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Lower to Middle Oxfordian sponges of the Polish Jura

ABSTRACT: Sponges predominate in the benthic fauna of the Oxfordian Jasna Góra Beds (*cordatum* and *plicatilis* Zones) of the Polish Jura, south Central Poland, making part of the European Upper Jurassic sponge megafacies. The Jasna Góra Beds comprise sponges mostly in bedded limestones, while bioherms occur but occasionally. The analysed assemblage includes 12 species of the Lithistida, 16 species of the Hyalospongea, and also non-lithistid demosponges represented by isolated spicules. The assemblage differs from that one found in the White Jurassic α of Swabia and Franconia, a facies equivalent of the Jasna Góra Beds, as the former is dominated by the Lithistida, while the latter by the Hyalospongea. The investigated sponges inhabited a deeper-shelf environment, not shallower than 150—200 m; they seem to have been slightly implanted in the soft bottom sediment. The sponge assemblage is species diverse in marly beds, but highly dominated by a single species in limestones. Sponge bioherms developed mostly at local slopes of the bottom, due to an improved water circulation.

The systematic part of the paper includes descriptions of 28 species, those represented by the material sufficiently rich to permit a departure from the pre-existing oversplitted taxonomy and a recognition of their proper taxonomic position.

INTRODUCTION

This paper presents the investigation of sponges from the Oxfordian Jasna Góra Beds of the Polish Jura, well exposed in the quarries at Zalas, Nowa Krystyna, Wysoka, Ogrodzieniec, and Wrzosowa (Text-fig. 1).

In the Oxfordian of the Polish Jura sponges are by no means confined to the Jasna Góra Beds; they occur also in other facies complexes of that stage (Text-fig. 2) and in fact, they have been widely known since over a century. Zittel (1876, p. 196; 1877, p. 41; 1878) gave general characteristics of the sponges of the Polish White Jurassic. Siemiradzki (1913) described several siliceous and calcareous sponges, mostly from the Middle to Upper Oxfordian but also from the Jasna

Góra Beds as well as from the Callovian and Kimmeridgian. Fibich (1973) investigated the Hyalospongea from the Jasna Góra Beds in the vicinity of Częstochowa. Hurcewicz (1975) studied calcareous sponges of the Polish Jura, mostly the Upper Oxfordian ones. Moczydłowska & Paruch-Kulczycka (1978) analysed sponge spicules found in the Jasna Góra Beds at Wrzosowa. Finally, the present author (Trammer 1979, 1981) discussed some paleobiologic problems exemplified by selected sponge species from the Jasna Góra Beds.

Acknowledgements. Two persons especially contributed to development of the present study: Professor J. Kutek (Warsaw) stimulated the author's interest in the Oxfordian sponges, while Dr. B. A. Matyja (Warsaw) was helpful to the extent by far exceeding what usually can be expected from a colleague. Both of them are here gratefully acknowledged. Thanks are also due to Dr. A. Hoffman (Warsaw, temporarily Tübingen), K. Małkowski, M.Sc. (Warsaw), W. Müller (Ludwigsburg), A. Pisera, M.Sc. (Warsaw), Professor A. Radwański (Warsaw), W. Riegraf, M.Sc. (Tübingen), Dr. W.-E. Reif (Tübingen), Professor A. Seilacher (Tübingen), S. Skompski, M.Sc. (Warsaw), Dr. F. Wiedenmayer (Basel, temporarily Melbourne), and Docent A. Wierzbowski (Warsaw).

CHARACTERISTICS OF THE JASNA GÓRA BEDS

LITHOLOGY AND AGE

The Jasna Góra Beds (*cf.* Bukowski 1887, Różycki 1953, Malinowska 1963) include mutually interbedded micritic limestones, marly limestones, and marls (Text-fig. 3; Pl. 1, Figs 1—2), with minor intercalations of nodular limestones and clays. The rocks are grey to yellow-grey in color, except for the southern part of the study area where red and green rocks do also occur (bed *1* at Zalas, and beds *9* and *17* at Nowa Krystyna, respectively). The red limestone bed of

Fig. 1
Exposures of the Jasna Góra Beds within the occurrence zone (*hachured*) of Upper Jurassic deposits in the Polish Jura; inset shows position of the area in Poland

Zalas is somewhat nodular in structure, packed with whole, corroded ammonite shells; it closely resembles the "ammonitico rosso" facies of the Tethyan Jurassic.

Limestone and marly beds vary in thickness among the particular exposures in the investigated area (Text-fig. 3). The limestone beds are thicker than the marly ones in Wrzosowa section, while the opposite holds true at Zalas.

In addition to bedded rocks, the Jasna Góra Beds comprise also a few small bioherms. Two bioherms were reported by Różycki (1953, p. 53) from a lost exposure at Mt. Jasna Góra at Częstochowa; another bioherm has been recorded by Tarkowski (1978) and Matyja & Tarkowski (1981) at Zalas. The latter bioherm (Text-fig. 4; Pl. 1, Fig. 2 and Pl. 2, Figs 1—2), described in more detail in a separate chapter, is built up by a mass occurrence of bodily preserved sponges surrounded with marly matter. The bioherm grades laterally into bedded limestones (Text-fig. 4) including a few beds of sparite detritic limestones forming the "talus". The detritic limestones, the only ones in the investigated area,

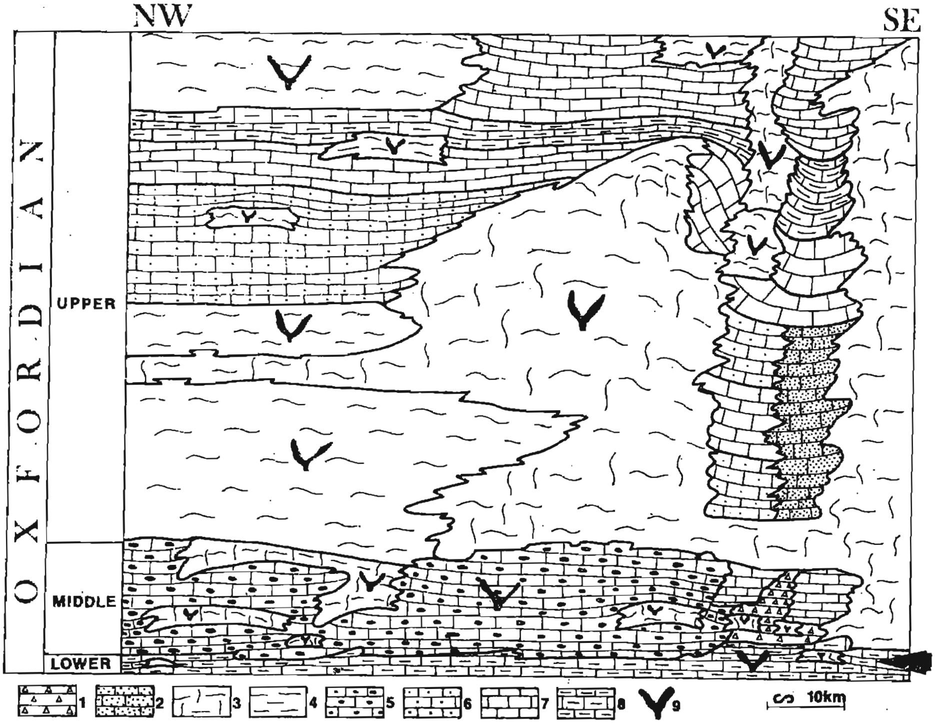


Fig. 2. Lithologic units of the Oxfordian in the Polish Jura, to show the range of the sponge-bearing units (marked by a schematic section of a sponge; *see* item 9 *in* explanations); position of the Jasna Góra Beds is indicated with a black arrow *(at right)*

1 detrital limestones, *2* non-detrital grained limestones, *3* algal-sponge massive limestones (within the Jasna Góra Beds, the sponge bioherms composed of bodily preserved sponges in marly matrix) *4* chalky limestones, *5* sponge-tuberolithic limestones, *6* friable micritic limestones, *7* micritic limestones, *8* marls and marly limestones, *9* idealized sponge, to denote the sponge-bearing lithologic units

The boundary between the Middle and Upper Oxfordian is drawn between the *bifurcatus* and *bimammatum* zones, according to Kutek, Matyja & Wierzbowski (1973); other stratigraphic boundaries are taken *after* Cariou, Enay & Tintant (1971)

The scheme is drawn on the basis of data presented by Kutek & *al.* (1977), and by Dr. B. A. Matyja *(personal communication)* consist of densely packed rounded calcareous intraclasts comprising numerous spicules and larger skeletal elements of sponges (Pl. 2, Fig. 3).

The Jasna Góra Beds overlie the Callovian; they represent the lowermost part of the Oxfordian in the study area (Text-fig. 2). At Zalas they comprise ammonites indicative of the *cordatum* Zone (Lower Oxfordian) and the lower part of the *plicatilis* Zone of the Middle Oxfordian (Matyja & Tarkowski 1981). They were previously attributed entirely to the *cordatum* Zone (see *e.g.* Arkell 1956, p. 479) but recent studies necessitated a reconsideration (Dr. B. A. Matyja, *personal communication*).

The lower part of the Jasna Góra Beds, that one representative of the *cordatum* Zone, decreases in thickness southwards (Text-fig. 3). It amounts to more than 3 m in thickness at Wrzosowa, but only 0.5 m at Zalas.

FAUNA

Bedded rocks of the Jasna Góra Beds comprise benthic organisms such as siliceous sponges, brachiopods, gastropods, bivalves, and echinoids, as well as nektic or nektobenthic ammonites and belemnites (*see* Bukowski 1887, Różycki

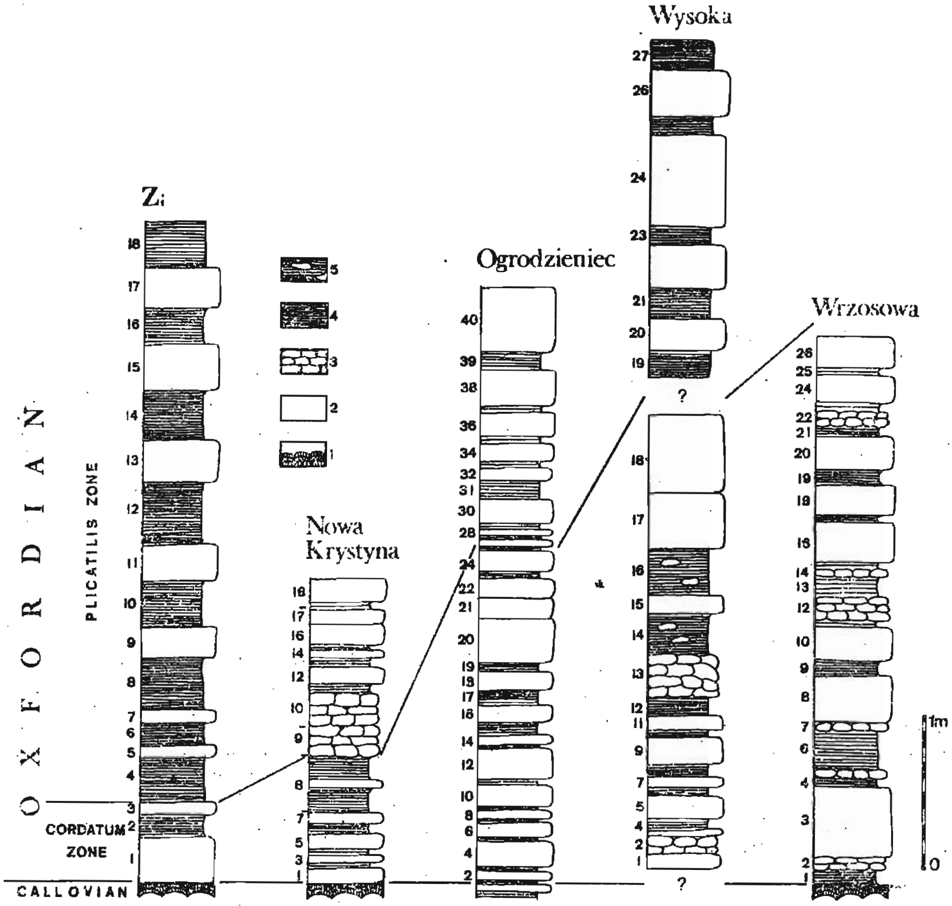
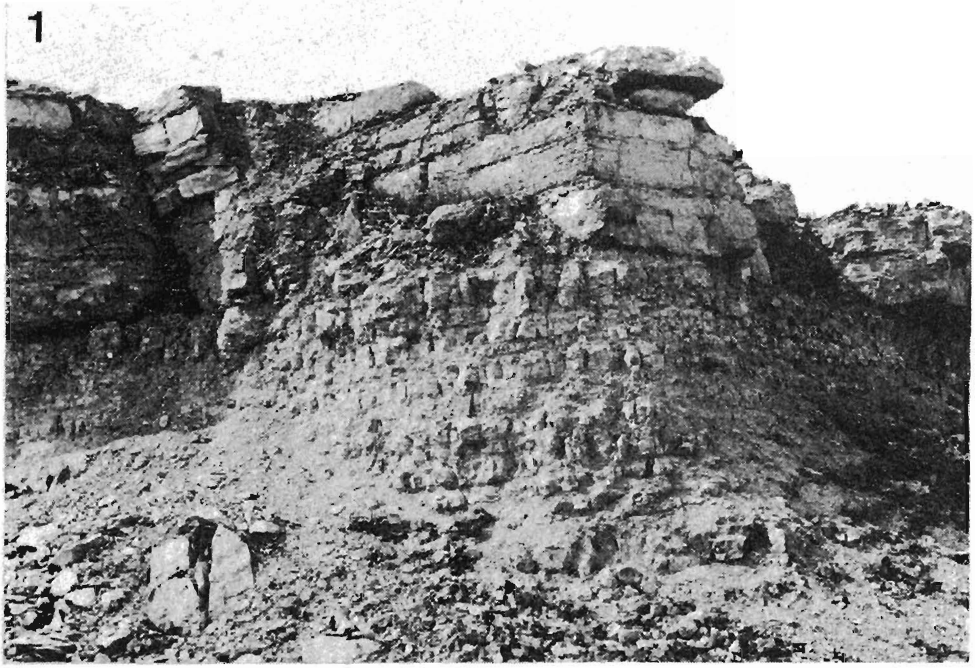
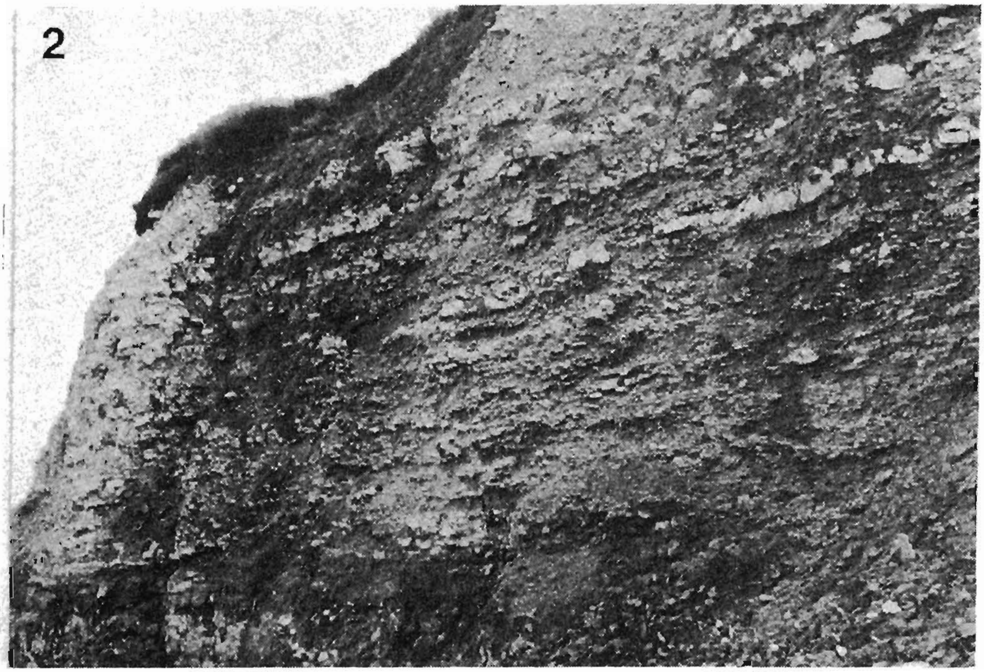


Fig. 3. Investigated sections of the Jasna Góra Beds (*cf.* Text-fig. 1)

1 stromatolite, *2* micritic limestones, *3* micritic, nodular limestones, *4* marls and marly limestones, *5* marls and marly limestones yielding micritic nodules

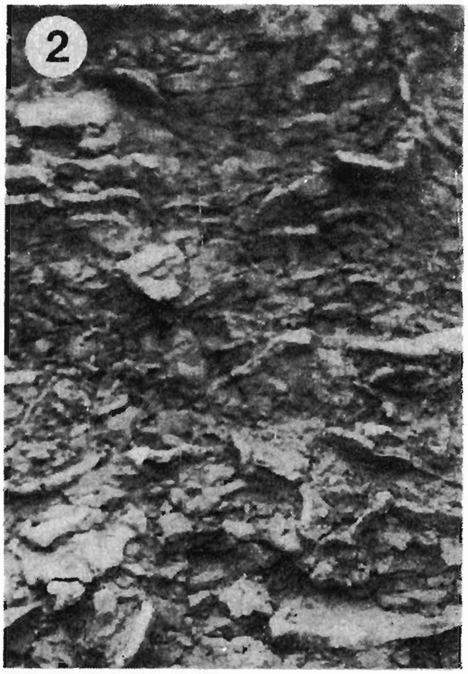


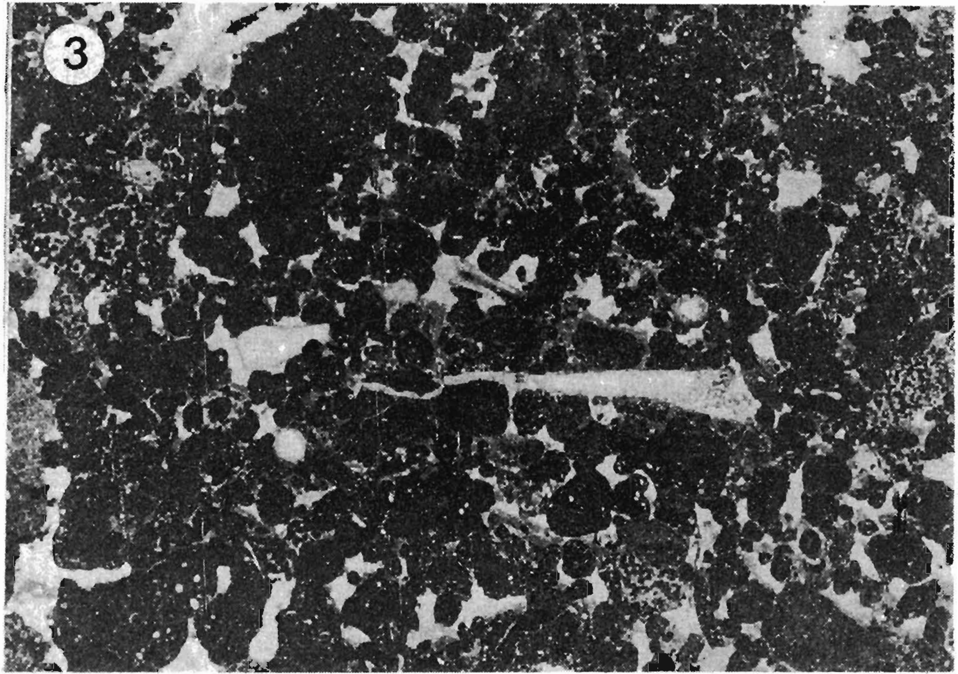


1 — Section exposed in the quarry at Ogrodzieniec: Jasna Góra Beds (*at the bottom*) overlain by thick-bedded gray limestones

2 — Jasna Góra Beds exposed at Zalas: visible is the contact between the bedded limestones and the bioherm (*at left*)

Both photos taken by Dr. B. Matyja





1—2 — Part of the bioherm at Zalas: visible are bodily preserved sponges embedded in marly matrix

3 — Detrital limestone composed of rounded intraclasts containing the sponge spicules; taken ×5; "talus" of the bioherm exposed at Zalas (*cf.* Text-fig. 4)

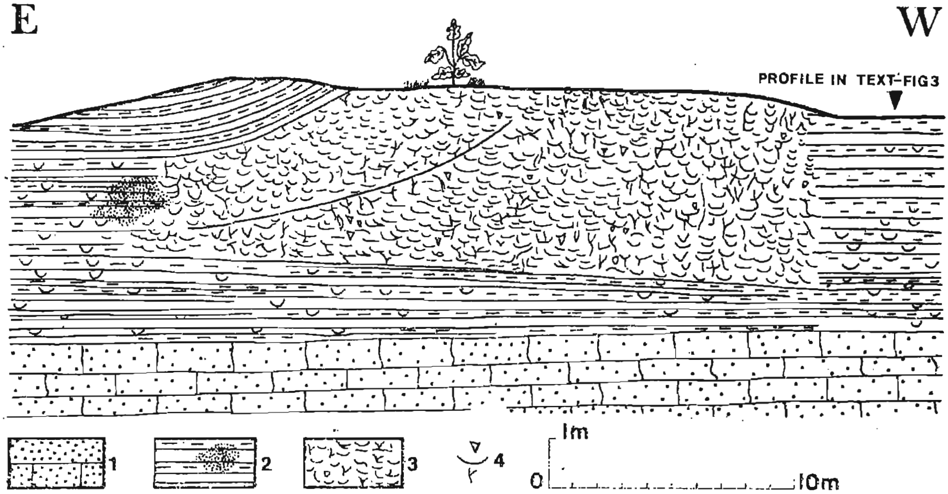


Fig. 4. The sponge bioherm exposed at Zalas

1 Callovian sandy limestones, *2* interbedded limestones and marls, locally also detrital limestones (Oxfordian *cordatum* and *plicatilis* zones), *3* bioherm composed of bodily preserved sponges in marly matrix (*plicatilis* Zone), *4* sponges

1953). There are also isolated asteroid plates. Some sponges bear epizoans, mostly serpulids and bryozoans and a trace fossil (Pl. 11, Fig. 9) attributed by Fuchs (1935) and Wagenplast (1972) to *Terebella* Linnaeus, 1767. Foraminifers *Tolypammina* and *Thurammina* occur rather commonly; they seem to have inhabited sponges (*cf.* Wagenplast 1972, Kaźmierczak 1973).

BED ►	6	7	8	9	12	13	14	16
SPONGES	12.5	42.4	10.9	18.6	37.1	26.6	64.6	17.4
BRACHIOPODS	10.4	9.2	6.2	22.8	22.4	11.3	8.8	12.1
GASTROPODS			0.3		0.9		1.3	
BIVALVES		3.0		2.2	2.6	0.8		
BELEMNITES	2.1	3.0	1.5	7.7	0.9			0.8
AMMONITES	75.0	42.4	80.8	48.7	36.1	61.3	25.3	69.7
ECHINOIDS			0.3					

SPONGES	54.5	77.7	61.7	42.8	58.9	68.8	86.4	59.0
BRACHIOPODS	45.5	16.7	35.3	52.4	35.6	29.1	11.9	41.0
GASTROPODS			1.5		1.4		1.7	
BIVALVES		5.6		4.8	4.1	2.1		
ECHINOIDS			1.5					

Fig. 5. Macrofaunal distribution in some beds of the Nowa Krystyna section, based on numbers of individuals (in per cents)
Upper chart presents distribution of all the recognized fossils, lower chart does it for the benthos

When the whole faunal assemblage is considered, the ammonites predominate. For instance, they account for 25 to 80% of the total number of macrofossils collected from various beds of the section Nowa Krystyna (Text-fig. 5). The ammonites are representative of the families Cardioceratidae, Perisphinctidae, Aspidoceratidae, Haploceratacea, Phylloceratidae, and Lytoceratidae (Matyja & Giżejewska 1979). In the northern part of the investigated area (Częstochowa region; *see* Text-fig. 1) the first four groups account for some 98% of the total number of ammonite specimens, each of these groups contributing equally. The share of the Haploceratacea, however, considerably increase in the south (Zalas) where this group accounts for some 50% of the total number of ammonites. This is at the expense of aspidoceratids, whereas the perisphinctids and cardioceratids maintain their share (for details *see* Matyja & Giżejewska 1979).

The second dominant group in the whole faunal assemblage of the Jasna Góra Beds are sponges, accounting for 12 to 64% of the macrofossils collected in various beds at Nowa Krystyna. Brachiopods rank the third (9 to 23%). All other organic groups occur in subordinate numbers (Text-fig. 5).

The benthic assemblage, however, is by far dominated by sponges which represent 42 to 86% of the benthic macrofossils found in various beds at Nowa Krystyna (Text-fig. 5). In the Zalas bioherm their share is even greater, as the faunal assemblage consist almost exclusively of sponges.

JASNA GÓRA BEDS AND THE EUROPEAN SPONGE MEGAFACIES

Sedimentary rocks rich in sponges, either in bioherms, or within bedded complexes (sponge megafacies of Matyja 1976) occur in a specified paleogeographic position in the European Upper Jurassic (Hiller 1964, Fig. 37; Hölder 1964, p. 258; Matyja 1976; Gwinner 1976; Sapunov & Ziegler 1976, pp. 8—9; Wiedenmayer 1980, p. 79). This megafacies makes up a relatively narrow belt ranging from Spain across France, Switzerland, West Germany, Poland, and up to the Dobruja in Rumania (Text-fig. 6). The facies grades southwards into deeper-water Tethyan facies (*e.g.* it contacts directly the ammonitico rosso in Spain; Behmel 1970), while it interfingers with shallow-water facies in the north. Thus, it represents deposits of the Tethyan deeper-shelf.

The sponge megafacies begins at variable time in various places. In Swabia, Franconia, and Switzerland this facies appears but in the *transversarium* Zone (Gygi 1969[1], Ziegler 1977), much later than in the Jasna Góra Beds. The oldest Oxfordian sponges of Dobruja come from the *transversarium* Zone, as well (Bârbulescu 1974, Fig. 19). In turn, sponges seem to appear already in the cordatum Zone in Spain (Behmel 1970), but they are rather poorly known therein. This con-

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[1] The present author follows Cariou, Enay & Tintant's (1971) concept of the *transversarium* Zone, whereas Gygi (1969, Tab. 9) considered it to be the uppermost subzone of the *plicatilis* Zone.

tributes to the significance of the sponges of the Jasna Góra Beds, as this is the oldest known representative of the European Upper Jurassic sponge megafacies.

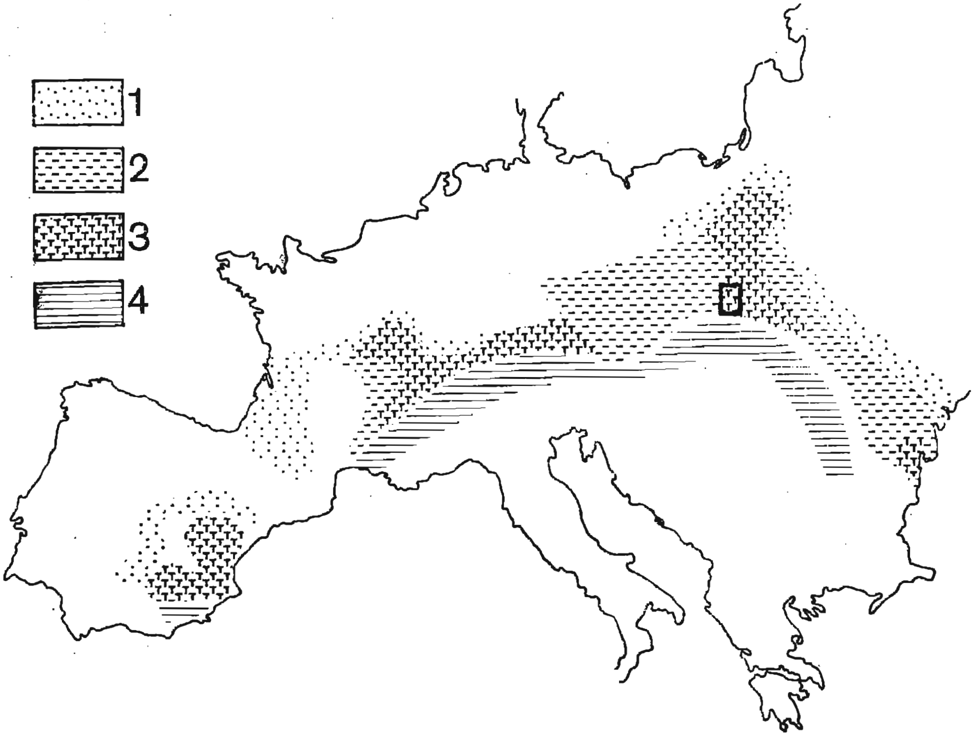


Fig. 6. Paleogeographic position of the Upper Jurassic sponge facies in Europe
1 shallow-water desposits, *2* probable extent of the sponge facies, *3* recognized range of the sponges facies, *4* Tethyan deposits
Rectagled is the investigated area (*cf.* Text-fig. 1); taken *after* Matyja (1976), slightly modified

SPONGES OF THE JASNA GÓRA BEDS

METHODS OF INVESTIGATION

Sponges were collected bed-by-bed in the five investigated exposures (Text-figs 1 and 3). To obtain compatible data, an area 1 m^2 was designated at the top of each bed and the whole thickness of the bed was searched for sponges within these limits. In addition, sponges from rock debris have also been collected (Text-fig. 7).

PRESERVATION STATE

All the sponge skeletons found at Nowa Krystyna and Ogrodzieniec have been calcified and hence, they could be examined only in thin sections or etched with a weak acid. Several sponge skeletons preserved in their original, siliceous form have been found in the remaining three exposures. Well preserved siliceous spicules occur in some 20, 25, and 34% of the total number of sponges found at Zalas, Wysoka, and Wrzosowa, respectively.

GENERAL CHARACTERISTICS

Totally, 28 sponge species have been recorded in the Jasna Góra Beds (Text-fig. 7). Out of these, 12 species are representative of the order Lithistida (class Demospongea), while the remaining 16 species belong to the class Hyalospongea. Numerically, however, the Lithistida are dominant, as they account for 96% of the total number of collected sponge specimens. This is consistent with the data provided by Moczydłowska & Paruch-Kulczycka (1978) who found the overwhelming predominance of desms, typical of the Lithistida, and only minor amounts of other sponge spicules in the Jasna Góra Beds at Wrzosowa.

Out of the recorded 28 sponge species, only a few ones have a significant share in the assemblage. Seven most abundant species (*Cnemidiastrum stellatum, C. rimulosum, Platychonia schlotheimi, Hyalotragos patella, H. pezizoides, Reiswigia ramosa*, and *Cylindrophyma milleporata*) account for 93% of the total number of specimens (Text-fig. 7).

The taxonomic and numerical composition of the sponge assemblage is variable among the exposures. In general, sponges are much less common at Ogrodzieniec than in the other exposures (Text-fig. 7). The newly recognized (Trammer 1979) form *Reiswigia ramosa* is very common in the southern and central part of the investigated area (Zalas, Nowa Krystyna, Ogrodzieniec), but it is very rare in the north (Wrzosowa). The species *Cylindrophyma milleporata* also decreases in abundance northwards, while the opposite holds true for *Hyalotragos patella*. The latter is not only much more abundant at Wrzosowa than in the south, but also its small individuals are accompanied by very large ones at Wrzosowa which is not the case in the south.

The bioherm of Zalas comprises the same sponge species as the surrounding bedded rocks do, but the sponge density is a few to a dozen or more times higher in the bioherm (Text-fig. 7). Furthermore, the bioherm is dominated by *Cnemidiastrum rimulosum* and *Reiswigia ramosa* which occur in minor amounts in the surrounding bedded rocks (Text-fig. 7).

The sponge assemblage of the Jasna Góra Beds probably included some non-lithistid (soft) demosponges in addition to the Lithistida and Hyalospongea. This is indicated by the occurrence of monaxons, tetraxons (triaenes), and asters (Text-fig. 8) in addition to desms and triaxons in the spicule assemblage from Wrzosowa (*cf.* Moczydłowska &

Distribution and frequency of sponges in the investigated sections (number of beds the same as in Text-fig. 3; *B*—bioherm, *W*—waste)

LOCALITY	ZALAS															N.KRYSTYNA										OGRODZIENIEC														WYSOKA																	WRZOSOWA																		
ZONE	CORD.			PLICATILIS												CORD.			PLICATILS							CORDATUM													PL	CORDATUM										PLICATILIS							CORDATUM																	
BED	1	2	3	4	5	6	7	8	9	10	11	12	18	B	W	6	7	8	9	10	11	12	13	14	16	4	8	9	11	13	14	15	16	17	20	21	22	25	36	4	5	10	11	13	14	15	16	17	18	19	20	21	22	23	24	W	2	3	4	5	6	7	8	9	10	11	12	13	19	20	21	24	26	W	TOTAL
DEMOSPONGEA, LITHISTIDA																																																																											1302(96%)
Rhizomorina																																																																										
Cnemidiastrum stellatum	1	7	4	14		8	6	12	2	1		2		32		2	2	15	19	5	8	9	22	12	1				1	1		2				1			1	4		9		4	2	2	4	2	2	7	1	8		4			10		24	2	19		1	2		2	12	3	2	1	4	1			322
Cnemidiastrum rimulosum		3		4		4	1	6		1				40		2	2	5	3	1	3	3	3	4			1					3							6	2	2	3			2	7	1	2	3	5		9	12	3	6				1	1	4									1	1	1			161
Cnemidiastrum pluristellatum																			1																																																									1
Jereica sp.				1																																																									3		11			4											19
Platychonia schlotheimi			3			4	2				3		2	12			1	1				28				2		1			2	5			1															6		3		6			1	1	5	1	13					1							2		105
Hyalotragos patella		2	9		9				7	1				10				1	1		1		1	30						2		2	1			2													3	2	2	3							2	2	4	6	20	9	8	8		1		1	3	14	2	12	8		167
Hyalotragos pezizoides		2			3	6	9		8				3	8			9	10	3	1		2			2					2		17	1			4	1			3	1	4		2			2	1		2			4	8					6		2	2					6				1	2			137
P. schlotheimi or *H.patella*																							2		18								1					2					6						2		16		7	12	17		2	9	2					2	9						1				108
Leidorella expansa								1																																																																				1
Leiodorella foliacea				2		1								10										1																												1	2		1																										18
Hyalospongia rugosa															2																																																													2
Reiswigia ramosa (fragments)				9	4			17					7	70		2		9	6	2	1		1			4				16	10	20	1		1	68													7	7			4									3		4														273
Anomocladina																																																																										
Cylindrophyma milleporata		2		3		4		4				2		3				5	6	4	3	2	8	4	2							1								1					1				1			2																		1						56
HYALOSPONGEA, DICTYIDA																																																																											34(2,5%)
Xenoschrammenum alternans										2																															1																																				3
Xenoschrammenum punctatum										1																																																																			1
Stauroderma lochense										3																																												1																			4
Tremadictyon reticulatum																																									2																																	1	3
Tremadictyon sp.								3																																																																					3
Craticularia sp.								1																																																																					1
Thyroidium schweiggeri										1																																																																			1
Walcotella pertusa																																			1	1										1							1																					2	6
Walcotella texturata				1		1																																							1						1														1				1	3						9
Rhogostomium corrugatum										1																																																																			1
Aulodomus sp.																																																																						1				1
Gen. et sp. indet.																																																																						1				1
HYALOSPONGEA, LYCHNISKIDA																																																																											22(1,5%)
Sporadopyle obliqua																			1		1			2							1		1		3																2											1			2		1									15
Trochobolus sp.																																																																1											1
Cypellia rugosa																																																							3																			3
Placotelia marcoui										1																																													1																			1	3

Paruch-Kulczycka 1978). The occurrence of criccorhabd spicules (Text-fig. 8*h*) is suggestive of some representatives of the order Hadromerida Topsent, 1898, of the subclass Tetractinimorpha Lévi, 1973 (*see* Wiedenmayer 1980, p. 72). The remainder of the recorded monaxons (Text-fig. 8*a*—*g*) are less diagnostic because most of them occur in lithistid as well as in soft demosponges (*cf.* Lévi 1973, Hartman 1980). The triaenes and asters (Text-fig. 8*i*—*o* and *u*—*y*) may represent some forms of the

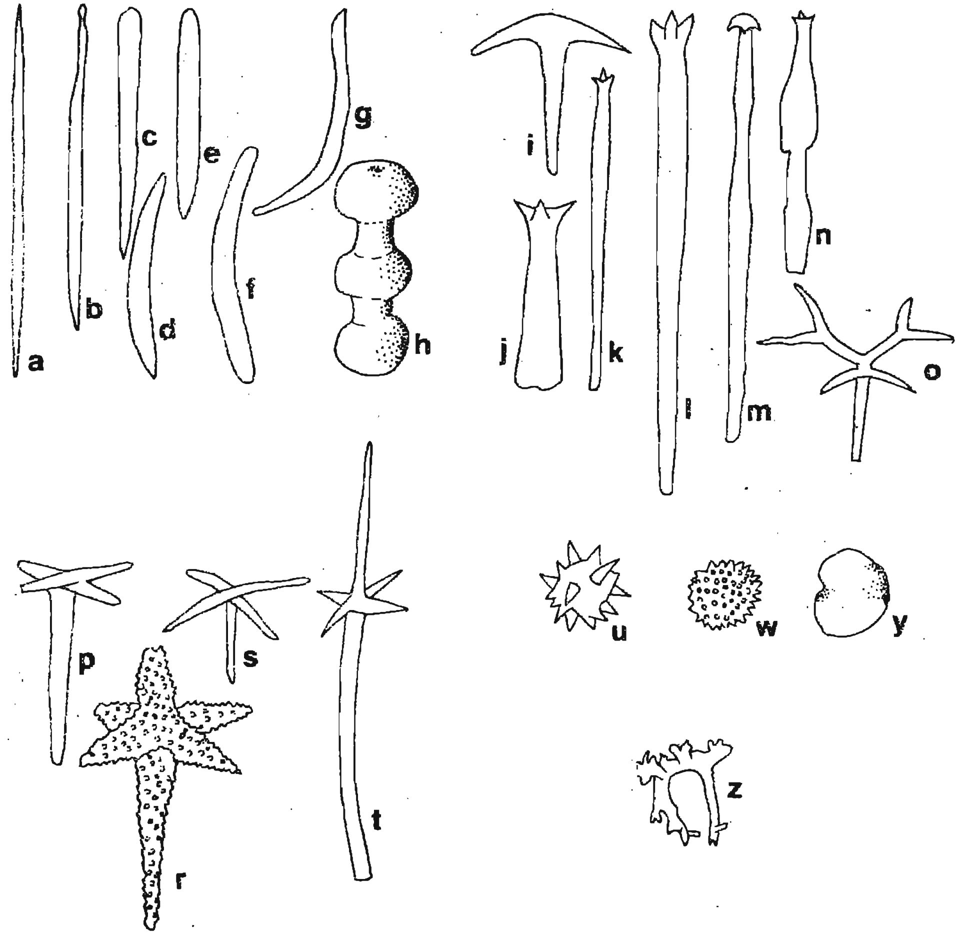


Fig. 8. Sponge spicules obtained from limestones of the Wrzosowa section

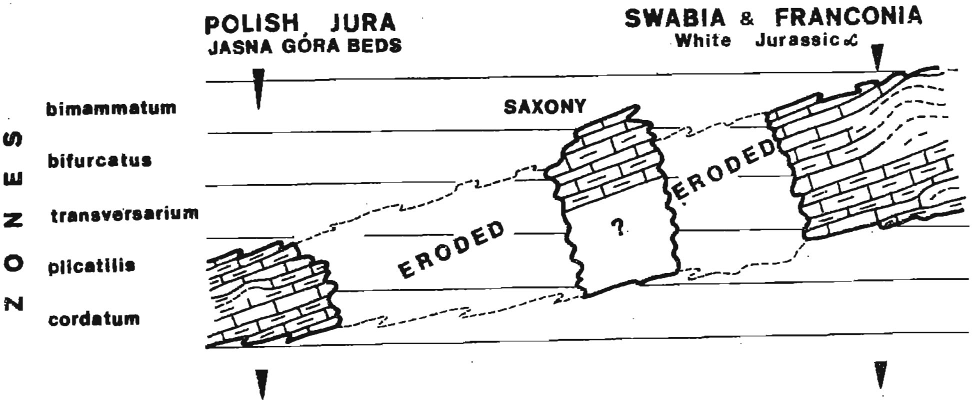
a — oxea, ×16; **b** — style, ×16; **c** — megastyle, ×10; **d** — amphioxe, ×70; **e** — strongyle, ×30; **f** — amphistrongyle, ×70; **g** — ophirhabd, ×30; **h** — criccorhabd, ×100; **i** — anadiaene, ×16; **j** — plagiotriaene, ×30; **k** — orthotriaene, ×10; **l** — protriaene, ×15; **m** — anatriaene, ×10; **n** — prostylotriaene, ×15; **o** — prodichotriaene, ×30; **p** — oxypentacine, ×30; **r** — echinohexactine, ×70; **s** — anatetraene, ×15; **t** — oxyhexactine, ×16; **u** — sphaeraster, ×100; **w** — sterraster, ×100; **y** — "rhax" (=corroded aster of Rützler & Macintyre, 1978), ×100; **z** — rhizoclone, ×50

Drawn from photographs presented by Moczydłowska & Paruch-Kulczycka (1978) order Astrophorida Sollas, 1888 (= Choristida), of the subclass Tetractinimorpha (*see* Lévi 1973, Bergquist 1978, Hartman 1980). Some lithistids may in fact comprise triaenes and asters in addition to desms. However, the Lithistida are represented in the Jasna Góra Beds almost exclusively by the Rhizomorina; whereas the extant rhizoclonid sponges have either no triaenes at all, or (*e.g.* the genus *Corallistes*) they have triaenes with long clads (Rauff 1893, Zittel 1878, Lévi 1973), different from those with very short clads found at Wrzosowa.

REGIONAL COMPARISONS OF THE SPONGE MEGAFACIES

SWABIA AND FRANCONIA

When the Jasna Góra Beds, typical of the White Jurassic, accumulated in the Polish Jura, sandy glauconitic marls typical of the Brown Jurassic still deposited in Swabia and Franconia (*see* e.g. Zeiss 1955; Nitzopoulos 1974; Ziegler 1977, Fig. 3). The latter rocks are devoid of sponges. The calcareous-marly sedimentation started in that area in the *transversarium* Zone. Since that time up to the end of the *bimam-*



mainly in bedded rocks	MODE OF SPONGES OCCURRENCE	mainly in bioherms
very rare	ALGAL CRUSTS ON SPONGES	very abundant
28	TOTAL NUMBER OF SPECIES	51
14	NUMBER OF SPECIES IN COMMON	14
12	NUMBER OF DEMOSPONGEA SPECIES	11
16	NUMBER OF HYALOSPONGEA SPECIES	40
dominant (96%)	ABUNDANCE OF DEMONSPONGEA	subordinate (5%)
subordinate (4%)	ABUNDANCE OF HYALOSPONGEA	dominant (95%)

Fig. 9. Stratigraphic position of the oldest members of the White Jurassic in Poland (= Jasna Góra Beds) and in southern Germany (= White Jurassic α), including short chracteristics of the sponge assemblages

matum Zone, limestones interbedded with marls were deposited in Swabia and Franconia; those rich in sponges rocks are called as the White Jurassic *a* or the *Oxford-Mergel* (Gwinner 1976, Ziegler 1977). The White Jurassic *a* and the Jasna Góra Beds are facies equivalent to each other. They appear at the begin of the sedimentary cycle of the White Jurassic, and they are almost indiscernible lithologically from each other. For instance, the rocks representative of the *bimammatum* Zone at Nusplingen, Swabia (*cf.* Dietl & *al.* 1980), are macroscopically identical to the Jasna Góra Beds.

A marine connection supposedly existed in the Oxfordian between Swabia and Franconia on one hand, and Poland on the other (Hölder 1964, p. 354; Geyer & Gwinner 1968). Consequently, the calcareous-marly facies marking the onset of the White Jurassic sedimentation is diachronous; it developed in the *cordatum* to *plicatilis* Zones in the Polish Jura (Jasna Góra Beds), while it appeared later (White Jurassic *a*) in Germany (Text-fig. 9).

The two complexes are facies equivalent to each other but nevertheless, their sponge assemblages are widely different (Text-fig. 9). In the Polish Jura the assemblage is dominated by the Demospongea, while the Hyalospongea prevail in Germany. The assemblage recorded in the White Jurassic *a* includes 51 sponge species (Schrammen 1937[2]), most of which occur very rarely (Schrammen 1937; W. Müller, *personal communication*). Only a few species of the genera *Cypellia, Sporadopyle, Stauroderma,* and *Tremadictyon* represent the vast majority of sponges found in Swabia and Franconia. These species occur also in the Jasna Góra Beds but only very rarely. In turn, the species dominant in the Jasna Góra Beds (representatives of the genera *Cnemidiastrum, Hyalotragos, Platychonia*) occur very rarely in the White Jurassic *a* (W. Müller, *personal communication*).

The apparent change in sponge assemblage of the considered calcareous-marly facies with time (Text-fig. 9) was mostly ecological in nature, as the dominance hierarchy has changed within the constant

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[2] Schrammen (1937, p. 187) described 61 sponge species from the White Jurassic *a*. However, the present author revisited Schrammen's collection kept at the Institut and Museum für Geologie und Paläontologie, University of Tübingen and realized that some forms collected from a single facies complex intergrade morphologically with each other with respect to characters recognized for diagnostic by Schrammen (1937). Consequently, the following species established by Schrammen (1937) have been recognized to be synonymous: *Phanerochiderma rugosa* and *P. infundibuliformis, Paracypellia prolifera* and *P. minor, Stauroderma lochense* and *S. microstomata, Craticularia clathrata* and *C. paradoxa, Paracraticularia procumbens* and *P. arborescens, Rhopalicus pertusus* and *R. cingulatus* and *R. macrostomata, Verrucocoelia verrucosa* and *V. gregaria, Polyphemus fungiformis* and *P. strombiformis.* Some other sponge species form Schrammen's (1937) may also be ecological variants (*cf.* Ziegler 1977, p. 35) but this cannot be demonstrated at the moment because of the scarcity of the material.

group of species. The evolutionary process seems to have played but a minor role, as the species absent from the Jasna Góra Beds but present in the White Jurassic α occur in the latter area in very small amounts.

The two sponge assemblages under discussion differ also from each other in the mode of occurrence of sponges. Sponges occur mostly in bedded rocks in the Polish Jura, while they are usually confined to bioherms in Germany. Furthermore, the upper surface of sponges very commonly displays a calcareous (? algal) crust in Germany (Hiller 1964, Wagenplast 1972, Nitzopoulos 1974, Gwinner 1976, Ziegler 1977, and others), whereas such crusts are rare and poorly developed on the sponges of the Jasna Góra Beds.

SWITZERLAND AND FRANCE

The Jasna Góra Beds are facies equivalent also to the Birmenstorf Beds of the Jura Mts. The latter complex consists of limestones interbedded with marls, and it marks the onset of the White Jurassic sedimentation. The accumulation of the Birmenstorf Beds was confined to the *transversarium* Zone almost everywhere in their outcrops (Gygi 1969).

The Jasna Góra Beds share 17 sponge species in common with the Birmenstorf Beds (*cf.* Oppliger 1915, 1926). Nevertheless, the latter sponge assemblage is dominated by the Hyalospongea (representatives of the genera *Tremadictyon, Stauroderma, Cypellia, Sporadopyle*), while the Lithistida occur in subordinate numbers (Oppliger 1915, 1926; Lagneau-Hérenger 1951). The Birmenstorf Beds, however, resemble the Jasna Góra Beds rather than the Swabian and Franconian White Jurassic α in that the sponges are mostly confined to bedded rocks, while bioherms occur only rarely (Behmel 1970; Wiedenmayer 1980, p. 79).

SPAIN

In the prebetic Jurassic of the eastern Spain the sponge facies ranges from the *cordatum* to *bifurcatus* Zones, and sometimes even up to *bimammutum* Zone (Behmel 1970, El Khoudary 1972). However, it differs from the Jasna Góra Beds, as it includes mostly irregularly bedded limestones without any marly intercalations. The Jurassic sponges of Spain have not been studied in detail but the general data given by Behmel (1970) indicate that the Hyalospongea are dominant and the Lithistida subordinate.

ECOLOGICAL REMARKS

SPONGE-SEDIMENT RELATIONSHIP

Some relationship between the composition of a sponge assemblage and the rock character has been found, well exemplified by the section of Wrzosowa (Text-fig. 10). All taxa contribute more or less equally to the assemblage recorded in marly beds, while a single species by far predominates in limestones. The dominant species in limestones of Wrzosowa (Text-fig. 10) is *Hyalotragos patella.* This sponge achieves

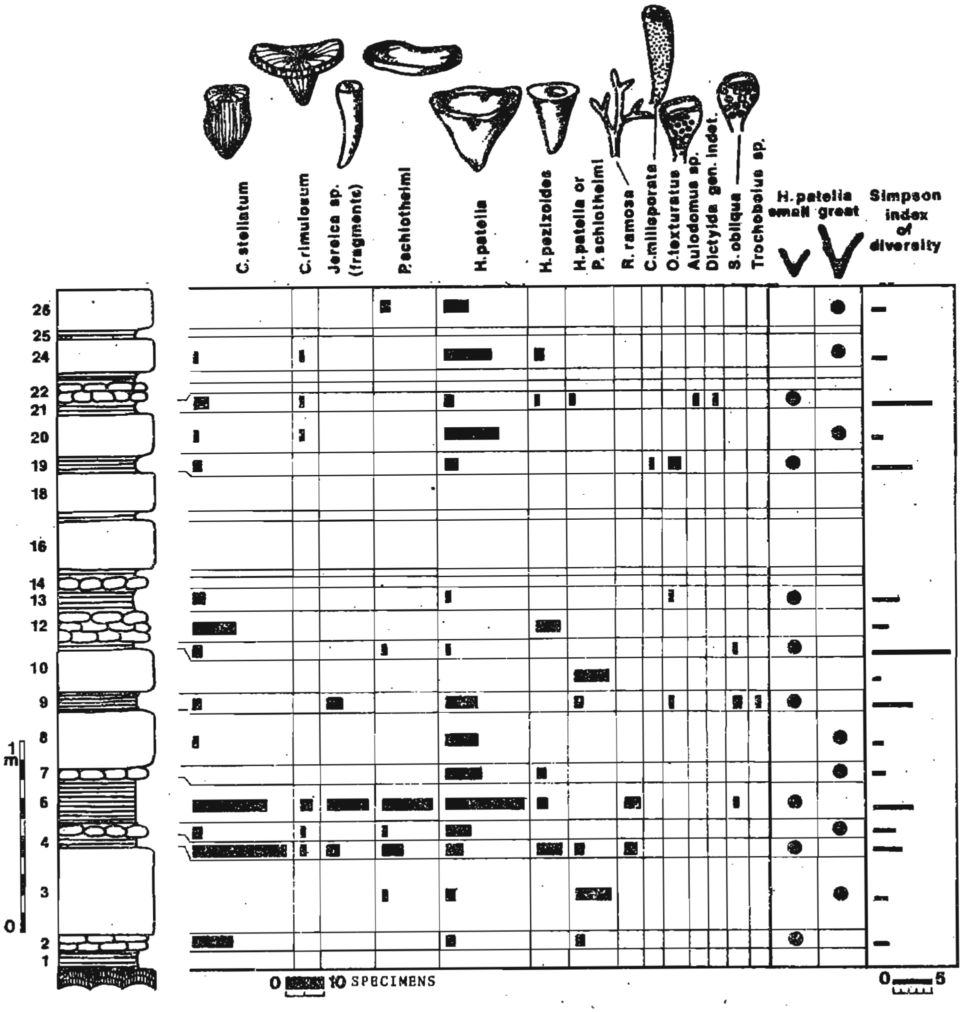

Fig. 10. Dependence of the sponge-assemblage diversity upon the nature of the embedding limestone (visible is greater diversity of assemblages from marly beds; for further comments see the text); lithology the same as in Text-fig. 3

also much larger size in limestones than in marls. The observed relationship is well evidenced (Text-fig. 10) by the Simpson index of diversity and equitability, while decreases with increasing dominance of an assemblage.

Whether this sponge-sediment relationship reflects a direct dependence of the sponges upon the substrate, or upon some other ecological factors correlated with bottom sediment nature, is unknown.

MODE OF ATTACHMENT

The rocks constituent of the Jasna Góra Beds contain a considerable amount of clay matter, which made impossible a rapid early lithification (*cf.* Shinn 1969, Zankl 1969). There are no hardgrounds. It seems that the bottom was never firm, as there are no traces of burrowers, no algal crusts or diastems. One is forced to conclude that the substrate was soft. Hard substrate areas, however, were provided by dead sponges, shells of ammonites, and skeletons of benthic organisms.

Only two specimens (*Platychonia schlotheimi* and *Leiodorella expansa*; Pl. 7, Fig. 1*a* and Pl. 10, Fig. 1*c*, respectively) have been found to display a flat attachment scar. None of the other specimens, including those very well preserved, displays a flat attachment scar, root tufs or peduncles; sometimes, however, an irregular, somewhat nodular, rounded element occurs at the lower surface. Any isolated root tufs have not been recorded.

The vast majority of the assemblage is represented by lithistid demosponges. Extant demosponges live usually at hard substrates, but a few forms have their lower part buried in the sediment or live freely on the bottom (Rauff 1893, Sarà & Vacelet 1973, Wiedenmayer 1979, Fry & Fry 1979). One may suppose that most sponges of the Jasna Góra Beds did also live slightly implanted in the sediment. This mode of life has already been proposed by Hess (1975) and Wiedenmayer (1980, Fig. 2.1—16) for the sponges of the Birmenstorf Beds of Switzerland.

It is noteworthy that species-diverse and abundant demosponge assemblages, those from shallow-water tropical environments as well as those from the continental slope of the Antarctic, prefer nowadays hard substrates (Sarà & Vacelet 1973, Wiedenmayer 1979); whereas extant demosponges adapted to soft bottoms occur in species-poor assemblages with very low population density. In the Upper Jurassic, however, at least in the Jasna Góra Beds and the Birmenstorf Beds, species-rich and abundant sponge assemblages seem to have consisted of forms adapted to soft substrate conditions.

BATHYMETRIC POSITION OF THE SPONGE FACIES

There are no sedimentary structures or rocks indicative of wave action on the bottom sediment in the Jasna Góra Beds, which indicates that these strata accumulated below the wave base. There are also no doubtless, well developed calcareous crusts similar to those widespread in the Upper Jurassic sponge facies of Swabia and Franconia where they have been interpreted to be algal in origin (see *e.g.* Ziegler 1977). One may conclude that the Jasna Góra Beds accumulated below the wave base and photic zone; hence, at the depth not less than 150—200 m. The faunal spectrum of the Jasna Góra Beds (Text-fig. 5; *cf.* also Matyja & Giżejewska 1979) is suggestive of the deeper shelf, as judged after the bathymetric model put forth by Ziegler (1967, 1971). The basin seems to have deepened southwards, as the ammonite spectra from Częstochowa region and Zalas (Matyja & Giżejewska 1979) are typical of the shallow to deeper shelf boundary and the proper deeper shelf, respectively (*cf.* Ziegler 1967). Furthermore, rocks resembling the ammonitico rosso facies have been observed at Zalas but not further to the north. This interpretation is consistent also with the general paleogeographic image (Text-fig. 6), as the sponge megafacies contacts the Tethyan realm in the south and shallow-water facies in the north.

The available geological evidence permits thus the conclusion that the sponge assemblage of the Jasna Góra Beds lived at the depth not smaller than 150—200 m[3]. The assemblage was dominated by the Lithistida. Extant lithistids range from subtidal zone down to at least 1500 m in depth, but most of them prefer the interval of 100 to 300 m in depth (Sara & Vacelet 1973, Hartman 1980). Their bathymetric requirements remained more or less constant since the Late Jurassic. However, the abundance and diversity of non-lithistid demosponges rapidly decrease below 50—60 m in depth in present-day warm seas (Sarà & Vacelet 1973, p. 550), whereas those deeper habitats were occupied in the warm (Fritz 1965, Veizer 1974) Jurassic seas by a rich lithistid assemblage. The Lithistida are now a relic organic group (de Laubenfels 1957). One may thus conclude that the deeper shelf of warm seas made void by the lithistid decline has nevertheless not been settled by non-lithistid demosponges. The latter, as well as the accompanying hexactinellids, seem to prefer the deeper shelf and the con-

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[3] The lower limit of the bathymetric range of the assemblage can hardly be determined with certainty. One may, however, suppose that at least locally this limit could be a little or even considerably below 200 m. The sponge facies interfingers in Swabia with pelagic Tethyan limestones (Hiller 1964, Fig. 37) deposited, according to Bosellini & Winterer (1975), at the depth of 200—1000 m. In Spain, the sponge facies grades southwards into the ammonitico rosso facies, the latter having accumulated at depths exceeding 1000 m (*cf.* Bosellini & Winterer 1975).

tinental slope of the cold climatic zone (Sarà & Vacelet 1973, Wiedenmayer 1980).

The sponge assemblage of the White Jurassic α of Germany is dominated by the Hyalospongea (lychniskids and dictyids), which contrasts to the lithistid-dominated assemblage of the Jasna Góra Beds. The white Jurassic α is commonly thought to have accumulated at the depth of 100-200 m or a little more (*see* Gwinner 1976). However, those strata commonly contain algal crusts, which indicates that the bottom was in the photic zone. Consequently, the White Jurassic α accumulated in shallower depositional environment than the Jasna Góra beeds did, or in exceptionally clear water.

The above presented considerations undermine the generality of the bathymetric model established after the Upper Jurassic sponge facies of Swabia and Franconia, according to which the Hexactinellida were characteristic of deeper water and the Lithistida of shallower water in the Late Jurassic (Gwinner 1962; Ziegler 1977, Fig. 31). That model was already partly questioned by Wagner (1963a) and Reid (1968). The problem in bathymetric requirements of fossil sponges has been for long discussed (de Laubenfels 1957; Nestler 1961; Gwinner 1962; Wagner 1963a, b; Reid 1968; Finks 1970; Ulbrich 1974; Wiedenmayer 1980) but it is still far from being solved.

Another problem concerns bathymetric requirements of particular species, which could contribute to the differences between the sponge faunas observed in the north and south of the investigated area in the Polish Jura. The species *Reiswigia ramosa* and *Cylindrophyma milleporata* commonly occur in the south which may suggest that they preferred deeper-water habitats; whereas *Hyalotragos patella*, dominant in the north, could show preference for shallower-water environments. The other common species are widespread in the whole study area, which may indicate that they were eurybathic within the limits of the deeper shelf.

SPONGE BIOHERM AT ZALAS

The bioherm recorded at Zalas (Text-fig. 4) consists almost exclusively of sponges, which makes a difference from the Swabian and Franconian bioherms as well as from those from the overlying parts of the Oxfordian in the Polish Jura (Text-fig. 2). In the Swabian and Franconian bioherms sponges are accompanied by algal crusts and actually, "the crusts are in most cases the predominant rock building components, rather than the sponges" (Gwinner 1971). Furthermore, the sponges are embedded in marly matter at Zalas, while the younger

Oxfordian bioherms of the Polish Jura as well as those from Swabia and Franconia are built by the so-called massive limestones (*Massenkalke*).

The bioherms are rare in the Jasna Góra Beds; hence, the factors that contributed to development of the Zalas bioherm will be shortly discussed.

The underlying strata rapidly decrease in thickness westwerds (Text-fig. 4). There are draping beds at the eastern side of the bioherm, but not at the western one. The bioherm contacts with detritic limestones in the east (Text-fig. 4 and Pl. 2, Fig. 3); the intraclasts constituent of those limestones probably derived from the slope of the bioherm.

This evidence indicates that the bioherm developed at a local slope of the bottom. The bioherm of Zalas is a miniaturized "model" of large fossil bioherms related very commonly to a "sloping sea bottom" or a "break of the slope" (Heckel 1974, pp. 144—145).

To explain this correlation between bioherms and sloping bottoms, a change in speed of the water flowing above the bottom can be invoked, which happens according to the Bernoulli law where the slope of the bottom changes. This improves the water circulation and supports the flourishment of benthic organisms.

TAXONOMY OF THE SPONGES

The large majority of the sponge species found in the Jasna Góra Beds have been described by various authors. Therefore, it might be enough to give herein merely the synonymies and additional remarks on newly discovered details of the structure. However, species established in the last century or at the beginning of this century commonly have no diagnose, but only a description and illustrations; the same specific names have also been variably conceived of by various authors. To avoid further misunderstandings, such species will be diagnosed in the present paper. The diagnoses are usually based on the original descriptions, but given in modern terms and supplemented with new observations wherever necessary.

Where the abundant material permits a study of morphological variability, the task will be undertaken to depart from the morphotype taxonomy by lumping under a single specific name morphotypes found in the same facies complex and interconnected by morphological transitions. This approach contrasts to such splitters as Oppliger (1897, 1907, 1915, 1926) who considered each new feature as sufficient to establish a new species irrespective of the morphological variability.

The variability of those species established after a single or only a few specimens and scarcely representd in the Jasna Góra Beds could not be investigated. With the enormous variability of sponges taken into account, one may often suppose that these are merely morphotypes of other species, which cannot be documented because of the lack of adequate samples.

SYSTEMATIC DESCRIPTION

Class **Demospongea** Sollas, 1875
Order **Lithistida** Schmidt, 1870
Suborder **Rhizomorina** Zittel, 1878

Genus *CNEMIDIASTRUM* Zittel, 1878
(= *Proseliscothon* Siemiradzki, 1913; = *Lithostrobilus* Schrammen,1937)

Diagnosis: Rhizomorine sponge with exhalatory channels densely spaced one over another, which pattern produces distinct radial grooves (*Radialspalten*) at weathered in — and exhalatory surfaces; the grooves may be straight, undulated, or in form of a network. This diagnosis follows Zittel (1878) who gave only description, but not diagnosis of the genus.

Remarks. — The genus *Proseliscothon* Siemiradzki, 1913, does not show any difference from *Cnemidiastrum.* Schrammen (1937) splitted Zittel's *Cnemidiastrum* into two genera: *Lithostrobilus,* including forms of tubular-stenoproct type, and *Cnemidiastrum,* including plate — or bowl-like forms. He attributed *C. stellatum* to the former genus, while *C. rimulosum* and *C. pluristellatum* to the latter. Thus, he considered *C. rimulosum* and *C. pluristellatum* to be more closely phylogenetically related to each other than to *C. stellatum.* However, *C. rimulosum* shares one characteristic feature in common with *C. stellatum* (presence of a single osculum) as well as with *C. pluristellatum* (bowl-like form). All the three species co-occur in the Jasna Góra Beds; this is their first appearance and hence some distinct but equally plausible phylogenetic trees can be presented (Text-fig. 11). There is no evidence whatsoever to claim that *C. rimulosum* and *C. pluristellatum* are more closely related to each other than to *C. stellatum* (*A* and *C* in Text-fig. 11), rather than that *C. rimolosum* and *C. stellatum* are more closely related to each other than to *C. pluristellatum* (*B* and *D* in Text-fig. 11). Therefore, all the three species are here considered congeneric and assigned to *Cnemidiastrum,* according to the Occam's Razor.

The genus *Cnemidiastrum* is morphologically very close to the Cretaceous rhizomorine genera *Cytoracea* Pomel, 1872, and *Astrobolia* Zittel, 1878, as well as to the Cretaceous and Tertiary genus *Pliobolia* Pomel, 1872, Perhaps, these are congeneric forms. However, the author has had no opportunity to investigate those post-Jurassic genera and hence, taxonomic decisions must be posponed.

Cnemidiastrum stellatum (Goldfuss, 1833)
(Pl. 3 and Pl. 5, Fig. 4)

1833. *Cnemidium stellatum* nobis; A. Goldfuss, p. 15, Pl. 6, Fig. 2.
1878. *Cnemispongia goldfussi;* F. A. Quenstedt, pp. 257—267, Pl. 126, Figs 73—74 and Pl. 127, Figs 1—15.
1878. *Cnemispongia corallina;* F .A. Quenstedt, pp. 267—268, Pl. 127, Figs 16 and 18.
1878. *Cnemidiastrum hoheneggeri* Zitt.; K. A. Zittel, p. 46, Pl. 2, Fig. 8.
1897. *Cnemidiastrum corallinum* Quenst. sp.; F. Oppliger, p. 41, Pl. 8, Fig. 4.
1897. *Cnemidiastrum stellatum* Goldf. sp.; F. Oppliger, pp. 41—42, Pl. 8, Fig. 5.
1910. *Cnemidiastrum stellatum* Goldf. sp.; R. Kolb, pp. 216—219.
1913. *Cnemidiastrum stellatum* Gf.; J. Siemiradzki, pp. 4—5, Pl. 1, Fig. 16.
1913. *Cnemidiastrum corallinum* Qu. emend. Siemir.; J. Siemiradzki, pp. 5—6, Pl. 1, Fig. 19.

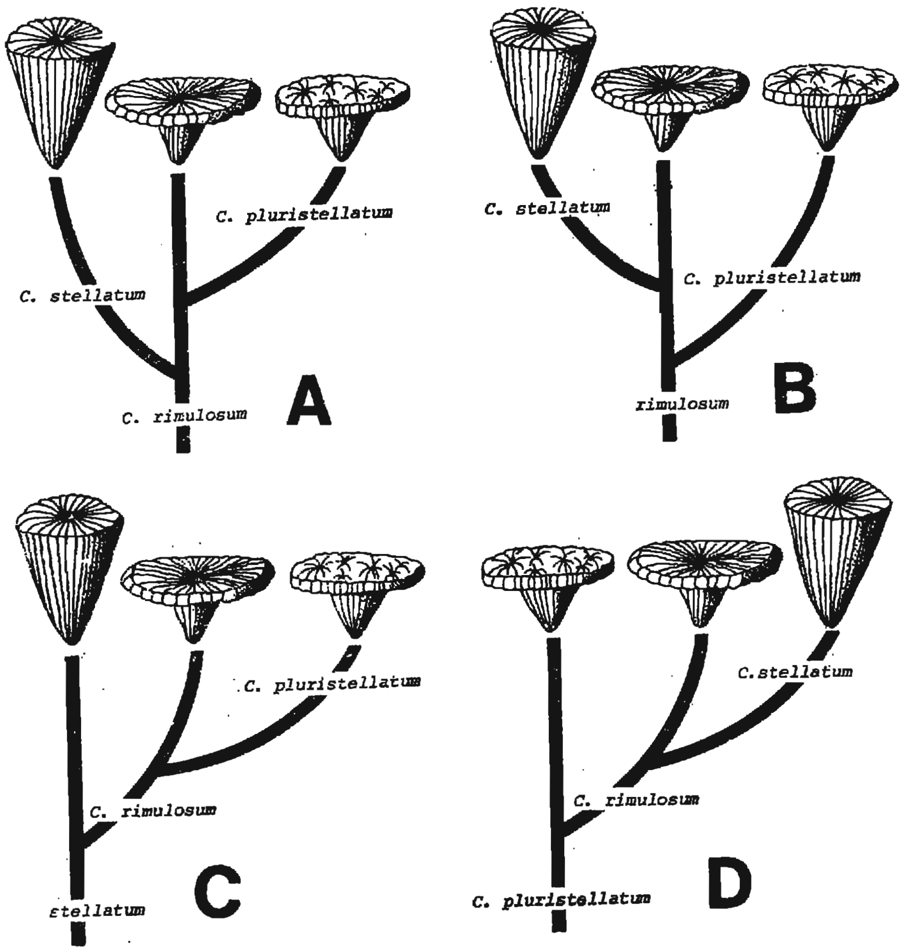


Fig. 11. Models of filogenic lineages between the species *Cnemidiastrum stellatum* (Goldfuss), *C. rimulosum* (Goldfuss) and *C. pluristellatum* Zittel

A — From the *C. rimulosum* stock, firstly is separated *C. stellatum* (change of shape from bowl-like to conical), and afterwards — *C. pluristellatum* (development of numerous oscula)

B — From the *C. rimulosum* stock, firstly is separated *C. pluristellatum*, and secondly — *C. stellatum*

C — From the *C. stellatum* stock, firstly originated *C. rimulosum* (change of shape from conical to bowl-like) from which *C. pluristellatum* developed afterwards

D — From the *C. pluristellatum* stock, firstly originated *C. rimulosum* (reduction of numerous oscula to one) from which *C. stellatum* developed afterwards

All these four models are of the same probability at the moment, and therefore it seems reasonable to give up the distinction between the genus *Lithostrobilus* Schrammen for the species *stellatum*, and genus *Cnemidiastrum* for the two remaining species.

1913. *Cnemidiastrum radiatum* n. sp.; J. Siemiradzki, p. 6, Pl. 1, Figs 20—21.
1913. *Cnemidiastrum hoheneggeri* Zitt.; J. Siemiradzki, p. 6, Pl. 2, Figs 25—26.
1915. *Cnemidiastrum stellatum* Goldf. sp.; F. Oppliger, pp. 61—62.
1937. *Lithostrobilus stellatus* Goldf. sp.; A. Schrammen, p .87.
1937. *Cytoracea pusilla* n. sp.; A. Schrammen, p. 89, Pl. 17, Fig. 7.
1937. *Cytoracea goldfussi* Quenstedt sp.; A. Schrammen, p. 90, Pl. 23., Fig. 6 and Pl. 24, Fig. 7.
1937. *Cytoracea corallina* Quenst. sp.; A. Schrammen, pp. 90—91.

Material: Over 300 specimens.

Diagnosis: Tubular-stenoproct *Cnemidiastrum* in form of a cone or a cylinder. This diagnosis follows the description given by Goldfuss (1833), but it is presented in modern terms.

Remarks. — Various morphotypes of *C. stellatum* have been recognized for distinct species, although the differences consisted mostly in preservation state and/or in features grading continuosly from one morphotype to another (*see* Text-fig. 12) For instance, Zittel (1878) attributed to *C. stellatum* those specimens with straight to undulated radial grooves at the surface, while those with an irregular network of grooves and ostia were assigned to *C. hoheneggeri*. This variation, however, is due to weathering or etching, and a single specimen may display radial grooves on one side and a network of grooves on the other, better preserved side (Trammer 1981, Fig. 2; and Pl. 3, Fig. 12 in the present paper). The other forms referred to in the synonyme were established after a difference in general shape, undulation of radial grooves or their thickness; whereas continuous transitions in those characters appear in the material from the Jasna Góra Beds.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle to Upper Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Tithonian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Oxfordian to Tithonian of France (Lagneau-Hérenger 1951); Middle Oxfordian of Dobruja (Bârbulescu 1974).

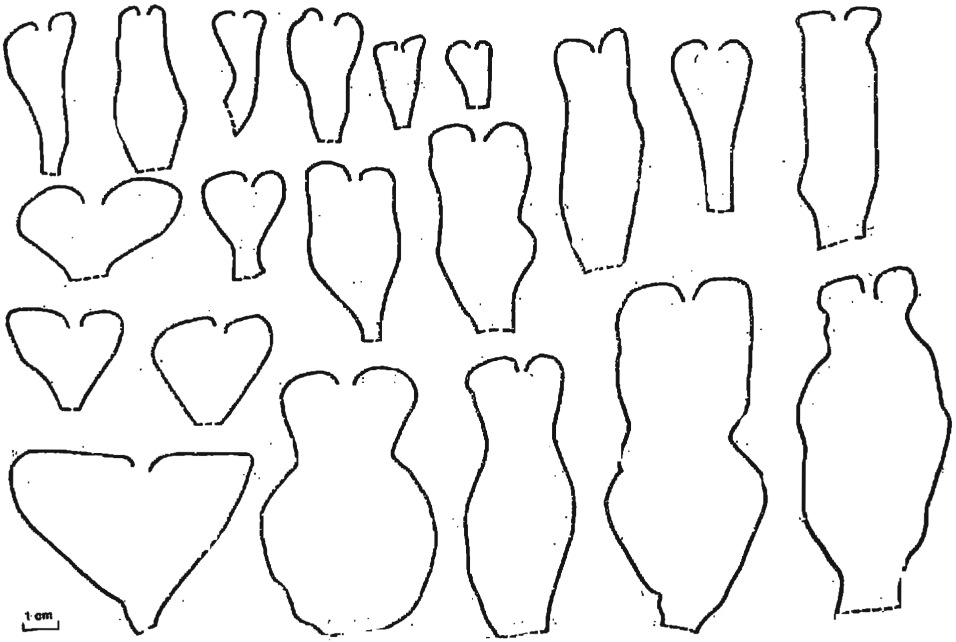
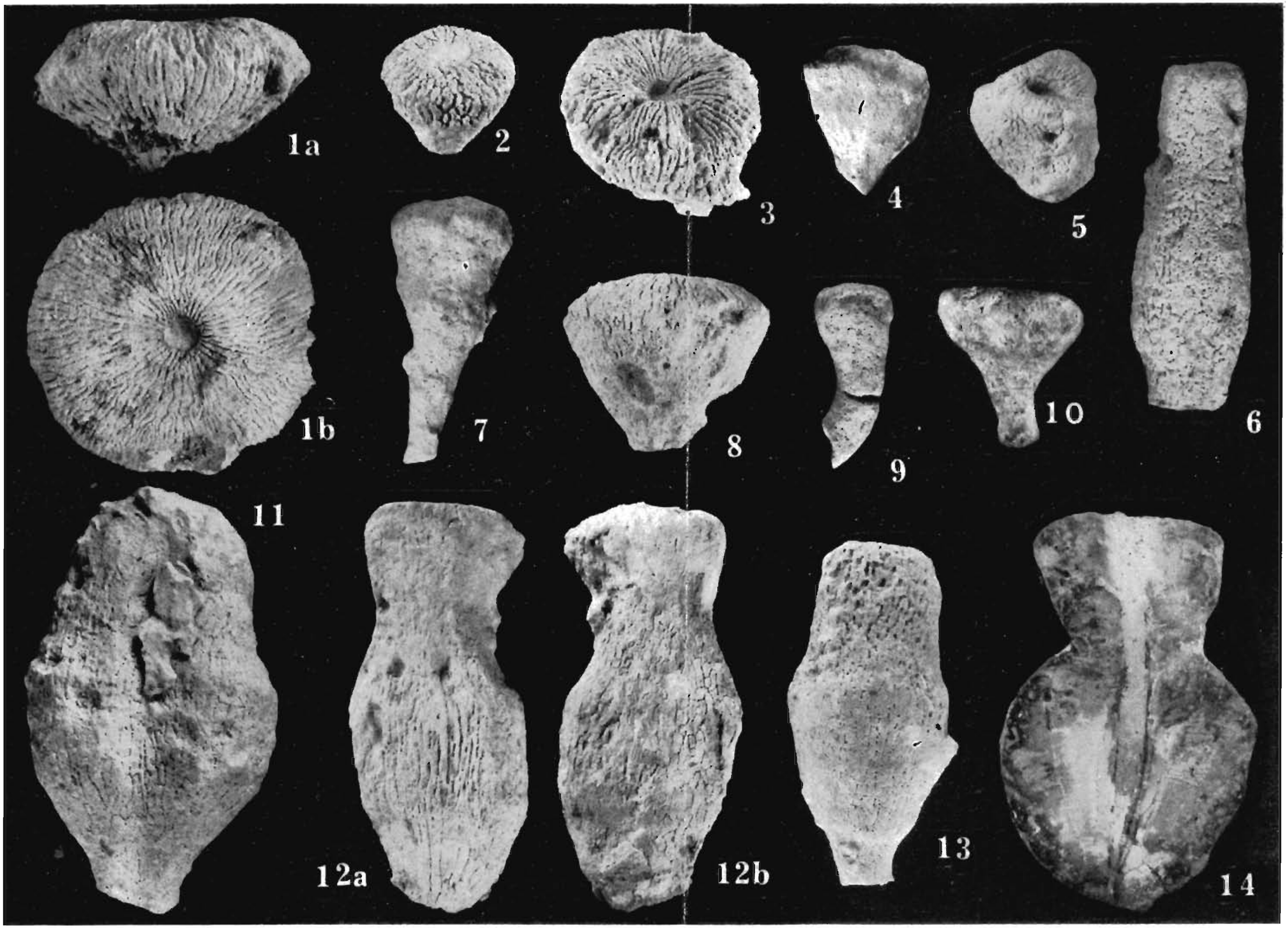


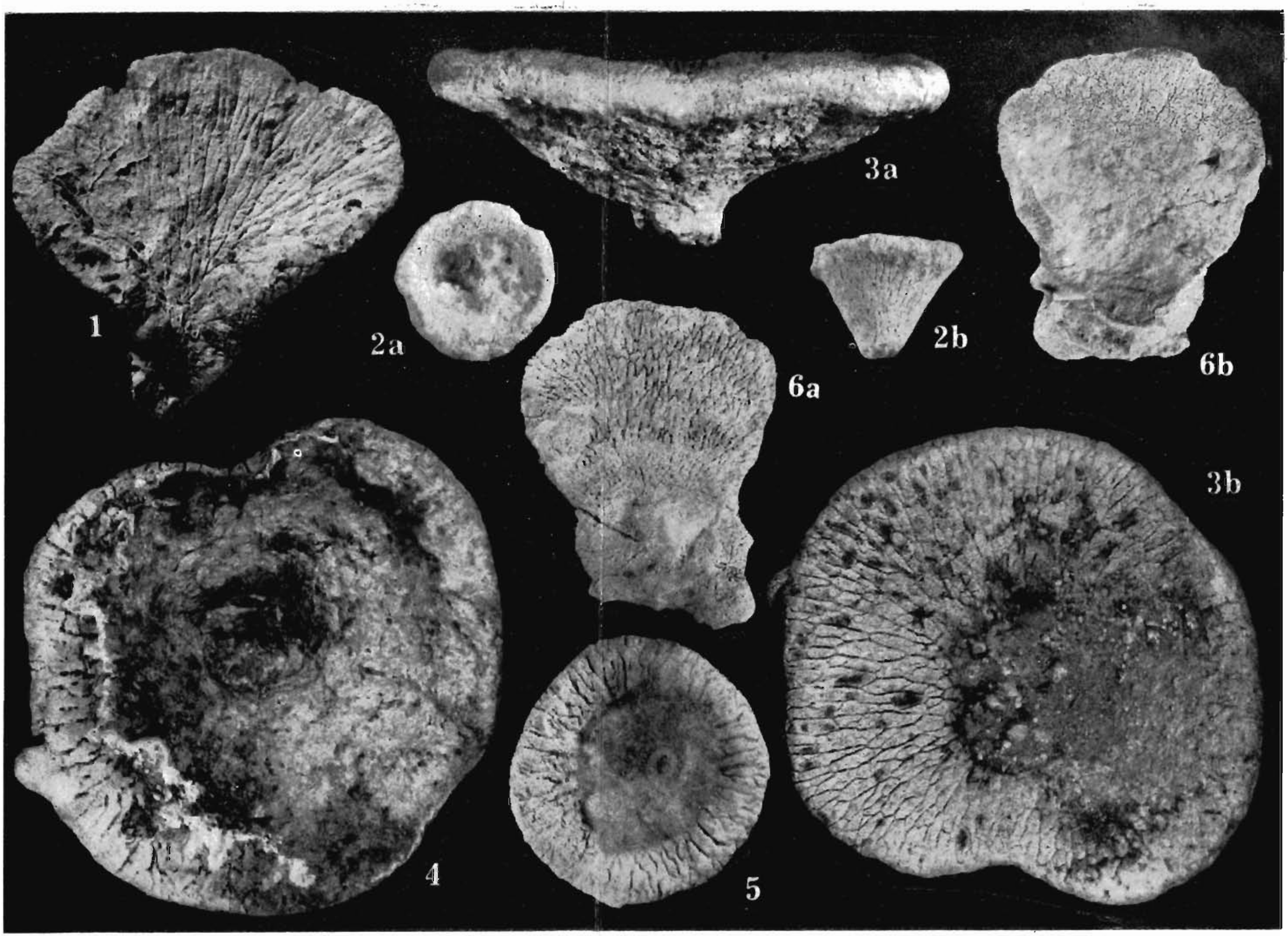
Fig. 12. Shape variability in the species *Cnemidiastrum stellatum* (Goldfuss)



Cnemidiastrum stellatum (Goldfuss) from various localities, to show the shape variability of the species (*cf.* Trammer 1981); external surface of the specimens is either weathered or etched with acid

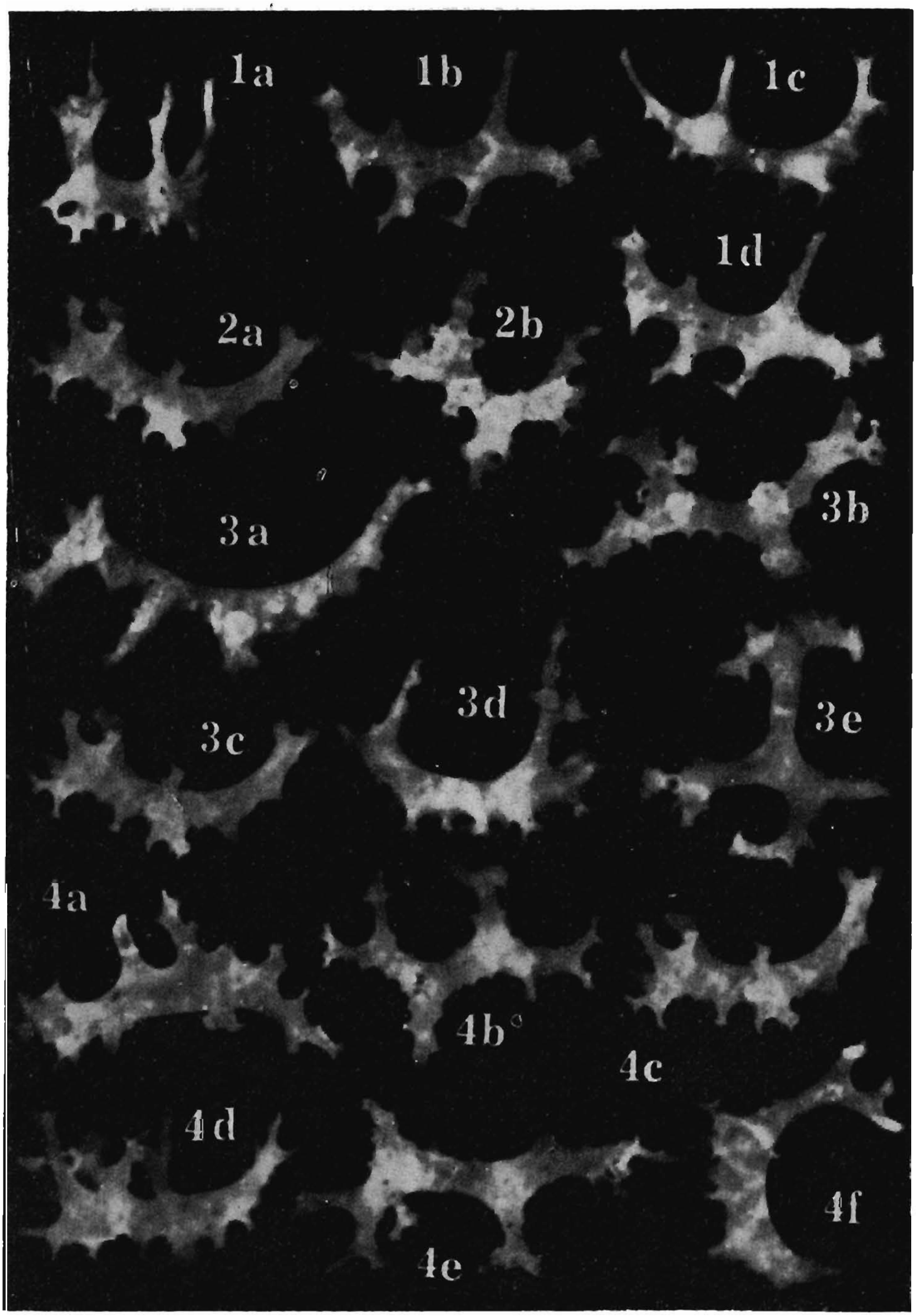
1 — Locality Zalas, bioherm; **2** — Nowa Krystyna, bed *14*; **3** — Nowa Krystyna, bed *13*; **4** — Nowa Krystyna, bed *14*; **5** — pathologic (?) specimen with several oscula; Nowa Krystyna, bed *14*; **6** — Nowa Krystyna, bed *10*; **7** — Nowa Krystyna, bed *14*; **8** — Nowa Krystyna, bed *8*; **9** — Nowa Krystyna, bed *14*; **10** — Zalas, bed *4*; **11** — two accreted specimens; Nowa Krystyna, bed *6*; **12** — specimen displaying radial grooves on one side (*12a*), and the network of grooves on the other, better preserved one (*12b*); Nowa Krystyna, bed *9*; **13** — Nowa Krystyna, bed *5*; **14** — polished specimen, to show the cloaca; Zalas, bioherm

All photos in nat. size; taken by S. Kolanowski



1—5 —*Cnemidiastrum rimulosum* (Goldfuss); **1** — locality Zalas, bed *8;* **2** — Nowa Krystyna, bed *8;* **3—4** — Zalas, bioherm; **5** — Nowa Krystyna, bed *8*
6 — *Cnemidiastrum pluristellatum* (Zittel): **6a** — bottom, **6b** — top view; Nowa Krystyna, bed *9*

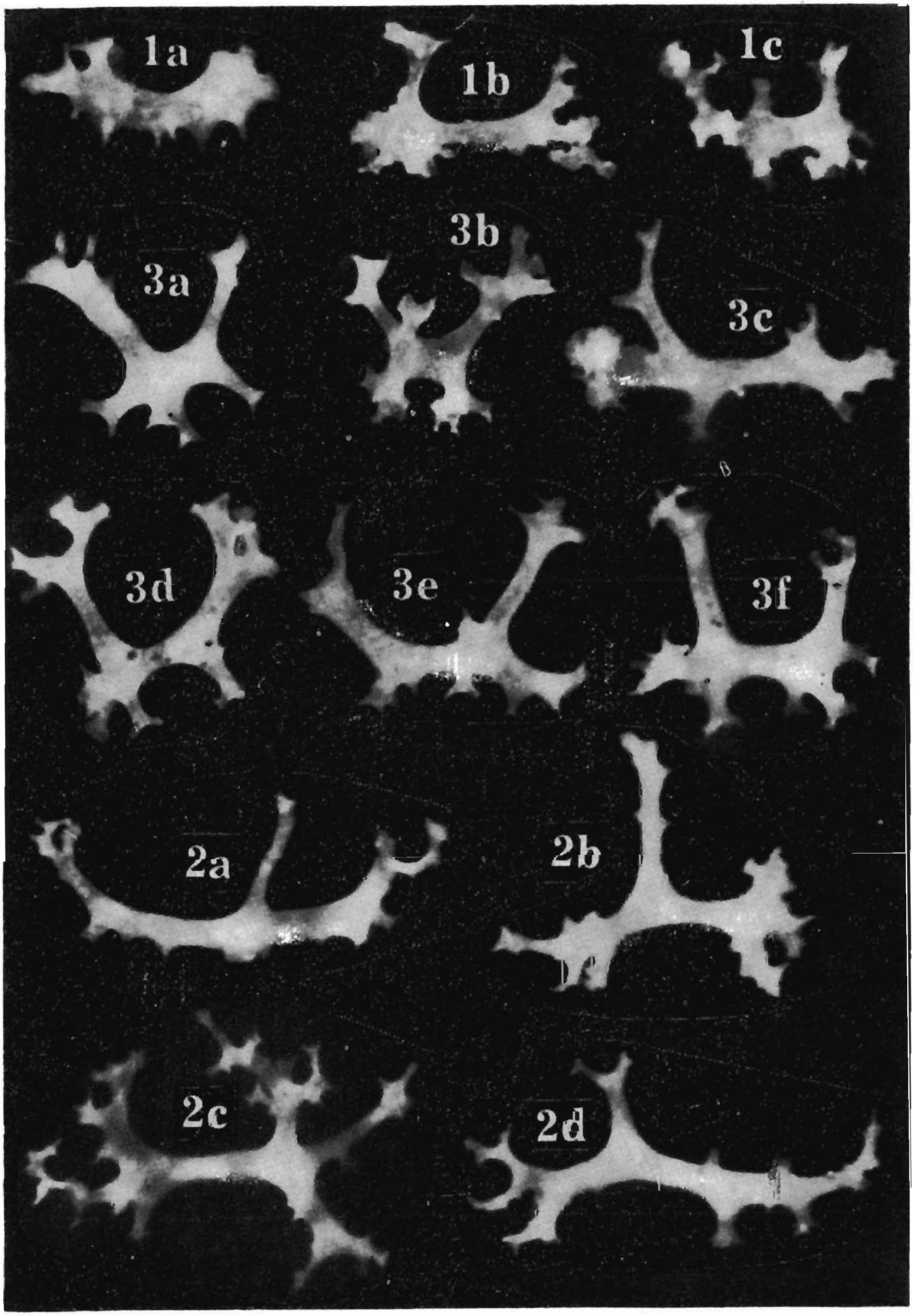
All photos in nat. size; taken by S. Kolanowski



1—3 — Rhizoclones of *Cnemidiastrum rimulosum* (Goldfuss): **1** — locality Zalas, bioherm; **2** — Zalas, bed *8*; **3** — Zalas, bed *4*

4 — Rhizoclones of *Cnemidiastrum stellatum* (Goldfuss); Zalas, bioherm

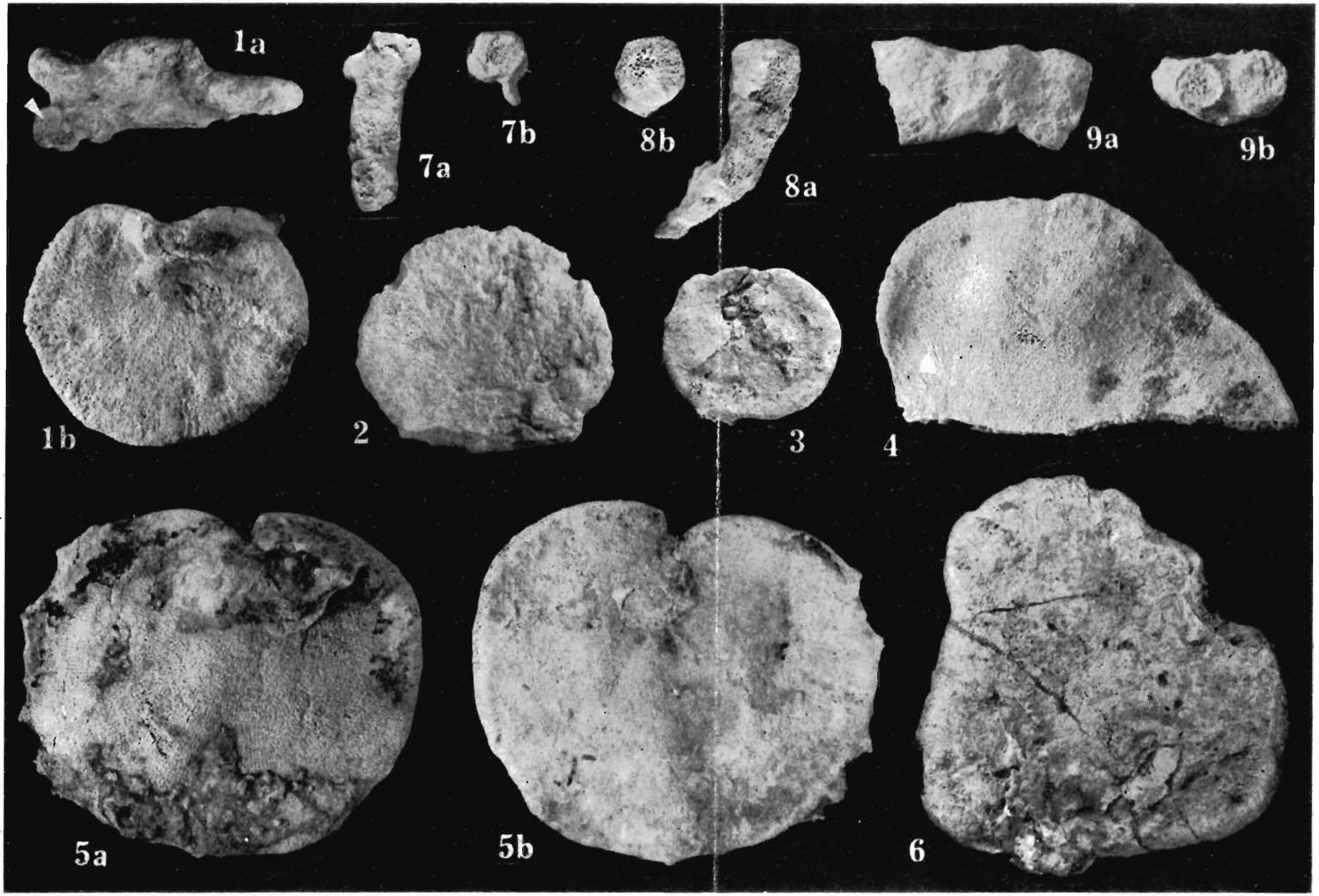
All photos ×100; taken by L. Łuszczewska, M. Sc.



1—2 — Rhizoclones of *Platychonia schlotheimi* (Münster *in* Goldfuss); locality Zalas, bioherm

3 — Rhizoclones of *Jereica* sp.; Wrzosowa, bed 4

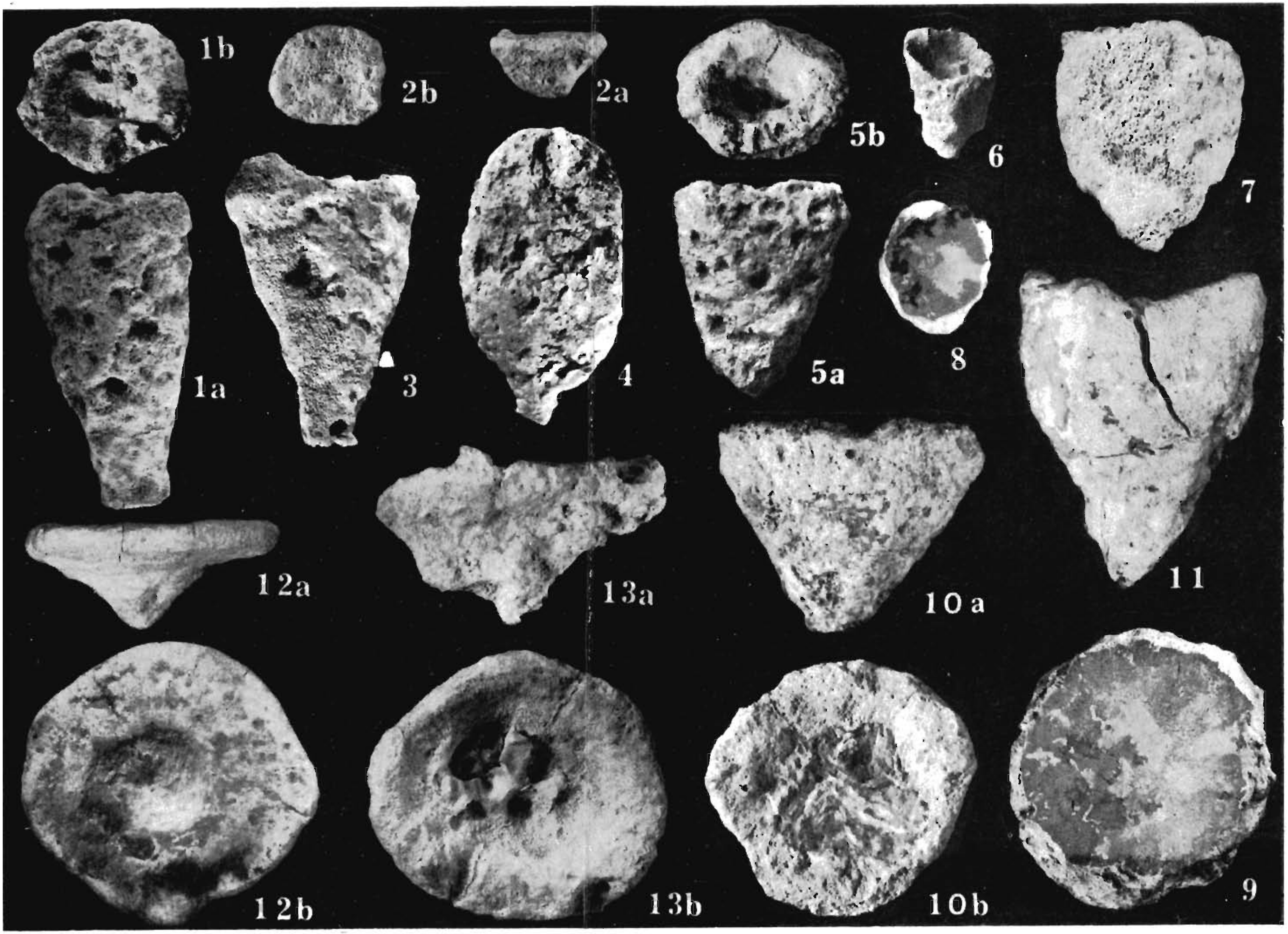
All photos ×100; taken by L. Łuszczewska, M. Sc.



1—6 *Platychonia schlotheimi* (Münster *in* Goldfuss): **1** — locality Zalas, bioherm (*1a* bottom view, arrowed is attachment scar; *1b* top view); **2** — Zalas, bed *6*; **3** — Zalas, bed *3*; **4** — Zalas, bioherm; **5** — Wysoka, bed *23*; **6** — Zalas, bioherm

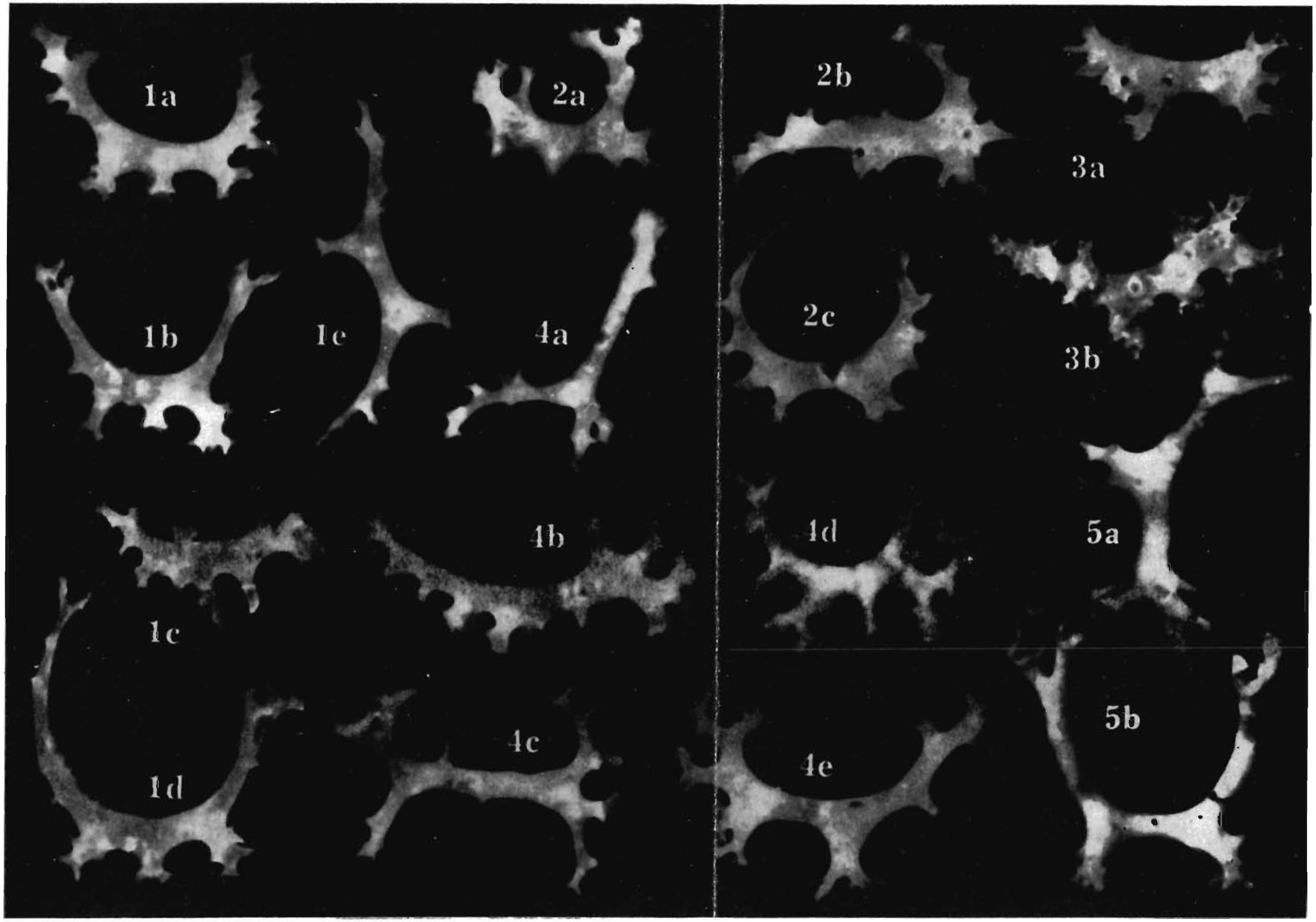
7—9 — *Jereica* sp.: **7** — Wrzosowa, bed *6* (*7a* bottom, *7b* top view); **8** — Wrzosowa, bed *4* (*8a* side, *8b* top view); **9** — specimen composed of the two individuals, parallely grown together; Zalas, bed *4* (*9a* side, *9b* top view)

All photos in nat. size; taken by S. Kolanowski

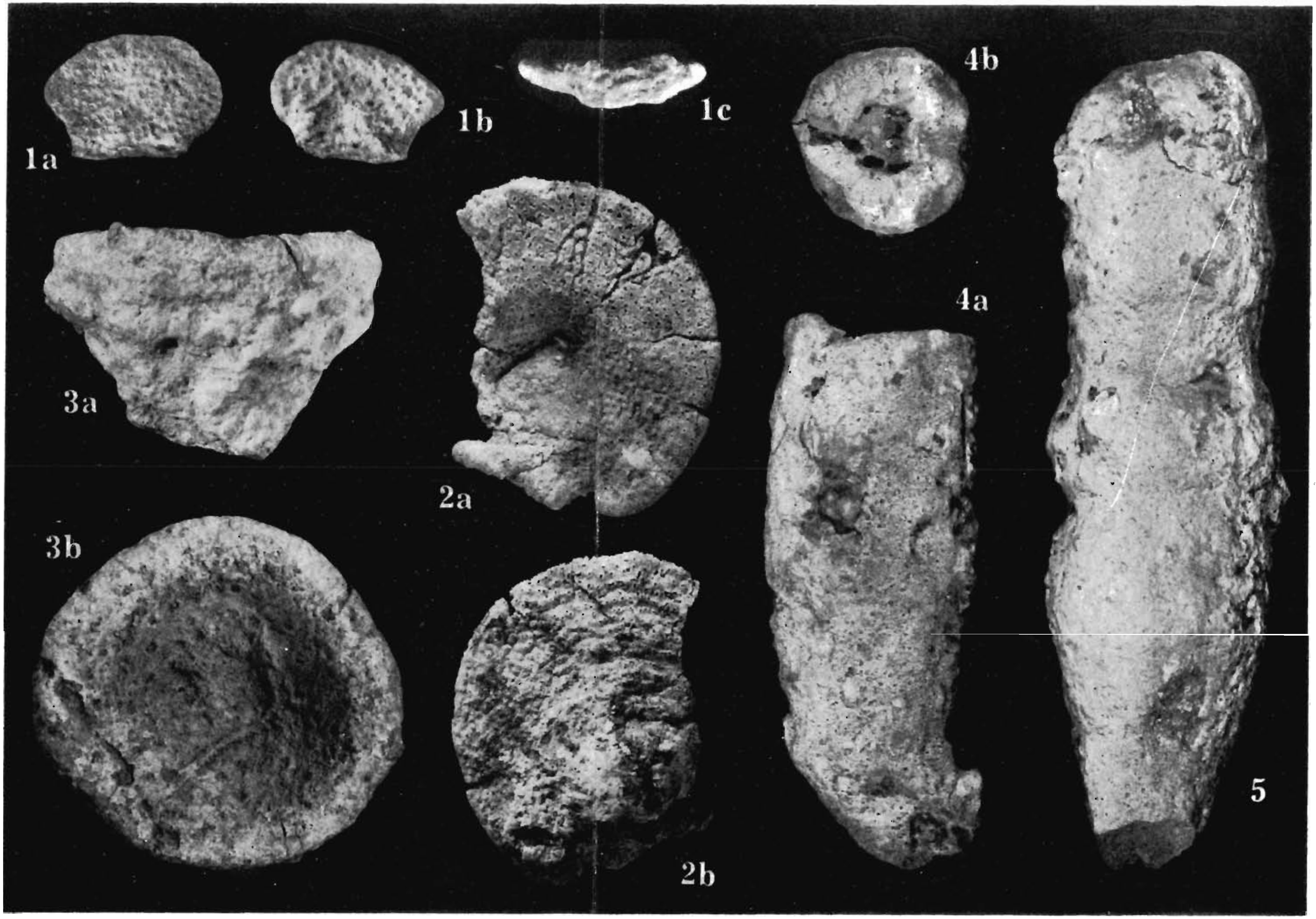


1—10 *Hyalotragos pezizoides* (Goldfuss): **1** — locality Nowa Krystyna, bed *8*; **2** — Wrzosowa, bed *7*; **3** — Ogrodzieniec, bed *15*; **4** — Wysoka, bed *10*; **5** — Nowa Krystyna, bed *8*; **6** — Nowa Krystyna, bed *12*; **7** — Nowa Krystyna, bed *9*; **8—9** — transverse sections, to show vertical canals; Zalas, bioherm; **10** — Wysoka, bed *23*

11—13 *Hyalotragos patella* (Goldfuss): **11** — Wysoka, bed *16*; **12** — Zalas, bioherm; **13** — Zalas, bed *5*
All photos in nat. size; taken by S. Kolanowski



1—4 — Rhizoclones of *Hyalotragos pezizoides* (Goldfuss): **1** — locality Wysoka, bed *16*; **2** — Wysoka, bed *23*; **3** — Zalas, bioherm; **4** — Zalas, bed *7*; **5** — Rhizoclones of *Hyalotragos patella* (Goldfuss); Wrzosowa, bed *6*
All photos ×100; taken by L. Łuszczewska, M.Sc.



1 — *Leiodorella expansa* Zittel: **1a** — lower or side part, **1b** — upper or side part, **1c** — lower or side part (visible is attachment scar); locality Zalas, bed *8*
2 — *Leiodorella foliacea* Oppliger: **2a** — upper part; **2b** — lower part;Zalas, bed *4*; **3** — *Hyalospongia rugosa* (Münster *in* Goldfuss); Zalas, waste
4—5 — *Cylindrophyma milleporata* (Goldfuss); Zalas, bed *6*
All photos in nat. size; taken by S. Kolanowski

Cnemidiastrum rimulosum (Goldfuss, 1833)
(Pl. 4, Figs 1—5 and Pl. 5, Figs 1—3)

1833. *Cnemidium rimulosum* nobis; A. Goldfuss, p. 15, Pl. 6, Fig. 4
1878. *Cnemispongia goldfussi;* F. A. Quenstedt, p. 268, Pl. 127, Fig. 19.
1878. *Cnemispongia nudipes;* F. A. Quenstedt, p. 270, Pl. 127, Fig. 24.
1878. *Cnemidium rimulosum;* F. A. Quenstedt, pp. 271—272, Pl. 128, Figs 1—5.
1878. *Tragos granulosum;* F. A. Quenstedt, pp. 285—286, Pl. 129, Figs 4—5.
1897. *Cnemidiastrum rimulosum* Goldfuss sp.; F. Oppliger, pp. 39—40, Pl. 8, Fig. 1.
1910. *Cnemidiastrum rimulosum* Goldfuss sp.; R. Kolb, pp. 220—221.
1913. *Cnemidiastrum gracile* n. sp.; J. Siemiradzki, pp. 6—7, Pl. 2, Fig. 27.
1913. *Cnemidiastrum rimulosum* Gf.; J. Siemiradzki, p. 7, Pl. 2, Figs 28—29.
1913. *Cnemidiastrum intusstriatum* n. sp.; J. Siemiradzki, p. 7, Pl. 2, Figs 30—31.
1913. *Cnemidiastrum foliaceum* n. sp.; J. Siemiradzki, pp. 7—8, Pl. 2, Figs 22—23 and Pl. 3, Fig. 36.
1913. *Proeliscothon cracoviense* n. sp.; J. Siemiraddzki, pp. 14—15, Pl. 5, Figs 64—65.
1915. *Cnemidiastrum rimulosum* Goldf. sp.; F. Oppliger, p. 63.
1915. *Cnemidiastrum rhizophorum* n. sp.; F. Oppliger, p. 64, Pl. 11, Fig. 2.
1915. *Cnemidiastrum calycinum* n. sp.; F. Oppliger, p. 65, Pl. 11, Fig. 3.
1926. *Cnemidiastrum linguiformis* n. sp.; F. Oppliger, p. 52, Pl. 3, Fig. 5.
1926. *Cnemidiastrum expansum* n. sp.; F. Oppliger, pp. 52—53, Pl. 3, Fig. 6.
1937. *Cnemidiastrum rimulosum* Goldf. sp.; A. Schrammen, pp. 85—86, Pl. 23, Fig. 3.
1937. *Cnemidiastrum granulosum* Quenst. sp.; A. Schrammen, pp. 86—87, Pl. 23, Figs 4—5.

Material: Over 160 specimens.

Diagnosis: *Cnemidiastrum* in form of a plate, fan, bowl, or vase; osculum absent in plate- or fan-like forms; a single osculum in bowl- or vase-like forms. This diagnosis follows the description given by Goldfuss (1833), but it is supplemented with remarks on osculum.

Remarks. — Most forms referred to in the synonymy are morphotypes variable in shape but continuously grading into one another in the investigated material from the Jasna Góra Beds (See Text-fig. 13). In turn, *Tragos granulosum* Quenstedt is distinctive due to its preservation state because the exhalatory channels, preserved usually as grooves, have been filled up with some resistant matter, which produces a pattern of rolls or ridges.

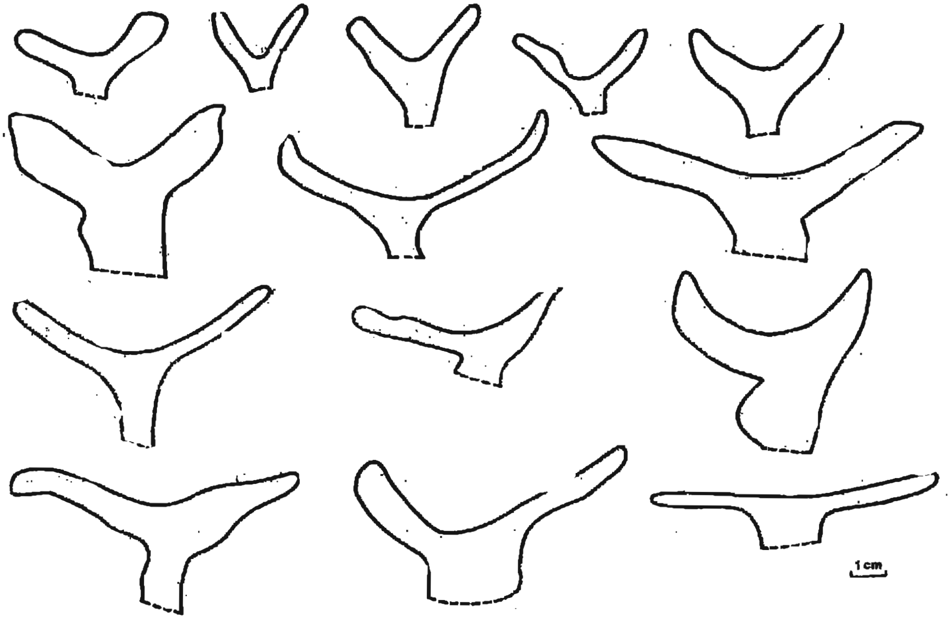


Fig. 13. Shape variability in the species *Cnemidiastrum rimulosum* (Goldfuss)

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Kimmeridgian of the Swiss Jura, Swabia, Franconia, and France (Oppliger 1926, Schrammen 1937, Lagneau-Hérenger 1951); perhaps also Middle Oxfordian of Spain (Behmel 1970).

Cnemidiastrum pluristellatum Zittel, 1878
(Pl. 4, Fig. 6)

1926. *Cnemidiastrum pluristellatum* Zitt.; F. Oppliger, pp. 50—51 [*cum syn.*].
1937. *Cnemidiastrum pluristellatum* Zittel; A. Schrammen, p. 85.
Material: One fragment.
Diagnosis: *Cnemidiastrum* in form of a plate, vase, bowl, or fan, with several oscula at the upper surface; radial grooves spread from each of the oscula.

Remarks. — The specimens from Swabia and Franconia (Quenstedt's and Schrammen's collections) differ from the investigated specimen in their oscula being wider, with less numerous and wider radial grooves.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); uppermost Oxfordian to lowermost Kimmeridgian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Lower Kimmeridgian of the Swiss Jura (Oppliger 1926).

Genus *JEREICA* Zittel, 1878

Diagnosis: Rhizomorine sponge in form a sphere, pear, cone, or cylinder, with multiple cloaca (*i. e.* a bunch of vertical channels; *Verticalröhren*) and multiple osculum; upper surface flat to convex (Zittel 1878; *cf. also* Moret 1948, Fig. 48*D*); skeleton fibroid (*sensu* de Laubenfelds 1955, p. *E45*).

Jereica sp.
(Pl. 6, Fig. 3 and Pl. 7, Figs 7—9)

1913. *Jerea cracoviensis* n. sp.; J. Siemiradzki, pp. 16—17, Pl. 6, Figs 70—72.
Material: One whole specimen and 18 fragments.

Description. — The only whole specimen is slender conical to claviform (Pl. 7, Fig. 8); the others are cylindrical, one of them (Pl. 7, Fig. 9) representing two cylindrical individuals laterally attached to each other. A bunch of vertical channels, 14 to 20 in number, occurs in the middle of the form. The channels are closely attached to each other, more or less constant in diameter (0.5 to 0.7 mm). Inhalatory channels are horizontal. The cortex is fairly thick (up to 1 mm), of "*Deckschicht*" type. Lateral sides are covered wirh regularly spaced, very numerous, circular to irregular ostia attached one to another. The skeleton consists of rhizoclones, relatively poor in processes. The spicules are distincly different from those typical of *Cnemidiastrum*, rich in processes; in turn, they resemble some spicules of the genus *Hyalotragos*. Some spicules of *Jereica* sp. seem to be intermediate between the rhizoclone and the tetraclone (Pl. 6, Fig. 3).

Remarks. — This form resembles very closely some Cretaceous congeners; e. g. *Jereica polystoma* (Roemer), and especially its morphotypes reported from deeper-water facies (*cf. e. g.* Ulbrich 1974, Pl. 6, Figs 3—4). However, the Cretaceous species of *Jereica* have spicules densely covered with processes (see *e. g.* Zittel 1878, Pl. 4, Figs 11—12).

The investigated form may be consepcific with the sponge from the Polish Oxfordian described by Siemiradzki (1913) as *Jerea cracoviensis*. This is suggested by the description and illustrations given by Siemiradzki; however, the spicules of the latter form are inadequately illustrated which makes impossible any ultimate decision.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); perhaps also Middle Oxfordian of the Polish Jura (Siemiradzki 1913).

Genus *PLATYCHONIA* Zittel, 1878

Diagnosis: Rhizomorine sponge circular to irregular in outline, in form of a flat plate, cake, or ear, rarely vase-like; margins flat to undulated; upper and lower surface covered with densely spaced, small pores; skeletal bands arranged in orderly raws, which pattern produces very fine, radial, densely spaced lines at the weathered surface. This diagnosis follows the description given by Zittel (1878).

Platychonia schlotheimi (Münster *in* Goldfuss, 1833)
(Pl. 6, Figs 1—2 and Pl. 7, Figs 1—6)

1833. *Scyphia Schlotheimi* Münster; A. Goldfuss, p. 90, Pl. 33, Fig. 5.
1978. *Spongites auriformis;* F. A. Quenstedt, p. 319, Pl. 131, Fig: 1
1878. *Spongites stragulus;* F. A. Quenstedt, p. 326, Pl. 131, Fig. 9.
1878. *Spongites feralis;* F. A. Quenstedt, p. 332, Pl. 131, Fig. 14.
1878. *Spongites vagans;* F. A. Quenstedt, pp. 328—330, Pl. 131, Figs 15—16.
1897. *Platychonia vagans* Quenst. sp.; F. Oppliger, pp. 45—46, Pl. 9, Fig. 2.
1897. *Platychonia auriformis* Quenst. sp.; F. Oppliger, p. 46.
1897. *Platychonia Wettingensis* n. sp.; F. Oppliger, p. 47, Pl. 9, Fig. 3.
1897. *Platychonia conchiformis* n. sp.; F. Oppliger, p. 47, Pl. 10, Fig. 2.
1907. *Platychonia Oppeli* Etall. sp.; F. Oppliger, p. 3, Pl. 1, Fig. 2.
1907. *Platychonia ostraeaformis* n. sp.; F. Oppliger, p. 4, Pl. 1, Fig. 3.
1907. *Platychonia rotundus* n. sp.; F. Oppliger, p. 4, Pl. 1, Fig. 4.
1910. *Platychonia vagans* Quenst, sp.; R. Kolb, p. 237.
1910. *Platychonia auriformis* Quenst. sp.; R. Kolb, pp. 237—238.
1910. *Platychonia compressa* n. sp.; R. Kolb, pp. 238—239, Pl. 16, Fig. 13 and Pl. 20, Figs 22—23.
1910. *Platychonia* cf. *feralis* Quenst.; R. Kolb, pp. 239—240.
1913. *Platychonia vagans* Quenst.; J. Siemiradzki, p. 15, Pl. 7, Fig. 84.
1913. *Platychonia auriformis* Quenst.; J. Siemiradzki, p. 15.
1913. *Platychonia stragulus* Quenst.; J. Siemiradzki, pp. 15—16, Pl. 7, Fig. 83.
1913. *Platychonia schlotheimi* Mstr.; J. Siemiradzki, p. 16, Pl. 6, Fig. 69 and Pl. 7, Fig. 86.
1915. *Platychonia lacinata* n. sp.; F. Oppliger, p. 71, Pl. 12, Fig. 1.
1915. *Platychonia argoviana* n. sp.; F. Oppliger, pp. 71—72, Pl. 12, Fig. 2.
1915. *Platychonia conchata* n. sp.; F. Oppliger, p. 73, Pl. 12, Fig. 3.
1926. *Platychonia cuspidata* n. sp.; F. Oppliger, p. 66, Pl. 4, Fig. 5.
1937. *Platychonia Schlotheimi* Goldfuss sp.; A. Schrammen, p. 95.
1937. *Platychonia feralis* Quenstedt sp.; A. Schrammen, p. 96, Pl. 22, Figs 6—11.

Material: Over 100 specimens, often very poorly preserved.
Diagnosis: As for the genus.

Remarks. — The morphotypes of *P. schlotheimi* considered previously to be distinct species were erected after slight differences in general shape, often recorded in a single specimen (see *e.g.* Oppliger 1907, pp. 2—4). With the wide

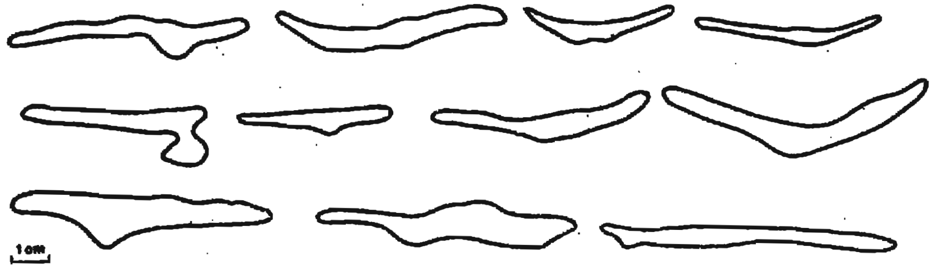


Fig. 14. Shape variability in the species *Platychonia schlotheimi* (Münster *in* Goldfuss)

individual variability in sponges taken into account, this must be considered unsound (*see* Text-fig. 14).

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian to Tithonian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Kimmeridgian of the Swiss and French Jura (Oppliger 1907, 1926).

Genus *HYALOTRAGOS* Zittel, 1878

Diagnosis: Rhizomorine sponge in form of a vase, plate, funnel, or cone, rarely pear-shaped, with more or less concave upper surface; vertical channels in the middle of the skeleton, either in form of a central bunch (Pl. 8, Fig. 8) as in the genus *Jereica*, or in a few fascicles (Pl. 8, Fig. 9); rhizoclones relatively large-sized; skeleton confused.

Remarks. — Some morphotypes (see *H. pezizoides*) resemble strikingly the genus *Jereica*, but the latter is distinctive due to its fibroid skeleton. Poorly preserved representatives of *Hyalotragos* do not show openings of vertical channels at the upper surface, which are nevertheless discernible in transversal sections.

Hyalotragos patella (Goldfuss, 1833)
(Pl. 8, Figs 11—13 and Pl. 9, Fig. 5)

1833. *Tragos patella* nobis; A. Goldfuss, pp. 14 and 96, Pl. 5, Fig. 10 and Pl. 35, Fig. 2.
1878. *Tragos patella*; F. A. Quenstedt, pp. 263—285, Pl. 128, Fig. 26 and Pl. 129, Figs 1—3.
1897. *Hyalotragos patella* Goldfuss sp.; F. Oppliger, p. 42, Pl. 8, Fig. 6.
1910. *Hyalotragos patella* Goldfuss sp.; R. Kolb, p. 226.
1913. *Hyalotragos patella* Gf.; J. Siemiradzki, pp. 8—9, Pl. 3, Figs 38—39.
1913. *Hyalotragos patelloides* n. nom.; J. Siemiradzki, pp. 9—10, Pl. 3, Fig. 40.
1915. *Hyalotragos patella* Goldf. sp.; F. Oppliger, pp. 65—66.
1926. *Hyalotragos patella* Goldf. sp.; F. Oppliger, pp. 53—54.
1926. *Hyalotragos patelloides* v. Siem.; F. Oppliger, pp. 54—55.
1926. *Hyalotragos geniculatus* spec. nov.; F. Oppliger, p. 56, Pl. 3, Fig. 7.
1937. *Hyalotragos patella* Goldf. sp.; A. Schrammen, pp. 91—92, Pl. 23, Fig. 9.

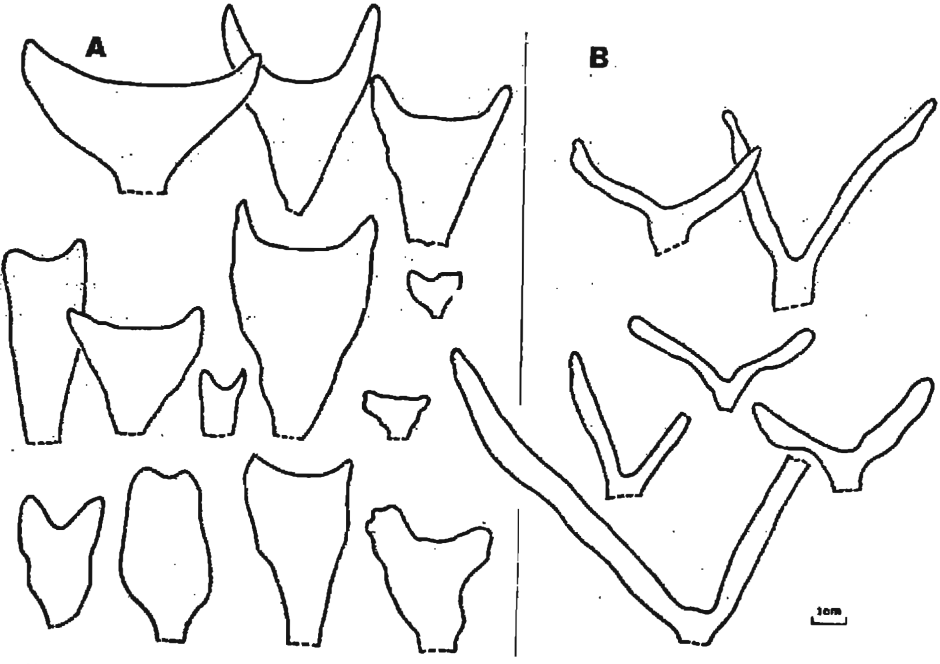
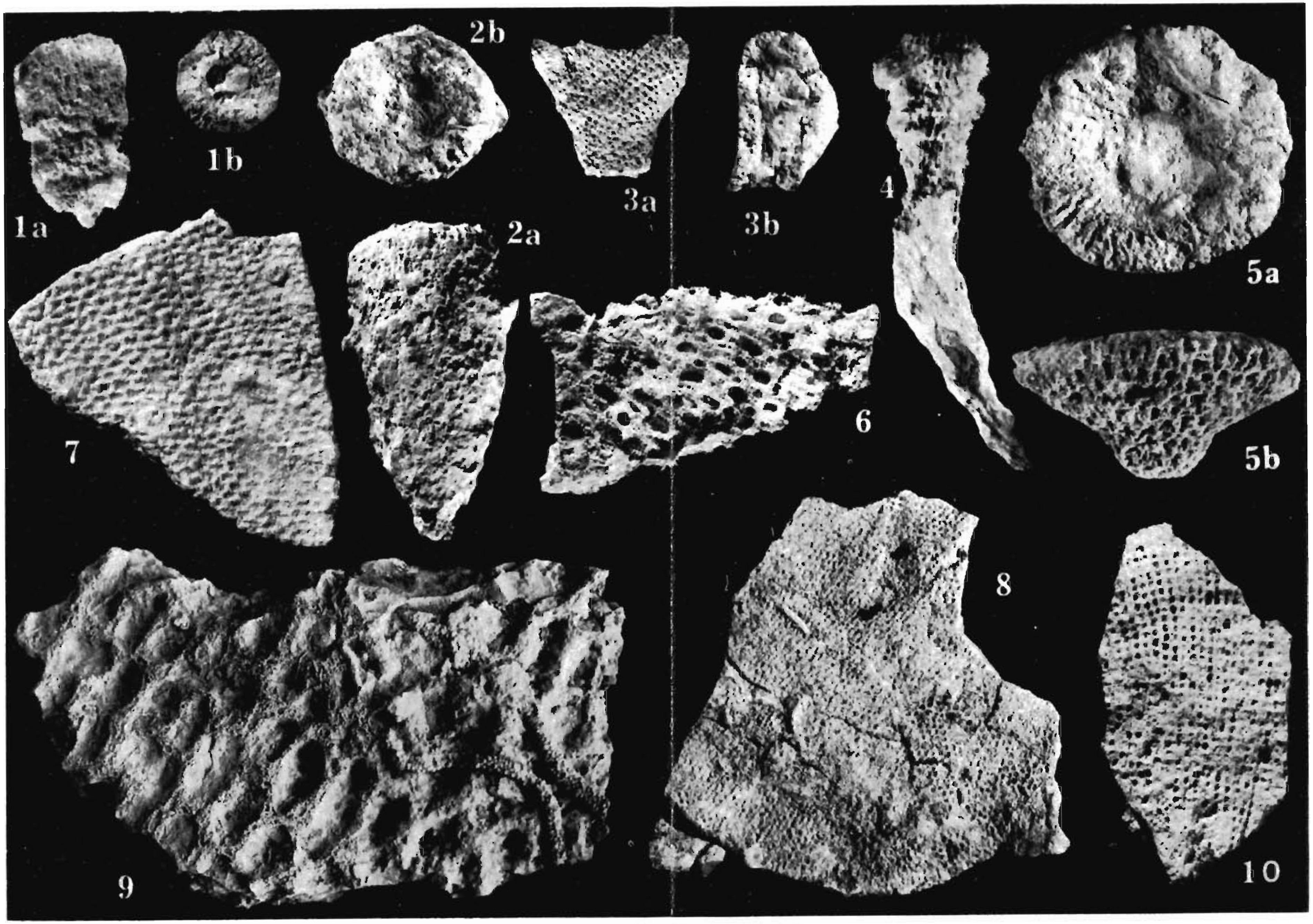
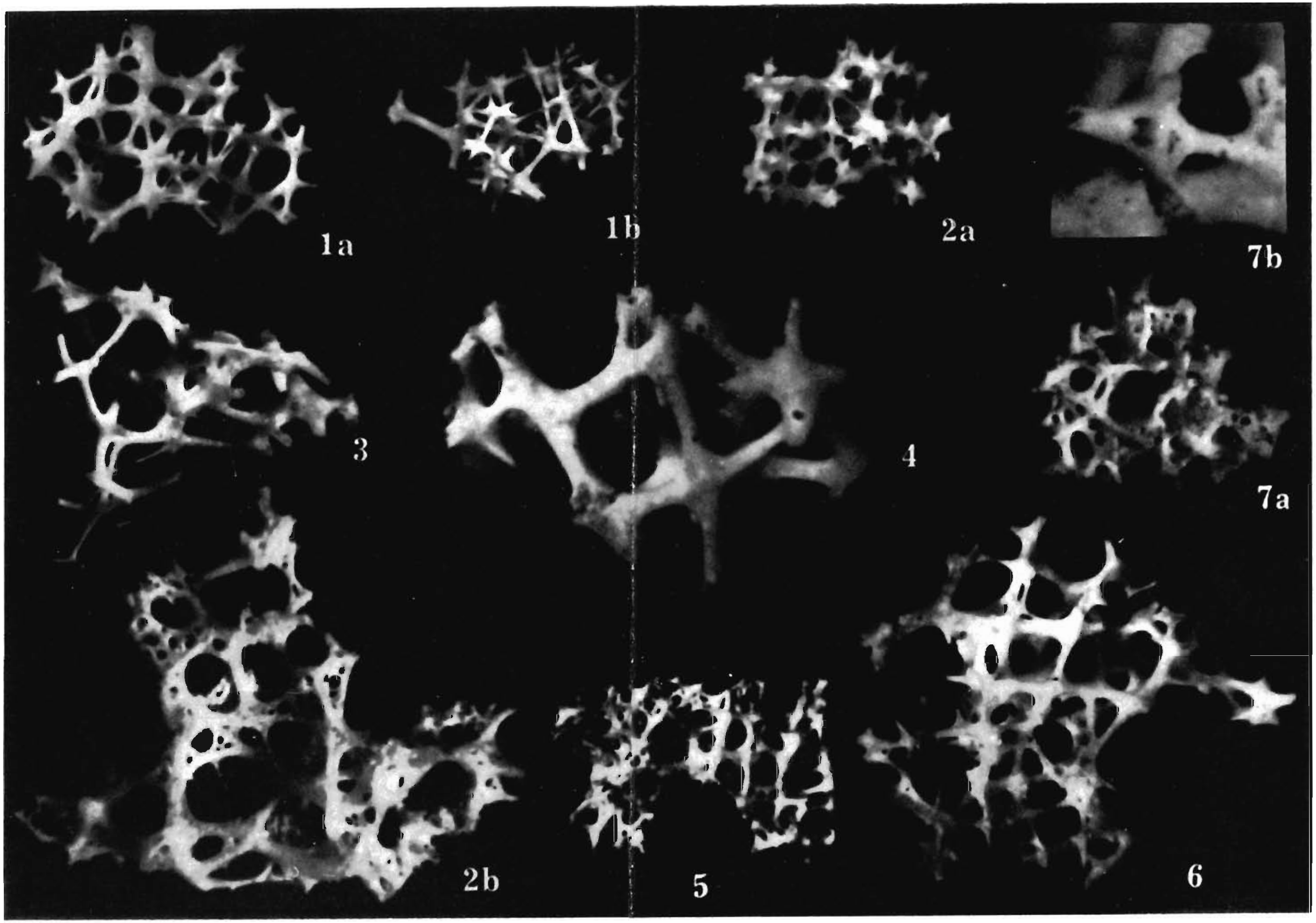


Fig. 15. Shape variability in the species: **A** — *Hyalotragos pezizoides* (Goldfuss), and **B** — *Hyalotragos patella* (Goldfuss)



1—2 — *Walcotella pertusa* (Goldfuss): **1** — locality Wrzosowa, waste; **2** — Wysoka, bed *15*; **3** —*Walcotella texturata* (v. Schlotheim); Wysoka, bed *14*; **4** — *Craticularia* sp.; Zalas, bed *8*; **5** — *Tremadictyon reticulatum* (Goldfuss); Wrzosowa, waste; **6** — *Tremadictyon* sp.; Zalas, bed *8*; **7** — *Xenoschrammenum alternans* (Schrammen); Zalas, bed *10*; **8** — *Xenoschrammenum punctatum* (Schrammen); Zalas, bed *10*; **9** — *Stauroderma lochense* (Quenstedt); Wysoka, waste; **10** — *Thyroidium schweiggeri* (Goldfuss); Zalas, bed *10*

Figures in nat. size, except of Fig. 1 (×1.5), Figs 4 and 6 (×2); taken by S. Kolanowski



1 — *Craticularia* sp.: parenchymal skeleton, ×40; locality Zalas, bed *8*; **2** — *Walcotella pertusa* (Goldfuss): 2a — parenchymal skeleton, ×40; 2b — subdermal skeleton, ×40; Wrzosowa, waste; **3** — *Stauroderma lochense* (Quenstedt): parenchymal skeleton, ×40; Wysoka, waste; **4** — *Walcotella texturata* (v. Schlotheim): parenchymal skeleton, ×100; Wysoka, bed *20*; **5** — *Walcotella texturata* (v. Schlotheim): subdermal skeleton, ×40; Wysoka, bed *14*; **6** — *Tremadictyon* sp.: parenchymal skeleton, ×40; Zalas, bed *8*; **7** — *Tremadictyon reticulatum* (Goldfuss): 7a — subdermal skeleton, ×40; 7b — lantern node from parenchymal skeleton, ×40; Wrzosowa, waste

All photos taken by L. Łuszczewska, M.Sc.

Material: Over 180 specimens, often poorly preserved.

Diagnosis: Representative of *Hyalotragos* in form of a vase, bowl, or plate at a leg (typical eury-, ambly-, or platyproct sponge *sensu* de Laubenfels 1955, p. *E*45). This diagnosis follows the description given by Goldfuss (1833), but it is presented in modern terms.

Remarks. — The form *H. patelloides* was established by Siemiradzki (1913) because of its thinner wall. It is here considered to be a junior synonym of *H. patella* because both the morphotypes grade continuously into each other in the investigated material. The species *H. geniculatus* was erected by Oppliger (1926) after a single specimen with irregularly swollen margin of the osculum. This seems, however, insufficient to justify distinction of a species.

In the Jasna Góra Beds the dominant morphotype is the bowl-like one (*see* Text-fig. 15*A*), whereas plate-like forms prevail in Germany (Quenstedt's and Schrammen's collections).

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Middle Kimmeridgian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Lower Kimmeridgian of the Swiss Jura (Oppliger 1926).

Hyalotragos pezizoides (Goldfuss, 1833)
(Pl. 8, Figs 1—10 and Pl. 9, Figs 1—4)

1926. *Hyalotragos pezizoides* Goldfuss sp.; Oppliger, p. 55 [*cum syn.*].
1937. *Hyalotragos pezizoides* Goldfuss; A. Schrammen, pp. 92—93, Pl. 23, Figs 10—11.

Material: Over 130 specimens.

Diagnosis: Representative of *Hyalotragos*, slender or stocky conical to pear-shaped (Text-fig. 12), with more or less concave upper surface.

Remarks. — The following comparison makes clear the differences between *H. pezizoides* and *H. patella*. The latter species is a typical eury- or amblyproct sponge, with inhalatory lower surface and exhalatory upper surfaces; the vertical channels are innumerous and loosely dispered. In turn, *H. pezizoides* resembles *Jerea* and *Jereica* in its channels being fused in form of a single bunch (cf. Moret 1948, Fig. 48*D*; de Laubenfels 1955, Fig. 15. 2*c*). Some rare, pear-shaped morphotypes of *H. pezizoides* (Tex-fig. 15 and Pl. 8, Fig. 4) do not differ in shape from representatives of *Jerea* or *Jereica*. However, *H. pezizoides* displays most commonly a more or less concave upper surface (*see* Text-fig. 15*A*), being morphologically intermediate in shape between eury- or amblyproct sponges and the genus *Jerea*.

Occurence. — Jasna Góra Beds (see Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Upper Oxfordian to Tithonian of Swabia and Franconia (Schrammen 1937); Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Middle Oxfordian of Dobruja (Bărbulescu 1974).

Platychonia schlotheimi or *Hyalotragos patella*

Material: Over 100 poorly and fragmentarily preserved specimens.

Remarks. — More precise identification has turned out to be impossible; therefore, this category has been used in Text-figs 7 and 10.

The feature making the genera *Hyalotragos* and *Platychonia* different from each other is the occurrence of vertical channels in the former. The channles are generally confined to the central part of the skeleton, whereas marginal fragments do not display that diagnostic feature and hence, they are indiscernible from fragmentarily preserved *Platychonia schlotheimi*.

Genus *LEIODORELLA* Zittel, 1878

Diagnosis: **Rhizomorine sponge in form of a plate, flat bowl, or fan; both the surfaces bear smooth cortex and numerous (up to 30 per cm^2) small oscula located each at a crater-like rise. This diagnosis follows the description given by Zittel (1878).**

Leiodorella expansa Zittel, 1878
(Pl. 10, Fig. 1)

1878. *Leiodorella expansa* Zitt.; K. A. Zittel, p. 49, Pl. 2, Fig. 5 and Pl. 3, Fig. 11.
1897. *Leiodorella expansa* Zittel; F. Oppliger, p. 45.
1913. *Leiodorella expansa* Zitt.; J. Siemiradzki, p. 13.

Material: **One specimen.**
Diagnosis: **Fan-like *Leiodorella*. Zittel (1878) gave neither diagnosis, nor description of the species, but only the figures.**

Remarks. — The holotype differs from the investigated specimen in its less numerous and larger oscula, and also in details of general shape.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and perhaps also upper Middle Oxfordian of the Polish Jura (Zittel 1878, Siemiradzki 1913); Kimmeridgian of the Swiss Jura (Oppliger 1897).

Leiodorella foliacea Oppliger, 1926
(Pl. 10, Fig. 2)

1926. *Leiodorella foliacea* spec. nov.; F. Oppliger, p. 60, Pl. 3, Fig. 8.

Material: **18 specimens.**
Diagnosis: **Flat bowl-like *Leiodorella*, with oscula arranged in rows parallel to the sponge margin. This diagnosis follows the description and illustration given by Oppliger (1926).**

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); Kimmeridgian of the Swiss Jura (Oppliger 1926).

Genus *HYALOSPONGIA* Siemiradzki, 1913

Diagnosis: **Rhizomorine sponge in form of a bowl, plate, funnel, or cone, with smooth cortex at both the surfaces; oscula confined to the upper surface, fairly uniformly dispersed (at most a few per cm^2), located each at a rise, delimited by sharp edges. This diagnosis follows the description and illustrations given by Siemiradzki (1913).**

Hyalospongia rugosa (Münster *in* Goldfuss, 1833)
(Pl. 10, Fig. 3)

1833. *Tragos rugosum* Münster; A. Goldfuss, p. 96, Pl. 35, Fig. 4.
1878. *Tragos infrajugosum*; F. A. Quenstedt, p. 292, Pl. 129, Fig. 16.
1926. *Hyalospongia rugosa* Goldf. sp.; F. Oppliger, pp. 56—57 [*cum syn.*].
1937. *Hyalotragos rugosum* Münst. sp.; A. Schrammen, p. 93.

Material: **2 specimens.**
Diagnosis: **As for the genus.**

Remarks. — Specimens with flat upper surface prevail in German collections (Quenstedt's and Schrammen's collections), whereas the two available specimens from the Jasna Góra Beds have their upper surface distinctly concave. Furthermore, the German specimens have larger but less numerous oscula.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle to Upper Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Kimmeridgian of Swabia and Franconia (Schrammen 1937).

Genus *REISWIGIA* Trammer, 1979

Reiswigia ramosa Trammer, 1979

1979. ***Resiwigia ramosa*** **sp. n.; Trammer, p. 41, Pls 1—3 and Text-fig. 2.**
Material: **Over 270 specimens, mostly fragmentarily preserved.**

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Suborder **Anomocladina** Zittel, 1878

Genus *CYLINDROPHYMA* Zittel, 1878

Cylindrophyma milleporata (Goldfuss, 1833)

(Pl. 10, Figs 4—5)

1926. ***Cylindrophyma milleporata*** **Goldf. sp.; F. Oppliger, pp. 43—44 [*cum syn.*].**
1937. ***Cylindrophyma milleporata*** **Goldf. sp.; A. Schrammen, pp. 102—103, Pl. 21, Fig. 5.**
Material: **58 specimens, none of the spicules has been preserved in original, siliceous form but nevertheless, typical sphaeroclone spicules are dicernible in thin sections and at etched surfaces.**

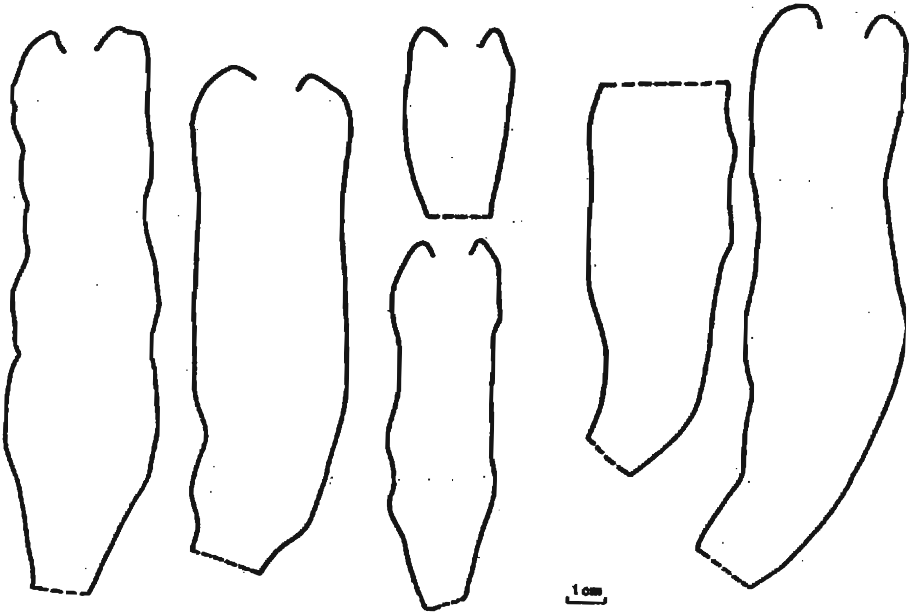


Fig. 16. Shape variability in the species *Cylindrophyma milleporata* (Goldfuss)

Remarks. — The investigated species occurs in the Middle Oxfordian to Tithonian of Swabia and Franconia where an increase in individual size upwards in the section appears very clearly (Schrammen 1937). The Oxfordian specimens are 5—7 cm long, the Lower Kimmeridgian ones exceed 10 cm in length, while higher in the section the average individual length is even greater. In the Jasna Góra Beds, however, large- and very large-sized cylindrical specimens (*see* Text-fig. 16) occur very commonly already in the Lower Oxfordian.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Tithonian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Middle Oxfordian of Dobruja (Bârbulescu 1974).

Class **Hyalospongea** Vosmager, 1886
Order **Dictyida** Zittel, 1877
Genus *XENOSCHRAMMENUM* de Laubenfels, 1955
(= *Amphiblestrum* Schrammen, 1937; = *Tremaphorus* Schrammen, 1937)

Remarks. — The name *Amphiblestrum* has turned out to be a homonym. Hence, de Laubenfels (1955, p. E79) replaced it with *Xenoschrammenum*. *Tremaphorus* is here considered synonymous with *Xenoschrammenum* because it was demonstrated by Wagner (1963a, pp. 6—7) that the morphological differences between the two taxa are very slight.

Xenoschrammenum alternans (Schrammen, 1937)
(Pl. 11, Fig. 7)

1937. ***Amphiblestrum alternans*** **n. sp.; A. Schrammen, p. 58, Pl. 8, Figs 1—2 and Pl. 13, Fig. 2.**

1963a. ***Tremaphorus alternans*** **(Schrammen); W. Wagner, p. 7, Pl. 1, Figs 4—5.**

Material: **3 fragmentarily preserved specimens.**

Remarks. — The investigated specimens are almost indiscernible in morphology from those described by Schrammen (1937) and Wagner (1963a). Because of the very small number of hitherto known specimens of this species (6 individuals) the variability cannot be studied and a possibility cannot be ruled out that this is merely an ecophenotype of another Jurassic dictyid species. The latter possibility seems plausible because *Xenoschrammenum* resembles very closely some species of the genera *Tremadictyon* Zittel, 1877, and *Pachyascus* Schrammen, 1937.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); Upper Kimmeridgian to Tithonian of Swabia and Franconia (Schrammen 1937, Wagner 1963a); perhaps also Middle Oxfordian of Spain (Behmel 1970).

Xenoschrammenum punctatum (Schrammen, 1937)
(Pl. 11, Fig. 8)

1937. ***Tremaphorus punctatus*** **n. sp.; A. Schrammen, p. 63, Pl. 15, Fig. 8 and Pl. 24, Fig. 2.**

Material; **One fragmentarily preserved specimen.**

Remarks. — The investigated specimen is almost entirely consistent in morphology with those described by Schrammen (1937). See also remarks on *X. alernans*.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); Middle Oxfordian to Upper Kimmeridgian of Swabia and Franconia (Schrammen 1937).

Genus *STAURODERMA* Zittel, 1877
Stauroderma lochense (Quenstedt, 1858)
(Pl. 11. Fig. 9 and Pl. 12, Fig. 3)

1858. ***Spongites lochensis;*** **F. A. Quenstedt, p. 669, Pl. 81, Fig. 96.**

1878. ***Spongites lochensis;*** **F. A. Quenstedt, p. 43, Pl. 115, Fig. 14.**

1878. ***Retispongia disciformis;*** **F. A. Quenstedt, pp. 41—42, Pl. 115, Figs 24—25.**

1897. ***Stauroderma Lochensis*** **Quenst. sp.; F. Oppliger, pp. 34—35.**

1897. ***Stauroderma disciformis*** **Quenst. sp.; F. Oppliger, pp. 36—37.**

1907. ***Stauroderma depressa*** **sp. nov.; F. Oppliger, pp. 12—13, Pl. 6, Fig. 2.**

1910. ***Stauroderma lochense*** **Quenst. sp.; R. Kolb, pp. 184—185, Pl. 12, Figs 12—14.**

1913. ***Stauroderma lochense*** **Qu.; J. Siemiradzki, p. 28.**

1915. *Stauroderma Birmersdorfense* spec. nov.; F. Oppliger, pp. 39—40, Pl. 5, Fig. 1.
1926. *Stauroderma lochense* Qu. sp.; F. Oppliger, pp. 21—22.
1937. *Stauroderma lochensis* Quenst. sp.; A. Schrammen, pp. 21—22, Pl. 3, Fig. 1 and Pl. 5, Fig. 3.
1937. *Stauroderma microstomata* n. sp.; A. Schrammen, p. 22, Pl. 16, Figs 1—2.
1963a. *Stauroderma lochense* (Quenstedt); W. Wagner, pp. 4—5.
1973. *Stauroderma lochensis* (Quenstedt); Z. Fibich, p. 49.

Material: 4 specimens, all of them fragmentarily preserved; without cortex; one specimen (Pl. 11, Fig. 9) must have approximated 1 m in diameter.

Remarks. — As documented by Schrammen's (1937) collection, the forms referred to in the synonymy grade continously into each other in morphology; this holds also for such characters as the wall thickness or ostia diameter, considered previously to be diagnostic of various species.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Lower Kimmeridgian of Swabia and Franconia (Schrammen 1937) and Tithonian of Franconia (Wagner 1963a); Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Middle Oxfordian of France (Lagneau-Hérenger 1951); perhaps also Middle Oxfordian of Spain (Behmel 1970).

Genus *TREMADICTYON* Zittel, 1877

Tremadictyon reticulatum (Goldfuss, 1833)

(Pl. 11, Fig. 5 and Pl. 12, Fig. 7)

1926. *Tremadictyon reticulatum* Goldf. sp.; F. Oppliger, p. 4 [*cum syn.*].
1937. *Tremadictyon reticulatum* Goldf. sp.; A. Schrammen, p. 23.
1963a *Tremadictyon reticulatum* (Goldfuss); W. Wagner, pp. 5—6, Pl. 2, Figs 1 and 4.
1973. *Tremadictyon reticulatum* (Goldf.); Z. Fibich, p. 49, Pl. 9, Fig. 3.

Material: 3 specimens preserved without cortex.

Remarks. — The investigated specimens are entirely consistent in external morphology with the holotype (Goldfuss 1833, Pl. 4, Fig. 1). However, the skeleton of the specimen presented in Pl. 11, Fig. 5 is very peculiar. In general, *T. reticulatum* have thick hexacts near the surface and thinner ones more inside (*cf.* Schrammen 1937, p. 23). According to Zittel (1877), Schrammen (1937), de Laubenfels (1955), and others, all the hexacts observed in *T. reticulatum* are typical of the Dictyida, *i. e.* without lychniscs or lantern nodes. The specimen under discussion, however, has hexacts with and without lychniscs as well. The latter occur near the surface, while the former inside the sponge. *T. reticulatum* has been nevertheless attributed to the order Dictyida because the Lychniskida are defined as follows: "parenchymal megascleres are united to form a rigid framework, *each* of the nodes of which is supported by twelve struts and is called a lychnisc" (Hartman 1980).

Presense or absence of lychniscs makes the difference between the orders Dictyida and Lychniskida. This problem should therefore be studied in more detail; so more, that the co-occurrence of hexacts with solid and lantern nodes in a single specimen was noted also by Oppliger (1907, p. 13; 1915, pp. 41—53) on the occasion of the genera *Placotelia* Oppliger and *Discophyma* Oppliger. At the moment, however, any far-reaching taxonomic and phylogenetic conclusions cannot be drawn.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Upper Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Lower Kimmeridgian (Schrammen 1937) and Tithonian (Wagner 1963a) of Swabia and Franconia; Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Oxfordian and Tithonian of France (Lagneau-Hérenger 1951); Lower to Middle Oxfordian of Spain (Behmel 1970); Middle Oxfordian of Dobruja (Bârbulescu 1974).

Tremadictyon sp.
(Pl. 11, Fig. 6 and Pl. 12, Fig. 6)

Material: **3 specimens, all of them are very small fragments with well preserved parenchymal skeleton but without dermal skeleton.**

Remarks. — These fragmentarily preserved specimens show alternately arranged pores and the skeletal structure typical of the genus *Tremadictyon* (cf. Pl. 12, Fig. 6 in this paper and Schrammen 1937, pp. 22—25).

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Genus *CRATICULARIA* Zittel, 1877
Craticularia sp.
(Pl. 11, Fig. 4 and Pl. 12, Fig. 1)

Material: **One specimen with well preserved parenchymal skeleton but without dermal skeleton.**

Remarks. — The features diagnostic of the genus are easily discernible: cylindrical shape, pores arranged in longitudinal and transversal rows at the inhalant and exhalant surfaces, regular skeleton with thickened solid nodes.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Genus THYROIDIUM de Laubenfels, 1955
(= *Thyridium* Schrammen, 1937)

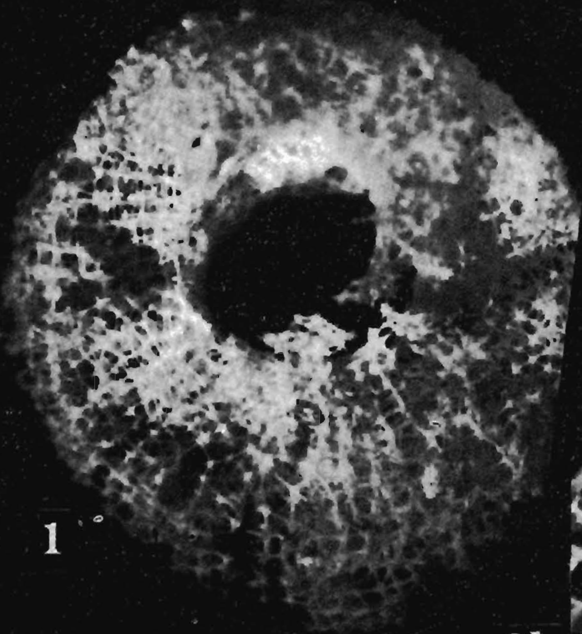
Remarks. — The name *Thyridium* has turned out to be a homonym; hence, it has been replaced by de Laubenfels (1955, p. E80).

Thyroidium schweiggeri (Goldfuss, 1833)
(Pl. 11, Fig. 10)

1833. ***Scyphia Schweiggeri*** **nobis; A. Goldfuss, p. 91, Pl. 33, Fig. 6.**
1878. ***Scyphia Schweiggeri;*** **F. A. Quenstedt, p. 63, Pl. 117, Fig. 3.**
1907. ***Craticularia subclathrata*** **Etall, sp.; F. Oppliger, pp. 6—7, Pl. 3, Fig. 2.**
1910. ***Craticularia*** **cf.** ***schweiggeri*** **Goldf.; R. Kolb, p. 163.**
1913. ***Leptophragma Schweigeri*** **Goldf.; J Siemiradzki, p. 23, Pl. 7, Fig. 81.**
1915. ***Craticularia Schweiggeri*** **Goldf. sp.; F. Oppliger, pp. 17—18.**
1926. ***Craticularia schweiggeri*** **Gold. sp.; F. Oppliger, p. 9.**
1937. ***Thyridium schweiggeri*** **Goldf. sp.; A. Schrammen, p. 31, Pl. 9, Fig. 4 and Pl. 37, Fig. 1.**
1973. ***Craticularia subclathrata*** **(Etall.); Z. Fibich, p. 50, Pl. 6, Fig. 9.**

Material: **One fragmentarily preserved specimen.**

Remarks. — There is no difference whatsoever between *T. schweiggeri* and *Craticularia subclathrata* Etall. sp. *in* Oppliger (1907). The scarcity of the material makes impossible any study of the variability and hence, a possibility cannot be ruled out that *T. schweiggeri*, as well as its congeners, is an ecophenotype of a species of the genus *Craticularia* Zittel, 1877, or *Paracraticularia* Schrammen, 1937. According to Schrammen (1937), the flat *Thyroidium* differs merely in its general shape from the cylindrical *Craticularia; Paracraticularia*, in its turn, makes up colonies of cylindrical individuals like those typical of *Craticularia*. Such a variation may occur even within a single sponge species.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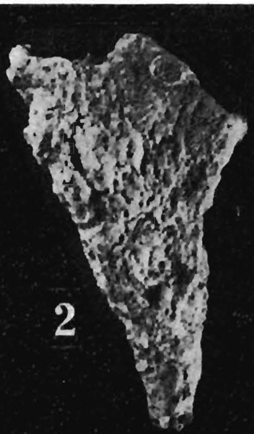
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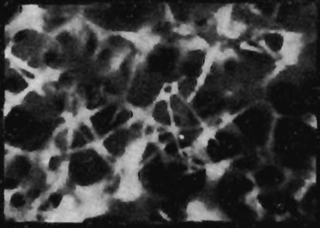
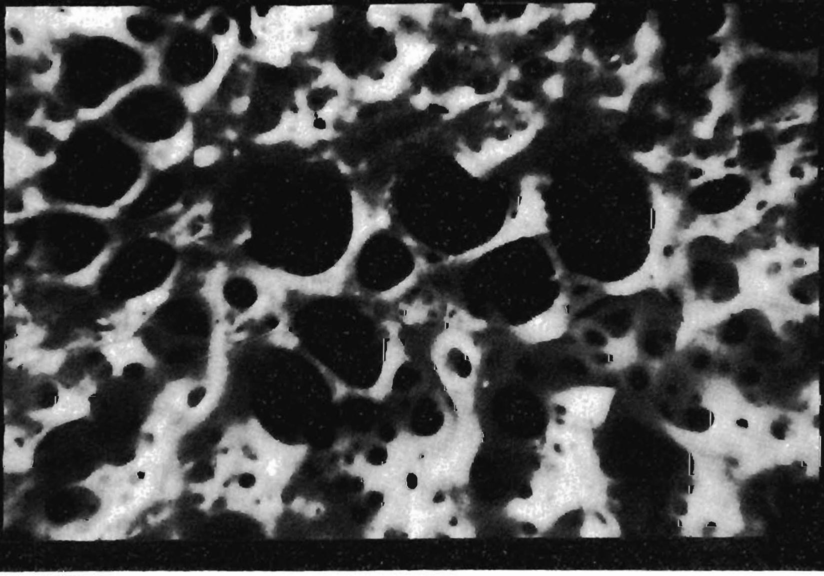

3b

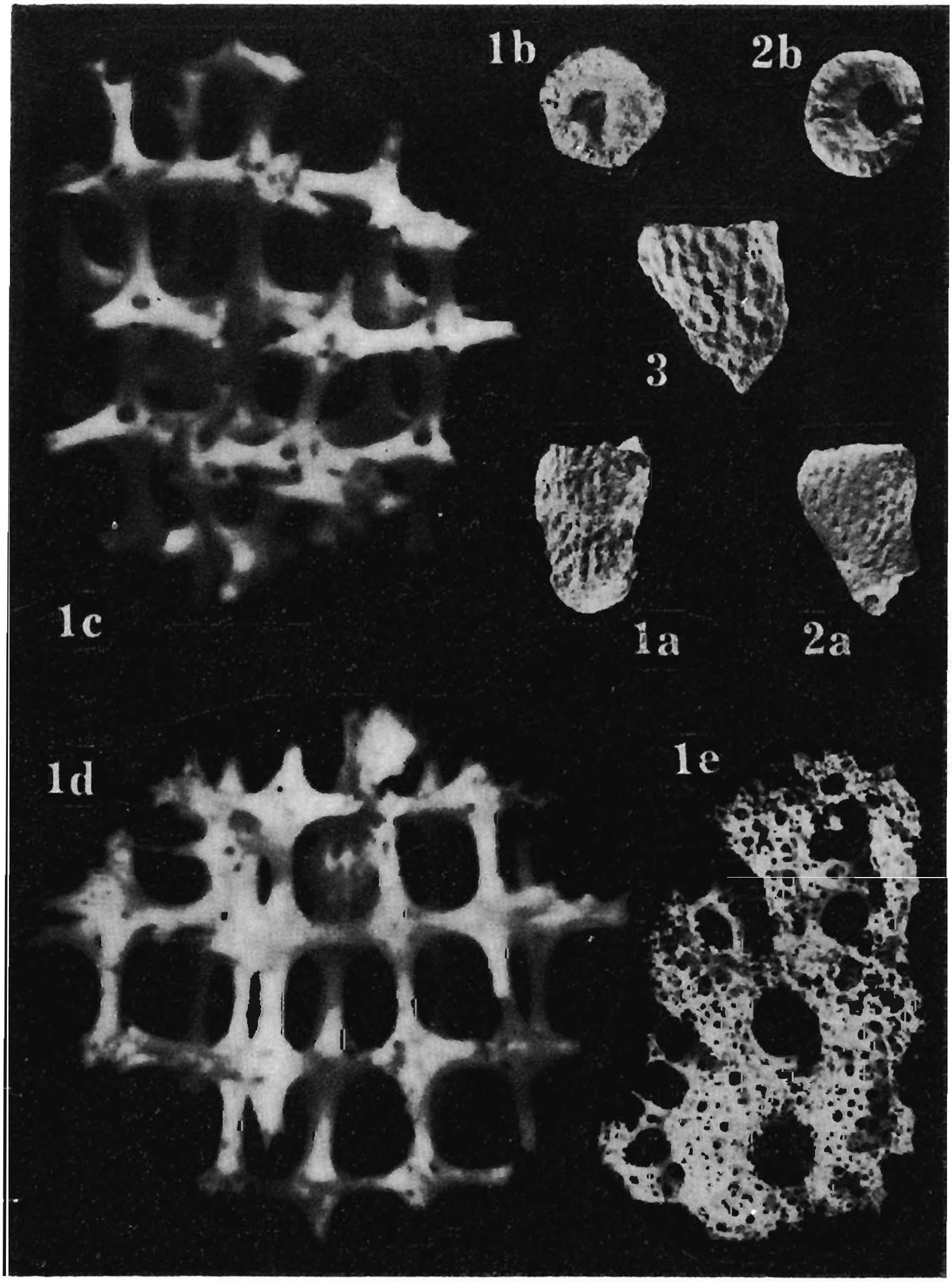

3a

1 — *Aulodomus* sp.: skeleton, ×15; locality Wrzosowa, bed *21*

2 — *Rhogostomium corrugatum* Schrammen; nat. size; Zalas, bed *10*

3 — Dictyida gen. et sp. indet.: **3a** — subdermal skeleton, ×40; **3b** — subdermal skeleton with fragments of dermal skeleton (*at foreground*), ×40; Wrzosowa, bed *21*

Figs 1 and 3 taken by L. Łuszczewska, M.Sc.; Fig. 2 by S. Kolanowski



Sporadodyle obliqua (Goldfuss): **1** — locality Wrzosowa, bed *9* (**1a** — side view, ×1.5; **1b** — top view, ×1.5; **1c—1d** — parenchymal skeletons, ×100; **1e** — subdermal skeleton, ×15); **2** — Nowa Krystyna, bed *14*; taken ×1.5; **3** — Wrzosowa, bed *6*; taken ×2

Photos of skeletons by L. Łuszczewska, M.Sc.; others by S. Kolanowski

Another problem concerns the relation of *Thyroidium schweiggeri* to its congeners: *T. cancellatum* (Goldfuss), *T. leptophyllum* (Quenstedt), *T. foliatum* (Quenstedt), and *T. lineatum* Schrammen. These species differ exclusively in the size of ostia from one another. One might suppose that these are conspecific morphotypes but any ultimate decision cannot be made because of the scarcity of material.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Lower Kimmeridgian of Swabia and Franconia (Schrammen 1937) and of the Swiss Jura (Oppliger 1926).

Genus *WALCOTELLA* de Laubenfels, 1955 (= *Rhopalicus* Schrammen, 1937; = *Eutactus* Schrammen, 1937; = *Ordinatus* de Laubenfels, 1955)

Remarks. — The names *Rhopalicus* and *Eutactus* have been replaced by de Laubenfels (1955, pp. E82—83) with *Walcotella* and *Ordinatus*, respectively, because they have been found to be homonyms. *Ordinatus*, however, is here considered a junior synonym of *Walcotella* because the only differences (somewhat thinner wall and more densely spaced ostia in *Ordinatus*) seem to be insufficient to permit a distinction at the generic level.

Walcotella pertusa (Goldfuss, 1833)
(Pl. 11, Figs 1—2 and Pl. 12, Fig. 2)

1913. *Sporadopyle pertusa* Gf.; J. Siemiradzki, p. 19 [*cum syn.*].
1915. *Sporadopyle pertusa* Goldf. sp.; F. Oppliger, pp. 20—21.
1937. *Rhopalicus pertusus* Goldf. sp.; A. Schrammen, pp. 36—37, Pl. 3, Fig. 13, Pl. 7, Fig. 14, Figs 6—7 and Pl. 26, Fig. 4.
1937. *Rhopalicus cingulatus* n. sp.; A. Schrammen, p. 37, Pl. 1, Fig. 11, Pl. 7, Fig. 6 and Pl. 15, Fig. 7.
1937. *Rhopalicus macrostomata* n. sp.; A. Schrammen, p. 37, Pl. 12, Fig. 6.

Material: 6 poorly preserved specimens.

Remarks. — The forms *R. cingulatus* and *R. macrostomata* have been here considered conspecific with *W. pertusa* because they were erected each after a single specimen different only very slightly from the latter species; those differences concern the regularity of arrangement of ostia. It seems unlikely that this variation represents anything else than individual variability.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle to Upper Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Lower Kimmeridgian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian and Lower Kimmeridgian of the Swiss Jura (Oppliger 1926).

Walcotella texturata (v. Schlotheim, 1820)
(Pl. 11, Fig. 3 and Pl. 12, Figs 4—5)

1910. *Sporadopyle texturata* Schloth. sp.; R. Kolb, pp. 168—169 [*cum syn.*].
1915. *Sporadopyle texturata* Schloth. sp.; F. Oppliger, p. 21.
1937. *Eutactus texturatus* Goldf. sp.; A. Schrammen, p. 38, Pl. 13, Fig. 5.

Material: 9 specimens.

Remarks. — The specimens from Germany (Quenstedt's and Schrammen's collections) are circular in cross section as a rule, whereas the investigated ones are mostly oval to irregularly suboval.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); Middle Oxfordian to Lower Kimmeridgian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian of the Swiss Jura (Oppliger 1926).

Genus *RHOGOSTOMIUM* Schrammen, 1937

Rhogostomium corrugatum Schrammen, 1937

(Pl. 13, Fig. 2)

1937. *Rhogostomium corrugatum* n. sp.; A. Schrammen, pp. 58—59, Pl. 2, Fig. 9, Pl. 5, Figs 6, 9 and Pl. 27, Fig. 3.

Material: One specimen.

Remarks. — The investigated specimen displays the diagnostic specific features: its ostia are arranged in longitudinal, somewhat irregular rows, and located in furrows.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7); uppermost Kimmeridgian of Swabia and Franconia (Schrammen 1937).

Genus *AULODOMUS* Schrammen, 1937

Aulodomus sp.

(Pl. 13, Fig. 1)

Material: One fragmentarily preserved specimen.

Remarks. — The specimen is attributed to the genus *Aulodomus* because of the following characteristics: small cubes of the skeletal network, only slightly thickened skeleton near the surface (most Jurassic dictyids have their skeleton considerably thickened near the surface), poorly developed channel system.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Dictyida gen. et sp. idet.

(Pl. 13, Fig. 3)

Material: One specimen with fragmentarily preserved subdermal skeleton and very small fragments of dermal skeleton.

Remarks. — Any more precise identification is impossible because the observable characteristics of the dermal and subdermal skeleton are shared by various Jurassic dictyid genera.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Order **Lychniskida** Schrammen, 1902

Genus *SPORADOPYLE* Zittel, 1877

Remarks. — De Laubenfels (1955, p. E84) assigned *Sporadopyle* to the order Dictyida, although Schrammen (1973) had already described skeletons with lantern nodes (lychniscs) representative of that genus.

Sporadopyle obliqua (Goldfuss, 1833

(Pl. 14)

1926. *Sporadopyle obliqua* Goldf. sp.; F. Oppliger, p. 10 [*cum syn.*].

1937. *Sporadopyle obliqua* Goldf. sp.; A. Schrammen, pp. 17—18, Pl. 2, Fig. 6 and Pl. 11, Fig. 1.

Material: 15 specimens, most of them well preserved.

Remarks. — Irregular, thickened, and porous subdermal skeleton (Pl. 14, Fig. 1e), completely different from the regular parenchymal skeleton (Pl. 14, Fig. 1c—d), has been for the first time observed in *S. obliqua.*

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Middle Kimmeridgian of Swabia and Franconia (Schrammen 1937); Middle Oxfordian to Kimmeridgian of the Swiss Jura (Oppliger 1926); Middle Oxfordian and Tithonian of France (Lagneau-Hérenger 1951).

Genus *TROCHOBOLUS* Zittel, 1877

Trochobolus sp.

Material: One fragment of a specimen.

Remarks. — The specimen shows diagnostic features of the genus: very regular skeleton with lantern nodes, external surface conspicuously ornamented with longitudinal irregular rises and deep furrows inbetween (*cf.* Schrammen 1937, Pl. 12, Fig. 3).

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7).

Genus *CYPELLIA* Pomel, 1872

Cypellia rugosa (Goldfuss, 1833)

(Pl. 15)

1833. *Scyphia rugosa* nobis; A. Goldfuss, p. 9, Pl. 3, Fig. 6.
1833. *Scyphia rugosa* nobis, var. *infundibuliformis;* A. Goldfuss, pp. 87—88, Pl. 32, Fig. 2.
1878. *Crucispongia annulata;* F. A. Quenstedt, p. 165, Pl. 123, Fig. 2.
1878. *Crucispongia cruciata;* F. A. Quenstedt, pp. 166—168, Pl. 123, Figs 3—5.
1878. *Spongites dolosus;* F. A. Quenstedt, p. 302, Pl. 130, Fig. 3.
1878. *Dolispongia semicruciata;* F. A. Quenstedt, pp. 306—310, Pl. 130, Figs 7 and 11.
1897. *Cypellia rugosa* Goldf. sp.; F. Oppliger, pp. 32—33.
1897. *Cypellia infundibuliformis* Goldf. sp.; F. Oppliger, p. 34.
1907. *Cypellia caliciformis* sp. nov.; F. Oppliger, p. 10, Pl. 4, Fig. 2.
1907. *Cypellia conica* sp. nov.; F. Oppliger, pp. 10—11, Pl. 4, Fig. 3.
1910. *Cypellia rugosa* Goldf. sp.; R. Kolb, pp. 177—181, Pl. 11, Figs 17—22 and Pl. 12, Figs 2—11.
1913. *Cypellia rugosa* Gf.; J. Siemiradzki, pp. 25—26.
1915. *Cypellia rugosa* Goldf. sp.; F. Oppliger, pp. 32—33.
1915. *Cypellia calyciformis* Oppl. sp.; F. Oppliger, pp. 37—38.
1926. *Cypellia rugosa* Goldf. sp.; F. Oppliger, pp. 17—18.
1926. *Cypellia rugosa* forma *infundibuliformis* Goldf.; F. Oppliger, p. 18.
1937. *Phanerochiderma rugosa* Goldf. sp.; A. Schrammen, p. 12, Pl. 1, Fig. 1, Pl. 2, Fig. 3 and Pl. 11, Fig. 7.
1937. *Phanerochiderma infundibuliformis* Goldf. sp.; A. Schrammen, pp. 12—13.
1973. *Phanerochiderma rugosa* (Goldf.); Z. Fibich, p. 47, Pl. 7, Figs 3—6.

Material: 3 variably preserved specimens with well preserved skeletons.

Remarks. — Various morphotypes referred to in the synonymy differ from the holotype exclusively in their general shape; for instance, *C. caliciformis* is euryproct, and *C. conica* is amblyproct in terms of de Laubenfels (1955, p. E25). All those morphotypes grade continuously into one another in Schrammen's collection.

The forms "*Cypellia labiosa* spec. nov." *in* Oppliger (1915, pp. 33—34) and "*Cypellia verrucosa* spec. nov." *in* Oppliger (1915, pp. 35—36) resemble *C. rugosa* in their general shape but their dermal skeleton is absent. The character of the latter is diagnostic of the genus *Cypellia* and hence, there is no reason to attribute these two forms to the genus under discussion.

Occurrence. — Jasna Góra Beds (*see* Text-fig. 7) and Middle to Upper Oxfordian of the Polish Jura (Siemiradzki 1913); Middle Oxfordian to Lower Kimmeridgian of Swabia and Franconia (Schrammen 1937) and of the Swiss Jura (Oppliger 1926); Middle Oxfordian of France (Lagneau-Hérenger 1951).

Genus *PLACOTELIA* Oppliger, 1907
(= *Placotelia* Oppliger, 1915; = *Discophyma* Oppliger, 1915)

Remarks. — Oppliger (1926) recognized the genera *Placotelia* and *Discophyma* to be synonymous; this conclusion is supported by the present author. However, contrary to the priority rule, Oppliger (1926) maintained the genus *Discophyma* instead of *Placotelia*.

Placotelia marcoui (Fromentel, 1859)
(Pl. 16)

1907 *Placotelia Marcou* Etall. sp.; F. Oppliger, p. 14, Pl. 5, Fig. 3 [*cum syn.*].
1907. *Placotelia dolata* Etall. sp.; F. Oppliger, p. 14, Pl. 5, Fig. 3.
1915. *Placotelia Marcoui* Oppl. (sic!); F. Oppliger, p. 41, Pl. 5, Fig. 2.
1926. *Discophyma marcoui* Oppl.; F. Oppliger, p. 22.
1926. *Discophyma dolata* Oppl. (Et.); F. Oppliger, pp. 22—23.

Material: 3 well preserved specimens.

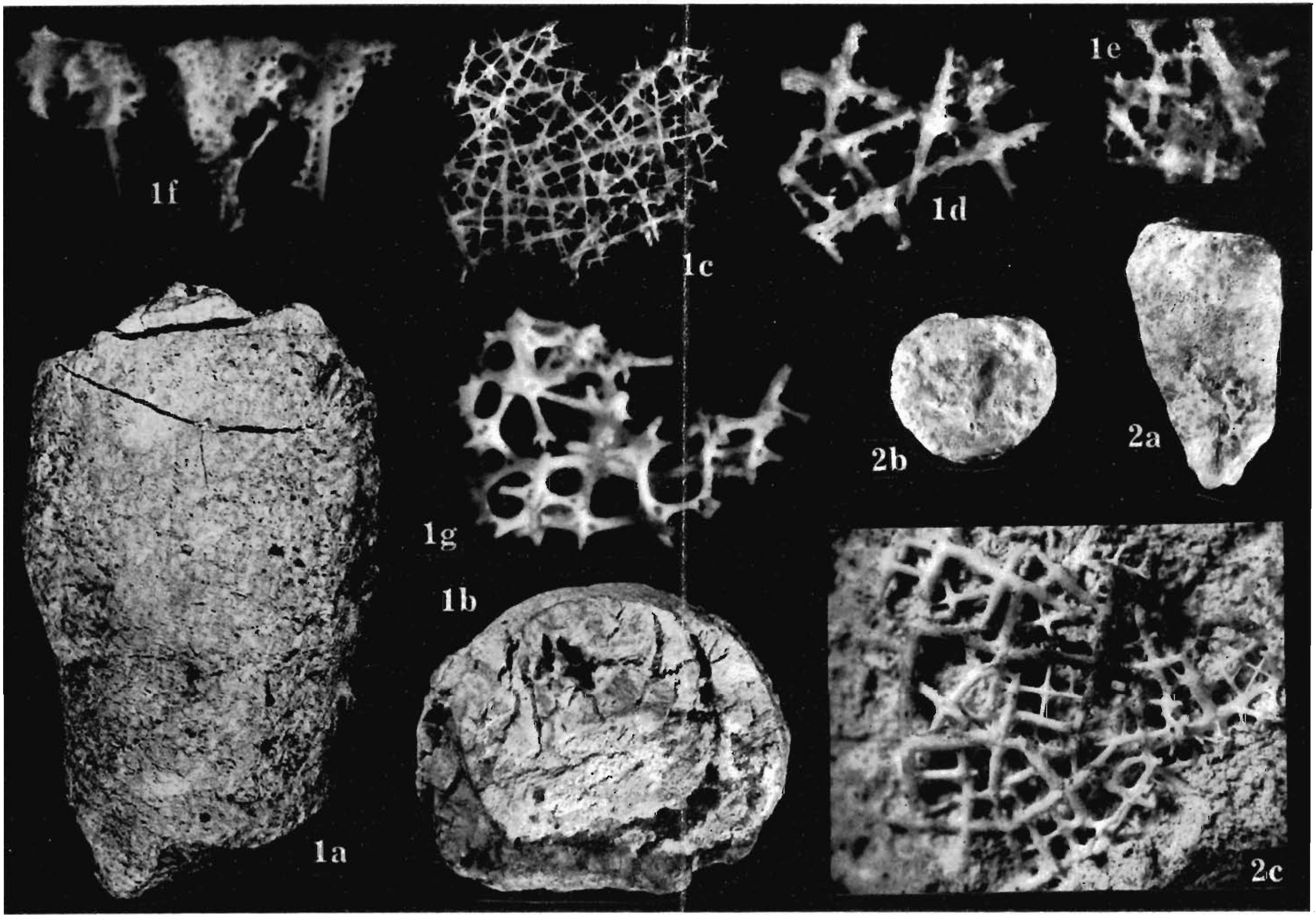
Remarks. — The forms *P. marcoui* and *P. dolata*, as described by Oppliger (1907), differ only slightly in general shape and also in the size of oscula; furthermore, Oppliger (1907) had only two specimens of *P. dolata* at his disposal. It is therefore very likely that one deals here with intra- rather than interspecific variation.

In turn, the relationship of *P. marcoui* to the following congeners remains unclear: *P. etalloni* (Oppliger, 1907) (= *Discophyma etalloni* spec. nov. *in* Oppliger, 1915), *P. pertusianum* (Oppliger, 1915), *P. rugatum* (Oppliger, 1915), *P. levigatum* (Oppliger, 1915), *P. cribratum* (Oppliger, 1926), and *P. foraminosa* (Oppliger, 1926). All those species have been established after a single to at most three specimens. Their holotypes have only fragmentarily preserved skeletons in some cases. Their qualitative diagnostic characters are in common with *P. marcoui*, while the differences consist in such quantitative features as the individual size, wall thickness, dimensions and number of inhalant pores. One may suppose that all, or some of, these species are conspecific with *P. marcoui*. To solve this problem, however, a larger sample of the latter species is needed.

Occurrence. — Jasna Góra Beds (see Text-fig. 7); Middle Oxfordian of the Swiss Jura (Oppliger 1926) and France (Lagneau-Hérenger 1951); perhaps also Middle Oxfordian of Spain (Behmel 1970).

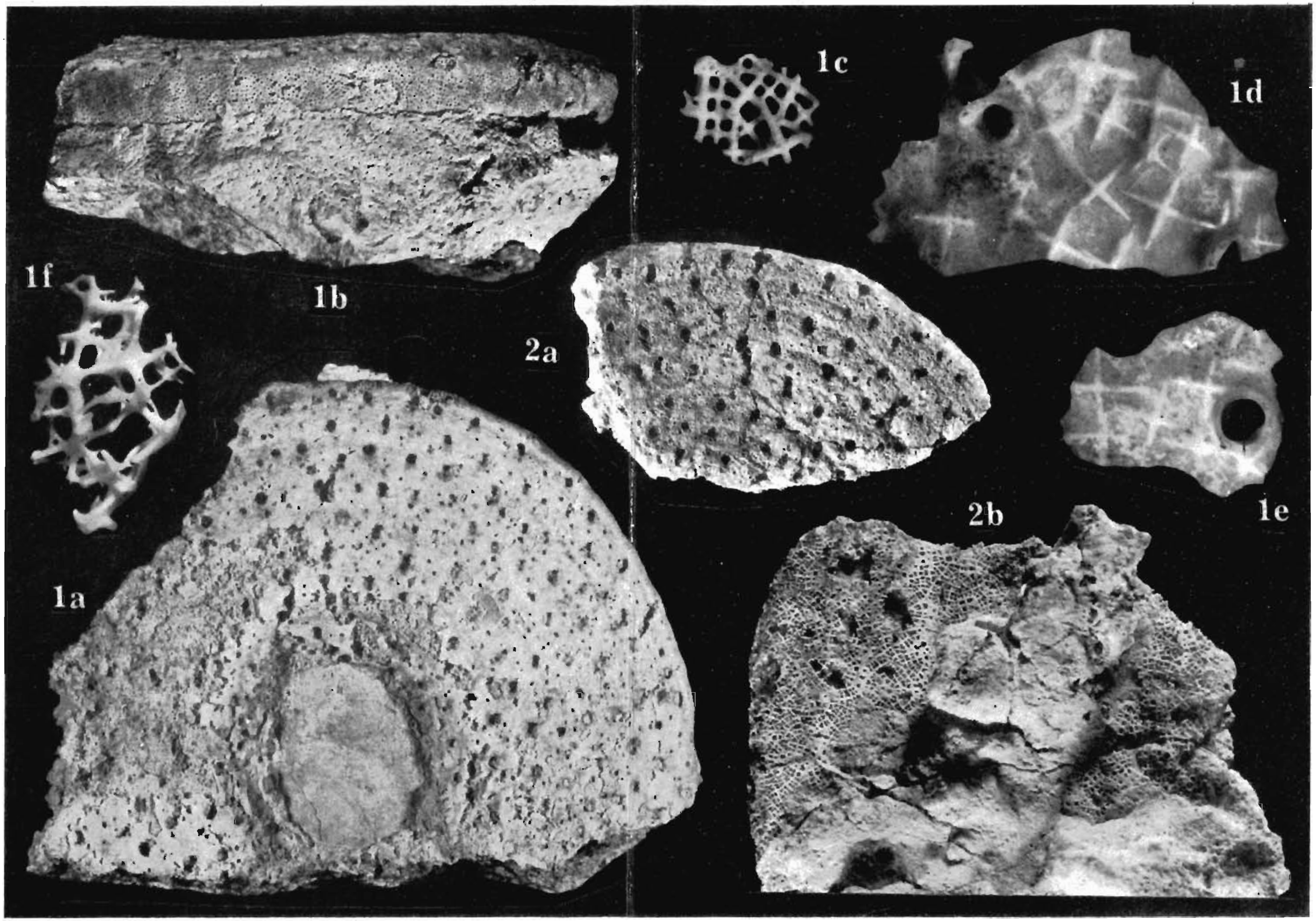
FINAL REMARKS

When giving the characteristic of the sponge assemblage of the Jasna Góra Beds, not only the taxonomy has been discussed but also some ecological and biogeographical aspects have been considered, as it is in fashion nowadays. The Jasna Góra Beds, however, present merely a small fraction of the space occupied by the lithologically variable sponge megafacies of the Upper Jurassic (*cf.* Text-fig. 6). They present also



Cypellia rugosa (Goldfuss): **1** — locality Wysoka, waste (**1a** — side view, nat. size; **1b** — top view, nat. size; **1c** — dermal skeleton, ×20; **1d—1e** — dermal skeletons, ×40; **1f** — subdermal skeleton embracing stauracts of the dermal skeleton, ×40; **1g** — perenchymal skeleton, ×40); **2** — Wysoka, waste (**2a** — side view, nat. size; **2b** — top view, nat. size; **2c** — dermal skeleton, ×15)

Photos of skeletons by L. Łuszczewska, M. Sc; others by S. Kolanowski



Placotelia marcoui (Fromentel): **1** — locality Wysoka, waste (**1a** — top view, nat. size; **1b** — side view, nat. size; **1c** — open-work dermal skeleton from lower side of the specimen, ×15; **1d—1e** — solid dermal skeleton from upper side of the specimen: stauracts are embedded within a continuous siliceous envelope, ×15; **1f** — subdermal skeleton, ×15); **2** — Wrzosowa, waste (**2a** — top view, nat. size; **2b** — bottom view, ×2)

Photos of skeletons by Łuszczewska, M.Sc.; others by S. Kolanowski a very small fraction, an early stage, of the stratigraphic section of this megafacies. To solve several ecological and biogeographical problems involved, a multifaceted study of the entire megafacies, a unique complex in the fossil record, will be needed. Especially important topics include relative abundances of particular sponge species in various areas and their relationship to lithology. The author is therefore fully aware that this report reflects merely the initial stage of the research, when the problems first appear but are still far from being satisfactorily solved.

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GĄBKI DOLNEGO I ŚRODKOWEGO OKSFORDU JURY POLSKIEJ

(Streszczenie)

Przedmiotem pracy są gąbki dolnego i środkowego oksfordu Jury Polskiej, zebrane w kamieniołomach Wrzosowa, Wysoka, Ogrodzieniec, Zalas i Nowa Krystyna (fig. 1). Gąbki te pochodzą z warstw jasnogórskich (fig. 2—3 oraz pl. 1—2), gdzie stanowią dominujący element wśród fauny bentonicznej (fig. 5), a sporadycznie tworzą biohermy (fig. 4). Warstwy jasnogórskie są najstarszą częścią górnojurajskiej megafacji gąbkowej, która jest przejściową między głębszymi utworami Tetydy i płytkimi osadami środkowej i północnej Europy (fig. 6). W badanych utworach (*patrz* fig. 7) stwierdzono obecność 16 gatunków należących do gromady Hyalospongea oraz 12 przynależnych do rzędu Lithistida gromady Demospongea. Ponadto, na podstawie analizy izolowanych spikuli (fig. 8), ustalono obecność „miękkich", o rozsypującym się po śmierci zwierzęcia szkielecie, przedstawicieli Demospongea należących do innych niż Lithistida rzędów. Ilościowo dominują przedstawiciele Lithistida stanowiąc 96% znalezionych okazów (fig. 7). Porównanie zespołów gąbkowych warstw jasnogórskich i ich odpowiednika facjalnego z obszaru Szwabii i Frankonii (kompleks jury białej α) wskazuje, iż oba te zespoły poważnie różnią się, gdyż w Niemczech dominują przedstawiciele Hyalospongea (fig. 9). Analiza sedymentologiczna warstw jasnogórskich prowadzi do wniosku, że występujące tu gąbki żyły na głębokościach prawdopodobnie nie mniejszych niż 150—200 m, i że rozwijały się na miękkim dnie. Prawie zupełny brak u badanych gąbek specjalnych organów mocujących do podłoża, pozwala przypuszczać, że żyły one nieco zagłębione swą dolną częścią w osad. Zauważono, iż w warstwach marglistych zespoły gąbkowe są gatunkowo zróżnicowane, podczas gdy w warstwach wapiennych dominuje zwykle jeden gatunek (fig. 10). Dzisiejsze zespoły gąbkowe głębszego szelfu stref ciepłych różnią się wyraźnie od zespołów górnej jury, gdyż obecnie dominują tam przedstawiciele Demonspongea należący do innych niż Lithistida rzędów, a ponadto są to formy wymagające twardego podłoża. Stwierdzono, że miejscami predysponowanymi dla powstawania bioherm gąbkowych były podczas powstawania warstw jasnogórskich lokalne nierówności dna, gdzie — zgodnie z prawem Bernoulliego — istniał zwiększony przepływ, a zatem lepsza cyrkulacja wód. W systematycznej części pracy opisano 28 taksonów (*patrz* fig. 12—16 oraz pl. 3—16). W stosunku do taksonów występujących na tyle licznie, że można było zbadać ich zmienność, podjęto próbę odejścia od panującej dotąd rozdrobnionej i często czysto morfotypowej taksonomii gąbek jury górnej.