
Larger specimen (Sp. II/1432)	70	15	8

Description. — Clublike sponge uniform in thickness. Upper part slightly rounded. Surface even, with irregularly scattered ostia, 0.3 to 0.45 mm. in diameter. Central cavity lacking. Apophyses not very distinct; postica, 0.6—0.8 mm. wide, situated on the apex.

Dermal skeleton consisting of densely arranged ortodichotriaenes ca. 0.6 mm. in span.

Parenchymal skeleton consisting of dicranoclones similar to those in *Ph. ramosum*. Numerous microamphioxeas, variable in length, less abundant microamphistongyles, microstyles, a few of them of the toxa type and 0.033 mm. long, as well as occasionally occurring sterrasters, 0.018 mm. in diameter, have been etched out of the specimen No. Sp. II/1430.

Comparison. — Polish specimens are smaller than French ones whose height amounts to 80—90 mm. and thickness — to 30 mm. The lack of

the central cavity and smaller dimensions differ the investigated species from *Ph. scytaaliforme* Schrammen.

Occurrence. — Poland: Pniaki and Zbyczyce, Lower Campanian; France: Senonian of the vicinities of Nice.

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Łódź, December 1964

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HELENA HURCEWICZ

GĄBKI KRZEMIONKOWE Z GÓRNEJ KREDY POLSKI
CZĘŚĆ I. TETRAXONIA

Streszczenie

Rozprawa stanowi pierwszą część monograficznego opracowania górno-kredowych gąbek krzemionkowych Polski i dotyczy Tetraxonia. Przeważającą część materiału stanowią okazy skrzemieniałe, z dobrze zachowanym, chociaż zwykle fragmentarycznie, szkieletem. U wielu okazów w czasie fosylizacji pierwotny szkielet krzemionkowy uległ wtórnie kalcyfikacji. Nieliczne okazy zachowane są w całości, ze spikulami w pierwotnym stanie.

W okazach przedstawicielei *Geodia* Lamarck, *Propachastrella* Zittel, u wszystkich gatunków rodziny Discodermiidae, u wielu z *Megacladina* oraz u *Pachynion scriptum* (Roemer) stwierdzono obecność dość licznych mikrosklerów, należących prawdopodobnie do tych gatunków.

Z opisanych dotychczas przez Biedę (1933) i oznaczonych przez autorkę 124 gatunków gąbek krzemionkowych, w pracy niniejszej opisano 62 gatunki należące do 14 rodzin, 29 rodzajów, w tym 19 nowych gatunków i 1 nowy rodzaj *Kozłowski-spongia*.

Zbadany materiał pochodzi z margli kampanu Wyżyny Krakowskiej i Niecki Nidziańskiej. Stwierdzono, że najliczniej gąbki występują w następujących miejscowościach:

Bonarka, na południe od Krakowa. Opoka krzemienista, określona przez Barczyka (1956) jako środkowa część kampanu dolnego.

Witkowice, na północ od Krakowa. Szaro-ilasty margiel i biały margiel z czerkami, uznane przez Bukowego (1956) za dolny kampan.

Miechów, parów koło stacji kolejowej. Białoszare margle ilaste, z licznymi rdzawymi plamkami. Skały te, według Kracha (1947), należą do senonu. Natomiast, zdaniem F. Huss (1963, MS) analiza otwornicowa pobranych prób wskazuje na górny kampan.

W obrębie progu Lelowskiego, w Niecce Nidziańskiej, stwierdzono trzy większe występowania gąbek:

Skrajniwa. Na polach uprawnych, położonych na skłonie kuesty, tuż przy wysoczyźnie, znajdują się wychodnie białych margli ilastych lub jasnoszarych lupków częściowo glaukonitowych, uznanych przez Różyckiego (1938) za środkową część kampanu dolnego. Zebrany w tych odkrywkach zespół gąbek reprezentowany jest przez 16 rodzajów i 35 gatunków, głównie z grupy Lithistida.

Zbyczyce. Margle jasnoszare, prawie białe, odsłonięte w kilku odkrywkach na wzgórzu. Zdaniem Różyckiego (1938) odpowiadają one senonowi, a znaleziona dawniej i obecnie makrofauna i mikrofauna pozwala je uznać za środkową część kampanu dolnego. Silnie skrzemieniałe gąbki rozmieszczone są tu warstwowo. Tworzą one skupienia na głębokości 0,5 i 1,0 m od powierzchni. W zespole gąbek dominują Rhizocladina.

Pniaki. Na zboczu kuesty i częściowo na jej wysoczyźnie położony jest kamieniołom. Odsłaniają się tu w ścianach, 1—8 m wysokości, biało-szare wapienie margliste grubopłytkowe, o niejednorodnym zabarwieniu, przewarstwione bardziej ilastymi smugami. Zawierają one ławice gąbek z grupy Rhizocladina i Megacladina. Według Różyckiego (1938) osady te stanowią środkową część kampanu dolnego.

W niniejszym opracowaniu gąbek przyjęto systematykę podaną przez Lagneau-Hérenger (1962), wprowadzając pewne przegrupowania, a mianowicie:

1) Rodzaj *Ragadinia* zaliczono do rodziny Discodermiidae na podstawie podobnej drobnogruzelkowatej morfologii tetraklonów parenchymalnych, filotrienów dermalnych i obecności licznych sterrasterów, charakterystycznych dla rodziny Discodermiidae;

2) Niektóre gąbki, dawniej zaliczane do *Hallirhoa*, mające szkielet parenchymalny zbudowany z gruzelkowatych tetraklonów i filotrienów dermalnych, uznano za należące do rodzaju *Phyllodermia* i, co za tym idzie, zaliczone do rodziny Discodermiidae;

3) Rodzaje *Carterella* i *Pachycothon* zaliczono do Tetralithistida na podstawie występowania dermalnych ortodichotrienów oraz typowych heloklonów parenchymalnych, połączonych w sieć za pomocą zygozy;

4) Na podstawie morfologii desmów przeniesiono rodzaj *Inodia* z rodziny Dorydermidae do Isoraphiniidae, zaliczonej przez Schrammena (1937) do Helocladina (= Helomorina);

5) Podrodziny Doryderminae i Homalodorinae podniesiono do rangi samodzielnych rodzin, odznaczających się wielkością megaklonów, ich sposobem ułożenia, typem spikul dermalnych, obecnością i brakiem wiązek komitalii, rozmieszczeniem i budową ostiów, a także typem mikrosklerów. Do Homalodoridae zaliczono rodzaje *Homalodora* i *Amphilectella*, zaś do Dorydermidae — rodzaje *Doryderma*, *Brochodora* i *Pachypoterion*.

Najszerze stratygraficzne rozprzestrzenienie w kredzie górnej Europy mają gatunki: *Propachastrella primaeva*, *Aulaxinia sulcifera*, *Siphonia tulipa*, *S. pyriformis*, *Eustrobilus callosus*, *Plinthosella squamosa*, *Brochodora roemeri* i *Pachynion scriptum*.

W kampanie szerokie rozprzestrzenienie geograficzne miały rodzaje: *Jerea*, *Siphonia*, *Ragadinia* oraz *Isoraphinia*. Gatunki *Siphonia tulipa*, *S. pyriformis* i *Ragadinia rimosa* znane są z utworów górnej kredy Europy zachodniej i wschodniej.

DIAGNOZY NOWYCH JEDNOSTEK TAKSONOMICZNYCH

Phymatella irregularis n.sp.

(Pl. III, fig. 5, 6; tekst-fig. 6)

Phymatella nieregularna, bez nóżki i jamy paragastralnej. W sieci parenchymalnej i w świetle kanałów występują charakterystyczne pęki oksów i trienów.

Thecosiphonia gracilis n.sp.

(Pl. IX, fig. 2; tekst-fig. 8)

Thecosiphonia krzaczasta, o delikatnych gałązkach dzielących się nieregularnie i pokrytych korteksem. Tetraklony parenchymalne delikatniejsze i mniejsze, aniżeli u *T. ramosa* Schrammen.

Rodzaj *Kozlowskispongia* n.gen.

Gatunek typowy: *Kozlowskispongia bulbosa* n.sp.

(Pl. VII, fig. 1 a—b)

Gąbki o pustych, bulwiastych wyrostkach, powstałych jako wypukłości falistej płytki. Aparat wodny słabo rozwinięty: brak typowej jamy paragastralnej, ostia

i apopory nierównej wielkości. Sieć szkieletowa niezbyt gęsta, utworzona z gładkich tetraklonowych desmów; szkielet dermalny z ortodichotrienami pokrywa ciągłą warstwą wszystkie wyrostki.

Rodzaj monotypowy.

Phyllodermia magna n.sp.

(Pl. XI, fig. 1 a—b; tekst-fig. 12)

Phyllodermia masywna, maczugowata, o nieregularnym biegunie górnym, zlekka pobrużdżonym. Ostia na korteksie niewidoczne, prosopyle o nieregularnych zarysach. Filotrieny dermalne głęboko powycinane, tetraklony parenchymalne drobno-gruzełkowate; liczne sterrastery zmiennej wielkości.

Phyllodermia pulchra n.sp.

(Pl. XII; fig. 2; tekst-fig. 13)

Phyllodermia nieregularnie stożkowata, o odmiennie wykształconych ściankach bocznych, jednej wypukłej, drugiej spłaszczonej i wachlarzowato rozszerzonej. Jamy paragastralnej brak. Korteks złożony z filotrienów ostrokańciastych, powycinanych. Tetraklony gruzełkowate. Obecne są sterrastery.

Eustrobilus extraneus n.sp.

(Pl. IX, fig. 1 a—c; tekst-fig. 15)

Eustrobilus o charakterystycznym kształcie zewnętrznym, zbliżonym do zdeformowanej maczugi z dwu stron odmiennie, z wyrostkami. Paragaster rurowaty, głęboki. Kanały wodne kręte, o skośnym przebiegu.

Ragadinia foraminifera n.sp.

(Pl. XII, fig. 1 a—c; tekst-fig. 17)

Ragadinia kształtu wachlarzowatego, o brzegu falistym. Na powierzchni wewnętrznej znajdują się luźno rozmieszczone, napastkowate wgłębienia ekshalacyjne. Na ścianie zewnętrznej znajdują się nieregularne wyrostki.

Plinthosella elegans n.sp.

(Pl. XIII, fig 2 a—c; tekst-fig. 21)

Plinthosella stożkowata, o nierównej płaszczyźnie szczytowej i powierzchni ścianek bocznych. Część dolna opatrzona wyrostkami. Gruzełki w tetramyrmeklonach ułożone regularnie, szeregowo. Płytki dermalne tylko na bocznych ściankach.

Heloraphinia chordata n.sp.

(Pl. XXII, fig. 9; tekst-fig. 23)

Heloraphinia walcowata, zmiennej wielkości, bez jamy paragastralnej. System inhalacyjny niewyraźny. Dermalne ortodichotrieny luźno wpięte w szkielet parenchymalny. Heloklony gęsto ułożone w nieregularne, podłużne pasemka.

Brochodora latiramea n.sp.

(Pl. XIV, fig. 3 a—b)

Brochodora o gałązkach trójkątnie wachlarzowatych, dwubocznie spłaszczonych, Rozgałęzienie następuje w jednym miejscu. Sieć parenchymalna zbudowana z megaklonów dość masywnych, ułożonych podobnie jak u *B. ramusculus*, lecz odmiennej długości i wypukłości.

Pachypoterion biedai n.sp.

(Pl. XV, fig. 1 a—c; tekst-fig. 27)

Pachypoterion kształtu cylindrycznego, rozszerzający się łopatkowato ku górze. Pory ułożone w faliste, pionowe szeregi. Brak jamy gastralnej. Silnie rozwinięty szkielec pleuralny.

Homalodora skrainivensis n.sp.

(Pl. XVIII, fig. 1 a—b; tekst-fig. 29)

Homalodora złożona z krótkich, bulwiastych odgałęzień, ze stożkowatymi wyniosłościami na górnej powierzchni. Nóżka krótka, stożkowata. Aporyzy ułożone w wiązki. Apopory skupione na szczytach wyniosłości. Megaklony mniejsze aniżeli u *H. ramosa*.

Homalodora polonica n.sp.

(Pl. XVI, fig. 1—2; tekst-fig. 30)

Homalodora w kształcie maczugi, pojedynczej bądź dwudzielnej. Ostia nierównej wielkości w dolnej i górnej części gąbki. Aporyzy ułożone w wiązki.

Homalodora breviramosa n.sp.

(Pl. XX, fig. 1)

Homalodora złożona z krótkich, grubych, walcowatych gałązek, nieregularnie skupionych, o płasko ściętych szczytach; ostia owalne, zmiennej wielkości; megaklony o zygomach silnie łopatkowo wydłużonych.

Propleroma campanica n.sp.

(Pl. XX, fig. 3; tekst-fig. 31)

Propleroma krzaczasta, złożona z delikatnych gałązek, zrosniętych wzdłuż ścianek. Pory są niewidoczne, kanały wodne niezbyt wyraźne. Dermalne dichotrieny ułożone oddzielnie.

Heterostinia phytoniformis n.sp.

(Pl. XXI, fig. 4; tekst-fig. 34)

Heterostinia masywna, pojedyncza, wydłużona, niezbyt szeroka, zlekka zgięta; ścianki grube, pory niewyraźne. Megaklony jak u *H. immanis* Schrammen.

Acrochordonia bifurcata n.sp.

(Pl. XX, fig. 4—5)

Acrochordonia krzaczasta, o gałązkach dzielących się dichotomicznie. Ostia niewyodrębnione. Kanaliki wodne węższe niż oczka sieci szkieletowej.

Acrochordonia regularis n.sp.

Acrochordonia o bardzo regularnym, maczugowatym kształcie, bez jamy paragastralnej. System ekshalacyjny złożony z licznych nieregularnych próżni; kanały bardzo krótkie. Tetraklony grubogruzełkowate, dichotrieny o rozpiętości kladomu 0,5 mm.

HELENA GURCEWICZ

ВЕРХНЕМЕЛОВЫЕ КРЕМНЕВЫЕ ГУБКИ ПОЛЬШИ
ЧАСТЬ I. TETRAXONIA

Резюме

Настоящая работа является первой частью монографического изучения верхнемеловых кремневых губок Польши и касается *Tetraxonia*. Главную часть материала становятся окременелые образцы с хорошо сохранным, хотя обычно фрагментарным скелетом. У многих образцов во время фоссилизации первичный кремневый скелет подвергнулся вторично кальцификации. Только немногие экземпляры сохранены целиком, со спикулами в первичном состоянии.

У представителей *Geodia* Lamarck, *Propachastrella* Zittel, у всех видов семейства *Discodermiidae*, у многих представителей *Megacladina* и у *Pachynion scriptum* (Roemer) констатируется наличие довольно многочисленных микросклер, вероятно принадлежащих этим видам.

Из описанных до сих пор Бедой (Bieda, 1933) и определенных автором 124 видов кремневых губок, в настоящей работе описано 62 вида принадлежащих 14 семействам, 29 родам, в этом 19 новых видов и один новый род *Kozlowskispongia*.

Изученный материал происходит из кампанских мергелей Краковской возвышенности и Нидзянской мульды. Констатируется, что наиболее обильно губки выступают в следующих местностях:

Бонарка, на юг от Кракова. Кремнистая опока, Барчиком (Baczyk, 1956) определена как средняя часть нижнекампанского яруса.

Витковице, на север от Кракова. Серо-глинистый мергель и белый с чертами, которых век Буковы (Bukowy, 1956) определил как нижнекампанский.

Мехув, овраг около железнодорожной станции. Бело-серые глинистые мергели с обильными ржавыми пятнышками. Эти образования зачислены Крахом (Krach, 1947) к сенону. По мнению Ф. Гусс (F. Huss, 1963, неопубликованная работа) анализ по фораминиферам из этих осадков указывает на их верхнекампанский век.

В пределах Лелёвского порога, в Нидзянской мульде констатируется три большие скопления губок:

Скрайнива. На обрабатываемых полях на склоне куэсты рядом с возвышенностью находятся обнажения белых глинистых мергелей или же светлосерых сланцев частично глауконитовых, принадлежащих по мнению Ружицкого (Różycki, 1938) к средней части нижнего кампана. Собранные в этих обнажениях сообщество губок состоит из 16 родов и 35 видов, главным образом из группы Lithistida.

Збычице. Светло-серые, почти белые мергели в нескольких обнажениях на холме. По мнению Ружицкого осадки эти сенонского века, а найденная прежде и в настоящее время макро- и микрофауна указывает на среднюю часть нижнего кампана. Сильно окременелые губки размещены здесь прослойно в виде скоплений на глубине 0,5 и 1 м под поверхностью. В сообществе губок преобладают Rhizocladina.

Пняки. На склоне куэсты и частично на ее возвышенности находится каменеломня. На стенах 1—8 м высоких видны обнажения бело-серых мергелистых, толстослоистых известняков, неоднородной окраски, с прослойками более глинистыми. В них находятся губки из групп Rhizocladina и Megacladina. По мнению Ружицкого (Różycki, 1938) осадки эти принадлежат к средней части нижнего кампана.

В настоящей работе принято систематику Lagneau-Hérenger (1962) но введено следующие перегруппировки:

1) Род *Ragadintia* зачислено к семейству Discodermiidae на основании сходства мелко бугорчатой морфологии паренхимальных тетраклонов, дермальных филотриэнов и наличия многих стеррастеров, характерных для семейства Discodermiidae.

2) Некоторые губки, прежде зачисляемые к роду *Hallirhoa*, имеющие паренхимальный скелет построенный с бугорчатых тетраклонов и дермальных филотриэнов, зачислено к роду *Phyllodermia*, а затем к семейству Discodermiidae.

3) Роды *Carterella* и *Pachycothon* зачислено к Tetralithistida на основании наличия дермальных ортодихотриэнов, а также типичных гелоклонов паренхимальных, соединенных в решетку при помощи зигоза.

4) На основании морфологии десм перемещено род *Inodia* из семейства Dorydermiidae к семейству Isographiniidae, которую Шраммен (Schrammen, 1937) зачислил к Helocladina (= Helomorina).

5) Подсемейства Doryderminae и Homalodorinae повышено в ранг самостоятельных семейств, отличающихся размером мегаклонов, способом их уложения, типом дермальных спикул, наличием и отсутствием пучков комиталий, распре-

делением и строением остий, а также типом микросклер. К Homalodoridae зачислено роды *Homalodora* и *Amphilectella*, а к Dorydermidae роды *Doryderma*, *Brochodora* и *Pachypoterion*.

Наиболее широкое стратиграфическое распространение в верхнемеловых отложениях Европы имеют виды: *Propachastrella primaeva*, *Aulaxinia sulcifera*, *Siphonia tulipa*, *S. pyriformis*, *Eustrobilus callosus*, *Plinthosella squamosa*, *Brochodora roemeri* и *Pachynion scriptum*.

В кампанских осадках широкое географическое распространение имели роды: *Jerea*, *Siphonia*, *Ragadinia* и *Isoraphinia*. Виды *Siphonia tulipa*, *S. pyriformis* и *Ragadinia rimosa* известны из верхнемеловых отложений восточной и западной Европы.

ДИАГНОЗЫ НОВЫХ ТАКСОНОМИЧЕСКИХ ЕДИНИЦ

Phymatella irregularis n. sp.

(Пл. III, фиг. 5, 6; текст-фиг. 6)

Phymatella нерегулярная, без ножки и парагастральной полости. В паренхимальной решетке и в просвете каналов находятся характерные пучки оксов и тризнов.

Thecosiphonia gracilis n. sp.

(Пл. IX, фиг. 2; текст-фиг. 8)

Thecosiphonia кустовидная, с тонкими ветвями, нерегулярно разветвленными и покрытыми кортексом. Паренхимальные тетраклоны более тонкие чем у *T. ramosa* Schrammen.

Род *Kozlowskispongia* n. gen.

Типичный вид: *Kozlowskispongia bulbosa* n. sp.

(Пл. VII, фиг. 1 a, b)

Губки с пустыми, клубневидными выростами, возникшими как выпуклости волнистой пластинки. Ирригационная система слабо развита; нет типичной парагастральной полости, остии и апопоры разного размера. Скелетная решетка не очень густая, состоит из гладких, тетраклоновых десм; дермальный скелет с ортодихотризмами покрывает сплошным слоем все выросты.

Род монотипный.

Phyllodermia magna n. sp.

(Пл. XI, фиг. 1 a, b; текст-фиг. 12)

Phyllodermia массивная, в виде палицы, с нерегулярным верхним полюсом на котором видны тонкие бороздки. Остий на кортексе не видно, прозопилы нерегулярных очертаний. Дермальные филотризы глубоко вырезанные, паренхимальные тетраклоны мелкобугорчатые; многочисленные стеррастеры изменчивых размеров.

Phylodermia pulchra n. sp.

(Пл. XII, фиг. 2; текст-фиг. 13)

Phylodermia нерегулярно конусовидная, с различно развитыми боковыми стенками, одной выпуклой, другой сплюсненной и веерообразно расширенной. Парагастральная полость отсутствует. Кортекс состоит из остроуголоватых вырезанных филотриэнов. Тетраклоны бугорчатые. Стеррастеры присутствуют.

Eustrobilus extraneus n. sp.

(Пл. IX, фиг. 1 а-с; текст-фиг. 15)

Eustrobilus характерной внешней формы, похожий на деформированную палицу, разную с обеих сторон, с выростами. Парагастральная полость трубчатая, глубокая. Ирригационные каналы извилистые и косые.

Ragadinia foraminifera n. sp.

(Пл. XII, фиг. 1 а-с; текст-фиг. 17)

Ragadinia веерообразная, с извилистым краем. На внутренней поверхности свободно расположены напёрстковидные экскаляционные углубления. Внешняя стенка снабжена нерегулярными выростами.

Plinthosella elegans n. sp.

(Пл. XIII, фиг. 2 а-с; текст-фиг. 21)

Plinthosella конусовидная с неровной вершинной плоскостью и поверхностью боковых стенок. Нижняя часть снабжена выростами. Бугорки в тетрамирмеклонах расположены регулярно рядами. Дермальные пластинки только на боковых стенках.

Heloraphinia chordata n. sp.

(Пл. XXII, фиг. 9; текст-фиг. 23)

Heloraphinia цилиндрическая, изменчивой величины, без парагастральной полости. Ингаляционная система нечеткая. Дермальные ортодихотриэны свободно воткнуты в паренхимальный скелет. Гелоклоны густо уложены в нерегулярные удлиненные полосы.

Brochodora latiramea n. sp.

(Пл. XIV, фиг. 3 а, б)

Brochodora с треугольно веерообразными ветвями, сплюсненными двухсторонно. Ветвление наступает в одном месте. Паренхимальная решетка построена из мегаклонов довольно массивных, уложенных подобно тому как у *B. ramuscilus*, но ее длина и выпуклость различные.

Pachypoterion biedai n. sp.

(Пл. XV, фиг. 1 а-с; текст-фиг. 27)

Pachypoterion цилиндрический, расширяется кверху в форме лопасти. Поры уложены извилистыми вертикальными рядами. Гастральная полость отсутствует. Плевральный скелет сильно развит.

Homalodora skrainivensis n. sp.

(Пл. XVIII, фиг. 1 а, b; текст-фиг. 29)

Homalodora построена из коротких клубенистых ветвлений, с конусными возвышенностями на верхней поверхности. Короткая конусная ножка. Алохеты уложены пучками. Алопоры собраны на верхушках возвышенностей. Мегаклоны меньше чем у *H. ramosa*.

Homalodora polonica n. sp.

(Пл. XVI, фиг. 1-2; текст-фиг. 30)

Homalodora в виде палицы, единичной или же двойной. Остии разного размера в нижней и верхней части губки. Микросклеры типа стеррастер, сферастер, микроамфиокс и микростронгиль.

Homalodora breviramosa n. sp.

(Пл. XX, фиг. 1)

Homalodora построена из коротких, толстых, цилиндрических ветвей скопленных нерегулярно, с плоско срезанными верхушками; остии овальные, изменчивых размеров; мегаклоны с зигомами сильно лопастновидно удлинеными.

Propleroma campanica n. sp.

(Пл. XX, фиг. 3; текст-фиг. 31)

Propleroma кустовидная, состоит из тонких ветвей, срастающихся вдоль стенок. Поры невидимы, ирригационные каналы не очень четкие. Дermalные дихотриэны расположены отдельно.

Heterostinia phytoniformis n. sp.

(Пл. XXI, фиг. 4; текст-фиг. 34)

Heterostinia массивная, единичная, удлинённая, не очень широкая, слегка согнутая; стенки толстые, поры нечеткие. Мегаклоны как у *H. immanis* Schrammen.

Acrochordonia bifurcata n. sp.

(Пл. XX, фиг. 4—5)

Acrochordonia кустовидная, с ветвями дихотомически разветвленными. Остии не выделяются. Ирригационные каналы уже чем петли скелетной решетки.

Acrochordonia regularis n.sp.

(Пл. XX, фиг. 6; текст-фиг. 36)

Acrochordonia очень регулярной палицеобразной формы, без парагастральной полости. Эксгалиационная система построена с многих нерегулярных пустот; каналы очень короткие. Тетраклоны крупнобуторчатые, дихотриэны с кладом 5 мм размаха.

PLATES

Plate I

Geodia sp.
(Zbyczyce, Lower Campanian)

- Fig. 1a. A fragment of sponge shaped like a flat, elongated plate (Z. Pal. UŁ Sp. II/729A); × 1.
Fig. 1b. A fragment of the parenchymal skeleton on the surface, bundles of amphioxeas and protriaenes *in situ* (Z. Pal. UŁ Sp. II/729A); × 8.5.
Fig. 1c. Sterrasters isolated from megascleres' network (Z. Pal. UŁ Sp. II/729A); × 65.
Fig. 2. A fragment of the dermal skeleton *in situ*: or ortodichotriaenes, *am* amphioxeas (Z. Pal. UŁ Sp. II/729B); × 16.

Callopegma Zittel
(Lower Campanian)

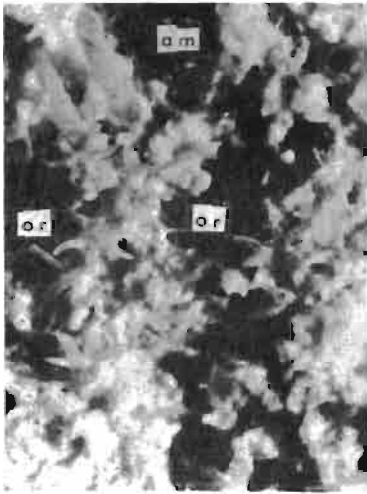
- Fig. 3. *Callopegma ficoideum* Hinde; Zbyczyce (Z. Pal. UŁ Sp. II/1287); × 1.
Fig. 4. *Callopegma ficoideum* Hinde; Zbyczyce (Z. Pal. UŁ Sp. II/1446); × 1.
Fig. 5. *Callopegma acaule* Zittel; Pniaki (Z. Pal. UŁ Sp. II/1290); × 1.



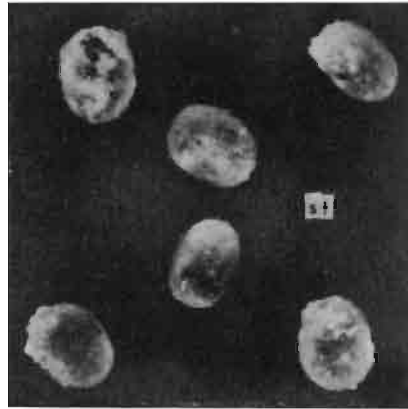
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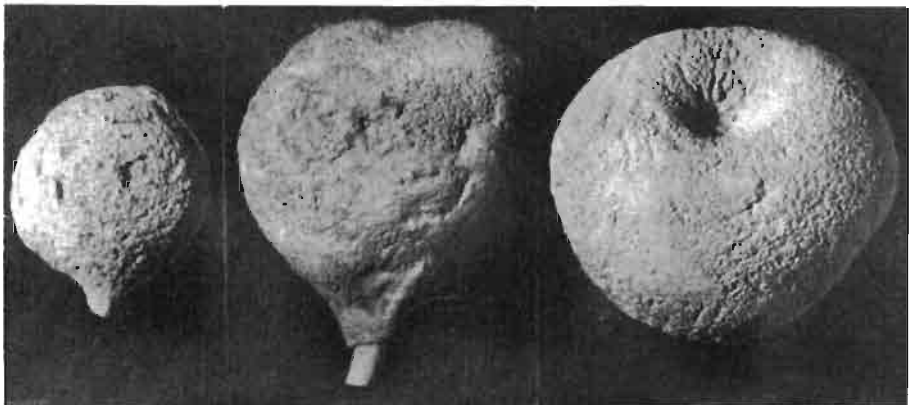
1b



2



1c



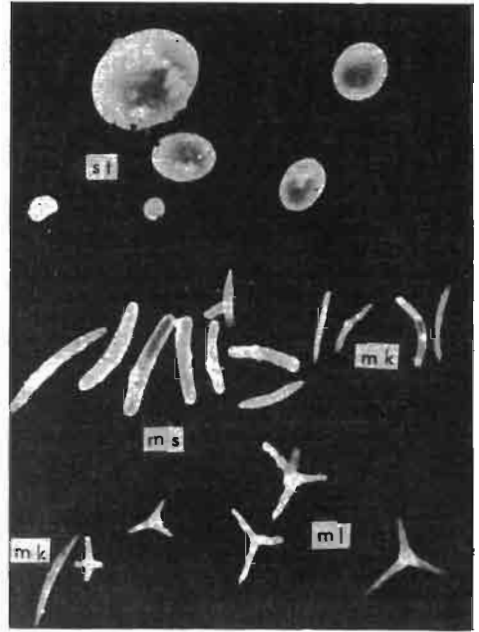
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4

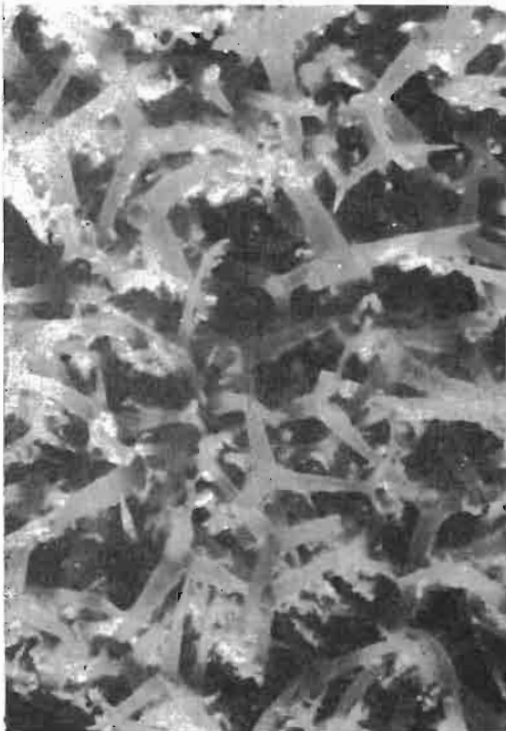
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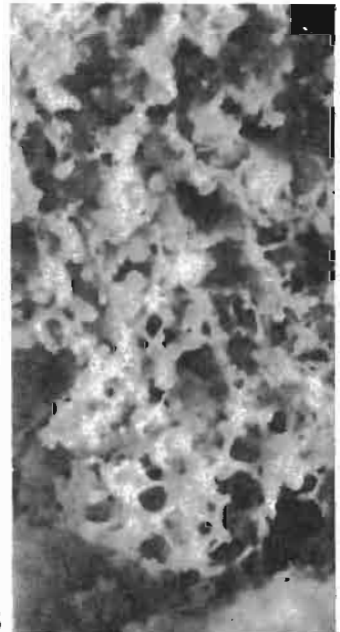
1



2b



2a



3

Plate II

Propachastrella primaeva (Zittel)
(Zbyczyce, Lower Campanian)

Fig. 1. Cuplike specimen (Z. Pal. UŁ Sp. II/1422); × 1.

Fig. 2a. A fragment of the parenchymal network on the surface of the wall, with a natural arrangement of chelotrops (Z. Pal. UŁ Sp. II/700); × 16.

Fig. 2b. Isolated microscleres: *ms* microstrongyles, *mk* microxeas, *ml* micro-calthrops, *st* sterrasters (Z. Pal. UŁ Sp. II/700); × 65.

Kozłowskispongia bulbosa n.sp.
(Miechów, Upper Campanian)

Fig. 3. A fragment of the parenchymal network (Z. Pal. UŁ Sp. II/93); × 20.
(See also Pl. VII, fig. 1)

Plate III

- Fig. 1. *Myrmeciophytum verrucosum* (Roemer), a fragment of sponge with postica; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1471); $\times 1$.
- Figs. 2, 3. *Aulaxinia sulcifera* (Roemer), young stage; Przesławice (Fig. 2), Gnato-
wice (Fig. 3), Lower Maastrichtian (Z. Pal. UŁ Sp. II/4 and 715); $\times 1$.
- Fig. 4. *Aulaxinia ventricosa* Schrammen, a fragment of the parenchymal network,
isolated on the surface of the wall; Skrajniwa, Lower Campanian (Z. Pal.
UŁ Sp. II/1296); $\times 30$.
- Fig. 5. *Phymatella irregularis* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ
Sp. II/1252); $\times 1$.
- Fig. 6. *Phymatella irregularis* n.sp., a fragment of the parenchymal network; Gna-
towice, Lower Maastrichtian (Z. Pal. UŁ Sp. II/31); $\times 17.5$.
- Fig. 7. *Phymatella bulbosa* Zittel; Pniaki, Lower Campanian (Z. Pal. UŁ Sp.
II/1028); $\times 1$.



1



2



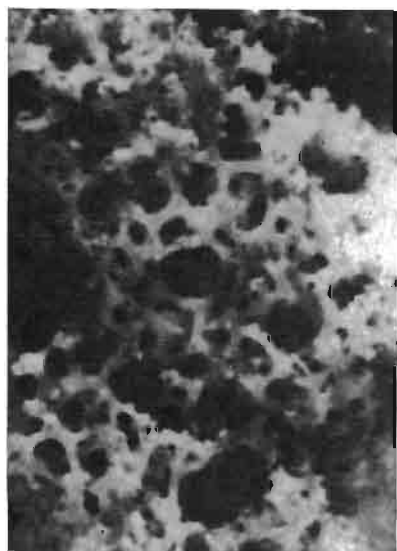
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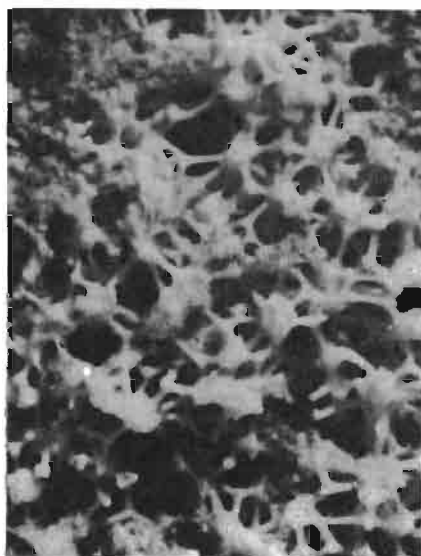
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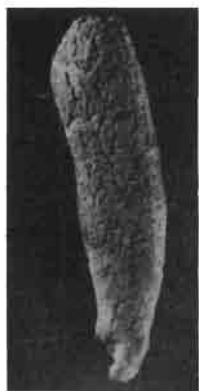
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4



6



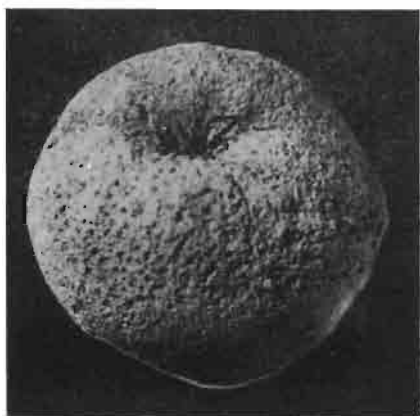
1



2



3a



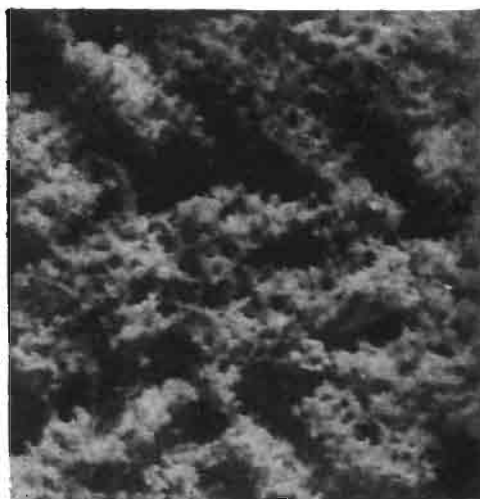
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5



6



3b

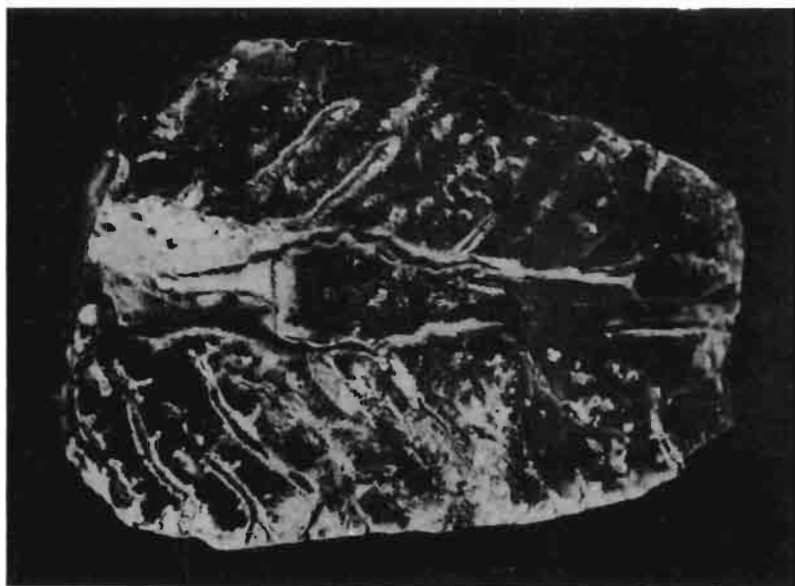
Plate IV

- Fig. 1. *Jerea pyriformis* Lamouroux; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/382); \times 1.
- Fig. 2. *Jerea pyriformis* Lamouroux; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1623); \times 1.
- Fig. 3a. *Jerea pyriformis* Lamouroux; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1624); \times 1.
- Fig. 3b. *Jerea pyriformis* Lamouroux, a fragment of the parenchymal network; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1624); \times 20.
- Fig. 4. *Siphonia tulipa* Zittel; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1234); \times 1.
- Fig. 5. *Siphonia pyriformis* Goldfluss; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/230); \times 1.
- Fig. 6. *Siphonia ficus* Goldfuss; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/382); \times 1.

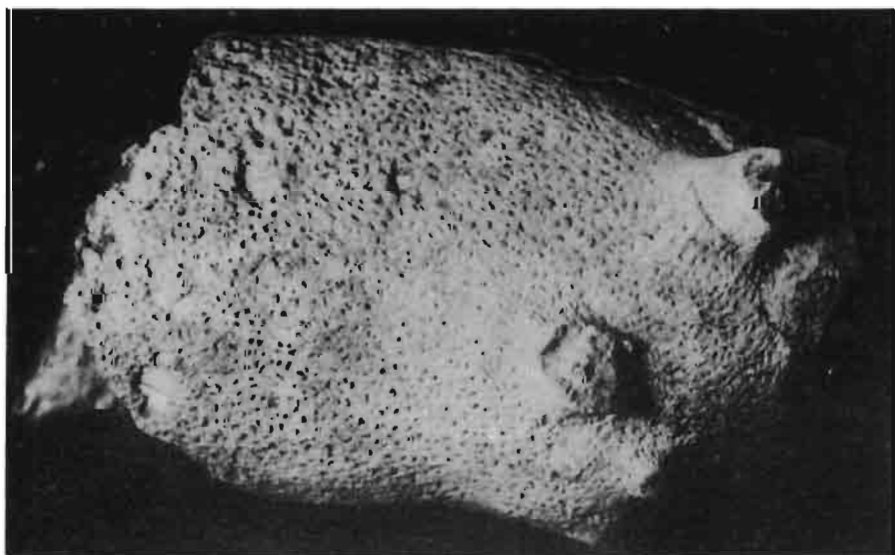
Plate V

Siphonia tubulosa (Roemer)
(Zbyczyce, Lower Campanian)

- Fig. 1. A fragment of the sponge without the upper pole, lateral view (Z. Pal. UŁ Sp. II/386); $\times 0.5$.
- Fig. 2. Longitudinal section through the lower part of the sponge; the bottom of the central cavity, epirhyses and aporhyses visible (Z. Pal. UŁ Sp. II/275) $\times 1$.

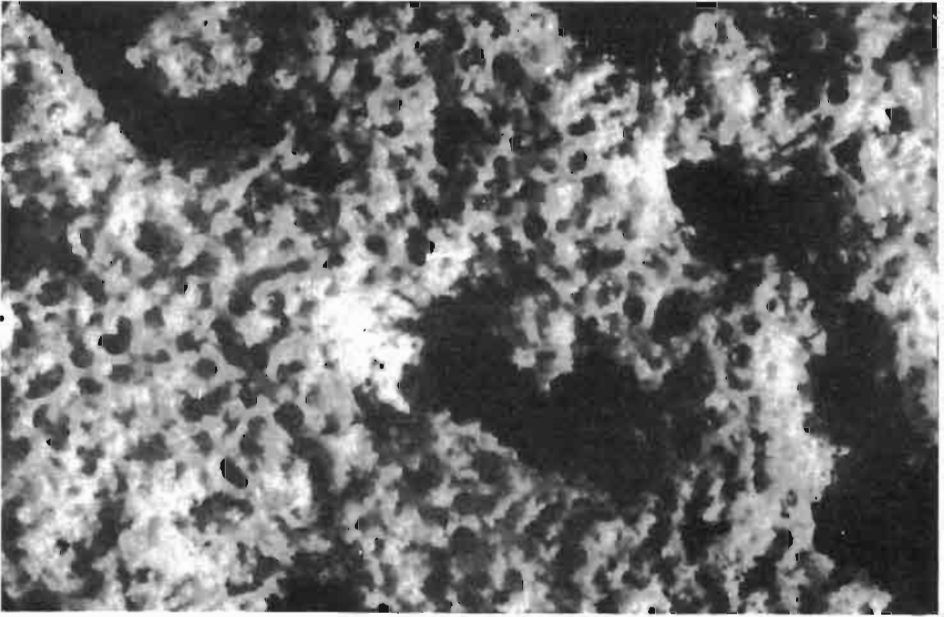


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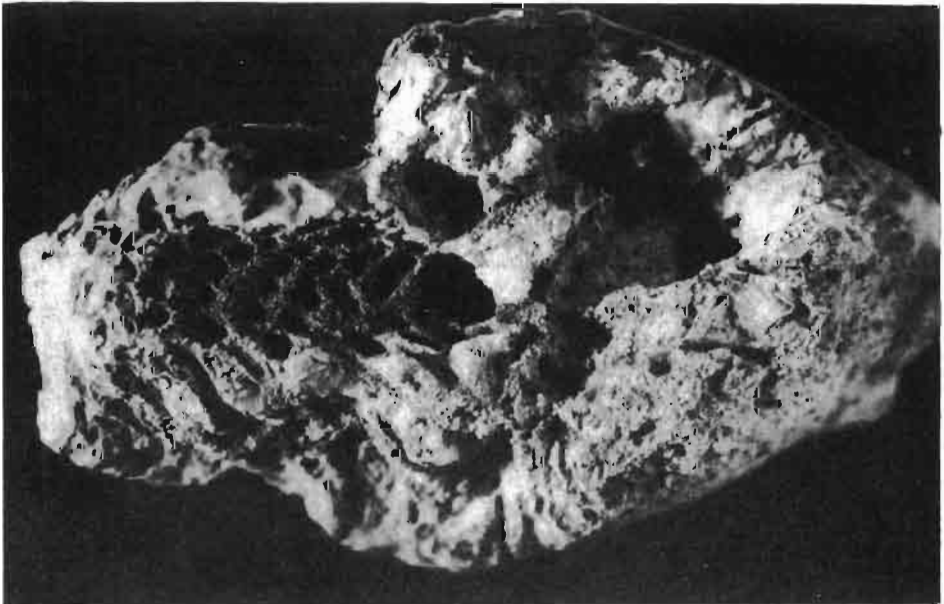
1

Phot. M. Czarnocka



2

1



Phot. M. Czarnocka & L. Łuszczewska

Plate VI

Siphonia tubulosa (Roemer)
(Zbyczyce, Lower Campanian)

- Fig. 1. A fragment of the lower part of the sponge with a leukonoidal structure of the water system; large postica visible on the wall of the central cavity (Z. Pal. UŁ Sp. II/670); $\times 1$.
- Fig. 2. A fragment of the parenchymal network, encircling prosopyles (Z. Pal. UŁ Sp. II/387); $\times 20$.

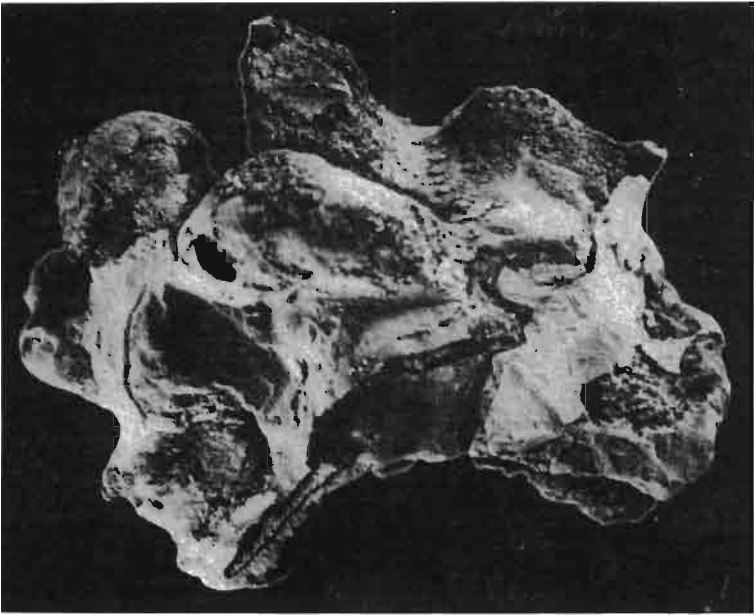
Plate VII

Kozlowskispongia bulbosa n.gen., n.sp.
(Miechów, Upper Campanian)

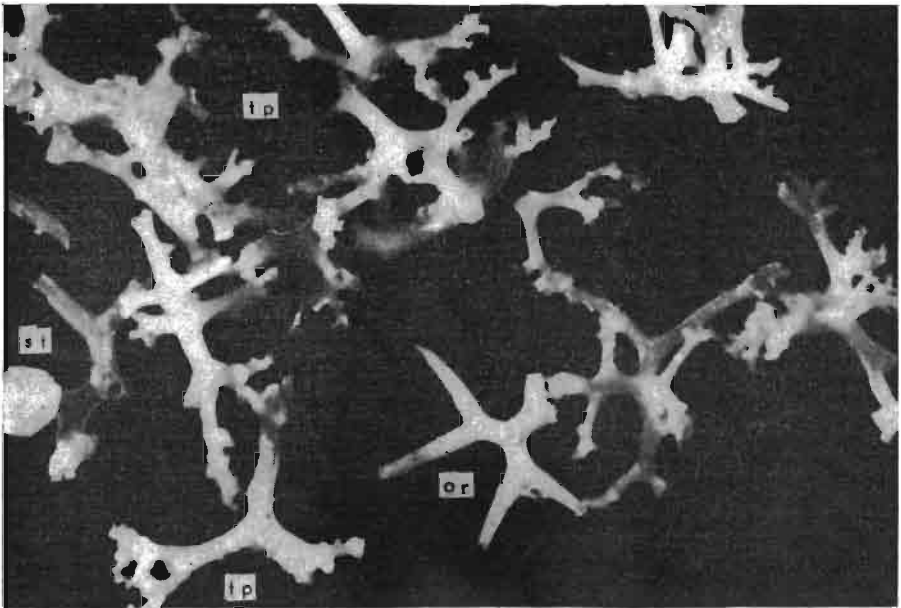
Fig. 1a. Lateral view of the sponge (Z. Pal. UŁ Sp. II/93); $\times 1$.

Fig. 1b. Isolated megascleres: *or* dermal ortodichotriaenes, *tp* parenchymal tetracles, *st* sterraster type microsclere (Z. Pal. UŁ Sp. II/93); $\times 60$.

(See also Pl. II, fig. 3)



1a

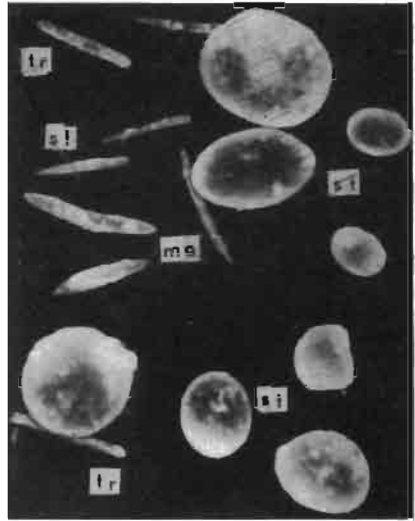


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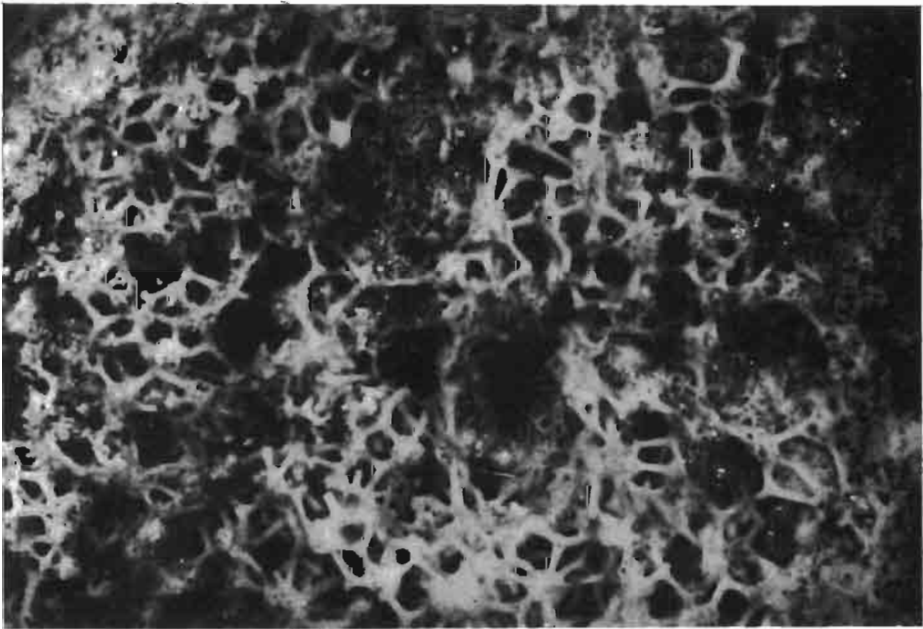
Phot. M. Czarnocka & L. Łuszczewska



1a



1b



2

Phot. M. Czarnocka & L. Łuszczewska

Plate VIII

- Fig. 1a. *Turonia variabilis* Michelin; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/381); $\times 1$.
- Fig. 1b. *Turonia variabilis* Michelin, isolated microscleres: *st* sterrasters, *tr* tornotes, *ma* microamphioxeas, *sl* style; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/381); $\times 65$.
- Fig. 2. *Turonia* aff. *variabilis* Michelin, a fragment of the parenchymal network consisting of tetracloves and ortodichotriaenes in the walls of water canals; Miechów, Upper Campanian (Z. Pal. UŁ Sp. II/127); $\times 17$.

Plate IX

- Fig. 1a. *Eustrobilus extraneus* n.sp., viewed from the side of the wall without the dermal skeleton; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1617); $\times 1$.
- Fig. 1b. *Eustrobilus extraneus* n.sp., viewed from osculum; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1617); $\times 1$.
- Fig. 1c. *Eustrobilus extraneus* n.sp., isolated sterrasters; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1617); $\times 65$.
- Fig. 2. *Thecosiphonia gracilis* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. I/1565); $\times 1$.



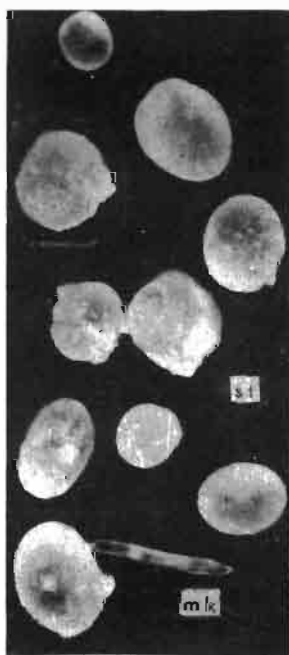
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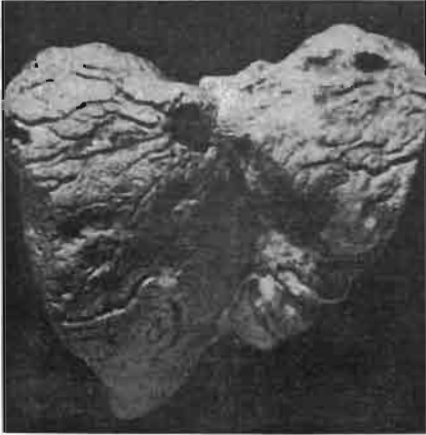
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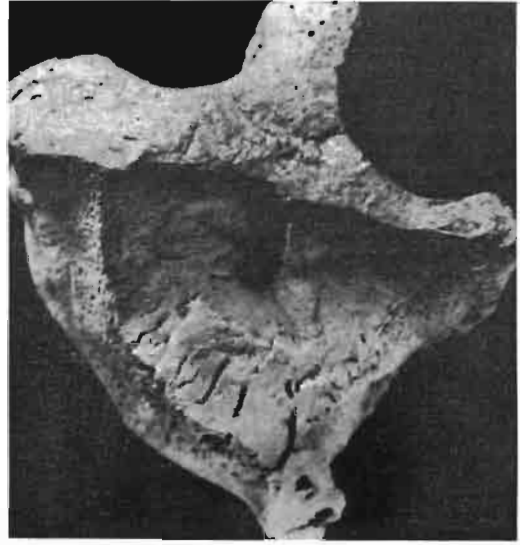
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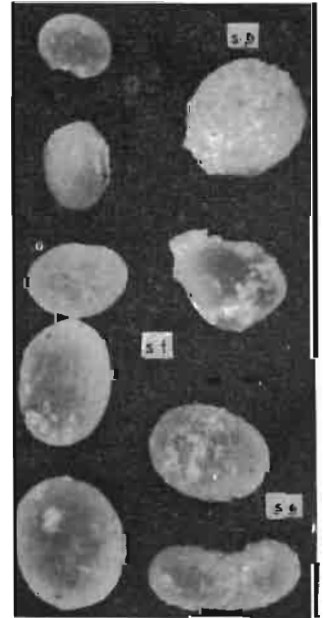
1c



2



1



3b

3a

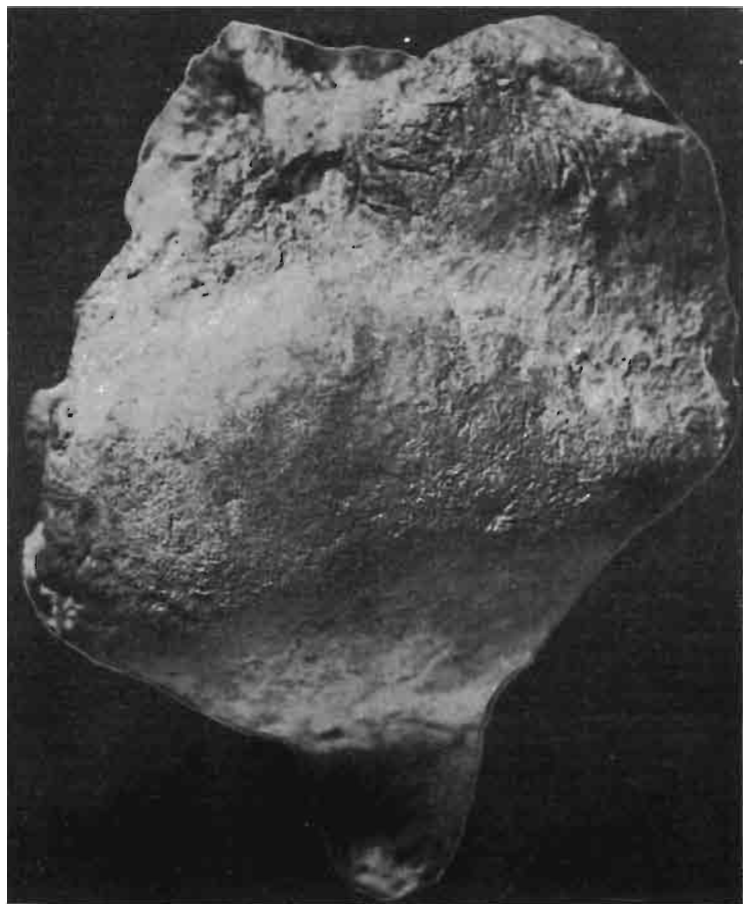
Plate X

- Fig. 1. *Phyllodermia costata brevicostata* Hinde, transverse section with uneven surface; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1200); $\times 1$.
- Fig. 2. *Eustrobilus callosus* Schrammen, complete specimen; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/726); $\times 1$.
- Fig. 3a. *Eustrobilus callosus* Schrammen; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1482); $\times 1$.
- Fig. 3b. *Eustrobilus callosus* Schrammen, isolated microscleres: *st* sterrasters, *sp* sphaerasters, *se* elongated and flattened sterraster with a small depression; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1482); $\times 65$.

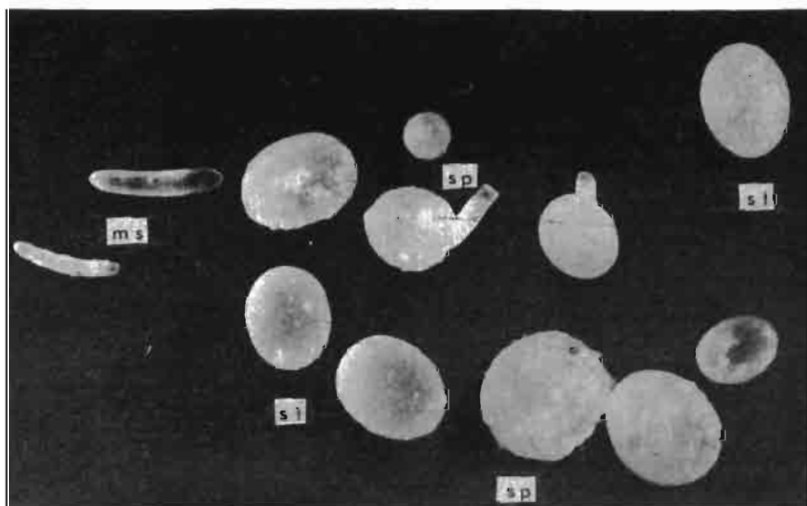
Plate XI

Fig. 1a. *Phyllodermia magna* n.sp.; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1295); $\times 1$.

Fig. 1b. *Phyllodermia magna* n.sp., isolated microscleres: *st* sterrasters, *sp* sphaerasters, *ms* microstrongyles; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1295); $\times 65$.

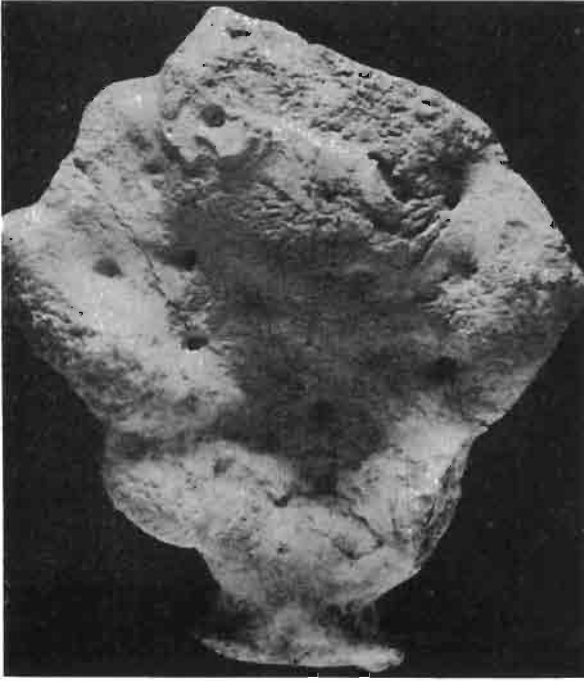


1a



1b

Phot. M. Czarnocka & L. Luszczewska



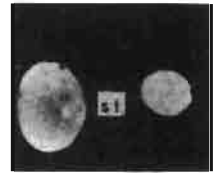
1a



1b



3



1c



2

Plate XII

- Fig. 1a. *Ragadinia foraminifera* n.sp., viewed from the exhalant side; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1466); $\times 1$.
- Fig. 1b. *Ragadinia foraminifera* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1466); $\times 1$.
- Fig. 1c. *Ragadinia foraminifera* n.sp., isolated sterrasters; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1466); $\times 65$.
- Fig. 2. *Phyllodermia pulchra* n.sp.; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/392); $\times 1$.
- Fig. 3. *Plinthosella* sp., viewed from the lower side; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/457); $\times 1$.

Plate XIII

Ragadinia rimosa (Roemer)
(Zbyczyce, Lower Campanian)

- Fig. 1a. Specimen without the dermal skeleton (Z. Pal. UŁ Sp. II/830); $\times 1$.
Fig. 1b. Isolated microscleres: *st* sterrasters, *sp* sphaerasters (Z. Pal. UŁ Sp. II/830);
 $\times 1$.
Fig. 1c. A part of surface (Z. Pal. UŁ Sp. II/830); $\times 2$.

Plinthosella elegans n.sp.
(Pniaki, Lower Campanian)

- Fig. 2a. Sponge with dermal plates and modified fine-lumped desmas visible
(Z. Pal. UŁ Sp. II/1013); $\times 2.7$.
Fig. 2b. Vertical view (Z. Pal. UŁ Sp. II/1013); $\times 1$.
Fig. 2c. Lateral view (Z. Pal. UŁ Sp. II/1013); $\times 1$.



2a



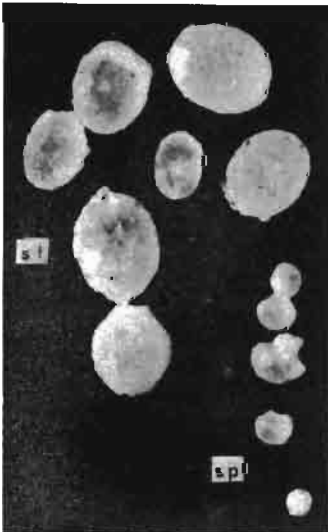
2c



2b



1c



1b



1a



1



2



3a

3b

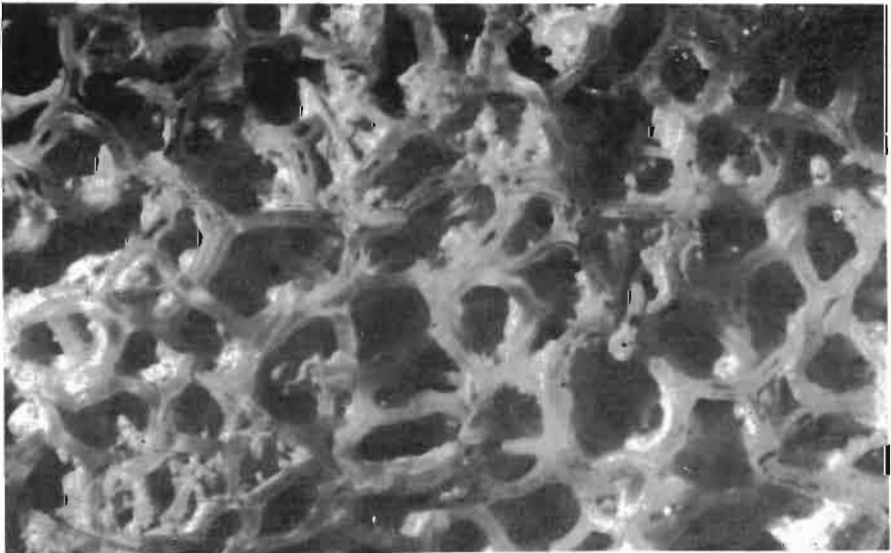


Plate XIV

- Fig. 1. *Brochodora roemeri* (Hinde); Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/737); $\times 1$.
- Fig. 2. *Brochodora ramusculus* Schrammen; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/875); $\times 1$.
- Fig. 3a. *Brochodora latiramea* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/888); $\times 1$.
- Fig. 3b. *Brochodora latiramea* n.sp., a fragment of the parenchymal network; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/888); $\times 20$.

Plate XV

Pachypoterion biedai n.sp.
(Pniaki, Lower Campanian)

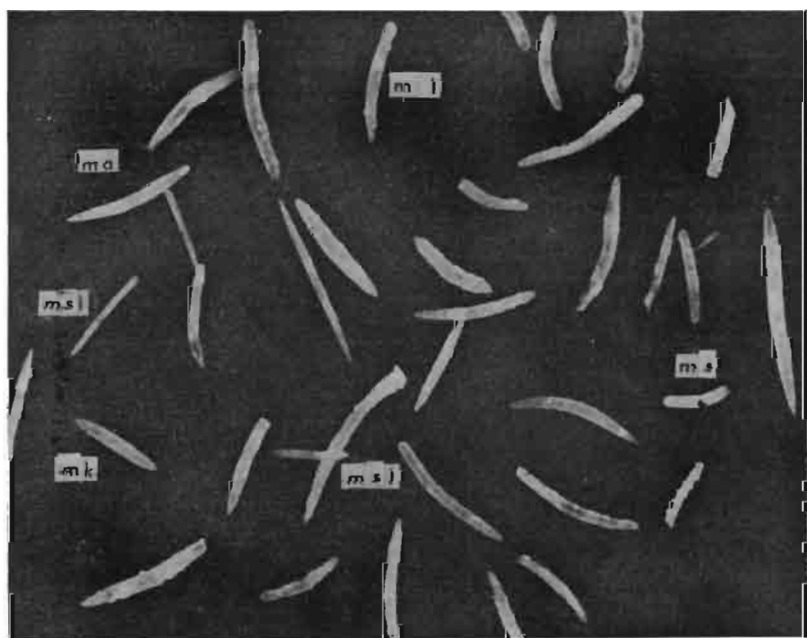
- Fig. 1a. A specimen without poles and with the pleural skeleton in the upper part (Z. Pal. UŁ Sp. II/1385); $\times 1$.
- Fig. 1b. A fragment of the parenchymal network (Z. Pal. UŁ Sp. II/1385); $\times 20$.
- Fig. 1c. Isolated microscleres: *ma* microamphioxeas, *mk* microxeas, *ms* microstrongyles, *msl* microstyles (Z. Pal. UŁ Sp. II/1385); $\times 65$.



1a



1b



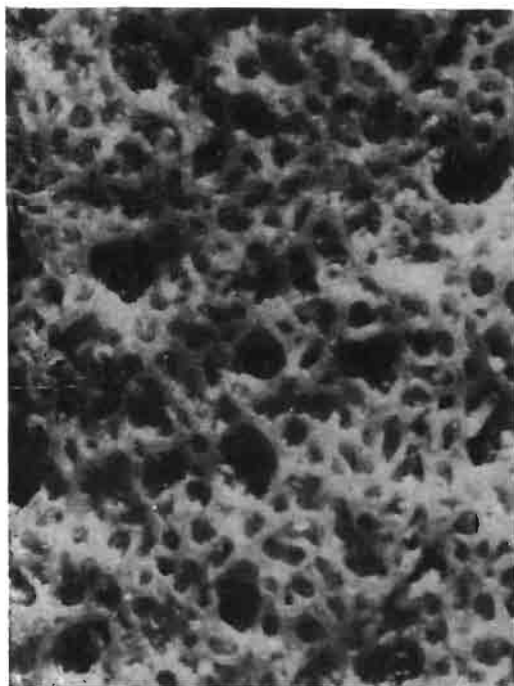
1c



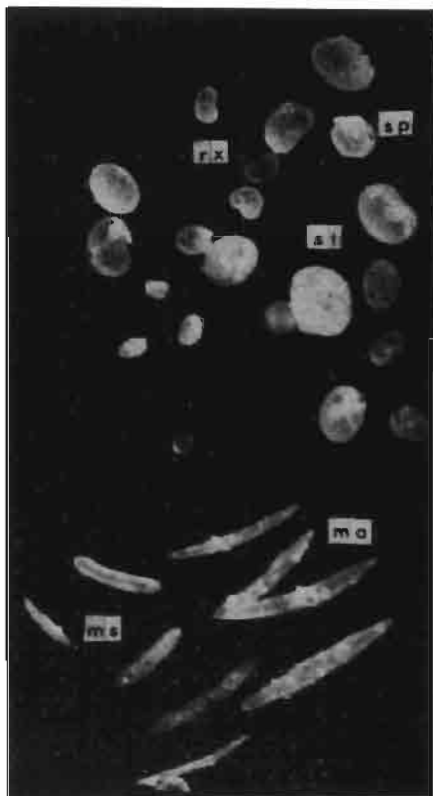
1a



2



1b



1c

Plate XVI

Homalodora polonica n.sp.
(Pniaki, Lower Campanian)

Fig. 1a. Single form (Z. Pal. UŁ Sp. II/1475); $\times 1$.

Fig. 1b. A fragment of the parenchymal network, encircling ostia (Z. Pal. UŁ Sp. II/1475); $\times 20$.

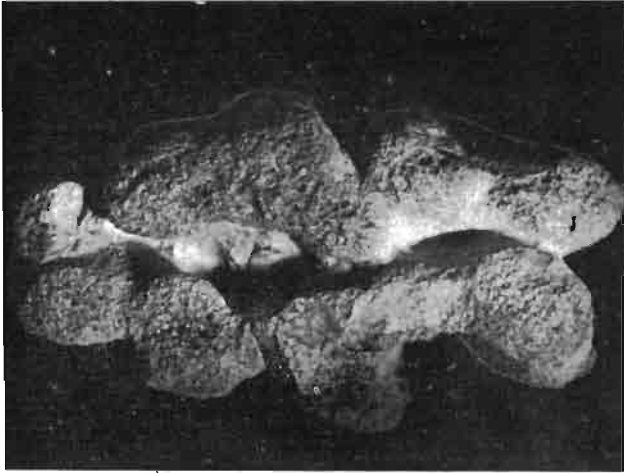
Fig. 1c. Isolated microscleres: *st* sterrasters, *rx* rhaxes, *sp* sphaerasters, *ms* microstrongyles, *ma* microampioxeas (Z. Pal. UŁ Sp. II/1475); $\times 65$.

Fig. 2. A form consisting of three individuals (Z. Pal. UŁ Sp. II/743); $\times 1$.

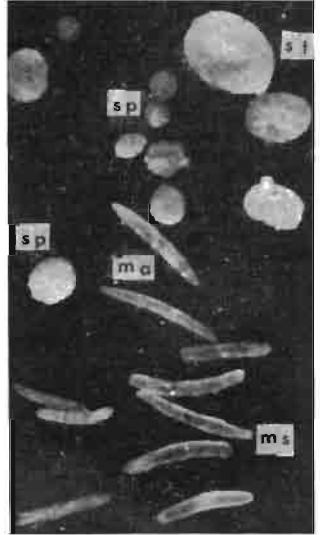
Plate XVII

Homalodora ramosa (Mantell)
(Skrajniwa, Lower Campanian)

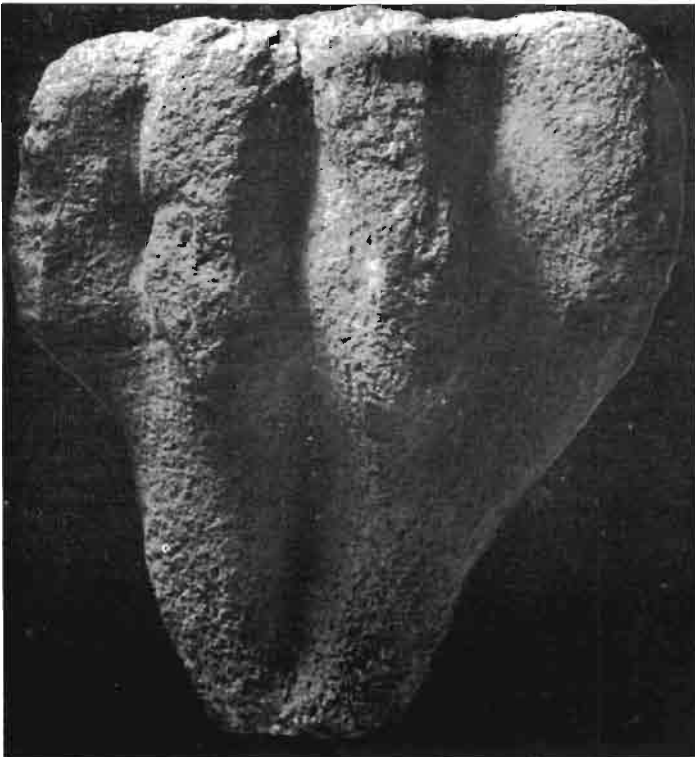
- Fig. 1a. A view from the lateral side having riblike processes (Z. Pal. UŁ Sp. II/869); $\times 1$.
Fig. 1b. The same specimen, upper view; $\times 1$.
Fig. 2. Isolated microscleres: *st* sterrasters, *sp* sphaerasters, *ma* microamphioxes, *ms* microstrongyles (Z. Pal. UŁ Sp. II/1117); $\times 65$.
Fig. 3a. *Homalodora pusilla* Schrammen (Z. Pal. UŁ Sp. II/379); $\times 1$.
Fig. 3b. The same specimen, upper view; $\times 1$.



1b



2



1a



3a

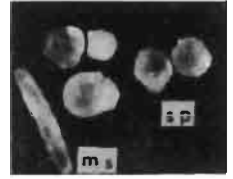


3b

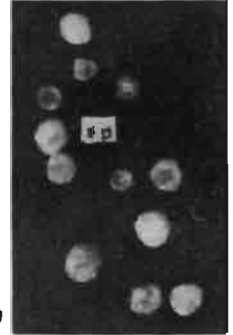


1a

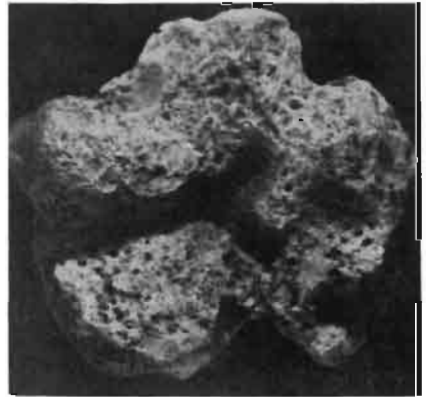
4b



1b



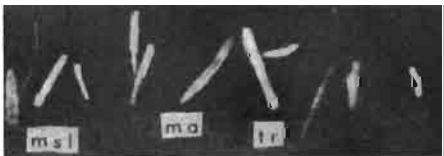
2



3b



3a



4a

Plate XVIII

- Fig. 1a. *Homalodora skrainivensis* n.sp.; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/385); $\times 1$.
- Fig. 1b. *Homalodora skrainivensis* n.sp., isolated microscleres: *sp* sphaerasters; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp II/385); $\times 65$.
- Fig. 2. *Homalodora tuberosa* Schrammen; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1073); $\times 1$.
- Fig. 3a. *Homalodora tuberosa* Schrammen; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1071); $\times 1$.
- Fig. 3b. The same specimen, upper view; $\times 1$.
- Fig. 4. *Homalodora tuberosa* Schrammen, microscleres isolated from a few specimens: *sp* sphaerasters, *ms* microstrongyle, *msl* microstyles, *ma* microamphioxeas, *tr* tornote; Skrajniwa, Lower Campanian; $\times 65$.

Plate XIX

Homalodora plana Schrammen
(Lower Campanian)

- Fig. 1. A specimen, representing the type of flatter forms; Pniaki (Z. Pal. UŁ Sp. II/373); $\times 1$.
- Fig. 2. A specimen, representing thicker type; Skrajniwa (Z. Pal. UŁ Sp. II/375); $\times 1$.
- Fig. 3. A specimen with a young individual; Zbyczyce (Z. Pal. UŁ Sp. II/660); $\times 1$.
- Fig. 4. A longitudinal section revealing the aporhyse system; Skrajniwa (Z. Pal. UŁ Sp. II/626); $\times 1$.
- Fig. 5. Microscleres, isolated from a few specimens: *st* sterrasters, *sp* sphaerasters, *ma* microamphioxeas, *ms* microstrongyles, *mt* microtornote; Skrajniwa; $\times 65$.



1



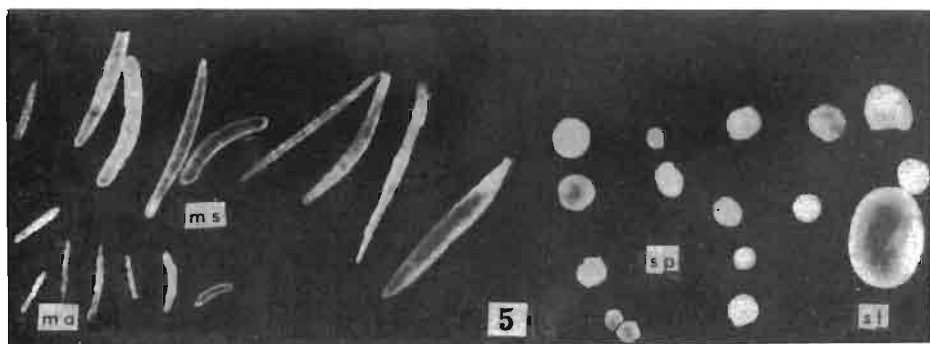
3



2



4



5



1



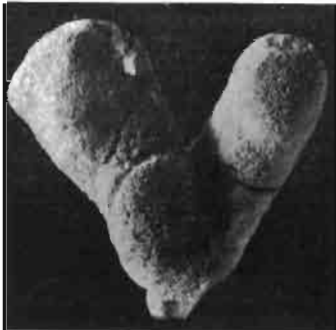
3



4



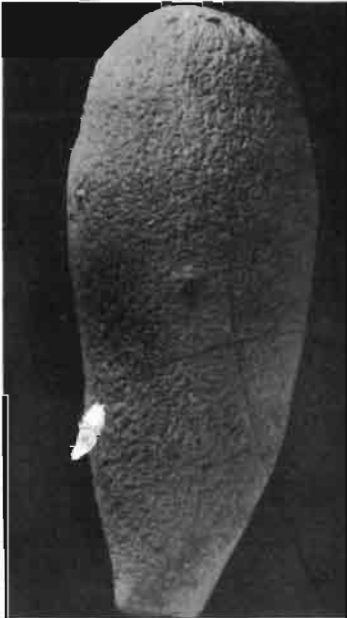
2b



5



2a



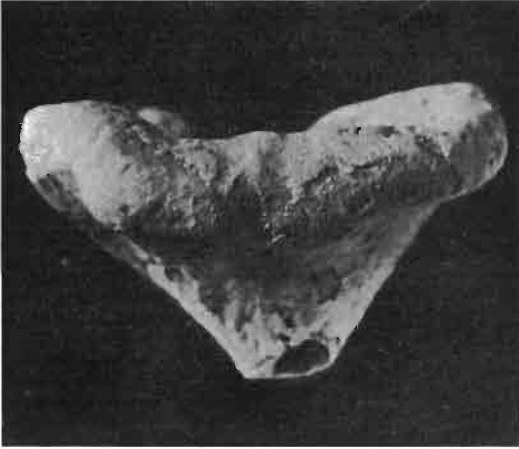
6

Plate XX

- Fig. 1. *Homalodora breviramosa* n.sp.; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1114); $\times 1$.
- Fig. 2a. *Homalodora ficus* Schrammen; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/629); $\times 1$.
- Fig. 2b. The same specimen, upper view; $\times 1$.
- Fig. 3. *Propleroma campanica* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/899); $\times 1$.
- Fig. 4. *Acrochordonia bifurcata* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1457); $\times 1$.
- Fig. 5. *Acrochordonia bifurcata* n.sp.; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1456); $\times 1$.
- Fig. 6. *Acrochordonia regularis* n.sp.; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/131); $\times 1$.

Plate XXI

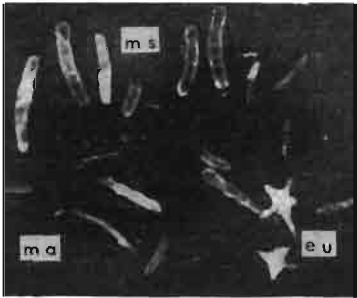
- Fig. 1. *Cycloclema compressa* (Hinde); Miechów, Upper Campanian (Z. Pal. UŁ Sp. II/86/58); $\times 1$.
- Fig. 2. *Cycloclema compressa* (Hinde), without dermal skeleton; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/826); $\times 1$.
- Fig. 3a. *Heterostinia obliqua* (Bennett); Bonarka, Lower Campanian (Z. Pal. UŁ Sp. II/1382); $\times 1$.
- Fig. 3b. *Heterostinia obliqua* (Bennett), isolated microscleres: *ms* microstrongyles, *ma* microamphioxeas, *eu* euaster; Bonarka, Lower Campanian (Z. Pal. UŁ Sp. II/1382); $\times 65$.
- Fig. 4. *Heterostinia phytoniformis* n.sp.; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/590); $\times 1$.



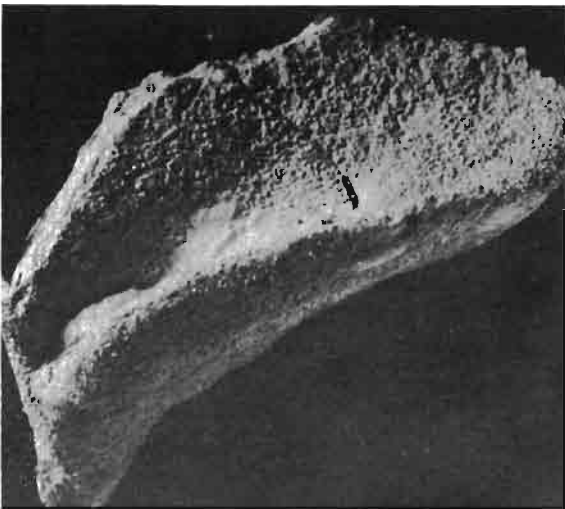
1



4



3b



3a



2



10

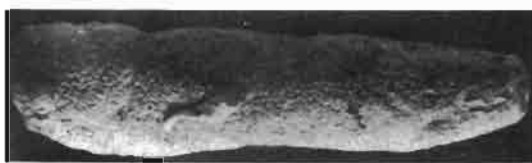


9



6

5



8



4

3



7



1

2

Phot. M. Czarnocka

Plate XXII

- Fig. 1. *Pachycothon giganteus* Schrammen; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1374); $\times 1$.
- Fig. 2. *Carterella* cf. *cylindrica* (Gümbel); Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1427); $\times 1$.
- Figs. 3—7. *Phalangium ramosum* Moret, different specimens; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1435, 821, 787, 1602, 825); $\times 1$.
- Fig. 8. *Phalangium tubulifera* Moret; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/477); $\times 1$.
- Fig. 9. *Heloraphinia chordata* n.sp.; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1585/63); $\times 1$.
- Fig. 10. *Inodia* sp.; Miechów, Upper Campanian (Z. Pal. UŁ Sp. II/136); $\times 1$.

Plate XXIII

- Fig. 1. *Prokaliapsis arborescens* (Michelin); Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1625); × 1.
- Figs. 2—4. *Prokaliapsis clavata* (Hinde), different specimens; Zbyczyce-Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1481, 1030, 1435); × 1.
- Fig. 5a. *Phalangium scytaliforme* Schrammen; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/1423); × 1.
- Fig. 5b. The same specimen, upper pole with osculum; × 1.
- Fig. 6a. *Pachynion scriptum* (Roemer); Pniaki, Lower Campanian (Z. Pal. UŁ Sp. II/1593); × 1.
- Fig. 6b. The same specimen, upper pole with osculum; × 1.



1



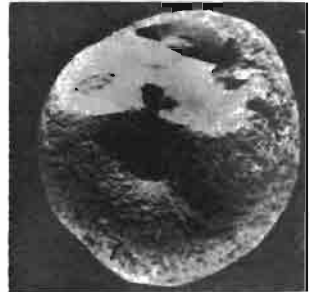
6a



5a



6b



5b



2

3

4



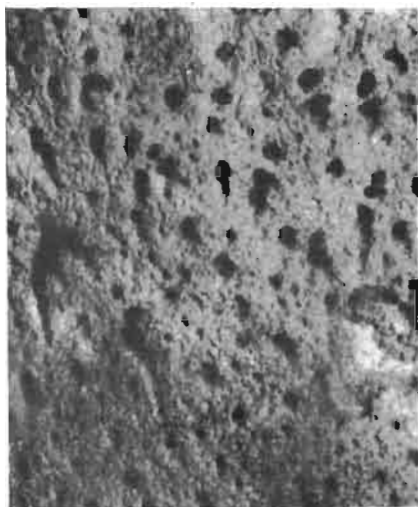
3a



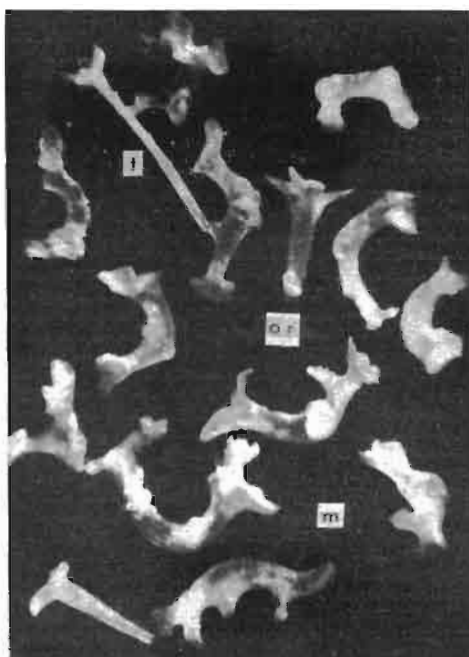
3b



2a



1



2b

Plate XXIV

- Fig. 1. *Aulaxinia ventricosa* Schrammen, part of outer surface; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. II/1296); $\times 2$.
- Fig. 2a. *Heterostinia conica* Schrammen, complete specimen; Zbyczyce (Z. Pal. UŁ Sp. II/399); $\times 1$.
- Fig. 2b. *Heterostinia conica* Schrammen, *m* isolated megaclones, *t* triaenes, or orthodichotriaenes; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/399); $\times 24$.
- Fig. 3a. *Heterostinia phytoniformis* n.sp., upper pole; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/591); $\times 1$.
- Fig. 3b. *Heterostinia phytoniformis* n.sp., lower part of the sponge; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. II/848); $\times 1$.