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# SILICEOUS SPONGES FROM THE UPPER CRETACEOUS OF POLAND
## PART II. MONAXONIA AND TRIAXONIA*

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*Abstract.* — Twenty five species of sponges, assigned to Monaxonia and 19 species — to Triaxonia, including 9 new ones (Monactellida: *Reniera munda*; Monalithistida:

* Part I: Tetraxonia — see *"Acta Palaeontologica Palonica"* Vol. XI, No. 1, 1966.

*Verruculina abnormis, Stichophyma pumiliformis, Coelocorypha bulboformis* and *Bolidium arbustum*; Hexactinosa: *Aphrocallistes kazimierzensis, A. bochotnicensis, A. mamillaris* and *A. vistulae*; Lychniscosa: *Rhizopoterion coniforme*), are described. In almost all of them, the general morphology, the structure of the skeleton and the morphology of megascleres have been studied. Differences have been shown in the development of ostia and postica in particular species of *Verruculina*.

## INTRODUCTION

Part I of the monograph of siliceous sponges from the Upper Cretaceous of Poland (Hurcewicz, 1966) contained descriptions of 62 species of Tetraxonia, represented by Tetractinellida (2 species), Tetracladina (32 species), Megacladina (16 species) and Dicranocladina (7 species).

The present paper is part II of this monograph and contains descriptions of 25 species of Monaxonia, including 2 of Monactinellida and 23 of Monalithistida, and 19 species of Triaxonia, including 9 of Hexactinosa and 10 of Lychniscosa.

My studies on this material have been continued under care and guidance of Professor R. Kozłowski whom I would like to express my heartfelt gratitude. My thanks are also due to Professor Z. Kielan-Jaworowska, Director of the Palaeozoological Institute of the Polish Academy of Sciences, for allowing me to use this Institute's laboratory.

I am also indebted to Docent A. Urbanek and Professor M. Kostyniuk for assuring a convenient working place at the Department of Palaeontology of the University of Warsaw, as well as to Docent J. Małecki, Jagiellon University, Cracow, for introducing me to the Cretaceous outcrops of the environs of Cracow. My gratitude is also due to Miss L. Łuszczewska (Department of Palaeontology of the Warsaw University) for taking photographs.

Methods of preparing and studying sponges have been given in Part I (Hurcewicz, 1966).

The material which makes up the basis of my studies is housed in the collections of the Palaeontological Laboratory of the University of Łódź and provided with a symbol *Z. Pal. UŁ Sp. III/No....* The documentary material consists of 170 specimens, as well as thin sections, drawings and photographs.

## MATERIAL

The sponges described in the present paper mostly come from a marly lithofacies and display a varying preservation state. Next to sporadically found, excellently preserved, complete sponges, there are also many fragments with clearly distinct morphology. They are silicified, limoni-

tized or, less frequently, phosphoritized (Nasiłów). A well-preserved shape, morphology of surface and pores of monaxonids suggest that the silification process took place by impregnating sponges with the colloidal silica. In some cases, skeletons are completely destroyed or preserved only on the surface.

Complete specimens of thin-walled forms with skeleton consisting of fine or unconnected megascleres are very scarce.

In the Polish material, there was a possibility to observe for the first time the arrangement of megascleres in fossil representatives of the genus *Reniera* Nardo. The Triaxonia here described mostly come from marls of the "opoka" type and are to a considerable extent limonitized or calcified. Some fragments of the parenchymal skeleton allowed us, however, to examine the manner of arrangement of hexactines within the network. The abundant fossil material, representing the genus *Aphrocallistes* Gray allowed us also to state that on the area of the Vistula Upper Cretaceous, a progressive development of *Aphrocallistes* took place in Maastrichtian which led to the appearance of a few new species.

## OUTCROPS

A considerable part of a total number of specimens, mostly of the Rhizocladina, was collected from the marls of the Lower Campanian at Pniaki, Zbyczyce and Skrajniwa (environs of Koniecpol and Lelów) (Fig. 1), as well as from the Maastrichtian marl outcrops on the Vistula River, between Puławy and Józefów (Fig. 2). In other localities, sponges occurred only occasionally (see Table 1).

Characteristics of Cretaceous of the Nida Basin and environs of Cracow have been presented in part I of the present monograph (Hurcewicz, 1966, pp. 17—20). In this part, the present writer confines herself only to the description of outcrops on the Vistula.

Between Puławy and Józefów, the Maastrichtian marl is exposed on both banks of the Vistula valley. The stratigraphy, tectonics and palaeogeography of this area were dealt with in detail by Krisztofowicz (1895—1898) and Pożaryski (1938, 1948, 1951). The petrographic-lithologic characteristics were presented by Sujkowski (1930), as well as by Pożaryska (1952) when she discussed the sedimentology of the Upper Maastrichtian and Danian of the environs of Puławy.

As regards palaeontology, the macrofauna of this area (pelecypods, gastropods, echinoids) was described by Łopuski (1911), Krach (1931), Kongiel (1935), Kongiel and Matwiejewówna (1937). Microfaunistic studies were carried out by Pożaryska (1953) and Pożaryski & Witwicka (1956).

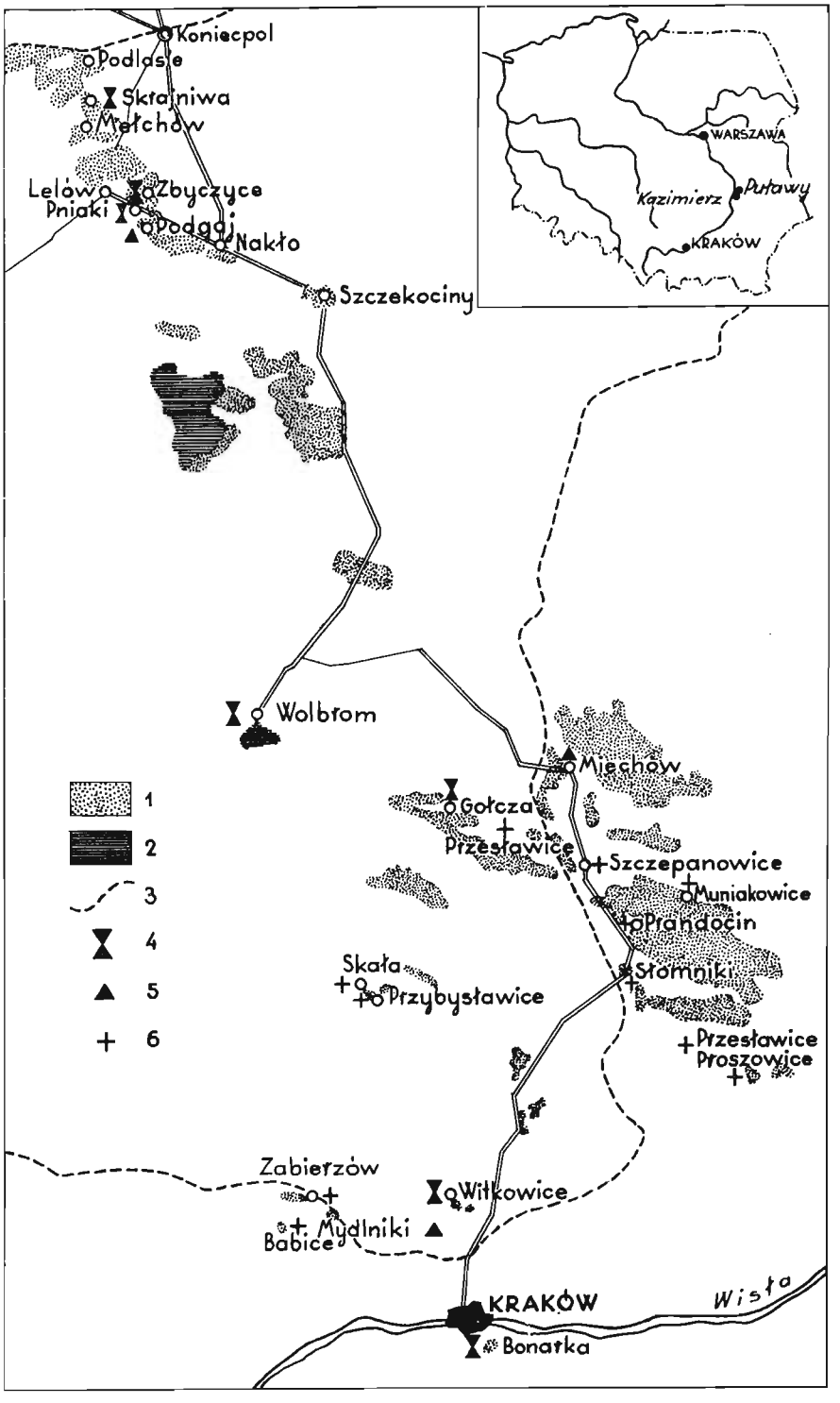


Fig. 1. — Occurrence of sponges in Lower Campanian of Kraków-Koniecpol area; *1* outcrops of Upper Cretaceous, *2* outcrops of Lower Cretaceous, *3* railway-track, *4—6* localities with sponges: *4* very numerous, *5* numerous, *6* rare. Scale 1 : 430 000.

In the Senonian deposits, outcropping along the Vistula, sponges make up a considerable percentage of the entire faunistic assemblage. Most examined sponges come from Kazimierz on the Vistula and from Bochotnica.

*Kazimierz.* — In southern outskirts of Kazimierz, in the Vistula valley, there is a several scores of metres high wall, outcropped in the civic quarry. It is built of marls of the "opoka" type, assigned by Pożaryski (1938) to the Upper Maastrichtian, local horizon "x". This "opoka", resistant to weathering is grey with a slightly yellowish tint. In the same quarry, there also occur more porous, as well as more compact layers of "opoka". The porous rock is pierced by many fine, elongated pores which are cavities left over by the dissolved spicules of sponges. In the residue, left after this "opoka" has been dissolved in hydrochloric acid and which consists mostly of a clayey substance, siliceous spicules or fragment of network are found occasionally. Calcium carbonate, varying in quantity from 55 to 79.6 per cent, is the main component of "opoka" at Kazimierz (Pożaryska, 1952, p. 29). A few metres thick banks of compact "opoka" are intercalated with thin layers of marl which is poor in sponges and in their spicules. In the top part of the wall, there are visible two 1 m thick marly layers, intercalated with a 3 m thick bank of hard, compact "opoka'.

The assemblage of sponges, collected from the hard "opoka", belongs mostly to Hexactinosa (Table 1). An abundant fauna accompanying it, consists of pelecypods, gastropods and cephalopods, among which belemnites and ammonites *Discoscaphites constrictus* v. *vulgaris* and *Baculites* sp. occur frequently. Specimens of the latter were very often found among bushy sponges.

"Opoka" of horizon "x" (Upper Maastrichtian) also outcrops on the opposite, i.e. lefthand slope of the Vistula valley at Janowiec (Fig. 2) where the layers are disposed almost horizontally. The fauna of sponges from Janowiec is much poorer as compared with that from Kazimierz as regards the quantity of specimens but, on the other hand, it is similar in its generic composition. In both these localities, sponges are strongly limonitized and, in most cases, it was impossible to separate them from rocks.

*Bochotnica.* — Four km north of Kazimierz, "opoka" outcrops in three quarries, situated near the highway. Horizon "x" of "opoka", about 5 m in thickness, is overlaid with a layer of almost white, hard (as a result of calcitization) limestone. This horizon was designated by Pożaryski (1938) with letter "y". An uneven top surface of this limestone which makes up a "hard ground" is overlaid with a 0.3—0.5 m thick, slightly cemented, fine-grained, glauconitic sandstone with a clayey-calcareous cement (local horizon "z"). This layer contains many pho-

sphorite concretions which often represent pseudomorphosis of sponges and other organisms, among which brachiopods occur frequently. On the other hand, a rich fauna of "opoka" consists of many gastropods, pelecypods and cephalopods, which were described by Pożaryski (1938). The

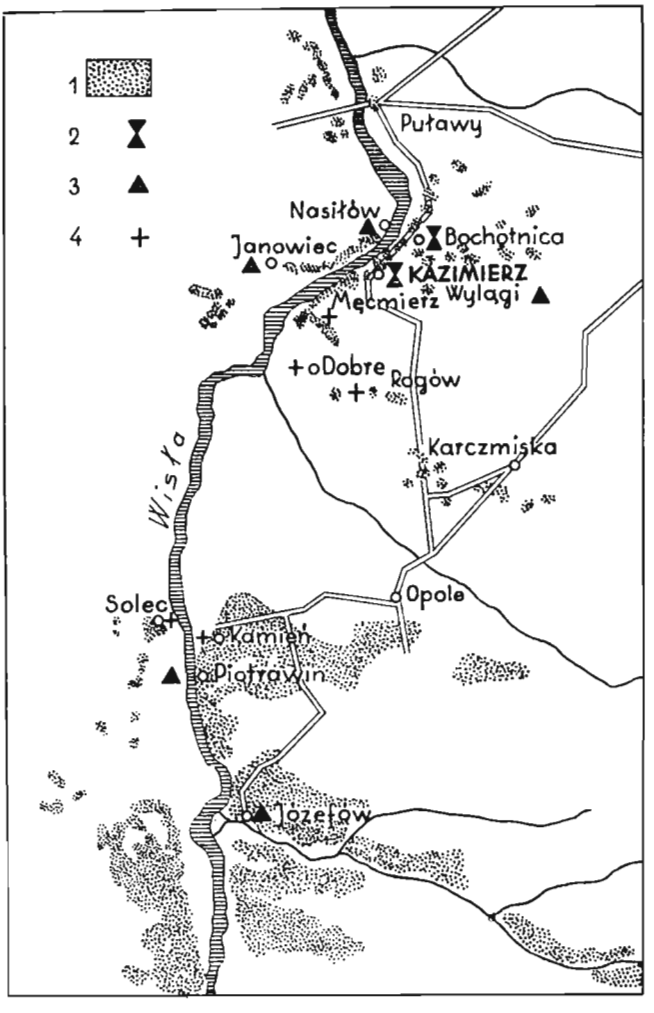


Fig. 2. — Occurrence of sponges in Upper Maastrichtian of the Vistula Valley, between Puławy and Józefów; *1* outcrops of Upper Cretaceous, *2—4* localities with sponges: *2* very numerous, *3* numerous, *4* rare. Scale 1 : 450 000.

part of sponges in the assemblage of fauna of "opoka" at Bochotnica is smaller than that at Kazimierz. They mostly represent the genera *Aphrocallistes* and *Ventriculites*.

According to Pożaryski (1938) and Kongiel (1949), all these layers belong to the Upper Maastrichtian.

## GEOGRAPHICAL AND STRATIGRAPHICAL DISTRIBUTION

Localites with a rich fauna of siliceous sponges from Campanian and Upper Maastrichtian are shown in the little maps enclosed (Figs. 1 and 2). It is clear from the distribution of individual localities (Fig. 1) that some assemblages of sponges from the Lower Campanian are disposed along the eastern margin of the Jurassic belt and those from Maastrichtian (Upper) — in the gorge valley (Fig. 2) of the Vistula, mostly its eastern slope, determined by a big fault, running NW of the environs of Rachów.

In the material under study, the greatest qualitative and quantitative development of all Rhizocladina (Table 1) is displayed by *Verruculina*, *Seliscothon* and *Scytalia*. In the Upper Campanian, they formed extensive assemblages connected with each other. The greatest accumulation of *Verruculina* at Zbyczyce and their excellent preservation state testify to the fact that the main centre of their development was situated in this neighbourhood and the peripheries of their distribution area reached south as far as Cracow (Bonarka and Witkowice) and north — beyond Skrajniwa. The presence of *V. tenuis* and *V. cupula*, species common with NW Germany, indicates a considerable extent of the area.

*V. seriatopora* (Roemer) known from Aptian of Spain (Lagneau-Hérenger, 1962) and NW Germany, as well as *V. tenuis* (Roemer), known from Aptian of Spain only, are geologically the oldest species. In Turonian of Germany, the genus *Verruculina* is represented by *V. seriatopora* (Roemer), *V. miliaris* (Reuss), *V. damaecornis* (Roemer) and *V. tenuis* (Roemer). An exuberant development of this genus is marked in Emscherian of France and as many as seven species are known in the Lower Campanian of Poland. In the Upper Campanian, a marked decline is observed in the development of *Verruculina* which is testified to by its presence in NW Germany only.

*Scytalia* is another genus with an extensive stratigraphical and geographical distribution. *S. turbinata* (Roemer) and *S. radiciformis* (Phillips) which, in Senonian, reveal the most extensive geographic range (Table 1), are known from Aptian of Spain.

Of Triaxonia, *Paracraticularia fittoni* (Mantell), recorded in the Upper Maastrichtian sediments of Poland, abundantly occurs in the Middle and Upper Cretaceous of France, Germany and England.

*Aphrocallistes alveolites* (Roemer) occurs in Eastern and Western Europe. The oldest site of this species occurs in Emscherian of the U.S.S.R. Its presence was also stated in the Santonian sediments of the U.S.S.R. and Campanian of Poland, Germany (Island of Rügen), England and France.

A considerable specific differentiation of the genus *Aphrocallistes*

Table 1

STRATIGRAPHICAL AND GEOGRAPHICAL DISTRIBUTION OF THE MONAXONIA AND TRIAXONIA

| No. | Species | Malm | Valanginian | Aptian | Albian | Ceno-manian | Turonian | Emscherian | Santonian | Lower Campanian | Upper Campanian | Senonian | Lower Maastricht-ian | Upper Mastricht-ian | Miocene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **I. Monactinellida** | | | | | | | | | | | | | | |
| 1 | *Reniera munda* n.sp. | — | — | — | — | — | — | — | — | — | — | — | — | Ka | — |
| 2 | *Euleraphe incrustans* Schrammen | NWG | — | — | — | — | — | — | — | Zb | — | — | — | — | — |
| | **II. Monalithistida** | | | | | | | | | | | | | | |
| | Rhizocladina | | | | | | | | | | | | | | |
| 3 | *Verruculina seriatopora* (Roemer) | — | — | S, G | G | — | G | F, SF | — | Zb | — | E, G | Mu | — | — |
| 4 | *V. reussi* (M'Coy) | — | — | — | — | — | — | — | — | Wi, Sk, Zb, Pn, Mi | — | E | — | — | Pd* |
| 5 | *V. miliaris* (Reuss) | — | — | — | — | — | G | F, FS | — | Bo, Zb | — | F | — | — | Pd* |
| 6 | *V.* cf. *damaccornis* (Roemer) | — | — | — | — | — | G | — | — | Zb | — | — | — | — | Pd* |
| 7 | *V. tenuis* (Roemer) | — | — | S | — | — | G | SF, G | G | Pn, Zb, Wi, Ko, G | G | O | — | — | Pd* |
| 8 | *V. cupula* Schrammen | — | — | — | — | — | — | — | F | Sk, G | G | — | — | — | — |
| 9 | *V. abnormis* n.sp. | — | — | — | — | — | — | — | — | Sk | — | — | — | — | — |
| 10 | *Amphithelion macrommata* (Roemer) | — | — | — | — | — | — | — | — | Pn, G | G | — | — | — | — |
| 11 | *Seliscothon planum* (Phillips) | — | — | — | — | — | G | — | — | Pn, Sk, Zb, Mi, G | G | F, SF | — | — | — |
| 12 | *S. verrucosum* Schrammen | — | — | — | — | — | — | — | — | Zb | G | G | — | — | — |
| 13 | *Jereica polystoma* (Roemer) | — | — | — | — | — | — | — | — | Wi, Sk, Zb, Prz, G | G | F | — | — | — |
| 14 | *Jereica* sp. | — | — | — | — | — | — | — | — | Zb | — | — | — | — | — |
| 15 | *Stichophyma turbinatum* (Roemer) | — | — | — | — | C | — | — | — | Sk, Zb, G | G | E | — | — | — |
| 16 | *S. pumiliformis* n.sp. | — | — | — | — | — | — | — | — | Po | — | — | — | — | — |
| 17 | *Coelocorypha bulbosa* n.sp. | — | | — | — | — | — | — | — | Sk, Pn | — | — | — | — | — |
| 18 | *Bolidium arbustum* n.sp. | — | — | — | — | — | — | — | — | Zb | — | — | — | — | — |
| 19 | *Coscinostoma fragilis* Schrammen | — | — | S | — | — | — | — | F | Sk, Zb | G | — | — | — | — |
| 20 | *Trachynotus auriculus* Schrammen | — | — | — | — | — | — | — | — | Mi | G | — | — | — | — |
| 21 | *Leiochonia cryptoporosa* Schrammen | — | — | — | — | — | — | — | — | G | G | — | Prz | — | — |
| 22 | *Scytalia turbinata* (Roemer) | — | — | S | — | C | C | — | — | Sk | — | G, F, E | — | — | — |
| 53 | *S. radiciformis* (Phillips) | — | — | S | — | — | — | — | — | Pn, Zb, Sk, NWG | NWG | F, E | — | — | — |
| 24 | *S. terebrata* (Phillips) | — | — | — | — | — | — | — | — | Sk, Zb | NWG | F | — | — | — |
| 25 | *Scytalia* sp. | — | — | — | — | — | — | — | — | Sk | — | — | — | — | — |
| 26 | *Stachyspongia tuberculosa* (Roemer) | — | — | — | — | — | — | — | F | Mi | — | F | — | — | — |
| | **III. Triaxonia** | | | | | | | | | | | | | | |
| | A. Hexactinosa | | | | | | | | | | | | | | |
| 27 | *Craticularia virgatula* Schrammen | — | — | S | F | — | — | — | — | Mi, G | — | — | — | Ka | — |
| 28 | *Paracraticularia fittoni* (Mantell) | — | F | S | — | G, F, E | F | F | — | F | F | E | — | Bt | — |
| 29 | *Leptophragma murchisoni* (Goldfuss) | — | — | — | — | U, E | — | — | — | G, U | Mi, G | F | — | — | — |
| 30 | *Leptophragma* sp. | — | — | — | — | — | — | — | — | Pn | — | — | — | — | — |
| 31 | *Aphrocallistes alveolites* (Roemer) | — | — | — | — | — | — | U | U | Bo, Wi, Gr, U, NWG | Bi, Z, U, NWG | E, F | R | Bt, Jf, Ka, R, Ja | — |
| 32 | *A. kazimierzensis* n.sp. | — | — | — | — | — | — | — | — | — | — | — | Pw, Jf | Bt, Ka, Wy | — |
| 33 | *A. bochotnicensis* n.sp. | — | — | — | — | — | — | — | — | — | — | — | — | Bt, Ka | — |
| 34 | *A. mammillaris* n.sp. | — | | — | — | — | — | — | — | — | — | — | Pw | — | — |
| 35 | *A. vistulae* n.sp. | — | — | — | — | — | — | — | — | — | — | — | — | Ka, Ja | — |
| | B. Lychniscosa | | | | | | | | | | | | | | |
| 36 | *Ventriculites radiatus* Mantell | — | — | — | S | O, F, B | NWG, F | Tr, F | — | Bo, Wi, Bl, Uj, Jsz, Mi, NWG, F | Ru, Mu, NWG, F | C, U, E | Mu, R | Ka | U |
| 37 | *V. convolutus* Hinde | — | — | — | — | — | — | F | — | Zb, Pn | — | B, E | — | Bt | — |
| 33 | *V. successor* Schrammen | — | — | — | — | — | — | — | — | — | NWG | — | — | Ja, Wy | — |
| 39 | *Rhizopoterion tubiforme* Schrammen | | — | — | — | — | F | — | — | Bo | — | F, S, U | — | — | — |
| 40 | *R. solidum* Schrammen | — | — | — | — | — | F | — | — | NWG | — | — | — | Wy | — |
| 41 | *R. coniforme* n.sp. | — | — | — | — | — | — | — | — | — | — | — | Pw, Jf | N | — |
| 42 | *Lepidospongia fragilis* Schrammen | — | — | — | — | — | — | — | — | Bo, Pn, Zb, G | G | — | — | — | — |
| 43 | *Orthodiscus fragilis* Schrammen | — | — | — | — | — | — | — | — | — | Mi, G | — | Pw | Wy | — |
| 44 | *Coeloptychium decimunum* Roemer | — | — | — | — | — | — | Tr | — | Bo, Wi, Zb, Po, G | Bi, Ko, My, G | — | — | — | — |
| 45 | *Sporadoscinia micrommata* (Roemer) | — | — | — | — | — | — | — | — | Bo, Wi, NWG | Ru, NWG | E | — | — | — |

* Cretaceous on the secondary bed in Miocene.

*Legend:* B — Belgium
C — Czechoslovakia
E — England
F — France
SF — Southern France
G — Germany
NWG — North-western Germany
R — Rügen Island, Germany
S — Spain
U — U.S.S.R.

Poland:
Bi — Bibice
Bl — Bielany
Bo — Bonarka
Bt — Bochotnica
Gr — Garlica
Ja — Janowiec
Jf — Józefów
Jsz — Januszewice
Ka — Kazimierz
Ko — Kobylany
Mi — Miechów
Mu — Muniakowice
Mu — Mydlniki
N — Nasiłów
O — Opole
Pd — Podgórze
Pn — Pniaki
Po — Podgaj
Prz — Przesławice
Pw — Piotrawin
Ru — Rudawa
Sk — Skrajniwa
Tr — Trojanowice
Uj — Ujazd
Wi — Witkowice
Wy — Wylągi
Z — Zabierzów
Zb — Zbyczyce

is displayed in the Upper Maastrichtian. From this stage, five species are known in Poland.

Of all Lychniscosa, *Ventriculites radiatus* Mantell occurs in Western Europe from Aptian to Maastrichtian, being particularly numerous in Cenomanian, Turonian and Emscherian of France and Campanian of NW Germany and Poland.

Fig. 3. — Southern wall of quarry in Pniaki, Lower Campanian; *1*, *2*, *3* intercalations of argillaceous marls containing very numerous sponges.

The lithofacies of the Lower Campanian, specific composition of the assemblages of Polish fauna of sponges and shapes of some species varying from flat bowl-like to earlike allow us to suppose that, according to Lagneau-Hérenger (1962, p. 115), the bottom was, within the boundaries of the area settled by sponges (Skrajniwa-Zbyczyce-Pniaki), sloping. The presence of some microscleres and, in particular, sterrasters and microxeas in the skeletons of sponges, as well as the preservation state of their cortex and the presence of sponges pertaining to Monactinellida, suggest that the waters of the then sea of the Lower Campanian were calm. Such a supposition is also confirmed by the presence of fine clayey marl intercalations (Hurcewicz, 1966, p. 19) at Pniaki (Fig. 3) and Zbyczyce.

A considerable predominance of the quantities of genera and species of the assemblage of the Lower Campanian sponge fauna over that of the Upper Campanian (Table 1), suggests the change in the conditions of the sea which was probably related with the emergence of the land.

A repeated, exuberant development of sponges on the territory of Poland is observed in Maastrichtian, in particular in the Upper one.

## REMARKS ON TAXONOMY

In the taxonomy of sponges, the group Rhizocladina (= Rhizomorina) is variously presented. Moret (1925, 1958), Bieda (1933), Laubenfels (1955), Pokorný (1958), Finks (1960) and Wagner (1963) consider it to be a suborder of the Lithistida, whereas Schrammen (1924, 1937) and Lagneau-Hérenger (1962) assign them to the Monaxonia, and Zhuravleva (1962) — to the order Cornacuspongida as a tribe Rhizomorina in the suborder Poikilorhabdina.

My own studies, although based on a numerous and variable material from Poland, do not allow me for an ultimate solution of this problem. The doubt whether or not Rhizocladina may be considered as modified Monaxonia was aroused by specimens (Sp. III/1960 and 1305), assigned to *Scytalia radiciformis* (Phillips), which, on the outer surface, have a few protriaenes situated among amphioxeas. The manner of disposition of these protriaenes on the surface of *S. radiciformis*, as well as the occurrence, next to them, of megaclones, indicate rather a strange origin of these spicules. Assuming that only monocrepidal spicules occur among the spiculation of the Rhizocladina, I resolved to assign the Rhizocladina to the Monaxonia.

In revising the diagnoses of the examined families within Rhizocladina, I ascertain a discrepancy of views on the position of the genera *Seliscothon* Zittel, *Amphithelion* Zittel, *Trachynotus* Schrammen and *Scytalia* Zittel.

On the basis of the similarity in external aspect and shape, Lagneau-Hérenger (1962) assigns the genus *Seliscothon* to the family Verruculinidae, whereas, on the basis of a lamellar structure of the skeleton, Schrammen (1924) places it within the family Seliscothonidae. Polish specimens display identical structure with that of German ones and, therefore, in conformity with Schrammen's views I assign the genus *Seliscothon* to Seliscothonidae, and not to Verruculinidae. Likewise, the genus *Amphithelion* Zittel has been separated from the family Verruculinidae and assigned to the family Amphithelionidae Schrammen.

According to Lagneau-Hérenger (1962), I consider the shape and thickness of walls to be characters of a lower taxonomic rank which allow one for the separation of species, and not families as has sometimes been done by Schrammen. On the other hand, the structure of the skeleton and water system characterize genera and, sometimes, also families. In this connection and in view of the structure of skeleton and a general appearance, I have assigned *Trachynotus auriculus* Schrammen to the Chonellidae.

The taxonomic position of the genus *Bolidium* Zittel, so far considered to be incertae sedis, has also been established by the present writer. On the basis of a similar morphology of rhizoclones and parenchymal network, as well as water system, *Bolidium* has been assigned to the family Jereicidae.

More detailed studies on the family Scytalidae, numerously represented on the territory of Poland, attracted our attention to the morphology of rhizoclones which is different than that in the remaining genera of this group. *Scytalia* and *Stachyspongia* have rhizoclones which are ramified and, therefore, similar to tetraclones. This phenomena indicates a possibility of a certain relationship between Rhizocladina and Tetracladina.

Among the examined representatives of Rhizocladina and Triaxonia, certain differences have been observed in the thickness of walls, diameter of pores and general size as compared with the specimens, described from other European countries. They testify to the phenotypic variability, which was probably resulting from different conditions of the environment which, on the territory of Poland, were favourable to the development of sponges. This is also indicated by both the quantitative and specific composition of individual assemblages of these animals.

The exuberant development of *Aphrocallistes* led to changes in growth, manner of branching, position of diaphragm, etc. In the specimens of *A. alveolites* (Roemer) and *A. cylindrodactylus* (Schrammen) from the Lower and Upper Campanian of Germany, diaphragm is situated on the outer ends, whereas in the Polish ones from the Upper Maastrichtian of the environs of Kazimierz, diaphragm is disposed on the inner end of the process and forms the surface of the pseudoparagastral cavity.

The genera *Ventriculites* and *Rhizopoterion*, externally similar to each other, have so far been distinctly delimited. Frequently, they were considered to be synonyms. Distinct differences were revealed by the analysis of the structure of their skeletons and water systems. In *Ventriculites*, aporrhyses and epirrhyses are short and have blind ends, whereas in *Rhizopoterion* they are tubelike and have an obliquely longitudinal trace.

The structure of the skeleton of stem in Lychniscosa and Hexactinosa constinues to be a problem open to discussion. According to Défretin-Lefranc (1958—1960), no correlation exists between the skeleton of stem and the upper part. Two specimens of *V. radiatus* (UŁ Sp. III/73) and *Orthodiscus fragilis* (UŁ Sp. III/5), owned by the present writer and which have a very well-preserved skeleton, display the presence of a parenchymal skeleton in stem 30 mm from the base, as well as the connection of the parenchymal with the cortical networks. These specimens have the skeleton modified only in the outer part of stem. Considerable transformations in the structure of skeleton have been observed in *Le-*

*ptophragma* sp. (UŁ Sp. III/1663). A detailed analysis of these cases allows one to state that there exists a direct continuation of the main skeleton in stem and "dependent" cortex, as well as that the modification of skeleton takes place at a larger or smaller height and with different thicknesses of wall, probably depending on variable conditions of the environment, such as, for instance, a more intensive waving of water around the individual, embedded in a soft substratum.

## SYSTEMATIC DESCRIPTIONS

### Order **Monaxonia** Schulze, 1887

Skeleton consisting of monaxonic spicules not connected to each other or connected in the parenchymal network. According to Lagneau-Hérenger, two suborders have been distinguished, Monactinellida Zittel, 1878 with freely distributed spicules and Monalithistida Lagneau-Hérenger, 1962 with megascleres connected with each other.

### Suborder **Monactinellida** Zittel, 1878
### Family **Renieridae** Ridley & Dendy, 1887

Skeleton consisting of amphioxeas, amphistrongyles, in addition, few spicules of the style type. Megascleres are cemented to each other with an organic substance or distributed in the form of strands (*fide* Schrammen, 1910, p. 36, and 1924, p. 70).

#### Genus *Reniera* Nardo, 1847
(Type species: *Reniera aquaeductus* Schmidt, 1862)

This genus is widely spread over Recent seas (English Channel, Mediterranean, Atlantic and Indian Ocean). Fossil species are known, beginning with Ordovician. According to Delage (1899, p. 180), these are branched or massively cylindrical sponges with porous surface. Pores, perpendicularly piercing the surface, are polygonal or triangular in outline.

According to Nardo (1887), Recent representatives of the genus *Reniera* are devoid of spongin fibres, but their megascleres are connected with each other by an insignificant amount of spongin. Oxeas and strongyles, as well as styles are the main types of spicules. Carter (1879—1881) was the first to describe and figure spicules of Recent species, whereas the fossil ones from Carboniferous were studied by Hinde (1883, p. 19) who assigned them to *R.? carteri* Hinde. He observed that megascleres of fossil forms were larger than those of Recent ones. This author states that in *Reniera? carteri,* an average length of strongyles amounts to

1.0 mm, and thickness — to 0.146 mm, whereas, according to Počta (1885, p. 12), the strongyles in *Reniera bochemica* Počta are 0.3—0.5 mm long and — in their middle part — 0.1 mm thick and, in *Reniera* sp., only 0.1—0.45 mm long. Strongyles also occur in the genera *Scleritoderma* Schmidt, 1879 and *Sollasella* Lendenfeld, 1887, known from Cretaceous. *Scleritoderma* has, only in the dermal skeleton, strongyles 0.005—0.018 mm long, as well as microscleres of the sigma type. On the other hand, the genus *Sollasella* Lendenfeld includes branched forms whose megascleres represent pinnately arranged oxeas and strongyles. Differences in the morphology of skeleton of the specimen examined (UŁ Sp. III/1136) indicate that it represents a new species of the genus *Reniera* Nardo.

*Reniera* is assigned by Laubenfels (1955, p. E 37) to the family Haliclonidae (1932) and to the order Haplosclerida Topsent, 1898, marked by the presence of a great amount of spongin in the skeleton. The same genus is placed by Schrammen (1910—1912) within the suborder Monactinellida Zittel, 1878, in the family Homoraphidae Ridley & Dendy, 1887 and subfamily Renierinae Ridley & Dendy, 1887.

*Reniera munda* n. sp.
(Pl. I, Figs. 1 *a-c*)

*Holotypus:* Pl. I, Figs. 1 *a-c* (Z. Pal. UŁ Sp. III/1136).
*Stratum typicum:* Upper Maastrichtian, marl facies.
*Locus typicus:* Kazimierz on the Vistula, Poland.
*Derivatio nominis: munda,* Lat. *mundus* = ornamented; in connection with long marginalia ornamenting osculum.

*Diagnosis.* — *Reniera* consisting of conical individuals, forming cluster on a common base. Walls of particular individuals thin, containing a parenchymal layer of massive strongyles and numerous oxeas. Spongocoel relatively roomy, tapering towards osculum. Osculum not very large, surrounded with long marginal monaxones.

*Material.* — A specimen which makes up an assemblage of 9 individuals. Skeleton well-preserved, oxeas calcitized.

Dimensions (in mm):

| | Length | Width |
|---|---|---|
| Specimen UŁ Sp. III/1136 . . . | 65.0 | 12.0 |

*Description.* — Assemblage of many individuals, densely and radially arranged, tapering outwards. In the lower part, a single individual is bluntly conical, in the upper part — slim. A bundle of long, oscular marginalia is situated at the top. Lateral walls, varying in thickness between 0.6 and 0.3 mm, have formless, fissurelike, sometimes rounded

cavities. Pores and canals invisible. Spongocoel conical. Parenchymal skeleton consisting of amphistrongyles, fine amphioxeas and oxeas, which are not connected with each other and do not form a network. All amphistrongyles are of equal length (0.36 mm) and thickness (0.12 mm), densely and obliquely distributed, sometimes crosswise overlapping each other. Numerous, very thin oxeas, to 0.75 mm long, are obliquely pinned between amphistrongyles. Long marginal oxeas form, around oscula, tubelike bunches extending outwards. Near the oscular surface, both oxeas and strongyles occur in these bunches, whereas only oxeas are observed in the terminal part. Amphistrongyles are smooth, without traces of a cementing, organic substance on their surface.

*Remarks.* — *Reniera munda* n.sp. differs from Recent and fossil species in the manner of development, arrangement and dimensions of amphistrongyles. *Reniera? carteri* Hinde (Hinde, 1883, p. 19), *R. bohemica* Počta (Počta, 1885, p. 12) and *R. zitteli* Počta, are known only on the basis of spicules scattered in the rock. Recent *R. implexa* Ridley & Dendy and *R. tufa* Ridley & Dendy are bushlike or bulbous.

*Occurrence.* — Poland: Kazimierz, Upper Maastrichtian, marl of the "opoka" type.

## Family **Euleraphidae** Schrammen, 1937

Sponges incrusting, skeleton dense, consisting of smooth, sinuous, small monaxonic eulerhabds irregularly crowded together and not connected with each other. Water system more or less individualized. Comitalia in the form of not very large amphioxeas and quite small oxeas. This family is represented by the genus *Euleraphe* Schrammen, 1937, known from Jurassic of Germany and Campanian of Poland.

Laubenfels (1955, p. 43) assigns this genus to Ophiraphiditidae Schrammen (Schrammen, 1903) and believes that spicules in *Euleraphe* are very similar to those in the genera *Megaloraphium* Schrammen and *Polytretia* Schrammen. Judging by the type of spicules contained in the skeleton, both these genera belong to Tetraxonia (Schrammen, 1910—1912, Pl. 7, pp. 7 and 8). Sponges, attributed to Ophiraphiditidae contain dermal triaenes and their derivatives, whereas the genus *Euleraphe* has neither dermal, nor parenchymal tetraxonic spicules, its skeleton consisting of monaxonic megascleres only and, therefore, the assignment of these genera to a common order and to the family Ophiraphiditidae, as it has been done by Laubenfels, is ill-grounded.

### Genus *Euleraphe* Schrammen, 1937

(Type species: *Euleraphe incrustans* Schrammen, 1937)

### *Euleraphe incrustans* Schrammen, 1937

(Pl. XXI, Fig. 4; Pl. VIII, Fig. 1 *a*; Text-fig. 4)

1937. *Euleraphe incrustans* Schrammen; A. Schrammen, Die Kieselspongien..., p. 82, Pl. 21, Fig. 12; Pl. 19, Figs. 16, 17.

*Material.* — A very well-preserved specimen with the intact system of spicules and pores visible.

Dimensions (in mm):

| | Total surface (sq mm) | Thickness (mm) |
|---|---|---|
| Specimen UŁ Sp. III/992 . . . | 900 | 0.15—0.3 |

*Description.* — Sponge incrusting on the margin of *Seliscothon verrucosum* Schrammen, where it developed on both sides of the wall, covering an area of about 900 sq mm and forming a smooth, 0.15—0.3 mm thick incrustation. Skeleton dense, consisting of small, smooth and irregularly sinuous eulerhabds varying in length between 0.2 and 0.4 mm and about 0.03 mm thick. Ends of eulerhabds blunt without any traces

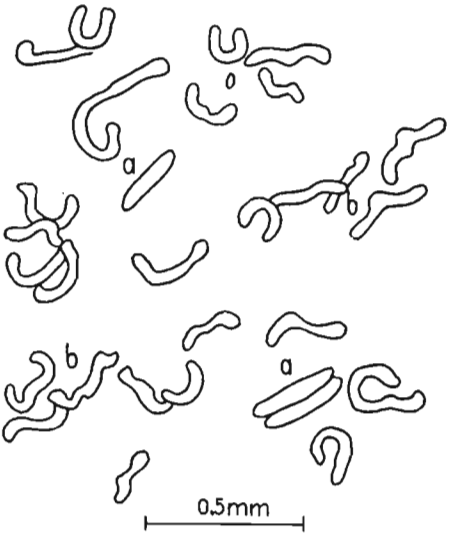


Fig. 4. — *Euleraphe incrustans* Schrammen; *a* amphioxeas, *b* parenchymal eulerhabds; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/992A).

of zygome. Eulerhabd system irregular, crowded but not connected together. Not very numerous, 0.35 mm long amphioxeas and 0.012 mm long microxeas play the role of comitalia. Two types of orifices, formless and oval, 0.03 and 0.045 mm in respective diameter, are visible in the skeleton. Canals are not clearly outlined, but the width and arrangement of apertures in the skeleton indicate their presence, tubelike shape and vertical position in the wall. Smaller orifices probably are parts of the inhalant and larger of the exhalant system.

*Remarks.* — All characters of *E. incrustans* Schrammen from Poland

are in conformity with those of the specimens of this species from Malm of Gerstetten, Germany. Schrammen's supposition that *E. incrustans* may represent a parasitic organism, is contradicted by quite not an accidental presence of oval apertures with two different dimensions which indicates the presence of a developed water system.

Single spicules of *E. incrustans* are similar to those of *Scolioraphis tesselata* (Roemer) from which they differ, however, in a smooth surface, smaller dimensions and greater degree of sinuousness. In *S. tessalata* monaxonic rhabds, also sinuous in a wormlike manner, are about 0.5 mm long and their surface is covered with collarlike swellings ("kragenförmige Anschwellungen" of Schrammen).

*Occurrence.* — Poland: Zbyczyce, Lower Campanian. Germany: Gerstetten, Malm.

## Suborder **Monalithistida** Lagneau-Hérenger, 1962
## Superfamily **Rhizocladina** Lagneau-Hérenger, 1962 (= **Rhizomorina** Zittel, 1878)

The representatives of Rhizocladina have irregular monocrepidal megascleres which cling to each other and form a network. Rhizoclones are usually provided, on the tips of actines, with spines different in length or, sometimes, fine knobs (*Amphithelion* Zittel). In the walls primordium is elongate and straight and near canals — bent. Cortical rhizoclones are smaller than those in parenchymal network, more branched and crowded. System of rhizoclones in parenchymal network may be of two different types, i.e. forming either strand of fibres, or a dense and compact network without a clear arrangement of rhizoclones. On this basis, the following two groups were distinguished by Moret (1925, p. 72): a) "Rhizomorinés à fibres" and b) "Rhizomorinés à squelette non fibreux".

Sponges varying in shape, mostly either platyproct or amblyproct. The presence of craterlike or pustulous pores is a frequent phenomenon.

As regards the external morphology, Rhizocladina are strongly differentiated and display not very conspicuous differences in the composition of the cortical skeleton. Schrammen (1924) ranks them in numerous families which are often monotypic. This author happens to assign genera very similar to each other in their shape and differing in such characters only as thickness of walls or size of papillae, to two different families.

Lagneau-Hérenger assigns genera, she studied, to the families described by Schrammen, but introduces certain changes resulting from the analysis of their structure and external similarity.

In the present work, I accepted in substance Lagneau-Hérenger's (1962) classification and based the assignment of genera not only on the

distribution of rhizoclones in the skeleton, i.e. on the character of a definite type of network, but also on the development of water system, general shape of sponge, as well as morphology and size of individual megascleres. Rhizocladina have been known from Cambrian to the present times. They are most numerously found in the Jurassic and Cretaceous sediments. In Recent seas, they are cosmopolitan and also numerous.

Family **Verruculinidae** Schrammen, 1924 emend. Lagneau-Hérenger, 1962

This family was erected by Schrammen for platy- or amblyproct sponges with more or less thick walls, provided with craterlike or pustulous pores. Two genera, *Verruculina* Zittel, limited by him to the forms with 10 mm thick walls and *Chondriophyllum* Schrammen with walls that do not exceed 5 mm in thickness, were assigned by Schrammen to this family. The skeleton in the genera of the Verruculinidae is fibrous and consists of small and strongly ramified rhizoclones. The outer, cortical layer of skeleton consists of densely crowded, smaller and flattened rhizoclones.

Table 2

Comparison of the diameter, shape of pores and thickness of walls in different species of the genus *Verruculina* Zittel. Dimensions in mm.

| Species | Diameter of | | Shape of | | Thickness of walls |
|---|---|---|---|---|---|
| | ostia | postica | ostia | postica | |
| *Verruculina seriatopora* | 0.2 | 0.5—0.75 | flat | papillary | 8 |
| *V. reussi* . . | 0.75 | 1.0—1.5 | pustulous | conical | 10—15 |
| *V. miliaris* . | 0.3 | 0.5—0.6 | conical | conical | 2—4 |
| *V. damaecornis* . . . . . | 0.5 | 1.0 | papillary | papillary | 3—5 |
| *V. tenuis* . . . | 0.15 | 0.45 | conical | conical | 3—4 |
| *V. cupula* . . | 0.5—0.6 | 1.5—2.0 | ridgelike | papillary | 10—20 |
| *V. abnormis* n.sp. . . . . | 0.3—0.45 | 1.5—1.8 | flat | slightly papillary | — |

Within this family Lagneau-Hérenger also places *Seliscothon* Zittel, whose species have a habitus similar to that of *Verruculina* but differ from them mostly in the morphology of skeleton and pores. For the last-named reasons, like Schrammen, I assign *Seliscothon* to Seliscothonidae and not to Verruculinidae. Laubenfels (1955) assigns *Verruculina* and *Amphithelion* to Leiodorellidae Schrammen, and *Seliscothon* — to the family Kaliapsidae erected by him.

## Genus *Verruculina* Zittel, 1878

(Type species: *Manon micrommata* (Roemer, 1841))

Sponges shaped like cups, funnels, plates or ears. Exhalant pores craterlike, inhalant flat or pustulous. Skeleton consisting of small rhizoclones, connected with each other and forming irregularly anastomozing fibres which make up a latticework. Cortex occurs either on one or both surfaces.

Schrammen (1924) tried to revise this genus which resulted in his assignment of the sponges, previously described (Schrammen, 1910—1912) as *Verruculina* Zittel, to as many as seven genera, assigned to five families. He did it on the basis of differences in thickness of walls, manner of distributing and shape of pores on one or both surfaces, as well as on the basis of either presence or lack of cortex. Since most of my sponges, belonging to the same family, despite a very numerous occurrence, became silicified and single rhizoclones of some specimens were corroded during fossilization, I had to adopt previous characteristics of the genus and accept the classification, presented by Zittel (1878), Moret (1925) and Schrammen (1910—1912). It was under much the same conditions that Lagneau-Hérenger studied *Verruculina* from the Lower Cretaceous of France and Spain.

### *Verruculina seriatopora* (Roemer, 1841)

(Pl. II, Figs. 1, 2; Pl. VI, Fig. 2; Text-fig. 5)

1841. *Manon seriatoporum* Roemer; F. A. Roemer, Die Versteinerungen..., p. 3, Pl. 1.
1864. *Chenendopora seriatopora* Roemer; F. A. Roemer, Spongitarien..., p. 43.
1878. *Verruculina seriatopora* (Roemer); K. Zittel, Beiträge..., p. 59, Pl. 4, Fig. 51.
1883. *V. seriatopora* (Roemer); J. G. Hinde, Catalogue..., p. 36, Pl. 3, Fig. 4.
1910. *V. seriatopora* (Roemer); A. Schrammen, Die Kieselspongien..., p. 141, Pl. 21, Fig. 1; Text-Pl. 8, Fig. 5.
1924. *V. aurita* (Roemer); A. Schrammen, *Ibid.*, p. 124, Pl. 3, Fig. 6
1925. *V. seriatopora* (Roemer); L. Moret, Contribution..., p. 84, Fig. 24; Pl. 11, Fig. 6.
1962. *V. seriatopora* (Roemer); L. Lagneau-Hérenger, Contribution..., p. 177, Text-Pl. 29, Fig. 1 a.

*Material.* — Two specimens; single prepared rhizoclones and a fragment of network.

Dimensions (in mm):

| | Surface of fragment | Thickness of wall |
|---|---|---|
| Specimen UŁ Sp. III/110 . . . | 75×50 | 8 |

*Description.* — Shape of an open cup with rounded brims. Postica papillary, 0.5—0.75 mm in diameter, irregularly disposed on the upper surface. Ostia 0.2 mm in diameter, densely concentrated on the entire

lower surface. Water canals tortuous and anastomozing, inhalant and exhalant systems without any visible delimitation. Parenchymal network dense, fibrous, consisting of fine, ramified rhizoclones. Network meshes suboval, unequal in size, variously distributed. Rhizoclones of two types,

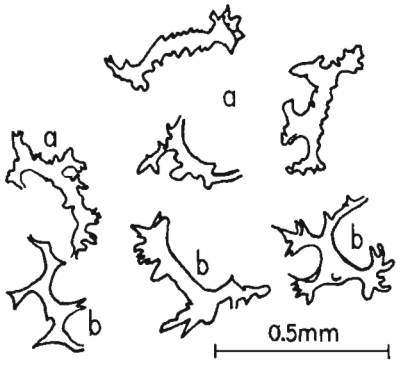


Fig. 5. — *Verruculina seriatopora* (Roemer); *a* parenchymal rhizoclones, *b* megarhizoclones; Muniakowice, Lower Maastrichtian (Z. Pal. UŁ Sp. III/110).

more massive, thornlike and thinner and finer, with smooth surface. Primordium distinctly separated, almost straight or bent, 0.3 mm long and, inside the network, short and ramified. Cortical network dependent, particularly dense around pores.

*Remarks.* — In German specimens described by Zittel and Schrammen, ostia are concentrically arranged, which is not visible either in Polish specimens from the Lower Campanian, or in sponges from Aptian of Catalonia, described by Lagneau-Hérenger. Polish specimens from Campanian, much the same as French ones (from Saint-Cyr and Nice) have postica 0.75 mm in diameter, whereas those in German ones reach 1 mm.

In specimens from Poland, diameters of postica equal those in *V. tenuis,* but *V. seriatopora* differs from the last-named species in the morphology of ostia and thicker walls.

*Occurrence.* — Poland: Zbyczyce, Lower Campanian; Muniakowice, Lower Maastrichtian. Germany: Aptian through Senonian, numerous in Turonian and Senonian. England: Upper Chalk. France: Saint-Cyr and Nice, Santonian. Spain: Mas de Artis, Catalonia, Aptian.

## *Verruculina reussi* (M'Coy, 1848)

(Pl. II, Figs. 3 *a*—*b*; Pl. III, Figs. 1, 2 *a*—*b*)

1883. *Verruculina reussi* (Mc'Coy); J. G. Hinde, Catalogue..., p. 40, Pl. 5?
1933. *Verruculina reussi* (M'Coy); F. Bieda, Gąbki..., p. 10.

*Material.* — Fifteen specimens, including one complete but with stem broken off; most specimens silicified. In one specimen (UŁ Sp. III/106), the network and rhizoclones very well-preserved.

Dimensions (in mm):

| | Height | Maximum thickness | Diameter of stem |
|---|---|---|---|
| Specimen UŁ Sp. III/1487 | 180 | 135 | 20×18 |

*Description.* — Shape auriculate or asymmetrically funnellike, widely open walls within limits of 10—15 mm in thickness. On the upper, exhalant side, there are strongly projecting, conical elevations, irregularly spaced at 3—8 mm intervals; at their top, postica open, 1—1.5 mm in diameter. Height of little cones amounts to 3 mm, that of their basis — to about 3.2 mm. Three to four postica were found over an area of 100 sq mm.

On the external (inhalant) side, elevations are much smaller, pustulous, surrounded by a small ridge, with ostia 0.75 mm in diameter, situated in hollowed tops of these elevations. Elevations are distributed at random and densely at 1—1.5 mm intervals. Twenty five ostia were found over 100 sq mm. Water canals anastomozing, difficult to distinguish from each other, piercing through the wall. They are connected with subdermal cavities, some of which, situated just below the outer surface, correspond to inhalant cavities and some others, below the inner surface — to exhalant cavities. Regardless of their functions, subdermal cavities open each with a single pore. They are similar in shape but different in volume, the exhalant cavities being larger and more widely spaced than inhalant ones.

Prepared rhizoclones vary in shape and size. Primordia happen to reach 0.3 mm (spec. UŁ Sp. III/1532) and even 0.6 mm (spec. 106) in length. Longer spicules are situated at the bases of cones (spec. 1532). In specimen 106, the network of parenchymal skeleton consists of rhizoclones which are more ramified and spiny and connected through a twist of spines to form the network. The number of actines and their spines in spicule is variable. Around canal meshes rhizoclones are arcuate and arranged in strands, containing two rhizoclones each, on each side of pore. On the other hand, between canals the network forms very dense strands.

*Remarks.* — *Verruculina reussi* and *Amphithelion macrommata,* considered by Schrammen (1924) to be synonyms, display a similarity only in external aspect and in structure of some rhizoclones with arcuate primordia. Rhizoclones of *Amphithelion macrommata,* figured by Schrammen (*l.c.*, Pl. 3, Fig. 1), as well as those in Polish specimens, differ from rhizoclones of *V. reussi* in being covered with nodes and not spines.

In addition, rhizoclones of *A. macrommata* are larger and more massive than those in *V. reussi*. The size and number of pores in both these species are also different. In *A. macrommata*, postica are 2 mm in diameter and 3—4 of them are found over an area of 100 sq mm. Ostia are also smaller in *V. reussi* (0.75 and not 1.0 mm). In the light of the differences shown Schrammen's view that *V. reussi* and *A. macrommata* are synonyms is not confirmed.

*Occurrence.* — Poland: Witkowice, Lower Campanian, marl of the "opoka" type; Skrajniwa, Zbyczyce, Pniaki and Miechów, Lower Campanian, clayey marl and as reworked fossils in the Miocene sediments of Podgórze near Cracow. England: Upper Chalk.

### *Verruculina miliaris* (Reuss, 1845)
(Pl. IV, Figs. 1, 2 *a—b*; Pl. VII, Fig. 5)

1845—46. *Manon miliaris* Reuss; A. F. Reuss, Die Versteinerungen..., p. 78, Pl. 19, Figs. 10—11.
1925. *Verruculina miliaris* (Reuss); L. Moret, Contribution..., p. 82.
1933. *Verruculina* cf. *miliaris* (Reuss); F. Bieda, Gąbki..., p. 9 (*here earlier synonymy*).

*Material.* — Numerous, strongly silicified fragments with a preserved characteristic morphology of surface.

Dimensions (in mm):

| | Height | Width | | Thickness of wall |
|---|---|---|---|---|
| | | at the top | at the base | |
| Smallest specimen, UŁ Sp. III/915 . . . . . | 30 | 20 | 8 | 3 |
| Middle-sized specimen, UŁ Sp. III/1629 . . . | 70 | 47 | — | 3—4 |
| Larger specimen without its top, UŁ Sp. III/912 . . . . . | 50 | 31 | 6 | 2 |
| Largest specimen, UŁ Sp. III/905 (fragment of wall) . . . . . | 53 | 42 | — | 2 |

*Description.* — Sponges thin-walled, differently flattened or in the form of an asymmetrical funnel with a side cut out. Margin rounded; conical elevations occur on both surfaces. On the external (= upper) side, cones are more widely scattered, very wide at their base (1—1.5 mm) and about 0.75—1.0 mm high. Postica round, 0.5—0.6 mm in diameter, distributed at irregular and uneven, about 1.5—2.5 mm intervals. Inhalant pores craterlike on the cone summit and more densely arranged than the exhalant ones. Their width, at the base, amounts to 0.75 mm

and height — to about 0.3 mm, i.e. as much as the diameter of ostia. Sometimes, cones closely adhere to each other, forming short rows.

*Remarks.* — The examined specimens of *V. miliaris* have postica narrower by half than those in German and French specimens. German specimens have only 4—6 postica over 100 sq mm, whereas Polish ones have 15—19 of them. Diameters of ostia are much the same, but their number per 100 sq mm is smaller: in German ones — 40-60 and in Polish — 65-115.

Polish specimens, determined as *V. miliaris* are similar to *V. tenuis* in the morphology of the upper surface, but the structure of their inhalant surface is identical with that in typical *V. miliaris*. Particularly the shape of inhalant cones is in conformity with that, figured by Hinde (1883, Pl. 3, Fig. 3a). The traces of rhizoclones, preserved on the silicified surface, are similar to rhizoclones, figured by Moret (1925, Figs. 24—4). As compared with *V. tenuis* (Roemer), *V. miliaris* has broader and more widely spaced postica, as well as a smaller concentration of ostia. According to Schrammen (1910, p. 139), in *V. tenuis* (Roemer) as many as 400 ostia are counted on an area of 100 sq mm.

At Zbyczyce, fragments of *V. miliaris* are numerously accumulated in a layer a few cm thick. All of them are strongly silicified. A great accumulation of amphioxeas, undoubtedly belonging to these specimens, occurs close to them. In view of thin walls, the preparation of entire specimens is difficult.

*Occurrence.* — Poland: Bonarka, Zbyczyce, Upper Campanian; Podgórze — as reworked fossils. Germany: Nettligen, Scaphiten-Pläner. England: according to Hinde, in Senonian. France: Nice, Emscherian — Senonian.

### *Verruculina* cf. *damaecornis* (Roemer, 1864)
(Pl. III, Fig. 3)

*Material.* — Numerous silicified fragments with poorly preserved skeletons.

Dimensions (in mm):

| | Height | Width | Thickness of wall |
|---|---|---|---|
| Specimen UŁ Sp. III/1504 (lateral processes) . . . . . | 25 | 27 | 35 |

*Description.* — Fragments thin-walled, with small, marginal processes varying in shape. Some processes are narrow and elongate, others spade-like and with battered margins. On both surfaces pores are papillary and varying in size. Ostia ca. 0.5 mm and, on processes, 0.3 mm in diameter, irregularly scattered on lower papillae. Postica, 1 mm in diameter,

arranged in rows on marginal processes. About 120 ostia are situated over an area of 100 sq mm.

*Remarks.* — The material under study is not uniform. Differences are recorded in shape and width of pores. Spadelike fragments have pores equal in width with those in *V. miliaris* Schrammen from which they differ in a smaller number of papillae and in the presence of marginal processes. Morphology of elongate processes is more similar to *Sporadothelion dissipatum* Schrammen (1924, Pl. 15, Fig. 3). In our material, rhizoclones are poorly preserved and for this reason any more accurate specific determination is difficult. Taking into account a development of the margin which is different from that in other species of *Verruculina,* I assign them with reservation to *V. damaecornis.*

According to Bieda (1933), *V. damaecornis* is a variety of *V. miliaris.* On the basis of the shape, Schrammen (1924, p. 121) assigned *V. damaecornis* and *V. miliaris* (Reuss) to a new genus *Sporadothelion,* he erected (1924, p. 121) and which was placed by Laubenfels (1955) among the genera, marked as "Family Uncertain".

*Occurrence.* — Poland: Zbyczyce, Upper Campanian, clayey marls; Podgórze, as reworked fossil in the Miocene sediments. Germany: Turonian.

### *Verruculina tenuis* (Roemer, 1841)
(Pl. VI, Figs. 1 *a*—*b*)

1841. *Manon tenue* Roemer; F. A. Roemer, Die Versteinerungen..., p. 3, Pl. 1, Fig. 7.
1864. *Chenendopora tenuis* (Roemer); F. A. Roemer, Spongitarien..., p. 43, Pl. 15, Fig. 4.
1870. *Chenendopora tenuis* (Roemer); F. A. Roemer, Oberschlesien..., p. 301, Pl. 31, Figs. 6—8.
1910—12. *Verruculina tenuis* (Roemer); A. Schrammen, Die Kieselspongien..., p. 136.
1924. *Chondriophylum tenue* (Roemer); A. Schrammen, Die Kieselspongien..., p. 126, Pl. 3, Fig. 13.
1925. *Verruculina tenuis* (Roemer); L. Moret, Contribution..., p. 83.
?1933. *Verruculina* cf. *tenuis* (Roemer); F. Bieda, Gąbki..., p. 8.
1962. *Verruculina tenuis* (Roemer); L. Lagneau-Hérenger, Contribution..., p. 178, Text-Pl. 29, Fig. 1c.
1964. *Verruculina tenuis* (Roemer); R. Giers, Die Grossfauna..., p. 221.

*Material.* — Numerous silicified fragments and a single complete specimen. Traces of rhizoclones observed on the surface.

Dimensions (in mm):

| | Height | Width of funnel | Width of base | Thickness of wall |
|---|---|---|---|---|
| Specimen UŁ Sp. III/746 | 50 | 200 | 18 | 3—4 |

*Description.* — Sponge shaped like a flat plate with a rounded, slightly undulating margin. Both surfaces with elevated, craterlike pores. Some exhalant cones, 0.6 mm high, have on their top pores 0.45 mm in diameter, others are rounded and covered with a sievelike diaphragm. They are distributed at 2.5 mm intervals. Ostia, 0.15 mm in diameter and 0.2 mm high, are distributed at 0.1—0.3 mm intervals and densely cover the entire outer surface. Sometimes, they are arranged in tortuous, irregular chains. An area of 100 sq mm is covered with 130 ostia and 16 postica.

Parenchymal skeleton contains 0.1—0.25 mm long rhizoclones which are irregularly ramified and pointed.

*Remarks.* — Specimens of *V. tenuis* here described differ from West-European ones in confusedly distributed postica and a smaller number of ostia. The type of rhizoclones (UŁ Sp. III/732) is, however, in conformity with Moret's description (1925, p. 84). Specimens of *V. tenuis* from Aptian of Catalonia (Lagneau-Hérenger, 1926, p. 178) have wider (=1.0 mm) postica than those of Polish ones from the Lower Campanian. Our forms differ from those from Campanian of Witkowice described by Bieda (1933) in an irregular arrangement of postica and in a smaller number of ostia (130 and not 300 per 100 sq mm).

*Occurrence.* — Poland: Pniaki, Zbyczyce, Lower Campanian, clayey marl, in which it forms banks; Witkowice, Kobylany, Lower Campanian; Opole, Senonian; Podgórze, as reworked fossil in Miocene sediments. France: Nice, Emscherian. Germany: Nettligen, Heere, Sudmerberg, Misburg, Oberg, Biewende, Turonian through Upper Campanian; Henneberg near Dolberg, Bosenberg and Kreutzberg, Upper Campanian. Spain: Can Casouyas Castellet, Aptian.

### *Verruculina cupula* Schrammen, 1910

(Pl. V, Figs. 1 *a*—*c*)

1864. *Chenendopora marginata* (Phillips); F. A. Roemer, Spongitarien..., p. 42.

1888/9. *Verruculina marginata* (Phillips); O. Griepenkerl, Die Versteinerungen..., p. 16.

1901. *Verruculina marginata* (Phillips); A. Schrammen, Neue Kieselschwämme..., p. 21.

1910—12. *Verruculina cupula* nom. Schrammen; A. Schrammen, Die Kieselspongien..., p. 142.

1925. *Verruculina cupula* Schrammen; L. Moret, Contribution..., p. 86, Pl. 20, Fig. 10; Pl. 21, Fig. 2; Text-fig. 24—3.

*Material.* — Three completely silicified specimens with well-preserved surface morphology and rhizoclones slightly swollen as a result of fossilization.

Dimensions (in mm):

| | Height | Thickness of wall |
|---|---|---|
| Specimen UŁ Sp. III/1131 | 63 | 10—12 |
| Specimen UŁ Sp. III/1141 | 80—95 | 13—20 |

*Description.* — Sponges massive, shaped like a not very deep funnel or ear, with rounded margins and thick walls. Lower pole conical, without ramification. Transverse section of aporrhyses, visible at the base, is round and 1.5—2 mm in diameter. Spongocoel of the euryproct type, with widely and irregularly scattered, round, papillary, fine postica, as wide as aporrhyses. Six to eight postica 1.5—3 mm distant from each other cover an area of 100 sq mm. Ostia, 0.5—0.6 mm in diameter, oval, sometimes pentagonal, are densely arranged and surrounded by a small, ridgelike elevation. A hundred ostia are distributed over 100 sq mm. Water system with a more strongly developed exhalant system, consisting of cavities and tubelike, obliquely disposed aporrhyses.

Parenchymal skeleton, preserved on the upper surface of funnel, forms a dense, fibrous network between pores. Primordia of rhizoclones thick, sometimes bent and ramified. Traces of spines or actines are visible on their surface. In view of a poor preservation state, the type of rhizoclones is difficult to determine.

*Variability.* — Polish specimens of *V. cupula* display a variable height, concavity of the upper part and massiveness of the lower.

*Remarks.* — Specimens under study are similar to German and French ones. The shape of rhizoclones and their primordia, visible on the surface (specimen UŁ Sp. III/1131) corresponds to that of rhizoclones, figured by Moret (1925, Text-pl. 24/3). According to Schrammen, this species is most similar to *V. seriatopora* (Roemer) from which it differs, however, in a greater thickness of walls, more massive and less flattened shape, greater number of pores and, mostly in a flat arrangement of postica. In *V. seriatopora* from Poland, postica are 1.0 mm and in *V. cupula* — 2.0—2.4 mm in diameter. Ostia are very small.

Schrammen (1924, pp. 90 and 118) erected a new genus *Heterothelion*, to which he assigned the previously described *V. cupula* having walls more than 10 mm thick. Laubenfels places this genus among forms with an uncertain appurtenance.

*Occurrence.* — Poland: Skrajniwa, Lower Campanian. Germany: Misburg and Oberg, "Quadraten-Kreide" and "Mucronaten-Kreide". France: Saint-Cyr, Santonian.

*Verruculina abnormis* n.sp.
(Pl. VIII, Fig. 2; Text-fig. 6)

*Holotypus:* Pl. VIII, Fig. 2; Text-fig. 6 (Z. Pal. UŁ Sp. III/361).
*Stratum typicum*: Lower Campanian, clayey marl.
*Locus typicus*: Skrajniwa near Koniecpol, Poland.
*Derivatio nominis*: Lat. *abnormis* = deviating from norm; on account of its shape which differs this species from others of the genus *Verruculina*.

*Diagnosis.* — *Verruculina* shaped like an inverted, high cone cut by an even, oval plane, covered with wide postica. Ostia small, distributed on lateral surface. Aporrhyses tubelike, longitudinal.

*Material.* — Two silicified specimens without basal parts. Fragments of skeleton embedded in chalcedony.

Dimensions (in mm):

| | Height | Maximum thickness | Thickness at lower part |
|---|---|---|---|
| Specimen UŁ Sp. III/361 | 90 | 28×50 | ca. 25×20 |

*Description.* — Shape similar to an elongated cone inverted upside down, oval in transverse section. Apex forms an even but obliquely situated plane, covered with loosely distributed postica. Surface of lateral walls somewhat bent. Spongocoel lacking. Aporrhyses tubelike, anastomozing, accumulated in the internal part of sponge and having their

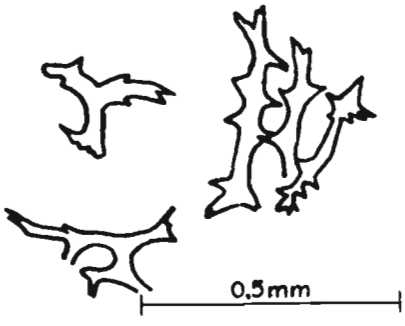


Fig. 6. — *Verruculina abnormis* n.sp., rhizoclones on outer surface; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/361).

apertures, at different heights, on the apical part. Postica slightly papillary, elevated, 1.5—1.8 mm in diameter and with uniform width of canals. Four to five of them are found on 100 sq mm. Ostia, 0.3—0.45 mm in diameter, almost flat, densely cover the lateral surface, forming irregularly distributed groups. About 90 ostia are found on 100 sq mm. Epirrhyses narrow, running obliquely downwards.

Parenchymal skeleton insufficiently studied. Single rhizoclones are embedded in chalcedony near outer surface or are visible on the external

side of some aporrhyses. Mostly they are elongate. As a result of fossilization, their lateral ramifications are modified and transformed into spiny branches. Primordia are arranged on walls of aporrhyses in conformity with their direction. Rhizoclones reach, on the outer surface, about 3.0—0.4 mm in length.

*Remarks.* — Both specimens of *V. abnormis* n.sp. we own have the morphology of their pores and rhizoclones characteristic of the genus *Verruculina* Zittel, i.e. postica are papillary and wider than ostia, ostia being very numerous and nearly flatly arranged. Rhizoclones are fine, elongate and seem to be spiny. They are most similar to those figured by Schrammen (1924, Pl. 3, fig. 6) in *V. aurita.*

*V. abnormis* n.sp. primarily differs from all known species of this genus in shape, massiveness and clearly developed water system in which the inhalant may easily be distinguished from the exhalant system. Tubelike aporrhyses are relatively wide and their trace is vertical and straight and not tortuous as in other species. In this respect, *V. abnormis* n.sp. is most similar to *V. cupula* Schrammen, from which it differs in a conical shape and smaller width of ostia (in *V. abnormis* 0.3—0.45 and in *V. cupula* 0.5—0.6 mm).

*Occurrence.* — Poland: Skrajniwa, Lower Campanian.

Family **Amphithelionidae** Schrammen, 1924

Genus *Amphithelion* Zittel, 1878, emend. Schrammen, 1924

(Type species: *Manon macrommata* (Roemer, 1864)

Two genera, *Verruculina* and *Amphithelion,* which differ from each other in the morphology of pores and rhizoclones, were erected by Zittel (1878) and, afterwards, united into one by Hinde (1883) who considered *Amphithelion* to be a synonym of *Verruculina.* The latter view was shared primarily by Schrammen (1910—1912) and Moret (1925) who more accurately worked out the genus *Verruculina* and distinguished several species. In 1924, Schrammen introduced a change and assigned *V. macrommata* once more to the genus *Amphithelion.* Both these genera differ from each other primarily in the morphology of rhizoclones. In *Verruculina* they are small, ramified and thorny, whereas in *Amphithelion* they are large, massive and with primordia straight or bent and densely covered with knots. A different morphology of lower surface which in *Verruculina* is more or less densely covered with papillae and in *Amphithelion* almost completely smooth, represents another difference between two genera.

Lagneau-Hérenger (1962) assigns both these genera to the Verruculinidae. A different morphology of rhizoclones testifies, however, against such a view. The distinction of a separate family, i.e. Amphithelionidae Schrammen is justified also by the Polish material.

## *Amphithelion macrommata* (Roemer, 1864)
(Pl. VI, Fig. 3; Text-fig. 7)

1864. *Verrucospongia macrommata* Roemer; F. A. Roemer, Spongitarien..., p. 45, Pl. 16, Fig. 4.
1878. *Amphithelion macrommata* (Roemer); K. Zittel, Studien..., p. 123, Pl. 3. Fig. 15.
1883. *Verruculina macrommata* (Roemer); J. G. Hinde, Catalogue..., p. 40.
1901. *Amphithelion macrommata* (Roemer); A. F. Schrammen, Neue Kieselspongien..., p. 21.
1910—12. *Verruculina macrommata* (Roemer); A. Schrammen, Die Kieselspongien..., p. 140.
1924. *Amphithelion macrommata* (Roemer); A. Schrammen, *Ibid.*, III, p. 117, Pl. 3, Fig. 1.
1964. *Verruculina macrommata* (Roemer); R. Giers, Die Grossfauna..., p. 220.

*Material:* — One complete specimen and four fragments, each of which represents a longitudinally cut sponge. Well-preserved. Single rhizoclones, preserved on the surface, are clearly visible, the same as their fibrous structure.

Dimensions (in mm):

| | Height | Diameter at the top | Diameter of stem | Thickness of wall |
|---|---|---|---|---|
| Larger specimen, UŁ Sp. III/1047 . . . | 40 | 90 | — | — |
| Smaller specimen, UŁ Sp. III/1067 . . . | 33 | 60 | ca. 15 | 12 |

*Description.* — Sponge shaped like an asymmetrical funnel with thick walls and rounded upper margin. Not very large, papillary pores are irregularly and fairly widely distributed on both surfaces. Postica papillary, not very high, 1.2—1.5 mm in diameter, 4—5 of them occurring over 100 sq mm. Ostia are smaller than postica and situated on small papillae. They are 0.6—1.0 mm ich diameter and 21—23 of them occur over 100 sq mm. Water canals do not form a separate system. They run through the meshes of network.

Parenchymal skeleton forms a network with polygonal meshes and consists of large, massive rhizoclones, arranged in short strands. Rhizoclones covered with fine knobs. Primordia thick, straight or slightly bent. Actines short, covered with knobs which form projecting, clusterlike assemblages, sometimes connected with each other. Zygomes fairly strongly ramified.

The outer surface is covered with cortex, forming a very dense network within which the morphology of spicules is indistinct. Numerous amphioxeas, varying in length, occur on the surface and in the meshes cf network.

*Remarks.* — The specimens of *A. macrommata* (Roemer) under study are very similar, in particular in their rhizoclones, to the German ones

(Schrammen, 1924, p. 117). In German specimens from Hanover, postica are ca. 2 mm in diameter, whereas those in Polish ones — only 1.5 mm. The number of pores also differs. In Schrammen's specimens, 5—7 postica occur over 100 sq mm, whereas in Polish ones — 4-5. Respective figures

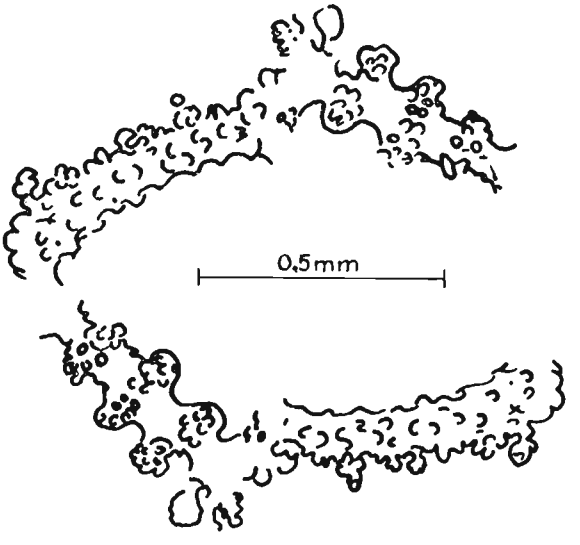


Fig. 7. — *Amphithelion macrommata* (Roemer), parenchymal rhizoclones covered with knobs; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1047).

for ostia are 24—30 and (in my specimens) 21—23. According to Giers (1964, p. 220), postica are 2—3 mm high.

*Occurrence.* — Poland: Pniaki, Lower Campanian, clayey marl. Germany: Misburg, Oberg, Adenstedt, Althen ("Quadraten-Kreide" and "Mucronaten-Kreide").

Family **Seliscothonidae** Schrammen, 1924
Genus *Seliscothon* Zittel, 1878
(Type species: *Spongia plana* (Phillips, 1835))

A revision of sponges, previously determined as *Spongia plana*, was carried out by Pomel (1872, p. 148) who erected two new genera: *Laosciadia*, to which he assigned "funnellike or cylindrical sponges with fine ostia and a skeleton consisting of rhizoclones", and *Trachydictya*, including specimens which are similar but have a "finely porous" upper surface. Zittel (1878, p. 117) expressed the opinion that Pomel's definition was too laconic and differences he mentioned — too small. Consequently Zittel considered both these names to be synonyms of the genus *Seliscothon*, he erected himself and which represented Rhizocladina.

The morphology of the skeleton of *Seliscothon* was worked out in detail by Zittel (1878) and Moret (1925, p. 72). Thus far, the taxonomic

position of this genus has not, however, been definitely stated. On the basis of the lamellar structure of walls, fibrous-radial structure of the skeleton and pores, differently built than those in *Verruculina*, Schrammen (1924, p. 89) assigned *Seliscothon* to the family Seliscothonidae which he erected.

This genus, as closely related to *Verruculina,* was assigned by Lagneau-Hérenger (1962, p. 178) to the Verruculinidae. At the same time, this author expresses the view that separating families for almost each genus, as it has been done by Schrammen, makes the taxonomy complex and intricate.

Laubenfels (1955, p. E 45) returns to the generic name of *Laosciadia* Pomel, 1872 and assigns it to Kaliapsidae Laubenfels, 1936 together with Recent genera as, for instance, *Kaliapsis* Bowerbank, 1869 with phyllotriaenes in its skeleton, and *Corallistes* Schmidt, 1870 with dichotriaenes.

Like Laubenfels, Wagner (1963, p. 206) pronounces himself in favour of the previous generic name of *Laosciadia* Pomel and assigns it to Seliscothonidae Schrammen. He also describes two species, *L. mantelli* (Goldfuss, 1833) and *L. columna* (Schrammen, 1924).

According to articles 23b and 24 of the International Code of Zoological Nomenclature (1963, pp. 15 and 17), the generic name introduced by Zittel should be accepted as justified and *Laosciadia* considered as *nomen oblitum.* This is also testified to by a detailed analysis of the skeleton, first carried out by Zittel.

The genus *Seliscothon* is characterized by the fibrous-radial structure of its parenchymal skeleton. Its rhizoclones, as compared with those of *Verruculina,* are larger, frequently elongate or falciform, slightly ramified and densely covered with spines varying in length. Cortex forms a thin layer of small, tangled rhizoclones. Ostia small, almost invisible, densely concentrated. Postica wider, more widely distributed and, in some species, slightly papillary. On the other hand, in all representatives of *Verruculina* Zittel, skeleton consists of small and very strongly ramified rhizoclones (0.1—0.25 and, in cortical ones, 0.3—0.6 mm in length), arranged in anastomozing strands and forming a latticework. Pores are papillary or pustulous. These pronounced differences indicate the belonging of these two genera to different families.

The fact that *S. planum* and *S. verrucosum* from Poland, as well as other European species do not have phyllotriaenes, acanthostyles or dichotriaenes, mentioned by Laubenfels (1955) in his description of Recent genera, precludes the appurtenance of *Seliscothon* to the family Kaliapsidae Laubenfels. On the other hand, a general appearance and morphology of the examined *S. planum* and *S. verrucosum,* are in conformity with Schrammen's diagnosis which allows one to assign them tc the Seliscothonidae, and not to the Verruculinidae, as it has been done by Lagneau-Hérenger (1962).

## *Seliscothon planum* (Phillips, 1835)

(Pl. VII, Figs. 1—4; Text-fig 8)

1835. *Spongia plana* Phillips: J. Phillips, Illustration of the Geology of Yorkshire...., p. 177, Pl. 1, Fig. 1 (*fide* Moret, 1925, p. 73).

1925. *Seliscothon planum* (Phillips); L. Moret, Contribution..., p. 73, Pl. 20, Fig. 1; Pl. 17, Fig. 13 (*here earlier synonymy*).

1964. *S. planum* (Phillips); R. Giers, Grossfauna..., p. 221.

*Material.* — Sixteen specimens and many fragments; most of them silicified; two specimens almost complete, with a very well-preserved structure of skeleton and water system.

Dimensions (in mm):

| | Height | Diameter of upper part | Thickness of walls at the base | Diameter of stem |
|---|---|---|---|---|
| Smallest specimen, UŁ Sp III/99 . . . . . | 18 | 10 | 3 | 3 |
| The middle-sized specimen, UŁ Sp. III/1193 . . . . . | 45 | 55 | 12 | 12 |
| Largest specimen, UŁ Sp. III/1523 . . . . . | 55 | 110 | 15 | 14 |

*Description.* — Sponge shaped like an open funnel, mounted on a short stem. Wall margin rounded, ca. 4 mm thick, oval and slightly wavy in outline. Distinct aporrhyses varying in arrangement are visible in the longitudinal section of walls. Around the bottom of funnel, they are vertical and fairly densely arranged, whereas in lateral walls they are shorter and arcuate. Diameter of aporrhyses not uniform, decreasing towards the surface of wall where it amounts to 0.45—0.60 mm. Epirrhyses, less distinct, running from margins of funnel towards stem. They are longer than aporrhyses and more arcuate. The entire inhalant zone in lateral walls is wider than in the lower part of sponge where epirrhyses are more widely arranged. Cortex consisting of fine, densely concentrated rhizoclones which form a thin, porous layer on the upper side, and almost completely smooth and devoid of pores on the lower side.

Parenchymal skeleton fibrous. Parenchymal rhizoclones have spiny processes with which they catch each other and form fairly loose strands running radially from stem to margin of wall. Primordia of rhizoclones straight or arcuate, to 0.5 mm long. Numerous amphioxeas to 1.5 mm long, microxeas and microstrongyles to 0.015 mm long, as well as very numerous sterrasters, varying in size between 0.15 and 0.03 mm, scattered

in network meshes of both surfaces and undoubtedly belonging to this sponge (UŁ Sp. III/1189) are observed on the outer surface.

*Variability.* — Specimens of *S. planum* from the Lower Campanian marl of Pniaki and Zbyczyce have walls on the average 0.5 mm thick

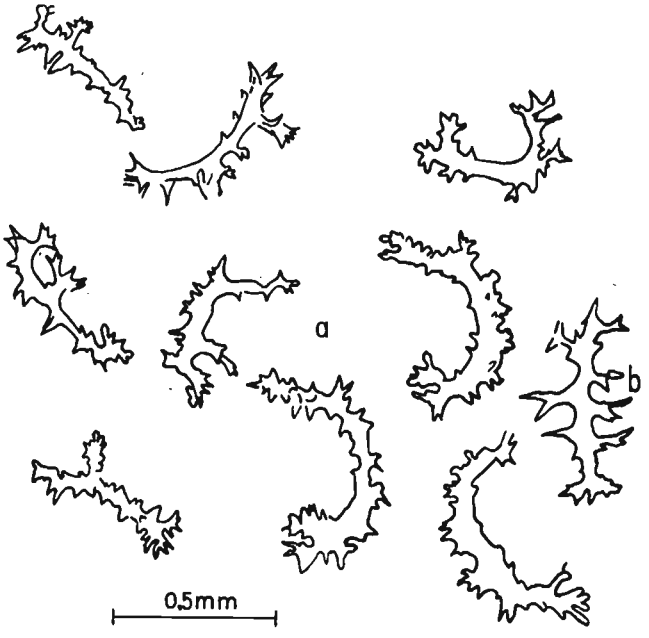


Fig. 8. — *Seliscothon planum* (Phillips); *a* rhizoclones, *b* megarhizoclones; Miechów, Upper Campanian (Z. Pal. UŁ Sp. III/1189).

and, in some forms, even reaching 10 mm in thickness. The general shape is flattened platyproct ca. 85 mm in radius.

The outer, i.e. lower surface has concentrical swellings which are marks of a not uniform growth. Wall margin not uniform, in thinner specimens rounded, in thicker evenly truncate at an angle of 90°. Postica 0.3—0.4 mm in diameter, loosely distributed on upper surface, spaced at 0.5—0.75 mm and, in some specimens, 1.2—1.5 mm (UŁ Sp. III/189) intervals. In specimens with destroyed cortex, parenchymal skeleton, exposed at various depths, has a not uniform structure. In some specimens, strands are anastomozing, just below the cortex (UŁ Sp. III/1632, 1633), in some others, strands are radial, 0.15—0.21 mm wide and make the structure of walls lamellar (UŁ Sp. III/1189).

*Remarks.* — Specimens of *S. planum* from Pniaki and Zbyczyce, as compared with West European ones, have the smallest diameter of postica and, at the same time, the smallest thickness of walls. Specimens from Germany, also coming from Campanian and described by Schrammen, have postica 0.5—0.8 mm, and those from France and England —

about 1 mm in diameter. According to Giers (1964, p. 221), there also occur forms shaped like a mushroom. *S. planum* occurs in the Cretaceous formations from Upper Turonian to Upper Senonian. Schrammen (1910—1912, p. 164) expresses the opinion that specimens from older horizons are characterized by smaller dimensions. Those coming from "Scaphiten-Pläner" were 35—100 mm high and their walls were 8 mm thick. Postica of these specimens were distributed over the entire upper surface, whereas in *S. plana* from the Upper Senonian, funnellike specimens 200 mm in diameter had their postica concentrated more towards the middle of the funnel. The above observation, made by Schrammen, has not been confirmed by the Polish material from Lower Campanian.

*Occurrence.* — Poland: Pniaki, Skrajniwa, Zbyczyce, Miechów, Lower Campanian. Germany: Turonian and Campanian. France: Nice, Saint-Cyr, Saumur, Senonian. England: Flamborough, Yorkshire, Upper Chalk.

### *Seliscothon verrucosum* Schrammen, 1924

(Pl. IV, Fig. 3; Pl. V, Fig. 3; Pl. VIII, Fig. 1 a—b; Pl. XIII, Fig. 4; Text-fig. 9)

1924. *Seliscothon verrucosum* Schrammen; A. Schrammen, Die Kieselspongien..., p. III, p. 93, Pl. 1, Figs. 4—5; Pl. 15, Fig. 7.

*Material.* — Two almost complete specimens and two fragments of walls. Parenchymal skeleton well-preserved, dermal — only in some places.

Dimensions (in mm):

| | Diameter | Thickness of wall margin | Diameter of stem |
|---|---|---|---|
| Specimen UŁ Sp. III/992 . . . . | 55 | 5 | 11 |
| Specimen UŁ Sp. III/1529 more than | 100 | 6 | — |

*Description.* — Sponge bowl-like or platelike in shape, with stem varying in length. Wall surface not uniform, upper papillary, lower smooth with finely outlined concentrical growth zones. Ostia invisible. Fine inhalant pores 0.06—0.15 mm in diameter are preserved only near stem. It results from their morphology that these are prosopyles. Postica, 0.6—0.75 mm in diameter, are situated on the top of papillary elevations and distributed at intervals varying from 0.5 to 2 mm. Water canals more strongly developed in the basal part. Cross sections of aporrhyses in stem have diameters ranging between 0.45 and 0.6 mm.

Cortical skeleton consists of very fine, flattened rhizoclones, about 0.03—0.06 mm long, crowded in a fairly thick layer. On its surface, there are preserved numerous pleural, single or grouped, amphioxeas. Bunches of very long oxeas, indicating the presence of marginalia, are

embedded in network meshes on the internal side of the marginal parts of walls.

*Remarks.* — Specimens of *S. verrucosum*, described by Schrammen from North-western Germany, are, as compared to Polish ones, larger (funnel diameter amounts to ca. 250 mm) and have broader (1.5 and not 0.6—0.75 mm) and more widely spaced postica. In its external aspect and

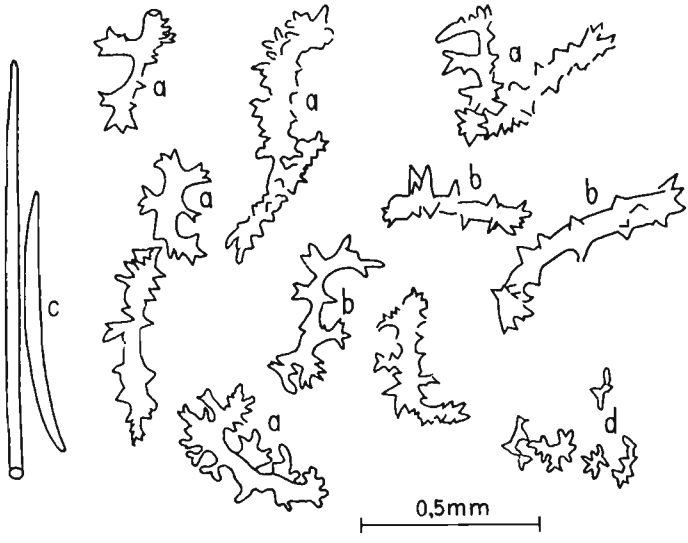


Fig. 9. — *Seliscothon verrucosum* Schrammen; *a* rhizoclones from parenchymal network on wall-surface of upper part of sponge, *b* rhizoclones from below of cortex from lower part of sponge, *c* amphioxeas, *d* flattened rhizoclones from cortex; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/992).

dimensions, *S. verrucosum* is similar to *Verruculina seriatopora*. In addition to the difference in the structure of skeleton, it is also characterized by a different morphology of the lower side. In *V. seriatopora*, ostia distributed over this surface are papillary, whereas in *S. verrucosum* the lower side is smooth and has fine pores. Another and fundamental difference becomes visible after the removal of the cortical layer. In *V. seriatopora*, after the destruction of papillae, the skeleton network meshes are exposed, whereas under analogous conditions in *S. verrucosum*, the radial-lamellar structure of skeleton is revealed.

*Occurrence.* — Poland: Zbyczyce, Lower Campanian. Germany: Sudmerberg, Misburg, Lower Senonian, sandy marl facies and calcareous marl of the "Mucronaten-Kreide".

Family **Jereicidae** Schrammen, 1924 emend. Lagneau-Hérenger, 1962

In the Lower Campanian of Poland this family is represented by the following three genera: *Jereica* Zittel,1878, *Stichophyma* Pomel,1872 and

*Coelocorypha* Zittel,1878. I also assign to this family the genus *Bolidium* Zittel, 1878 whose taxonomic position has not so far been precisely determined. Laubenfels (1955, p. E. 49) mentions *Bolidium* as a genus of an uncertain family. Morphological character of skeleton and water system in *Bolidium capreoli* (Roemer) are similar to those in *Jereica polystoma* (Roemer) from Poland.

The genus *Scytalia* Zittel is also assigned by Schrammen (1924, p. 98) to the Jereicidae. However, the rhizoclones in this genus do not form fibrous strands and a general look of individual rhizoclones is quite different. Moreover, the water system contains, in addition to canals, also a tubelike and deep spongocoel. Like Lagneau-Hérenger (1962), I assign the genus *Scytalia* to a separate family, i.e. the Scytaliidae Laubenfels,1955.

## Genus *Jereica* Zittel,1878

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

Laubenfels (1955, p. E. 48) considered *Jereica* Zittel to be a synonym of the genus *Jereopsis* Pomel,1872 and derived from it the family name Jereopsiidae Laubenfels. However, Zittel's names — both that of the genus and that of the family — are in general use, whereas the name of Pomel should, according to article 20 of the International Code of Zoological Nomenclature (1963), be considered rather as a modified name.

### *Jereica polystoma* (Roemer, 1864)

(Pl. IX, Figs. 1 *a*–*c*)

1864. *Jerea polystoma* (Roemer); A. Roemer, Spongitarien..., p. 34, Pl. 12, Fig. 5.
1933. *Jereica polystoma* (Roemer); F. Bieda, Gąbki..., p. 10 (*here earlier synonymy*).

*Material.* — Five specimens complete except for stems which are lacking; isolated, very well-preserved rhizoclones and fragments of parenchymal network.

Dimensions (in mm):

| | Height | Maximum thickness | Diameter of apex |
|---|---|---|---|
| Specimen UŁ Sp. III/1538 . . . . . | 65 | 75 | 60×20 |
| Smallest specimen, UŁ Sp. III/1011 . . . . . | 60 | 42 | 40×30 |

*Description.* — Sponge shaped like a bilaterally flattened mace; upper pole rounded. Sponge tapering towards the lower pole. Three contractions, varying in width, are slightly outlined on lateral walls. The

entire lateral surface is uniformly and densely covered with ostia, 0.3—0.45 mm in diameter and situated in small depressions. Here and there, ostia form vertical and horizontal rows. About 100—120 ostia occur over an area of 100 sq mm. Spongocoel lacking. Longitudinal aporrhyses tubelike and uniform in width. Small, closely spaced contractions are outlined on their walls. Epirrhyses short and more clearly visible in the marginal part of sponge, inclined downwards and arranged fanwise. They occur more numerously than aporrhyses. Postica oval, concentrated at the top, 1.8—2.1 mm in diameter.

Parenchymal skeleton makes up a network consisting of fairly large, thick rhizoclones with short, lateral actines which, at their ends, are ramified in a single plane. Primordia elongate, straight and, in most desmas, arcuate and dichotomously terminating. Length of rhizoclones amounts to 0.75 and thickness — to 0.06 mm. Rhizoclones, each with three actines, occur occasionally. On the surface, dense skeletal network forms strands surrounding ostia; inside the sponge, network is loose. Separate canal meshes, encircled by strands of spicules, are visible in the network. A strand consists of 2—5 strongly spiny rhizoclones, connected with each other by hooking processes. Amphioxeas, varying in length and thin, long (0.1—1.0 mm) oxeas are stuck in some network meshes, either single or in small bundles. Not very numerous microxeas 0.018 mm long are also met with.

*Remarks.* — Single rhizoclones of *J. polystoma* have a similar morphology to that presented by Schrammen (1924, Pl. 1, Fig. 1). In their external look and width of ostia, Polish specimens from Skrajniwa are similar to *J. polystoma* from the Paris Basin and in their narrower postica they differ from German forms.

According to Schrammen, *J. polystoma* from littoral facies of Emscherian are low, cylindrical and with a pointed or concave apex, whereas those from the deep sea zone of Senonian are elongate, cylindrical and with a longer stem. This author believes (1924, p. 97) that, during the period from Emscherian to Campanian, *J. polystoma* displays a progressive growth from hand size to giant forms ("Riesenformen"). Polish specimens from Campanian are not very large.

*Occurrence.* — Poland: Witkowice, Skrajniwa, Zbyczyce and Przesławice, Lower Campanian. France: Paris Basin and Montrichard, Senonian. Germany: Misburg, Oberg, Althen, and Biewende, "Quadraten-Kreide" and "Mucronaten-Kreide".

### *Jereica* sp.

(Pl. X, Fig. 5)

*Material.* — A single specimen with a poorly preserved skeleton, settled on the surface of *Verruculina (?)* sp.

Dimensions (in mm):

| | Height | Thickness |
|---|---|---|
| Specimen UŁ Sp. III/1513 . . . . | 80 | 45×20 |

*Description.* — Sponge shaped like an irregular, bilaterally flattened mace. Upper pole rounded, covered with cortex. On the apex, there are wrinkles, arranged almost parallel to the longer axis. Lower pole makes up a short stem, distinctly separated by a contraction and terminating in an extension of the plate. Lateral surface irregularly humpy and covered with a smooth, crusty layer. Ostia barely visible, preserved here and there on cortex, are 0.03 mm and, under cortex, 0.6 mm in diameter. Postica are not individualized. A destroyed cortex reveals canal sections on the lateral side. Short, sloping downwards epirrhyses are 0.3 mm in diameter. In the axial part of sponge, aporrhyses are wide (ca 0.75 mm), anastomozing and, sometimes, extended to a length of 20 mm. Apopyles covered with cortex. Irregular cavities, to 3 mm wide, occur between aporrhyses. Numerous, tortuous, anastomozing, subcortical exhalant canals are exposed in the upper part of sponge, in particular on apex. In places where covered with cortex they form apical wrinkles. Lower part of sponge smooth.

Cortical skeleton forms a thin, mineralized, crusty layer in which fine ramified rhizoclones are visible, together with single amphioxeas whose longer axis runs parallel to the height of sponge. The latter undoubtedly belong to pleuralia.

*Remarks.* — The form described differs from known species of the genus *Jereica* in lacking postica on apex. Water, drained through aporrhyses, probably first reached tortuous subcortical canals and did not directly flow to the common reservoir. In view of a poor preservation state it is difficult to determine the specific appurtenance of this form. The specimen under study represents a sponge which, in its larval stage, settled on the surface of *Verruculina (?)* sp. and developed in this position. The development of basal processes, transformed into spines, was probably inhibited by the organic substratum. A delimitation of the surface of both sponges is visible in the structure of basal plate.

*Occurrence.* — Poland: Zbyczyce, Lower Campanian.

## Genus *Stichophyma* Pomel,1872 emend. Zittel,1878

(Type species: *Manon turbinatum* Roemer, 1841)

### *Stichophyma turbinatum* (Roemer, 1841)

(Pl. IX, Figs. 2, 3; Text-fig. 10)

1840/41. *Manon turbinatum* Roemer; F. A. Roemer, Die Versteinerungen..., p. 3, Pl. 1, Fig. 5.

1910—12. *Stichophyma turbinatum* (Roemer); A. Schrammen, Die Kieselspongien..., p. 144 (*here earlier synonymy*).

*Material.* — One calcified and two silicified specimens with a general shape well-preserved and skeleton in a poorer state.

Dimensions (in mm):

| | Height | Diameter of apex | Lenght of stem | Diameter of stem |
|---|---|---|---|---|
| Specimen UŁ Sp. III/689 | 45 | 25 | 6 | 5 |

*Description.* — Sponge almost macelike; upper pole flat with rounded margins, lower conical, terminating in a short, pivotlike stem. Six to 12 postica ca 1.5 mm in diameter situated in the middle of apex. Ostia papillary, 0.5 mm in diameter, numerously concentrated in groups distributed at varying, 0.15—1.0 mm intervals on lateral surface. About 60—85 ostia occur over 100 sq mm. In the upper part, ostia are flat, more densely arranged and in the lower part are papillary and more

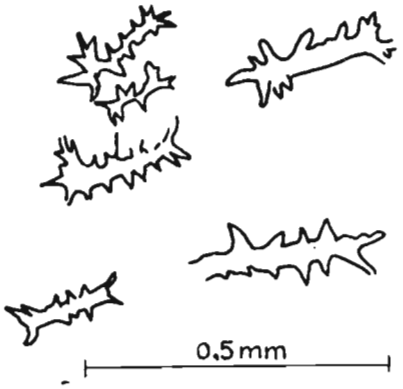


Fig. 10. — *Stichophyma turbinatum* (Roemer), rhizoclones in skeletal network on wall-surface; Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/1198).

loosely distributed. Spongocoel lacking. Vertical aporrhyses scarce, epirrhyses short and anastomozing. Parenchymal skeleton contains small, ramified rhizoclones. Structure of cortex obscure. Amphioxeas, varying in length within limits of 0.18 and 1.2 mm, and sterrasters 0.018 mm in diameter, their belonging to the specimens examined being uncertain, are preserved on the upper surface.

*Remarks.* — Polish specimens differ from German ones coming from Lower and Upper Senonian in a smaller height (40 vs. 60 mm) and greater number of inhalant pores. Diameter of pores in German specimens amounts to 0.5—1.0 mm, 30—60 pores occurring over 100 sq mm.

*Occurrence.* — Poland: Skrajniwa, Zbyczyce, Lower Campanian. Germany: Sudmerberg, Lower Senonian; Misburg, Upper Senonian. Czechoslovakia: Cenomanian. Southern England: Goslar, Upper Chalk.

*Stichophyma pumiliformis* n.sp.
(Pl. V, Figs. 2 *a*—*b*)

*Holotypus*: Pl. V, Figs. 2 *a*—*b* (Z. Pal. UŁ Sp. III/747).
*Stratum typicum*: Lower Campanian, marly facies.
*Locus typicus*: Podgaj near Lelów, Poland.
*Derivatio nominis*: Lat. *pumiliformis* = similar in shape to the species *Stichophyma pumilis* Moret.

*Diagnosis.* — *Stichophyma* shaped like an inverted cone with its amblyproct upper part slightly concave. Postica papillary, ostia not individualized. Fibroidal, parenchymal network consisting of strongly spiny rhizoclones.

*Material.* — A silicified specimen without stem and with a well-preserved external morphology. Cortex visible on margin. Single rhizoclones occurring here and there.

Dimensions (in mm):

| | Height | Diameter of central part | Diameter of base | Diameter of apex |
|---|---|---|---|---|
| Specimen UŁ Sp. III/747 | 35 | 20 | 12 | 30 × 35 |

*Description.* — Sponge similar in shape to an inverted cone, with a fairly slender lower and wide upper part. A fairly sudden lateral growth causing the transformation of the conical into amblyproct shape is marked about 12 mm from the apex. Apex subround, slightly concave, surrounded, with a thick, rounded rim. Elevated, papillary postica, 0.5 mm in diameter, are distributed over the upper surface at 0.5—1.2 mm intervals, more densely concentrated on the concave part than on rounded margins. Papillae small, about 0.3 mm high. Ca. 40 papillae occur over 100 sq mm. Outer surface of lateral walls almost completely smooth without papillary pores. Ostia not individualized. Irregularly outlined openings 0.3—0.6 mm in diameter, probably of inhalant canals, are formed by strands of cortical network. Inhalant system consists of numerous, fairly short, anastomozing epirrhyses, running from apex downwards. Near the outer surface, epirrhyses are arranged radially.

Skeleton of the two types, parenchymal and pleural. Parenchymal network fibroidal, reticular and with strands built, on the outer surface, of rhizoclones to 0.4 mm long and strongly spiny. Very numerous amphioxeas which are thin (mostly broken transversely), 0.3—1.8 mm and some of them, even 3.0 mm long and which stick in network meshes around the margin on the outer side, testify to the existence — during the animals' lifetime — of the pleural skeleton. Numerous are also microxeas 0.018 mm long. Sterrasters 0.18 mm in diameter occur occasionally. In

the sediment which fills network meshes on the surface of the specimen, there are single protriaenes, but it is doubtful whether or not they belong to this specimen.

*Remarks.* — *S. pumiliformis* n.sp. is to the greatest extent similar in the morphology of rhizoclones to *S. pumilis* Moret (1925, p. 92, Text-pl. 28b) from which it differs, however, in a smaller width of the upper section, smaller diameter of postica (0.5 mm vs. 1.0 mm) and in more densely concentrated pores. *S. pumiliformis* n.sp. has not the cortex which occurs in *S. pumilis* Moret, but it has numerous pleuralia. Our species differs from other ones of the genus *Stichophyma* Zittel in the type of inhalant pores which are flat, their dimensions and a general shape of body.

*Occurrence.* — Poland: Podgaj, Upper Campanian.

## Genus *Coelocorypha* Zittel,1878

(Type species: *Coelocorypha socialis* (Roemer, 1841))

### *Coelocorypha bulbosa* n.sp.

(Pl. II, Figs. 4, 5)

*Holotypus*: Pl. II, Fig. 4 (Z. Pal. UŁ Sp. III/1197).
*Paratypus*: Pl. II, Fig. 5 (Z. Pal. UŁ Sp. III/1658).
*Stratum typicum*: Lower Campanian, marl.
*Locus typicus*: Skrajniwa, Poland.
*Derivatio nominis*: Lat. *bulbus* = a bulb; after a characteristic bulblike shape.

*Diagnosis.* — *Coelocorypha* characteristically bulbous in shape. Spongocoel narrow, tubelike, with osculum situated at the apex. Ostia not individualized. Exhalant system more strongly developed than inhalant one. Aporrhyses variable in width, tortuous and parallel to apex. Skeleton dense, consisting of small thorny rhizoclones.

*Material.* — Two complete specimens. Skeleton fairly strongly silicified. Section reveals rhizoclones.

Dimensions (in mm):

| | Length | Diameter | | Thickness | Stem | |
|---|---|---|---|---|---|---|
| | | at apex | of base | | Diameter | Height |
| Smaller specimen, UŁ Sp. III/1197 | 28 | 30 | ca. 10 | 20 | 10×18 | — |
| Larger specimen, UŁ Sp. III/1658 | 50 | 45 | 15 | 38 | 13 | 4 |

*Description.* — Characteristically bulbous, bilaterally flattened shape. One end of specimen makes up a short, thick stem, another is narrowed,

rounded and bent in a hookline maner. An oval osculum, 3—5 mm in diameter, to which radialy converge tortuous, anastomozing canals varying in length and width, is situated either in the centre of apex, or excentrically. Fine wrinkles, bent in an arcuate manner in relation to apical surface, are visible on both surfaces. Their occurrence is determined by the system of exhalant canals which mark the growth of sponge. The exhalant system is more strongly developed than the inhalant one. Spongocoel tubelike, narrow and not very deep. Some aporrhyses originate near the basal end of sponge; in the initial part, aporrhyses are 0.3 mm and, in the terminal part, near osculum, 0.75 mm in diameter. Inhalant system invisible. Ostia visible, probably they were not individualized. Oval, surface meshes of the skeletal network, which might play an inhalant role, are 0.1 mm in diameter.

Parenchymal skeleton dense, consisting of small, thorny rhizoclones. Within canals, primordia elongate and arcuate. Rhizoclones arranged in short strands, crossing each other and forming a latticework.

Cortical skeleton makes up a thin, dense, mineralized layer.

*Remarks.* — Water system in *C. bulbosa* n.sp. is similar to that in *C. subglobosa* Zittel, but the shape of sponge is different. According to Schrammen (1910—1912, p. 152), *C. subglobosa* Zittel may be sphaerical, pyriform or oviform and, according to Zittel (1878), this sponge may be single or compound.

A divergence of views may be observed in the descriptions of rhizoclones in *C. subglobosa*. According to Zittel (1878, p. 128), rhizoclones are small and irregularly ramified, whereas Schrammen (1924, p. 100) maintains that they are large, slightly ramified and more or less covered with nodes and thorns.

Polish specimens, much the same as those, figured by Zittel (*l.c.*, Pl. 4, Fig. 9), have rhizoclones small, fairly fine, without papillae but spiny. The character of spines, the fragments of which are now and then visible on primordia, is — in view of a poor preservation state — difficult to determine. Lagneau-Hérenger (1962, Text-pl. 29, Fig. 3) fairly accurately studied the rhizoclones of *C. catalonica* L.-H. which are similar in outline to those of *C. bulbosa* n.sp.

German specimens, studied by Zittel and Schrammen and assigned to *C. subglobosa*, have very fine and closely distributed ostia. In specimens of *C. bulbosa* n.sp., no separate inhalant pores are visible. Instead only the meshes of the cortical network may be observed.

Of two specimens, the larger one is attached to the apex of a sponge stipe of the group Megacladina. Probably, in its larval stage, *C. bulbosa* settled on the stipe and incrusted it only superficially, causing the inhibition of its growth.

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

## Genus *Bolidium* Zittel,1878 emend.

(Type species: *Amorphispongia palmata* (Roemer, 1864))

This is a representative of Rhizocladina, distinguished from all other genera of this group by its bushlike form. Ostia very small or even invisible at all. Parenchymal skeleton fibroidal. Rhizoclones medium in size, elongate and bent, sometimes fairly ramified. They are covered with spines and not nodes, as mentioned by Zittel (1878, p. 144) and Počta (1882, p. 10). Numerous oxeas stick in network meshes. Cortical skeleton dense, covering the entire surface and consisting of small, flattened and more rhizoidal elements.

In Poland, this genus is represented by *Bolidium arbustum* n.sp. from the Lower Campanian of Zbyczyce. In single skeletal elements and in the manner, in which they are arranged in strands, *Bolidium* resembles *Jereica* Zittel. In both cases, similarity is also displayed by the morphology of exhalant system. These common characters allow one to assign *Bolidium* and *Jereica* to the same family-Jereicidae Schrammen (1924). *Bolidium* is known from Cenomanian of Czechoslovakia. Roemer mentioned its occurrence in the sediments of Upper Turonian (Cuvieri-Pläner) and Schrammen (1910) — in the Lower Senonian of NW Germany. In Poland, it occurs abundantly in clayey marl of the Lower Campanian of Zbyczyce.

### *Bolidium arbustum* n.sp.

(Pl. X, Figs. 1—4; Text-fig. 11)

*Holotypus*: Pl. X, Fig. 4 *a*—*c* (Z. Pal. UŁ Sp. III/999).
*Paratypi:* Z. Pal. UŁ Sp. III/1547, 750 and 988.
*Stratum typicum*: Lower Campanian, clayey marl.
*Locus typicus*: Zbyczyce near Lelów, Poland.
*Derivatio nominis*: Lat. *arbustum* = bush; after a characteristic, bushlike shape.

*Diagnosis.* — A bushlike, irregularly ramified *Bolidium*. Ostia not outlined, prosopyles in the form of irregular polygons. Postica concentrated on apex of stipes. Rhizoclones strongly spiny, to 0.5 mm in length.

*Material.* — Numerous fragments of stipes and a prepared skeleton. Dimensions (in mm):

| | Length of stipes | Width of stipes |
|---|---|---|
| Specimen UŁ Sp. III/750 | to 50 | 10 |

*Description.* — Stipes cylindrical, straight or slightly bent, varying in length and uniform in thickness. Outer surface smooth, covered with densely arranged openings, surrounded with strands of rhizoclone. Se-

parate pores lacking. Subcortical pores irregular in outline, polygonal or oval, varying in diameter between 0.2 and 0.36 mm. Epirrhyses short and wide, perpendicular to the surface. Postica situated on apices of stipes. Network system indicates that the trace of aporrhyses is in conformity with the elongation of stipes but tortuous and anastomozing. Aporrhyses not very regular in outline, concentrically arranged.

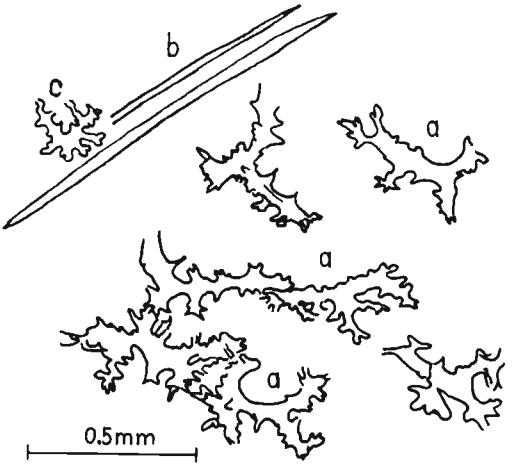


Fig. 11. — *Bolidium arbustum* n.sp.; *a* parenchymal rhizoclones, *b* amphioxeas, *c* rhizoidal, platelike elements from cortex; Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/999).

Cortical skeleton dependent. Actines of the surface network and spines of rhizoclones are arranged in the plane of the sponge surface. They are also directed towards inhalant canals and, consequently, the diameter of prosopyles and canals decreases. In some meshes of network, there occur loosely arranged, small and — rhizoidally — very deeply indentated elements. Over the entire length of branches, numerous thin oxeas, to 1.2 mm long and differently oriented, stick in meshes of the surface network.

Parenchymal skeleton loose, with short, formless meshes, encircling canals. Inside the network, meshes are surrounded by single rhizoclones which are turned — with the outer side of primordia and ends of actines — towards canals, whereas on the outer surface, around subcortical pores of desma, they form fine, short strands, mostly consisting of 2—3 rhizoclones. Single rhizoclones of the parenchymal network are strongly spiny and 0.5 mm long. They have short lateral actines which bifurcate and are sharply pointed.

*Variability.* — A bud 18 mm long, at the base 3 mm and at a pointed apex 1.5 mm thick, closely adheres to the surface of one of the branches. A swelling lobularly extending on one side of the branch has been formed in the parenchymal network in the place of attachment of this bud.

This swelling has ecresced two new buds one of which developed and the other remained in the form of a very thin "plate". At the base of the bud, rhizoclones are similar to those of the parent stipe, whereas in the upper completely separated part of the bud rhizoclones are finer, primordia thinner and less spiny. The largest rhizoclones in the bud are 0.3 mm long. Network meshes are smaller in the bud than those in the parent stipe. In the upper part, they are 0.15 mm in diameter.

*Remarks.* — Rhizoclones of *B. arbustum* n.sp. are similar to those of *Jereica polystoma* (Roemer, 1864) but considerably smaller. Similar is also their arrangement in strands. Likewise, common features are displayed by the morphology of the water system, in particular, its exhalant part.

Zittel (1878, p. 144) erected the genus *Bolidium* within which five species were distinguished, characterized by a branched shape. The new species differs from *B. palmata* (Roemer) in a smaller number of branches. In their shape and dimensions they resemble those of *B. capreoli* (Roemer) from Czechoslovakia from which they differ, however, in the lack of a regular dichotomous ramification. This difference is sufficient to consider the Polish form as a separate species.

*Occurrence.* — Poland: Zbyczyce, Lower Campanian, clayey marl.

Family **Chonellidae** Schrammen, 1924 emend. Lagneau-Hérenger, 1962

These are more or less euryproct sponges, with a different morphology of both surfaces, small pores being distributed over the upper and furrows over the lower surface. Parenchymal rhizoclones more or less spiny, connected with each other to form a coherent network.

Three genera: *Chonella* Zittel, 1878, *Coscinostoma* Schrammen, 1910—1912 and *Plinthodermatium* Schrammen, 1910—1912, thin-walled, cuplike forms, are assigned by Schrammen (1924) to this family. In 1924, this author erected a monotypic family Trachynoidae to which he assigned *Trachynotus auriculus*, a massive sponge with walls 8—12 mm thick. Lagneau-Hérenger (1962, p. 187) expresses a correct view that the thickness of walls is not a character of the taxons of a higher rank and, consequently, she assigns to the family Chonellidae also the genus *Leiochonia* Schrammen, 1901, with still thicker walls than those in *Trachynotus* Schrammen, 1924. Lagneau-Hérenger believes that it is more logical to group the sponges with a similar general shape within a common family, the more so if they do not display considerable differences in the structure of skeleton. Accordingly, she assigns the genus *Trachynotus* Schrammen to the family Chonellidae.

## Genus *Coscinostoma* Schrammen, 1910—1912
(Type species: *Pliobolia vermiculata* Pomel, 1872)

This genus was erected by Schrammen for thin-walled sponges funnel-, ear- or plate-shaped, having on upper surface a small, starlike group of exhalant canals and, on lower surface, fine, closely arranged pores and traces of tortuous, not very deep, small canals. Skeleton compact, consisting of small, straight or bent, less frequently ramified rhizoclones with short and thorny zygomes and primordium.

According to Lagneau-Hérenger (1962), rhizoclones in the genus *Coscinostoma* from Aptian of Catalonia are small, stocky and strongly indentated. This author does not share Schrammen's view, expressed in 1924, as regards the assignment of the species *C. fragilis* Schrammen, 1910 and *C. auricula* Schrammen, 1910 to two different genera..

As compared with *Trachynotus*, the Polish material, in fact not very numerous, also displays a considerable difference in size of rhizoclones, their appearance and thickness of walls. Species of the genus *Coscinostoma* Schrammen are rather delicate sponges, whereas *Trachynotus* Schrammen includes more massive and larger forms.

*Coscinostoma* is known from Albian of Catalonia and Senonian (Santonian) of France, Upper Senonian of Germany and Lower Campanian of Poland. Sponges with a similar structure from Miocene of Algeria were assigned by Pomel (1872, p. 15) to the genus *Pliobolia* (Pomel, 1872). Despite the priority of the name *Pliobolia*, I uphold the generic designation *Coscinostoma* and consider the original name to be *nomen oblitum*.

### *Coscinostoma fragilis* Schrammen, 1910—1912
(Pl. XIII, Figs. 1, 2)

1910—12. *Coscinostoma fragilis* Schrammen; A. Schrammen, Die Kieselspongien..., p. 162, Pl. 21, Fig. 7.
1924. *C. fragilis* Schrammen; A. Schrammen, *Ibid.*, III, p. 129, Pl. 3 Fig. 8.
1925. *C. fragilis* Schrammen; L. Moret, Contribution..., p. 97, Pl. 20, Fig. 2, Text-Pl. 28 d.
1962. *C. fragilis* Schrammen; L. Lagneau-Hérenger, Contribution..., p. 190, Text-Pl. 30—3.

*Material.* — A single, complete specimen and six flat, silicified fragments with a well-preserved morphology of surface. Skeleton and water canals poorly preserved.

Dimensions (in mm):

| | Height | Diameter of the funnel opening | Thickness of wall | Diameter of stem |
|---|---|---|---|---|
| Specimen UŁ Sp. III/405 | 26 | 25×15 | 4 | 8 |

*Description.* — Sponge funnel-shaped, sometimes more or less flattened. Walls 4—7 mm thick. On the upper surface, exhalant pores form concentrations oval in outline and are surrounded by short groovelike canals, radially disposed. Single exhalant pores are 0.2 mm in diameter. Surface canals are tortuous, varying in length and width, slightly tapering at ends. Apopyles open on their bottom. A radial arrangement of postica is observed over the entire upper surface and, partly, near the margin of lower surface. Inhalant pores fine, 0.15—0.2 mm in diameter, densely distributed, at 0.12 mm intervals, over a smooth lower surface and surrounded by cortical network.

*Remarks.* — Both the fragments and the complete specimen, assigned to *C. fragilis*, display generic and specific characters corresponding to those of Schrammen's specimens. Traces of primordia, here and there preserved on the surface, resemble in their outline rhizoclones, figured by Schrammen (1924, III, Fig. 8). The specimens examined differ from *C. fragilis* from France in a considerably smaller number of postica in particular groups (15—20 as opposed to a few). Specimens of *C. fragilis* from Albian of Catalonia, similar in thickness of wall (4 mm), differ from the Polish ones in: a) occurrence of single, radial exhalant pores instead of radial groups and b) microscopic size of inhalant pores.

According to Lagneau-Hérenger, single rhizoclones of Albian specimens seem to be smaller and stockier than those of Senonian forms.

*Occurrence.* — Poland: Skrajniwa, Zbyczyce, Upper Campanian, marly facies. NW Germany: Upper Campanian ("Mucronaten-Kreide"). France: environs of Saint-Cyr, Santonian. Spain: Catalonia, Albian.

## Genus *Trachynotus* Schrammen, 1924

(Type species: *Coscinostoma auricula* Schrammen, 1912)

A general appearance of sponges of the genus *Trachynotus* strongly resembles that of the representatives of *Coscinostoma* Schrammen. This similarity is observed in the shape and stellate form of postica. A fundamental difference between these genera consists in a different character and type of rhizoclones, different thickness of walls and the presence of papillary humps on the internal surface of the funnel.

In *Trachynotus auriculus* rhizoclones are large, more strongly ramified and not very spiny, exhalant pores papillary, stellate and walls thick, whereas in *C. fragilis* rhizoclones are small and rather straight, exhalant pores stellate but flatly arranged.

A general similarity of *Coscinostoma* and *Trachynotus* justifies the assignment of these genera to the same family, Chonellidae. The genus *Trachynotus* has so far been known only from the Upper Cretaceous ("Mucronaten-Kreide") of NW Germany and Campanian of Poland.

*Trachynotus auriculus* (Schrammen, 1910)
(Pl. XI, Figs. 1 *a*—*b*)

1910—12. *Coscinostoma auricula* Schrammen; A. Schrammen, Die Kieselspongien..., p. 163, Pl. 21, Fig. 8.

1924. *Trachynotus auriculus* Schrammen; A. Schrammen, *Ibid.*, p. 113, Pl. 2, Figs. 2, 3.

*Material.* — A single specimen without both poles; isolated rhizoclones very well-preserved.

Dimensions (in mm):

| | Height | Diameter of stem | Thickness of wall |
|---|---|---|---|
| Specimen UŁ Sp. III/110 (fragment) . . . . . | more than 60 | 20 | more than 13 |

*Description.* — Sponge large, funnel-shaped, terminating in a massive stem, with thick walls which externally are somewhat longitudinally wavy. Folds are more strongly marked in the upper than in the lower part. Around the stem, near the base of funnel, there are visible slight swellings which mark a gradual growth of individual. Inhalant pores small. About 10 not very large elevations, surrounded by radially disposed grooves, are preserved on the inner surface of funnel. The transversal and sagittal sections through the walls reveal exhalant canals oval in outline and 0.6—0.75 mm in diameter. Water canals short and tortuous, wider than meshes of network, irregularly distributed in the axial part and sometimes closely adhering to each other in the marginal zone. Spongocoel funnellike, euryproct.

Skeletal network dense, consisting of rhizoclones, varying in length, now and then reaching 0.6 mm. No fibroidal assemblages are visible in the system of rhizoclones. As regards their size and manner of ramification, rhizoclones are fairly different; their clones are not very long, sometimes of equal length, fairly numerous and terminating in a ramified zygome; primordia elongate, slightly spiny, with almost completely smooth surface, varying in length. Among these desma, there occur smooth rhizoidal elements almost completely devoid of ornamentation and roughly resembling megarhizoclones.

*Remarks.* — The specimen from Poland has thicker and less flattened walls than that from Hannover. It has not cortical rhizoclones, mentioned by Schrammen.

*Occurrence.* — Poland: Miechów, Campanian, marl. NW Germany: Misburg, marl of "Mucronaten-Kreide".

## Genus *Leiochonia* Schrammen, 1901

(Type species: *Leiochonia cryptoporosa* Schrammen, 1901)

### *Leiochonia cryptoporosa* Schrammen, 1901

(Pl. XI, Fig. 2)

1901. *Leiochonia cryptoporosa* Schrammen; A. Schrammen, Neue Kieselschwämme..., p. 16, Pl. 5, Fig. 6.
1910—12. *L. cryptoporosa* Schrammen: A. Schrammen, Die Kieselspongien..., p. 160, Pl. 21, Figs. 4—5.
1924. *L. cryptoporosa* Schrammen; A. Schrammen, *Ibid...*, p. 108, Pl. 3, Fig. 10.
?1925. *L. cryptoporosa* Schrammen; L. Moret, Contribution..., p. 94, Pl. 19, Fig. 10; Text-fig. 29.
?1933. *L.* aff. *cryptoporosa* Schrammen; F. Bieda, Gąbki..., p. 11.

*Material.* — A specimen without the upper marginal part. Prepared rhizoclones and fragments of network very well-preserved. One microscopic section.

Dimensions (in mm):

| | Height | Diameter of upper part | Thickness of wall |
|---|---|---|---|
| Specimen UŁ Sp. III/44 | more than 40 | 35 | 5—6 |

*Description.* — Euryproct sponge with lower pole conical, obtusely terminating, without stem. Lateral walls smooth; pores not marked. Spongocoel funnellike. Water canals irregular and slightly outlined, except for some places where oval cross sections of tubelike canals 0.15 mm in diameter may be observed.

Skeletal network very dense, consisting of fine, thin rhizoclones varying in size to 0.3 mm, and fairly ramified. Primordia mostly tortuous, almost completely smooth, except for small spines occurring on the outer part. Lateral stipes terminating in a spiny zygome, in some cases elongate, only slightly hooking each other so that, during chemical preparation, rhizoclones may be completely isolated. Between network meshes, rhizoclones are irregularly crowded.

*Remarks.* — On the basis of its rhizoclones very similar to those, described and figured by Schrammen (1924, p. 108), I assign the specimen under study to *Leiochonia cryptoporosa* Schrammen. The lack of growth wrinkles and of any visible pores in our specimen is probably the result of considerably smaller dimensions. *L. cryptoporosa* from the "Mucronaten-Kreide" of Hannover represented the type of giant sponges, reaching 150 mm in length and, in the upper plate-shaped part, 1 500 mm in diameter. According to Schrammen, in *L. cryptoporosa*, the surface covered with cortex gave the impression of being smooth, although actually it was covered with fine pores. Ostia and postica were about 1 mm in size. All specimens of *L. cryptoporosa*, described by Bieda, Moret

and Schrammen, are characterized by a truncate upper margin forming an almost right angle with a sharply protruding edge. The trace of these edges remained in the form of concentric swellings, marking a gradual growth of an individual.

Specimens from France, described by Moret (1925, p. 94), despite a considerable similarity in the body shape, marginal edge and width of pores to those of *L. cryptoporosa* from NW Germany, display (as is clear from figures and descriptions) great differences in the structure of rhizoclones. According to Moret, in *L. cryptoporosa* rhizoclones are large (*l.c.*, 1925, p. 95), whereas Schrammen maintains that the genus *Leiochonia* has small rhizoclones and, frequently, bent primordium. The sponges studied and described by Moret as *Leiochonia cryptoporosa*, as well as Bieda's specimens similar to them and coming from the environs of Cracow, seem to belong to a different genus. In analyzing skeletons of *L. cryptoporosa*, varying in size, Schrammen found that rhizoclones of both large and small individuals were identical in size and shape.

*Occurrence.* — Poland: Przesławice, Maastrichtian. Germany: Misburg, Adenstedt, Oberg, Biewende and Sudmerberg, "Quadraten-Kreide" and "Mucronaten-Kreide".

## Family **Scytaliidae** Laubenfels, 1955 emend. Lagneau-Hérenger, 1962

This family includes more or less cylindrical sponges with a deep, tubelike spongocoel and strongly developed canal system. Rhizoclones, linked together in a compact but not fibrous skeleton. Numerous inhalant pores situated on the lateral surface of walls are connected with canals. Apopyles are disposed on the surface of spongocoel. I assign to this family the genera *Scytalia* Zittel and *Stachyspongia* Zittel, both occurring in the Upper Campanian of Poland. Schrammen (1924) assigns them to two different families. Lagneau-Hérenger (1962) partly revised the families erected by Schrammen within Rhizocladina and, in view of the similarity in the morphology of water system and a general structure of skeletal network, assigned both genera referred to above to Scytaliidae.

### Genus *Scytalia* Zittel, 1878

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

Cylindrical Rhizocladina, more or less slender, with truncate or rounded apex. Spongocoel tubelike, narrow, deep and extending as far as stem. Osculum oval, situated on the apex. Lateral walls fairly thick, covered with inhalant pores arranged in verticils. Exhalant canals fairly long and tubelike, obliquely disposed. Skeleton compact, consisting of fairly small, slightly thorny and slightly ramified rhizoclones.

Sponges, described by Schrammen (1910) and grouped in the genus *Scytalia* were, in 1924, once more studied by this author who distinguished then three new genera: *Scytalia* with the type species *S. turbinata* (Roemer), *Aulosoma* for which he accepted the *S. radiciformis* (Phillips) as a type species, and *Pseudoscytalia* with the type species *S. terebrata* (Phillips). Since specific characters are considered by Schrammen to be generic one, the assignment of these genera to separate families, as it has been done by this author, is in no case justified.

Schrammen (1924) assigns the genus *Scytalia* to the family Leiochonidae in which he includes sponges with a quite different structure of water system and different general form but similar in size of rhizoclones.

In the present work, I based my analysis of sponges, attributed to the genus *Scytalia*, on Zittel's (1878) definition and shared Moret's (1925) and Lagneau-Hérenger's (1962) view that the dimensions of rhizoclone elements, variability of shape of sponges and variable arrangement of the canal openings are specific and not generic characters.

The genus *Scytalia* Zittel is, as to the number of specimens, abundantly represented in the Campanian of Poland, NW Germany, France and England. It occurs in Aptian of Catalonia where it is represented by the following three species, distinguished by Lagneau-Hérenger: *S. turbinata, S. radiciformis* and *S. excavata.*

## *Scytalia turbinata* (Roemer, 1864)

(Pl. XI, Figs. 3, 4)

1962. *Scytalia turbinata* (Roemer); L. Lagneau-Hérenger, Contribution..., p. 191, Pl. 30—5 (*here earlier synonymy*).

*Material.* — Twenty one almost complete, fairly strongly silicified specimens. General morphology and structure of water system clearly visible. Rhizoclones preserved in some canals.

Dimensions (in mm):

| | Height | Maximum thickness of | | Diameter of | | Depth of spongocoel |
|---|---|---|---|---|---|---|
| | | sponge | wall | apex | osculum | |
| Smallest specimen, UŁ Sp. III/547 . . . . . | 40 | 50 | — | 55×40 | 11×6 | — |
| Middle-sized specimen UŁ Sp. III/543 . . . . | 60 | 55 | — | 60×42 | 10×6 | 53 |
| Largest specimen, UŁ Sp. III/724 . . . . . | 100 | 55 | 15—20 | 55×45 | 13 | 75 |

*Description.* — Morphology of sponge, in particular of its apex, is determined by the structure of water system and the development stage of an individual. Sponge macelike in shape, with a distinct margin of apical plane. Apex hemispherical or oval in outline, asymmetrically bent or flat, more or less obliquely disposed with radius equalling the length of exhalant canals. Surface of apical plane is smooth or covered with tortuous, anastomozing grooves. Transverse swellings which are traces of apical margins, succeeding each other, are marked on lateral walls. They mark growth stages of the sponge and give walls a specific crenate appearance. Lower pole terminates in a stem 8 mm in diameter. From the basal part, sponge gradually extends, thickness of walls increases and, consequently, length of aporrhyses increases, too. Spongocoel centrally situated, in the upper part of sponge tubelike, slightly extended and reaching almost as deep as stem. Numerous, tubelike aporrhyses, uniform in width (0.75—1.5 mm), with an inclination angle varying in different specimens, run from the bottom, upwards over the entire thickness of walls. Inclination angle of aporrhyses decreases with the growth of sponge from the bottom upwards. The shape of apical plane depends on this angle of inclination of aporrhyses and on their length. Prosopyles arranged fairly regularly, close to each other and in a verticillate manner. Verticils are arranged at 1.5—2 mm intervals. Epirrhyses short, 0.6 mm in width, 0.2—0.5 mm distant from each other. Apopyles oval, arranged, on the surface of spongocoel, in vertical rows and with a diameter equal to that of aporrhyses.

Skeleton silicified to a considerable extent. Single rhizoclones, visible in canals, are elongate and covered with loose spines; their primordia are swollen. There is no separate cortical network. Flattened rhizoclones form, on the surface of sponge, a dense dermal layer whose structure is indistinct.

*Variability.* — In the material under study, differences observed in the thickness of walls, height and degree of flattening of apex are manifestation of individual variability, whereas a different shape of poles probably distinguish particular ecological types. Some specimens have a tapering lower pole, in some others — stem is sharply separated by a contraction from the rest of sponge which makes the lower part of it similar to a funnel. Upper pole also is not uniform. In specimens whose canals run almost horizontally (UŁ Sp. III/347) apex is flattened, whereas in others (UŁ Sp. III/724, 547), with an oblique trace of canals running over the entire height of sponge, apex is more or less conically convex. As compared with the thickness of walls (max. 30 mm), the diameter of spongocoel is small. In all specimens the outline of osculum is similar to that of the apical surface.

*Remarks.* — As compared with *S. radiciformis*, *S. turbinata* displays differences which result from a different manner of growth. In *S. radi-*

*ciformis*, the sponge grew faster heightwise and in *S. turbinata* — widthwise. Hence the individuals of the last-named species are shorter and thicker than those of *A. radiciformis*.

As compared with *S. turbinata* from NW Germany, Polish specimens do not display any major differences, except for not having distinct inhalant pores. *S. turbinata* from the Aptian sediments of Catalonia differs from Senonian forms in a more asymmetric body shape and the presence, in the basal part, of conical knobs similar to those of the genus *Stachyspongia* Zittel, also assigned to Scytaliidae.

*Occurrence.* — Poland: Skrajniwa, Lower Campanian. Germany: Senonian. France: Saint-Cyr and Senonian at Menton. England: environs of Flamborough, Upper Chalk. Czechoslovakia: Cenomanian and Turonian. Spain: Catalonia, Aptian.

### *Scytalia radiciformis* (Phillips, 1835)
(Pl. XII, Figs. 1—3; Text-fig. 12)

1962. *Scytalia radiciformis* (Phillips); L. Lagneau-Hérenger, Contribution..., p. 192, Text-Pl. 30—6 (*here earlier synonymy*).

*Material.* — About 150 silicified or calcitized specimens. External morphology and structure of water system clearly visible. Megascleres accessible to study only in microscopic sections and on etched surfaces.

Dimensions (in mm):

| | Height | Thickness | Diameter of | |
|---|---|---|---|---|
| | | | apex | stem |
| Smallest specimen, UŁ Sp. III/964 . . . . . | 40 | 20 | 28 | 12 |
| Middle-sized specimen, UŁ Sp. III/1305 b . . . | 80 | 23 | 12 | 8 |
| Largest specimen, UŁ Sp. III/1305a . . . . . | 110 | 30 | 20 | 10 |

*Description.* — Sponge shaped like an elongate cylinder with variable number of irregular contractions and swelling of walls. In most specimens, upper role rounded and conically raised around osculum. Lower pole terminating in a stem. A variable number of knobs occur on the surface of some specimens. Inhalant pores are densely distributed over the entire surface, in the lower part — at random and in the upper, as well as around osculum — grouped in vertical, almost straight rows. Sometimes, short, tortuous canals diverge from these pores and cause the surface to look as if scratched. A tubelike spongocoel runs throughout the sponge as far as stem and resembles in shape the external form of the sponge. In some specimens, contractions of spongocoel correspond

to those of the sponge. Osculum oval, 4—12 mm in diameter and equalling the width of spongocoel. Ostia 0.3—0.45 mm in diameter. Inhalant canals short, radially arranged near outer surface, equalling in diameter inhalant pores. Exhalant canals longer, running obliquely from the bottom upwards and around spongocoel. Apopyles, 0.6 mm in diameter,

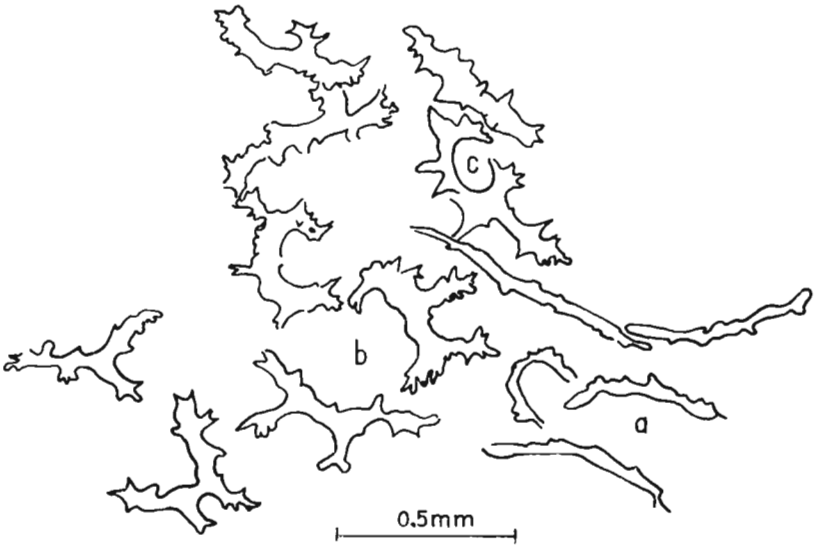


Fig. 12. — *Scytalia radiciformis* (Phillips); *a* cortical rhizoclones modified around knobs on outer surface, *b* parenchymal rhizoclones, *c* megarhizoclones; Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1064).

arranged in a regularly concentric manner at 1.2 mm intervals from each other; in the lower part of spongocoel they are round and in upper — slightly elongate. Aporrhyses, 0.75 mm in basal part and in stem, form a bundle.

Near the surface, skeleton has ramified, spiny rhizoclones with a variable number of actines. Their primordia, 0.2—0.3 mm long, are straight or resemble tetraclones. On the outer side of rhizoclones, spines are shorter than those in zygomes. Network, with irregular arrangement of rhizoclones, is close, with two types of oval canal meshes, narrower and wider ones. Amphioxeas, 0.18—0.2 mm long, stick in smaller meshes. On the outer surface of specimens having small knobs, network consists of less spiny rhizoclones. Around knobs, rhizoclones are elongate and between them, as well as in the inner part of network — ramified. Rhizoclones of the surface are finer and thinner. Numerous microxeas, 0.015 mm long and scattered sterrasters are observed. On the surface of some specimens, there occur very numerous amphioxeas 0.6—2.5 mm long which belong to pleuralia; fragments of massive megascleres transversally broken occur sometimes among them and also stick in the meshes of cortical network. In one specimen, large amphioxeas 2.5 mm

long and 0.012 mm thick, obliquely arranged among pleuralia, are situated on the surface. Occasional protriaenes, whose appurtenance is difficult to conclude on the basis of their arrangement, occur sometimes among them.

*Variability.* — Specimens of *S. radiciformis* from Poland are fairly variable. They differ from each other in height and thickness, morphology of apex, width of osculum and spongocoel, as well as in the number and width of annular contractions. In most normally developed specimens, apex is rounded and has a conically raised osculum. There are also specimens with a tapering, considerably elongate and arcuate apex and with a laterally situated osculum (specimens UŁ Sp. III/340, 954, 307). As regards the size of specimens from Poland, it has been found that, despite variable shapes, no major differences were observed. The ratio of thickness to height is not constant and mostly amounts to 2.3 : 1 or 3.8 : 1.

Specimens of *S. radiciformis* occurred by ones or formed not very large assemblages. Single individuals have their basal parts extended in a bowl-like manner, with small nodular processes occurring on the margins (UŁ Sp. III/1302). In groups, they are connected with each other within the stem (UŁ Sp. III/1351, 513).

Table 3

Comparison of characteristic features of *Scytalia radiciformis* from West-European countries

| Country and age | Height | Thickness | Length of rhizoclones | Diameter of osculum |
|---|---|---|---|---|
| Poland, Lower Campanian | 40—110 | 20—30 | 0.2—0.3 | varying from 2 to 10 |
| England, Upper Chalk | 65—215 | 22—38 | — | 8 |
| France, Senonian | 80—100 | — | — | 10 |
| Spain, Aptian | 80 | 20 | stocky | narrow |

*Occurrence.* — *S. radiciformis* known from Aptian to Campanian. Its specimens numerously occur in Poland and Germany. Poland: Pniaki, Zbyczyce and Skrajniwa, Lower Campanian. England: Flamborough, Upper Chalk. NW Germany: Misburg, Oberg, Adenstedt and Biewende, "Quadraten-Kreide" and "Mucronaten-Kreide". France: Saumur, Nice, Saint-Cyr and Basses Alpes, Senonian. Spain: Can Casanyas Castellet and Mas de Artis, Aptian.

## *Scytalia terebrata* (Phillips, 1829)

(Pl. XII, Fig. 4; Text-fig. 13)

1924. *Pseudoscytalia terebrata* Schrammen; A. Schrammen, Die Kieselspongien..., p. 110, Pl. 3, Fig. 11.

1925. *Scytalia terebrata* (Phillips); L. Moret, Contribution..., p. 98, Pl. 18, Fig. 7 & Fig. 30 *(here earlier synonymy)*.

*Material.* — Five silicified specimens with a preserved external morphology; skeleton preserved only on the surface.

Dimensions (in mm):

| | Height | Thickness | Length of stem | Diameter of stem |
|---|---|---|---|---|
| Larger specimen, UŁ Sp. III/1138 . . . . . | 85 | 40 | 10 | more than 30 |
| Smaller specimen, UŁ Sp. III/5 . . . . . | 50 | 30 | 10 | more than 30 |

*Description.* — Single sponges on a fairly high stem distinctly delimited. Upper part oval, 55×30 mm in transverse section. Upper pole rounded and slightly narrowed. Osculum, 8 mm in diameter centrally situated. Lower pole terminating in a conical stem, sometimes separated

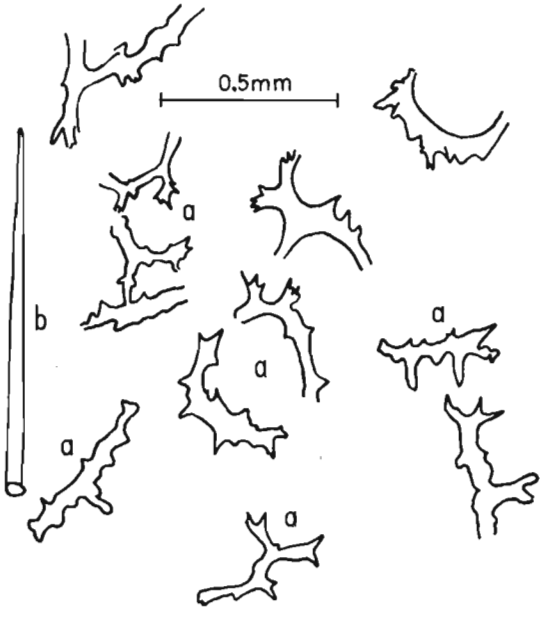


Fig. 13. — *Scytalia terebrata* (Phillips); *a* rhizoclones on outer surface, *b* amphioxeas (fragment); Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/1190).

by an abrupt contraction. Lateral walls with very mild, irregular, transverse swellings. Inhalant pores, 0.25—0.35 mm in diameter, irregularly distributed, here and there, in upper part, forming rows. Subcortical inhalant canals numerous, anastomozing, short and tortuous, 0.3—0.45 mm in diameter. Spongocoel with a morphology characteristic of the genus *Scytalia*. Rhizoclones, visible on the surface, are formlessly rami-

fied, with actines varying in length and sometimes corroded. Parenchymal network dense, with rhizoclones ramified in the form of a tetraclon. Amphioxeas about 1.0 mm long are preserved in this network.

*Remarks.* — The species under study differs from *S. radiciformis* in a shortly cylindrical shape, and slightly different morphology of rhizoclones. Parenchymal spicules in *S. terebrata* are finer and smaller than those in other species of this genus, known from the territory of Poland. *S. terebrata* is to the greatest extent similar to *S. turbinata,* from which it differs in a lack of growth swellings, in its irregularly distributed pores and its system of canals.

In the examined specimens of *S. terebrata,* skeletal network is silicified and difficult to study. Single rhizoclones on the surface display a similarity to those, described by Schrammen in *Pseudoscytalia terebrata* and to the rhizoclones of *S. turbinata,* figured by Lagneau-Hérenger (1962, p. 188, Text-pl. 30—5).

*Occurrence.* — Poland: Skrajniwa and Zbyczyce, Lower Campanian. NW Germany: Misburg, "Mucronaten-Kreide". France: environs of Nice, Senonian.

*Scytalia* sp.
(Pl. III, Fig. 4)

*Material.* — Four silicified specimens with indistinct skeletons. Dimensions (in mm):

| | Height | Maximum diameter | Diameter of stem |
|---|---|---|---|
| Specimen UŁ Sp. III/329 . . . . . | 50 | 25 | 5 |

*Description.* — Single sponge shaped like a short mace with a thin stem. Width to height ratio 2 : 1. Upper pole conical. Lateral surface displays a contraction and insignificantly conical knobs scattered at random. Exhalant system identical with those in all species of *Scytalia.* Osculum 7 mm in diameter.

*Remarks.* — The specimens under study are to the greatest extent similar to *S. radiciformis* (Phillips), from which they differ in a considerably smaller height, smaller degree of slimness and one contraction only. An accurate determination is made difficult by a poor preservation state.

*Occurrence.* — Poland: Skrajniwa, Lower Campanian.

## Genus *Stachyspongia* Zittel, 1878

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

Fairly massive, cylindrical sponges with nodular elevations on lateral walls. Spongocoel tubelike, deep. Water canals distinct. Rhizoclones fairly large (according to Lagneau-Hérenger, stocky), varying in length, ramified and mostly irregular. Their primordia with conical spines, distributed irregularly or in a verticillate manner. This species, represented by *S. tuberculosa* (Roemer), *S. ramosa* Quenstedt and *S. spica* (Roemer), occurs in sediments from Aptian to Miocene. Its presence has been stated in Senonian of Hannover and France, in Gray Chalk and Upper Chalk of Southern England, in Miocene of Australia, and in the Aptian deposits of Catalonia. In Poland, only two specimens of *S. tuberculosa* (Roemer) have been found in Campanian marls at Miechów.

### *Stachyspongia tuberculosa* (Roemer, 1864)

(Pl. XII, Fig. 5; Pl. XIII, Fig. 3)

1925. *Stachyspongia tuberculosa* Zittel; L. Moret, Contribution..., p. 100, Figs. 32, 33 (*here earlier synonymy*).

*Material.* — Two almost complete, fairly strongly limonitized specimens with an original shape preserved. Single rhizoclones have been etched out.

Dimensions (in mm):

| | Height | Maximum thickness | Thickness in contraction | Diameter of apex |
|---|---|---|---|---|
| Specimen UŁ Sp. III/104 | 110 | 80 | 43 | 45 |

*Description.* — Sponge in the form of an irregular cylinder, deformed by contractions and knobs, varying in shape and size. Upper pole flat with a centrally situated, wide osculum 15 mm in diameter, encircled by a rounded rim. Wall thickness variable, determined by the presence or absence of knobs. Spongocoel more or less uniform in width, amounting to 15—20 mm, tubelike, running throughout the sponge. Inhalant pores, visible here and there, are oval, fairly fine, ca. 0.3 mm in diameter and irregularly distributed. Rhizoclones of the parenchymal skeleton mostly ramified, here and there fairly regular, with three actines resembling tetraclones. Most of them are, however, irregularly ramified, with a variable length reaching 0.3 mm. Primordia, less than 0.03 mm thick, are covered with conical spines, in some cases distributed in a verticillate manner. Zygomes and lateral actines are more spiny than primordia. Outer surface after being etched, reveals traces of skeletal network which, judging from rhizoclone cavities, was dense.

*Remarks.* — Specimens of *S. tuberculosa* from Poland, the same as French ones, have a smooth surface devoid of fissurelike canals on tops

of knobs such as those observed in Roemer's (1864, Pl. 11, Fig. 4) and Schrammen's (1910, p. 149) specimens. The rhizoclones etched out (UŁ Sp. III/10, 105) are similar to those of *S. tuberculosa,* figured by Moret (1925, Fig. 32, p. 98). French specimens are, however, slimmer than Polish ones. Their height amounts to 110 mm and thickness — to 35—40 mm. They have a narrow spongocoel 4 mm in diameter and their knobs form, after Moret, in the upper part, "un véritable verticille de prolongements conoïdes". According to Zittel, species of *Stachyspongia* are very thick-walled, with fairly large conical knobs and have the skeleton and water system identical with those in *Scytalia.*

Specimens, originally determined as *S. tuberculosa* are assigned by Schrammen, in part III of his monograph (1924, p. 106), to *Aulosoma radiciformis.* He considers *Scytalia radiciformis* to be a synonym of the last-named species. He also maintains that rhizoclones of *Stachyspongia* are fairly strongly ramified and similar to those of *Scytalia radiciformis.*

The rhizoclones, etched out of Polish specimens and assigned to *Scytalia radiciformis* and *Stachyspongia tuberculosa* differ from each other. In *S. radiciformis* Schrammen (Schrammen's Text-pl. 10), they are smaller (0.2—0.3 mm long), less ramified and their primordia seem to be thicker and, on the outside, mostly covered with spines, whereas in *S. tuberculosa* — both in my and Moret's (1925) specimens — rhizoclones are larger and more ramified. Their primordia are 0.36 mm long in Polish and about 0.5 mm long in Moret's specimens, as results from calculations, shown in the latter author's illustration.

The difference in the thickness of walls, presence of fairly large, irregular knobs occurring on the surface and a different structure of rhizoclones justify the assignment of the sponges under study to the genus *Stachyspongia* Zittel and not to *Aulosoma* Schrammen as it has been done by Schrammen.

*Occurrence.* — Poland: Miechów, Lower Campanian. France: Saumur and Nice, Senonian; Saint-André des Alpes, Saint-Cyr, Santonian.

Order **Triaxonia** Schulze, 1887 (= **Hexactinellida** Schmidt, 1872)
Suborder **Dictyonina** Zittel, 1877
Superfamily **Hexactinosa** Schrammen, 1903
Family **Craticulariidae** Rauff, 1893 emend. Schrammen, 1937
Genus *Craticularia* Zittel, 1878 emend. Schrammen, 1937
(Type species: *Craticularia parallela* (Goldfuss, 1833))
*Craticularia virgatula* Schrammen, 1912
(Pl. XIV, Fig. 3)

1910—12. *Craticularia virgatula* Schrammen; A. Schrammen, Die Kieselspongien..., p. 234, Pl. 30, Fig. 1; Pl. 43; Fig. 3; Text-Pl. 11, Fig. 9.
1962. *Craticularia virgatula* Schrammen; L. Lagneau-Hérenger, Contribution..., p. 49, Pl. 2, Figs. 3, 8; Text-Pl. 7. Fig. 5.

*Material.* — Fragmentary specimens; one calcified but with a well-preserved morphology of wall and two strongly limonitized.

Dimensions (in mm):

| | Height | Thickness of wall |
|---|---|---|
| Specimen UŁ Sp. III/23/96 . . . | 90 | 5 |

*Description.* — *Craticularia* funnellike in shape. Outer surface regularly latticed. Inhalant and exhalant pores oval, of much the same dimensions, 0.5—0.75 mm in diameter, oriented with their longer axis parallel to the height of sponge and arranged in regular longitudinal and transverse orthogonal rows, which are spaced at about 0.4—0.5 mm intervals. Fifty pores are distributed over an area of 100 sq mm. Water canals and skeleton not preserved.

*Remarks.* — Specimens of *C. virgatula* here described have narrower pores than those in Aptian specimens from France (Lagneau-Hérenger, 1962) whose diameters usually amount to 1.0 mm, whereas in our specimens they are wider than in German ones (Schrammen, 1910—1912) which are 0.3—0.5 mm in diameter. In its general outline, *C. virgatula* is similar to *C. roemeri* Schrammen, *C. relicta* Schrammen and *C. tenuis* Moret, but differs from *C. roemeri* and *C. relicta* in a considerably smaller thickness of walls, smaller diameter of pores and larger number of pores per 100 sq mm (50 vs. 16). It is to the greatest extent similar to *C. tenuis* from which it differs in a less distinct arrangement of pores in horizontal rows and in thicker walls.

*Occurrence.* — Poland: Miechów, Campanian, clayey marl; Kazimierz, Upper Maastrichtian, "opoka". Germany: Oberg, Lower ("Quadraten-Kreide") Campanian. France: Andon, Escragnolles, Gourdon, Albian. Spain: Can Casanyas Castellet, Aptian.

## Genus *Paracraticularia* Schrammen, 1937

(Type species: *Paracraticularia procumbens* (Goldfuss, 1833))

### *Paracraticularia fittoni* (Mantell, 1822)

(Pl. XIV, Fig. 4)

1822. *Millepora Fittoni* Mantell; G. A. Mantell, Geology of Sussex..., p. 106, Pl. 15, Fig. 10.
1864. *Dendrospongia fenestralis* Roemer; F. A. Roemer, Spongitarien..., p. 21, Pl. 8, Fig. 6.
1883. *Craticularia Fittoni* (Mantell); J. G. Hinde, Catalogue..., p. 94, Pl. 23, Fig. 2 a—b.
1925. *C. Fittoni* (Mantell); L. Moret, Contribution..., p. 214.
1962. *Paracraticularia fittoni* (Mantell); L. Lagneau-Hérenger, Contribution..., p. 53.
1963. *P. fittoni* (Mantell); W. Wagner, Schwammfauna..., p. 209, Pl. 28, Fig. 7.

*Material.* — A fragment of a branch with a prepared skeletal network and a dichotomously ramified specimen with strongly limonitized surface.

Dimensions (in mm):

| | Length of stipe | Width of stipe |
|---|---|---|
| Specimen UŁ Sp. III/77 . . . . . | 40 | 30×15 |

*Description.* — Cylindrical branch, 40 mm long and about 30×15 mm in cross section, with 3—4 mm thick walls. Outer surface latticed. Ostia oval, 0.6—0.75 mm in diameter. Postica not preserved. Parenchymal skeleton dictyonal, smooth and forming a fairly regular network with subsquare meshes; beams of about 0.3 mm long and 0.03 mm thick. Actines forming beams give the network the appearance of a strand of the euretoidal type and with separated oval apertures which are equal in diameter to ostia.

*Remarks.* — In addition to the genus *Craticularia* Zittel, Schrammen (1937, p. 28) separated bushlike-branched forms and erected for them a new genus, *Paracraticularia.* According to Reid (1962), this is only a subgenus of the genus *Craticularia* Zittel. This view does not seem to be completely correct since, in addition to the type of skeleton and the presence of small stauractines in cortex, it is also a bushlike shape that indicates the separateness of this genus.

The examined specimen of *P. fittoni* differs from the forms described from France and England in a smaller diameter of branches and smaller width of ostia (0.60—0.75 mm as compared with 1.0—1.5 mm). It has also slightly larger hexactines than those in the specimens, studied by Hinde (1883) in which the thickness of radii amounts to 0.05 and length — to 0.25 mm.

*Occurrence.* — This species is known from Valanginian to Maastrichtian. Poland: Bochotnica and Kazimierz, Upper Maastrichtian. Germany: Cenomanian. France: Valanginian, Cenomanian, Turonian; Pyrenees, Coniacian and Campanian. England: Cenomanian and Senonian. .

## Genus *Leptophragma* Zittel, 1877

(Type species: *Scyphia murchisoni* Goldfuss, 1826)

### *Leptophragma murchisoni* (Goldfuss, 1826)

(Pl. XIV, Figs. 1 *a—b*)

1826. *Scyphia Munchissonii* Goldfuss; A. Goldfuss, Petrefacta..., p. 219, Pl. 65, Fig. 8.
1841. *Scyphia Murchisoni* (Goldfuss); F. A. Roemer, Die Versteinerungen..., p. 9.
1864. *Cribrospongia Murchisoni* (Goldfuss); F. A. Roemer, Spongitarien..., p. 10.
1877. *Leptophragma Murchisoni* (Goldfuss); K. Zittel, Studien..., p. 48.
1883. *L. Murchisoni* (Goldfuss); J. G. Hinde, Catalogue..., p. 102.

1889. *L. Murchisoni* (Goldfuss); O. Griepenkerl, Die Versteinerungen..., p. 22.
1910—12. *L. Murchisoni* (Goldfuss); A. Schrammen, Die Kieselspongien..., p. 235, Pl. 32, Figs. 1—2; Text-pl. 9, Fig. 6.
?1925. *L. Murchisoni* (Goldfuss); L. Moret, Contribution..., p. 217.
1964. *L. Murchisoni* (Goldfuss); R. Giers, Die Grossfauna..., p. 221.

*Material.* — Two calcitized fragments of walls; an etched out dictyonal network.

Dimensions (in mm):

| | Height | Width | Thickness of wall |
|---|---|---|---|
| Specimen UŁ Sp. III/142 . . . . | 80 | 50 | 2 |

*Description.* — The larger, logitudinally undulated specimen indicates the shape of a widely open sponge. Both surfaces of walls similar to each other, are covered with uniformly distributed pores resembling in shape, size and manner of distribution. Ostia and postica oval, 0.4—0.45 mm in diameter, arranged in vertical and horizontal rows intersecting each other. An area of 50 sq mm is covered with 100—120 of them. Canals short, tubelike, about 1.2—1.5 mm long, vertically oriented within walls; their ends are rounded and situated close to the surface just below the cortical skeleton.

Dermal skeleton forms a dependent cortex, surrounding pores. It is called by Reid (1962) a "dictyonal cortex". This network is fairly strongly modified. The centre of spicules is marked only by a swelling with a not very large conical knob of a reduced apical actine.

Parenchymal skeleton fine, fairly dense, built of small, smooth or finely tuberculate hexactines, irregularly connected with each other. Network meshes not uniform, sometimes square in shape, with beams 0.12 mm long. Now and then, diagonals and — in places with an irregular system of hexactines — knots, formed by the interconnection of a few actines, occur in meshes. Numerous amphioxeas, varying in length, are scattered over the surface of sponge.

*Remarks.* — The species under study is to the greatest extent similar to *L. micropora* Schrammen, from which it differs in a flatly funnellike shape with a deeply indentated marginal edge. The examined specimens have smaller pores than those of German ones, described by Schrammen (1910—1912). In Polish specimens, about 100—120 pores occur over 50 sq mm, whereas in German ones, according to Schrammen, only 50, but — as results from his calculations in Pl. 32, Fig. 1 — this number may even reach about 100. Polish specimens are more similar to English forms, described by Hinde (1883), in which pores are 0.5 mm in diameter.

Bieda (1933) studied a few species of the genus *Leptophragma* and

assigned all of them to *L. striatopunctata* (Roemer), characterized by 1.0—1.5 mm thick walls, smaller inhalant pores and the presence of concentrical wrinkles on outer surface. Over an area of 50 sq mm this author counted about 160—180 ostia. In the synonymy of the description of *L. striatopunctata* he also included *L. murchisoni*, figured by Schrammen (1910—1912, Pl. 32, Fig. 3).

In the light of my studies and analysis of literature, it is clear that the sponges, considered by Schrammen to be *L. murchisoni*, had larger pores than those of English specimens, as well as those, studied in the present work and all the more to those, described by Bieda (1933). This conclusion results from the following calculation: Schrammen counted only 50—100 pores over 50 sq mm and Bieda — as many as 160—180. Both Schrammen's and my specimens undoubtedly represent *L. murchisoni*, whereas Bieda's ones — *L. striatopunctata*.

*Occurrence.* — Poland: Miechów, Upper Campanian. Germany: Upper and Lower Campanian, calcareous marl. U.S.S.R.: Crimea, Lower Campanian, Stanislavov District, Cenomanian. France: Villentrois, Senonian. England: Cenomanian.

### *Leptophragma sp.*

(Pl. XIV, Fig. 2; Pl. XX, Fig. 5)

*Material.*— One almost complete specimen with a very well-preserved external morphology of walls; parenchymal network embedded in silica.

Dimensions (in mm):

| | Height | Width at the top | Thickness of walls | Length of roots |
|---|---|---|---|---|
| Specimen UŁ Sp. III/1663 . . . . . | 50 | 40×50 | 3—12 | 70 |

*Description.* — Sponge shaped like a low cup. Basal part short, very strongly ramified. Marginal edge rounded. Walls of cup reinforced by strongly developed to 10 mm thick roots adhering to them. Inner surface latticed as in *L. murchisoni*. Postica round, varying in diameter from 0.3 mm in the lower part of spongocoel to 0.45 mm in the upper parts of walls. Water canals in wall not preserved. On the edge of cup, there are visible tubelike outlets, obliquely oriented in relation to the surface of spongocoel. Ostia invisible. Skeleton differentiated, with distinct trabecular and cortical skeleton, as well as a network of rooty processes marked in it. Parenchymal network has oval canal meshes 0.30—0.45 mm in diameter.

Cortical skeleton of the outer surface and of rooty processes is irregular in structure and consists of elongate strands formed as a result

of a strong modification of hexactines. These strands are tortuous, varying in length and transversely connected with each other. Cortex of the paragastral surface makes up a thin layer of a dense network, surrounding postica and devoid of elongate strands. Sharply terminating radii of hexactines protrude on the outside the network.

*Remarks.* — Cicatrized traces of a mechanical hurt of the sponge are visible on the surface of spongocoel. They stand out from the normal structure in a swelling of wall, elongation of postica to 0.6 mm and their oblique arrangement.

The examined specimen of *Leptophragma* sp. probably represents an ecological type with a strong modification in the structure of the parenchymal and cortical skeletons. We may suppose that an almost entire lower part of sponge was burried in a soft substratum and that the water circulation in canals was disturbed. It resulted in the modification of skeleton in the upper, cuplike part which became similar to the cortex of basal part. For this reason, an accurate specific determination is difficult.

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

## Family **Aphrocallistidae** Gray, 1867

This family belongs to the Scopularia Schulze, 1885 and is characterized by the presence of a skeleton of the eurytoidal type and diarhyses. Terminal oscula are sometimes closed with a diaphragm. Body cuplike or tubelike in shape, with thin walls and a characteristic appearance of outer surface.

According to Lagneau-Hérenger (1962), only the genus *Aphrocallistes* Gray, 1858, occurring from Albian to the present, belongs to the Aphrocallistidae, whereas Reid (1962) maintains that this family also includes *Heterochone* Ijima, 1927. At present, it lives in the Indian, Atlantic and Pacific oceans and occurs at depths ranging from 130 to 1150 m (80—700 brasses).

### Genus *Aphrocallistes* Gray, 1858

(Type species: *Scyphia alveolites* (Roemer, 1841))

*Aphrocallistes alveolites* (Roemer, 1841)

1841. *Scyphia alveolites* Roemer; F. A. Roemer, Die Versteinerungen..., p. 8, Pl. 111, Fig. 6.
1878. *Aphrocallistes alveolites* (Roemer); K. Zittel, Studien..., p. 49.
1883. *A. alveolites* (Roemer); J. G. Hinde, Catalogue..., p. 106.
1910—12. *A. alveolites* (Roemer); A. Schrammen, Die Kieselspongien..., p. 219, Pl. 25, Figs. 8—10; Pl. 31, Fig. 3; Text-Pl. 11, Fig. 5.
1919. *A. alveolites* (Roemer); Ph. D. C. O'Connell, The Schrammen..., p. 168.

1933. *A. alveolites* (Roemer); F. Bieda, Gąbki..., p. 21, Pl. 2, Fig. 2.
1943. *A. alveolites* (Roemer); L. Moret & L. Hérenger, Sur quelques..., p. 49.
1961. *A. alveolites* (Roemer); H. Nestler, Spongien..., pp. 28—29, Pl. 6, Figs. 1—4.
1964. *A. alveolites* (Roemer); R. Giers, Die Grossfauna..., p. 220.

*Material.* — Numerous, strongly limonitized fragments; trabecular skeleton fragmentarily preserved in two specimens.

Dimensions (in mm):

| | Length of stipe | Thickness of stipe |
|---|---|---|
| Specimen UŁ Sp. III/2a . . . . . | 20—45 | 15 |

*Description.* — Branches cylindrical, slightly flattened, 15—20 mm long, with apical ends rounded. Surface displays a characteristic appearance of a honeycomb. Ostia penta- or hexagonal, distributed closely and uniformly. Canals tubelike, short, vertical, with a diameter equalling that of pores and varying, in different specimens, from 0.45 to 1.05 mm. In the best-preserved specimen, 40 ostia occur over 50 sq mm.

Parenchymal network variable in density, consisting of small, smooth hexactines with 0.06 mm long beams. Network meshes rectangular, triangular or polygonal. The embryonic dictyonalia have very thin radii.

*Remarks.* — The specimens under study differ from *A. alveolites* from NW Germany in a different morphology of apical ends of branches. The specimens, described by Schrammen (1910—1912) have apices which are either pointed, or closed with a flat, sievelike diaphragm thinner than lateral walls. Postica, varying in size but wider than ostia, occur in this diaphragm. In our specimens, diaphragm does not occur and pores are uniform in size over the entire lateral and apical surfaces. In this species, the number of ostia is variable: in the specimens, described by Schrammen (1910—1912), 50—70 pores occur over an area of 50 sq mm, in those, described by Nestler (1961) — 25, and in my specimens — 40.

*Occurrence.* — Poland: Bonarka, Witkowice, Garlica, Lower Campanian; Bibice, Zabierzów, Upper Campanian; Bochotnica (abundant occurrence), Kazimierz, Janowiec, Piotrawin, Józefów, Maastrichtian. U.S.S.R.: Southern Donbas, Upper Campanian; Ulyanovsk District, Coniacian; Volgogradsk District, Santonian-Campanian. England: Senonian. NW Germany: Misburg, Oberg, Lower and Upper Campanian; Bosenberg near Vorhelm, Upper Campanian; the Island of Rügen, Maastrichtian. France: Senonian.

*Aphrocallistes kazimierzensis* n.sp.
(Pl. XV, Figs. 1, 2; Text-fig. 14)

*Holotypus*: Pl. XV, Figs. 1 *a—d* (Z. Pal. UŁ Sp. III/393).
*Paratypus*: Pl. XV, Fig. 2 (Z. Pal. UŁ Sp. III/78).
*Stratum typicum*: Maastrichtian, marly facies of the "opoka" type.
*Locus typicus*: Wylągi near Kazimierz on the Vistula, Poland.
*Derivatio nominis*: *kazimierzensis* — after the locality in which these sponges occur in Maastrichtian.

*Diagnosis.* — *Aphrocallistes* cuplike in shape, with processes varying in length and width and formed as a result of a peculiar, not uniform swelling of the lateral wall. They are empty inside. The surface of gastral wall (diaphragm) is sievelike and covered with polygonal, irregularly distributed postica. In transverse section, spongocoel is polygonal in outline.

*Material.* — Very numerous, cylindrical, calcitized or limonitized fragments with a very well-preserved general morphology. Three specimens are almost complete. Fragments of the trabecular skeleton very well-preserved.

Dimensions (in mm):

| | Height | Thickness of wall | Diameter of osculum | Diameter of processes | Length |
|---|---|---|---|---|---|
| Specimen UŁ Sp. III/393 . . . . | ca. 80 | 1.5—2.0 | ca. 45 | cylindrical 5—6, flat 5×25 | 20—60 |

*Description.* — Sponge cup-shaped, provided with processes. Upper pole flat, with osculum, lower without distinct attachment. Spongocoel cuplike, situated in the central part of body which is polygonal in trans-

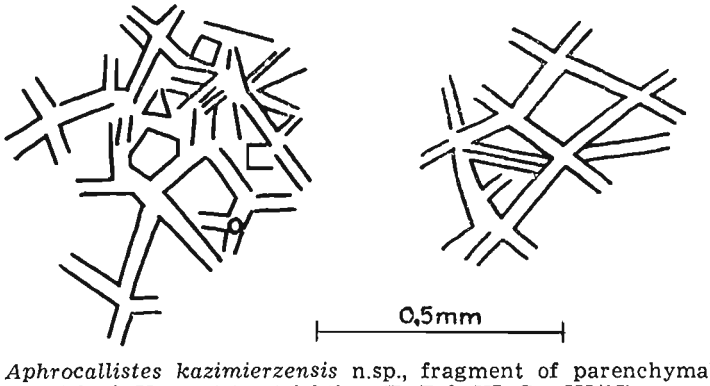


Fig. 14. — *Aphrocallistes kazimierzensis* n.sp., fragment of parenchymal network; Wylągi, Upper Maastrichtian (Z. Pal. UŁ Sp. III/15).

verse section. Digital processes cylindrical, sometimes flattened, varying in number and size. Their ends are rounded and apices flat or slightly concave, terminating in a 0.5—0.7 mm diaphragm. The entire outer surface covered with polygonal ostia, 0.5 mm in diameter, densely and

uniformly distributed. About 110 ostia are recorded over an area of 100 sq mm. Postica irregular, 1.2—1.35 mm in diameter, densely and irregularly covering the entire paragastral surface. About 45—47 of them are distributed over an area of 100 sq mm.

Water system of the diplorhizoid type. Epirrhyses very numerous, tubelike, vertical, with their length equalling thickness of walls and running towards exhalant cavities inside of processes. Exhalant system consists of chambers inside of stipes, of very short aporrhyses, postica in diaphragm and a spacious spongocoel, 60—80 mm deep and reaching as far as the base of sponge. Osculum, 45—60 mm in diameter, has a sharp edge, sometimes surrounded by a wreath of branches.

Parenchymal skeleton dense, consisting of smooth hexactines with beams varying in length from 0.1 to 1.15 mm, irregularly distributed in the network so that meshes are mostly triangular. Cortical skeleton dependent, formed by superficially situated radii, swolled, deformed and surrounding ostia with arcuate, thick rings.

*Remarks.* — *A. kazimierzensis* n.sp. is similar in shape to *A. cylindrodactylus* Schrammen from NW Germany, from which they differ, however, in thicker outer walls (1.5—2 mm vs. 0.3 mm) and more widely spaced ostia. In *A. kazimierzensis* n.sp., 110 ostia occur over 100 sq mm, and in *A. cylindrodactylus* from Germany there are 200 ostia over 100 sq mm. *A. kazimierzensis* has also larger postica (1.2—1.35 mm vs. 1.0 mm). From *A. alveolites* (Roemer) this species differs in the situation of diaphragm and from other species — in the manner of growth and ramification.

*Occurrence.* — Poland: Bochotnica, Kazimierz, Wylągi, Piotrawin, Józefów, Lower and Upper Maastrichtian.

### *Aphrocallistes bochotnicensis* n.sp.
(Pl. XVI, Figs. 1, 2; Text-fig. 15)

*Holotypus*: Pl. XVI, Figs. 1 *a*—*b* (Z. Pal. UŁ Sp. III/377).
*Stratum typicum*: Upper Maastrichtian, "opoka".
*Locus typicus*: Bochotnica near Kazimierz on the Vistula, Poland.
*Derivatio nominis*: *bochotnicensis* — after the locality of occurrence.

*Diagnosis.* — A ramifying *Aphrocallistes*, consisting of short, cylindrical stems and long, lateral, strongly flattened and radially situated branches. Branches are hollow inside and delimited from each other by a very thin diaphragm which occurs at the joint. Ostia more densely concentrated than in the remaining species.

*Material.* — Two complete specimens, fragments of limonitized branches and small fragments of the parenchymal and cortical skeletons.

Dimensions (in mm):

| | Length of process | Diameter of process |
|---|---|---|
| Specimen UŁ Sp. III/377, branch | ca. 120 | 32×12 |

*Description.* — Sponge consisting of branches of two types: shorter, cylindrical and longer, wide, strongly flattened. Cylindrical branches, varying in thickness, consist of a fundamental stem from which flat, more than 100 mm long, 30—35 mm wide and 6—10 mm thick processes grow in a verticillate manner. They are separated from cylindrical processes by a thin, porous membrane. Outer walls of branches are 1.0—

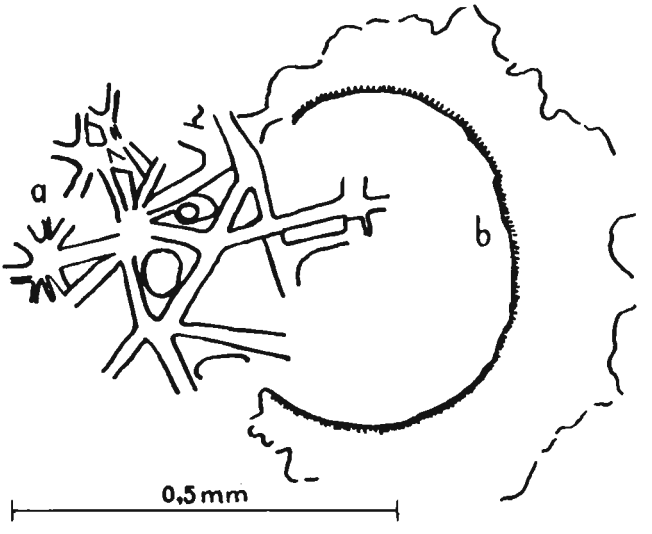


Fig. 15. — *Aphrocallistes bochotnicensis* n.sp., *a* fragment of parenchymal network, *b* cortex around ostium; Bochotnica, Upper Maastrichtian (Z. Pal. UŁ Sp. III/43).

1.5 mm thick. Ostia, about 0.45 mm in diameter, uniformly cover the entire surface. Over an area of 100 sq mm, there are about 90 ostia. Water system consists of short epirrhyses and exhalant cavities which occupy the inside of branches. Spongocoel lacking.

Parenchymal skeleton consists of smooth and fairly fragile hexactines with beams varying in length between 0.1 and 0.5 mm and about 0.015 mm thick. Dictyonal network fine, with triangular, quadrangular and sometimes even oval meshes. The latter shape is a result of corners between actines being filled with silica. Cortical network around ostia consists of strongly modified hexactines.

*Remarks.* — *A. bochotnicensis* n.sp. differs from *A. kazimierzensis* n.sp., as well as from other species, in the presence of branches of two types, in a somewhat thinner outer wall and denser concentration of ostia. In addition, the new species differs from those from NW Germany,

described by Schrammen (1910—1912), in the occurrence of the diaphragm at the distal ends of flat processes but not on their apices as in *A. alveolites* (Roemer) and *A. cylindrodactylus* Schrammen.

*Occurrence.* — Poland: Bochotnica, local horizon "z"; Kazimierz, horizon "x", Upper Maastrichtian.

### *Aphrocallistes mammillaris* n.sp.
(Pl. XVI, Fig. 3)

*Holotypus*: Pl. XVI, Fig. 3 (Z. Pal. UŁ Sp. III/370).
*Stratum typicum*: Lower Maastrichtian, "opoka".
*Locus typicus*: Piotrawin on the Vistula, Poland.
*Derivatio nominis*: *mammillaris*, Lat. *mammilla* = a nipple; after a spherical shape of processes having osculum.

*Diagnosis.* — An *Aphrocallistes* irregular in shape, with short, rounded processes, each of them with a single, very small osculum, situated on apex. Walls 1—2 mm thick.

*Material.* — A specimen with a well-preserved morphology, but without preserved skeleton.

Dimensions (in mm):

| | Height of specimen | Diameter of processes | Height of processes |
|---|---|---|---|
| Specimen UŁ Sp. III/370 | 40 | 8—10 | 10 |

*Description.* — Sponge irregular in shape, consisting of a flattened axial branch, with an area of the plane of cross section amounting to 22×10 mm, and of rounded processes variously distributed. Walls 1—2 mm thick. Ostia oval, 0.4 mm in diameter, densely and uniformly distributed. Single oscula, 1 mm in diameter, situated on apices of processes. Epirrhyses short, tubelike, perpendicular to walls. Exhalant cavities are similar in shape to a general outline of sponges.

The preserved traces of parenchymal network reveal irregular, mostly triangular, meshes with beams varying in length.

*Remarks.* — The species described differs from all other representatives of this genus primarily in a spherical shape of processes and presence of oscula devoid of diaphragm. It is to the greatest extent similar to *A. bochotnicensis* n.sp. in the thickness of walls, diameter of ostia and central part and differs from the last-named species in the manner of development and shape of processes.

*Occurrence.* — Poland: Piotrawin, Lower Maastrichtian.

*Aphrocallistes vistulae* n.sp.
(Pl. XVII, Fig. 1)

*Holotypus*: Pl. XVII, Fig. 1 (Z. Pal. UŁ Sp. III/376).
*Stratum typicum*: Upper Maastrichtian, "opoka".
*Locus typicus*: Bochotnica near Kazimierz on the Vistula, Poland.
*Derivatio nominis*: *vistulae* — after Vistula river, on whose bank the studied specimen was found.

*Diagnosis.* — An *Aphrocallistes*, dichotomously divided into short, cylindrical, tubelike branches, uniform in width. Walls 3—4 mm thick. Diaphragm lacking.

*Material.* — A large, almost complete, ramifying specimen with a well-preserved general morphology.

Dimensions (in mm):

| | Height | Thickness of walls | Diameter of branches |
|---|---|---|---|
| Specimen UŁ Sp. III/376 | ca. 100 | 3—4 | 15×12 to 20×25 |

*Description.* — A cylindrical sponge, dichotomously divided into relatively short, empty offshoots, uniform in width and 3—4 mm thick walls. Knoblike convexities occur on lateral walls. Upper ends of branches obliquely truncate, terminating in an oval osculum with rounded edges and 10—15 mm in diameter. Morphology of surface and water system identical with that in all representatives of the genus *Aphrocallistes*. Ostia on apices of knoblike convexities, 0.45—0.6 mm in diameter, distributed irregularly, whereas at the base of branchings they are arranged in short, vertical rows spaced at 0.9—2.0 mm intervals. On the average, 32 ostia occur over an area of 100 sq mm. Exhalant system consists of tubelike cavities. Parenchymal and cortical networks limonitized, their remains preserved have an identical structure with that of *A. kazimierzensis* n.sp.

*Remarks.* — *A. vistulae* n.sp. is similar in shape to the Recent species, *A. ramosus* Schulze (1877), known from the coasts of Japan and the Philippines; the latter differs from fossil species, described by Schrammen (1910—1912), such as *A. alveolites, A. cylindrodactylus* and *A. lobatus*, in the lack of sievelike diaphragm on the apices of branches. As compared with other species, erected in the present work, it differs in the manner of growth and, consequently, in a different shape of exhalant system. In *A. kazimierzensis* n.sp., the swelling of walls led to a broadwise growth of sponge, whereas in *A. vistulae* the growth took place in the direction of height and ramification. Differences in dimensions between particular species of *Aphrocallistes* are given below in Table 4.

Table 4

Differences in dimensions displayed by species of the genus *Aphrocallistes* from Poland

| Species | Number of ostia per 100 sq mm | Thickness of wall (in mm) | Diameter of ostia (in mm) |
|---|---|---|---|
| *Aphrocallistes kazimierzensis* n.sp. | 110 | 1.5—2 | 0.5 |
| *A. bochotnicensis* n.sp. . . . . | 90 | 1.0—1.5 | 0.45 |
| *A. alveolites* (Roemer) . . . . . | 80 | 1 —2 | 0.45—1.05 |
| *A. vistulae* n.sp. . . . . | 32 | 3 —4 | 0.45—0.6 |
| *A. mammillaris* n.sp. . . . . | — | 1 —2 | — |

A specific structure of water system and manner of growth of the species from Poland, as compared with those from Germany, indicate their endemic character.

*Occurrence.* — Poland: Kazimierz, Janowiec, Upper Maastrichtian, "opoka".

## Superfamily **Lychniscosa** Schrammen, 1903
## Family **Ventriculitidae** Zittel emend. Schrammen, 1910
## Genus *Ventriculites* Mantell, 1822

(Type species: *Ventriculites radiatus* Mantell, 1822)

### *Ventriculites radiatus* Mantell, 1822

(Pl. XIX, Figs. 1—3; Pl. XX, Fig. 4)

1822. *Ventriculites radiatus* Mantell; G. Mantell, Geology of Sussex..., p. 168, Pl. 14, Figs. 1—2; *fide* H. Nestler, 1961, p. 30.
1826—33. *V. radiatus* Mantell; A. Goldfuss, Petrefacta Germaniae, p. 246.
1870. *Retispongia radiata* Roemer; F. A. Roemer, Geologie..., p. 30, Pl. 32, Figs. 5—6.
1871. *Ventriculites radiatus* Mantell; I. Sincov, O melovych..., p. 27, Pl. 5, Figs. 1—3.
1878. *V. radiatus* Mantell; F. A. Quenstedt, Petrefactenkunde..., V, Pl. 136, Figs. 24—34.
1883. *V. radiatus* Mantell; J. G. Hinde, Catalogue..., p. 108.
1885. *V. radiatus* Mantell; Ph. Počta, Beiträge..., p. 33.
1910—12. *V. radiatus* Mantell; A. Schrammen, Die Kieselspongien..., p. 265, Pl. 36. Figs. 1—3, 7; Pl. 13, Figs. 3—6.
1933. *V. radiatus* Mantell; F. Bieda, Gąbki..., p. 25.
1958—60. *V. radiatus* Mantell; S. Défretin-Lefranc, Contribution..., pp. 56—58, Pl. 3, Figs. 1—4; Text-fig. 16.
1961. *V. radiatus* Mantell; H. Nestler, Spongien..., pp. 30—32, Pl. 6, Figs. 5—7; Pl. 7, Figs. 1—3; Messtabellen pp. 54—65.
1962. *V. radiatus* Mantell; L. Lagneau-Hérenger, Contribution..., p. 92, Text-Pl. 14, Fig. 1.
1964. *V. radiatus* Mantell; R. Giers, Die Grossfauna..., p. 222.

*Material.* — One complete specimen, three with the upper pole preserved and 39 fragments varying in size. Parenchymal and cortical network etched out, are very well-preserved.

Dimensions (in mm):

| | Height | Diameter at the top | Diameter at the bottom | Thickness of wall |
|---|---|---|---|---|
| Specimen UŁ Sp. III/170 | more than 70 | 40 | 20 | 3—7 |

*Description.* — Sponge cylindrical or funnellike in shape, towards base passing into a single or ramified stem. Walls of different specimens varying in thickness. Outer surface longitudinally grooved as a result of ostia being arranged in rows. "Ribs" between pores, about 2.7 mm wide, are flat and parallel to each other or dichotomously ramified. Spongocoel tubelike-conical, deeply penetrating into stem. Fissure-shaped ostia, 3.0×0.75 mm, are arranged in rows along the entire sponge. Five to six of them occur over 100 sq mm. Postica invisible. Epirrhyses tubelike, perpendicularly pierce the wall almost clear through. Their ends are rounded and closed with network. Aporrhyses also tubelike but shorter than epirrhyses.

Parenchymal skeleton dictyonal, not very dense, with irregular meshes, most of them quadrangular. Network consisting of large lychnisks, either smooth, or thorny, with central nodes perforated. Beams 0.32—0.36 mm long. Some actines bifurcate or have irregular branchings. A thin reticular layer consisting of fibres occurs around canals. A similar network covers the surface of spongocoel. In inter-canal spaces, the dictyonal network is the most regular and has square meshes; radii, here connected with each other, form short rows of 5—6 lychnisks. Long oxeas, varying in length and single hexactines are stuck in parenchymal network.

Cortical skeleton consists of closely arranged fibres, crosswise connected with each other. In the upper part of sponge, it forms a thin layer, whereas in stem this layer is 2—8 mm thick. The inner part of stem is filled with a network identical in structure with the parenchymal network. In transverse section, this "core" oval and 6×10 mm in cross section. A distinct boundary is marked between the cortex of stem and network of core. With the use of a small magnification a passage may be observed of one of these networks into the other and when the image is 40 times magnified one may see the elongation of lychnisks and the disappearance of their octohedral nodes. The transformation of network is sudden. Numerous tortuous, tubelike vertical canals, communicating with each other by oval openings, occur in the cortex of stem. Walls of these canals are bristling, with densely distributed actines with spiny ends. On the other hand, in the parenchymal network of stem, tubelike canals are few and their walls, in contradistinction to cortical ones, are smooth. The diameter of both cortical canals of stem and parenchymal canals amounts to 0.6 mm.

*Variability.* — Individual variability of *V. radiatus* from Poland is manifested in the size of specimens, thickness of walls and size of ostia. In one specimen (Ul Sp. III/170), 120 mm high, a juvenile individual 4 mm high and similar in size and shape of furrows to the parent sponge, is preserved in its basal part. Its osculum is 0.5 mm in diameter, and furrows — 0.15 mm in width. Spiculation not preserved.

*Remarks.* — In studying the skeleton of the basal part in *V. radiatus*, Défretin-Lefranc (1958) concluded that between the parenchymal and cortical skeleton of the upper part and the stem, there was surely no interrelation. According to this author, "celle-ci est enchâssée dans la partie supérieure de la racine comme le gland du chêne dans sa cupule". Since this statement is not confirmed by fairly well-preserved Polish specimens, one can suppose that Defrétin-Lefranc's specimen was probably not well-preserved. In my both specimens, the cortical and parenchymal networks extend in stem as deep as 30 mm and display a passage from one to the other network. A similar phenomenon was observed by Nestler (1961).

Specimens of *V. radiatus* frequently occur over the entire Cretaceous. An abundant occurrence of this species in Upper Turonian and Senonian is stated by Schrammen. According to the last-named author (1910—1912, p. 266), specimens of *V. radiatus* from the *Scaphites* zone are small and thin-walled. Specimens of similar size (40 mm high) have been found in Cenomanian of Belgium and France. In Turonian of these countries, large (to 70 mm high with a diameter of 110 mm) specimens occur alongside of small ones. Consequently, the size of *V. radiatus* is not related with the geological age. Défretin-Lefranc believes that neither dimensions, nor shape of pores and furrows display any deviations in forms coming from different zones. According to Schrammen (1910—1912), the skeletal network also was not subject to transformation over such a long time. Polish specimens, coming from different zones of Senonian, display a not very large variability.

*Occurrence.* — Poland: Bonarka, Witkowice, Bielany, Ujazd, Januszowice, Miechów, Lower Campanian; Rudawa, Upper Campanian; Muniakowice, Lower Maastrichtian; Kazimierz, Upper Maastrichtian; Trojanowice, Emscherian; Opole, Cenomanian. NW Germany: Scaphiten-Pläner, Cuvieri-Pläner, "Quadraten-Kreide" and "Mucronaten-Kreide". England: Upper Chalk. N. France: Cenomanian, Turonian, Emscherian, Aturian; Savoy, Albian. Belgium: Cenomanian, *Actinocamax plenus* zone. Czechoslovakia: Senonian. U.S.S.R.: Upper Cretaceous.

### *Ventriculites convolutus* Hinde, 1883
(Pl. XX, Fig. 1)

1883. *Ventriculites convolutus* Hinde; J. G. Hinde, Catalogue..., p. 110, Pl. 25, Figs. 5,5a.

1958. *Ventriculites convolutus* Hinde; S. Défretin-Lefranc, Contribution..., pp. 59—60, Pl. 4, Figs. 1, 2.

*Material.* — Two limonitized and two calcified specimens with a well-preserved morphology and, in addition, two fragments of skeletal network.

Dimensions (in mm):

| | Height | Width | Thickness of | | Height of stem |
|---|---|---|---|---|---|
| | | | walls | stem | |
| Specimen UŁ Sp. III/85 | ca. 100 | — | 2—3 | — | — |
| Specimen UŁ Sp. III/74 | 55 | 120 | 2—5 | 15×10 | 35 |

*Description.* — Sponge shaped like a flat plate or undulated plate with or without stem. Rootlike ends of stems, to 75 mm long and 8 mm thick, are disposed in one plane. Margin of upper part even or undulated; walls varying in thickness, the thinnest being at the top. Outer surface radially ribbed. Ribs 1.0—1.6 mm wide are transversely connected with each other. Ostia oval, varying in length (2.4—3.3 mm) and width (1.0—1.6 mm), arranged in rows; postica invisible; the only traces of skeleton are its imprints. The fragments of network preserved have subsquare meshes and the distance between centres of lychnisks amounts to 0.36 mm.

*Remarks.* — All my specimens, assigned to *V. convolutus*, the same as specimens of this species and genus, described by Défretin-Lefranc (1958), differ in shape from Hinde's holotype. The most different, in its deeply undulated margin, is one specimen (UŁ Sp. III/85) shaped like a vertically situated plate. The remaining characters of this specimen are identical with those of *V. convolutus* from France, described by Défretin-Lefranc. Dimensions of network meshes make up another difference. According to Hinde (1883), the holotype has rectangular meshes 0.3 mm in diameter, whereas corresponding figures for French specimens are 0.3—0.4 mm and for Polish (UŁ Sp. III/85) — 0.36 mm. The manner of attachment to the substratum in Polish specimens is similar to that observed in specimens, described by Défretin-Lefranc (1958).

*Occurrence.* — Poland: Zbyczyce, Pniaki, Lower Campanian, clayey marl; Bochotnica, Upper Maastrichtian, marl of the "opoka" type. Northern France: Emscherian. England: Upper Chalk.

### *Ventriculites* cf. *successor* Schrammen, 1924
(Pl. XX, Fig. 2; Text-fig. 16)

*Material.* — Three limonitized specimens, difficult to etched out of marl.

Dimensions (in mm):

| | Height | Diameter at the top | Diameter of stem |
|---|---|---|---|
| Largest specimen UŁ Sp. III/9 | 110 | ca. 320 | 20 |

*Description.* — Sponge shaped like a more or less open funnel; walls 2—3 mm thick. Outer form, aspect and distribution of pores similar to those in Schrammen's holotype. A poor preservation state of spiculation makes a more accurate analysis difficult.

*Occurrence.* — Poland: Janowiec and Wylągi, Upper Maastrichtian, marl. NW Germany: marly limestone of the "Mucronaten-Kreide".

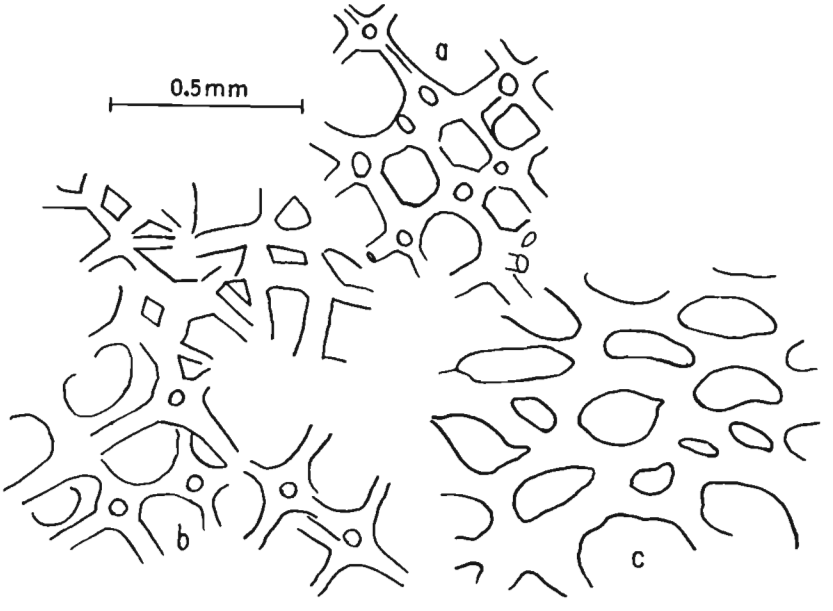


Fig. 16. — *Ventriculites* cf. *successor* Schrammen; *a* fragment of parenchymal network between canals, *b* fragment of network adjacent to canals, *c* irregular network surrounding surface of canals; Kazimierz on Vistula (Z. Pal. UŁ Sp. III/9).

## Genus *Rhizopoterion* Zittel, 1878

(Type species: *Scyphia cervicornis* Goldfuss, 1826)

In its external appearance, the genus *Rhizopoterion* Zittel is similar to *Ventriculites*. Erecting it in 1878, Zittel attracted attention to an oblique-longitudinal trace of aporrhyses. Schrammen (1910—1912) takes a different view concerning the trace of these canals. He maintains that in *Rhizopoterion*, the trace of epirrhyses and aporrhyses is identical with that in *Ventriculites*.

It is clear from the studies on the Polish material that the genus *Ventriculites* is characterized by the presence of short epi- and aporrhyses, blindly terminating near the surface as a result of which lateral walls appear more undulated, whereas the genus *Rhizopoterion* is marked by tubelike aporrhyses, running obliquely-longitudinally, less projecting and wider ribs, ostia varying in outline in different species and a different morphology of the network surrounding canals.

Of the species studied, *Rhizopoterion tubiforme* Schrammen and *R. coniforme* n.sp. are marked by an external similarity to *Ventriculites radiatus* Mantell.

The genus *Rhizopoterion* is known from the Turonian and Senonian. Sometimes, it is also found in the Campanian.

*Rhizopoterion tubiforme* Schrammen, 1910
(Pl. XXI, Figs. 1, 2)

1910. *Rhizopoterion tubiforme* Schrammen; A. Schrammen, Die Kieselspongien..., p. 213, Pl. 34, fig. 1.
1923. *R. tubiforme* Schrammen; L. Moret, Sur quelques Spongiaires..., p. 7, Pl. 1, Fig. 7.
1942. *R. tubiforme* Schrammen; L. Hérenger, Contribution..., t. 24, p. 174, Pl. 2, Fig. 6, Text-fig. 9b.
1958. *R. tubiforme* Schrammen; S. Défretin-Lefranc, Contribution..., p. 62, Pl. 4, Fig. 6.
1964. *R. tubiforme* Schrammen; R. Giers, Die Grossfauna..., p. 222.

*Material.* — Two specimens without apical and basal parts; skeletal network calcitized; a fragment of cortex preserved.

Dimensions (in mm):

| | Height | Diameter | | Thickness of wall at the bottom |
|---|---|---|---|---|
| | | at the top | at the bottom | |
| Specimen UŁ Sp. III/175 | 70 | 25 | 13 | 5 |

*Description.* — Sponge shaped like a cylinder tapering downwards. Outer surface longitudinally furrowed. Riblike ridges have rounded and fairly projecting crests, uniform in width over the entire length. Ostia, arranged between ribs, form vertical rows, alternately situated. They vary in length between 2.0 and 2.5 mm, but are uniform in width, which amounts to 1.5—2.0 mm. Postica invisible (covered with sediment). Spongocoel tubelike, deep, nearly reaching the basal part. Epirrhyses indistinct, aporrhyses varying in diameter, are oval in transverse section. In the cortical network, the vertical arrangement of beams is more distinct than the horizontal.

*Remarks.* — As compared with *R. tubiforme* from Misburg, described by Schrammen (1910), Polish specimens, the same as those from North-eastern France, are different in not having crenated rims around pores. A different morphology of exhalant canals makes up another difference. In Polish specimens, exhalant system has a trace compatible with Zittel's diagnosis, and not with Schrammen's (1910, p. 272) description.

*Occurrence.* — Poland: Bonarka, Lower Campanian, siliceous "opoka". NW France: Turonian and Senonian. Spain: Catalonia, Senonian. U.S.S.R.: Ulyanovsk District, Upper Cretaceous.

### *Rhizopoterion solidum* Schrammen, 1910—1912
(Pl. XX, Fig. 3)

1910—12. *Rhizopoterion solidum* Schrammen; A. Schrammen, Die Kieselspongien..., p. 272, Pl. 34, Fig. 6; Pl. 13, Fig. 8; Text-pl. 14 Fig. 8.
1958. *Rhizopoterion solidum* Schrammen; S. Défretin-Lefranc, Contribution..., p. 61, Pl. 4, Fig. 5; Text-fig. 17.

*Material.* — One almost complete, calcified specimen, without osculum and stem; calcitized fragments of skeleton, single comitalia and dermalia.

Dimensions (in mm):

| | Height | Width | |
|---|---|---|---|
| | | at the top | at the base |
| Specimen UŁ Sp. III/16 | 130 | 80 | 10 |

*Description.* — Sponge shaped like an inverted cone with outer surface longitudinally ribbed. Ribs rounded, 1.0—1.5 mm wide, connected with each other by short and narrow ridges. Ostia varying in size rectangular in outline, in the lower part smaller than in the upper. Spongocoel conical, surrounded with ca. 10 mm thick walls; canals not preserved, but their place is marked by strands of skeleton and oxeas. Parenchymal skeleton forms a network, consisting of fairly thick lychnisks with perforated centres and fairly short beams, 0.15 mm in length. Length of radii, measured from the centre amounts to 3 mm. Lychnisks fairly regularly arranged in network. Their vertical beams are marked by fine longitudinal strands. Large monactines are situated along canals. Cortical network fine with many cavities left by oxeas, more than 3 mm long.

*Remarks.* — The specimen under study has been assigned to *R. solidum* on the basis of its considerable similarity in structure of outer surface and ostia to those described by Schrammen (1910—1912) and Défretin-Lefranc (1958). In Polish specimens, network meshes are almost

0.3 mm wide, much the same as those in one of the Défretin-Lefranc specimens. The number of ostia per 100 sq mm is greater than that in Schrammen's specimens from Germany (Misburg and Oberg), that is 11 as opposed to 4—5. In the last-named specimens ostia measured 2.0—2.5×1.0—1.5 mm.

*Occurrence.* — Poland: Wylągi, Upper Maastrichtian, marl of the "opoka" type. France: Upper Turonian. NW Germany: Lower Campanian ("Quadraten-Kreide"), marly limestone.

*Rhizopoterion coniforme* n.sp.
(Pl. XXI, Fig. 3; Text-fig. 17)

*Holotypus:* Pl. XXI, Figs. 3 *a-b* (Z. Pal. UŁ. Sp. III/48).
*Stratum typicum:* Maastrichtian, "opoka".
*Locus typicus:* Piotrawin on the Vistula, Poland.
*Derivatio nominis: coniforme, Lat. conus* = cone; after a conical shape of sponge.

*Diagnosis.* — A *Rhizopoterion* shaped like a slender cone with roomy spongocoel and with outer surface regularly ribbed. Ostia elongated; aporrhyses tubelike, vertical, anastomozing, surrounded by a trabecular network; lychnisks in parenchymal network display a fibrous structure arranged vertically.

*Material.* — Three specimens with poles broken off, preserved in marl; fragments of parenchymal skeleton.

Dimensions (in mm):

| | Height | Diameter | | Thickness of wall |
|---|---|---|---|---|
| | | at the top | at the bottom | |
| Larger specimen UŁ Sp. III/72 | 110 | 180×60 | 85×40 | 10 |
| Smaller specimen UŁ Sp. III/48 | 180 | 50×25 | 20 | — |

*Description.* — Sponge shaped like a slender, conical cup bilaterally flattened. Ostia varying in length, elongate in outline; postica oval, their dimensions amounting to 3.9×2.5 mm. Spongocoel roomy, similar in shape to the shape of sponge. Epirrhyses invisible, aporrhyses varying in width between 0.25 and 0.6 mm, tubelike, sometimes anastomozing (UŁ Sp. III/48) running along walls.

Parenchymal network dictyonal, built of smooth, short-radius lychnisks with pronouncedly and strongly perforated nodes. Beams about 0.3 mm long. Network meshes triangular, square or oval as a result of the corners being filled with silica. The octohoedric part large with fine, 0.9—0.12 mm long buttresses. Sometimes, lychnisks, adjoining each other,

are connected with each other in such a manner that they have a common, formless, central part of the spicule, or their actines are split. A fibrous trabecular network, smooth or fine-thorny is, sometimes, preserved around aporrhyses. Elongate, vertical fibres were formed from the swelling and elongation of beams directed concordantly with the

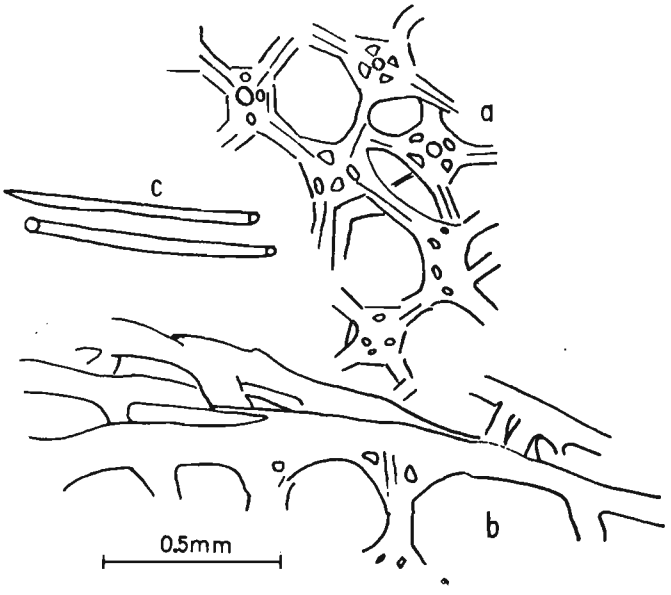


Fig. 17. — *Rhizopoterion coniforme* n.sp., *a* parenchymal network composed of lychnisks, b fibrous network covering inner surface of aporrhyses, c comitalia, oxeas (fragments) (Z. Pal. UŁ Sp. III/72).

height of sponge and of filling of the octohoedric part. Apertures and transverse buttresses of lychnisks are also visible here and there. Few oxeas, 0.75 mm long, arranged parallel to vertical beams stick in the meshes of parenchymal network. Cortex forms a layer, fairly thick in basal part where it is strongly mineralized.

*Remarks.* — The species described is similar in the morphology of surface and water system to *R. tubiforme* Schrammen from which it differs in the shape and morphology of megascleres. In the appearance of parenchymal lychnisks, figured by Schrammen (1910, Pl. 14, Fig. 8), it is similar to *R. solidum* Schrammen. It differs from the last-named species in the appearance of outer surface and outline of ostia. In their external shape, the examined specimens resemble *Ventriculites striatus* Smith (cf. Laubenfels, 1955, p. E87, Fig. 68-1a) which indicates a relationship of both genera.

*Occurrence.* — Poland: Nasiłów, Piotrawin and Józefów, Maastrichtian.

## Genus *Lepidospongia* Roemer, 1864

(Type species: *Lepidospongia denticulata* Rauff, 1893)

### *Lepidospongia fragilis* Schrammen, 1902

(Pl. XVI, Fig. 4)

1902. *Plectodermatium fragile* (Schrammen); A. Schrammen, Neue Hexactinelliden..., p. 13, Pl. 4, Fig. 4 a-b.

1910—12. *Lepidospongia fragilis* Schrammen; A. Schrammen, Die Kieselspongien..., p. 270, Pl. 45, Fig. 6; Text-Pl. 13, Fig. 1.

1933. *Lepidospongia fragilis* Schrammen; F. Bieda, Gąbki..., p. 29, Pl. 2, Fig. 1.

*Material.* — Eight pieces of marl, containing limonitized or calcified fragments of walls difficult to prepare. Skeleton rather poorly preserved. Single lychnisks have been prepared.

*Description.* — Fragments of walls indicate a fanlike or funnellike shape of sponge with a short stem. Outer surface longitudinally ribbed; ribs about 1.2 mm wide, slightly convex, almost parallel to each other, sometimes transversely connected with each other and bifurcated at various heights. Ostia oval, varying in length, but uniform in width which amounts to about 1 mm, distributed between ribs. Traces of postica, about 0.6 mm wide, which occur on outer surface of walls, indicate their concentric system. Exposed epirrhyses 1.5 mm long are blindly terminating, conical, close to the surface 1.0—1.2 mm and at the end — 0.45 mm in diameter. Walls 2—3 mm thick.

Single lychnisks are smooth and form a network whose beams are to 0.3 mm long. The inner, i.e. paragastral surface is covered with plates, arranged in a tilelike manner and forming flattened and anastomozing strands.

*Remarks.* — *L. fragilis* is similar to *L. rugosa* from which it differs, however, in a smaller thickness of walls (2—3 mm vs. 3—6 mm) and primarily in a platelike structure of the skeleton of exhalant surface.

According to Schrammen (1910), in *L. fragilis* from Germany, the skeleton on paragastral surface consists of plates, wheras in Polish specimens it looks like flat concentrical fibres, in which the presence of rounded tilelike plates may be observed only here and there.

*Occurrence.* — Poland: Bonarka, flinty "opoka"; Pniaki, Zbyczyce, clayey marl of Lower Campanian. Germany: Oberg, Misburg, Lower and Upper Campanian.

## Genus *Orthodiscus* Schrammen, 1924

(Type species: *Orthodiscus fragilis* Schrammen, 1924)

### *Orthodiscus fragilis* Schrammen, 1924

(Pl. XVII, Figs. 2, 3)

1924. *Orthodiscus fragilis* Schrammen; A. Schrammen, Die Kieselspongien..., III, p. 26, Pl. 13, Fig. 4; Pl. 14, Figs. 1—2.

1958—60. *Orthodiscus fragilis* Schrammen; S. Défretin-Lefranc, Contribution..., pp. 67—69, Pl. 5, Fig. 5; Text-fig. 19.

*Material.* — Three well-preserved specimens with large parts of stems and walls; fragments of parenchymal network and a well-preserved skeleton of stem.

Dimensions (in mm):

| | Height | Width of disc | Thickness of stem at the base |
|---|---|---|---|
| Smaller specimen, UŁ Sp. III/29 | 60 | 60 | 38×20 |
| Larger specimen, UŁ Sp. III/71 | 63 | 140 | 32 |

*Description.* — A cuplike sponge, with horizontally laid out walls of upper part, mounted on a thick, short, conical-funnellike stem. Walls of the cuplike part are 5 mm and those of stem — about 8 mm thick. Outer (i.e. lower) surface of walls of both the disclike and funnellike part has longitudinal ribs with rounded ridges, 1.5—2.0 mm wide, running radially. Furrows between ribs are shallow. Ostia elongate varying in length 3—4 mm, distributed between ribs. Postica round, 3—5 mm in diameter, distributed uniformly and in alternating rows on upper surface. Strands of cortical network between postica are uniform in width (1.5—3.0 mm). Four to five postica occur over an area of 100 sq mm. Spongocoel varying in depth, situated centrally and occurring in the form of a shallow bowllike depression or is deep, funnellike and reaches as far as stem. Water canals in walls of disc short, straight and alternately distributed on both sides of wall, whereas in stem they run more tortuously.

Parenchymal skeleton consists of fairly large, smooth lychnisks which form a loose dictyonal network. Network meshes regular, subsquare, open, with 0.015 mm thick and 0.4 mm long beams. Spicule centre pronouncedly octohoedric but, as compared with the length of beams, small. Trabecular network occurs around canals.

Cortical skeleton of two types. In the upper, funnellike part, it forms a thin layer consisting of a dense network, with fine meshes, which covers ribs and spaces between pores, whereas in stem it makes up an 8 mm thick layer, consisting of anastomozing fibres and which is fairly clearly divided from the parenchymal network.

*Remarks.* — Both specimens, assigned to this species display a considerable similarity to those from NW Germany. They differ from French specimens, described by Défretin-Lefranc (1958) only in a smaller depth of furrows on outer surface and in a larger width of strands between postica (1.5—3.0 mm as opposed to 1.0—1.2 mm).

*Occurrence.* — Poland: Miechów, Upper Campanian, marl; Piotrawin and Kamień, as well as Wylągi, Maastrichtian of the "opoka" type. Ger-

many: "Mucronaten-Kreide" at Misburg. France: Turonian, *Micraster breviporus* zone in northern departments; Coniacian, *Micraster cortestudinarium* zone; Campanian, *Actinocamax quadratus* zone at Tincourt-Bouchy.

## Family **Coeloptychidae** Zittel, 1877

## Genus *Coeloptychium* Goldfuss, 1833

(Type species: *Coeloptychium agaricoides* Goldfuss, 1826)

### *Coeloptychium deciminum* Roemer, 1841

(Pl. XVIII, Figs. 1, 2)

1841. *Coeloptychium deciminum* Roemer; F. A. Roemer, Die Versteinerungen.., p. 10, Pl. 4, Fig. 3.
1864. *C. deciminum* Roemer; F. A. Roemer, Spongitarien..., p. 3.
1876. *C. deciminum* Roemer; K. Zittel, Über Coeloptychium..., p. 62, Pl. 1, Figs. 6—7; Pl. 3, Fig. 2.
1883. *C. deciminum* Roemer; J. G. Hinde, Catalogue..., p. 147.
1910—12. *C. deciminum* Roemer; A. Schrammen, Die Kieselspongien..., p. 329.
1920. *C. deciminum* Roemer; H. Fritsche, Über Coeloptychium..., p. 101.
1933. *C. deciminum* Roemer; F. Bieda, Gąbki..., p. 35.
1964. *C. deciminum* Roemer; R. Giers, Die Grossfauna..., p. 223.

*Material.* — Five specimens of upper part of sponge and two stems broken off. Skeleton difficult to prepare, but very well-visible on a polished surface of wall. Cortical network preserved on upper surface.

Dimensions (in mm):

| | 1/2 of diameter of surface | | Thickness of wall | | Width of marginal wall |
|---|---|---|---|---|---|
| | upper | lower | in the middle | at the margin | |
| Specimen UŁ Sp. III/127 | 25 | 28 | 4 | 11 | 4 |
| Specimen UŁ Sp. III/209 | 43 | 45 | 3 | 6 | 4 |
| Specimen UŁ Sp. III/208 | 35 | 40 | 5 | 15 | 6—15 |

*Description.* — Sponge shaped like a flat, slightly concave shield, mounted on a short, cylindrical stem. Shield walls, not very thick in the middle, around stem thicken towards margins. Margin of shield, obliquely truncate, form with lower side an acute angle. Upper (exhalant) surface is marked by radially distributed, not very large depressions, which are the deepest in the marginal part of shield. Twenty two to twenty four dichotomous, flat, radially arranged folds, about 2.5—2.7 mm wide in the centre near the stem and 5.0—7.8 mm wide at the margin, occur on the lower, inhalant side of shield. They are divided from each other by uniform furrows, 2.5—3.0 mm wide and 5.0—6.0 mm deep. On the folds, round ostia 0.5 mm (UŁ Sp. III/208, 209) in diameter, are arranged along

the median, straight line at 1.5—3.6 mm intervals. Number of ostia on all folds of a given specimen is constant and amounts to 12. A similar arrangement of ostia is also observed on stem. Postica not individualized since they were smaller than network meshes. Water canals not developed. Parenchymal network of the dictyorhysoid type, formed by lychnisks, arranged very regularly, with subsquare meshes (0.24×0.3 mm or 0.36×0.33 mm). The morphology of the parenchymal network in stem is similar in character.

Cortical skeleton on the upper side (called by Schrammen, a diaphragm) is loose. In this network, octohoedric centres of lychnisks and horizontal beams form, over the entire surface of shield, characteristic fibrous strands, concentrically arranged. Cortex meshes, fairly regular, quadrangular, sometimes surrounded by slightly modified lychnisks. On the lower and marginal side, cortex is denser, reticulate and without concentric strands. Ostia surrounded by individualized network meshes.

*Remarks.* — Of all representatives of *C. deciminum,* previously described, the specimens under study have the smallest number of folds. According to Bieda (1933), a specimen which represented only a half of a sponge had 16 folds. Roemer (1841) counted 10 folds in the centre and 40 in the marginal zone, whereas Schrammen (1910—1912) found 40—60 folds situated near the margin of his specimens. On the whole, *C. deciminum* is, to the greatest extent, similar to *C. sulciferum* Roemer. The last-named species differs from *C. deciminum* in shape, more funnellike depression on shield and rounded margin.

*Occurrence.* — Poland: Bonarka, Lower Campanian, siliceous "opoka"; Witkowice, marls; Zbyczyce and Podgaj, clayey marl of Lower Campanian; Bibice, Mydlniki, Kobylany, Upper Campanian; Trojanowice, Emscherian. Germany: "Quadraten-Kreide" and "Mucronaten-Kreide" at Misburg, Oberg, Biewende, Althen, Vordorf, Henneberg and near Dolberg.

## Family **Sporadosciniidae** Schrammen, 1910—1912
## Genus *Sporadoscinia* Zittel, 1878
(Type species: *Scyphia decheni* Goldfuss, 1826)
## *Sporadoscinia micrommata* (Roemer, 1841)

1841. *Scyphia micrommata* Roemer; F. A. Roemer, Die Versteinerungen..., p. 7, Pl. 1, Fig. 4.
1877—78. *Sporadoscinia micrommata* (Roemer); K. Zittel, Studien..., I, p. 52.
1883. *Sporadoscinia micrommata* (Roemer); J. G. Hinde, Catalogue..., p. 116.
1910—92. *Sporadoscinia micrommata* (Roemer); A. Schrammen, Die Kieselspongien..., p. 281, Pl. 38, Figs. 5—6.
1919. *Sporadoscinia micrommata* (Roemer); Ph. D. O'Conriel, The Schrammen..., p. 179.
1933. *Sporadoscinia* cf. *micrommata* (Roemer); F. Bieda, Gąbki..., p. 30.

*Material.* — Six calcified specimens with a well-preserved morphology of outer surface; traces of lychnisks, as well as parenchymal and cortical networks fragmentarily preserved in three specimens.

Dimensions (in mm):

| | Height | Thickness of specimen | Thickness of | | |
|---|---|---|---|---|---|
| | | | base | stem | wall |
| Specimen UŁ Sp. III/250 | more than 100 | 70×42 | ca. 20 | 8 | 3—6 |

*Description.* — Stenoproct sponge in the form of a high cup; oscular margin destroyed, lower pole rounded, with a trace of a thin stem excentrically situated. Lateral walls, the thickest in the middle part, growing thinner and thinner upwards. Outer surface even or slightly transversely undulated. Ostia varying in size (0.55—1.2×0.5—0.6 mm), elliptical-oval, almost uniformly distributed over the entire surface. With their longer axis oriented transversely, ostia form rows in which the distances between pores amount to 0.18—0.5 mm, and sometimes even 0.75 mm. Postica 1.0—1.1 mm in diameter. Spongocoel deep, very similar in outline to a general shape of sponge.

Epi- and aporrhyses, alternately and vertically situated, display slight differences in width. Canals taper off towards the inside of sponge.

Parenchymal network dictyonal in character, smooth, with square and triangular meshes. Distance from lychnisk centres, measured on the imprints of these spicules, amounts to 0.24 mm, whereas in spicules etched out of the specimen (Uł Sp. III/143) — it equalls 0.4—0.45 mm. Cortical skeleton dense, with fine meshes occurring on both the outer surface and on the surface of spongocoel.

*Remarks.* — Morphologically the material studied is not very uniform. One of the specimens (UŁ Sp. III/250) has ostia larger (1.5×1.0 mm) than those in the remaining five and the spaces between these pores are narrower and projecting. In the lower part of this sponge, ostia are regularly arranged in almost straight rows, whereas, in the upper part, their arrangement is disturbed. This specimen is to the greatest extent similar to *S. micrommata,* figured by Schrammen (1910). Four specimens of *S. micrommata* display a similarity to those, described by Hinde (1883) but have thicker walls (3.0—6.0 vs. 1.0 mm), which — according to Hinde — is not important since his specimens might be secondarily compressed. The number of ostia per 100 sq mm in *S. micrommata* is not constant. In specimens, described by Bieda in 1933 from the environs of Cracow, there are 20—25 ostia over an area of 100 sq mm, whereas in those from Germany, described by Schrammen (1910—1912), one may count (on the Pl. 38) 33—42 of them and in my specimens there are 30—45 ostia.

One of the specimens under study (UŁ Sp. III/210) differs from *S. micrommata,* described above, in a different appearance of its outer surface. It displays a similarity to *S. teutoniae* Schrammen (1910) from which it differs in a less slender shape, larger thickness of walls (3.5 vs. 2—3 mm) and smaller ostia. In my specimen, the number of inhalant pores per 100 sq mm amounts to 58, and in *S. teutoniae* (according to Défretin-Lefranc) — to 48—50. Since this specimen (UŁ Sp. III/210) is more similar to *S. micrommata,* I assign it to the last-named species.

The number of ostia per 100 sq mm, that may be counted in Schrammen's (1910) Fig. 5, Pl. 38, displays a considerable deviation from those given by this author in the text of his work. In this illustration, there are 33—42 inhalant pores per 100 sq mm, and not 16—24 as quoted in the description.

*Occurrence.* — Poland: Bonarka, Witkowice, Lower Campanian; Rudawa, marly facies of the Upper Campanian. England: Upper Chalk. NW Germany: "Quadraten-" and "Mucronaten-Kreide".

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HELENA HURCEWICZ

# GĄBKI KRZEMIONKOWE Z GÓRNEJ KREDY POLSKI CZĘŚĆ II. MONAXONIA I TRIAXONIA*

*Streszczenie*

Praca niniejsza stanowi drugą część monograficznego opracowania górno-kredowych gąbek krzemionkowych Polski i obejmuje Monaxonia i Triaxonia. Opisano 45 gatunków, w tym 10 nowych należących do 24 rodzajów i 13 rodzin, pochodzących z litofacji marglistej kampanu Wyżyny Krakowskiej, Niecki Nidziańskiej i z mastrychtu w dolinie przełomu Wisły.

Charakterystykę kredy Niecki Nidziańskiej i okolic Krakowa podano w I części monografii (Hurcewicz, 1966, p. 17—20). Na odcinku od Puław do Józefowa margiel odsłonięty jest na obu brzegach doliny Wisły. Margiel ten jest typu opoki, zaliczanej przez Kongiela (1935) i Pożaryskiego (1938) do górnego mastrychtu. Według Pożaryskiego (1938), w Kazimierzu nad Wisłą i w Janowcu występuje lokalny poziom „x", zaś w Bochotnicy — poziom „y" mastrychtu.

Na materiale gąbek polskich udało się zaobserwować po raz pierwszy sposób ułożenia i charakter megasklerów u rodzaju *Reniera* Nardo, należącego do Monactinellida.

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* Część I: Tetraxonia — vide "*Acta Palaeontologica Polonica*" Vol. XI, No. 1, 1966.

Budowa opisanego tu *Euleraphe incrustans* Schrammen z dolnego kampanu Zbyczyc, mającego charakterystyczne cechy zgodne z opisem holotypu z malmu Niemiec (Schrammen, 1937), zaprzecza poglądowi Schrammena odnośnie pasożytniczego trybu życia wymienionego gatunku.

Spośród Monalithistida, gąbki należące do rodziny Verruculinidae Schrammen mają słabo zachowane rizoklony, bardzo dobrze zaś widoczną morfologię powierzchni zewnętrznej oraz niezmodyfikowane ostia i postika. Pozwoliło to wykazać różnice między gatunkami w obrębie rodzaju *Verruculina* Zittel, reprezentowanego w Polsce przez 7 gatunków.

Badania spikulacji parenchymalnej i dermalnej, jak również komitalii, nie pozwoliły rozstrzygnąć definitywnie przynależności grupy Rhizocladina do Monaxonia czy do Tetraxonia. Obecność kilku protrienów, znajdujących się na powierzchni zewnętrznej okazów (UŁ Sp. III/960, 1302) *Scytalia radiciformis*, nie przesądza przynależności Rhizocladina do Tetraxonia, gdyż wymienione spikule są obcego pochodzenia. Natomiast obecność typowych rizoklonów monokrepidalnych przemawia na korzyść jej przynależności do Monaxonia.

Rewizja diagnoz rodzin i rodzajów należących do Rhizocladina ujawniła przynależność: 1) rodzaju *Seliscothon* do Seliscothonidae Schrammen, a nie do Verruculinidae Schrammen, 2) rodzaju *Amphithelion* — do Amphithelionidae Schrammen, 3) rodzaju *Trachynotus* — do Chonellidae Schrammen.

W niniejszej rozprawie ustalono stanowisko systematyczne rodzaju *Bolidium* Zittel, dotychczas uważanego za *incertae sedis*. Opierając się na zbliżonej morfologii rizoklonów i sieci parenchymalnej oraz aparatu wodnego, zaliczono go do rodziny Jereicidae.

Liczne okazy pozwoliły wykazać różnice w morfologii, strukturze szkieletu oraz w budowie systemu wodnego pomiędzy zewnętrznie podobnymi rodzajami *Ventriculites* i *Rhizopoterion*. U przedstawicieli *Ventriculites* aporyzy i epiryzy są krótkie, ślepo zakończone, zaś u *Rhizopoterion* aporyzy są rurowate, o biegu skośnie longitudinalnym.

Wśród Triaxonia z górnego mastrychtu najliczniej występują przedstawiciele rodzaju *Aphrocallistes*. Bujny ich rozwój w mastrychcie górnym prowadził do zmian wzrostu, sposobu krzewienia się i innego położenia diafragmy w porównaniu z formami z kampanu Niemiec. W okolicach Kazimierza nad Wisłą, w mastrychcie (poziom „x") stwierdzono 4 nowe gatunki tego rodzaju.

Załączona tabela oraz mapki stanowisk gąbek w kampanie i mastrychcie przedstawiają geologiczne i geograficzne ich rozmieszczenie. Spośród Rhizocladina największy jakościowy i ilościowy rozwój wykazują rodzaje *Verruculina, Seliscothon* i *Scytalia*. Zasiedliły one w kampanie dolnym rozległe obszary, zazębiające się ze sobą. Najliczniejsze nagromadzenie przedstawicieli rodzaju *Verruculina* w Zbyczycach świadczy, że ośrodek ich rozwoju znajdował się w tych okolicach, natomiast krańce jego sięgały na południe po Kraków (Bonarka i Witkowice) oraz na północ za Skrajniwę. Obecność wspólnych dla Polski i NW Niemiec gatunków *V. tenuis* Roemer i *V. cupula* Schrammen wskazuje na rozległość areału.

Zdaniem autorki, niektóre rodzaje gąbek, np. *Verruculina* i *Scytalia*, mają

pewne znaczenie stratygraficzne. Spośród *Verruculina* najstarszym geologicznie jest *V. seriatopora* (Roemer), znany z aptu Hiszpanii (Lagneau-Hérenger, 1962) i z NW Niemiec, oraz *V. tenuis* (Roemer) — tylko z aptu Hiszpanii. W turonie *Verruculina* reprezentowana jest przez *V. seriatopora* (Roemer), *V. milliaris* Reuss, *V. damaecornis* (Roemer) i *V. tenuis* (Roemer). Bujny rozwój tego rodzaju zaznacza się w emszerze Francji. W Polsce, w kampanie dolnym znanych jest siedem gatunków. W kampanie górnym obserwuje się schyłek rozwoju *Verruculina*, o czym świadczy obecność ich tylko w NW Niemczech. Drugim rodzajem o szerokim rozprzestrzenieniu geologiczno-geograficznym jest *Scytalia*. Z aptu Hiszpanii znane są *S. turbinata* (Roemer) i *S. radiciformis* (Phillips), które w senonie wykazują najszersze geograficzne rozmieszczenie. W Polsce rodzaj ten jest znany z kampanu dolnego.

Spośród Triaxonia zwraca uwagę *Paracraticularia fittoni* (Mantell), liczna w utworach środkowej i górnej kredy Francji, Niemiec i Anglii, zaś w Polsce — w mastrychcie górnym.

*Aphrocallistes alveolites* (Roemer) występuje zarówno na wschodzie, jak i na zachodzie Europy. Najstarsze jego stanowisko datuje się z emszeru Z.S.R.R. Od kampanu zaznacza się rozprzestrzenianie ku zachodowi, na co wskazuje jego obecność w Polsce, Niemczech (Rugia), Anglii i Francji. W Europie zachodniej, spośród Lychniscosa, *Ventriculites radiatus* występuje od aptu po mastrycht. Gatunek ten szczególnie licznie reprezentowany jest w cenomanie, turonie i emszerze Francji, oraz w kampanie NW Niemiec i Polski.

Różnice w składzie gatunkowym zespołów fauny gąbkowej Polski oraz zmienne kształty w obrębie niektórych gatunków, od płasko miskowatych do uchokształtnych, pozwalają przypuszczać, że gąbki rozwijały się w rozmaitych warunkach ekologicznych. Różnice kształtów w obrębie gatunku można, zgodnie z obserwacjami Lagneau-Hérenger (1962), tłumaczyć osiedlaniem się gąbek na dnie pochyłym. Obecność niektórych mikrosklerów, a szczególnie sterrasterów i mikroksów w okazach gąbek, jak również stan zachowania ich korteksu, oraz znajdowane gąbki z grupy Monactinellida o luźnych spikulach, sugerują, że wody ówczesnego morza kampanu dolnego były spokojne. Przypuszczenie to potwierdza również obecność wkładek pelitowych margli w Pniakach i Zbyczycach.

Znaczna przewaga rodzajowa i ilościowa zespołu fauny gąbkowej kampanu dolnego w stosunku do kampanu górnego sugeruje zmianę warunków ekologicznych, związanych prawdopodobnie z wynurzaniem się lądu. Ponowny bujny rozwój gąbek na terenie Polski zaznacza się głównie w mastrychcie górnym.

## DIAGNOZY NOWYCH GATUNKÓW

### *Reniera munda* n.sp.
(Pl. I, Fig. 1)

*Reniera* złożona z osobników stożkowatych, skupionych na wspólnej podstawie. Ścianki poszczególnych osobników cienkie, zawierające warstwę parenchymalnych, masywnych strongyli oraz liczne oksy. Jama paragastralna stosunkowo obszerna,

zwężająca się ku oskulum. Oskulum nieduże, otoczone długimi monaksonami marginalnymi.

*Verruculina abnormis* n.sp.
(Pl. VIII, Fig. 2; Text-fig. 6)

*Verruculina* w kształcie odwróconego wysokiego stożka, z równą, owalną płaszczyzną apeksu, pokrytą szerokimi postikami. Ostia małe, rozmieszczone na bocznej powierzchni. Aporyzy rurkowate, longitudinalne.

*Stichophyma pumiliformis* n.sp.
(Pl. V, Fig. 2)

*Stichophyma* w postaci odwróconego stożka, mającego amblyproktową część górną lekko wklęsłą. Postika brodawkowate, ostia nie są wyodrębnione. Sieć parenchymalna fibroidalna, złożona z rizoklonów kolczastych.

*Coelocorypha bulbosa* n.sp.
(Pl. II, Figs. 4, 5)

*Coelocorypha* o charakterystycznym kształcie bulwiastym. Jama paragastralna wąska, rurowata, z oskulum położonym na szczycie. Ostia nie wyodrębnione. System ekshalacyjny rozwinięty silniej niż inhalacyjny. Aporyzy zmiennej szerokości, kręte i równoległe do szczytu. Szkielet gęsty, złożony z małych, ciernistych rizoklonów.

*Bolidium arbustum* n.sp.
(Pl. X, Figs. 1—4; Text-fig. 11)

*Bolidium* krzaczaste, nieregularnie rozgałęzione. Ostia nie są wyodrębnione, prosopyle w kształcie nieregularnych wieloboków. Postika skupione na szczycie gałązek. Rizoklony silnie kolczaste.

*Aphrocallistes kazimierzensis* n.sp.
(Pl. XV, Figs. 1, 2; Text-fig. 14)

*Aphrocallistes* pucharowaty, z palczastymi wyrostkami zmiennej długości, utworzonymi wskutek nierównomiernego wypuklania się ścianki bocznej; wyrostki wewnątrz puste. Powierzchnia ścianki gastralnej (zwana diafragmą) sitowata, pokryta wielokątnymi postikami nieregularnie rozmieszczonymi. Zarys jamy paragastralnej w przekroju poprzecznym jest wielokątny.

*Aphrocallistes bochotnicensis* n.sp.
(Pl. XVI, Figs. 1, 2; Text-fig. 15)

*Aphrocallistes* rozgałęziający się, złożony z krótkich, cylindrycznych odgałęzień, mających wyrostki boczne silnie spłaszczone i rozmieszczone okółkowo. Wyrostki wewnątrz puste, odgraniczone cienką diafragmą. Ostia gęsto skupione.

*Aphrocallistes mammillaris* n.sp.
(Pl. XVI, Fig. 3)

*Aphrocallistes* nieregularnego kształtu, o niedużych, zaokrąglonych wyrostkach, z pojedynczym małym oskulum, położonym na szczycie. Ścianki grubości 1—2 mm.

*Aphrocallistes vistulae* n.sp.
(Pl. XVII, Fig. 1)

*Aphrocallistes* dzielący się dichotomicznie na krótkie, rurkowate gałązki jednakowej średnicy. Ścianki 3—4 mm grubości, diafragmy brak.

*Rhizopoterion coniforme* n.sp.
(Pl. XXI, Fig. 3; Text-fig. 17)

*Rhizopoterion* w kształcie wysmukłego stożka, z obszerną jamą paragastralną, o powierzchni zewnętrznej regularnie żeberkowanej. Ostia wydłużone; aporyzy rurkowate, pionowe, anastomozujące, otoczone siecią trabekularną. W sieci parenchymalnej lichniski tworzą włóknistą pionową strukturę.

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ГЕЛЕНА ГУРЦЕВИЧ

## ВЕРХНЕМЕЛОВЫЕ КРЕМНЕВЫЕ ГУБКИ ПОЛЬШИ ЧАСТЬ II. MONAXONIA И TRIAXONIA*

*Резюме*

Настоящая работа является второй частью монографического изучения верхнемеловых кремневых губок Польши и касается Monaxonia и Triaxonia. Описано 45 видов, в этом 10 новых, принадлежащих к 24 родам и 13 семействам. Изученный материал происходит из кампанской мергелистой литофации Краковской возвышенности, Нидзянской мульды, а также из маастрихта в долине перелома Вислы.

Характеристику верхнемеловых отложений Нидзянской мульды и окрестностей Кракова приведено в I части монографии (Hurcewicz, 1966, стр. 17—20). В полосе между Пулавами и Юзэфовом по обоим берегам Вислы находятся обнажения мергеля типа опоки, причисляемой Конгелем (Kongiel, 1935) и Пожарыским (Pożaryski, 1938) к верхнему маастрихту. По мнению Пожарыского, в Казимержу над Вислой и в Яновцу находится локальный горизонт „x", а в Бохотницы — горизонт „y" маастрихта.

На материале польских губок удалось впервые проследить способ расположения и характер мегасклер у рода *Reniera* Nardo, принадлежащего к Monactinellida.

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* Часть I: Tetraxonia — см. „*Acta Palaeontologica Polonica*" T. XI, № I, 1966.

Строение описанного тут *Euleraphe incrustans* Schrammen из нижнего кампана Збычиц, имеющего характерные черты сходные с описанием голотипа из мальма Германии (Schrammen, 1937), противоречит взгляду Шраммена относительно паразитического образа жизни этого вида.

Среди Monalithistida, губки принадлежащие к семейству Verruculinidae Schrammen имеют слабо сохраненные ризоклоны, но очень хорошо заметную морфологию наружной поверхности и немодифицированные остии и постики. Разрешило это установить разницы между видами в пределах рода *Verruculina* Zittel, представленного в Польше 7 видами.

Исследования паренхимальной и дермальной спикулации, а также комиталий, не позволили окончательно решить вопроса касающегося принадлежности группы Rhizocladina к Monaxonia или же Tetraxonia. Присутствие нескольких протриенов на наружной поверхности образцов *Scytalia radiciformis* не позволило решить вопроса о принадлежности Rhizocladina к Tetraxonia, так как эти спикулы являются вероятно постороннего происхождения. А присутствие типичных монокрепидных ризоклонов указывает на принадлежность этой группы к Monaxonia.

Ревизия диагноз семейств и родов в пределах Rhizocladina обнаружила принадлежность: 1) рода *Seliscothon* к Seliscothonidae Schrammen, а не к Verruculinidae Schrammen, 2) рода *Amphithelion* к Amphithelionidae Schrammen, 3) рода *Trachynotus* к Chonellidae Schrammen.

В настоящей работе установлено систематическую позицию рода *Bolidium* Zittel, до сих пор считаемого как *incertae sedis*. На основании сходной морфологии ризоклонов и паренхимальной решетки, а также водного аппарата, род этот причислено к семейству Jereicidae.

Многочисленные образцы позволили обнаружить различия в морфологии, в структуре скелета и в строении водной системы между внешне похожими родами *Ventriculites* и *Rhizopoterion*. У представителей *Ventriculites* апоризы и эпиризы короткие, слепо законченные, а у *Rhizopoterion* апоризы трубчатые, о косо продольном направлении.

Среди верхнемаастрихтских Triaxonia, наиболее многочислены представители рода *Aphrocallistes*. Обильное их развитие в верхнем маастрихте вызывало смену возраста, способа их разветвления и иного положения диафрагмы по сравнению с кампанскими формами Германии. В окрестностях Казимержа, в маастрихте (горизонт „x") констатировано 4 новых вида этого рода.

Прилагаемая таблица и карты размещения губок в кампане и маастрихте представляют их геологическое и географическое распространение. Среди Rhizocladina самое большое качественное и количественное развитие проявляют роды *Verruculina, Seliscothon* и *Scytalia*. Заселили они в нижнем кампане широкие пространства, смыкающиеся с собой. Наиболее обильные накопления представителей рода *Verruculina* в Збычицах свидетельствуют, что центр их развития находился в этих местах, а его края протягивались к югу по Краков (Бонарка и Витковице) и к северу за Скрайниву. Присутствие совместных для

Польши и северо-западной Германии видов *V. tenuis* Roemer и *V. cupula* Schrammen свидетельствует о широком ареале их распространения.

По мнению автора, некоторые роды губок (напр. *Verruculina, Scytalia*) имеют несомненно стратиграфическое значение. Среди *Verruculina* наиболее древним, в геологическом смысле, является *V. seriatopora* (Roemer), вид известный из апта Испании (Lagneau-Hérenger, 1962) и из северо-западной Германии, а также *V. tenuis* (Roemer), выступающий в апте Испании. В туроне *Verruculina* представлена видами *V. seriatopora* (Roemer), *V. miliaris* Reuss, *V. damaecornis* (Roemer) и *V. tenuis* (Roemer). Обильное развитие этого рода отмечается в эмшере Франции. В Польше, в нижнем кампане, известных 7 видов. В верхнем кампане наблюдается регрес развития *Verruculina*, о чем свидетельствует их присутствие только в северо-западной Германии. Следующим родом о широком геолого-географическом распространении является *Scytalia*. Из апта Испании известны *S. turbinata* (Roemer) и *S. radiciformis* (Phillips), которые в сеноне имеют наиболее широкое географическое распространение. В Польше этот род известен из нижнего кампана.

Среди Triaxonia обращает внимание *Paracraticularia fittoni* (Mantell), обильная в средне- и верхнемеловых отложениях Франции, Германии и Англии, а в Польше известна в верхнем маастрихте.

*Aphrocallistes alveolites* (Roemer) известен в западной и востойной Европе. Наиболее древнее его появление известно из эмшера СССР. Начиная от кампана намечается его распространение к западу, о чем свидетельствует присутствие этого вида в Польше, Германии (Ругия), Англии и Франции. В западной Европе, среди Lychniscosa, *Ventriculites radiatus* выступает от апта по маастрихт. Этот вид представлен особенно обильно в сеномане, туроне и эмшере Франции, а также в кампане северо-западной Германии и Польши.

Различия в видовом составе сообществ губок Польши, а также разнообразие форм в пределах некоторых видов, от плоско-кубковидных к ухообразным, позволяют предполагать, что губки обитали в разных экологических условиях. Разнообразие форм в пределах вида можно объяснить, согласно с наблюдениями Lagneau-Hérenger (1962), тем, что обитали они на покатом дне водоема. Присутствие некоторых микросклеров, а особенно стеррастеров и микроксов в образцах губок, сохранность их кортекса, а также присутствие губок из группы Monactinellida о несвязанных спикулах, позволяют предполагать, что воды нижнекампанского бассейна были спокойные. Присутствие прослоек пелитовых мергелей в Пняках и Збычицах также свидетельствует в пользу такого предположения.

Значительное родовое и видовое преимущество сообщества нижнекампанских губок по отношению к верхнекампанским может свидетельствовать о смене экологических условий, вызванных поднятием материка. Обильное развитие губок на территории Польши вновь намечается главным образом в верхнем маастрихте.

## ДИАГНОЗЫ НОВЫХ ВИДОВ

*Reniera munda* n. sp.
(Пл. I, фиг. 1)

*Reniera* состоящая из конусовидных особей, скопленных на общей основе. Стенки отдельных особей тонкие, со слоем паренхимальных, массивных стронгилий и многочисленных оксов. Парагастральная полость довольно обширная, суживается по направлению к оскулюм. Оскулюм небольшое, окруженное длинными маргинальными монаксонами.

*Verruculina abnormis* n. sp.
(Пл. VIII, фиг. 2; текст — фиг. 6)

*Verruculina* в виде обратного высокого конуса, с ровной, овальной плоскостью апекса, покрытой широкими постиками. Остии малые, расположенные на боковой поверхности. Апоризы трубчатые, удлиненные.

*Stichophyma pumiliformis* n. sp.
(Пл. V, фиг. 2)

*Stichophyma* в виде обратного конуса, со слегка вогнутой амблипроктовой верхней частью. Постики бугорчатые, остии необособленные. Паренхимальная решетка фиброидальная, построена с шипообразных ризоклонов.

*Coelocorypha bulbosa* n. sp.
(Пл. II, фиг. 4, 5)

*Coelocorypha* характерной, клубневидной формы. Парагастральная полость узкая, трубчатая, с оскулюм расположенном на верхушке. Остии необособленные. Эксгаляционная система развита сильнее чем ингаляционная. Апоризы изменчивой ширины, извилистые и параллельные к вершине. Скелет густой, построен из малых, тернистых ризоклонов.

*Bolidium arbustum* n. sp.
(Пл. X, фиг. 1—4; текст — фиг. 11)

*Bolidium* кустовидное, нерегулярно разветвленное. Остии необособленные, прозопилы в виде нерегулярных многоугольников. Постики скоплены на вершине ветвей. Ризоклоны сильно кольчатые.

*Aphrocallistes kazimierzensis* n. sp.
(Пл. XV, фиг. 1, 2; текст — фиг. 14)

*Aphrocallistes* кубкообразный, с пальчатыми выростами, разной длины, образованными в результате неравномерного вздутия боковой стенки; выросты внутри пустые. Поверхность гастральной стенки (диафрагмы) ситовидно пористая, покрыта многоугольными постиками, расположенными нерегулярно. Контур парагастральной полости в поперечном сечении многоугольный.

*Aphrocallistes bochotnicensis* n. sp.
(Пл. XVI, фиг. 1, 2; текст — фиг. 15)

*Aphrocallistes* разветвленный, построен из коротких, цилиндрических ветвей, имеющих боковые выросты сильно сплющенные; выросты эти образуют венец вокруг ветви на подобие мутовки. Выросты внутри пустые, отделены тоненькой диафрагмой. Остии густо накоплены.

*Aphrocallistes mammillaris* n. sp.
(Пл. XVI, фиг. 3)

*Aphrocallistes* нерегулярный, с небольшими, закругленными выростами, с единичным малым оскулюм расположенном на верхушке. Толщина стенок 1—2 мм.

*Aphrocallistes vistulae* n. sp.
(Пл. XVII, фиг. 1)

*Aphrocallistes* дихотомически делящийся на короткие, трубчатые ветви одинакового диаметра. Стенки толщиной 1—2 мм, диафрагма отсутствует.

*Rhizopoterion coniforme* n. sp.
(Пл. XXI, фиг. 3; текст — фиг. 17)

*Rhizopoterion* в виде тонкого конуса, с просторной парагастральной полостью, о внешней поверхности регулярно ребристой. Остии удлиненные, апоризы трубчатые, вертикальные, анастомозирующие, окруженные трабекуларной решеткой. В паренхимальной решетке лихниски образуют волокнистую вертикальную структуру.

# PLATES

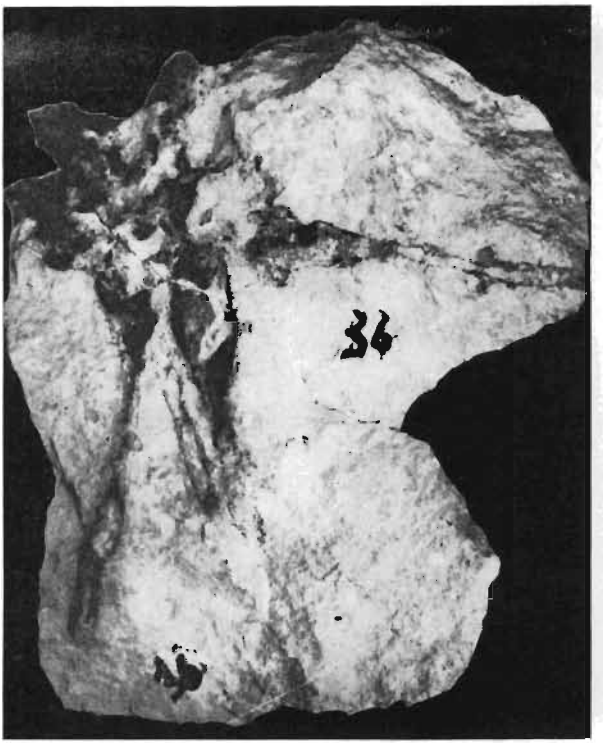
## Plate I

*Reniera munda* n.sp.
(Kazimierz, Upper Maastrichtian)

Fig. 1*a*. Fragment of bulbous cluster (Z. Pal. UŁ Sp. III/1136); ×1.

Fig. 1*b*. Single individual with bundle of monaxone marginalia around osculum, holotype; ×2.

Fig. 1c. Fragment of parenchymal skeleton with strongyles preserved *in situ*; ×30.



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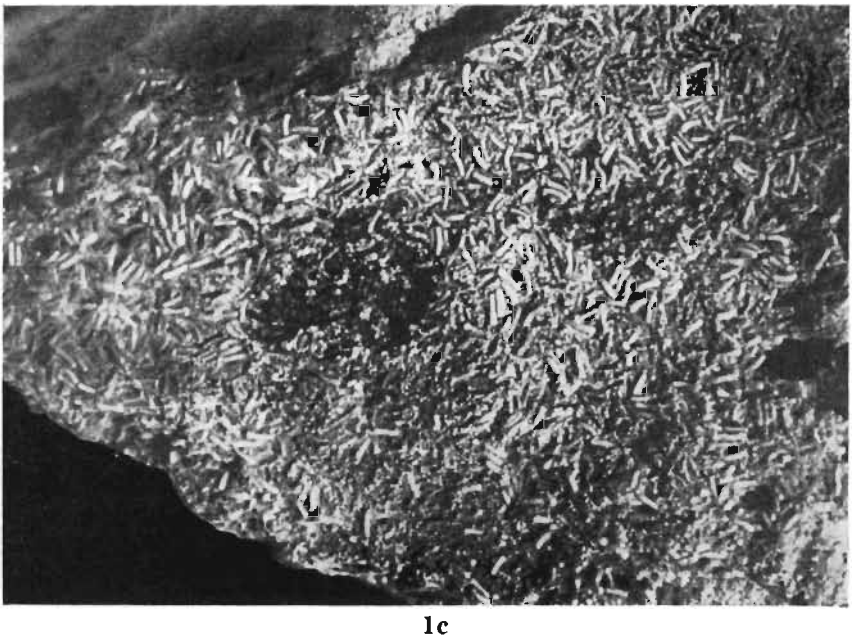
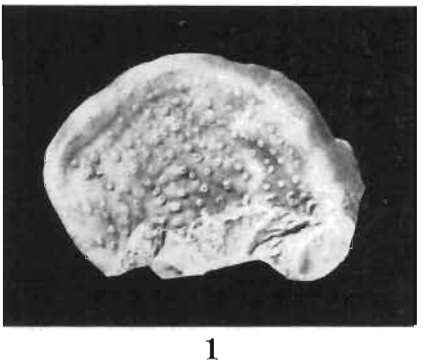


1c

4

5

3b



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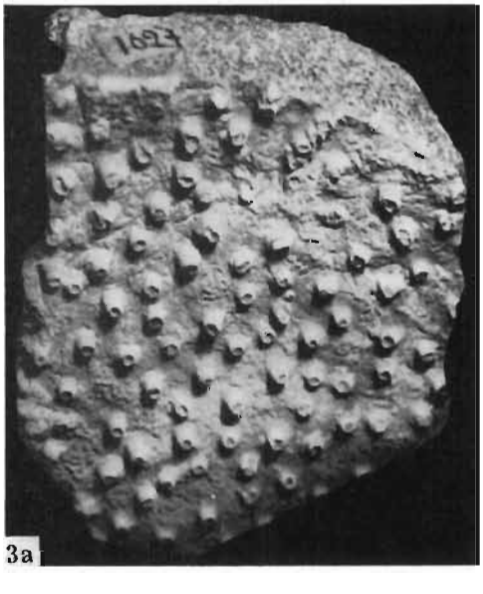

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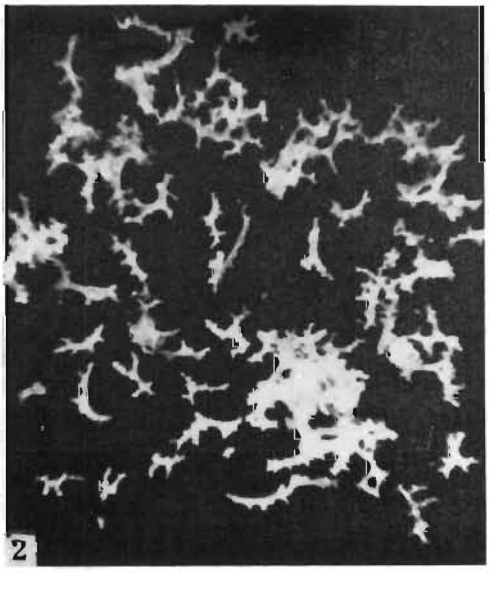


2

## Plate II

*Verruculina seriatopora* (Roemer)
(Zbyczyce, Lower Campanian)

Fig. 1. Exhalant surface (Z. Pal. UŁ Sp. III/1629); ×1.

Fig. 2. Rhizoclones isolated out of parenchymal network (Z. Pal. UŁ Sp. III/110); ×30.

*Verruculina reussi* (M'Coy)
(Pniaki, Lower Campanian)

Fig. 3*a*. Fragment of exhalant surface with postica (Z. Pal. UŁ Sp. III/1627); ×1.

Fig. 3*b*. Fragment of inhalant surface with ostia; ×1.

*Coelocorypha bulbosa* n.sp.

Fig. 4. Side view, holotype. Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/1197); ×1.

Fig. 5. Top view, paratype. Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1658); ×1.

## Plate III

*Verruculina reussi* (M'Coy)
(Pniaki, Lower Campanian)

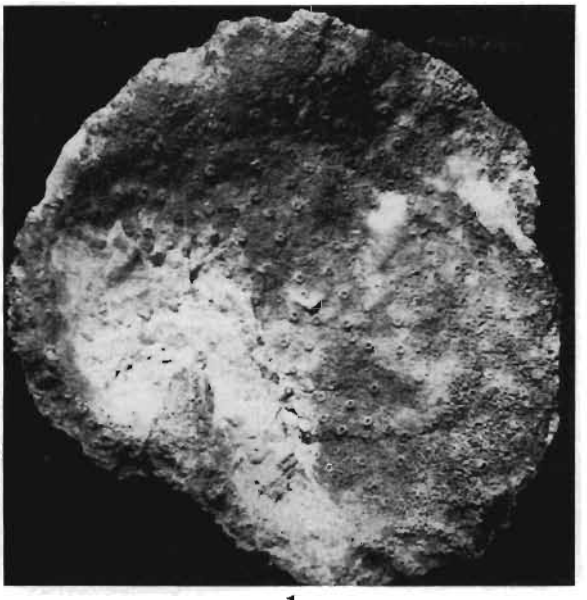
Fig. 1. Complete specimen, view of exhalant surface (Z. Pal. UŁ Sp. III/1487); ×0.5.

Fig. 2*a*. Fragment of parenchymal network (Z. Pal. UŁ Sp. III/106); ×10.

Fig. 2*b*. Rhizoclones isolated out of parenchymal network; ×30.

Fig. 3. *Verruculina* cf. *damaecornis* (Roemer), marginal processes, view of inhalant side. Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/1504); ×1.

Fig. 4. *Scytalia* sp. Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/329); ×1.



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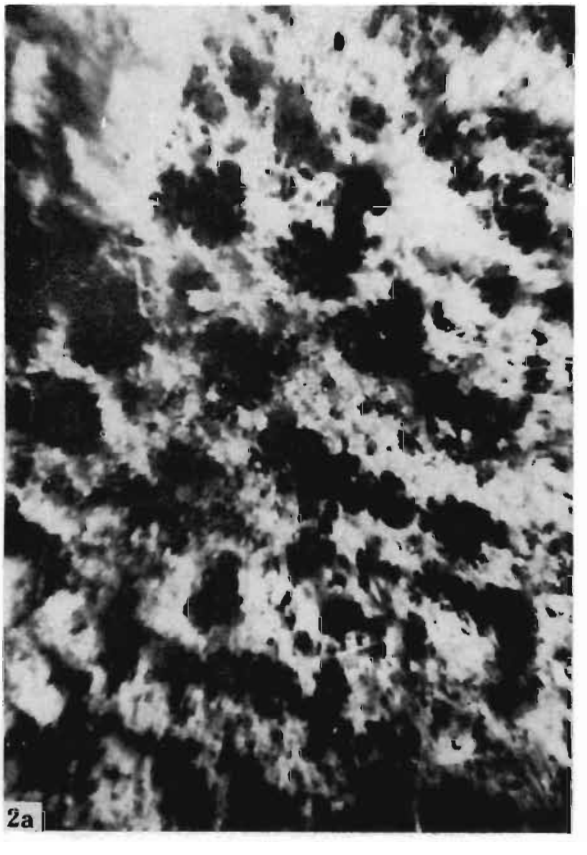
4

3



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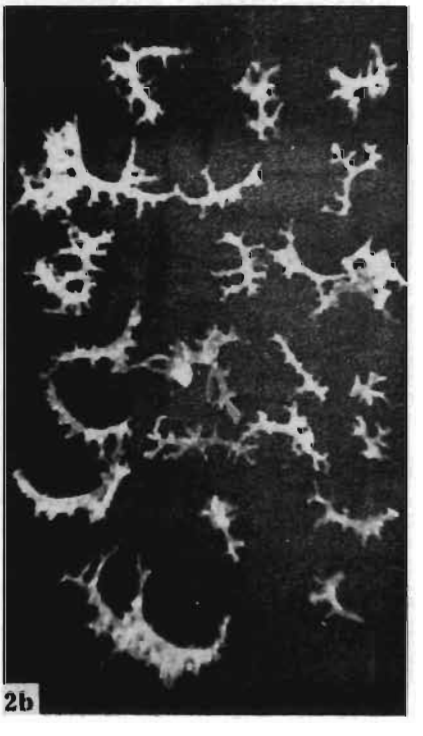

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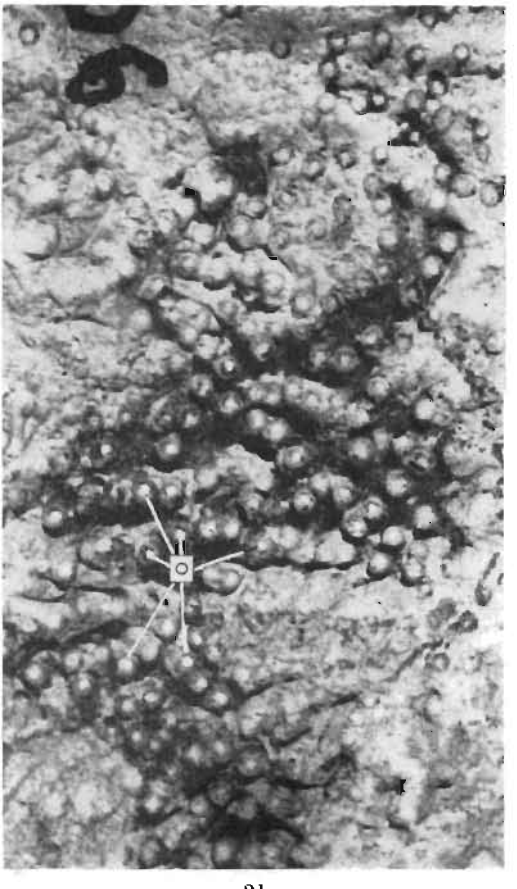

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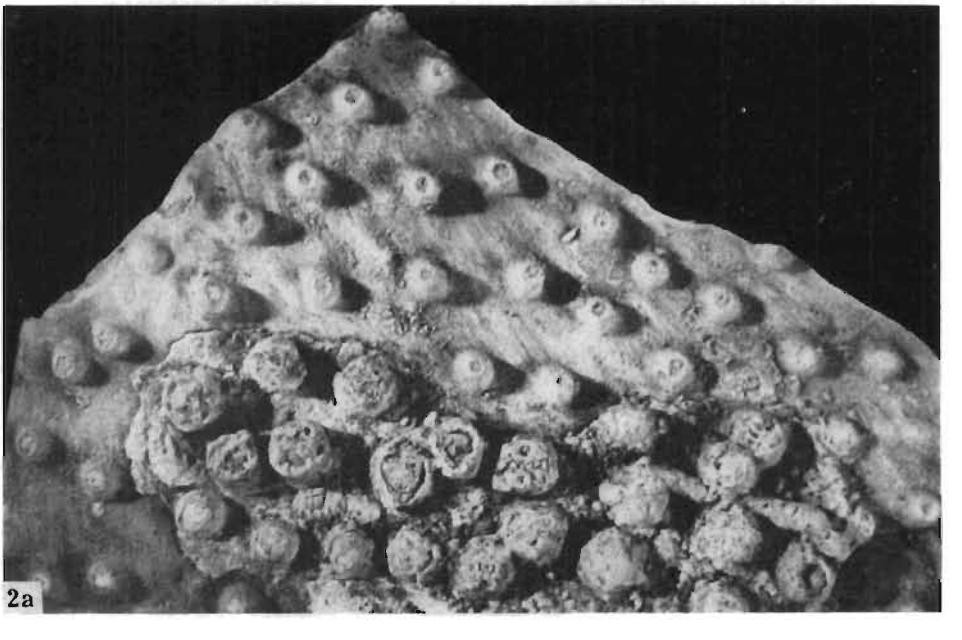


2a

Plate IV

*Verruculina miliaris* (Reuss)
(Zbyczyce, Lower Campanian)

Fig. 1. Fragment of a specimen with marginal edge torn off (Z. Pal. UŁ Sp. III/912); ×1.

Fig. 2*a*. Fragment of exhalant surface (Z. Pal. UŁ Sp. III/905); ×7.

Fig. 2*b*. Fragment of inhalant surface, *o* ostia arranged in short rows; ×7.

Fig. 3. *Seliscothon verrucosum* Schrammen. Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/770); ×1.

## Plate V

*Verruculina cupula* Schrammen
(Skrajniwa, Lower Campanian)

Fig. 1*a*. Complete specimen (Z. Pal. UŁ Sp. III/1141); ×1.

Fig. 1*b*. Fragment of inhalant surface; ×10.

Fig. 1*c*. Fragment of exhalant surface, *p* postica on warty elevations, *v* vacuities in places of damaged elevations; ×10.

*Stichophyma pumiliformis* n.sp.
(Podgaj, Lower Campanian)

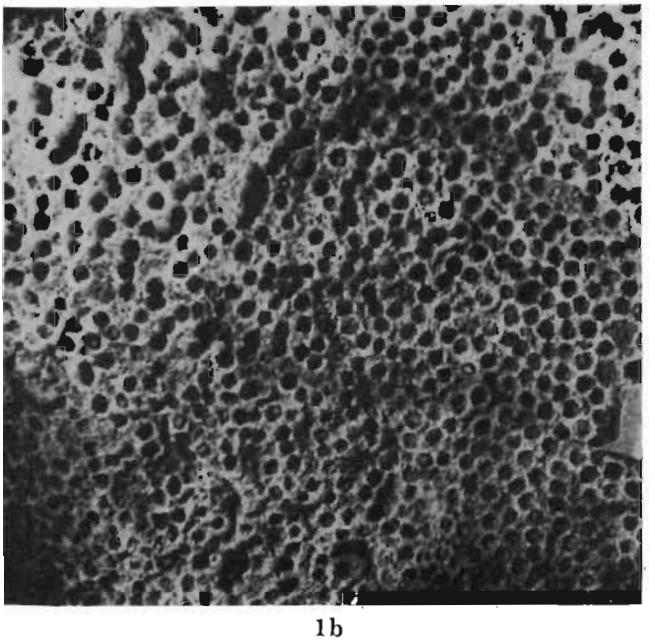
Fig. 2*a*. View of inhalant side, holotype (Z. Pal. UŁ Sp. III/747); ×1.

Fig. 2*b*. View of upper (= exhalant) side; ×1.

Fig. 3. *Seliscothon verrucosum* Schrammen: microxeas, amphioxeas and microstyles (Z. Pal. UŁ Sp. III/770); ×30.

3

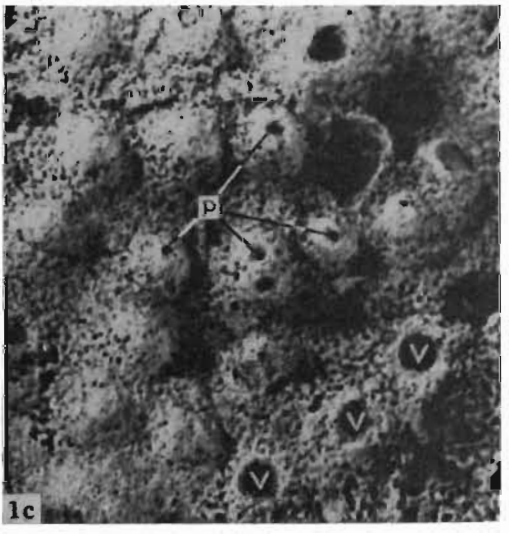
2b



1b

2a

1a

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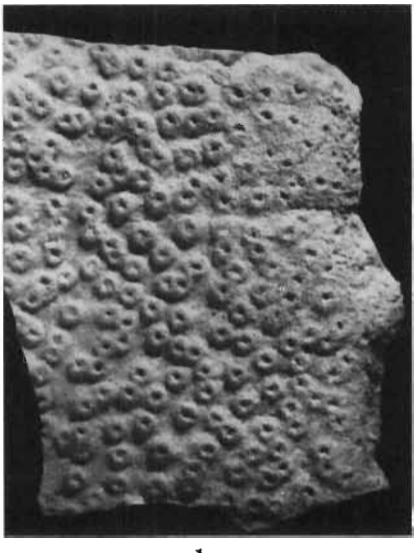

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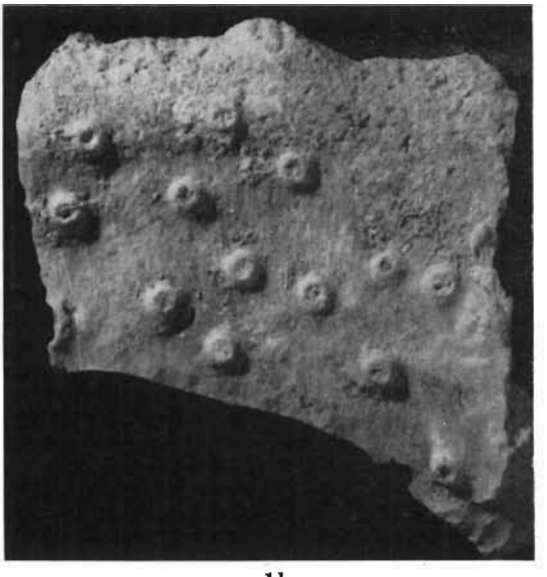

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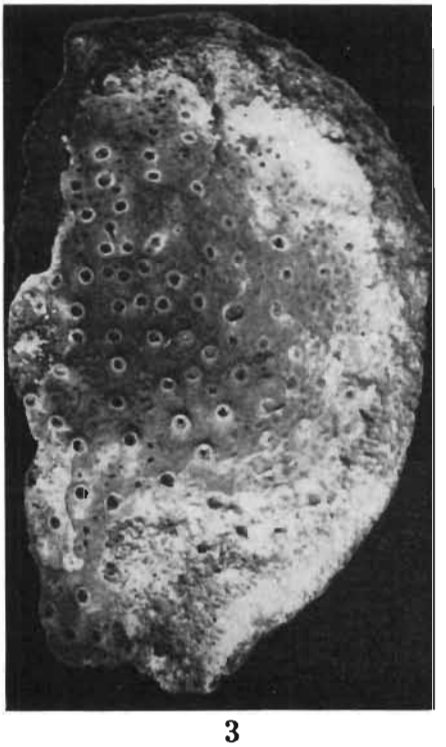


3

## Plate VI

*Verruculina tenuis* (Roemer)
(Zbyczyce, Lower Campanian)

Fig. 1*a*. Fragment of inhalant surface (Z. Pal. UŁ Sp. III/746); ×4.

Fig. 1*b*. Fragment of exhalant surface; ×4.

Fig. 2. *Verruculina seriatopora* (Roemer): fragment of parenchymal network, Muniakowice, Lower Maastrichtian (Z. Pal. UŁ Sp. III/110); ×30.

Fig. 3. *Amphithelion macrommata* (Roemer): fragment of calycal part with postica. Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1047); ×1.

Plate VII

*Seliscothon planum* (Phillips)
(Miechów, Upper Campanian)

Fig. 1. Nearly complete specimen (Z. Pal. UŁ Sp. III/993); ×1.

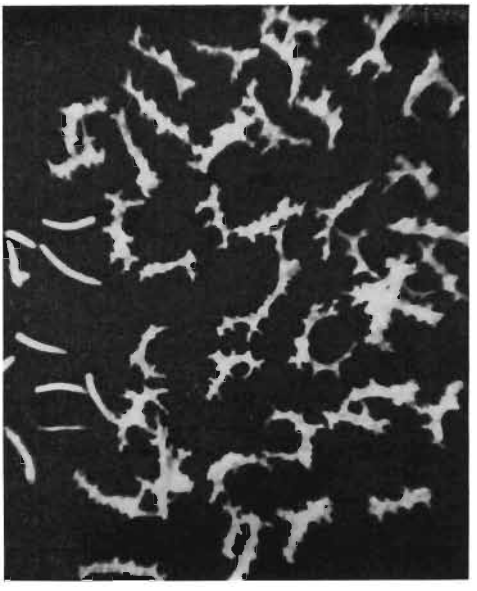
Fig. 2. Longitudinal section through the wall of upper part, with strandlike arrangement of network (Z. Pal. UŁ Sp. III/910); ×2.

Fig. 3*a*. Inhalant surface of platelike wall, exposed after destroying of cortex. Strandlike arrangement of parenchymal skeleton visible. Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1139); ×1.

Fig. 3*b*. Preserved pleural spicules (oxeas and amphioxeas) on exhalant surface; ×30.

Fig. 4. Parenchymal spicules (rhizoclones and microstyle). Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/99/58b); ×30.

Fig. 5. *Verruculina miliaris* (Reuss). Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/913); ×1.



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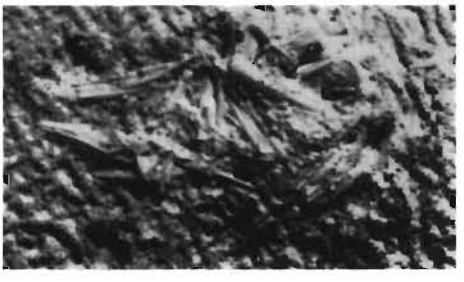

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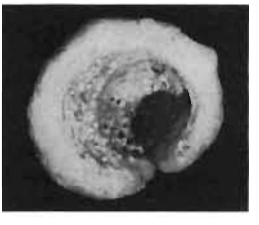

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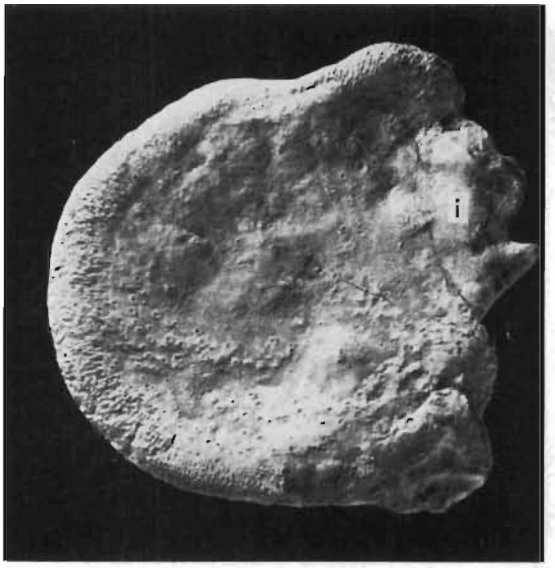


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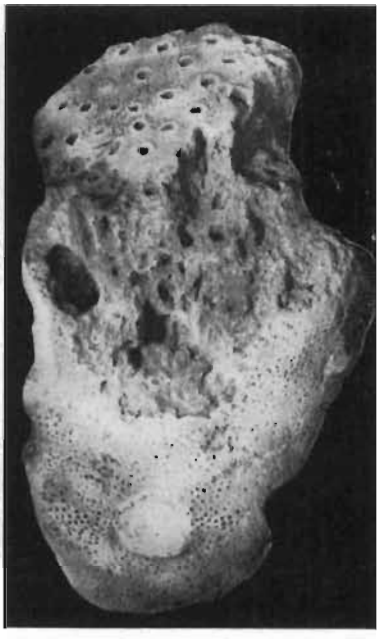

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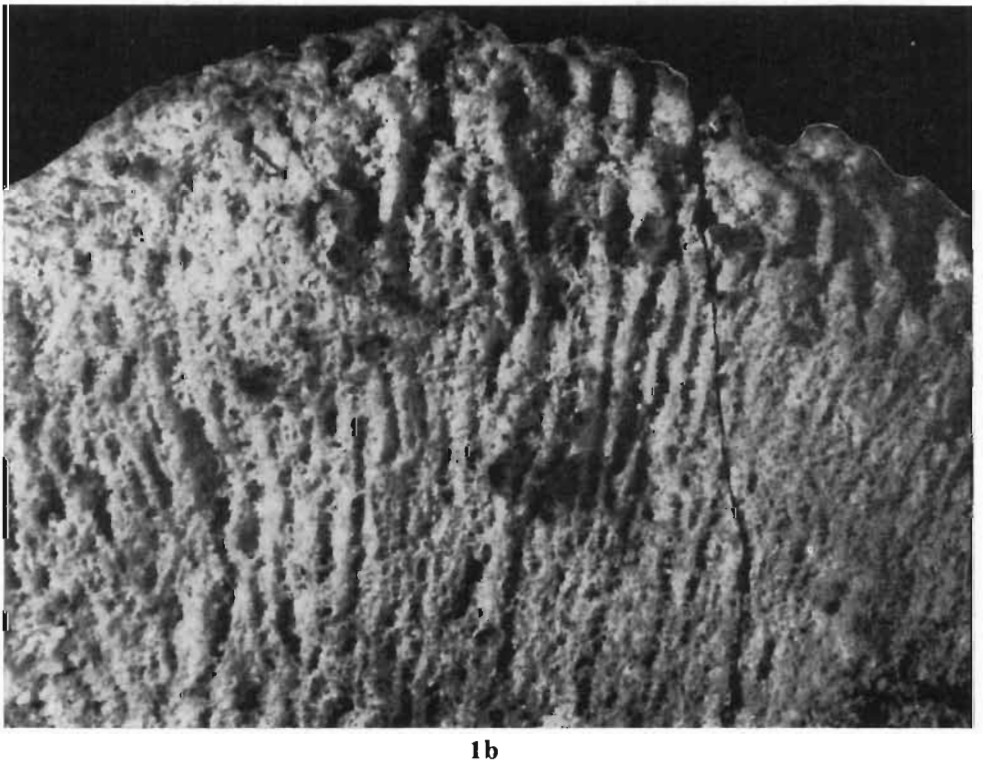


1b

Plate VIII

*Seliscothon verrucosum* Schrammen
(Zbyczyce, Lower Campanian)

Fig. 1*a*. View of exhalant side, *i* incrusting sponge *Euleraphe incrustans* Schrammen (Z. Pal. UŁ Sp. III/992); ×1.

Fig. 1*b*. Fragments of outer surface with damaged cortex; ×10.

Fig. 2. *Verruculina abnormis* n.sp., holotype. Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/361); ×1.

## Plate IX

*Jereica polystoma* Zittel
(Przesławice, Lower Campanian)

Fig. 1*a*. Side view (Z. Pal. UŁ Sp. III/51); ×1.

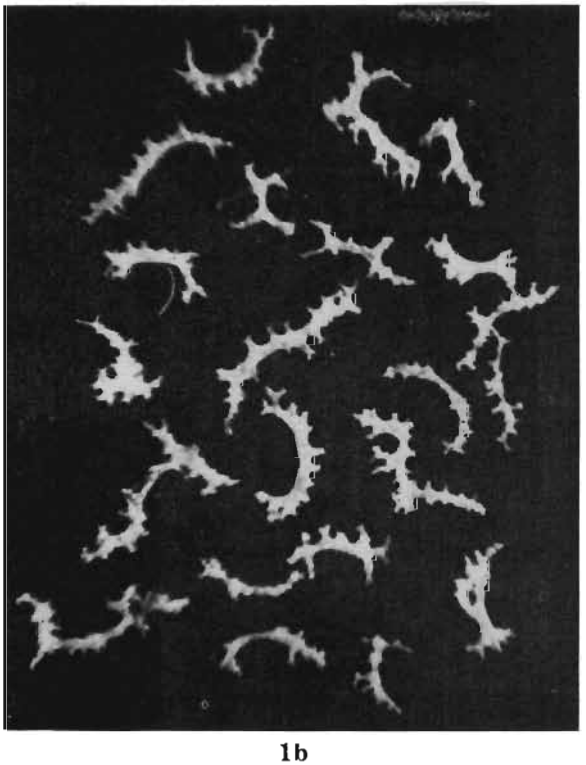
Fig. 1*b*. Rhizoclones isolated from parenchymal network; ×30.

Fig. 1*c*. Fibroidal arrangement of parenchymal network; ×10.

*Stichophyma turbinatum* (Roemer)
(Skrajniwa, Lower Campanian)

Fig. 2. Complete specimen (Z. Pal. UŁ Sp. III/1198); ×1.

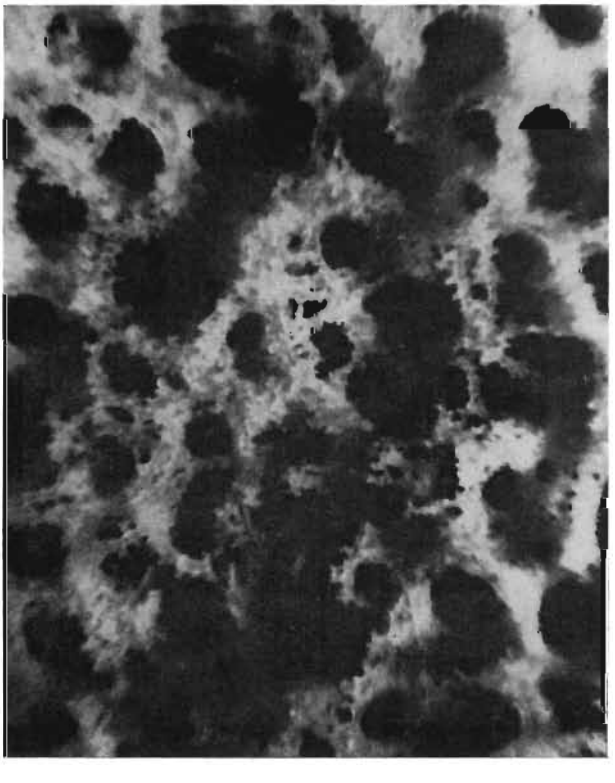
Fig. 3. View of apex (Z. Pal. UŁ Sp. III/689); ×1.



1b

1a

2



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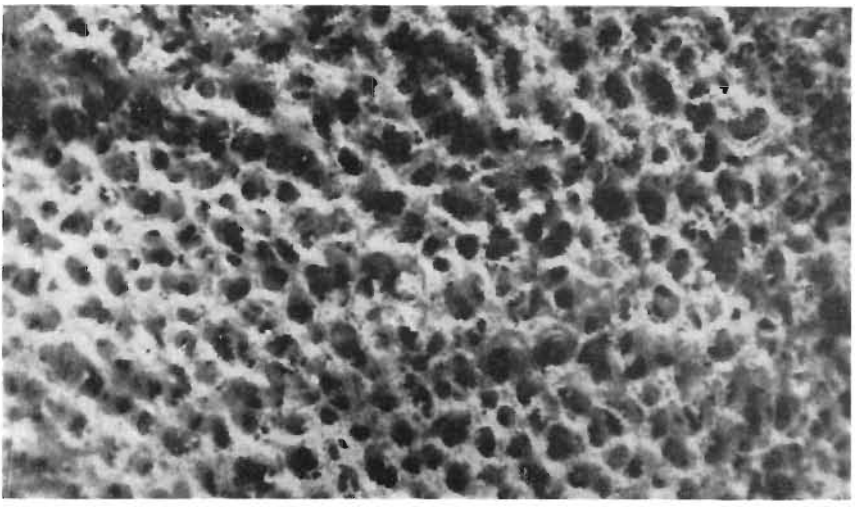


4b

1

4a

2

3

5

4c

## Plate X

*Bolidium arbustum* n.sp.
(Zbyczyce, Lower Campanian)

Figs. 1—4*a*. Branching fragments of different specimens: *1* paratype, *4a* holotype (Z. Pal. UŁ Sp. III/1547, 750, 999); ×1.

Fig. 4*b*. Structure of network unmodified and morphology of outer surface around developing bud (Z. Pal. UŁ Sp. III/999); ×10.

Fig. 4*c*. Parenchymal network *in situ*, nearby the bud; ×3.

Fig. 5. *Jereica* sp. Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/1513); ×1.

Plate XI

*Trachynotus auriculus* Schrammen
(Miechów, Upper Campanian)

Fig. 1*a*. Lower part of "calyx" with thickness of wall and stem visible (Z. Pal. UŁ Sp. III/110); ×1.

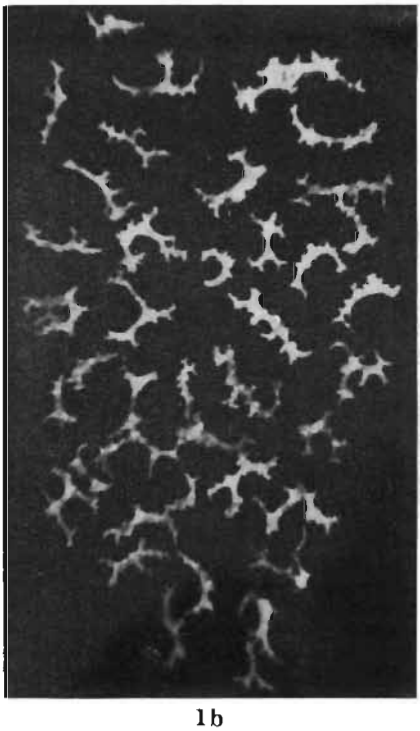
Fig. 1*b*. Parenchymal rhizoclones; ×30.

Fig.2. *Leiochonia cryptoporosa* Schrammen, parenchymal rhizoclones. Przesławice, Maastrichtian (Z. Pal. UŁ Sp. III/44); ×30.

*Scytalia turbinata* (Roemer)
(Skrajniwa, Lower Campanian)

Fig. 3. Side view (Z. Pal. UŁ Sp. III/543); ×1.

Fig. 4. View of apex (Z. Pal. UŁ Sp. III/724); ×1.



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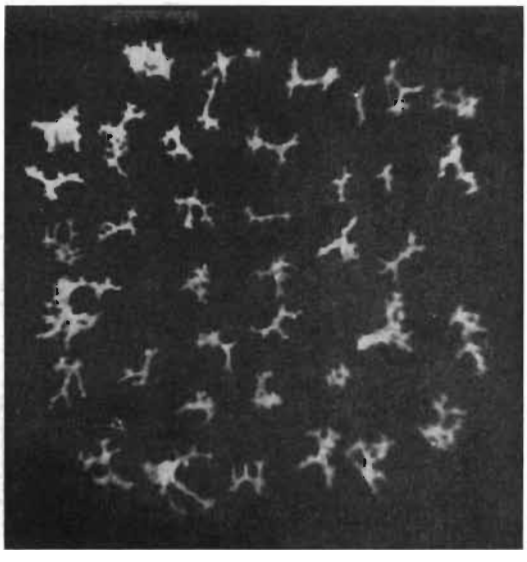


2

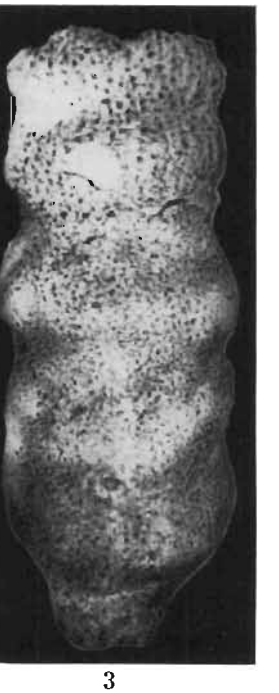
4

3

1a

2

1



3

5

4

Plate XII

*Scytalia radiciformis* (Phillips)
(Zbyczyce and Skrajniwa, Lower Campanian)

Fig. 1. Young individual with weakly developed osculum (Z. Pal. UŁ Sp. III/639); ×1.

Fig. 2. Cluster of young individuals formed by budding (Z. Pal. UŁ Sp. III/513); ×1.

Fig. 3. Adult form (Z. Pal. UŁ Sp. III/312); ×1.

Fig. 4. *Scytalia terebrata* (Phillips). Skrajniwa, Lower Campanian (Z. Pal. UŁ Sp. III/329); ×1.

Fig. 5. *Stachyspongia tuberculosa* (Roemer). Miechów, Upper Campanian (Z. Pal. UŁ Sp. III/104/58); ×1.

## Plate XIII

*Coscinostoma fragilis* Schrammen
(Skrajniwa and Zbyczyce, Lower Campanian)

Fig. 1. Complete specimen (Z. Pal. UŁ Sp. III/405); ×1.

Fig. 2*a*. Fragment of exhalant surface (Z. Pal. UŁ Sp. III/408); ×3.5.

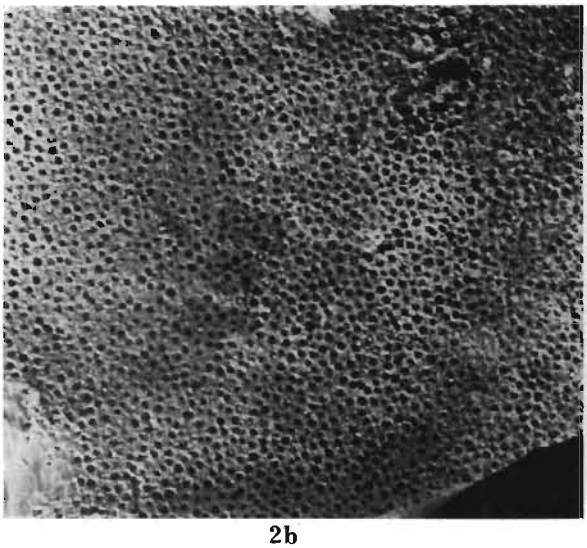
Fig. 2*b*. Fragment of inhalant surface; ×3.5.

Fig. 3. *Stachyspongia tuberculosa* (Roemer), parenchymal rhizoclones. Miechów, Upper Campanian (Z. Pal. UŁ Sp. III/104); ×30.

Fig. 4. *Seliscothon verrucosum* Schrammen, plate-shaped specimen. Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/992); ×1.

4

1



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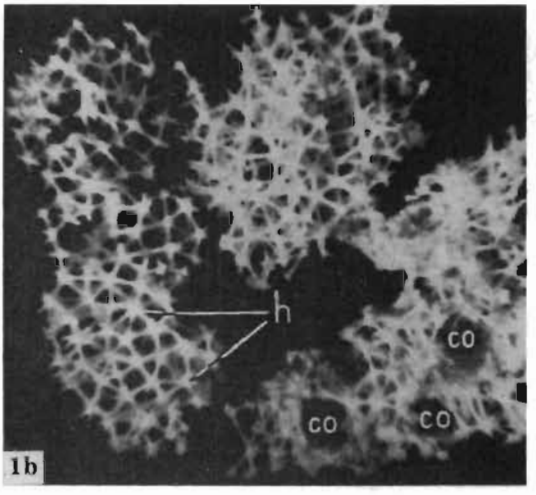
3

2a



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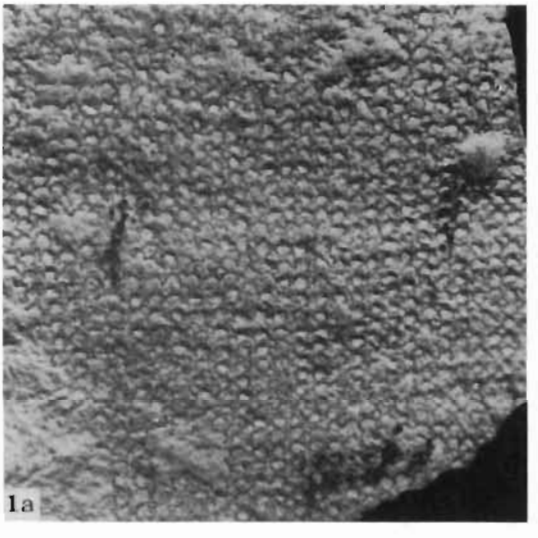
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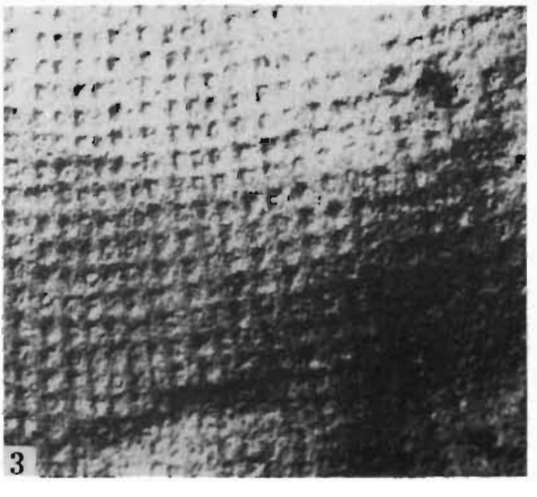
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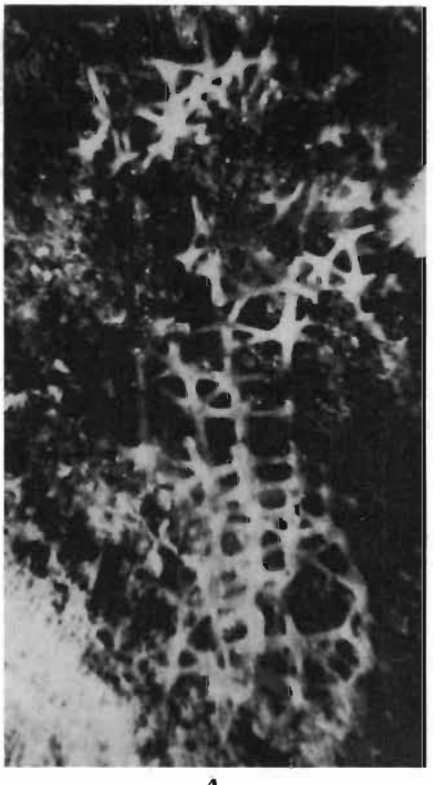

4


2

## Plate XIV

*Leptophragma murchisoni* (Goldfuss)
(Miechów, Upper Campanian)

Fig. 1*a*. Part of outer (= exhalant) surface (Z. Pal. UŁ Sp. III/142); ×3.

Fig. 1*b*. Fragments of parenchymal network, *co* canal openings, *h* place of connections of hexactines; ×30.

Fig. 2. *Leptophragma* sp. Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1663); ×1.

Fig. 3. *Craticularia virgatula* Schrammen, part of outer surface. Wyląg, Upper Maastrichtian (Z. Pal. UŁ Sp. III/23); ×3.

Fig. 4. *Paracraticularia fittoni* (Mantell), fragment of parenchymal network *in situ*. Bochotnica, Upper Maastrichtian (Z. Pal. UŁ Sp. III/77); ×30.

Plate XV

*Aphrocallistes kazimierzensis* n.sp.
(Kazimierz, Upper Maastrichtian)

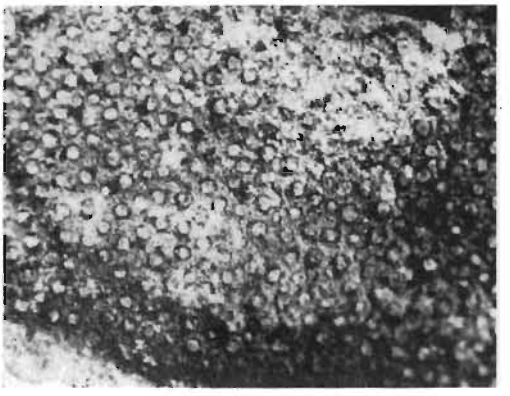
Fig. 1*a*. Side view, holotype, *p* paragastral cavity (Z. Pal. UŁ Sp. III/393); ×0.5.

Fig. 1*b*. Top view, *o* osculum; ×1.

Fig. 1*c*. Part of inhalant surface; ×3.

Fig. 1*d*. Part of exhalant surface (so-called diaphragm); ×3.

Fig. 2. Fragments of parenchymal network consisting of hexactines, paratype (Z. Pal. UŁ Sp. III/78); ×30.



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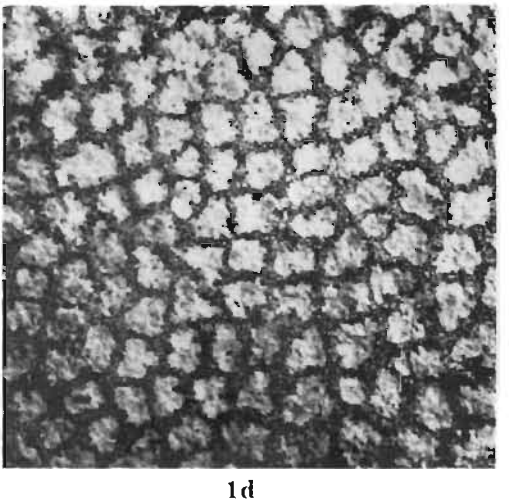
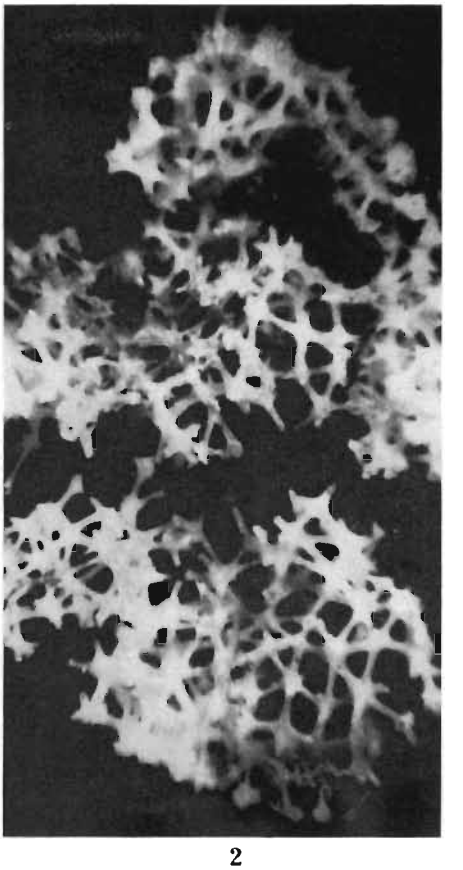


1d



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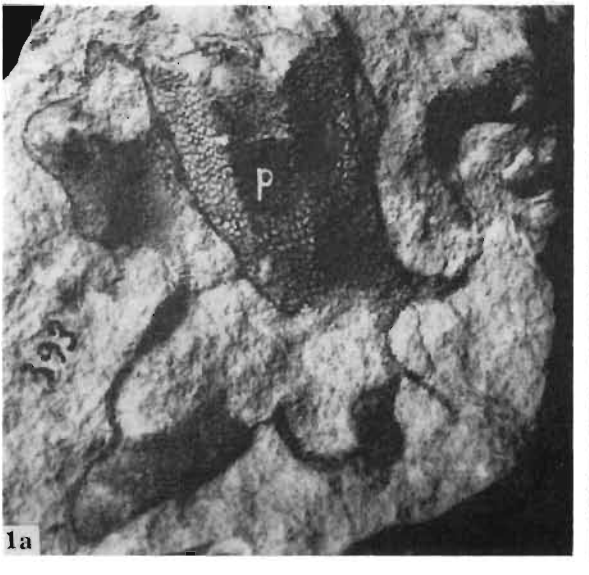
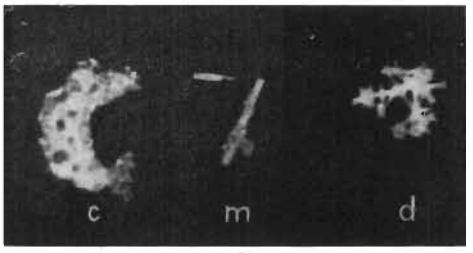



1a


1b

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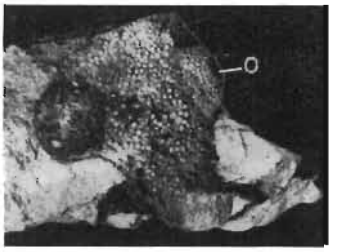


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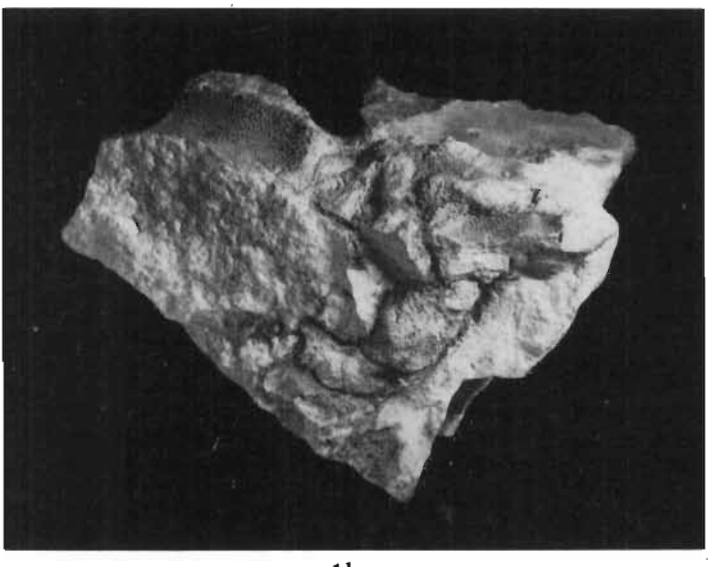
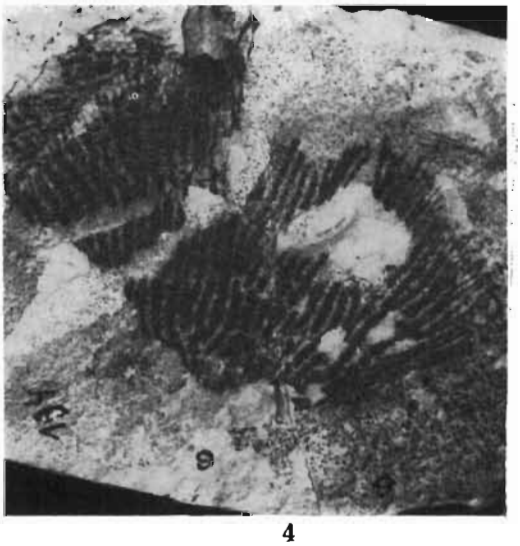


1b

1a



4

## Plate XVI

*Aphrocallistes bochotnicensis* n.sp.
(Bochotnica, Upper Maastrichtian)

Fig. 1*a*. Branches with postica, holotype (Z. Pal. UŁ Sp. III/377); ×0.5.

Fig. 1*b*. Assemblage of cylindrical branches; ×0.5.

Fig. 2. Fragments of skeleton: *c* cortical skeleton around pore, *d* dictyonal parenchymal network, *m* monaxones (Z. Pal. UŁ Sp. III/43); ×30.

Fig. 3. *Aphrocallistes mammillaris* n.sp., *o* osculum. Kazimierz, Upper Maastrichtian (Z. Pal. UŁ Sp. III/370); ×1.

Fig. 4. *Lepidospongia fragilis* Schrammen. Bonarka, Lower Campanian (Z. Pal. UŁ Sp. III/194); ×1.

Plate XVII

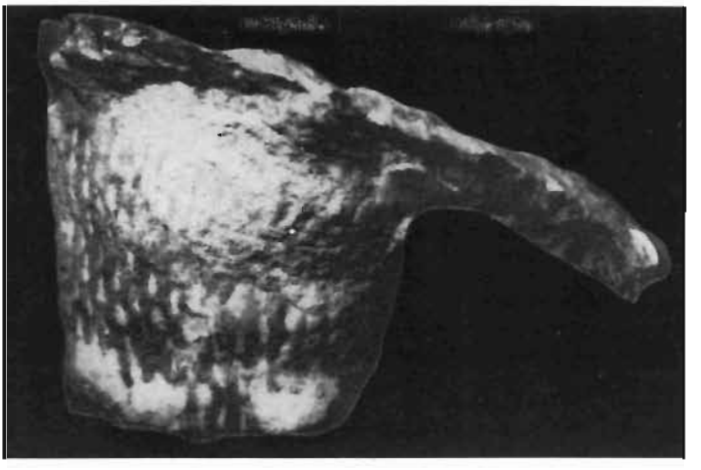
Fig. 1. *Aphrocallistes vistulae* n.sp., holotype. Bochotnica, Upper Maastrichtian (Z. Pal. UŁ Sp. III/376); ×1.

*Orthodiscus fragilis* Schrammen

Fig. 2. Fragment with a part of marginal disc. Miechów, Upper Campanian (Z. Pal. UŁ Sp. III/29); ×1.

Fig. 3*a*. Fragment of specimen. Kazimierz, Upper Maastrichtian (Z. Pal. UŁ Sp. III/5); ×1.

Fig. 3*b*. Cross-section of stem, *p* parenchymal skeleton, *c* skeleton of dependent cortex; ×5.



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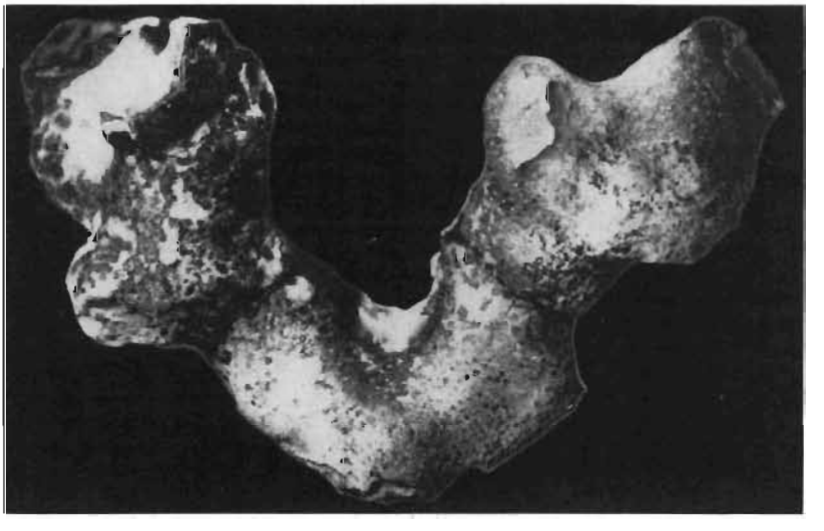

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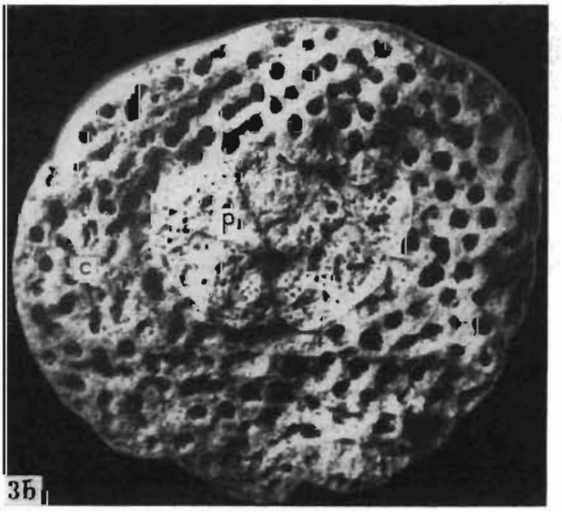
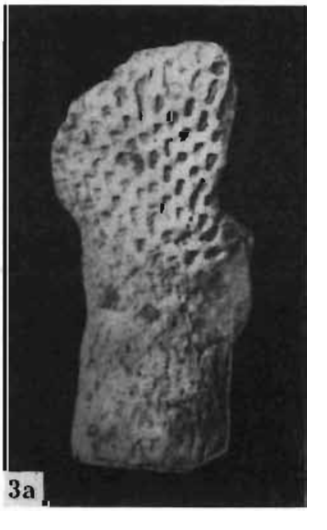
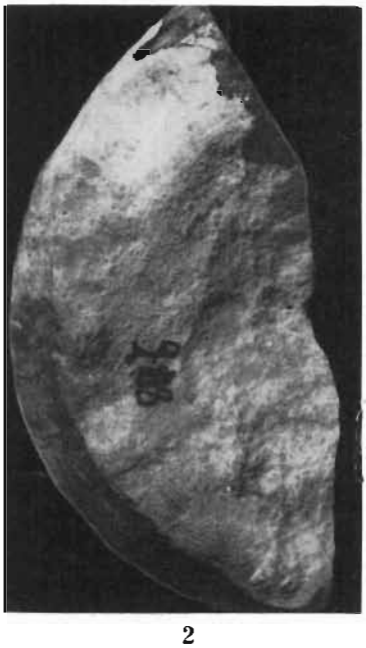



3b



3a

1b



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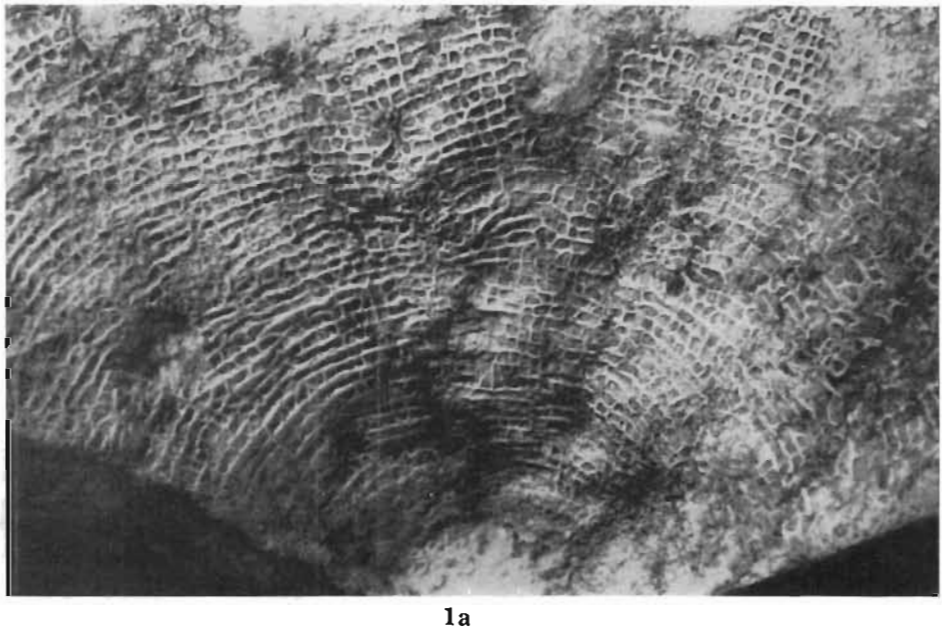


1a

Plate XVIII

*Coeloptychium deciminum* (Roemer)
(Witkowice, Lower Campanian)

Fig. 1*a*. Part of upper (=exhalant) surface (Z. Pal. UŁ Sp. III/284); ×4.
Fig. 1*b*. Fragment of stem with traces of postica; ×4.
Fig. 2. Fragment of specimen (Z. Pal. UŁ Sp. III/288); ×1.

## Plate XIX

*Ventriculites radiatus* Mantell
(Bonarka, Lower Campanian)

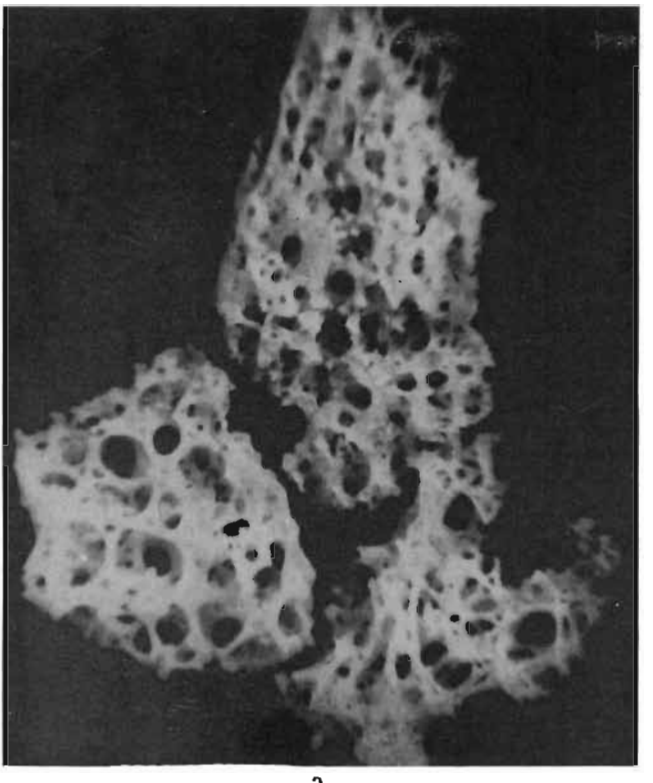
Fig. 1*a*. Adult form, side view: *o* osculum, *b* bud, *r* rhizoidal processes (Z. Pal. UŁ Sp. III/170); ×1.

Fig. 1*b*. Enlarged bud from Fig. 1*a*; ×5.

Fig. 2*a*. Cross section of stem, *p* parenchymal network, *c* cortical network. Bochotnica, Upper Maastrichtian (Z. Pal. UŁ Sp. III/73); ×4.

Fig. 2*b*. Fragment of parenchymal network *in situ*; ×30.

Fig. 3. Fragment of parenchymal network isolated from upper part of sponge. Bonarka, Lower Campanian (Z. Pal. UŁ Sp. III/170); ×3.

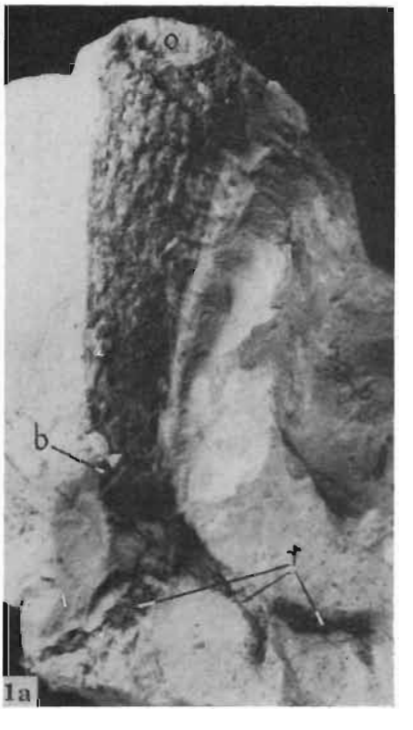


3

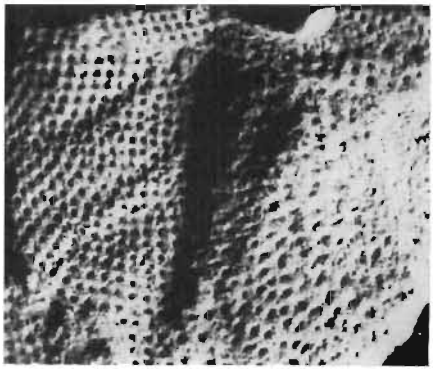

2a

1b

2b




1a



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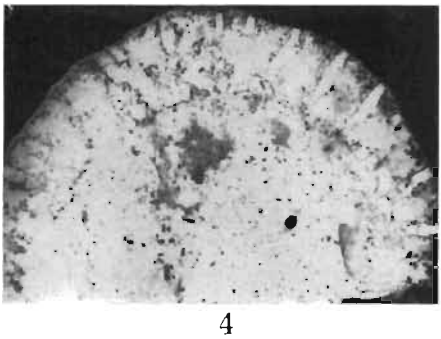
2



4

3 1

## Plate XX

Fig. 1. *Ventriculites convolutus* Hinde, top view. Bochotnica, Upper Maastrichtian (Z. Pal. UŁ Sp. III/74); ×1.

Fig. 2. *Ventriculites* cf. *successor* Schrammen, top view. Wylągi, Upper Maastrichtian (Z. Pal. UŁ Sp. III/9); ×0.25.

Fig. 3. *Rhizopoterion solidum* Schrammen, side view. Wylągi, Upper Maastrichtian (Z. Pal. UŁ Sp. III/16); ×0.5.

Fig. 4. *Ventriculites radiatus* Mantell, section through wall. Bonarka, Lower Campanian (Z. Pal. UŁ Sp. III/190); ×3.

Fig. 5. *Leptophragma* sp., part of exhalant surface with trace of irregular arrangement of pores. Pniaki, Lower Campanian (Z. Pal. UŁ Sp. III/1663); ×3.

## Plate XXI

*Rhizopoterion tubiforme* Schrammen
(Bonarka, Lower Campanian)

Fig. 1. Side view (Z. Pal. UŁ Sp. III/166); ×1.5.

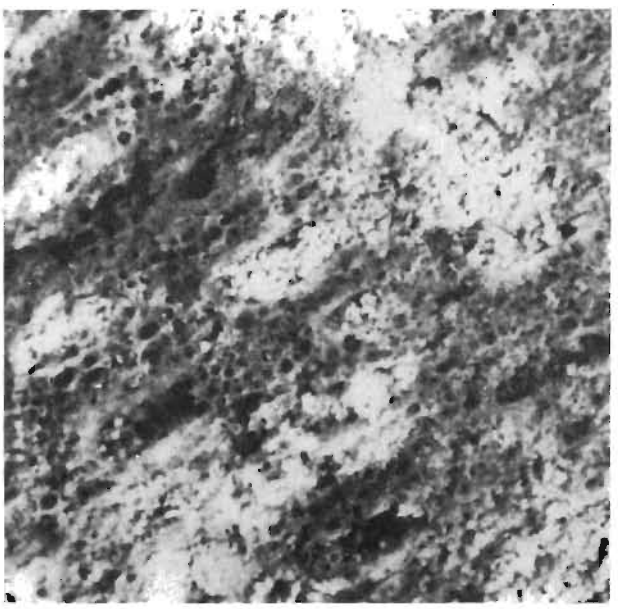
Fig. 2. Cross section of wall with longitudinal arrangement of canals visible (Z. Pal. UŁ Sp. III/175); ×4.

*Rhizopoterion coniforme* n.sp.
(Piotrawin, Lower Maastrichtian)

Fig. 3*a*. Side view, holotype (Z. Pal. UŁ Sp. III/48); ×0.5.

Fig. 3*b*. Fragment of parenchymal network; ×30.

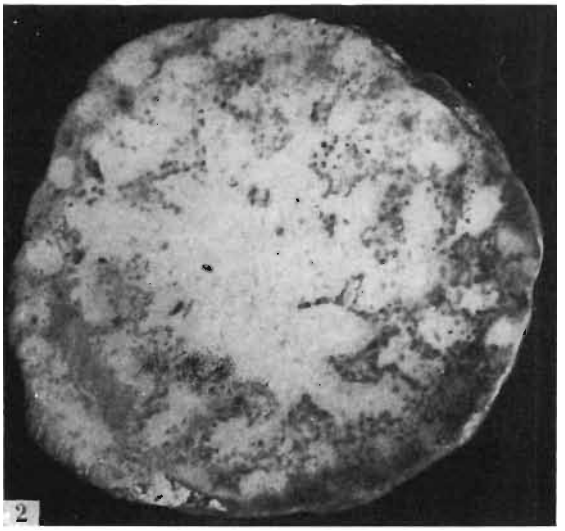
Fig.4. *Eulcraphe incrustans* Schrammen. Zbyczyce, Lower Campanian (Z. Pal. UŁ Sp. III/5/63); ×2.



3b

1

4



2

3a