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LYSSAKIDAE SPONGES FROM THE CARBONIFEROUS LIMESTONE AND THE CULM OF SOUTHERN POLAND AND THEIR ENVIRONMENTAL DIFFERENTIATION

Gąbki Lyssakida z wapienia węglowego i kulmu południowej Polski i ich zróżnicowanie środowiskowe

Helena Hurcewicz & Stanisław Czarniecki: Lyssakide sponges from the Carboniferous Limestone and the Culm of southern Poland and their environmental differentiation. Ann. Soc. Geol. Poloniae, 55/3–4: 333–354, 1985 Kraków

Abstract: Two assemblages of Lyssakidae sponges are described from the Visean deposits, i.e. from the Carboniferous Limestone of Gałęzice (Holy Cross Mts.) and the Culm of Orlej (west of Kraków), in southern Poland. The assemblages are possibly equivalent in age, and occur in deposits of the same basin. Twelve genera are described, five of them new: *Prenehydnoceras*, *Carbonella*, *Czarnockiella*, *Dialyscyphia*, *Repospongia*. Of 17 species, 13 occur at Gałęzice and four at Orlej. The sponges at Gałęzice occur with diversified benthic fauna, in a reef limestone deposited above the wave-base. The sponges at Orlej lived below the wave-base, probably as the only benthic organisms.

Key words: silicious sponges, texonomy, ecology, Carboniferous Limestone, Culm, Lower Carboniferous, Holy Cross Mts., Kraków Upland, Poland.

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INTRODUCTION

Sponges are only rarely encountered in Lower Carboniferous strata. They are reported from the vicinities of Moscow, from Thuringia, Westphalia, Scotland, Ireland and South Wales. Somewhat more numerous and more diversified are sponges in the Lower and Upper Carboniferous strata of North America. The habitat of Carboniferous sponges is poorly known (Okulitch & Nelson, 1957).

In Poland, the only study devoted to Carboniferous sponges was a description of spicules from the upper Visean shales at Bolesław near Olkusz (Alexandrowicz, 1978).

During the years 1955–1975 the second author (S.C.) collected numerous

specimens of sponges at two Lower Carboniferous localities: in the Culm shales at Orlej Quarry near Zalas, south of Krzeszowice (Fig. 1) and in the Carboniferous Limestone at Gałęzice, the Holy Cross Mts. (Fig. 1). Both occurrences are considered equivalent in age, are distant only about one hundred kilometres from one another, and occur in deposits of the same basin.

External morphology of the sponges is well preserved, less so the skeletal structure. In sponges from Galęzice, the spicules underwent mineral transformation, not affecting their outlines. At Orlej, some sponges are piritized or calcified,

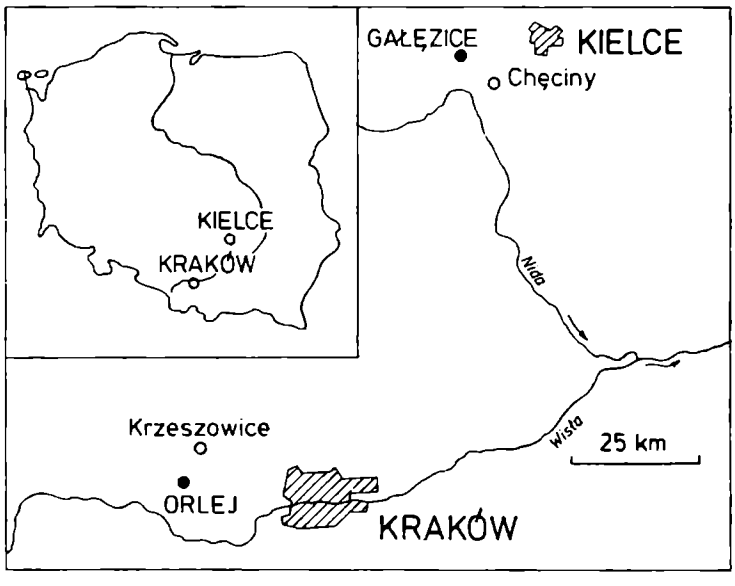


Fig. 1. Location of described sites with Visean sponges

in the others unstable hydrated silica was dissolved and replaced with sediment, forming molds of spicules. In both cases the external structure was studied with MP3 microscope in thin sections cut longitudinally and transversally. Stereoscopic viewing of thin sections was applied. Photographying of complete skeletons was precluded by oblique arrangement of spicules in parenchymal networks at almost all of the investigated sponges. The line drawings of spicules, accompanying the systematic part of the paper (Figs. 5 – 17), demonstrate the actual shape of spicules drawn from thin sections or photographs. The drawings are not interpretative, but illustrate the observed outlines of the skeletal elements.

The described specimens are stored at the Geological Museum in Kraków affiliated at the Institute of Geological Sciences, Polish Academy of Sciences, and are registered under numbers AI-68/1 – 60. The chapter "Geological setting and environmental differentiation of sponge assemblages" was written by the second author (S.C.), the "Systematic part" by the first one (H.H.), and the conclusions by both.

The authors express their thank to Dr. K. Konopacka of Zoological Institute of Łódź University and to Prof. G. Biernat of the Institute of Palaeobiology of the Polish Academy of Sciences, Warsaw, for their critical remarks and discussions. Thanks are due to an anonymous reviewer for his thorough comments, helpful during the revision of the manuscript. We thank Mrs D. Kościelska for preparing the thin sections, and Mr Mr L. Jędrasik and M. Dziewiński for making the photographs.

GEOLOGICAL SETTING AND ENVIRONMENTAL DIFFERENTIATION OF SPONGAE ASSEMBLAGES

CARBONIFEROUS LIMESTONE AT GAŁĘZICE

All sponge specimens at this locality were found in fossiliferous "series II" of reef limestones, in the exposure named "railway cut" (Fig. 2; Czarniecki, 1973). The sponges were found in the lower part, ca. 1 metre thick, of this series. They were collected over a surface equivalent to ca. 6 sq. metres of ancient sea bottom. Thirty eight specimens were obtained from 6 cubic metres of rock, suggesting a fairly frequent occurrence of sponges within faunistic assemblage of the reef limestone. The limestone is massive, includes dispersed lenses of dark, bioclastic lime-

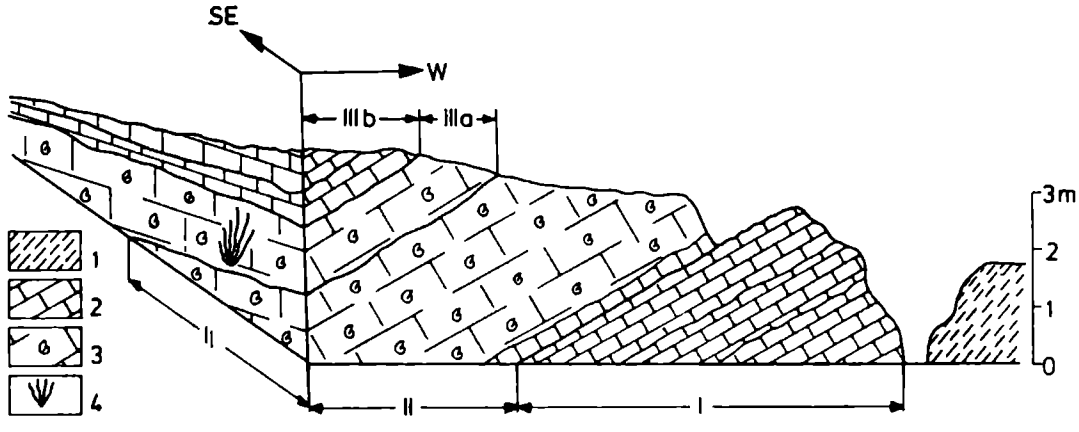


Fig. 2. Sketch of the exposure "railway cut" in Gałęzice (after Czarniecki, 1973). *I–III* – informal lithostratigraphic divisions; *1* – Culmian shales, *2* – stratified detritic limestones, *3* – reef limestones with abundant fauna, *4* – large coral colony

stone with varying amount of clay. Greater coral colonies in life position and large gigantoproductid shells accur among the lenses (Czarniecki, 1973, p. 231). Organic remains are numerous and mostly well preserved. They occur in accumulations, varying in composition and shell size, sometimes with such delicate skeletal elements preserved as productid spines, paired shells of spiriferids, rhynchonellids and pelecypods. These debris-rich accumulations, with matrix of pelitic limestone, are interspaced by zones of limestone containing more clay, composed of fragmented brachiopod shells, crinoid ossicles, broken coral colonies and massive solitary corals.

The fossils are not sorted, but their fragmentation seems to be due to water turbulence, suggesting that the limestones were deposited above the wave-base. Benthic organisms dominate, especially brachiopods and corals, both colonial and solitary Tabulata (Nowiński, 1976) and Rugosa. Less numerous are gastropods (Gromczakiewicz-Łomnicka, 1973), pelecypods, trilobites and bryozoans. Nektonic organisms are reprezented by fairly numerous cephalopods (Czarniecki, 1973), less frequent conularia and fish. Sponges occur in various lithological types of limestones. Complete specimens suitable for preparation are rarely encountered, but their external features can be studied also on fragments. The easy extraction of sponge fragments is due to the clayey admixture in the limestone.

It should be stressed that no sponges were found either in the layered detritic limestone of the "series" I and III (Fig. 2), or in detritic limestones in others exposures of the Visean strata at Gałęzice. It is probably due to the small resistance of sponges to transportation together with clastics.

The sponges in the "railway cut" at Gałęzice are rich in specimens and diversified in species composition. Both these features are indicative of an environment favourable for a given taxonomic group. Similar features, i.e. significant frequence of specimens and diversity are characteristic also for the other groups of fossils in this exposure, especially brachiopods. At those fragments of the bottom where the sponges lived, there were conditions favourable for their preservation. In other areas, transported together with brachiopod and crinoid remains, the sponges were probably completely destroyed. Differentiated conditions in areas between large coral colonies led to development of different benthic associations. Rapid accumulation of sediments, indicated by the absence of stratification and preservation of large coral colonies in life position, favoured the preservation also of delicate organic remains.

CULM AT ORLEJ

A sequence of black shales, 6 metres thick, is exposed in the cutting of Orlej Quarry, in the middle part of the Lower Carboniferous strata (Fig. 3). Few mollusc shells were found in its lower part, whilst the upper part beared isolated sponges and their accumulations consisting of up to 20 specimens. The shale sequence is underlain by porphyry conglomerate, and overlain by tuffite (Czarniecki & Łydka, 1959).

The solitary sponges, as well as those occurring in groups of small individuals are usually preserved in life position. Saucer-shaped and cake-shaped forms are situated with spongocoel upside or sideways. Some specimens are larger than those in Gałęzice, attaining above 10 centimetres across, but accumulations of small individuals prevail. No other fossils were found in the surrounding rock. In the lower part of the shale sequence, devoid of sponges, pelecypod and gastropod shells occur, suggesting that during the deposition of the shales the conditions

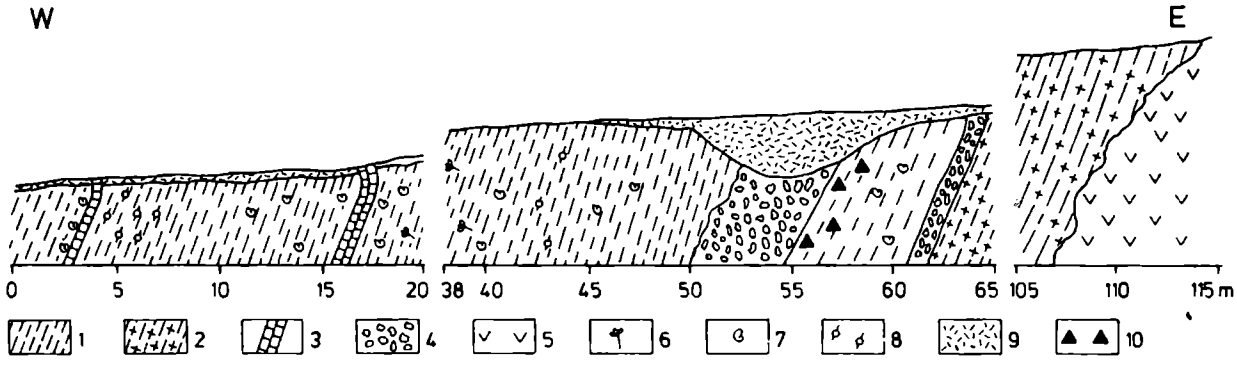


Fig. 3. Section of Culmian strata in Orlej Quarry (after Czarniecki & Łydka, 1958). *1* – argillaceous shales, *2* – silicified shales, *3* – limestones, *4* – conglomerates and tuffite, *5* – porphyry, *6* – plant detritus, *7* – macrofauna, *8* – ferruginous concretions, *9* – weathered cover, *10* – sponge accumulations

in the basin changed, eliminating molluscs and pertmitting the development of sponges. This seems related to the manifestations of volcanic activity preserved below and above the shales. It should be stressed that no sponges were found in the rich assemblage of benthic fauna in shales and limestones of the higher part of the Lower Carboniferous strata in Orlej Quarry (Czarniecki, 1955).

Depositional environment at Orlej was quite different from that at Gałęzice (Fig. 4). The sponge-bearing strata were laid down in deeper part of the basin, where only carbonate-free clays accumulated.

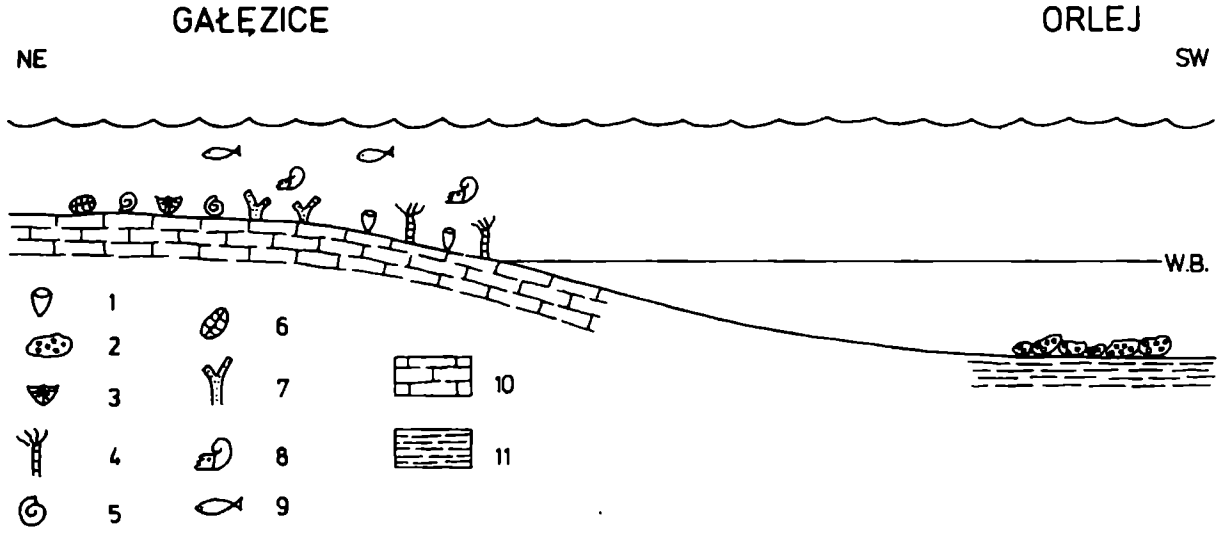


Fig. 4. Reconstruction of palaeoenvironments of Visean sponge assemblages at Gałęzice (Carboniferous Limestone facies) and at Orlej (Culm shale facies). *1* – solitary sponges, *2* – colonial sponges, *3* – brachiopods, *4* – rugose corals, *5* – gastropods, *6* – trilobites, *7* – tabulate corals, *8* – goniatites, *9* – fish, *10* – carbonate sediment, *11* – argillaceous sediment

The sponges from both localities differ in shape and species composition. At Orlej, the accumulations and individuals are mostly saucer-shaped or discoidal, with a tendency to build clustered colonies, while conical, rounded and branching forms dominate at Gałęzice. None of 12 described sponge genera occurs at both localities, but there are many genera and even species in common between the brachiopod faunas of both localities.

CORRELATION OF SPONGE-BEARING HORIZONS AT ORLEJ AND GAŁĘZICE

The limestone at Gałęzice is dated by a goniatite fauna concurrent with sponges as Go-α Zone of the Visean (Czarniecki, 1973). At Orlej, rich assemblages of brachiopods, indicative of the D_2-D_3 Zone of the Upper Visean (Czarniecki, 1955), occur ca. 50 m above the sponge-bearing shales. The conodonts from the limestone ca. 40 m above the sponge-bearing shales are indicative of the *Gnathodus girtyi collinsoni* Zone (Bełka, 1982). It is therefore suggested that the sponge-bearing strata at Orlej belong to a zone of Upper Visean older than D_3, and may be time-equivalent to the reef limestone from Gałęzice. This is indirectly corroborated by the traces of diastrofic movements during the transition from clay to limestone sedimentation at Gałęzice, and by erosion of older deposits (see Czar-

niecki, 1973). The two localities are less than a hundred kilometres apart, and the relation between the diastrofic phenomena at Gałęzice and the traces of the volcanic activity at Orlej seems very likely.

SYSTEMATIC PART

Class Hexactinellida Schmidt, 1869/70 = (Hyalospongea Claus, 1872)
Order Lyssakida Zittel, 1878 = (Lyssacinossida Hartman)
Family Dictyospongidae Hall, 1884
Genus *Dictyospongia* Hall & Clarke, 1898

Dictyospongia galensicensis n.sp.

Pl. I: 1a–d; Fig. 5

Holotype: AI-68/4, two thin sections

Derivation of name: After Gałęzice – name of the locality in the Holy Cross Mountains where the holotype was found.

Material: 2 specimens

Diagnosis: Ovoid or pear-shaped sponges with uneven surface, lacking spongocoel. Exhalant pores small. Canals are not outlined. Lyssakide skeleton.

Description: Ovoid sponge with uneven surface. External dimensions 43 × 34 × 30 mm. Basal part poorly individualized. Exhalant pores invisible; inhalant pores funnel-shaped, varying in diameter from 1.5 to 3 mm. Canals not delineated. Spongocoel and osculum lacking. Dermal skeleton

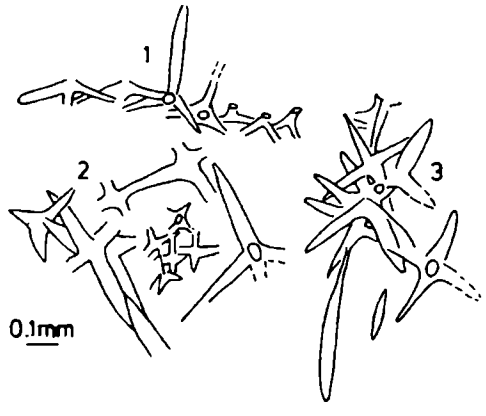


Fig. 5. Spicules of *Dictyospongia galensicensis* drawn from thin section. *1* – dermal pentacts, *2* – parenchymal hexats and stauracts, *3* – diacts and arrangement of spicules

delicate, incompletely preserved, comprising pentacts and stauracts. Parenchymal skeleton comprises hexacts and stauracts, both biform, greater and smaller, with equal rays; not fused into a rigid framework. Numerous diacts present.

Comparison: Net-like skeleton, differentiation of triaxons, their arrangement, and the presence of diacts indicate its attribution to the genus *Dictyospongia* Hall & Clarke. The lack of spongocoel, the massive subsphaerical instead of cup-like form, the non-layered pattern of spicules with a disordered arrangement, all distinguish this species from the type species *D. sceptrum* Hall, and from the other species.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Dictyospongia sp.

Pl. VII: 1a, b; Fig. 6

Description: The specimen AI-68/37 is irregularly sphaerical, lacking spongocoel, with external dimensions 38 × 40 × 50 mm; canals not individualized. Exhalant pores ovate, funnel-shaped, present over all surface, more distinct at apex. Dermal skeleton 2–5 mm thick, reticulate. Parenchymal

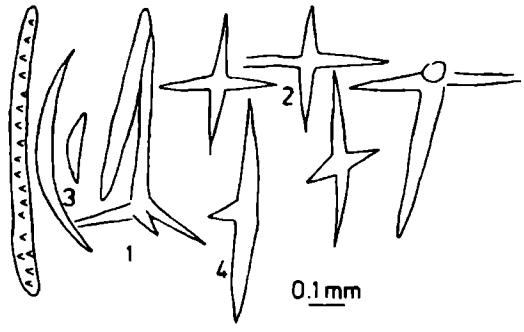


Fig. 6. Spicules of *Dictyospongia* sp. drawn from thin section. *1* – pentacts, *2* – stauracts, *3* – smooth and curved diacts, *4* – side view of tetract

skeleton fairly regular, consists of triaxons and their derivates of similar size. At some places they seem concentrated in fascicules, of several pieces each. These spicules have elongated the so called axial rays.

Comparison: They differ from *D. galensicensis* by the presence of elongated triaxons, their arrangement, and different morphology of subdermal surface.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Genus *Microstaura* Finks, 1960

Microstaura cf. *dolium* Finks, 1960

Pl. II: 3,4

Material: 3 calcitized specimens

Dimensions in mm: AI-68/5 – 20 × 10 × 22
AI-68/12 – 15 × 23 × 24
AI-68/18 – 13 × 14

Comparison: Size and distribution of hexacts conform the description of young specimens of the species *M. dolium* Finks, which have spicule rays 0.2 to 0.4 mm long (Finks, 1960, Pl. 34, Figs. 3 and 8), and body size up to 3.4 × 3.5 mm. They differ from the adult specimens of the same species by the lack of osculum and the presence of smaller hexacts.

Occurrence: Visean, zone Go-α – Poland (Gałęzice); Lower Permian, Leonardian – North America (New Texas)

Genus *Prenehydnoceras* n. gen.

Derivation of name: *prenes* (Gr.) – inclined, falling down

Type species: *Prenehydnoceras trachys* n.sp.

Diagnosis: Thick-walled sponges lacking osculum, of cribriporal morphotype. Lyssakide skeleton with hexacts, oxeas and dermal pentacts.

Discussion: The new genus resembles in outline *Hydnoceras tuberosus* Conrad, 1842 from the Upper Devonian and Carboniferous (*vide* Hall & Clarke, 1898, p. 55). Nevertheless the *Hydnoceras* specimens are thin-walled, tureen or bowl-shaped, with lumps on outer surface arranged in 4 – 8 longitudinal rows, whilst the described species is thick-walled, of cribriporal form, with internal spongocoel lacking osculum.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Prenehydnoceras trachys n.sp.

Pl. II: 1a – f; Fig. 7

Holotype: AI/68/19, two thin sections

Derivation of name: *trachys* (Gr.) – rough

Material: complete specimen AI-68/19, thin sections

Diagnosis: Club-shaped, ovate in transversal section, with internal spongocoel, lacking osculum. Outer surface with low lumps. Lyssakide skeleton.

Dimensions: 6 mm in height, 34 × 50 mm across, 12 × 14 mm at base.

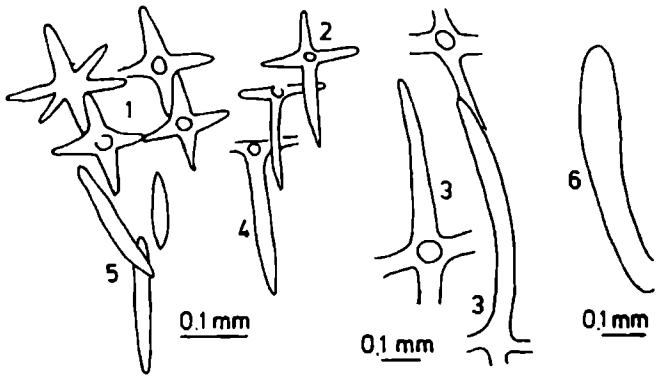


Fig. 7. Spicules in parenchymal skeleton of *Prenehydnoceras trachys* n.sp. drawn from thin section. *1* – regular hexacts, *2* – axial hexacts with longer one or two rays, *3* – large hexacts, *4* – pentacts, *5* – oxeas, *6* – strongyle

Description: Club-shaped, ovate in transversal section. Apex rounded, cribriporal. Lower part oblate. Outer surface lacking stration, finely porous. Low conicular lumps arranged in two longitudinal rows on narrower side. Internal spongocoel ovoid in shape, surrounded with walls 10–15 mm thick. Inhalant pores fine, poorly discernible. Exhalant pores slightly wider, irregularly distributed, more numerous towards the apex, sometimes densely grouped at lumps. Inhalant canals short, almost invisible. Exhalant canals sinuous, tubular, better developed arround the apex. Dermal skeleton thin, containing pentacts and oxeas. Spicular network in parenchyma dense, with square openings, built of hexacts with blunt and smooth rays. Rays 0.2 mm long, 0.03 mm across. Few "axial" hexacts present, with longer rays 0.8 to 1 mm, straight or slightly curved. Few oxeas and strongyles.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Prenehydnoceras sp.

Pl. II: 2

Description: The specimen AI-68/14 flattened, rounded in horizontal section, 30 mm in diameter, 13–18 mm high. Sideways ribbed with coalesced lumps. Spongocoel narrow, funnel-shaped, reaching to the base. Oscular margin rounded. Dermal skeleton thin, with hexacts and oxeas discernible at places. Parenchymal skeleton with rounded quadrangle openings. It differs from *P. trachys* n.sp. by its shape, size and arrangement of coalescent lumps.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Genus *Actinodictya* Hall, 1890

According to the diagnosis of Hall and Clarke (1898, p. 143, pls. 30, 31) irregular leaf-shaped Hexactinellida lacking traces of attachement.

Actinodictya patanoforme n.sp.

Pl. III: 1a–d; Figs. 8, 9

Holotype: AI-68/9, two thin sections

Derivation of name: *patane* (Gr.) – plate

Material: Specimen AI-68/9 in two fragments. Two thin sections.

Diagnosis: Flat, plate-shaped or leaf-shaped, with tuft of basal spicules on short stalk. Canals irregular in width, opposite to one another. Dermal skeleton present. Parenchymal hexacts not fused.

Description: Plate-shaped sponge, 52 mm high and of 40 mm maximum width. Rim irregularly thick. Walls 2–16 mm thick. Basal part short, stalk with tuft of anchoring spicules. Inhalant pores not individualized. Exhalant pores varying in width. Canals irregular, branching. Dermal skeleton locally up to 0.5 mm thick, with reticularly arranged stauracts and oxeas. Spicular network in parenchyma with regular hexacts and stauracts, arranged in diagonal rows. Rays 0.3–0.6 mm long, ca 0.07 mm across. The spicules in the basal tuft are up to 15 mm long and 0.10–0.13 mm across.

Comparison: It differs from the type species *A. placenta* by better development of canals, more regular arrangement of parenchymal spicules, and the presence of basal spicules in stalk.

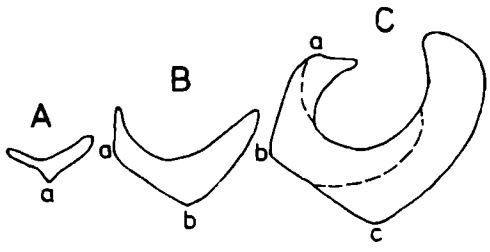


Fig. 8. *Actinodictya patanoforme* n.sp. Side view of sponge in successive stages of ontogeny, showing its progressive turning relative to substratum during growth. A, B, C – basal lumps

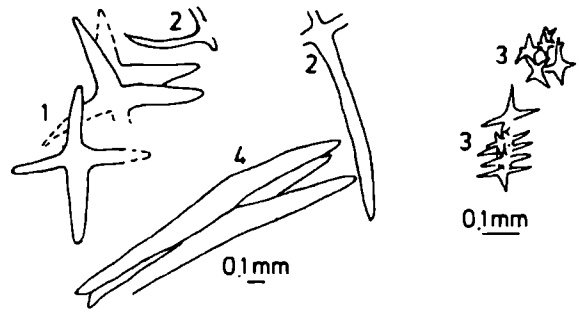


Fig. 9. Spicules of *Actinodictya patanoforme* n.sp. drawn from thin section. *1* – stauracts, *2* – large stauracts in wall, *3* – small stauracts, *4* – fragment of basal spicules

Remarks: Elongated spicules embedded within each lump (a, b, c), mutually similar (Pl. III: 1b), suggest that the sponge changed its position relative to substratum during its life. It is also suggested by the external outline and the pattern of canals. The interpretation of successive stages of this individual's development is shown in Fig. 8.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Genus *Carbonella* n. gen.

Type species: *Carbonella rotunda* n.sp.

Diagnosis: Cribroporate sponges, lacking osculum, with vast atrial caverns. Lyssakide skeletal network dense, with stauracts, hexacts and diacts.

Discussion: They are distinguished from the other sphaerical and club-shaped Palaeozoic Lyssakida by their lumpy surface, lack of osculum accompanied by presence of internal thick-walled spongocoels. Lumps do not display linear arrangement.

They differ from *Prenehydnoceras* n. gen., representing the same morphotype, by the arrangement of spicules. Compared to *Czarnockiella* n. gen., they lack paragaster cavity, have dismembered cribriporate exhalant cavity, and less developed canals. They lack large pentacts in dermal skeleton.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Carbonella rotunda n.sp.

Pl. III: 3a, b; Pl. IV: 1, 2; Fig. 10

Holotype: AI-68/32

Derivation of name: *rotundus* (Lat.) – rounded, circular

Material: two specimens, AI-68/32, 3

Diagnosis: Sphaerical sponges with internal spongocoel, but lacking osculum. Inhalant pores fine, exhalant pores stellate or ovate. Exhalant canals irregular. Hexacts, stauracts and diacts present.

Description: Pear-shaped or subsphaerical with short basal part. Height 55 mm, maximum width 40 mm. Outer surface with irregularly distributed, low lumps. Inhalant pores poorly discernible. Exhalant pores 3–5 mm across, spaced, flattened or funnel-shaped. Subdermal cavities present. Exhalant canals of irregular width. Internal spongocoel dismembered. Dermal skeleton thin, with stauracts and diacts forming fine reticulum on the outer surface. Parenchymal skeleton dense; hexacts and stauracts equiradial, with rays 0.2 mm long. Fragments of gastral skeleton with diacts arranged vertically are preserved in canals and cavities. Greater hexacts irregularly distributed, with rays 1.1 mm long and 0.2 across; diacts 1.3 mm long and 0.2 mm across.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

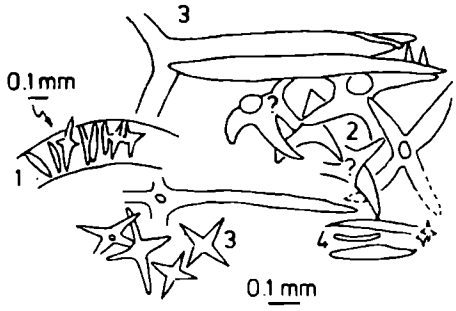


Fig. 10. Spicules of *Carbonella rotunda* n.sp. drawn from thin section. *1* – stauracts and diacts in dermal skeleton, *2–3* – hexacts and stauracts in parenchymal skeleton, *4* – diacts

Carbonella sp.

Pl. III: 2

Material: 2 specimens AI-68/15a, b

Description: Hemisphaeric form, without individualized pores. Canals not visible. Dimensions 33 × 24 × 17 mm. Central cavity curved, 20 mm across at exit, and 3–8 mm across inside. Walls varying in thickness, with irregular exhalant cavities, which locally pierce to the outer surface. Dermal skeleton poorly developed, similar to that of *C. rotunda* n.sp. Parenchymal skeleton comprises: 1) smooth hexacts 1.1 mm long and 0.07–0.15 mm across at tips, 2) smaller hexacts, and 3) stauracts with rays 0.2–0.3 mm long. Diacts biform, 2 mm or 0.25 mm long.

Remarks: The form the internal cavity resembles a trace of boring organism or a trace of an elongated object around which the sponge grew.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Genus *Czarnockiella* n. gen.

Type species: *Czarnockiella concinella* n.sp.

Derivation of name: Dedicated to memory of Jan Czarnocki who discovered the Carboniferous strata at Gałęzice.

Diagnosis: Sponges massive, conical or discoidal, with exhalant depression and well developed canal system. Exhalant pores larger and rounded. Lyssakide skeleton.

Discussion: Comparable to the genera *Physsospongia* Hall (Hall & Clarke, 1898, Pl. LXII: 1–11) and *Hyphantena* (= *Uphantena* venuxem, Hall & Clarke, 1898, Pl. LXII: 3, 6, 8). It displays, however, some differences: a) lack of some types of spicules occurring additionally at *Physsospongia*, e.g. clemes and umbels; b) lack of arrangement of spicules in fascicules and those in bands; c) different shape and texture of pores than in *Uphantena* = *Hyphantena* emend. Hall 1898. The reticulate instead of banded structure of skeleton, lack of lumps coalescing into ridges, and the morphotype with only shallow apical depression, indicate a genus hitherto unknown from the Palaeozoic.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Czarnockiella concinella n.sp.

Pl. V: 1–4; Fig. 11A

Holotype: AI-68/13, thin section

Derivation of name: *concinus* (Lat.) – skilfully joined, beautifull

Material: six complete specimens (AI-68/13, 20, 25, 30, 34, 36) and five fragments, thin sections

Diagnosis: Thick-walled conical sponges with even apex. Lower part separated from the upper by a margin. Spongocoel shallow, canals strongly developed. Triaxons numerous, differenciated, not interconnected.

Dimensions in mm:

specimen number	height			maximum diameter		diameter		wall thickness
	total	lower part	upper part	specimen	canal	osculum	posticum	
13	25	20	5	31	4	18	1	14–17
34	27	20	7	55	4	21	1.1	16
36	50	30	20	82	5	22	1.8	24–33
25	46	36	10	71	7.5	25	2	–

Description: Conicular sponges with more or less flattened upper part. Lower part with oblate termination, separated from the upper by a margin. Apical surface densely reticulate, may be covered with small lumps concentrically arranged. Surface of the lower part porous. Osculum funell--shaped, rounded, 20–28 mm across, bordered by marginal skeleton. Spongocoel concave. Inhalant pores imperceptible. Numerous exhalant pores widest at the bottom of the cavity circular, up to 3 mm across in side wall. Exhalant canals varying in width, attaining 8 mm, branching, directed upwards. Inhalant canals ca. 1 mm in diameter, short. Dermal skeleton fine, comprises pentacts, stauracts and diacts. Parenchymal skeleton well developed, perforated by gaps. Spicules arranged densely, obliquely to one another. Hexacts with rays 0.4–2.2 mm long, pentacts, stauracts, irregular tetractines, and diactines 1–7 mm long, moderately thick.

Comparison: It differs from *Cz. viriosa* by shape, exhalant pores limited to lower side, and by occasional presence of small lumps, concentrically arranged around osculum.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Czarnockiella viriosa n.sp.

Pl. VI: 1–5; Pl. VII: 2, 3; Figs. 11B, 12

Holotype: AI-68/24, two thin sections, adolescent form

Derivation of name: *viriosus* (Lat.) – strong, robust

Material: eleven specimens: AI-68/1, 2, 6, 8, 16, 17, 21, 24, 31, 33, 35, two of them young, i.e. 1 and 2

Diagnosis: Sphaerical or flattened sponges with shallow spongocoel or exhalant depression. Exhalant pores large, open or obstructed by dermal skeleton. Canals irregularly developed. Triaxons and diacts present.

Dimensions in mm:

specimen	length	height	thickness	osculum diameter
AI-68/24	77	39	39 × 60	31
AI-68/31	111	52	52 × 72	35
AI-68/1	–	33	42 × 40	12
AI-68/17	36	31	27	10 × 11

Description: Sponges sphaerical or flattened, elongated, lacking attachement. Exterior smooth, porous. Oscular margin rounded. Spongocoel shallow, with wide bottom, surrounded by wall 16–18 mm thick. Inhalant pores fine. Exhalant pores numerous, rounded, recessed, 2–5 mm across, arranged in oblique lines. Some are obstructed by dermal skeleton. Exhalant canals of uneven thickness,

transitional to gaps. Dermal skeleton diagonally reticulate, composed of pentacts. Parenchymal skeleton with hexacts, stauracts and diacts. Hexacts are larger, with axial rays longer than the transversal ones, or regular with equal rays. Diacts few. Larger axial hexacts, with longer rays directed to the outer surface

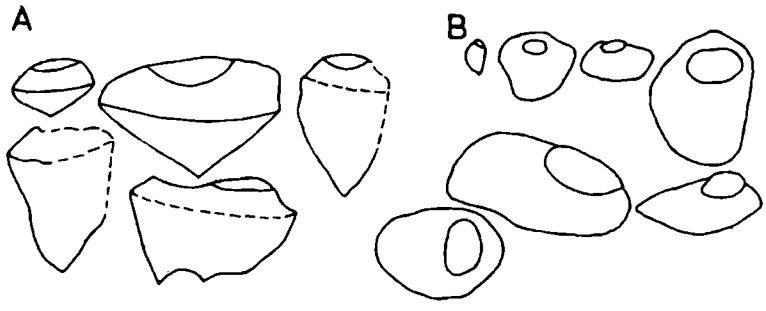


Fig. 11. Variations in outline of specimens of *Czarnockiella concinella* n.sp. (A) and *Czarnockiella viriosa* n.sp. (B)

of sponge, form skeletal framework with wide openings. Among them a network of smaller spicules, arranged diagonally to one another.

Variability is marked in sponge shape, canal width, paragastric cavity depth. Different ontogenic stages are observed:

1. Small specimen AI-68/2, 10 mm in diameter, still devoid of exhalant depression. Exhalant pores are few, poorly developed.

2. Specimen AI-68/16, diameter ca. 35 mm, with developed exhalant canals but lacking gaps. Depression is shallow, narrower.

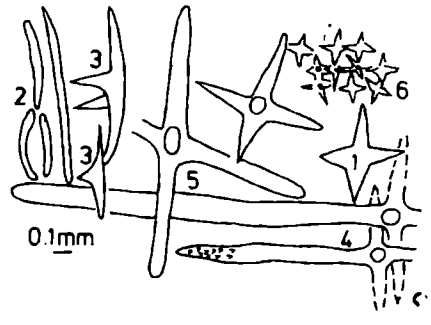


Fig. 12. Spicules of *Czarnockiella viriosa* drawn from thin section. *1* – stauracts, *2* – oxeas, *3* – tractines and tatractines, *4* – hexacts with longer ray, *5* – regular hexacts, *6* – small hexacts and stauracts

3. Specimen AI-68/17, also sphaerical, with wide osculum, deeper spongocoel and with gaps.

4. The mentioned forms are accompanied by older specimens, of flattened outline, excentric (specimens 1, 8, 24, 31).

Comparison: Differs from *Cz. concinella* in shape, distribution of pores over all surface, irregular lumps and less frequent diacts in the skeleton.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Genus *Dialyscyphia* n. gen.

Type species: *D. breviramosa* n.sp.

Derivation of name: *dialyo* (Gr.) – to be derived

Diagnosis: Stick-shaped, branching sponges, lacking spongocoel. Skeleton comprising exclusively hexacts and diacts.

Discussion: Studied specimens of *Dialyscyphia breviramosa* and *Dialyscyphia* sp. can be compared to *Heliospongia* Girty (1908), with cylindrical large-sized anastomosing branches, and a spongocoel along the branches. *Heliospongia* Girty was attributed by Laubenfels (1955, p. E64) to Anomocladina, and by Finks (1960) to Epipolasida. King (1943) reports the presence of Hexactinellida-type spicules, but Finks denies it. At *Heliospongia* Girty spicules are arranged transversally and radially, sometimes even concentrically. *Dialyscyphia* differs from the latter by the differentiation in hexacts size, their arrangement, lack of gaps and of spongocoel, and by branching shape without anastomosis. *Dialyscyphia* n. gen. is attributed to the family Dictyospongiidae Hall.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Dialyscyphia breviramosa n.sp.

Pl. I: 2a, b; Fig. 13

Holotype: AI-68/28, specimen with two branches, thin section
Derivation of name: *ramosus* (Lat.) – branching; *brevis* (Lat.) – short
Diagnosis: same as for the genus
Dimensions in mm:

	stem		branches		hexacts
	height	across	lenght	across	lenght of rays
holotype	50	14 × 21	11	11 × 18	0.7 – 1 rare 0.3 – 0.4 numerous

Description: Stick-shaped, flattened in one plane, dichotomous with short branches. Apices slightly depressed. Inhalant pores small. Exhalant pores wider than network openings, 0.7 – 1 mm across, situated at apex and side walls. Exhalant canals varying in outline concentrated in axial part.

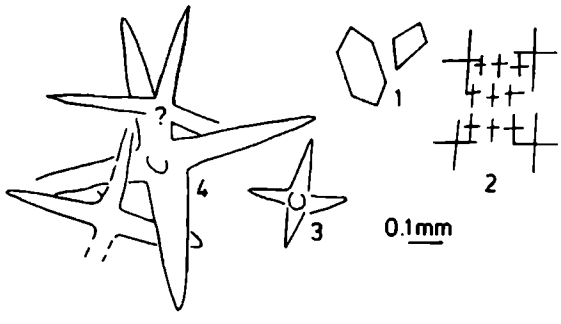


Fig. 13. Spicules of *Dialyscyphia breviramosa* n.sp. drawn from thin section. *1* – outlines of pores in skeletal network, *2* – scheme of spicule distribution, *3* – outline of small hexact, *4* – three larger hexacts

Dermal skeleton thin, composed of pentacts of two sizes, smaller and larger. Diagonal spicular network in parenchyma composed of regular hexacts.
Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Dialyscyphia sp.

Pl. I: 3a, b; Fig. 14

Description: The specimen AI-68/10 represents two interconnected bulb-shaped individuals, lacking spongocoel, 12 mm high and 21 × 12 mm across. Apex uneven with a depression. Exhalant pores rounded, depressed, irregularly distributed. Inhalant pores imperceptible. Canals indistinct. Small exhalant cavities present. Dermal skeleton 1 mm thick. Spicular network in parenchymal skeleton composed of few larger hexacts, with rays straight or curved, 0.65 – 0.8 mm long and 0.075 mm across, and smaller regular hexacts with rays 0.2 mm long. Diacts are larger and smaller, dispersed in dermal skeleton.
Comparison: They differ from *D. breviramosa* n. sp. in form, smaller hexacts and less developed system of gaps.
Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Rhombodictyon lentiformis n.sp.

Pl. VIII: 1a – c; Fig. 15

Holotype: specimen AI-68/7, two thin sections
Derivation of name: *lens* (Lat.) – lens

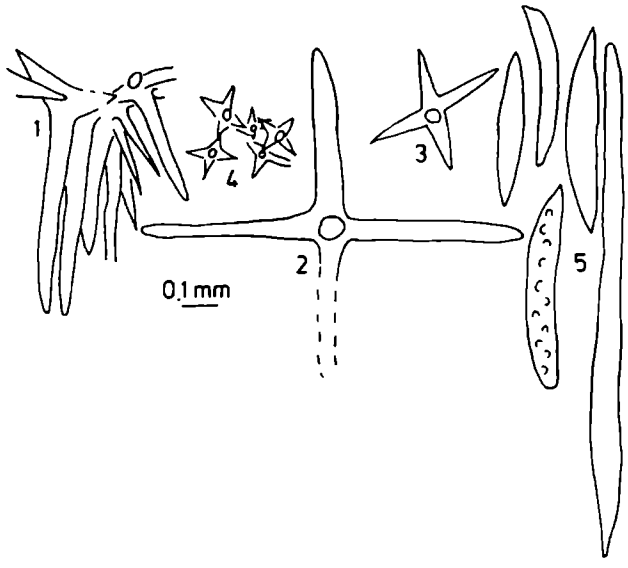


Fig. 14. Spicules of *Dialyscyphia* sp. drawn from thin section. *1* – pentacts in dermal skeleton, *2–4* – hexacts in parenchyma: *2* – large, *3–4* – small, *5* – diacts

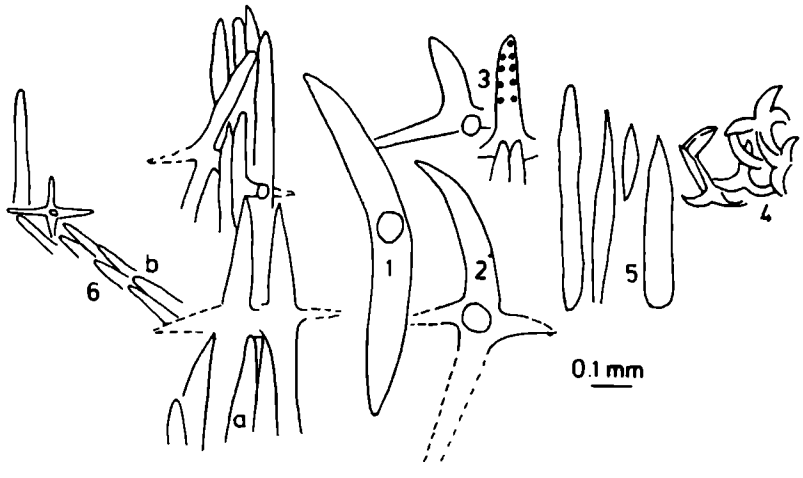


Fig. 15. Spicules of *Rhombodictyon lentiformis* n.sp. drawn from thin section. *1* – stauracts in dermal skeleton, *2* – hexacts with curved rays, *3* – smooth and ornamented rays of spicules, *4* – small stauracts, *5* – diacts and styles, *6* – spicules grouped in fascicules (*a* – elongated, *b* – transversal)

Diagnosis: Discoidal or lenticular sponges lacking spongocoel. Canals tubular, irregular. Exhalant pores arranged obliquely. Dermal and parenchymal skeletons present.

Description: Discoidal or lenticular sponges, ovate in cross-section without traces of attachment, lacking spongocoel and osculum. Dimensions in mm: 104 × 74 × 34. Exhalant pores rounded, ca. 5 mm across, obliquely arranged. Some of them are obstructed by dermal skeleton. Inhalant pores imperceptible. Canals and cavedias irregular. Dermal skeleton of cortex type, attaining 5 mm in thickness, layered, composed of superimposed stauracts. Parenchymal skeleton comprises: hexacts with straight, smooth rays, transversal ones 0.4 mm long, and axial ones 1.3 mm long; stauracts with arcuate rays 0.2 – 0.3 mm long; diacts with pointed or blunt rays, of uneven length. The spicules are not arranged in parallel planes. Locally preserved rhomboidal network composed of fascicules of diacts and axial hexacts, obliquely arranged.

Comparison: They differ from *Rh. reniforme* Whitfied from the Devonian strata of U.S.A., by their larger size, flattened form and differentiated assemblage of spicules.

Occurrence: Visean, zone Go-α – Poland (Gałęzice)

Order Lyssacines

Species *1*

Pl. I: 4; Pl. III: 4

Material: two calcified specimens AI-68/42 and AI-68/43

Description: Specimen 68/42 ovate with porous surface, 35 mm high and maximally 25 mm thick, lacking spongocoel. Inhalant pores imperceptible. Lower part short, stalk-like, lacking external

bundle of spicules. Exhalant pores uniporate or cribroporate, rounded attaining 2 mm across, arranged in oblique rows all over the outer surface. Dermal skeleton fine, includes casts of small triactine spicules with equal rays, forming a fine mesh. Parenchyma with a network of hexacts. Specimen 68/43 triangular in outline, laterally flattened. The preserved morphology and surface structure conforms the former specimen.

Comparison: Both specimens are similar to *Arakespongia mega* Rigby, from the Carboniferous strata of U.S.A., especially to the specimen shown in Pl. 117–3 (Rigby, 1970), but they lack spongocoel and seem to have not differentiated spiculation.

Occurrence: Upper Visean – Poland (Orlej near Zalas)

Family Mattaspongiidae Rigby, 1970

Genus *Mattaspongia* Rigby, 1970

Mattaspongia sp.

Pl. VIII: 2

Material: three fragments AI-68/44, 45, 46, calcified, partly piritized

Description: The preserved fragments suggest a flat platy shape of sponge, 14 mm high and above 60 mm wide. Walls ca. 6 mm thick in central part, and 1.5 mm thick at margins. Upper surface with local gentle swellings. Lower surface with several short stalk-like basal appendages. Inhalant pores not individualized in the skeleton, smaller than meshes of dermal network. Exhalant pores few, ovate, imperfectly preserved. Canals sinuous. Dermal skeleton of same structure on both surfaces, similar as in *Mattaspongia apaches* Rigby from the Upper Devonian strata of Alberta (Rigby, 1970, pl. 3, figs. 1 and 2), but triaxons, probably pentacts, are smaller and more densely packed. Parenchymal skeleton comprises hexacts with equal rays, equal in size, almost regularly arranged into a fine mesh with oblique rows. The second specimen was probably bowl – or funnel-shaped.

Comparison: Smaller than *M. apaches* Rigby, have less and smaller postica (= exhalant pores), finer hexacts and not so horizontally arranged.

Occurrence: Upper Visean – Poland (Orlej near Zalas)

Family Titusvillidae Caster, 1939

Four genera of branching sponges were included in this family by Laubenfels (1955), all with individuals linearly arranged and aggregated in colonies. The proposed genus *Repospongia* n. gen. is included here, taking into account its lyssakide skeletal structure, small dimensions of individual, and characteristic shrub-like clusters resulting from apical division of individuals, interconnected by tubular paragastric cavity.

Genus *Repospongia* n. gen.

Type species: *Repospongia carbonaria* n. sp.

Derivation of name: *repo* (Gr.) – incline

Diagnosis: Small sponges forming shrub-like colonies originating from bifurcate division of individuals interconnected by tubular paragastric cavity. Lyssakide skeleton.

Comparison: The sponges are characterized by bifurcate division of each individual in the colony, giving rise to broomy panicles. The genus differs from *Titusvilla* Caster (1939) from the Lower Carboniferous of U.S.A. in: 1) presence of several broom-like panicles in each colony, instead of lined arrangement, 2) cylindrical and bottle-shaped individual sponges, instead of cup-shaped ones, 3) lack of oscular margin spicules. From *Armstrongia* Clarke (1920) from the Upper Devonian strata of U.S.A. it differs by lack of annulation and mode of branching.

Occurrence: Upper Visean – Poland (Orlej near Zalas)

Repospongia carbonaria n.sp.

Pl. IX: 1–5; Figs. 16 and 17

Holotype: AI-68/47

Derivation of name: from the name of Carboniferous system, in which it occurs in Poland.

Diagnosis: Small cylindrical or bottle-shaped sponges with tubular spongocoel, apically bifurcating. They form broom-like panicles. Surface finely porous. Apex rounded. Skeleton with isolated hexacts.

Material: 6 complete colonies, five fragments, two thin sections: AI-68/47 to 57

Dimensions in mm:

Specimen	colonies		individual	
	height	diameter	height	maximum thickness
holotype 68/47	20–30	74	6	3
paratype 68/48	20–35	105	8	2
68/49	15–26–40	75×85	11	2.5

Description: Sponges forming dense accumulations. Colonies discoidal or oblong: ovate or excentric in outline. Lateral surface tuberculate due to projecting apices.

Individuals in colonies numerous, distinctly separated, cylindrically elongated, of small size. Apices rounded or slightly concave, cribroporate or with osculum. Spongocoel tubular, narrow. Exterior of

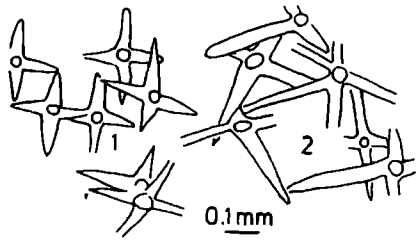


Fig. 16. Spicules of *Repospongia carbonaria* n.sp. drawn from thin section. *1* – small hexacts, *2* – large hexacts

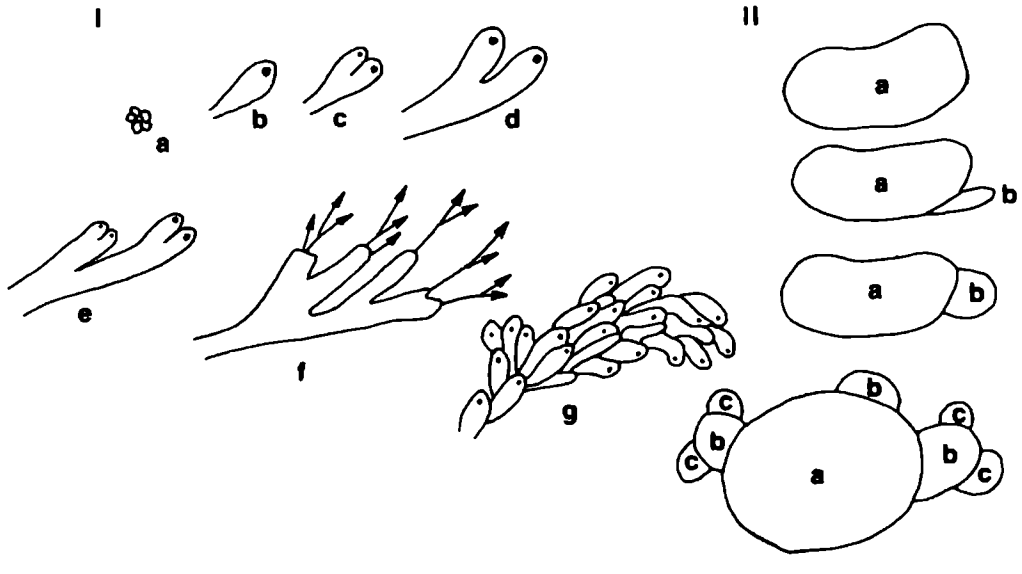


Fig. 17. Colony development in *Repospongia carbonaria* n.sp. I – development of individual panicle-like branch: *a–b* – separate sponge individuals, *c* – division of upper part of individual, *d–f* – successive stages of division of each individual in a branch, *g* – one of numerous branches forming a colony. II – successive stages in colony development: *a* – parental colony in a side view, *b* – subsequent panicle-like branch forming a smaller, filial colony, *c* – patchy arrangement of colonies

individuals finelly porous. The whole colony covered by common dermal skeleton, with traces of stauracts. Parenchyma with hexacts twofold in size, with small difference between them. The smaller have rays 0.1 – 0.15 mm long, the larger 0.25 – 0.4 mm long. Hexacts with equal rays, not fused.

Development of colony: Colonies are small, low. Some are isolated, others laterally coalescing. Show tendency to aggregate into panicles arranged in horizontal spirals (Pl. IX: 1a) and in layers (Pl. IX: 2a, 2b). In one specimen 11 layers were found. The development and growth are characterized by: a) development with growth and formation of panicle-like branch, b) formation of clustered colonies. Figure 17 present the successive stages of the broomy-panicle formation by bifurcating divisions of the upper part of each individual, parallel to the substratum. Such panicle-like groupings appear successively, are numerous, and are constituent parts of a colony. The appearance of the common dermal skeleton impeds the further growth and is followed by appearance of sisterly colonies, growing from the lower, basal part (Fig. 17-II). Sprouting individuals give origin to new colonies, spreading over the bottom in a patchy pattern.

Occurrence: Upper Visean – Poland (Orlej near Zalas)

Family ?

Genus *Polylophidium* Finks, 1960

Polylophidium orleii n.sp.

Pl. VII: 4a, b; Fig. 18

Holotype: AI-68/58

Derivation of name: from the locality Orlej, where the holotype was found.

Material: 2 specimens, AI-68/58 and AI-68/59

Diagnosis: Platy or flat lenticular sponges. Inhalant system not discernible. Exhalant canals vertical tubular. Exhalant pores rounded. Dermal skeleton present. Parenchymal skeleton comprises numerous diacts aggregated in fascicules, and small hexacts with equal rays.

Description: Platy or flat lenticular sponges, 28 mm high and 90 mm in diameter. Inhalant pores and inhalant canals are not visible. Exhalant canals tubular and vertical, terminating in rounded

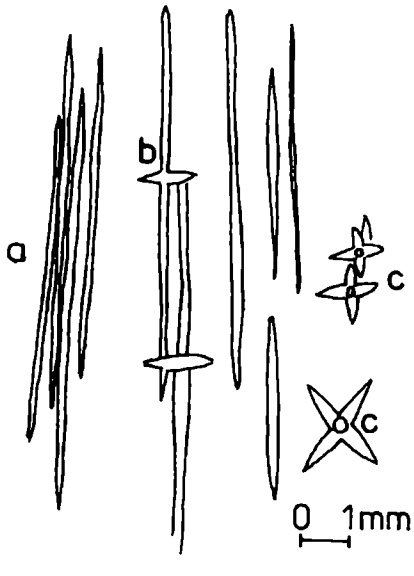


Fig. 18. Spicules of *Polylophidium orleii* n.sp. drawn from photograph (see Pl. VII: 4b). *a* – oxeas, *b* – hexacts with longer rays, *c* – regular hexacts

exhalant pores 1.0 – 2.5 mm across. Dermal skeleton thin, finely reticulate, comprises poorly preserved spicules. Parenchymal skeleton comprises numerous diacts of varying length, up to few milimetres, vertically arranged around the exhalant canals. The diacts form a fascicular-radial layered structure of the skeleton. Small hexacts equal rays are present among the diacts.

Comparison: Similar to *Polylophidium discus* Finks (1960, Pl. 36: 14 – 17, p. 111) from the Leonardian (Lower Permian) of the west Texas, U.S.A., differing from it by larger diameter (90 mm instead of 30 – 40 mm) and height (28 mm instead of 2 – 3 mm). *P. orleii* is characterized by layered

growth (2—4 layers) and smooth surface, devoid of projecting fascicules of long spicules. Exhalant pores are larger and varying in diameter.

Occurrence: Upper Visean — Poland (Orlej near Zalas)

CONCLUSIONS

1. Two sponge assemblages of nearly the same age but from different sublitoral environments are described from the Lower Carboniferous of Poland. The assemblage in the Carboniferous Limestone at Gałęzice is more diversified. It comprises 13 species. Dominating are massive forms of medium size. The assemblage in the Culm shales at Orlej displays low diversity (four species), greater frequency of individuals, and relatively larger size of colonies formed of small individuals.

2. Five new genera are described: *Prenehydnoceras*, *Carbonella*, *Czarnockiella* and *Dialyscyphia* at Gałęzice, and *Repospongia* at Orlej. *Prenehydnoceras trachys* n.sp. and *Carbonella rotunda* n.sp. represent morphotypes with spongocoel devoid of osculum, so called cribroporate, hitherto not reported from fossil sponges.

3. Intrespecific variability was observed only among the specimens of *Czarnockiella concinella* and *Czarnockiella viriosa*, representing different ontogenic stages.

4. Sponges from Gałęzice lived in shallow, strongly agitated water, near coral colonies. Sponges from Orlej lived at greater depth, below the wave-base, and were probably the only bottom dwellers (Fig. 4).

5. Both occurrences are apparently related to an increased supply of volcanogenic silica to the environment, suggesting that the relative abundance of sponges was related to manifestations of volcanic activity and supply of pyroclastics. The reverse relation is not observed.

6. The preservation of sponge skeleton not disintegrated into loose spicules in both localities was due to rapid burial. Favourable for this kind of preservation was the structure of parenchymal skeletons, with triaxons of different sizes, some of them with elongated proximal and distal rays. These skeletal elements formed oblique mesh-like frameworks, lacking preferred planes of spicule orientation which could favour later disintegration of skeleton.

REFERENCES

Alexandrowicz, S.W., 1978. Zespół spikul gąbek z łupków górnego wizenu w Bolesławiu. *Materiały Sympozjum Paleontologów*. Sosnowiec, pp. 19—20.

Bełka, Z., 1982. Upper Visean conodonts from Orlej in Cracow Upland: stratigraphical and paleothermal implications. *Acta Geol. Pol.*, 32: 57—67. Warszawa.

Czarniecki, S., 1955. Lower Carboniferous fauna in the Culm facies of the eastern Upper Silesian Coal Basin. *Bull. Acad. Pol. Sci.*, cl. III, 3: 461—464. Warszawa.

Czarniecki, S., 1973. Goniatyty wapienia węglowego z Gałęzic. *Rocz. Pol. Tow. Geol.*, 43: 227—248. Kraków.

Czarniecki, S. & Łydka, K., 1958. Ślady dolnokarbońskiej działalności wulkanicznej w re-

jonie Krzeszowic. Lower Carboniferous volcanism in the Krzeszowice area (English summary). *Acta Geol. Pol.*, 8: 501 – 514. Warszawa.

Finks, R.M., 1960. Late paleozoic sponge faunas of the Texas region. The siliceous sponges. *Bull. Am. Mus. Nat. Hist.*, 120; 160 pp. New York.

Gromczakiewicz-Łomnicka, A., 1973. Visean Gastropods from Gałęzice (Holy Cross Mts., Poland) and their stratigraphical value. *Studia Geol. Pol.*, 41, 54 pp. Warszawa.

Hall, J. & Clarke, J.M., 1898 (1900). A memoir on the Palaeozoic reticulate sponges constituting the family Dictyospongiidae. *N. York State Mus. Mem.*, 2: 1 – 350. New York.

Laubenfels, M.W., de, 1955. Porifera. *In*: *Treatise on Invertebrate Paleontology*. Lawrence, pp. E21 – E122.

Okulitch, W.J. & Nelson, S.I., 1957. Sponges of the Paleozoic. *Treatise on Marine Ecology and Paleontology*, 2, *Geol. Soc. Am. Mem.*, 67.

Nowiński, A., 1976. Tabulata and Chaetitida from the Devonian and Carboniferous of Southern Poland. *Palaeont. Pol.*, 35: 1 – 125. Warszawa.

Rigby, J.K., 1970. Two new Upper Devonian Hexactinellid sponges from Alberta. *J. Paleont.*, 44: 7 – 16. Lawrence.

STRESZCZENIE

Po raz pierwszy na terenie południowej Polski zostały znalezione w osadach górnego wizenu (fig. 1) dwa zespoły gąbek żyjących niemal w tym samym czasie w dwu odmiennych środowiskach. W Gałęzicach (Góry Świętokrzyskie) występują one w osadach wapienia węglowego (fig. 2), a w kamieniołomie Orlej koło Zalasu (na W od Krakowa) w łupkach ilastych kulmu (fig. 3). W obu stanowiskach występują gąbki o szkielecie krzemionkowym, lyssakidowym. Zarówno w Gałęzicach jak i w Orleju gąbki uległy przeobrażeniu i ich spikule są obecnie zwapniałe.

Z odsłonięcia „przekop kolejki" w Gałęzicach opisano 13 gatunków, w tym sześć nowych, zaliczonych do dziewięciu rodzajów, z których cztery: *Prenehydnoceras*, *Carbonella*, *Czarnockiella* i *Dialyscyphia* są nowo utworzone (pl. I, II, IV, V). Wśród zespołu gąbek z Gałęzic przeważają morfotypy bez jamy paragastralnej, lecz z silnie rozwiniętym systemem kanałów ekshalacyjnych, tworzących w wielu przypadkach szczeliny wodne. Obecne są również gąbki z jamą wewnętrzną, lecz bez oskulum. Ich szkielet zawiera triaksony i spikule od nich pochodne, zróżnicowane pod względem wielkości i ułożenia (fig. 4b; pl. V). Badając płytki cienkie przekroju podłużnego nie zauważono ani poziomego, ani pionowo-równoległego ułożenia elementów szkieletowych. Ułożenie to jest sieciowo-skośne, bez wzajemnego scementowania w trwałe rusztowanie.

W Orleju gąbki tworzą zespół mniej zróżnicowany rodzajowo i gatunkowo. Poznano tu zaledwie cztery rodzaje, z których oznaczono trzy, w tym jeden nowy – *Repospongia* (fig. 16 i 17), tworzący kolonie. Również wymiary osobników i morfologia gąbek z Orleja są inne. Gąbki są miskowate oraz cylindryczno-buteleczkowate, małe, tworzące krzaczkowate skupienia rozrastające się plackowato w owalne kolonie ze wspólnym szkieletem dermalnym jak u *Repospongia carbonaria* n.sp. Kolonie te rozwijały się bez konkurencji ze strony innych grup fauny.

Warunki życia organizmów bentonicznych były znacznie korzystniejsze w rejonie Gałęzic (Czarniecki, 1973). Wśród dość dużych kolonii korali Rugosa i Ta-

bulata występują tu liczne ramienionogi, liliowce, małże, ślimaki, trylobity oraz otwornice, a z nektonu goniatyty, konularie i ryby (fig. 4). Wapienie z Gałęzic powstawały w płytkowodnym środowisku morskim, powyżej podstawy falowania.

W ławicy łupków ilastych z Orleja gąbki stanowią jedyne obserwowane szczątki organiczne. Charakter osadu (Czarniecki, 1953) i uwarunkowane czynnikami środowiskowymi morfotypy gąbek wskazują, że łupki te powstawały poniżej podstawy falowania. W spągu i stropie ławicy łupków, w której znaleziono gąbki, występują w Orleju wkładki utworów tufogenicznych. Osady tej części profilu z Orleja deponowane były w morzu głębszym, poniżej podstawy falowania (Czarniecki & Łydka, 1958). Oba występowania gąbek są związane ze środowiskiem płytkomorskim.

EXPLANATIONS OF PLATES

Plate I

1. *Dictyospongia galensicensis* n.sp., holotype AI-68/4:
   a – side view, ×0.5,
   b – fragment of dermal skeleton, ×4; location shown in 1a,
   c – fragment of parenchymal skeleton, thin section, ×10,
   d – fragment of microstructure of parenchymal skeleton (*a* – hexacts, *b* – stauracts), thin section, ×120; location shown in 1c
2. *Dialyscyphia breviramosa* n.sp., holotype AI-68/28:
   a – side view, ×2,
   b – cross-section of lower part of sponge (*a* – inhalant canals, *b* – axial, exhalant part), ×2.2
3. *Dialyscyphia* sp. AI-68/10:
   a – side view, ×0.5,
   b – top view, ×2.2
4. Lyssacines, species I, AI-68/42, casts of spicules; ×1.5 in rectangle fragments of skeleton

Plate II

1. *Prenehydnoceras trachys* n.gen., n.sp., holotype AI-68/19:
   a – view of wider side, natural size; black line – trace of section,
   b – view of narrower side, natural size,
   c – side view opposite to 1b, lumps visible, ×1.5,
   d – vertical cross-section, internal spongocoel, lacking osculum and filled with bioclasts, ×1.5,
   e – fragment of wall demonstrating its structure, thin section nr 19 (*a* – spongocoel, *b* – wall, *c* – subdermal and subgastric cavities), ×4,
   f – fragment of microstructure of parenchymal skeleton, ×120
2. *Prenehydnoceras* sp., AI-68/14, flattened form, ×0.5
3. *Microstaura* cf. *dolium* Finks, AI-68/5, side view of juvenile stage, ×1.5
4. *Microstaura* cf. *dolium* Finks, AI-68/8, side view, ×1.5

Plate III

1. *Actinodictya patanoforme* n.sp., holotype AI-68/9:
   a – side view, ×0.5,

b – longitudinal cross-section (*a*, *b*, *c* – successive basal attachments, reflecting overturning of sponge during growth), × 1.2,
c – fragment of wall with structure visible (*a* – gaps, *b* – basal spicules), × 4; in rectangle – vide 1d,
d – microstructure of basal lump, × 120

2. *Carbonella* sp., AI-68/15, cross-section showing curved spongocoel filled with bioclasts and traces of spicules in wall, natural size; in rectangle – fragment of skeleton
3. *Carbonella rotunda* n.sp., AI-68/3:
   a – side view, × 1.2,
   b – longitudinal cross-section showing internal spongocoel, natural size
4. Lyssacines, species I, AI-68/43, side view, × 1.5

Plate IV

Carbonella rotunda n.gen., n.sp.:

1. Holotype AI-68/32:
   a – side view, × 0.6,
   b – longitudinal section showing cribroporate structure, natural size,
   c – fragment of wall showing branching of internal spongocoel (*a* – cross-sections of canals, *b* – bioclasts), × 2.5,
   d – microstructure of parenchymal skeleton (*a* – spicules with curved rays), × 120,
   e – another fragment of microstructure (*a* – diactine, *b* – stauracts, *c* – larger hexacts with axial rays), × 120
2. Specimen AI-68/3, side view, natural size

Plate V

Czarnockiella conncinella n.gen., n.sp.:

1. Holotype AI-68/34:
   a – top view, × 0.6,
   b – side view, × 1.2,
   c – side view opposite to 1b, × 1.2; small arrow – larger hexacts
2. Specimen AI-68/25, × 0.5, vertical section
3. Fragment of conical form, AI-68/23: (*a* – basal part, *b* – exhalant pores)
4. Specimen AI-68/22:
   a – internal structure of wall (*a* – hexacts, *b* – canals), × 2.5,
   b – microstructure of skeleton in parenchyma (*a* – axial hexacts, *b* – regular hexacts, *c* – stauracts), thin section AI-68/22a, × 120; location shown in 4a

Plate VI

Czarnockiella viriosa n.sp.:

1. Holotype AI-68/24:
   a – vertical section, natural size,
   b – top view, natural size (*a* – spongocoel, *b* – inhalant pores),
   c – thin section nr 24, showing internal structure, × 2.5,
   d – microstructure of parenchymal skeleton, × 120
2. Syntype AI-68/31:
   a – top view, × 0.5,
   b – side view, × 0.5
3. Specimen AI-68/6, young sphaerical form, natural size
4. Specimen AI-68/16, thin section cut tangentially through cortex, × 4
5. Specimen AI-68/17, sphaerical form, side view, × 2

Plate VII

1. *Dictyospongia* sp., AI-68/37:
   a – side view, × 0.6,
   b – thin section nr 37, structure without canals, × 2.5
2. *Czarnockiella viriosa* n.sp., specimen AI-68/6, thin section nr 22-1, microstructure of parenchymal skeleton (*a* – axial hexact, *b* – regular hexacts, *c* – stauracts), × 120
3. *Czarnockiella viriosa* n.sp., specimen AI-68/1, tangential section (*a* – inhalant depression, *b* – canals, *c* – gastric skeleton), × 2.5
4. *Polylophidium orleii* n.sp., holotype AI-68/58:
   a – side view, × 1.5,
   b – microstructure of skeleton (*a* – oxeas, *b* – hexacts), × 5

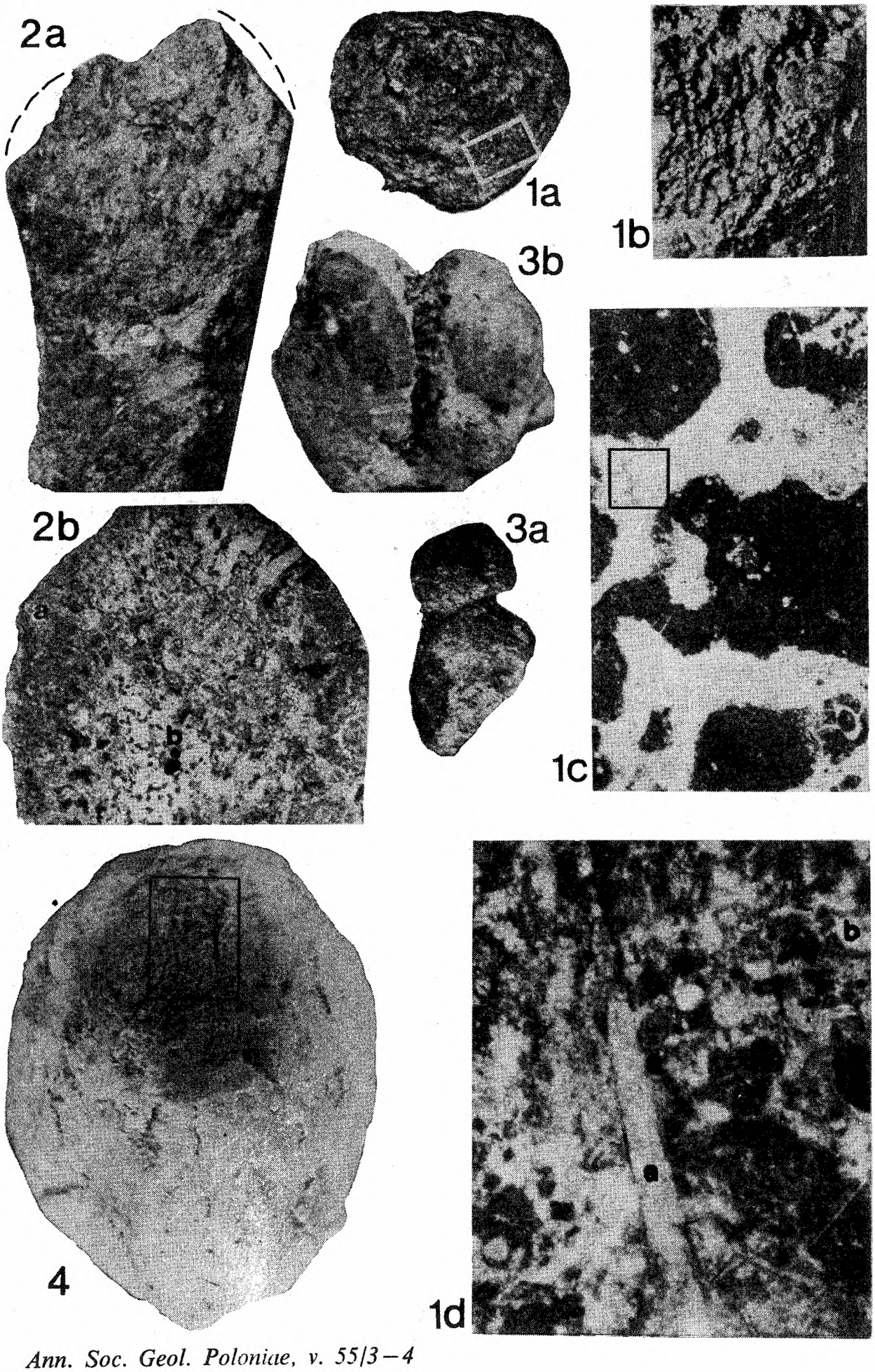
Plate VIII

1. *Rhombodictyon lentiformis* n.sp., holotype AI-68/7:
   a – top view, × 0.5,
   b – transversal section, thin section nr 7b, fragment of internal microstructure (*a* – fascicules of axial hexacts, *b* – their cross-sections), × 30,
   c – axial hexact with long rays in parenchymal skeleton, × 120
2. *Mattaspongia* sp., specimen AI-68/44, top view, × 1.75; arrowed – cortex

Plate IX

Repospongia carbonaria n.sp.:

1. Holotype AI-68/47:
   a – top view with panicle-like branches visible, × 1.5,
   b – cross-section through one individual, × 10
2. Paratype AI-68/48:
   a – top view of two joined colonies (*a* – cortex), natural size,
   b – side view, natural size
3. Specimen AI-68/50:
   a – side view of whole colony, natural size,
   b – side view opposite to 3a, natural size
4. Specimen AI-68/71, cross-section of calcified and piritized colony with dermal skeleton, × 0.7
5. Specimen AI-68/52, longitudinal section of one individual, × 2.5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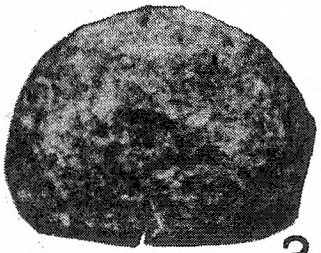
3b
1c
2b
a
b
3a
4
1d
b
a

1f



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4

2

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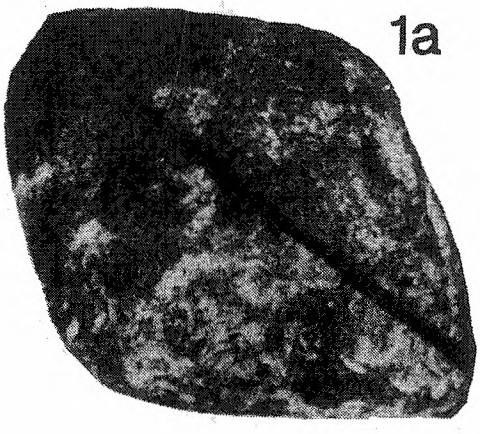

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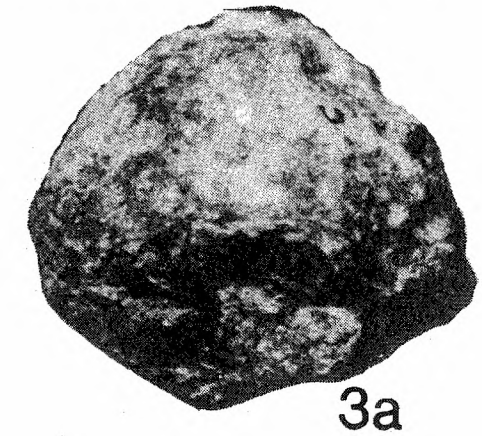
1c

1d



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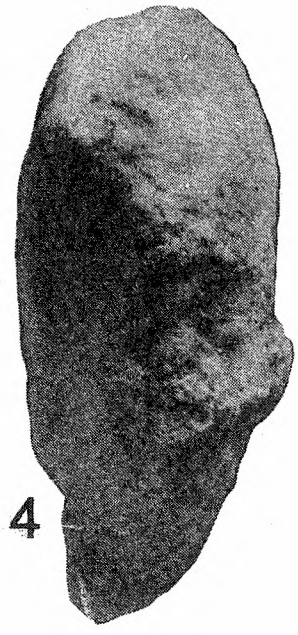

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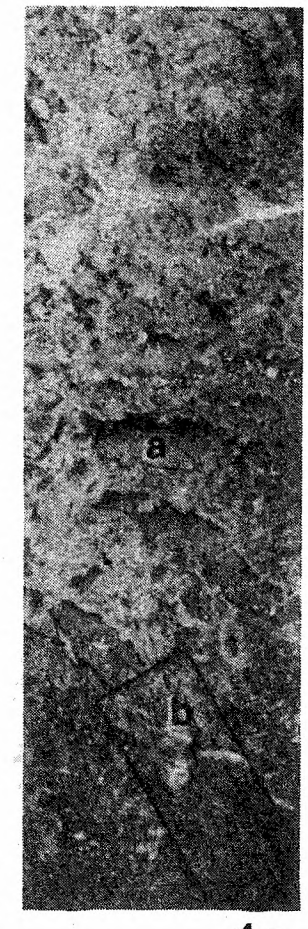

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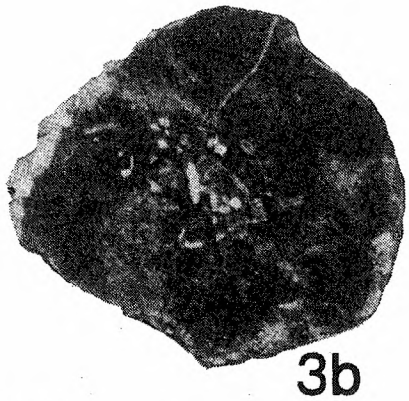

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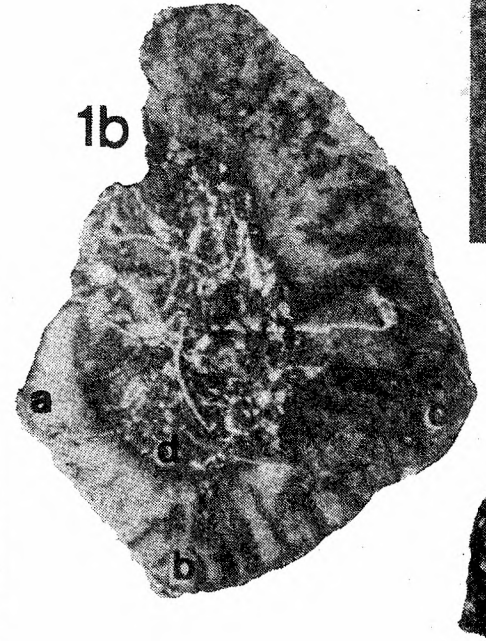

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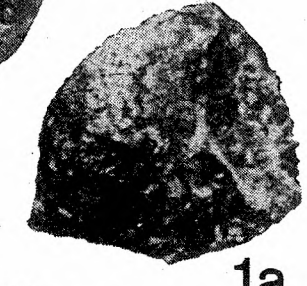

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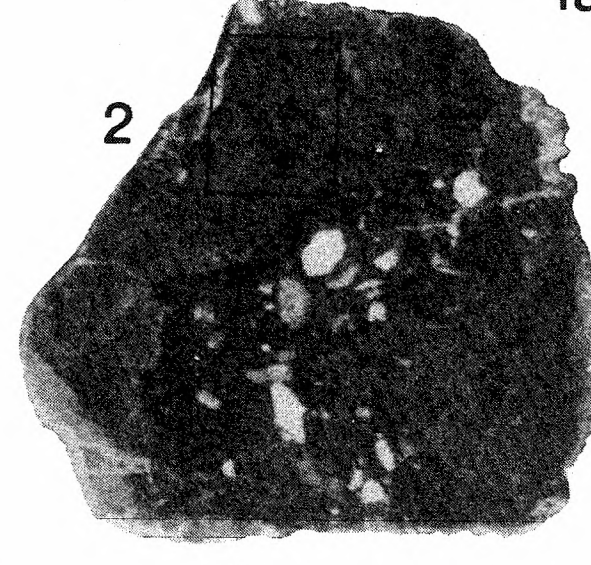

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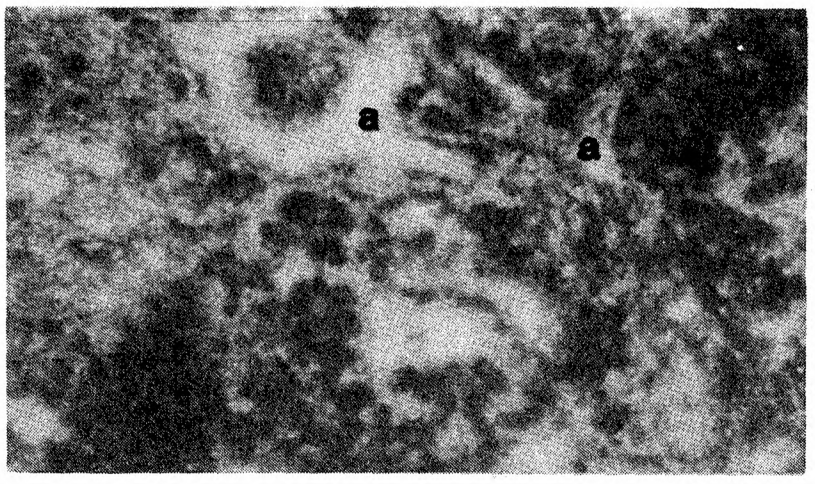

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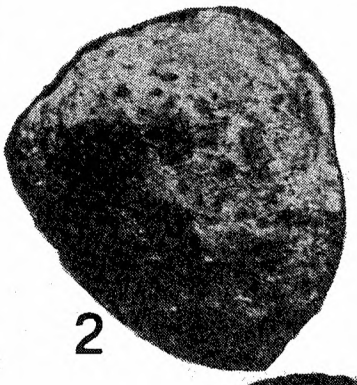

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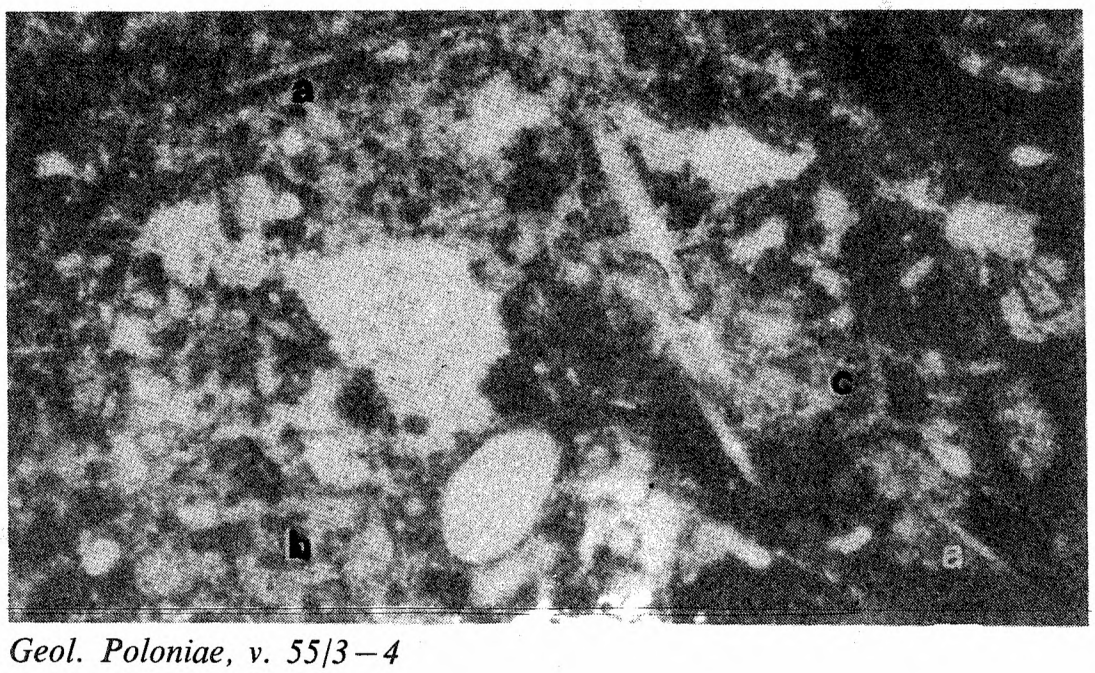

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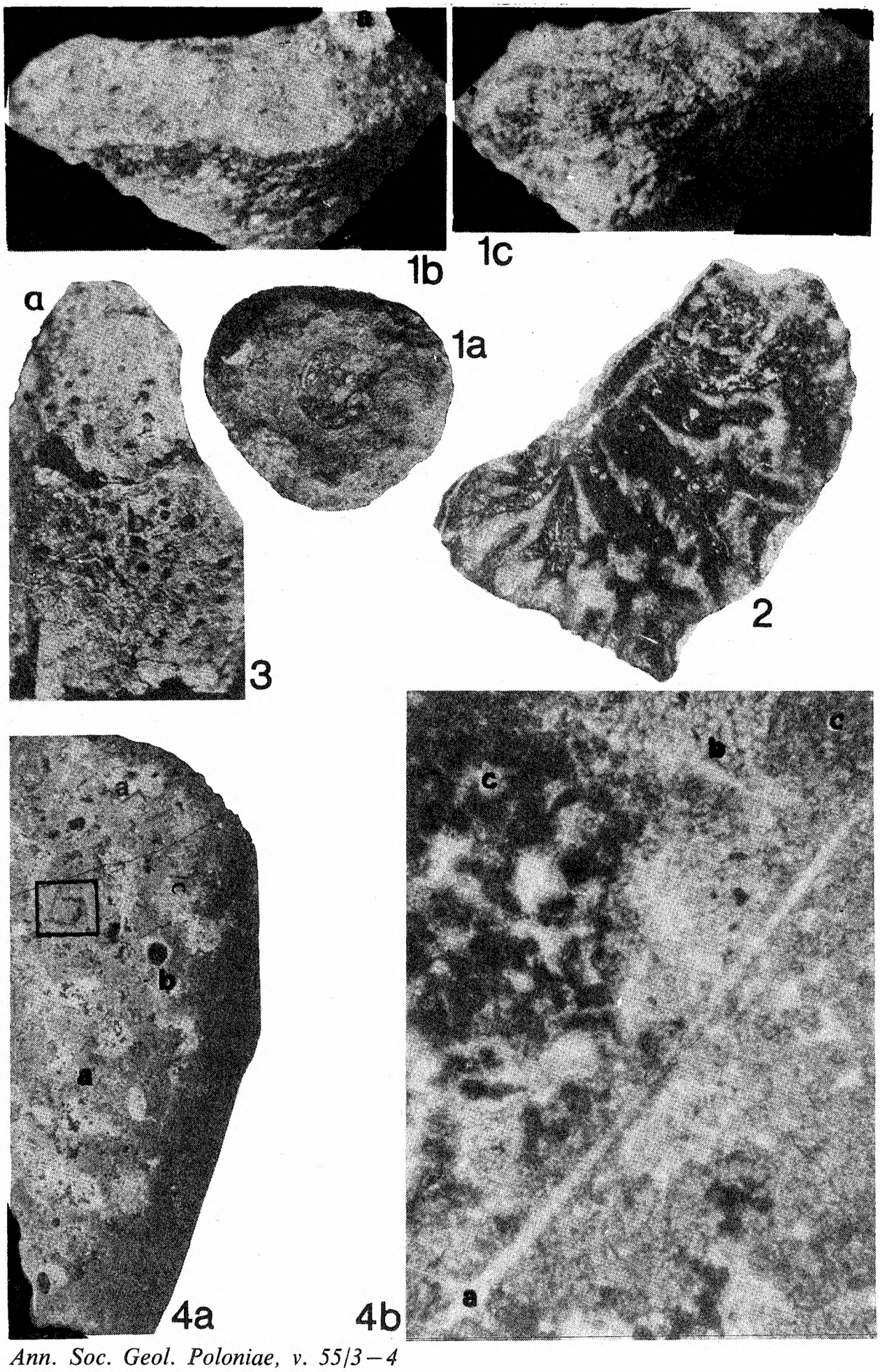
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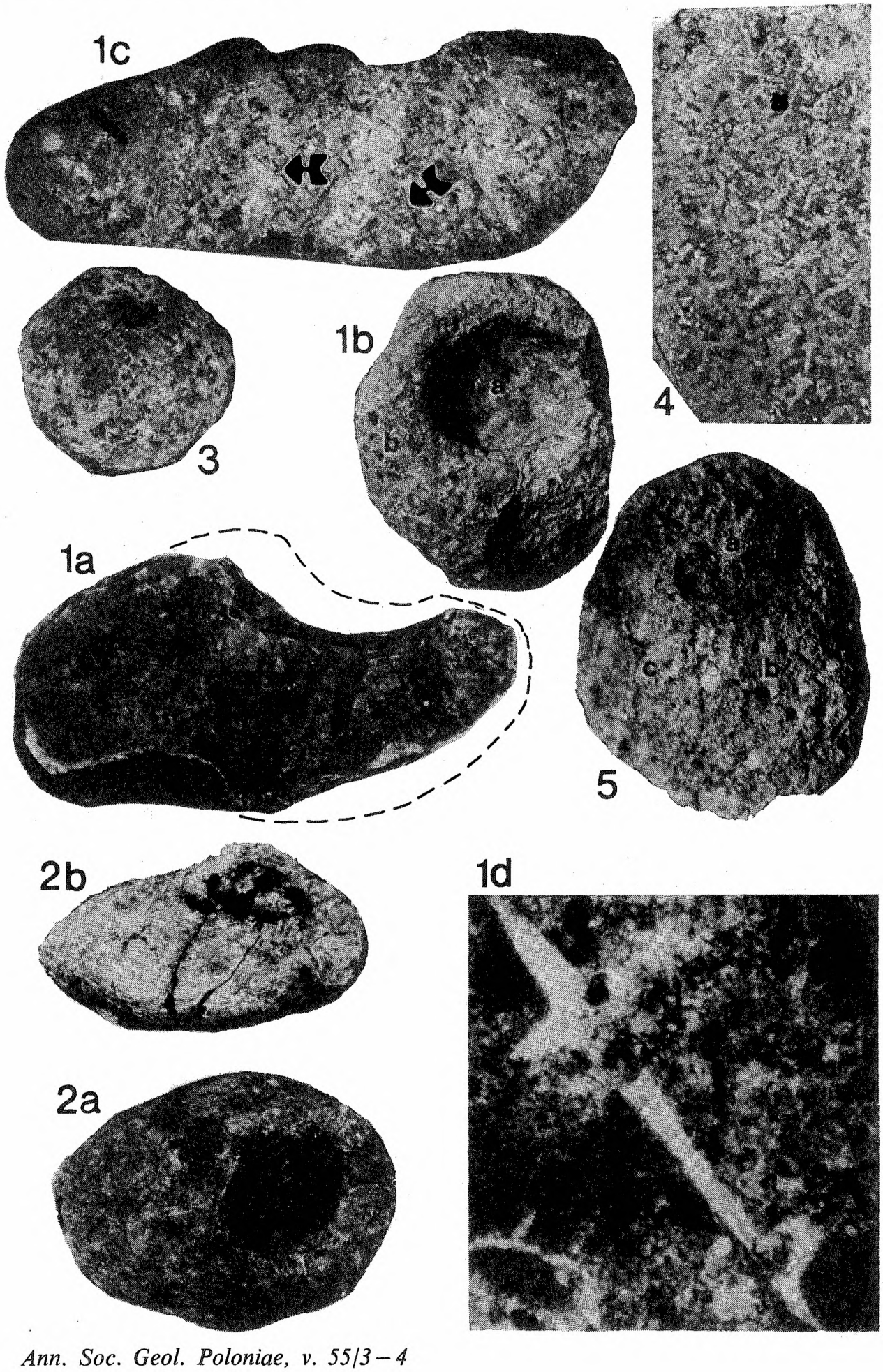
c
b
c
a
4b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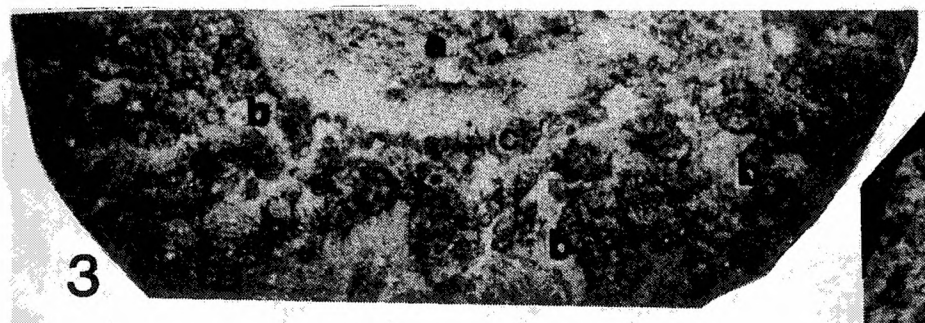
a
c
b
2b
1d
2a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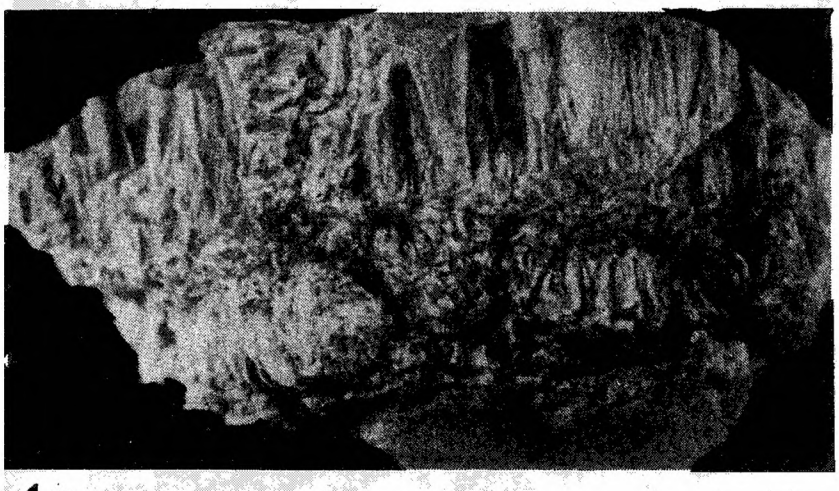
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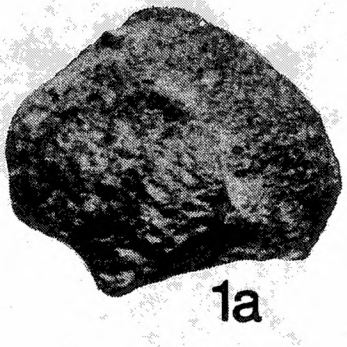
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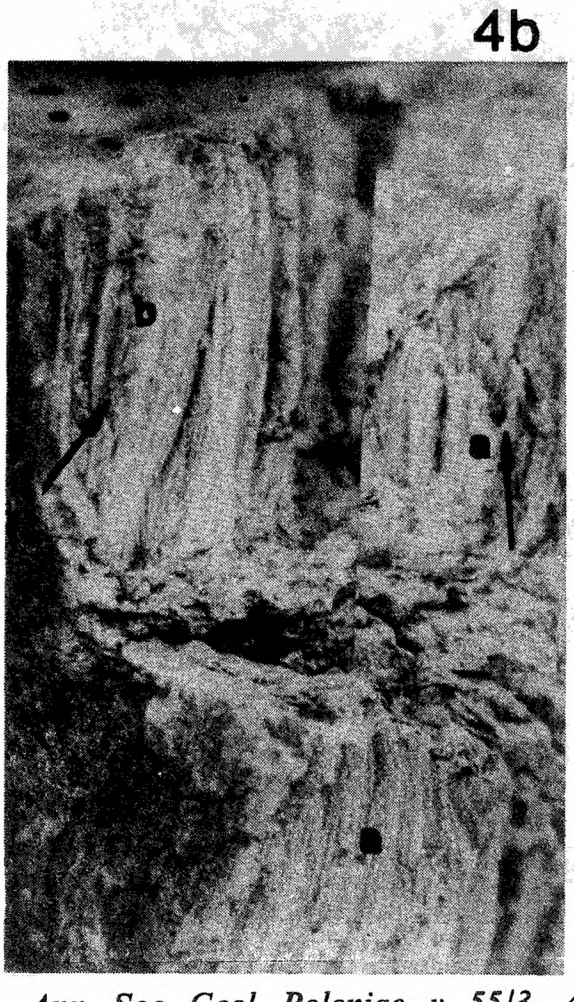
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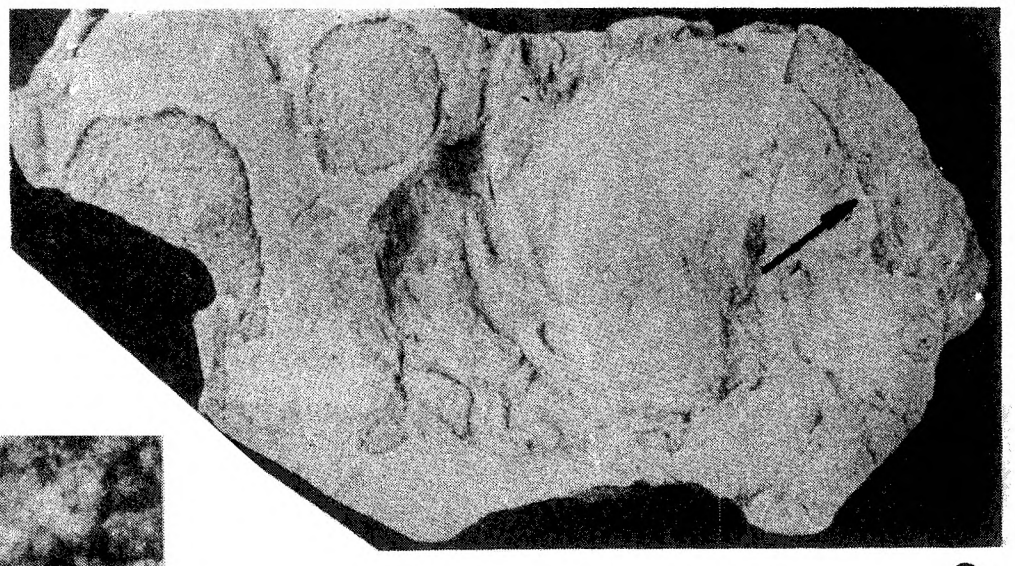

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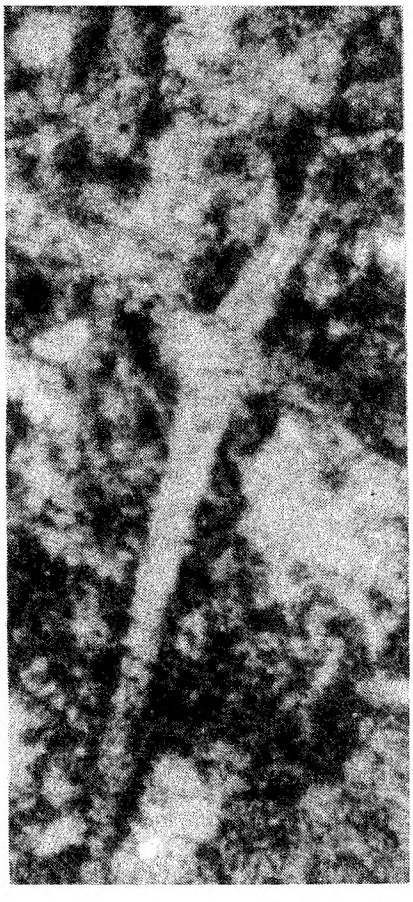

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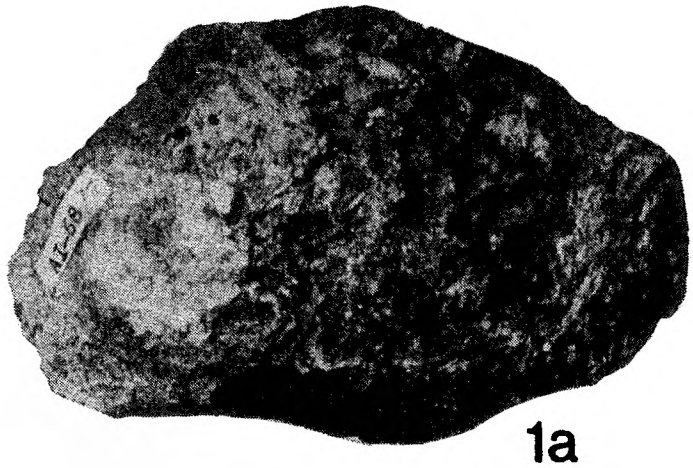

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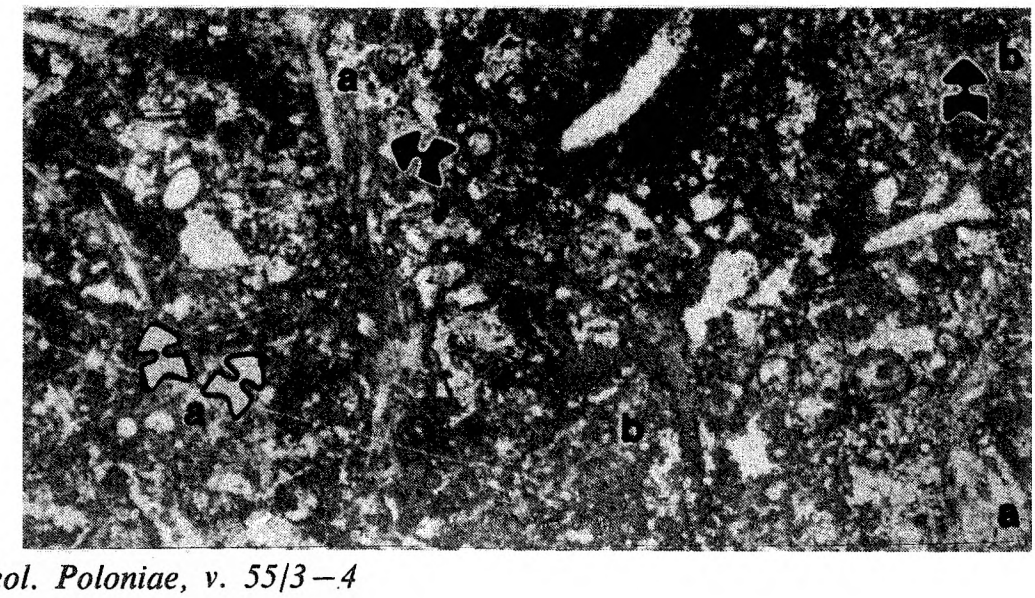

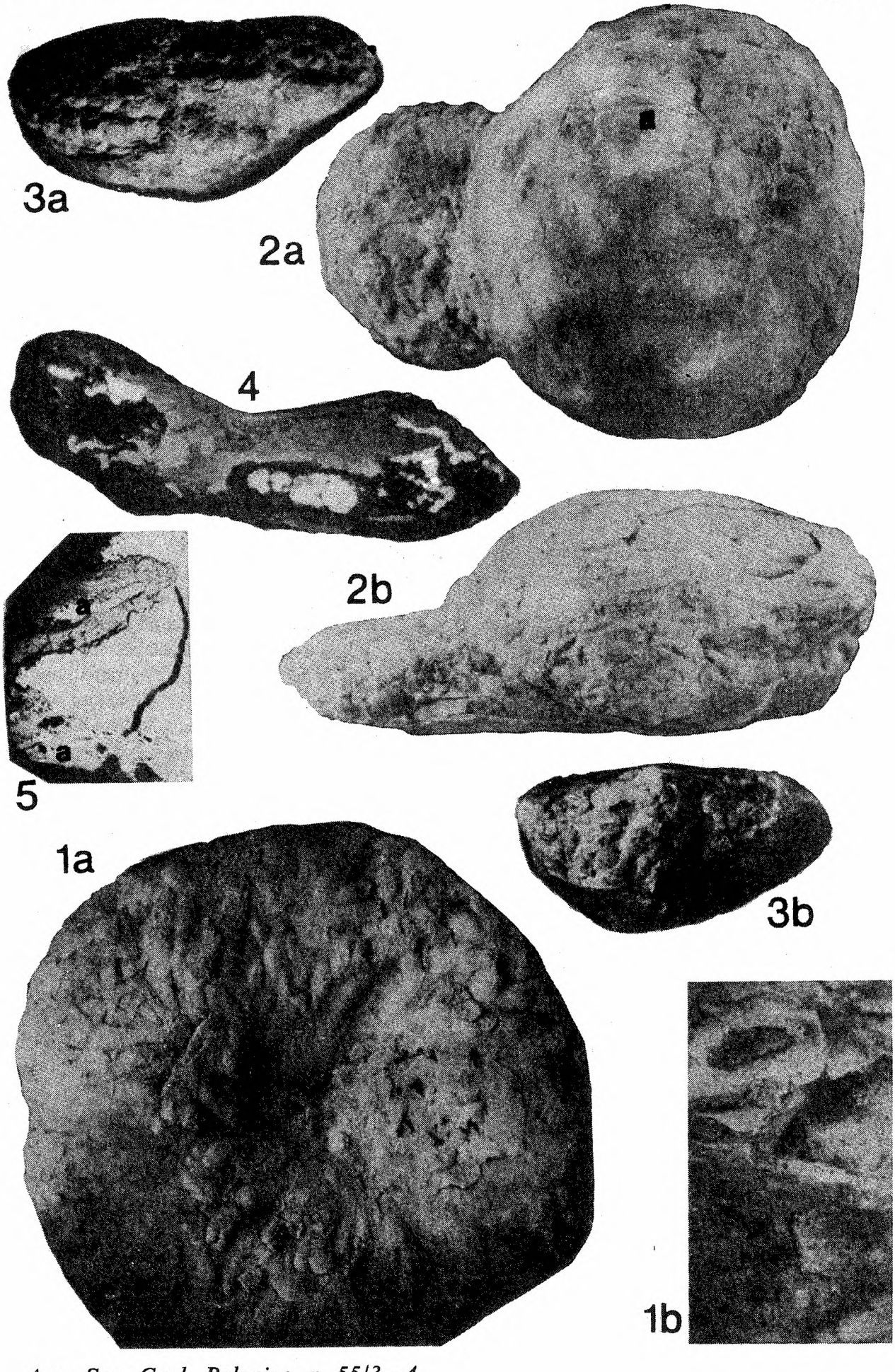
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