

HANNA GÓRKA, LIDIA ŁUSZCZEWSKA *

HOLOTHURIAN SCLERITES FROM THE POLISH JURASSIC AND TERTIARY

(Pl. LXVIII—LXXIX)

Skleryty holoturii z jury i trzeciorzędu Polski

(Tabl. LXVIII—LXXIX)

Abstract. Holothurian sclerites from the Polish Jurassic and Tertiary, assigned to the families: Synaptitidae, Priscopedatidae, Calclamnidae, Theeliidae and Achistridae have been described. Ten genera, including a new one, *Priscolongatus* n. gen. and 30 species, including 13 new ones, have been distinguished. The new species are: *Croneisites polonicus* n. sp., *Priscopedatus triangularis* n. sp., *P. batoniensis* n. sp., *P. jaworznicensis* n. sp., *P. pentaradiatus* n. sp., *P. denticulatus* n. sp., *P. bolkoviensis* n. sp., *P. octoperforatus* n. sp., *Priscolongatus quadriperforatus* n. sp., *P. obliquobrachiatus* n. sp., *Paracucumarites similis* n. sp., *Theelia dentata* n. sp. and *Hemisphaeranthos ogrodzieniecensis* n. sp.

INTRODUCTION

As compared with the Foraminifera and the Ostracoda, the calcareous skeletal elements of the Holothuroidea occur in sediments rather sporadically. The materials for the present paper have been collected over several years. They come from the Jurassic and Tertiary deposits. Their descriptions from the stratigraphic and micropalaeontological points of view either have been already published or are housed in the Archives of the Geological Institute in Warsaw.

Boring I.G.¹ Gałkówka 3. Lower Vesulian (Kuiavian), *Garantiana tetragona* zone and Middle Vesulian (Kuiavian), *Parkinsonia subarietis* zone (Archives of I.G.).

Boring I.G. Jarocin 1. Middle Vesulian (Kuiavian), *Parkinsonia schloenbachii* zone (Znosko, 1959).

Boring I.G. Turów. Lower Bathonian, *Asphinctites tenuiplicatus* zone (Archives of I.G.).

Ogrodzieniec brickyard — an outcrop in the southern region of the Cracov—Częstochowa Jurassic. Middle Bathonian, *Morrisiceras morrisoni* zone (Błaszyk, 1967; Kopik, 1967; Pazdrowa, 1967).

Boring I.G. Jaworznik. Middle Vesulian (Kuiavian), *Parkinsonia parkinsoni* zone, Upper Vesulian (Kuiavian), *Parkinsonia compressa* zone, Lower Bathonian, *Asphinctites tenuiplicatus* zone, Middle Bathonian,

* Dr Hanna Górka, Lidia Łuszczewska, Zakład Paleontologii Uniwersytetu, Warszawa 22, al. Żwirki i Wigury 93, Poland.

¹ I.G. — Geological Institute.

Morrisiceras morrisi zone, Upper Bathonian, *Paroecotraustes heterocostatus* zone (Znosko, 1954, Archives of G.I.; Błaszyk, 1967).

Boring I.G. Bolków. Kimmeridgian (Archives of I.G.).

Boring I.G. Gorzów Wielkopolski. Middle Oligocene (Lower Rupelian), *Ceratobulimina contraria* zone (Wolańska, 1959, Archives of I.G.; Gortyńska, 1962; Wolańska, 1962; Woźny, 1962).

Boring I.G. Choszczno 1. Middle Oligocene (Lower Rupelian), *Ceratobulimina contraria* zone (Gortyńska, 1962; Wolańska, 1962).

Boring Żrecze 3. (near Chmielnik). Lower Sarmatian, *Anomalinoides dividens* zone (Łuczowska, 1963, 1964).

Holothurian sclerites are not rather met with in the Cretaceous deposits of Poland. Among a few hundred samples examined from the Cretaceous materials, one Upper Maestrichtian specimen only was found in an upper marly layer at Kazimierz on the Vistula. This specimen, probably belonging to the genus *Theelia* Schlumberger, has not been taken into account in the present paper.

The holothurian sclerites described are assigned to the following five families: Synaptitidae Frizzel & Exline, emend. Frizzel & Exline, Priscopedatidae Frizzel & Exline, Calclamnidae Frizzel & Exline, Theeliidae Frizzel & Exline and Achistridae Frizzel & Exline. Ten genera, including a new one, i.e., *Priscolongatus* n. gen. and 30 species, including 13 new ones, have been distinguished. The new species are as follows: *Croneisites polonicus*, *Priscopedatus triangularis*, *P. batoniensis*, *P. jaworznicensis*, *P. pentaradiatus*, *P. denticulatus*, *P. bolkoviensis*, *P. octoperforatus*, *Priscolongatus quadriperforatus*, *P. obliquobrachiatus*, *Paracucumarites similis*, *Theelia dentata* and *Hemisphaeranthos ogrodzieniecensis*.

The present writers had at their disposal many specimens, in particular those of the families Priscopedatidae Frizzel & Exline and Achistridae Frizzel & Exline, which were well-preserved and occurred only in an isolated state. The material which came from a relatively long period (Jurassic-Tertiary) enabled the conclusion that the sclerites of the Holothuroidea formed certain assemblages of particular species and even genera characteristic of definite epochs and geological stages (Table 1).

The taxonomy adopted in the present paper is based on the publications by Deflandre-Rigaud (1949a, b, 1950, 1952, 1959, 1961), Frizzel & Exline (1955, 1957, 1966) and Rioult (1960).

In Poland, the sclerites of the Jurassic Holothuroidea were first described by Garbowska & Wierzbowski (1967).

A stereomicroscope, made by the Leitz Company, was used for the observation and drawing of the Holothurian sclerites, whereas the photographs of sclerites assigned to the genus *Croneisites* Frizzel & Exline were taken by means of a biomicroscope made by Zeiss Co. Photographs were taken in a transmitted light, except for a single specimen (Pl. LXIX, Fig. 9) which was photographed in a reflected light. Since test photographs of the remaining sclerites (which were small, glossy, relatively thick and with many, small details) were hardly legible, the present writers gave up their photographic documentation.

The specimens are housed in the collections of the Micropalaeontological Laboratory of the University of Warsaw where they have been marked with numbers ranging from H-I-1-1 to H-I-4-508. The letter H designates the Holothuroidea, the Roman numeral I — the first elaboration.

tion, the first Arabic numeral — the successive number of a folder and the last Arabic numeral — the successive numbers of individual specimens.

The present writers would like to express their special gratitude to Professor O. Pazdro from the Micropalaeontological Laboratory of the Polish Academy of Sciences Department of Geological Sciences in Warsaw, to Doctor E. Łuczowska from the Chair of Palaeontology of the Mining and Metallurgy Academy in Cracow, as well as to the Directors of the Geological Institute in Warsaw for supplying samples and specimens for the elaboration.

Likewise, the present writers are indebted to Professor G. Deflandre and Doctor M. Deflandre-Rigaud from the Laboratoire de Micropaléontologie de l'Ecole Pratique des Hautes Etudes in Paris who, during the authors' work at that Laboratory, allowed them to study both their own and C. Schlumberger's collections and discussed a few problems in the domain of taxonomy.

SYSTEMATIC DESCRIPTION

Family Synaptitidae Frizzel & Exline, 1955 emend. Frizzel & Exline, 1957

Genus *Croneisites* Frizzel & Exline, 1957

Types species: *Croneisites oligocaenicus* (Spandel). Syn. *Synapta oligocaenica* Spandel from Oligocene of Germany (Spandel, 1900, pp. 50—51, Figs. 3—5).

Diagnosis of the genus: Sclerites in the form of perforated, concavo-convex plates, oval to elliptical in outline, with a narrow, arcuate strap connecting the peripheries of the sclerite at its narrower end on the concave side. Ten to twenty perforations, round or elliptical in outline, with even or denticulate edges, larger in the middle and smaller in the upper part of the plate.

Croneisites insignis Kristan-Tollmann, 1964

(Pl. LXVIII, Figs. 1, 2, 4, 6; Pl. LXIX, Fig. 9; Pl. LXX, Fig. 1)

1964 *Croneisites insignis* n. sp.; E. Kristan-Tollmann, *Holothurien Sklerite...*, pp. 92—93, Pl. 1, Figs. 3 and 4, Pl. 3, Figs. 1—4.

Material: Eighteen complete, well-preserved plates.

Dimensions (in mm): Length 0.21—0.28, width 0.19—0.24, cardinal perforations ab. 0.04×0.05 to 0.06×0.07 .

Description: A perforated, concavo-convex plate, hexagonal in outline, elongate in the plane of symmetry and contracted in the upper part. Edge of plate even. Six cardinal perforations distributed in three longitudinal rows, more or less oval in outline. Their edges are finely denticulate, the denticles of one side of periphery being distributed in the plane of the convex side of plate and those of the other side of periphery — on the opposite side, i.e., in the plane of the concave side of plate. Among cardinal perforations, almost uniform in size and shape, conspicuous are the upper perforations of the middle row, distinguished by its subround shape and the smallest, denticulate perforations usually occurring over the last-named and being shaped like a rounded triangle.

OCCURENCE OF THE HOLOTHURIAN SCLERITES
IN THE JURASSIC AND TERTIARY SEDIMENTS OF POLAND

Localities	Stages		Zones	Cronisites insignis Krist.-Tol.	C. cf. insignis Krist.-Tol.	C. polonicus n.sp.
Zrecze 3	Sarmatian	Lower	Anomalinoidea dividens	X	X	X
Gorzów Wlkp.1	Rupelian	Lower	Ceratobulimina contraria			
Choszczno 1	Rupelian	Lower	Ceratobulimina contraria			
Bolków	Kimmeridgian					
Ogrodzieniec	Bathonian	Middle	Morrisiceras morrisi			
Turów	Bathonian	Lower	Asphinctites tenuiplicatus			
Jaworzniak	Bathonian	Upper	Oecotraustes heterocostatus			
		Middle	Morrisiceras morrisi			
		Lower	Asphinctites tenuiplicatus			
	Vesulian /Kuiavian/	Upper	Parkinsonia compressa			
		Middle	Parkinsonia parkinsoni			
Jarocin 1	Vesulian /Kuiavian/	Middle	Parkinsonia schloenbachi			
Gałkówek 3	Vesulian /Kuiavian/	Middle	Parkinsonia subarictis			
		Lower	Garantiana tetragona			

Over the denticulate one, there occur two, symmetrically arranged, perforations shaped like elongate ellipses and devoid of denticles. An arcuate, smooth strap with one or more denticles on its most conspicuous curvature is attached to the edges of the elliptical perforations which are the nearest to the periphery of the plate. A single, small, round hole occurs in the apical, narrowed part of plate. In most specimens, the surface of plate is smooth, glossy and almost transparent, except for the denticles which are white and opaque. Three white, completely opaque plates have been found (Pl. LXIX, Fig. 9).

Variability: Variability is observed in the outer outline of plates. It may be pronouncedly hexagonal (Pl. LXVIII, Fig. 4), more rounded (Pl. LXVIII, Fig. 1) and elongate (Pl. LXIX, Fig. 9) or with its width equalling length (Pl. LXVIII, Fig. 6). Apical part is sometimes asymmetric with a larger or smaller hole and with a wider or narrower space between upper perforations devoid of denticles.

Remarks: *Croneisites insignis* Kristan-Tollmann from Poland differs from the specimens of this species, described by Kristan-Tollmann from Austria in almost twice as large dimensions and a smaller surface of the plate between cardinal perforations.

Occurrence: Middle Tortonian of Austria (Kristan-Tollmann, 1964). Poland: Lower Sarmatian of Żrecze 3 (depths, 64.80—64.90 m and 59.30—59.40 m).

Croneisites cf. insignis Kristan-Tollmann, 1964

(Pl. LXVIII, Figs. 3 and 5; Pl. LXX, Figs. 2 and 3)

Material: Two complete, well-preserved and two damaged plates. Dimensions (in mm): length, 0.23—0.28, with, 0.23—0.25, cardinal perforations, ab. 0.05×0.06 to 0.06×0.07 .

Description: (cf. *C. insignis* Kristan-Tollmann). Half-way the length of the plate, a small, oval, finely denticulate depression occurs on one edge of the periphery.

Variability: On one of the plates (Pl. LXVIII, Fig. 5), there occurs a process which grows out of the periphery of the smallest, denticulate perforations of the middle row.

Remarks: *Croneisites cf. insignis* Kristan-Tollmann differs from *C. insignis* Kristan-Tollmann described above (p. 363) in the presence of a denticulate socket which occurs on the periphery of the plate and in almost twice as large dimensions.

Occurrence: Lower Sarmatian of Żrecze 3 (depth, 64.80—64.90 m).

Croneisites polonicus n. sp.

(Pl. LXVIII, Fig. 7; Pl. LXIX, Figs. 1—6, 8 and 10; Pl. LXX, Fig. 4)

Holotypus: Pl. LXVIII, Fig. 7 (H-I-4-408).

Locus typicus: Żrecze 3 (depth, 64.80—64.90 m).

Stratum typicum: Lower Sarmatian.

Derivatio nominis: Lat. polonicus, from Poland.

Material: Seventeen complete, well-preserved and four damaged plates.

Dimensions (in mm): holotype, length, 0.23, width, 0.20, cardinal perforations, ab. 0.007×0.008 ; paratypes, length, 0.24—0.26, width, 0.21—0.22, cardinal perforations, 0.005—0.008.

Diagnosis: Plate perforate, concavo-convex, hexagonal in outline, with an even edge. Six cardinal perforations are denticulate. Above them, in the apical part, there occur three smaller perforations with an arcuate strap.

Description: A perforate, concavo-convex plate, hexagonal in outline, with rounded sides, elongate in the plane of symmetry. Edge of plate even. Six cardinal perforations are distributed in three longitudinal rows. They are oval in outline and have finely denticulate peripheries. Denticles of one side of periphery are distributed in the plane of the convex side of plate and those of the opposite side of periphery — in the plane of the concave side of plate. Among the cardinal perforations, the upper one of the middle row is distinguished by its rounded subtriangular shape. It is smaller but also denticulate. Two perforations shaped like an elongate ellipsis and devoid of denticles are symmetrically arranged over it. An arcuate strap grows out of their edges which are nearer the periphery of the plate. Three, very regularly distributed, small perforations occur in the apical part of plate. The surface of plate is smooth and glossy.

Variability: The plates of *Croneisites polonicus* n. sp. differ from each other in their outer outline which is either markedly hexagonal (holotype) or rounded (Pl. LXIX, Fig. 8) or more elongate (Pl. LXIX, Fig. 1) and in the thickness of the strap which in some cases is covered with tubercles (Pl. LXIX, Fig. 1). A specimen was also found which had only two small perforations in its apical part.

Remarks: *Croneisites polonicus* n. sp. is similar to *C. insignis* Kristan-Tollmann described above (p. 366) in the shape and situation of its cardinal perforations and in the presence of a strap occurring in the apical part. On the other hand, it differs from this species in smaller dimensions and greater number of small perforations in the apical part. In the last-named character Polish specimens resemble the plates of the Recent Holothuroidea, i.e., *Synapta recta* Semper described from the Philippine Islands (Semper, 1868, p. 14, Pl. 4, Figs. 2 and 3) and *Polypsectana kefersteinii* (Selenka) (fide Clark, 1907, p. 77, Pl. 4, Fig. 20). *C. polonicus* n. sp. is also similar in its general shape to *Synaptites laevigatus* (Schlumberger) Deflandre-Rigaud from Eocene of France (fide Frizzel & Exline, 1955, p. 147, Pl. 9, Fig. 11), except for the fact that the latter species has smaller and more numerous perforations, irregularly distributed in the apical part of the plate.

Occurrence: Lower Sarmatian of Zrecze 3 (depth 64.80—64.90 m).

Croneisites sp.

(Pl. LXIX, Fig. 7; LXX, Fig. 5)

Material: One well-preserved specimen.

Dimensions (in mm): length, 0.22, width, 0.20, cardinal perforations, ab. 0.04×0.05 .

Description: An asymmetric plate, irregularly hexagonal in outline, concavo-convex. Six cardinal perforations, oval in outline, are distributed in three longitudinal rows. Their peripheries are finely denticulate, the denticles of one side of the periphery being distributed in the plane of the convex part of plate and those of the opposite side of the periphery — in the plane of the concave part of plate. A small perforation, shaped

like a rounded triangle and devoid of denticles occurs over cardinal perforations of the middle row. Above this triangular perforation, there are distributed two other perforations, devoid of denticles, somewhat than the cardinal ones and shaped like an elongate ellipsis, one of them being slightly deformed. On their edges nearer the periphery of the plate, a small arcuate strap with a fine denticle, occurring at the point of the strongest curvature, is attached to the concave side of the plate. A very small, round hole occurs axially in the apical part of the plate. Half-way the length of the plate, another oval perforation devoid of denticles and half the size of cardinal ones occurs on one of the sides of the plate. On the same side, in the lower part of the periphery of the plate, a fairly large, oval depression is observed which in the side is limited by a small convexity and, on the other, by a massive, hooklike protuberance.

Remarks: *Croneisites* sp. differs from *C. insignis* Kristan-Tollmann and *C. polonicus* n. sp. described above in an asymmetric structure which, however, cannot be considered a symptom of variability.

Occurrence: Lower Sarmatian of Żrecze 3 (depth, 59.30—59.40 m).

Family *Priscopeditidae* Frizzel & Exline, 1955

Genus *Priscopeditus* (Schlumberger, 1890) emend.

Deflandre-Rigaud, 1961

Type species: *Priscopeditus pyramidalis* Schlumb. from Eocene of France (Schlumberger, 1890, p. 201, Figs. 26—29).

Diagnosis of the genus: A sclerite in the form of a perforate plate, variable in shape, i.e. circular, oval, stellate or more or less regularly polygonal. On one side of the plate, there occurs an elevation in the form of a cone or crossed straps, which may be either smooth or denticulate, low or high and covering one or four central perforations. Perforations smooth, elliptical or polygonal.

Priscopeditus triangularis n. sp.

(Pl. LXXI, Figs. 1—6)

Holotypus: Pl. LXXI, Fig. 5 (H-I-1-52).

Locus typicus: Jaworzniak (depth, 21.50 m).

Stratum typicum: Middle Bathonian.

Derivatio nominis: Lat. triangularis = triangular.

Material: Thirty well-preserved specimens.

Dimensions (in mm): holotype, length 0.26, width 0.20; paratypes, length 0.21—0.23, width 0.18—0.22.

Diagnosis: A plate triangular in outline, with rounded corners and three perforations. A conical elevation, consisting of four pillars and covering a central perforation, occurs in the middle of the plate.

Description: A plate shaped like a triangle with rounded corners and with one side always more or less concave. Round perforations, usually more or less uniform in size, are regularly distributed near the corners. In the middle of one side of the plate, a conical elevation with rounded apex is formed by four pillars and covers a central perforation, usually larger than the rest of them. Plates glossy, almost transparent.

Variability: Slight differences are observed in the outer outline of plates. The conical elevation more or less completely covers the central

perforation. Two plates have been found having five and not three perforations varying in length and irregularly distributed (Pl. LXXI, Figs. 4 and 6).

Remarks: A plate of *Priscopedatus triangularis* n. sp. does not resemble any other of the species of this genus described so far.

Occurrence: Middle (depths, 34.0 and 21.5 m) and Upper Bathonian (depth, 19.0 m) of Jaworznik.

Priscopedatus batoniensis n. sp.

(Pl. LXXI, Figs. 7—10; Pl. LXXII, Figs. 1—7)

Holotypus: Pl. LXXI, Fig. 7 (H-I-2-67).

Locus typicus: Jaworznik (depth, 19.0 m).

Stratum typicum: Upper Bathonian.

Derivatio nominis: Lat. batoniensis — from the Bathonian.

Material: Fifteen well-preserved plates.

Dimensions (in mm): Holotype, length 0.32, width 0.23; paratypes, length 0.23—0.30, width 0.23—0.27.

Diagnosis: A perforate, triangular plate with a process. It has a central perforation covered with a conical elevation.

Description: A perforate plate, having three arms narrowing towards a rounded apex and a projecting process. A conical elevation with a rounded apex, consisting of four pillars covering the central perforation occurs in the middle on one side of the plate. This perforation, twice as large as the rest of them, is clearly visible from the opposite of the plate. Usually, it is surrounded by three round, fairly regularly distributed, perforations. The surface of the plate is smooth and glossy.

Variability: The plates of *Priscopedatus batoniensis* n. sp. are marked by a considerable degree of variability in the outer outline and distributions of perforations. An angle of deflection of the process from the axis of symmetry of the plate and the thickness of pillars which, in some cases, are so massive and fused together that they form a solid cone, are other variable characters.

Remarks: *Priscopedatus batoniensis* n. sp. differs from *P. triangularis* n. sp., described above, in outer outline of the plate and in the presence of not more than one only solid process.

Occurrence: Middle (depths, 34.0, 29.2, 23.0 and 21.5 m) and Upper (depths, 20.5 and 19.0 m) Bathonian of Jaworznik.

Priscopedatus jaworznicensis n. sp.

(Pl. LXXII, Figs. 8—10; Pl. LXXIII, Figs. 1—8)

Holotypus: Pl. LXXIII, Fig. 1 (H-I-2-74).

Locus typicus: Jaworznik (depth, 19.0 m).

Stratum typicum: Upper Bathonian.

Derivatio nominis: Lat. jaworznicensis — from Jaworznik.

Material. Twenty well-preserved specimens.

Dimensions (in mm): Holotype, length 0.25, width 0.19; paratypes, length 0.19—0.29, width 0.19—0.27.

Diagnosis: A quadrilateral plate with undulate sides. A large, central perforation, covered by a conical elevation, is surrounded by eight smaller, oval perforations.

Description: A perforate plate, fairly regular in structure. Its outer outline is approximating that of a tetragon with undulate sides. The

undulation is formed by convexities which correspond to the situation of perforations surrounding the middle of the plate. A conical elevation consisting of four pillars, having a common apex, which is more slender than the entire cone, occurs in the middle of one side of the plate. It covers a fairly large central perforation which is surrounded by eight oval, marginally distributed perforations which are almost uniform in size but each of them is about half the size of the central one. Surface smooth, glossy.

Variability: The outer outline of the plate may be more or less undulate. Sometimes, the width of the plate equals the length (Pl. LXXII, Fig. 9a; Pl. LXXIII, Fig. 3).

Remarks: In its general outline, *Priscopedatus jaworznicensis* n. sp. slightly resembles *P. pyramidalis* Schlumberger from Eocene of France (Schlumberger, 1888, p. 440, Figs. 8—11, in particular Fig. 8), first described as *Thyonidium* sp. and then as *Priscopedatus* Schlumberger (Schlumberger, 1890, p. 201, Figs. 26—29). This specimen is housed in the collections of the Micropalaeontological Laboratory of the E.P.H.E. in Paris under No. AV62. Our new species differs from this specimen in the shape of the apex of the conical elevation which, in cross section, is not quadrilateral and has not characteristic longitudinal incisions. In addition, all specimens of *P. jaworznicensis* n. sp. have eight marginal perforations and the dimensions of a specimen are twice as large.

Occurrence: Lower (depth, 43.0 m), Middle (depths, 29.2, 24.0 and 21.5 m) and Upper (depths, 20.5 and 19.0 m) Bathonian of Jaworznik.

Priscopedatus pentaradiatus n. sp.

(Pl. LXXIII, Figs. 9—11)

Holotypus: Pl. LXXIII, Fig. 9 (H-I-2-71).

Locus typicus: Jaworznik (depth, 19.0 m).

Stratum typicum: Upper Bathonian.

Derivatio nominis: pentaradiatus, Greek penta — five, Lat. radiatus — radiate, having five radii or being pentaradial.

Material: Ten well-preserved specimens.

Dimensions (in mm): Holotype, length 0.30, width 0.22; paratypes, length 0.24—0.28, width 0.16—0.20.

Diagnosis: Plate pentaradial with five oval, marginal perforations and a central perforation, covered with a conical elevation formed by four pillars.

Description: A perforate, pentaradial plate, fairly regular in structure. Outer outline determined by five incisions and five bulges slightly narrowing towards apexes. Each bulge corresponds to one of the five oval, marginal perforations which regularly surround the middle of the plate. In the middle, on one side of the plate, a conical elevation occurs which consists of four solid pillars completely covering the central perforation. The latter is visible only on the opposite side of the plate. The bases of pillars are, in all cases, oriented towards the largest three incisions of the outer outline of the plate which in turn are oriented towards each other at a right angle.

Variability: Plates slightly differ from each other in the depth of incisions and size of bulges.

Occurrence: Middle (depth, 21.5 m) and Upper (depth, 19.0 m) Bathonian of Jaworznik.

Priscopedatus denticulatus n. sp.

(Pl. LXXIV, Figs. 1—4)

Holotypus: Pl. LXXIV, Fig. 1 (H-I-1-49).

Locus typicus: Jaworznik (depth, 65.5 m).

Stratum typicum: Middle Vesulian (Kuiavian).

Derivatio nominis: Lat. denticulatus — denticulate.

Material. — Ten specimens, including two well-preserved.

Dimensions (in mm): Holotype, length 0.21, width 0.18; paratypes, length 0.25—0.26, width 0.20—0.22.

Diagnosis: A pentaradial plate with five oval perforations and a central perforation covered with a conical elevation formed by four denticulate pillars.

Description: A perforate plate, fairly regular in structure, almost symmetrical. The outer outline is determined by an undulate line forming what looks like five arms connected with five oval perforations surrounding a central, larger perforation, which — on one side of the plate — is covered with a conical elevation formed by four solid pillars. One or two denticles occur on the edges of the pillars. Bases of pillars are, in all cases, oriented towards the surrounding perforations. Surface smooth, glossy.

Variability: Plates differ from each other in their outline which may be more or less undulate. The height of conical elevations is also variable. In addition, the denticles on the edges of pillars may be more or less conspicuous.

Remarks: *Priscopedatus denticulatus* n. sp. differs from *P. pentaradiatus* n. sp., described above (p. 370) in a different orientation of these bases of pillars which form a conical elevation and which are shifted by 45°. In addition, in all specimens of *P. denticulatus* n. sp., denticles occur on the edges of pillars.

Occurrence: Middle Vesulian (Kuiavian) (depth, 65.60 m), Middle (depths, 35.0, 34.2 and 27.0 m) and Upper (depth, 19.0 m) Bathonian of Jaworznik.

Priscopedatus bolkoviensis n. sp.

(Pl. LXX, Figs. 6—9)

Holotypus: Pl. LXX, Fig. 6 (H-I-2-118).

Locus typicus: Bolków (depth, 50.3 m).

Stratum typicum: Kimmeridgian.

Derivatio nominis: bolkoviensis — from Bolków.

Material: Fourteen well-preserved plates.

Dimensions (in mm): Holotype, length 0.17, width 0.15; paratypes, length 0.19—0.23, width 0.12—0.14.

Diagnosis: An irregular plate, with scalloped margins, with or without marginal perforations, provided with a conical elevation covering the central perforation.

Description: A plate with outer outline irregular, scalloped, slightly perforate or devoid of perforations. In the middle of one side of the plate, there occurs a fairly large, clearly predominant conical elevation completely covering the central perforation which is larger than the remaining ones — if any of them are present — and visible on the opposite side. The plane of a horizontal section through the conical elevation is shaped like a strongly rounded tetragon. Plate is fairly thin, its surface smooth.

Variability: Variability concerns the outer outline of the plate and the presence of marginal perforations.

Remarks: In all specimens of *Priscopedatus bolkoviensis* n. sp. the apex of conical elevation is broken off. The central perforation is mostly filled with sediment, the same as the conical elevation which seems to be hollow and thin-walled. This species does not resemble any representative of this genus described so far.

Occurrence: Kimmeridgian of Bolków (depth, 50.3 m).

Priscopedatus octoperforatus n. sp.

(Pl. LXXIV, Figs. 5—8)

Holotypus: Pl. LXXIV, Fig. 5 (H-I-1-12).

Locus typicus: Jaworzniak (depth, 50.3 m).

Stratum typicum: Lower Bathonian.

Derivatio nominis: octoperforatus, Greek octo — eight, Lat. perforatus — perforate; having eight perforations.

Material: Twelve well-preserved specimens.

Dimensions (in mm): Holotype, length 0.21, width 0.16; paratypes, length 0.24—0.28, width 0.16—0.23.

Diagnosis: An irregular plate, with outer outline undulate and with eight oval perforations. Central perforation covered with a conical elevation consisting of four pillars.

Description: A perforate plate, more or less undulate in outline, with small incisions and bulges, two of which, facing each other, are usually the most elongate. In the middle of one side of the plate, a conical elevation formed by four solid pillars covers the central perforation which is clearly visible from the opposite side of the plate. The conical elevation is surrounded by eight, regularly distributed, oval perforations. Four of them, situated at the bases of pillars, are usually smaller than the remaining ones. Surface smooth, glossy.

Variability: The outer outline of the plates is variable. The difference in size between the perforations situated at the bases of pillars and the remaining ones is either considerable or small. One of the plates (Pl. LXXIV, Figs. 7a, b) has an additional, ninth perforation situated nearer the periphery of the plate and outside the circle of perforations which surround the conical elevation.

Occurrence: Middle Vesulian (Kuiavian) of Gałkówka (depth, 112.60 m), Lower (depth, 50.30 m) and Middle (depths, 39.20 and 34.0 m) Bathonian of Jaworzniak.

Priscopedatus sp.

(Pl. LXXV, Figs. 1—6)

Material: Many specimens in which the perforate plate is strongly damaged and the conical elevation very well-preserved.

Dimensions: The height of the conical elevation amounts to 0.05—0.10 mm.

Description: A conical elevation formed by four solid pillars which on their margins have mostly one or two denticles. Apex of the conical elevation elongate and, in all cases, terminating in a finely denticulate crown.

Remarks: A considerable degree of damage done to the plates prevents an accurate determination of the plan of their structure and of their specific assignment. It is possible, however, that the specimens of the

species *P. jaworznicensis* n. sp. and *P. denticulatus* n. sp., described above, are characterized by precisely such conical elevations. It seems in turn that, in these specimens, as a result of fossilization, the conical elevations have not been preserved, to such an extent.

Occurrence: Middle Bathonian of Ogrodzieniec, as well as Middle (depths, 29.20, 27.0, 24.0 and 23.0) and Upper (depths, 20.5 and 19.0 m) Bathonian of Jaworznik.

Genus *Priscolongatus* n. gen.

Type species: *Priscolongatus quadriperforatus* n. gen., n. sp. from the Middle Oligocene of Choszczno 1. boring.

Derivatio nominis: *Priscolongatus*, Lat. *priscus* — old, ancient, *longatus* — elongate.

Diagnosis: An elongate, concavo-convex sclerite, with two or four arms. A conical elevation, mostly surrounded by four perforations, occurs in the central part.

Remarks: Despite the fact that this genus is similar to *Priscopedatus* (Schlumberger) emend. Deflandre-Rigaud, 1961 and *Calclamnella* Frizzel & Exline, 1955, it seems right to erect a new genus, *Priscolongatus* within the family Priscopedatidae Frizzel & Exline. It differs from *Priscopedatus* in its always elongate shape and in the lack of central perforation and from *Calclamnella* Frizzel & Exline — in the presence, in the central part, of a characteristic conical convexity and in a different arrangement of perforations.

Priscolongatus quadriperforatus n. sp.

(Pl. LXXV, Figs. 7—12)

Holotypus: Pl. LXXV, Fig. 7 (H-I-3-215).

Locus typicus: Choszczno 1 (depth, 148.8 m).

Stratum typicum: Middle Oligocene.

Derivatio nominis: *Quadriperforatus*: Lat. *quadri* — four, *perforatus* — perforate; having four perforations.

Material: — Many, well-preserved specimens, some of them having perforations filled with sediment.

Dimensions (in mm): Holotype, length 1.03, width 0.47; paratypes, length 0.75—1.0, width 0.20—0.41.

Diagnosis: An elongate sclerite, rhomboidal in outline, with a small conical elevation and four perforations occurring in the central part.

Description: An elongate sclerite, rhomboidal in outline, more or less rounded, with two arms which are elongate and narrowing towards rounded apices. On one side of the plate, in the middle of the central, extended part, a small conical elevation is surrounded by four, oval, regularly distributed, perforations. The plate is slightly concavo-convex, the lumen of perforation being narrower on the concave side.

Variability: Variability is observed in the elongation of arms, extension of the central part and size of perforations.

Remarks: In the general shape and the presence of four perforations in the central part, *Priscolongatus quadriperforatus* n. sp. resembles a sclerite of the Recent *Molpadia musculus* (Risso) — fide Croneis & Cormack (1932, pp. 121—122, Pl. 17, Figs. 11—13 and 18—23) and Clark (1907, Pl. 11, Fig. 13), from which it differs, however, in the presence of a convexity in the central part and in larger dimensions. In

their outline and concavo-convex shape, some specimens of *P. quadriperforatus* n. sp. (H-I-3-218) also resemble *Calclamnella fusiformis* Defl.-Rig. from the Middle Oligocene of Halstein (Deflandre-Rigaud, 1959, Pl. 1, Figs. 8 and 9, Pl. 2, Fig. 11), but differ from it in having a conical elevation in the central part (a generic character) and in a different distribution of perforations.
Occurrence: Lower Rupelian of Choszczno 1 (depth, 154.0, 153.7 and 148.8 m) and Gorzów Wielkopolski 1 (depth, 167.7 m).

Priscolongatus obliquobrachiatus n. sp.
(Pl. LXXV, Fig. 13; Pl. LXXVI, Figs. 1—3)

Holotypus: Pl. LXXV, Fig. 13 (H-I-3-207).

Locus typicus: Choszczno 1 (depth, 148.8 m).

Stratum typicum: Middle Oligocene.

Derivatio nominis: obliquobrachiatus, Lat. obliquus = oblique, brachiatus = branched.

Material. — Twelve well-preserved specimens; in some of them perforations are filled with sediment.

Dimensions (in mm): Holotype, length 0.90, width 0.49; paratypes, length 0.64—1.05, width 0.45—0.61.

Diagnosis: An elongate sclerite, with four arms, having in the central part a conical elevation and four perforations.

Description: A sclerite subquadrilateral in outline, with four, elongate and rounded arms, two of which, larger and more solid, are situated along the same axis. The remaining two are shorted and situated not axially but obliquely to the former two, the angles of intersection of their axes amounting to ab. 60°. A conical elevation, surrounded by four oval perforations regularly distributed along the axis of arms, occurs in the central part. The plate is slightly concavo-convex. On the concave side, the lumens of perforations are narrower.

Variability: Variability is observed in the thickness of arms, degree of their elongation and rounding, as well as in the size of perforations.

Occurrence: Lower Rupelian of Choszczno 1 (depths, 150.1 and 148.8 m) and Gorzów Wielkopolski 1 (depth, 176.0 m).

Priscolongatus sp. 1
(Pl. LXXVI, Fig. 4)

Material: One very well-preserved specimen.

Dimensions (in mm): length, 0.73, width, 0.16.

Description: A sclerite in the form of an elongate, thick concavo-convex plate, fusiform in outline. On the convex side, a conical elevation shaped like a 5-pointed star occurs in the central, extended part. Five oval, very small perforations are distributed between the arms of this star. On the opposite side of plate which is concave the lumens of perforations are narrower.

Remarks: *Priscolongatus* sp. 1 does not resemble any holothurian sclerite described so far.

Occurrence: Lower Rupelian of Choszczno 1 (depth, 148.8 m).

Priscolongatus sp. 2
(Pl. LXXVI, Figs. 5 and 6)

Material: Two specimens, one well-preserved and one damaged.

Dimensions (in mm): length, 0.64—0.70, width 0.39—0.41.

Description: An asymmetric sclerite, in the form of a thick plate subtetragonal in outline, with three narrowing arms, having rounded apexes and two of which are situated along the same axis. An elevation occurs instead of the fourth arm. The central part is provided, on one side of the plate, with a conical elevation, four oval perforations at the bases of arms and a fifth, crescentiform, which occurs laterally.

Variability is observed in the size of perforations.

Occurrence: Lower Rupelian of Choszczno 1 (depth, 148.8 m).

Family *Calclamnidae* Frizzel & Exline, 1955

Genus *Calclamnella* Frizzel & Exline, 1955

Type species: *Calclamnella irregularis* (Schlumb.) Frizzel & Exline from Eocene of France (Schlumberger, 1890, pp. 199—200, Text-figs. 20 and 21).

Diagnosis: A sclerite in the form of a perforate, flat plate rectangularly to elliptically elongate with two longitudinal rows of perforations; periphery even or incised and irregular.

Calclamnella sp.

(Pl. LXXVI, Fig. 7)

Material: One very well-preserved specimen.

Dimensions (in mm): length, 0.70, width, 0.22.

Description: A sclerite in the form of an elongate plate with two arms along one axis and with rounded apexes. Three oval perforations occur in the central, extended part. Two of them are situated one over another and the third — to one side. Edges even.

Remarks: In its shape and in the presence of perforations arranged in two rows, *Calclamnella* sp. resembles *C. fusiformis* Defl. - Rig. from the Middle Oligocene of Holstein (Deflandre - Rigaud, 1959, p. 192, Pl. 1, Figs. 8 and 9, Pl. 2, Fig. 11), from which it differs, however, in larger dimensions and different number of perforations. In its shape, *Calclamnella* sp. also resembles the Recent sclerites of *Molpadia musculus* (Risso), discussed above (p. 373) from which it differs in the number of perforations.

Occurrence: Lower Rupelian of Gorzów Wielkopolski 1 (depth, 170.6 m).

Genus *Calclamma* Frizzel & Exline, 1955

Types species: *Calclamma germanica* Frizzel & Exline from the Lias of Germany and England (Frizzel & Exline, 1955, pp. 76—77, Pl. 2, Figs. 1—5).

Diagnosis: A sclerite in the form of a perforate plate, frequently with a bilateral symmetry, rectangular or subrectangular, relatively wide. Perforations varying in size, arranged in more than two rows or forming a cruciform pattern.

Calclamma sp. 1

(Pl. LXXVI, Fig. 9)

Material: One well-preserved specimen.

Dimensions (in mm): length, 0.22, width, 0.18.

Description. A sclerite in the form of a concave-convex, perforate

plate, subrectangular and slightly undulate in outline. Perforations round, almost uniform in size, arranged in three rows. The fourth row consists of four smaller perforations distributed in pairs.

Remarks: *Calclamma* sp. 1 does not resemble any representative of this genus described so far.

Occurrence: Lower Sarmatian of Żrecze 3 (depths, 64.8—64.9 m).

Calclamma sp. 2

(Pl. LXXVI, Fig. 8)

Material: One well-preserved specimen.

Dimensions (in mm): length, 0.22, width, 0.20.

Description: A sclerite in the form of a concave-convex, perforate plate with an outline resembling a rounded rectangle with deep, undulate incisions. Perforations round, more or less identical in size, arranged in three rows.

Remarks: *Calclamma* sp. 2 does not resemble any representative of this genus described so far.

Occurrence: Lower Sarmatian of Żrecze 3 (depths, 64.8—64.9 m).

Genus *Cucumarites* Deflandre-Rigaud, 1949

(Syn. *Thuroholia* Gutschick, 1954 = *Eocaudina* Martin, 1952 emend. Frizzel & Exline, 1955).

Type species: *Cucumarites mortenseni* (Frizzel & Exline) Rioult = Syn. *Eocaudina mortenseni* Frizzel & Exline from Lias of Germany (Deflandre-Rigaud, 1959, p. 191).

Diagnosis: A sclerite in the form of a flat or slightly convex plate varying in shape from round to elliptical, rounded or polygonally rounded. Periphery of the plate smooth, incised, denticulate, or scalloped. Perforations round or polygonal, devoid of denticulations, irregularly distributed.

Remarks: This genus was discussed by Deflandre-Rigaud (1959, p. 191) and Rioult (1960, pp. 134—135).

Cucumarites mortenseni (Frizzel & Exline)

Deflandre-Rigaud, 1959

(Pl. LXXVI, Figs. 10—13)

1937 Spicules of dendrochirote holothurians (in part); T. Mortensen, Some echinoderm remains..., p. 24, Pl. 4, Fig. 5 (not Fig. 4).

1955 *Eocaudina mortenseni* n. sp.; L. Frizzel & H. Exline, Monograph of Fossil Holothurian..., p. 88, Pl. 3, Fig. 10.

1959 *Cucumarites mortenseni* (Frizzel & Exline); M. Deflandre-Rigaud, Sur quelques sclérites..., p. 191.

1960 *Cucumarites mortenseni* (Frizzel & Exline); M. Rioult, Les sclérites d'Holothuries..., p. 135.

1961 *Cucumarites mortenseni* (Frizzel & Exline) Deflandre-Rigaud; M. Deflandre-Rigaud, Contribution..., p. 62, Fig. 37—42, Pl. 1, Fig. 8.

Material: Many, incomplete specimens.

Dimensions (in mm): diameter, 0.30—0.40, perforations, 0.04—0.06.

Description: A sclerite in the form of a flat and thin plate irregularly rounded in outline. Perforations more or less round, varying in size and arranged in rows. Edge of plate slightly incised.

Variability is observed in the shape of plate and perforations, size of the latter and degree of incision of the edge of plate.

Remarks: In its general outline, *Cucumarites mortenseni* (Frizzel & Exline) Deflandre-Rigaud resembles *Eocaudina subtrigonalis* Kristan-Tollmann from the Middle Tortonian of Austria (Kristan-Tollmann, 1964, p. 86, Pl. 6, Figs. 1 and 2) from which it differs in a greater number of perforations.

Occurrence: Lias of Germany and England (Frizzel & Exline, 1955), Oxfordian of France (Deflandre-Rigaud, 1961). Poland: Middle Vesulian (Kuiavian) (depths, 66.7 and 62.4 m), Middle (depths, 29.2 and 21.0 m) and Upper (depths, 20.0 and 19.0 m) Bathonian of Jaworzniak.

Cucumarites robustus Deflandre-Rigaud, 1961

(Pl. LXXVII, Figs. 1—4)

1961 *Cucumarites robustus* cent. nov. vel parasp. nov.; M. Deflandre-Rigaud, Contribution..., p. 64, Figs. 50 and 51.

Material: Many, well-preserved but incomplete specimens.

Dimensions (in mm): diameter, 0.21—0.34, perforations, 0.02—0.07.

Description: A sclerite in the form of an irregular, thick plate. Perforations round. Periphery of plate incised.

Remarks: Specimens of *Cucumarites robustus* Defl.-Rig., including a holotype, described by Deflandre-Rigaud (1961) were also incomplete and, therefore, it is difficult to determine what their shape was like.

Occurrence: Oxfordian of France (Deflandre-Rigaud, 1961). Poland: Upper Vesulian (Kuiavian) (depth, 57.9 m), Lower (depths, 53.3, 48.0, 39.0 and 36.2 m), Middle (depths, 34.0 and 27.0 m) and Upper (depth, 19.0 m) Bathonian of Jaworzniak, as well as Lower Sarmatian (depths, 64.8—64.9 m) of Żrecze 3.

Genus *Paracucumarites* Deflandre-Rigaud, 1961 emend.

Type species: *Paracucumarites hamptoni* Defl.-Rig. from the Oxfordian of France (Deflandre-Rigaud, 1961, p. 68, Figs. 57—60). The diagnosis (given by Deflandre-Rigaud, 1961, p. 67) is as follows: „Sclérites en plaques perforées à double couche, la seconde occupant d'abord la partie centrale et pouvant éventuellement s'étendre jusqu' au bord.”

Remarks: The present writers suggest to supplement the above diagnosis by the introduction of the following terms: the upper and lower layer (or plate) and the more or less incised outline.

Paracucumarites similis n. sp.

(Pl. LXXVII, Figs. 5—8)

Holotypus: Pl. LXXVII, Fig. 6 (H-I-3-351).

Locus typicus: Jaworzniak (depth, 24.5 m).

Stratum typicum: Middle Bathonian.

Derivatio nominis: Lat. similis = similar.

Material: Eight specimens varying in their state of preservation.

Dimensions (in mm): Holotype, diameter ab. 0.32; paratypes, 0.20—0.25.

Diagnosis: A bilamellate perforate plate, with an incised outline similar to a rounded rectangle. Perforations round to oval.

Description: A plate with an incised outline, similar to a rounded rectangle, consisting of two layers. The lower layer has round to oval perforations, more or less uniform in size and forming a regular network. Perforations of the upper layer, which incompletely covers the lower one, are identical in shape and size or slightly larger than those of the lower layer.

Variability is observed in the relation of the size of both layers and their perforations, as well as in the extent to which the outline of plate is incised.

Remarks: In the characters of its perforations (their shape, size and distribution) and the incised outline of its plate, *Paracucumarites similis* n. sp. is similar to *Cucumarites mortenseni* (Frizzel & Exline) Deflandre-Rigaud described above (p. 376). Our new species may be compared with *P. hamptoni* Deflandre-Rigaud from Oxfordian of France (Deflandre-Rigaud, 1961, p. 68, Figs. 57—60) and particularly to those specimens in which, according to the author of this species, the upper layer resembles *C. mortenseni* (Frizzel & Exline) Defl.-Rigaud. Our species differs, however, from these specimens in larger and more numerous perforations, as well as in a more strongly incised outline.

Occurrence: Lower (depth, 43.0 m), Middle (depths, 24.0, 23.0 and 22.5 m) and Upper (depth, 19.0 m) Bathonian of Jaworzniak.

Paracucumarites sp.

(Pl. LXXVII, Fig. 9)

Material: One specimen.

Dimensions (in mm): length, 0.37, width, 0.27.

Description: An irregular plate, with an incised outline and consisting of two perforate layers, the lower, relatively thick and with densely, regularly distributed, round perforations and the upper which covers 3/4 of the surface of the lower. Perforations of the upper layer are large, irregular and polygonal in outline.

Remarks: In its polygonal perforations of the upper layer and in its outer outline, *Paracucumarites* sp. resembles *P. anceps* Deflandre-Rigaud from Oxfordian of France (Deflandre-Rigaud, 1961, pp. 68—69, Figs. 62, 63), particularly the specimen shown in Pl. 2, Fig. 9, from which it differs, however, in more numerous perforations of the lower layer and in the lack, on one side, of a Y-shaped „bride.”

Occurrence: Middle Bathonian (depth, 22.5 m) of Jaworzniak.

Family Theeliidae Frizzel & Exline, 1955

Genus *Theelia* Schlumberger, 1890. Syn. *Chiridotites*
Deflandre-Rigaud, 1949

Types species: *Chiridota undulata* Schlumb. from Eocene of France (Schlumberger, 1888, p. 439, Text-fig. 7 not Fig. 6).

Diagnosis: A sclerite in the form of a wheel with 6—12 spokes connecting the central part with the outer rim, which is denticulate. A star with the number of arms corresponding to that of spokes occurs in the middle of the lower side.

Theelia heptalampra (Bartenstein, 1936)

Frizzel & Exline

(Pl. LXXVIII, Figs. 1—3)

- 1936 *Chiridota heptalampra* n. sp.; H. Bartenstein, Kalk-Körper von Holothurien..., pp. 6—8, texte-fig. 10ab—11ab.
1950 *Chiridotites heptalampra* (Bartenstein); M. Deflandre-Rigaud, Les sclérites rotiformes..., pp. 27—28, Fig. 49—50.
1952 *Chiridotites heptalampra* (Bartenstein); M. Deflandre-Rigaud, Contribution à la systématique..., p. 9.
1952 „*Chiridota leptalampra* Bartenstein”; A. G. Fischer in R. C. Moore, C. G. Lalicker & A. G. Fischer, Intervertebrate fossils, texte-fig. 19-2-10.
1955 *Theelia heptalampra* (Bartenstein); L. Frizzel & H. Exline, Monograph..., pp. 120—121, Pl. 7, Fig. 1.
1960 *Chiridotites heptalampra* (Bartenstein); M. Rioult, Les sclérites d'Holothuries..., pp. 142—143, Pl. 1, Fig. 21.
1967 *Theelia heptalampra* (Bartenstein); J. Garbowska & A. Wierzbowski, Holothurian sclerites..., pp. 533—534, Fig. 6A—C, Pl. 1, Fig. 1.

Material: Very numerous, well-preserved specimen.

Dimensions. Diameter, 0.18—0.22 mm.

Description: A wheel-like sclerite which also may resemble in outline a strongly rounded heptagon, consisting of a central part, seven radial spokes and an outer rim. On the upper side (Pl. LXXVIII, Fig. 1b), the central part of the sclerite is convex (Pl. LXXVIII, Figs. 1c, 2b and 3b). On the lower side (Pl. LXXVIII, Fig. 1a—3a), a seven-pointed star with its arms situated in the extension of the axes of spokes, occurs in the middle of the central part. Spokes are convex and tapering towards both the middle of the sclerite and the outer rim. In transverse section they are more or less arcuate or, less frequently, flat. A fairly wide outer rim has its edges curved towards the middle and, on the upper side, finely denticulate. Variability is observed in the outer outline which may be round (Pl. LXXVIII, Figs. 1a, b) or more or less heptagonal (Pl. LXXVIII, Fig. 3a).

Remarks: *Theelia heptalampra* (Bartenstein) Frizzel & Exline is compared by many authors with various species of this genus but there is not a single species which might simultaneously represent such important characters as, the shape, the presence of seven spokes and — in the central part — of a markedly regular seven-pointed star.

Occurrence: Middle Lias of Northern Germany (Bartenstein, 1936; Deflandre-Rigaud, 1950; Frizzel & Exline, 1955) and Lias of France (Rioult, 1960). Poland: Upper Oxfordian (*Idoceras planula* zone) of Wieluń Upland (Garbowska & Wierzbowski, 1967); Middle Vesulian (Kuiavian) of Jarocin 1 (depth, 254.0 m); Lower (depth, 39.2 m) and Middle (depth, 29.2 m) Bathonian of Jaworznik and Middle Bathonian of Ogrodzieniec.

Theelia dentata n. sp.

(Pl. LXXVIII, Figs. 4 and 5)

Holotypus: Pl. LXXVIII, Fig. 4 (H-I-4-464).

Locus typicus: Jaworznik (depth, 64.4 m).

Stratum typicum: Middle Vesulian (Kuiavian).

Derivatio nominis: *dentata*, Lat. *dentatus* = denticulate.

Material: A dozen or so well-preserved specimens.

Dimensions (in mm): Holotype, diameter 0.180; paratypes, 0.175—0.190.

Diagnosis: A sclerite hexagonal in outline, consisting of a central part, six spokes and an outer rim. On the lower side, a tetradial elevation occurs in the central part. Edges of the rim and spokes are denticulate.

Description: A sclerite shaped like a wheel, more or less hexagonal in outline and consisting of a central part, six radially arranged spokes and an outer rim. The upper side of the central part of the sclerite is convex (Pl. LXXVIII, Figs. 4b and 5b). A slight tetradial elevation occurs on the lower side (Pl. LXXVIII, Figs. 4a and 5a) of the central part. Spokes are slightly convex. The upper part of the edge of the rim and the edges of spokes are finely denticulate.

Remarks: In its general shape and the presence of six spokes, *Theelia dentata* n. sp. resembles *T. angulata* (Defl. - Rig.) from Bathonian of France (Deflandre - Rigaud, 1951, pp. 24—25, Text-figs. 25—28), from which it differs, however, in smaller dimensions, in the presence of denticles on spokes and edges of the rim, as well as in a different appearance of the central part of the sclerite which, maybe on account of a poor state of preservation of the specimen, has in fact been omitted in Deflandre - Rigaud's description. In its outline and in the presence of six radial spokes, our species is slightly similar to *T. wartschensis* Garbowska & Wierzbowski from the Lower Kimmeridgian of Dworszowice Kościelne (Garbowska & Wierzbowski, 1967, pp. 534—536, Figs. 7 A—H, Pl. 1, Figs. 2—4), from which it differs in the presence of a tetradial elevation and denticles which occur on the edges of spokes.

Occurrence: Middle Vesulian (Kuiavian) of Jaworznik (depths, 66.7 and 64.4 m).

Genus *Hemisphaeranthos* Terquem & Berthelin, 1875
emend. Frizzel & Exline, 1966

Syn. *Myriotrochites* Deflandre - Rigaud, 1949

Type species: *Hemisphaeranthos costifera* Terquem & Berthelin from Lias of France (Terquem & Berthelin, 1875, pp. 115—116, Pl. 20, Figs. 13, 15 and 16, not Figs. 12 and 14).

Diagnosis: A wheel-like sclerite consisting of a central part, usually 9—17 spokes and a characteristically denticulate outer rim.

Hemisphaeranthos malmensis Frizzel & Exline, 1955
(Pl. LXXVII, Fig. 10)

- 1937 *Myriotrochus* sp.; Th. Mortensen, Some echinoderm remains..., p. 20, Pl. 3, Figs. 1—2.
- 1950 *Myriotrochus sieboldi* (Schwager); M. Deflandre - Rigaud, Les sclérites rotiformes..., pp. 35—37, text-fig. 84 (not text-fig. 75—83, 85—87).
- 1950 *Myriotrochus costiferus* (Terquem & Berthelin); M. Deflandre - Rigaud, Les sclérites rotiformes..., pp. 37—38, text-fig. 93 (not text-fig. 88—92, 94).
- 1952 *Myriotrochus* sp.; A. G. Fischer, in R. C. Moore, C. G. Lalicker & A. G. Fischer, Intervertabrate fossils, text-fig. 19-2-11.
- 1955 *Hemisphaeranthos malmensis* n. sp.; L. Frizzel & H. Exline, Monograph of Fossil Holothurian..., pp. 133—134, Pl. 8, Fig. 7—8.

Material: Five specimens in part filled with sediment.

Dimensions: Diameter, 0.81—0.90 mm.

Description: A wheel-like sclerite consisting of a central part, 9—17 straight spokes radially diverging from the center and an outer rim. On the upper side, the edge of the outer rim terminates in 27—29 large, slender teeth whose apexes point towards the middle of the sclerite. They reach about $\frac{1}{3}$ or $\frac{1}{2}$ of the length of a spoke. Usually two teeth occur in the space between successive two spokes and one tooth — opposite each spoke. On the lower side, the outer rim forms a fairly wide peripheral margin with characteristic perpendicular lines, their number corresponding to that of teeth. Central part rather small.

Remarks: In its general shape and number of spokes, *Hemisphaeranthos malmensis* Frizzel & Exline resembles the specimens of *H. mirabilis* (Deflandre-Rigaud) from the Middle Oligocene of Germany (Deflandre-Rigaud, 1959, pp. 194—195, Pl. 1, Figs. 18—20), from which it differs in a greater number of teeth on the outer rim and in a different shape and arrangement of these teeth.

Occurrence: Middle Lias of Northern Germany (Mortensen, 1937; Deflandre-Rigaud, 1950; Frizzel & Exline, 1955) and Lias of France (Riout, 1960). Poland: Middle Vesulian (Kuiavian) of Jarocin 1 (depths, 254.0 m), Lower (depths, 39.2 and 36.2 m) Bathonian of Jaworzniok, as well as Middle Bathonian of Ogrodzieniec.

Hemisphaeranthos ogradzieniecensis n. sp.

(Pl. LXXVIII, Figs. 6 and 7)

Holotypus: Pl. LXXVIII, Fig. 6 (H-I-4-466).

Locus typicus: Ogradzieniec.

Stratum typicum: Middle Bathonian.

Derivatio nominis: ogradzieniecensis from Ogradzieniec.

Material: A few well-preserved specimens.

Dimensions (in mm): Holotype, diameter 0.18; paratypes, 0.17—0.19.

Diagnosis: A wheel-like sclerite, polygonal in outline, consisting of a central part, 6—9 spokes and an outer rim with teeth the number of which corresponds to that of spokes.

Description: A wheel-like sclerite, polygonal in outline, consisting of a central part, 6—9 spokes radially diverging from the center and an outer rim. On the upper side of the sclerite, an edge of the outer rim is formed by teeth with wide bases and the number of which corresponds to that of spokes. The apexes of teeth are situated in the space between spokes. The upper side of the central part of the sclerite is concave, the lower — convex. Spokes, narrower near the middle, extend towards the outer rim.

Remarks: In its morphology, *Hemisphaeranthos ogradzieniecensis* n. sp. does not resemble any species of this genus described so far.

Occurrence: Middle Bathonian of Ogradzieniec.

Family Achistridae Frizzel & Exline, 1955

Genus *Achistrum* Etheridge, 1881 emend. Frizzel & Exline, 1955

Type species: *Achistrum nicholsoni* Etheridge, 1881 from the Lower Carboniferous of Scotland (Etheridge, 1881, p. 95, Pl. 5, Figs. 7a, b).

Diagnosis: A hooklike sclerite consisting of a terminal loop, shank and spear.

Remarks: The division of the genus *Achistrum* Frizzel & Exline into a few morphological groups corresponding to subfamilies successively erected by Hodson, Harris & Lawson (1956), Hampton (1958) and Rioult (1960) has been discussed by Garbowska & Wierzbowski (1967, pp. 528—529).

Achistrum (*Achistrum*) *issleri* (Croneis, 1932) Hodson, Harris & Lawson
(Pl. LXXIX, Fig. 1)

1960 *Achistrum* (*Achistrum*) *issleri* (Croneis); M. Rioult, Les sclérites d'Holothuries..., p. 139, Pl. 1, Fig. 1 (earlier synonymy enclosed).

1967 *Achistrum* (*Achistrum*) *issleri* (Croneis); J. Garbowska & A. Wierzbowski, Holothurian sclerites..., pp. 529—530, Figs. 3A—F.

Material: Very numerous but mostly incomplete (lacking spear) specimens.

Dimensions (in mm): length, 0.40—0.62.

Description: A hooklike sclerite with an empty, round or oval terminal loop, situated centrally in relation to the axis of the sclerite. Shank straight or arcuate. Spear arcuate.

Variability is observed in the shape of the opening of the shank, as well as in the length and degree of curvature of the shank and spear. **Remarks:** In its general morphology, *Achistrum* (*Achistrum*) *issleri* (Croneis) Hodson, Harris and Lawson may be compared to *A. brownwoodensis* (Croneis) from Permian of Texas and *A. bathonianum* Frizzel & Exline from Jurassic of France (fide Frizzel & Exline, 1955, pp. 95—97).

Occurrence: Jurassic of Germany (Eichenberg, 1935; Mortensen, 1937), France (Terquem & Berthelin, 1875; Issler, 1908; Deflandre-Rigaud, 1952; Rioult, 1960) and England (Hodson, Harris & Lawson, 1956). Poland: Upper Oxfordian (*Idoceras planula* zone) and Lower Kimmeridgian (*Sutneria platynota* ? and *Ataxioceras hypselocyclum* zone) of Wieluń Upland (Garbowska & Wierzbowski, 1967). Lower (depth, 38.4 m) Bathonian of Jaworznik and Middle Bathonian of Ogrodzieniec.

Achistrum (*Cancellrum*) *monochordata* Hodson, Harris & Lawson, 1956
(Pl. LXXIX, Figs. 2—6)

1960 *Achistrum* (*Cancellrum*) *monochordata* Hodson, Harris & Lawson; M. Rioult, Les sclérites d'Holothuries..., pp. 139—140, Pl. 1, Fig. 2 (earlier synonymy enclosed).

1962 *Achistrum* (*Cancellrum*) *monochordata* Hodson, Harris & Lawson; B.N. Fletcher, Some holothurian..., p. 325, Figs. 6, 7.

1967 *Achistrum* (*Cancellrum*) *monochordata* Hodson, Harris & Lawson; J. Garbowska & Wierzbowski, Some holothurian sclerites..., pp. 530—531, Figs. 4A—M.

Material: Very numerous, frequently damaged specimens.

Dimensions: Length, 1.25—2.0 mm.

Description: A hooklike sclerite consisting of a terminal loop, shank

and spear. Terminal loop round or elliptical, provided with a straight, thin crossbar directed along the axis of the sclerite. It may be situated either centrally or laterally or, sometimes, it may completely adhere to the wall. Shank straight or arcuate. Spear arcuate, its bent part being perpendicular to the terminal loop. In most specimens, four to five denticles, pointing towards the end of the sclerite, occur on the outer edge of the shank.

Variability: Variability is observed in the situation and thickness of the crossbar within the terminal loop, in the shape of the loop and in a more or less arcuate shape of shank and spear.

Remarks: The presence of 4—5 denticles in the lower part of spear has been revealed owing to the application of strongly magnifying microscopes used during the studies. Probably, these denticles also occurred in other specimens of this species, described by previous authors, but they were missed by them.

In the case, in which the crossbar of the terminal loop is damaged, it leaves a trace in the form of two slight convexities or processes.

Achistrum (Cancellrum) monochordata Hodson, Harris & Lawson, 1956 differs from *A. (Cancellrum) gamma* Hodson, Harris and Lawson, described below, in a straight shape of the crossbar in the terminal loop.

Occurrence: Upper Jurassic of North America (Frizzel & Exline, 1955; Hampton, 1957), England (Hodson, Harris & Lawson, 1956; Fletcher, 1962), France (Rioult, 1960) and Germany (Eichenberg, 1935; Bartenstein, 1936). Poland: Upper Oxfordian (*Idoceras Planula* zone) and Lower Kimmeridgian (*Sutneria platynota?* and *Ataxioceras hypselocyclum* zone) of Wieluń Upland (Garbowska & Wierzbowski, 1967). Lower Vesulian (Kuiavian) of Gałkówka 3 (depth, 134.0 m) and Middle Vesulian (Kuiavian) of Jarocin 1 (depth, 252.0 m), Lower Bathonian of Jaworznik (depths, 36.2 and 31.5 m) and Turów (depths, 352.7—353.7 m) and Middle Bathonian of Ogrodzieniec.

Achistrum (Cancellrum) gamma Hodson, Harris & Lawson, 1956
(Pl. LXXIX, Figs. 7—9)

1967 *Achistrum (Cancellrum) gamma* Hodson, Harris & Lawson; J. Garbowska & W. Wierzbowski, Some holothurian..., pp. 531—532, Fig. 5 (earlier synonymy enclosed).

Material: Many incomplete (lacking spears) specimens.

Dimensions: Length, 0.50—0.66 mm.

Description: A hooklike sclerite, consisting of a terminal loop, shank and spear. The terminal loop is oval and filled with a bifurcate, Y-shaped crossbar, two arms of which are, in all cases, directed upwards. The shank is straight or slightly arcuate.

Variability is observed in the size of the terminal loop, as well as in the length and thickness of the shank.

Remarks. In some specimens, the crossbar filling the terminal loop is somewhat thinner halfway its length (Fletcher, 1962, Text-fig. 2). This phenomenon was also confirmed by the appearance of the specimens from Poland.

Occurrence: Bathonian and Oxfordian of England (Hodson, Harris & Lawson, 1956; Hampton, 1958 and Fletcher, 1962,

Text-fig. 2). Poland: Callovian of Łuków (Garbowska & Wierzbowski, 1967), as well as Lower (depth, 36.2 m) and Middle (depth, 31.5 m) Bathonian of Jaworzniak.

*Micropalaeontological Laboratory,
University of Warszawa*

REFERENCES

- Bartenstein H. (1936), Kalk-Körper von Holothurien in norddeutschen Lias-Schichten. *Senckenbergiana*. 18 (1/2), 1—10, Frankfurt a. M.
- Błaszyk J. (1967), Middle Jurassic Ostracods of the Częstochowa region (Poland). (Mażoraczki środkowojurajskie regionu częstochowskiego). *Acta palaeont. pol.* 12, 1, 1—75, Warszawa.
- Clark H.L. (1907), The Apodous Holothurians. A Monograph of the Synaptidae and Molpadiidae. *Smiths. Contr. Knowledge*, 35, 1—206, Washington.
- Croneis C. & McCormack J. (1932), Fossil Holothuroidea. *J. Paleont.*, 6, 2, 11—148, Menasha.
- Deflandre-Rigaud M. (1949a), Révision du manipule Synaptites, sclérites d'Holothurides fossiles. *Bull. Inst. Océanogr.* 946, 1—11, Monaco.
- Deflandre-Rigaud M. (1949b), La nomenclature des fragments fossiles (organites et sclérites) d'Invertébrés. *Congr. Intern. Zool. 13^e session*, sect. 3, p. 576, Paris.
- Deflandre-Rigaud M. (1950), Les sclérites rotiformes des Holothurides fossiles. *Ann. Paléont.*, 36, 1—45, Paris.
- Deflandre-Rigaud M. (1952), Contribution à la systématique des sclérites d'Holothurides fossiles. *Bull. Inst. Océanogr.*, 1012, 1—12, Monaco.
- Deflandre-Rigaud M. (1959), Sur quelques sclérites d'Holothurides de l'Oligocène d'Innien, Holstein. *Rév. Micropaléont.*, 1, 4, 190—200, Paris.
- Deflandre-Rigaud M. (1961), Contribution à la connaissance des sclérites d'Holothurides fossiles. (1—135), Paris. *Mém. Mus. Hist. Nat.*, C. 11, 1—123, Paris.
- Eichenberg W. (1935), Holothurien-Kalkkörperchen aus dem Jura nord Deutschlands. *Z. Dtsch. Geol. Ges.*, 87, 318—320, Berlin.
- Etheridge R. (1881), On the Presence of the Scattered Skeletal Remains of Holothuroidea in the Carboniferous Limestone Series of Scotland. *Proc. R. Phys. Soc. Edinburgh*. 6, 183—198, Edinburgh.
- Fischer A.G. (1952), In Moore R.C., Lalicker C.G. & Fischer A.G. Invertebrate Fossils. Holothuroids. 653—658, New York, Toronto, London.
- Fletcher B.N. (1962), Some Holothurian Spicules from the Ampthill Clay of Melton, near Hull (Yorkshire). *Geol. Mag.*, 99, 4, 322—326, Hertford.
- Frizzel D.L. & Exline H. (1955), Monograph of Fossil Holothurian Sclerites. *Bull. Univ. Missouri School Mines Metall.*, 89, 1—204, Rolla, Missouri.
- Frizzel D.L. & Exline H. (1957), Revision of the Family Synaptitidae, Fossil Holothurian Sclerites (Echinodermata Holothuroidea). *Anal. Soc. Geol. Peru*, 32, 97—119, Lima.
- Frizzel D.L. & Exline H. (1966), Holothuroidea — fossil record. In: Moore R.C. (Ed.). *Treatise on Invertebrate Paleontology*, part U, Echinodermata, 3/2, 646—672, Lawrence, Kansas.
- Garbowska J. & Wierzbowski A. (1967), Some Holothurian Sclerites from the Polish Jurassic (Skleryty Holothurioidea z utworów jurajskich Wyżyny Wierzuńskiej i okolic Łukowa). *Acta palaeont. pol.*, 12, 4, 523—541, Warszawa.

- Gortyńska S. (1962), Kilka uwag o Oligocenie w Polsce zachodniej (Some remarks of the Oligocene of Western Poland). *Kwart. geol.* 6, 1, 125—133, Warszawa.
- Gutschick R.C. (1954), Holothurian Sclerites from the Middle Ordovician of Northern Illinois. *J. Paleont.*, 28, 6, 827—829, Menasha.
- Hampton J.S. (1957), Some Holothurian Spicules from the Upper Bathonian of the Dorset Coast. *Geol. Mag.*, 94, 6, 507—510, Hertford.
- Hodson F., Harris B. & Lawson L. (1956), Holothurian Spicules from the Oxford Clay of Redcliff, near Weymouth (Dorset). *Geol. Mag.*, 93, 4, 336—344, Hertford.
- Issler A. (1908), Beiträge zur Stratigraphie und Mikrofauna des Lias in Schwaben. *Palaeontographica A*, I, 55, 1—104, Stuttgart.
- Kopik J. (1967), The Middle and Upper Jurassic of the Częstochowa-Zawiercie Sedimentary Basin (The Cracow-Częstochowa Jura). A. General Characteristics. B. Stratigraphy (Środkowa i górna jura częstochowskiego i zawierciańskiego obszaru sedymentacyjnego (Jura Krakowsko-Częstochowska). In: X Europejskie kolokwium Mikropaleontologiczne w Polsce. 1967. I. 93—106, Warszawa.
- Kristan-Tollmann E. (1964), Holothurien-Sklerite aus dem Torton des Burgenlandes, Österreich, Sitzungsberichte d. mathem.-naturw. Kl. I, 173, 1, 2, 75—100, Wien.
- Łuczowska E. (1963), Foraminiferal Zones in the Miocene, South of the Holy Cross Mts. *Bull. Acad. Pol. Sc.* 11, 1, 29—34, Warszawa.
- Łuczowska E. (1964), Stratygrafia mikropaleontologiczna miocenu w rejonie Tarnobrzeg—Chmielnik (The Micropaleontological stratigraphy of the Miocene in the region of Tarnobrzeg—Chmielnik). *Pr. geol. PAN. Oddz. Kraków.* 20, 1—72, Warszawa.
- Martin W.R. (1952), Holothuroidea from the Iowa Devonian. *J. Paleont.*, 26, 5, 728—729, Menasha.
- Mortensen T. (1937), Some Echinoderm Remains from the Jurassic of Württemberg. *D.K.D. Vid. Selsk. Biol. Medd.*, 13, 1—28, København.
- Pazdrowa O. (1967), The Middle and Upper Jurassic of the Częstochowa-Zawiercie Sedimentary Basin (The Cracow-Częstochowa Jura). H. The Bathonian Microfauna from the vicinity of Ogrodzieniec Exposure at the Ogrodzieniec brick-yard (Mikrofauna batonu okolic Ogrodzieńca. Cegielnia Ogrodzieniec). In: X Europejskie kolokwium Mikropaleontologiczne w Polsce, 1967, t. I, *Inst. Geol., Biul.* 181, 146—163, Warszawa.
- Rioult M. (1960), Les „sclérites d'Holothuries fossiles du Lias”. Colloque sur le Lias. 85^e Congr. Soc. Sav. Chambéry, 121—153, Paris.
- Schlumberger C. (1888), Note sur les Holothuridées du Calcaire grossier. *Bull. Soc. Géol. France.* 3, 16, 437—441, Paris.
- Schlumberger C. (1890), Seconde note sur les Holothuridées fossiles du Calcaire grossier. *Bull. Soc. Géol. France.* 3, 18, 191—206, Paris.
- Semper C. (1868), Die Holothurien. Reisen in Archipel der Philippinen. II, 1, 1—606, Leipzig.
- Spandel E. (1900), Eine fossile Holothurie (Synapta-Reste aus den oberoligozänen Cerithiensichten des Mainzer Beckens). *Abh. Naturhist. Ges. Nürnberg* 13, 45—56, Nürnberg.
- Terquem O. & Berthelin G. (1875), Etude microscopique des marnes du Lias moyen d'Essey-lès-Nancy, zone inférieure de l'assise à Ammonites margaritatus. *Mém. Soc. Géol. France.* 10, 2, 1—126, Paris.
- Wolańska H. (1959), Stratygrafia mikropaleontologiczna trzeciorzędu (rupelu) w profilu wiertniczym Gorzów Wielkopolski IG1. *Arch. Inst. Geol. (maszynopis).* Warszawa.

- Wolańska H. (1962), Stratygrafia mikropaleontologiczna oligocenu Polski zachodniej (Micropaleontological stratigraphy of the Oligocene of Western Poland). *Kwart. geol.* 6, 1, 149—156, Warszawa.
- Woźny E. (1962), Stratygrafia oligocenu Polski zachodniej na podstawie makrofauny (The Stratigraphy of the Oligocene of Western Poland on the basis of its macrofauna). *Kwart. geol.* 6, 1, 134—148, Warszawa.
- Znosko J. (1959), Wstępny zarys stratygrafii utworów jurajskich w południowo-zachodniej części Niżu polskiego (Preliminary Description of Stratigraphy of Jurassic Sediments in Southwestern Part of Polish Lowland). *Kwart. geol.* 3, 3, 501—528, Warszawa.

STRESZCZENIE

Opracowano skleryty holoturii z utworów jurajskich i trzeciorzędowych Polski należące do 5 rodzin: Synaptitidae, Priscopedatidae, Calclammidae, Theeliidae i Achistridae. Wyróżniono 10 rodzajów, z tego 1 nowy: *Priscolongatus* oraz 30 gatunków, w tym 13 nowych. Są to: *Croneisites polonicus*, *Priscopedatus triangularis*, *P. batoniensis*, *P. jaworznicensis*, *P. pentaradiatus*, *P. denticulatus*, *P. bolkoviensis*, *P. octoperforatus*, *Priscolongatus quadriperforatus*, *P. obliquobrachiatus*, *Paracucumarites similis*, *Theelia dentata* i *Hemisphaeranthos ogrodzieniecensis*.

EXPLANATION OF PLATES

Plate LXVIII

Figs. 1a, b, 2, 4, 6. *Croneisites insignis* Kristan-Tollmann.

(a) convex side,

(b) concave side;

1 — (H-I-4-400), 2 — (H-I-4-402),

4 — (H-I-4-403), 6 — (H-I-4-404)

Figs. 3a, b, 5a, b. *Croneisites* cf. *insignis* Kristan-Tollmann.

(a) convex side,

(b) concave side;

3 — (H-I-4-406), 5 — (H-I-4-407)

Figs. 7a, b. *Croneisites polonicus* n. sp., holotype.

(a) convex side, (b) concave side (H-I-4-408).

All specimens come from Żrecze 3 boring, depth, 64.8—64.9 m. Lower Sarmatian. $\times 175$

Plate LXIX

Figs. 1a, b—6, 8, 10. *Croneisites polonicus* n. sp., paratypes.

(a) convex side,

(b) concave side;

1 — (H-I-4-409), 2 — (H-I-4-410),

3 — (H-I-4-411), 4 — (H-I-4-412),

5 — (H-I-4-413), 6 — (H-I-4-414),

8 — (H-I-4-415), 10 — (H-I-4-416). Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian

Figs. 7a, b. *Croneisites* sp. (a) convex side, (b) concave side (H-I-4-417), Żrecze 3, depth, 59.3—59.4 m, Lower Sarmatian

Fig. 9. *Croneisites insignis* Kristan-Tollmann (H-I-4-405), Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian. $\times 175$

Plate LXX

Figs. 1a, b. *Croneisites insignis* Kristan-Tollmann. (a) convex side, (b) concave side; (H-I-4-414), Żrecze 3, depth, 64.8—64.9 m. Lower Sarmatian

Figs. 2a, b, 3. *Croneisites* cf. *insignis* Kristan-Tollmann

(a) convex side,

(b) concave side;

2 — (H-I-4-407), 3 — (H-I-4-406), Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian

Figs. 4a, b. *Croneisites polonicus* n. sp., holotype. (a) convex side, (b) concave side; (H-I-4-408), Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian

Figs. 5a, b. *Croneisites* sp. (a) convex side, (b) concave side; (H-I-4-417), Żrecze 3, depth, 59.3—59.4 m, Lower Sarmatian

Figs. 6a-c—9a-c. *Priscopodatus bolkoviensis* n. sp., holotype. (a) top view, (b) bottom view, (c) lateral view; 6 — (H-I-2-118); paratypes: 7 — (H-I-2-116), 8 — (a) top view, (b) lateral view; (H-I-2-117), 9 — (a) top view, (b) bottom view, (c) lateral view, (H-I-2-115). All specimens of *Priscopodatus bolkoviensis* n. sp. are from Bolków, depth, 50.3 m, Kimmeridgian.

Figs. 1—5 ab. $\times 150$; Figs. 6—9 ab. $\times 200$

Plate LXXI

Figs. 1a, b—6a, b. *Priscopodatus triangularis* n. sp. (a) top view, (b) lateral view; 1 — paratype (H-I-2-53), Jaworznik, depth, 19.0 m, Upper Bathonian, 2 — paratype (H-I-2-54), Jaworznik, depth, 19.0 m, Upper Bathonian, 3 — paratype (H-I-1-5), Jaworznik, depth, 34.0 m, Middle Bathonian, 4 — paratype (H-I-1-30), Jaworznik, depth, 19.0 m, Upper Bathonian, 5 — holotype (H-I-1-52), Jaworznik, depth, 19.0 m, Upper Bathonian

Figs. 7a, b—10a, b. *Priscopodatus batoniensis* n. sp. (a) top view, (b) lateral view; 7 — holotype (H-I-2-67), Jaworznik, depth, 19.0 m, Upper Bathonian; paratypes: 8 — (H-I-2-56), Jaworznik, depth, 19.0 m, Upper Bathonian, 9 — (H-I-2-64), Jaworznik, depth, 34.0 m, Middle Bathonian, 10 — (H-I-2-63), Jaworznik, depth, 34.0 m, Middle Bathonian. $\times 150$

Plate LXXII

Figs. 1a, b—7a, b. *Priscopodatus batoniensis* n. sp., paratypes, (a) top view, (b) lateral view

1 — (H-I-2-86), Jaworznik, depth, 23.0 m, Middle Bathonian,

2 — (H-I-1-34), Jaworznik, depth, 19.0 m, Upper Bathonian,

3 — (H-I-1-41), Jaworznik, depth, 21.5 m, Middle Bathonian,

4 — (H-I-2-62), Jaworznik, depth, 29.2 m, Middle Bathonian,

5 — (H-I-1-43), Jaworznik, depth, 21.5 m, Middle Bathonian,

6 — (H-I-2-68), Jaworznik, depth, 19.0 m, Upper Bathonian,

7 — (H-I-1-6), Jaworznik, depth, 31.5 m, Middle Bathonian

Figs. 8a, b—10a, b. *Priscopodatus jaworznicensis* n. sp., paratypes, (a) top view, (b) lateral view

8 — (H-I-1-76), Jaworznik, depth, 20.5 m, Upper Bathonian,

9 — (H-I-2-75), Jaworznik, depth, 19.0 m, Upper Bathonian,

10 — (H-I-1-39), Jaworznik, depth, 24.0 m, Middle Bathonian. $\times 150$

Plate LXXIII

- Figs. 1a, b—8a, b. *Priscopedatus jaworznicensis* n. sp. (a) top view, (b) lateral view; 1 — holotype (H-I-2-74), Jaworznik, depth, 19.0 m, Upper Bathonian, paratypes:
- 2 — (H-I-2-90), Jaworznik, depth, 19.0 m, Upper Bathonian,
 - 3 — (H-I-1-25), Jaworznik, depth, 29.2 m, Middle Bathonian,
 - 4 — (H-I-1-23), Jaworznik, depth, 21.5 m, Middle Bathonian,
 - 5 — (H-I-2-73), Jaworznik, depth, 19.0 m, Upper Bathonian,
 - 6 — (H-I-1-26), Jaworznik, depth, 29.2 m, Middle Bathonian,
 - 7 — (H-I-1-48), Jaworznik, depth, 43.0 m, Lower Bathonian,
 - 8 — (H-I-2-21), Jaworznik, depth, 20.5 m, Upper Bathonian
- Figs. 9a, b—11a, b. *Priscopedatus pentaradiatus* n. sp. (a) top view, (b) lateral view; 9 — holotype (H-I-2-71), Jaworznik, depth, 19.0 m, Upper Bathonian, 10 — paratype (H-I-1-1), Jaworznik, depth, 19.0 m, Upper Bathonian, 11 — paratype (H-I-2-88), Jaworznik, depth, 19.0 m, Upper Bathonian. $\times 150$

Plate LXXIV

- Figs. 1a, b—4a, b. *Priscopedatus denticulatus* n. sp. (a) top view, (b) lateral view; 1 — holotype (H-I-1-49), Jaworznik, depth, 65.6 m, Middle Vesulian (Kuia-vian); paratypes: 2 — (H-I-1-11), Jaworznik, depth, 27.0 m, Middle Bathonian, 3 — (H-I-1-38), Jaworznik, depth, 34.2 m, Middle Bathonian, 4 — (H-I-2-69), Jaworznik, depth, 19.0 m, Upper Bathonian
- Figs. 5a, b—8a, b. *Priscopedatus octoperforatus* n. sp. (a) top view, (b) lateral view; 5 — holotype (H-I-1-12), Jaworznik, depth, 50.3 m, Lower Bathonian, paratypes:
- 6 — (H-I-1-18), Jaworznik, depth, 39.2 m, Lower Bathonian,
 - 7 — (H-I-2-119), Gałków 3, depth, 112.6 m, Middle Vesulian,
 - 8 — (H-I-1-14), Jaworznik, depth, 34.0 m, Middle Bathonian. $\times 150$

Plate LXXV

- Figs. 1—6. *Priscopedatus* sp. (conical elevation)
- 1 — (H-I-2-107), Jaworznik, depth, 24.0 m, Middle Bathonian,
 - 2 — (H-I-2-103), Jaworznik, depth, 39.2 m, Lower Bathonian,
 - 3 — (H-I-2-108), Jaworznik, depth, 19.0 m, Upper Bathonian,
 - 4 — (H-I-2-100), Jaworznik, depth, 24.0 m, Middle Bathonian,
 - 5 — (H-I-2-110), Jaworznik, depth, 23.0 m, Middle Bathonian,
 - 6 — (H-I-2-112), Ogrodzieniec, outcrop, Middle Bathonian
- Figs. 7a, b—12. *Priscolongatus quadriperforatus* n. gen., n. sp. (a) top view, (b) lateral view; 7 — holotype (H-I-3-215), Choszczno 1, depth, 148.8 m, Lower Rupelian, paratypes: 8 — (H-I-3-216), Choszczno 1, depth, 148.8 m, Lower Rupelian, 9 — (H-I-3-218), Choszczno 1, depth, 148.8 m, Lower Rupelian, 10 — (H-I-3-217), Choszczno 1, depth, 148.8 m, Lower Rupelian, 11 — (H-I-3-212), Choszczno 1, depth, 153.7 m, Lower Rupelian, 12 — (H-I-3-219), Gorzów Wielkopolski 1, depth, 167.7 m, Lower Rupelian
- Fig. 13. *Priscolongatus obliquobrachiatus* n. gen., n. sp., holotype, (a) top view, (b) lateral view (H-I-3-207), Choszczno 1, depth, 148.8 m, Lower Rupelian. Figs. 1—6 $\times 150$; Figs. 7—13 $\times 60$

Plate LXXVI

- Figs. 1—3. *Priscolongatus obliquobrachiatus* n. gen., n. sp., paratypes: 1 — (H-I-3-222), Gorzów Wielkopolski 1, depth, 176.0 m, Lower Rupelian, 2 — (H-

-I-3-203), Choszczno 1, depth, 150.1 m, Lower Rupelian, 3 — (H-I-3-205), Choszczno 1, depth, 148.8 m, Lower Rupelian

Fig. 4. *Priscolongatus* sp. 1 (H-I-3-201), Choszczno 1, depth, 148.8 m, Lower Rupelian

Figs. 5 and 6. *Priscolongatus* sp. 2, 5 — (H-I-3-210), 6 — (H-I-3-208), Choszczno 1, depth, 148.8 m, Lower Rupelian

Fig. 7. *Calclamnella* sp. (H-I-3-220), Gorzów Wielkopolski 1, depth, 170.6 m, Lower Rupelian

Fig. 8. *Calclamna* sp. 2 (H-I-3-301), Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian

Fig. 9. *Calclamna* sp. 1 (H-I-3-303), Żrecze 3, depth, 64.8—64.9 m, Lower Sarmatian

Figs. 10—13. *Cucumarites mortenseni* (Frizzel & Exline) Deflandre-Rigaud. 10 — (H-I-3-316), Jaworznik, depth, 29.2 m, Middle Bathonian, 11 — (H-I-3-304), Jaworznik, depth, 19.0 m, Upper Bathonian, 12 — (H-I-3-306), Jaworznik, depth, 19.0 m, Upper Bathonian, 13 — (H-I-3-324), Jaworznik, depth, 62.4 m, Middle Vesulian (Kuiavian)

Figs. 1—7 $\times 60$; Figs. 8—13 $\times 110$

Plate LXXVII

Figs. 1—4. *Cucumarites robustus* Deflandre-Rigaud.

1 — (H-I-3-329), Jaworznik, depth, 27.0 m, Middle Bathonian,

2 — (H-I-3-331), Jaworznik, depth, 53.3 m, Lower Bathonian,

3 — (H-I-3-330), Jaworznik, depth, 36.2 m, Lower Bathonian,

4 — (H-I-3-310), Jaworznik, depth, 19.0 m, Upper Bathonian

Figs. 5—8. *Paracucumarites similis* n. sp.

5 — paratype, (H-I-3-350), Jaworznik, depth, 22.5 m, Middle Bathonian,

6 — holotype, (H-I-3-351), Jaworznik, depth, 24.5 m, Middle Bathonian,

7 — paratype, (H-I-3-309), Jaworznik, depth, 19.0 m, Upper Bathonian,

8 — paratype, (H-I-3-352), Jaworznik, depth, 43.0 m, Lower Bathonian

Fig. 9. *Paracucumarites* sp. (H-I-3-360) Jaworznik, depth, 22.5 m, Middle Bathonian

Fig. 10a-c. *Hemisphaeranthos malmensis* Frizzel & Exline (H-I-4-460), Ogrodzieniec, outcrop, Middle Bathonian.

Figs. 1—4, 7, 9 $\times 110$; Figs. 5, 6, 8, 10 $\times 150$

Plate LXXVIII

Figs. 1a-c—3a, b. *Theelia heptalampra* (Bartenstein) Frizzel & Exline.

(a) lower side, (b) upper side, (c) lateral view; 1 — (H-I-4-461), Jaworznik,

depth, 39.2 m, Lower Bathonian, 2 — (a) lower side, (b) lateral view; (H-I-

-4-462), Jaworznik, depth, 29.2 m, Middle Bathonian, 3 — (H-I-4-463), Ogro-

dzieniec, outcrop, Middle Bathonian

Figs. 4a, b, 5a, b. *Theelia dentata* n. sp. (a) lower side, (b) lateral view; 4 — holo-

type, (H-I-4-464), Jaworznik, depth, 64.4 m, Middle Vesulian (Kuiavian), 5 —

paratype, (H-I-4-465), Jaworznik, depth, 66.7 m, Middle Vesulian (Kuiavian)

Figs. 6a-c, 7a-c. *Hemisphaeranthos ogrodzieniecensis* n. sp. (a) upper side, (b) lower

side, (c) lateral view, 6 — holotype (H-I-4-466), 7 — paratype (H-I-4-467),

Ogrodzieniec, outcrop, Middle Bathonian. $\times 200$

Plate LXXIX

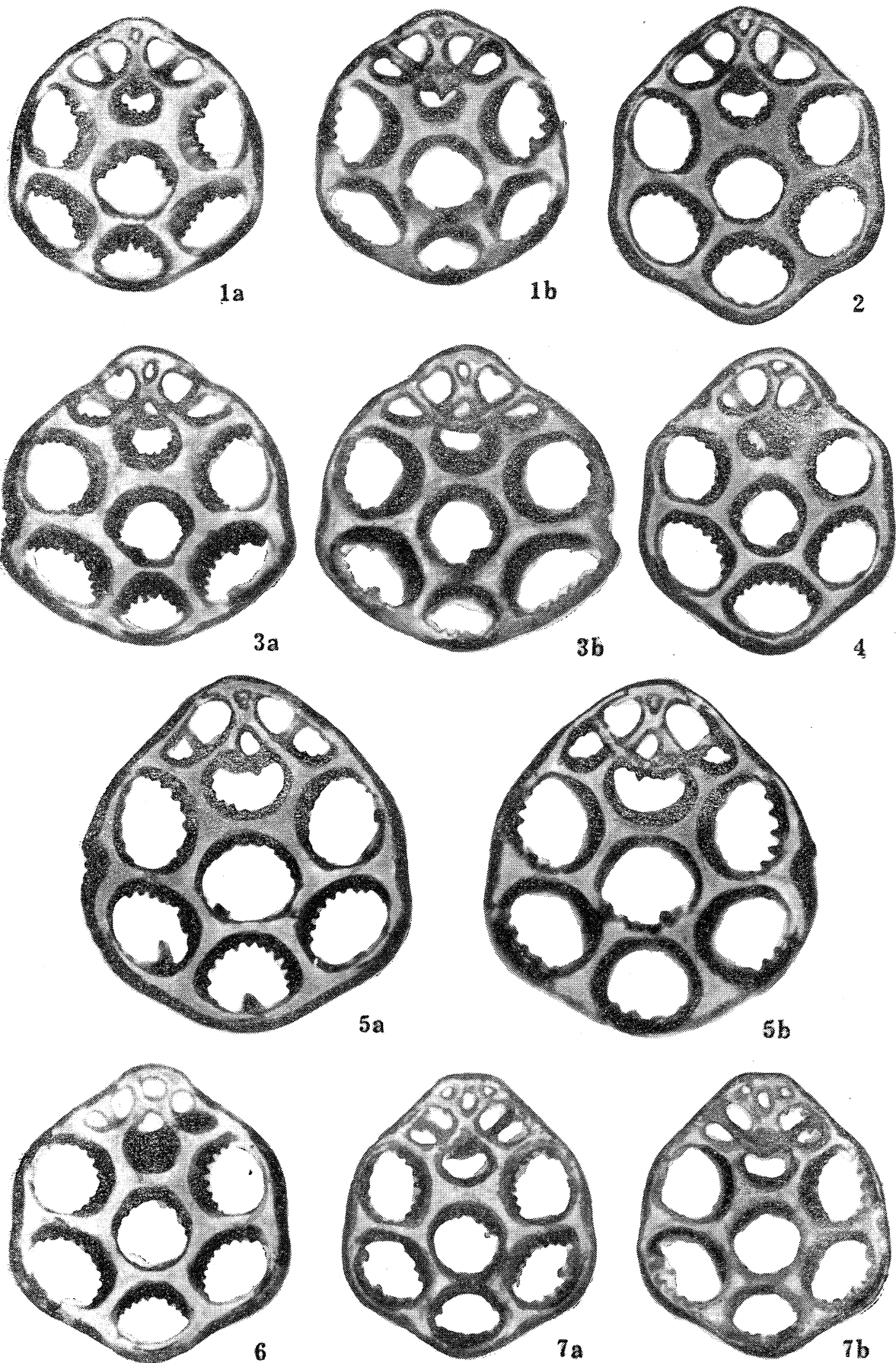
Figs. 1a, b. *Achistrum (Achistrum) issleri* (Croneis) Hodson, Harris & Law-

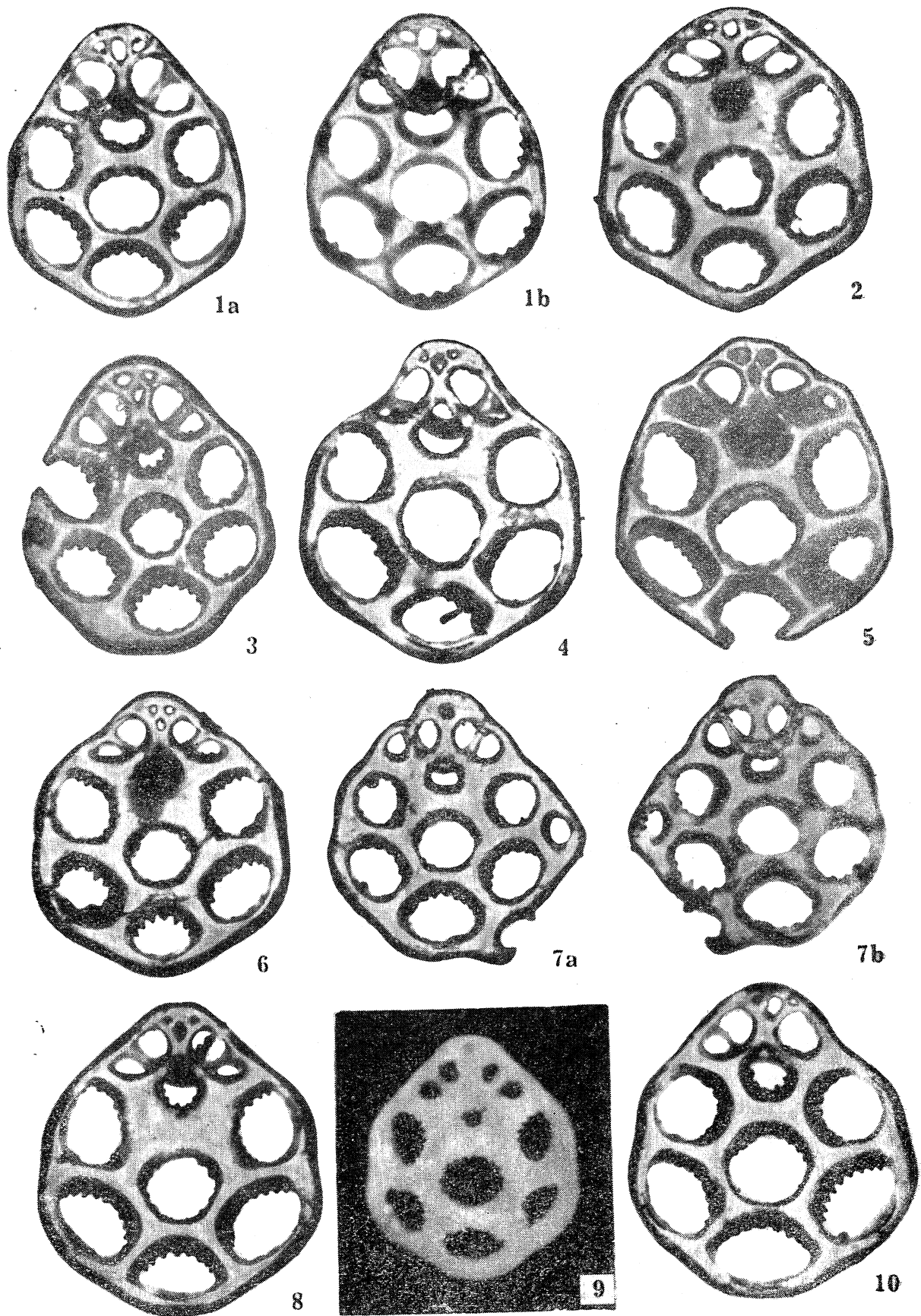
son. (a) viewed from the loop, (b) lateral view, (H-I-1-4-500), Jaworznik,

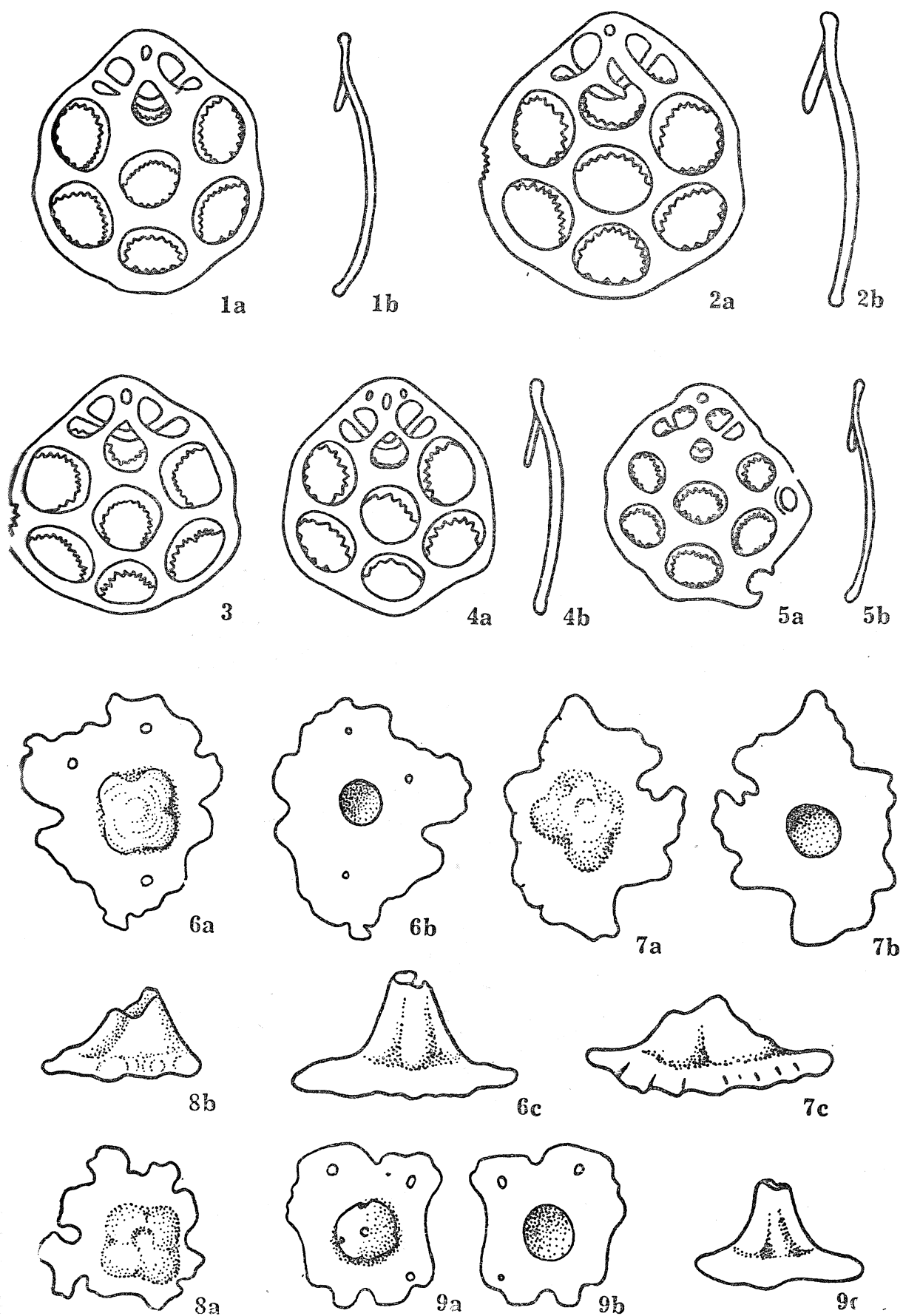
depth, 38.4 m, Lower Bathonian.

- Figs. 2—6. *Achistrum (Cancellrum) monochordata* Hodson, Harris & Lawson.
2 — (H-I-4-505), Gałkówek 3, depth, 134.0 m, Lower Vesulian (Kuiavian), 3 — (H-I-4-504), Ogrodzieniec, outcrop, Middle Bathonian, 4 — (H-I-4-502), Ogrodzieniec, outcrop, Middle Bathonian, 5 — (H-I-4-503), Ogrodzieniec, outcrop, Middle Bathonian, 6 — (H-I-4-501), Ogrodzieniec, outcrop, Middle Bathonian
- Figs. 7—9. *Achistrum (Cancellrum) gamma* Hodson, Harris & Lawson.
7 — (H-I-4-507), Jaworznik, depth, 31.5 m, Middle Bathonian, 8 — (H-I-4-508), Jaworznik, depth, 31.8 m, Middle Bathonian, 9 — (H-I-4-506), Jaworznik, depth, 36.2 m, Middle Bathonian.

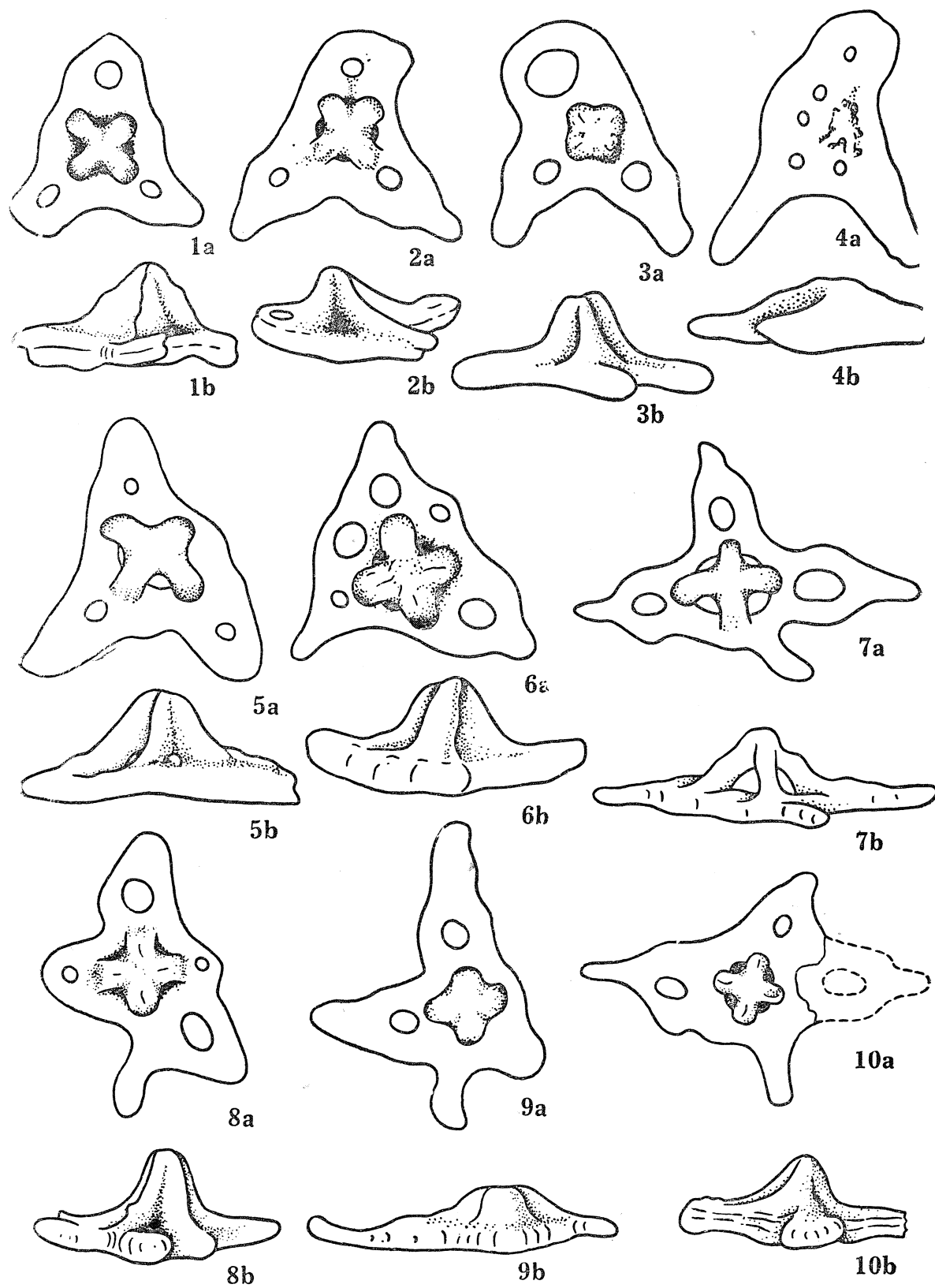
Figs. 1, 2, 7—9 $\times 110$; Figs. 3—6 $\times 50$

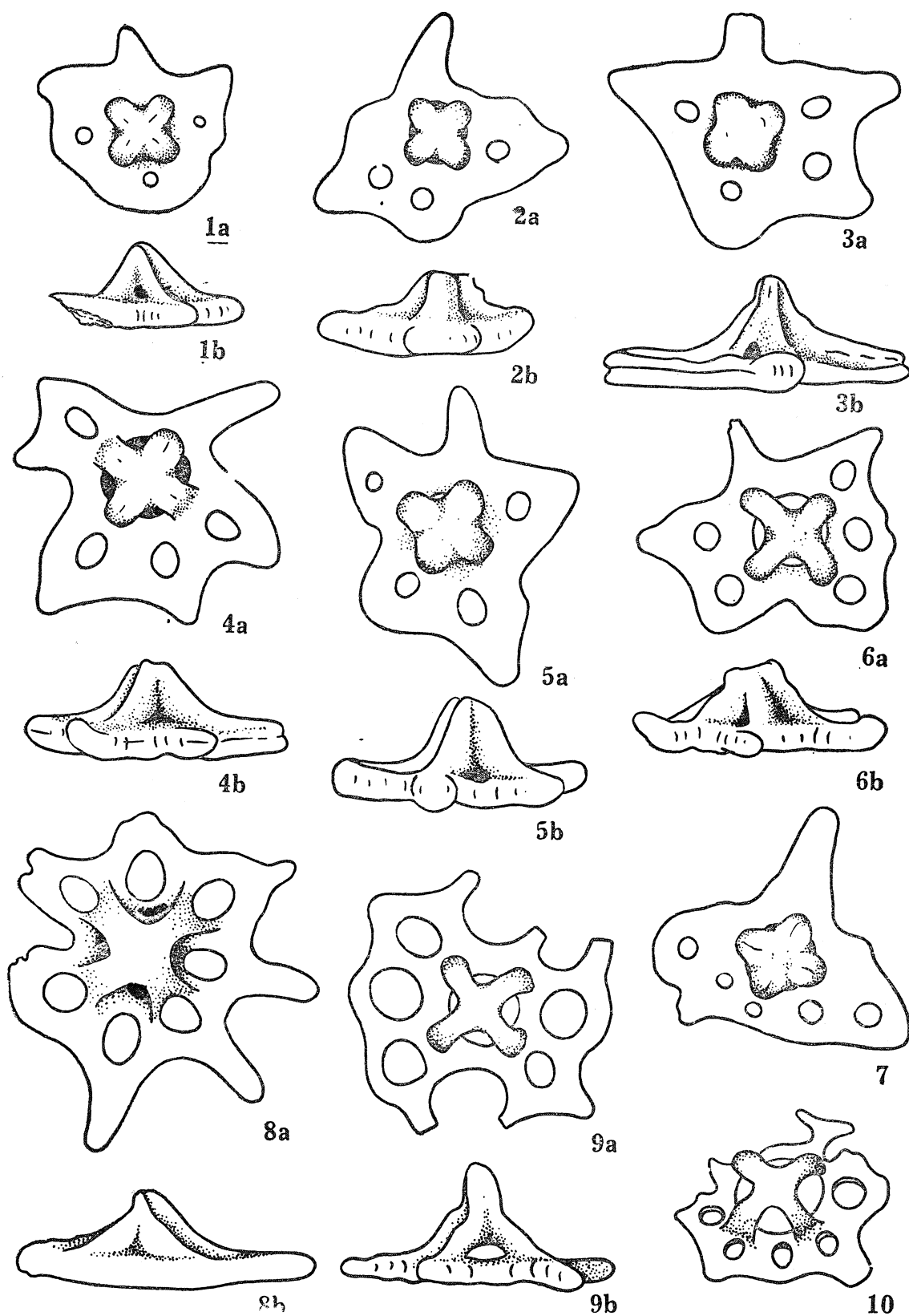


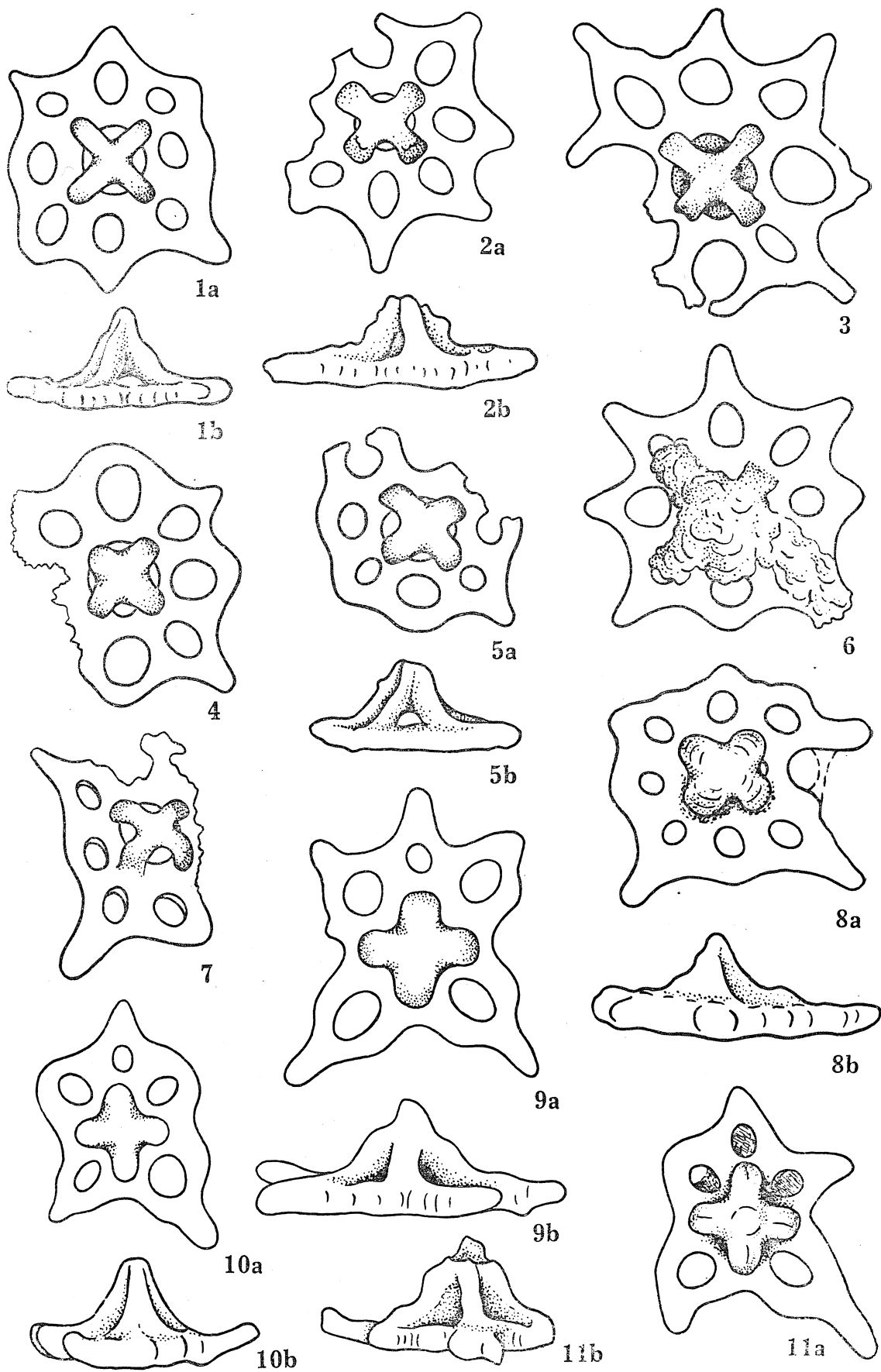


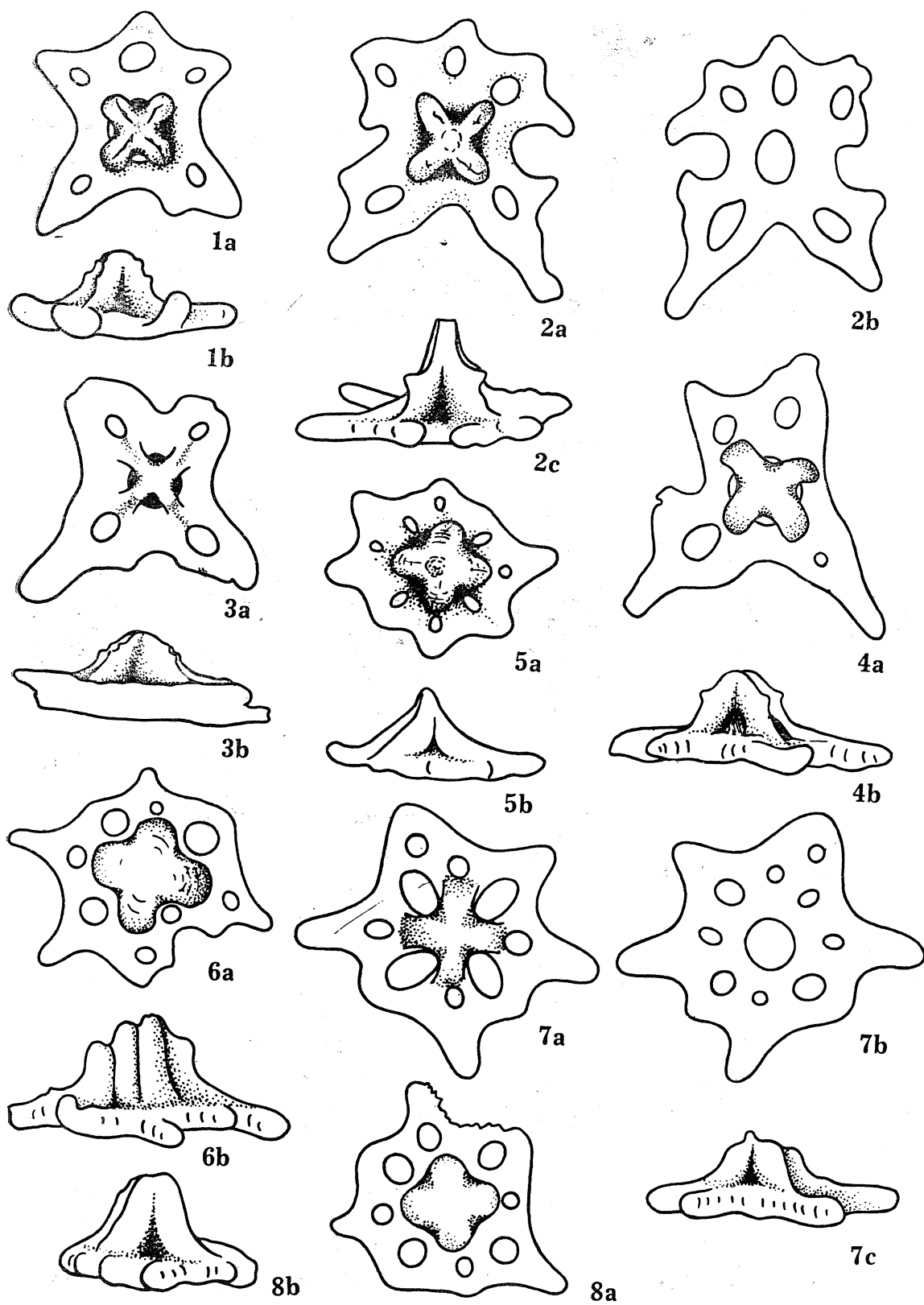


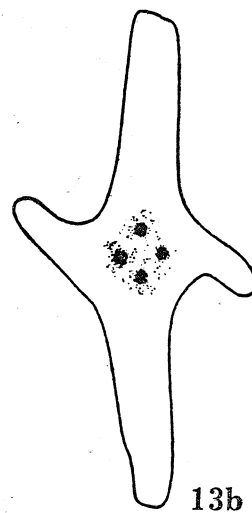
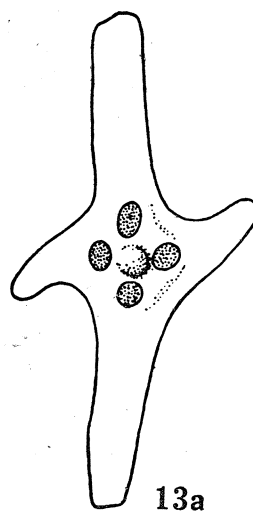
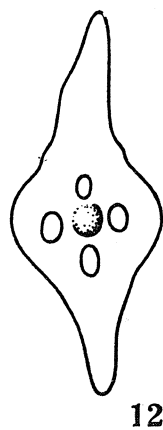
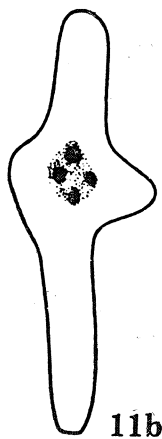
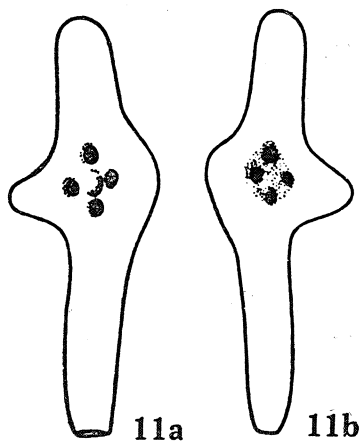
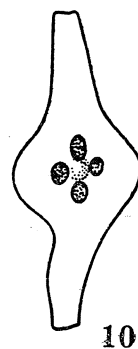
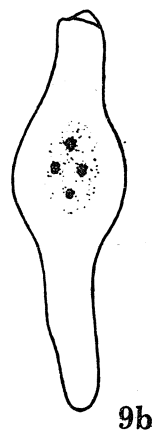
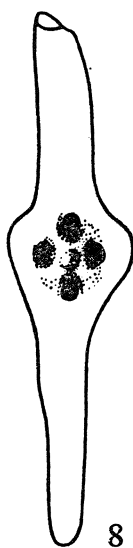
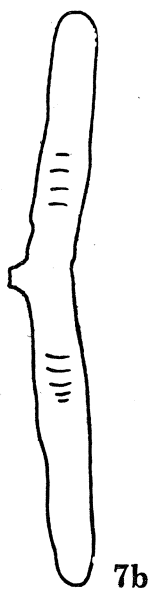
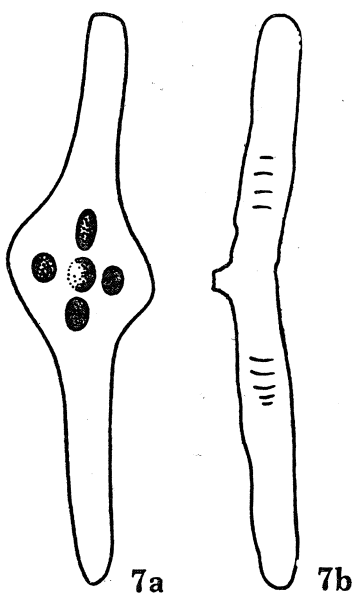
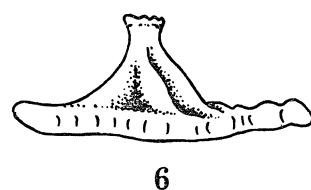
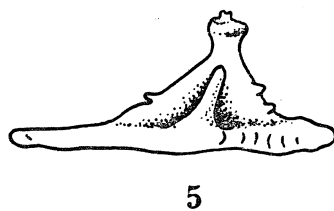
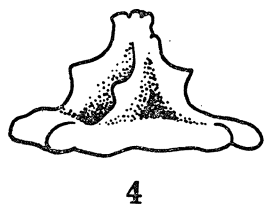
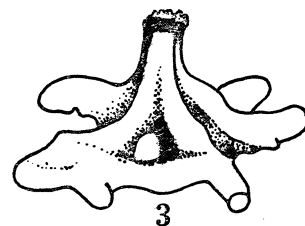
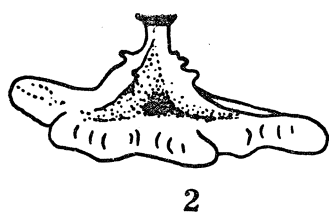
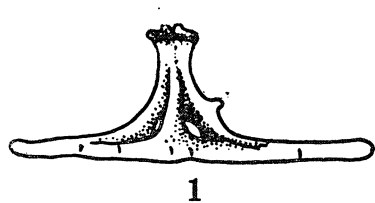
H. Górka, L. Łuszczewska

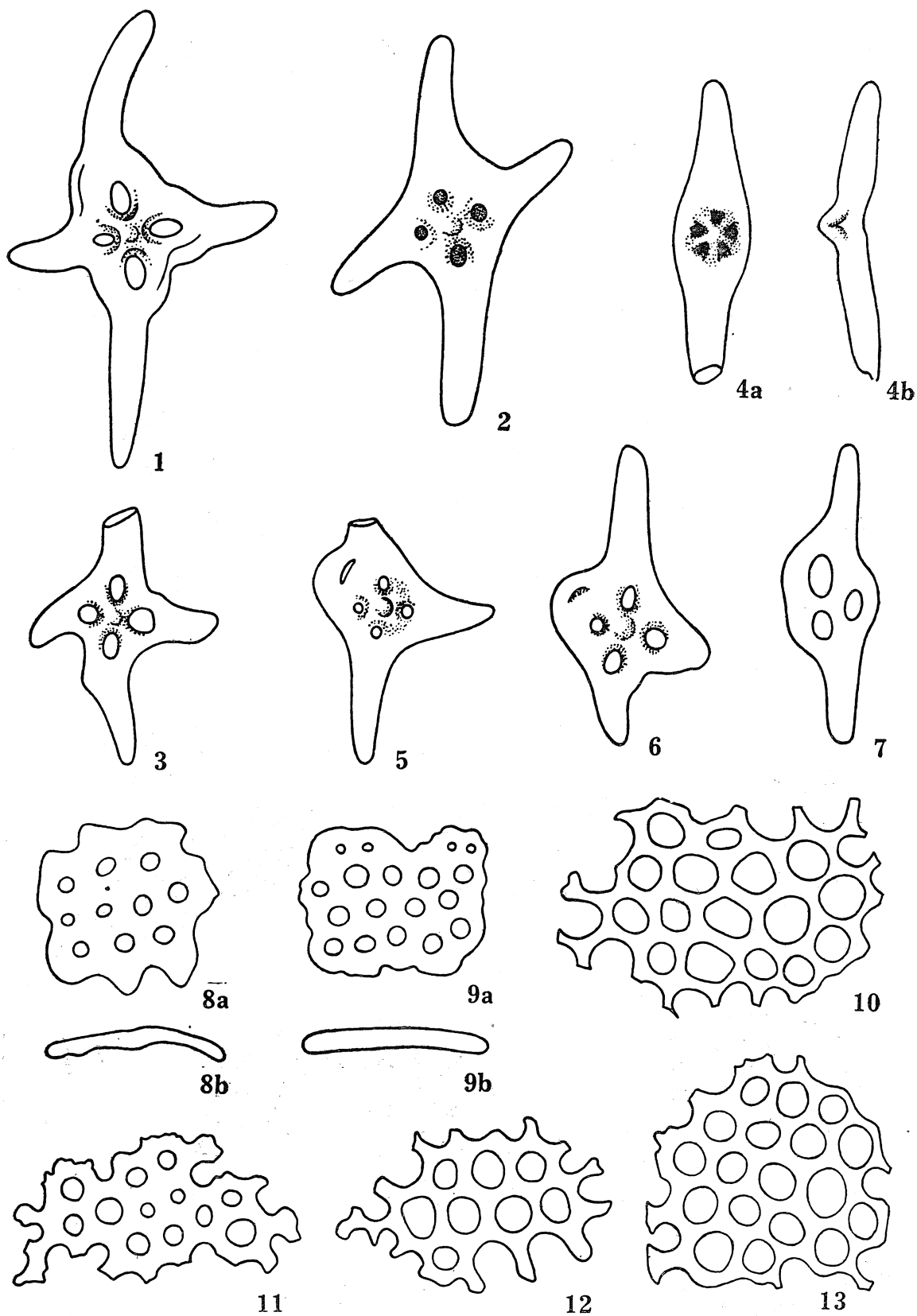


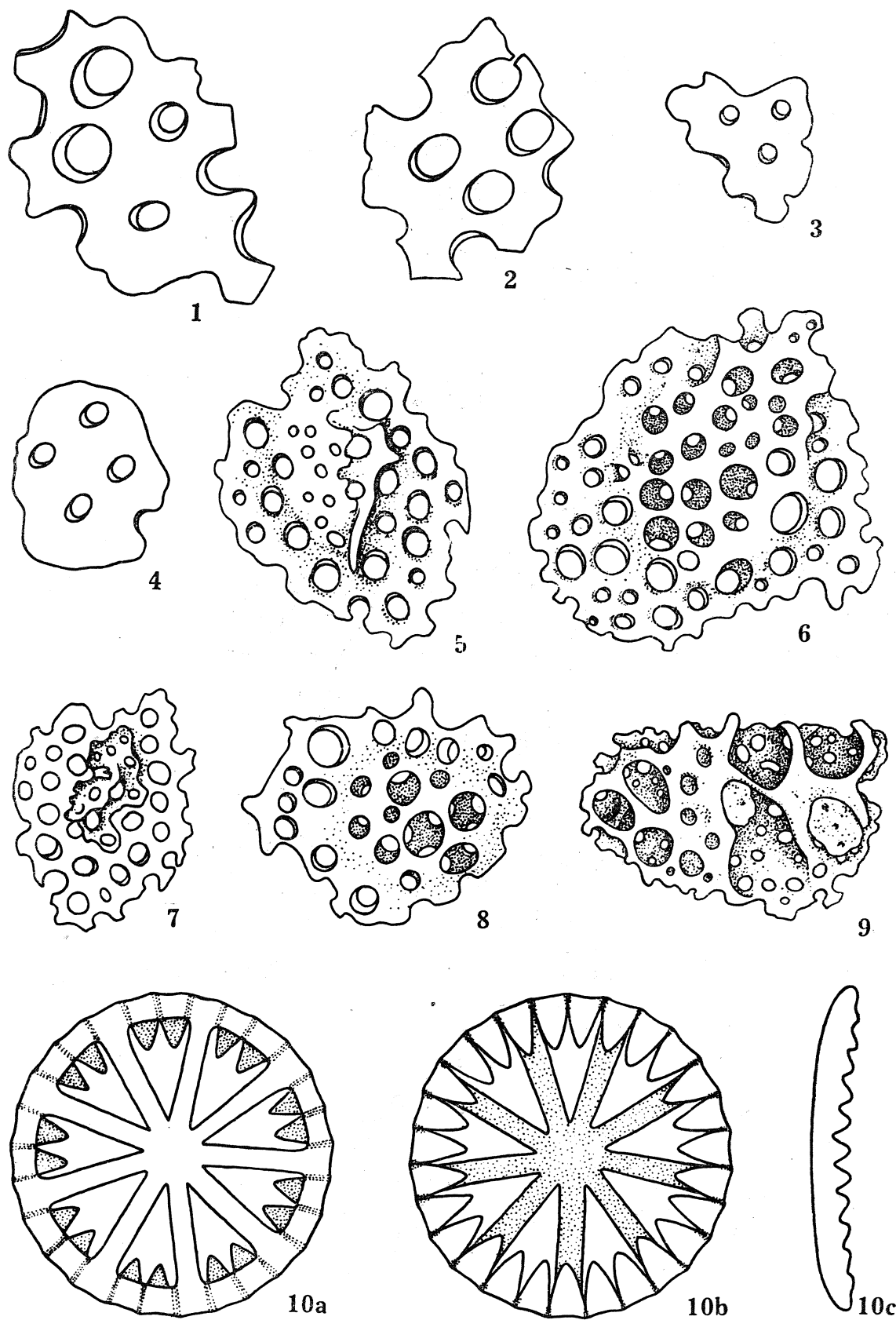


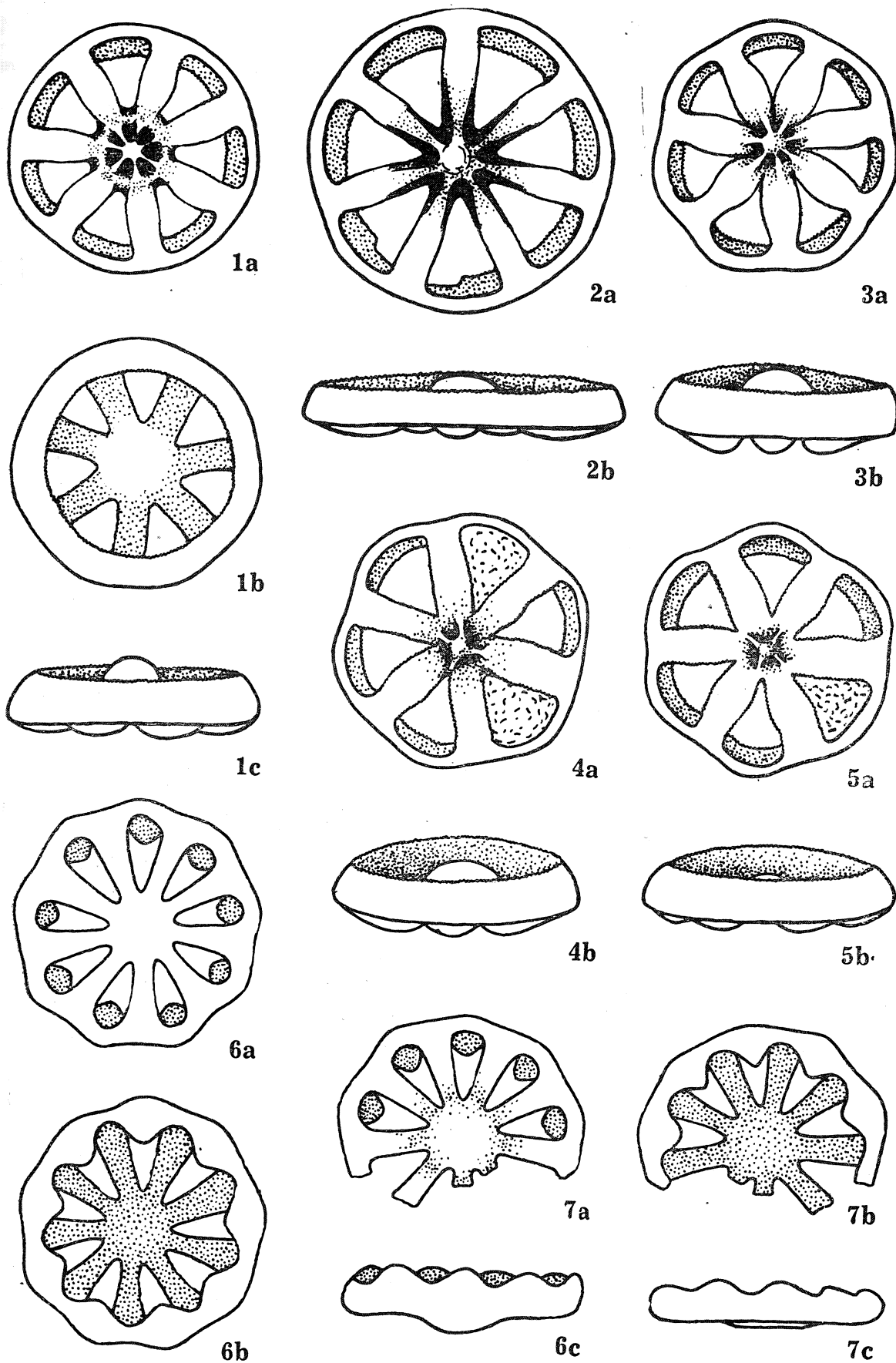












H. Górka, L. Łuszczewska

