Siboga-Expeditie

THE PORIFERA OF THE SIBOGA-EXPEDITION

I

THE GENUS PLACOSPONGIA

BY

G. C. J. VOSMAER AND J. H. VERNHOUT

With five plates

Monographie VI*a* of:

UITKOMSTEN OP ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

verzameld in Nederlandsch Oost-Indië 1899—1900

aan boord H. M. Siboga onder commando van Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER

Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig onderzoek der Nederlandsche Koloniën)

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ENTREPRISES AUX INDES NÉERLANDAISES ORIENTALES en 1899—1900,

à bord du SIBOGA

SOUS LE COMMANDEMENT DE G. F. TYDEMAN

PUBLIÉS PAR MAX WEBER

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Gray described (1867 β p. 127—129) a very remarkable sponge for which he established the new genus *Placospongia*. "The bodies have much the appearance of the underground rhizome of a plant, with a number of scars whence leaves or flowering branches have separated; but when more closely examined, it will be found that what appears to be a scar is a separate plate. And when so examined they have so much the appearance of a very large kind of Nullipore or Melobesia that, when I first observed them, I believed that they were probably corals covered with large plates of a Melobesia . . . ." Gray called, therefore, the species melobesioides. The author further states that "the sponge (is) hard, angular, stony, angularly branched", that it is composed of a solid axis of siliceous globules, around which is a layer of "sarcode", which is then "covered with variously shaped hard plates of similar tubercular siliceous globules". Bundles of pin-shaped spicules run from the axis towards the periphery.

This description, accompanied by a woodcut, sufficiently enables us to recognize the sponge at once.

Though specimens of Placospongia have been studied by many spongiologists, our knowledge of the anatomy of this genus is still very insatisfactory. This may be due to the fact that only a few specimens, perhaps not even well preserved, were at the disposal of the investigators. The Siboga, however, has brought home a fine collection of numerous specimens.

Externally, the two species we found in this collection, cannot be distinguished from each other; nor could we find specific differences with regard to the canal-system. And yet, two species must be accepted on account of the spiculation, viz. *melobesioides* and *carinata*. We will first describe the external appearance and the general anatomy of both these species together, and afterwards treat separately on their spiculation.

I. EXTERNAL APPEARANCE OF PLACOSPONGIA MELOBESIOIDES AND CARINATA. (Pl. I, fig. 1—9).

Shape. Fullgrown specimens seem to be always branching. The diameter of the branches is variable; in some specimens they are of about the same size (figs. 3 and 8), in others they differ considerably (fig. 1). Though the branches are usually more or less cylindrical, it happens not unfrequently that they are flattened in one direction (163 a)[1]. In several cases the ramification is markedly dichotomous (1033, 1848, 1849 a, 1849 b), in other cases it is more irregular (311 b, 311 c, 311 e, 311 f); both may be seen in one and the same specimen (1850, 1851). Concrescence of neighbourhing branches is often seen. When young, the sponge seems to be incrusting (fig. 4); in fig. 3 a crust (*a*) is seen to have produced lateral branches. Though we have reason to believe that the whole complex of branches in older specimens may grow in an erect position, we are almost certain that in one case the branches have been growing in a horizontal position. This specimen (1847) is illustrated in fig. 8. The bottom on which it was dredged, is said to consist of "sand, small stones and shells." We see our sponge attached to such a mass of sand and shells; it is of course most probable that such a comparatively loose mass simply lay on the bottom. Consequently the place where the sponge is attached, is the upper part, and the Placospongia, therefore, grew in a horizontal direction.

Surface. As no spicula are projecting beyond the surface, this is smooth; it shows usually very distinct, numerous carinae, which are especially conspicuous if in a longitudinal direction. A closer examination shows that the carinae are the borders of a system of grooves, which form a kind of network on the surface. The meshes of this network are composed of hard cortical plates usually showing a polygonal shape, and somewhat concave. In the ridges or grooves a large number of incurrent apertures (stomata) and a few large, excurrent ones (procts) are situated. The size of the cortical plates is very variable. — On some parts of the surface small tubercles are visible; these are, at least for the greater part, incipient branches. — The surface is frequently covered with Bryozoa, Tunicata, Algae etc.; likewise visible on the surface, holes are very often met with, occupied by some species of Cirripedia (fig. 5, *a*).

Size. It is rather difficult to judge about the exact size our sponges can reach, for none of the large specimens are quite uninjured. The total height of our largest fragment is 36 cm. (1849 a), i. e. almost twice as much as the largest specimen known hitherto. The greatest diameter of the branches does not correspond with this, as will be easily seen from the following

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1) These numbers indicate the running numbers of the specimens.

table. The figure in the second column represents the maximum dimension — as a rule the height, but e. g. in specimen 1847 (fig. 8) the distance between the two extremities. In the first column are the running numbers of the specimens: 163 a to 1857 for *P. carinata*, 660 a to 1853 for *P. melobesioides*.

Running number.	Max. size in cm.	Max. diam. in cm.	Colour (in spirit).
163 a	7.8	2	light red-brown.
163 b		0.9	white.
311 b	23	4	dark red-brown.
311 c	23		" " "
311 e	17	4	" " " & white.
311 f	19.5	4.5	" " "
577	crust.		light " "
1004	9	1.5	dark " "
1458	6.5* [1])	0.9	white.
1500	0.2 (crust)		light purple.
1848	12*	1	white.
1850	30	2.5	dark red-brown.
1852	11		" " "
1854	11	1.5	" " "
1855	6.5*	0.8	" " "
1856	12	1.3	" " "
1857	8	1.5	dark purple.
660 a	2.7	1.3	light red-brown.
660 b	crust.	3.5	" " "
660 c	4.5	5	" " "
1033	6.7	1.5	dark purple.
1847	16*	1.2	purple.
1849 a	36	1.5	white.
1849 b	19	1.2	"
1851	16.5*	2	red-brown.
1853	17.5		white.

Colour. In the fourth column of the above table we have noted the colour of *Placospongia melobesioides* and *carinata*, judged from the material preserved in alcohol. But Professor Weber informs us that the specimens had about the same colour when alive. It seems that all the known species of Placospongia appear in two colours, viz. purplish red and pale buff. The two specimens from which Gray originally made his description were "chalky white" and "pale purplish red." The purplish red we observe in various shades, lighter or darker, more bluish or brownish red, etc., etc. A very remarkable fact it is, observed already by Thiele (1899 p. 9), that red specimens, when quite dry, have a pale buff or dirty white colour, which again turns red after moistening. We shall see presently that the red colour resides in the sterrospirae. A few specimens (e. g. 311 e) show white (i. e. pale) portions amidst the general red colour. The above mentioned grooves are of a yellowish colour.

1) * Entire, uninjured specimens.

Additional remarks. A very striking feature of Placospongia is that it is very hard and stony, owing to the fact that it possesses a thick siliceous axis, and a similar cortex, both composed of closely packed sterrospirae.

II. GENERAL ANATOMY. (Pl. II—III).

A transverse section through a branch of *P. melobesioides* or *carinata* (Pl. V, fig. 8) shows a sharply marked cortex at the periphery and a likewise sharply marked axis in the centre of the parenchyma. This is especially distinct in red specimens; axis and cortex are red-brown, whereas the parenchyma is of a yellowish tint. It will, however, easily be seen that the red cortex is not continuous; it is interrupted in several places by almost white bands, about 1 mm. broad. These interruptions of the red cortex are nothing but the longitudinal grooves, cut transversely, which, although belonging to the cortex are destitute of sterrospirae. One may count ten or more such places on a transverse section, dividing the whole cortex into as many portions of unequal size. SOLLAS (1888 Pl. XL, fig. 7) and KELLER (1891 Pl. XVIII, fig. 30) give illustrations of transverse sections, apparently of young branches, for in both cases the cortex is only divided into four portions. The general outline of transverse sections is, however, as a rule, not square but polygonal. The outline of the axis is not a circle but a lobed figure. It is in some sections continuous with the cortex, which represents a beginning of ramification. — From the axis we can, still with the unassisted eye, easily see white bundles (of tylostyles), radiating towards the periphery.

A longitudinal section (Pl. V, fig. 9) shows, mutatis mutandis, the same. Only we see here the red cortex less frequently interrupted, and, if so, the cortical grooves are generally cut longitudinally and consequently of much greater dimensions.

As stated before, the incurrent apertures are situated in the grooves. These are in most specimens exceedingly narrow, owing to the contraction of the cortical fibres. In one specimen, however, they were but little contracted and we have, therefore, chosen this specimen (*P. melobesioides* 1033) for the greater part of our drawings. The numerous stomata are the entrances of narrow canals, some of which unite with neighbouring canals, and form somewhat wider ones, but they debouch all into two or three longitudinal canals (Pl. II, fig. 6; Pl. III). From these canals start others in more or less radial direction and enter the parenchyma. They are in communication with each other by circular canals, which are sometimes very long indeed. The system of incurrent canals in one groove may communicate in the parenchyma with that of another groove (Pl. II, fig. 2; Pl. III). From the moment the canals enter the parenchyma, they give off much narrower branches, which ramify and terminate by means of prosodi into ellipsoid-shaped mastichorions [1]). From here the water is moved through aphodi into narrow excurrent canals,

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1) We propose to call a region, bearing choanocytes, as e. g. in Leucosolenia: mastichore; the localised small regions, known as ciliated or flagellated chambers, we wish to call mastichorions, in order to have a shorter expression which can be used in every language. The words are derived from μάστιξ, flagellum and χώρα, dimin. χωρίον, region.

which debouch into wider, more or less longitudinal canals, in order to terminate in a few main excurrent canals, opening by a simple proct, situated in one of the grooves (Pl. II, fig. 5). We are, however, bound to say that we are not quite sure whether the canal represented in fig. 5 is really an excurrent one. In the large number of transverse, longitudinal and tangential sections we prepared, we could find but very seldom anything resembling an excurrent apparatus, neither was there seen on the sponge surface any larger aperture, which might belong to the excurrent system. We have several times made sections through apertures we observed on the surface of the sponge and which might be excurrent openings. Almost always these turned out to be of quite another nature; generally they were holes of animals living in the sponge. One of the most probable main excurrent canals opening on the surface is the one figured on Pl. II. There was nothing against the supposition. The specimens at our disposal — like those of previous authors — are generally so much contracted that the grooves appear simply as yellowish lines between the red cortical plates. As stated above, the specimen 1033 (Pl. I, fig. 5) was not so much contracted; here we could study the incurrent canal system, and, once acquainted with it, we could easily understand the sections made of contracted specimens. Unfortunately specimen 1033 did not show anything like excurrent apertures. That the system of canals, described above, really belongs to the incurrent one, we have a right to suppose because of the abundance of apertures with which it begins. Series of sections prove that the incurrent canals intercommunicate over large regions; since we found other canals between them *not* communicating directly with the former ones, we concluded the latter to be excurrent. The narrow ramifications of both are situated near each other, but they do not fuse. Though in such a case we could not actually state it, we must conclude, that the somewhat elongated mastichorions with which prosodi and aphodi are seen in contact, really do communicate with the two systems of canals, just mentioned.

Keller says (1891 p. 325): "Da Rindenporen fehlen, so dienen die schlitzförmigen Oeffnungen der Kanten zur Einfuhr und Ausfuhr des Wassers. Unter jeder Platte befindet sich ein weiter Raum von vierseitig-prismatischer Gestalt, welcher die Hälfte des Schwammkörpers beansprucht. Ob er als riesiger Subdermalraum oder als Gastralraum zu deuten ist, muss ich unentschieden lassen, für die erstere Auffassung spricht der Umstand, dass die schlitzförmigen Oeffnungen nicht direkt in denselben einmünden." We cannot agree with these statements. Obviously Keller's specimens were much contracted. What he calls "schlitzförmige Oeffnungen" are nothing but folds of the contracted grooves. Consequently the true incurrent apertures ("Rindenporen") are not absent, but situated at the bottom of the fold. As to the "weiter Raum" we believe this to be a hole, which has been occupied by some commensalistic animal, of which our specimens at least are crowded. We found especially Cirripedia (Balanus?) and Polychaeta. See, e. g., in fig. 2 (Pl. II) the large hole on the left hand side. Whether such holes are made by the parasite or not, we are not prepared to say. In many cases Polychaeta certainly occupy canals; this was e. g. the case in the widened portions of the canals marked *i. c.* in figs. 2 and 6 on Pl. II. Why those canals are so much wider, must remain an open question. Is the canal widened by the animal living in it, or could the canal not contract so much as in other places, through the presence of the parasite?

The skeleton of *Placospongia melobesioides* and *carinata* (Pl. II, fig. 2) consists of a very hard central axis, composed of sterrospirae [1]; bundles of tylostyles radiate from the axis towards the periphery, without projecting beyond the surface. The chief mass of the cortical skeleton consists, like the axis, of densely packed sterrospirae. In the parenchyma a large quantity of these spicules are found in various stages of development. It seems, therefore, that they are formed in the parenchyma in order to be transported towards the axis and the cortex, where the adult ones are deposited. Lining the distal part of the cortex, as well as the greater part of the canals, very minute spicula are found which are different in the two species. Entering the cortex at places where there are grooves, the bundles of tylostyles split up into thinner bundles (Pl. II, fig. 6). Tangential sections through the proximal portion of the cortex show us the distribution of such bundles (Pl. II, fig. 4*b*). In the distal portion of the grooves the tylostyles, much smaller here, project somewhat beyond the surface, being arranged in the shape of reversed cones.

The tissue of the cortex is always distinctly separated from that of the parenchyma. The greater part is so crowded with sterrospirae, that hardly anything else is visible; only in the most proximal part circular fibres may be seen. In the grooves a rather complicated system of contractile fibres is met with, especially in the proximal three quarters. Here we observe numerous fibres, arranged concentrically, and in addition to these some groups of fibres in other directions: longitudinally, obliquely, radially. We have given illustrations of these contrivances in figs. 1 and 3 on Pl. II. The same sort of fibrous bundles accompany the radiating bundles of tylostyles (Pl. III).

So far *P. melobesioides* and *carinata* agree. With regard to the spiculation there are striking differences. In *P. melobesioides* the dermal spiculum is a spherule, generally smooth, sometimes slightly roughened or otherwise modified. In *P. carinata* this spiculum is a microspira (reduced sigmaspire or spinispire?). In the latter species we find numerous spinispirae with short axis and long spines (the spirasters, metasters or plesiasters of Sollas), whereas these spicula are entirely absent in *P. melobesioides*. Since these facts are absolutely constant and never show any transition, we are obliged, according to the views of Hugo de Vries, to distinguish two species.

III. THE STERROSPIRAE OF PLACOSPONGIA.

Gray, the father of the genus *Placospongia*, compared the "siliceous globules" of his new genus with the so-called "ovaria" (sterrasters) of Geodia; this view was generally accepted, till Keller wrote (1891 p. 298): "Analysirt man die Kieselkugeln näher, so ergiebt sich sofort, dass dieselben aus Spirastern hervorgegangen sind. Man findet im Schwamm-gewebe zwischen Kugeln, Spirastern und bedornten Stäben alle möglichen Zwischenformen."

1) Cf. p. 7.

These statements were confirmed by LENDENFELD (1894 δ p. 115): "die Geodia-Sterraster gehen aus kleinen Stechapfelförmigen Kugeln mit zahlreichen, ungemein feinen, streng konzentrischen und unter einander gleich grossen Strahlen hervor; während die Jugendstadien der Placospongia-Sterraster gekrümmte, dornige Stäbe sind. Demnach wäre der Geodia-Sterraster als eine polyaxone, der Placospongia-Sterraster aber als eine monaxone Nadel aufzufassen."

HANITSCH described (1895 p. 214—216) a new sponge, *Physcaphora decorticans*. Here he found "a new type of microscleres" for which he proposed the name "selenasters." These spicules correspond in position, according to the author, to the sterrasters of Geodidae. There are however fundamental differences. "In the youngest condition present the spicules had the shape of rods, nearly straight or slightly twisted, beset with minute spines. . . . . In the next stage the spicule is still pretty straight, but the spines are large and numerous, although still distinctly separated. . . . . In the next stage, the spicule has already its typical sausage-shape, the spines are very closely set, but still recognisable in their individuality. . . . . The last stage is the full-grown selenaster, in which the spines, except their most distal ends, are all fused so as to form one solid mass. . . . . The distal ends of the spines project a short distance beyond the surface of the spicule, and being polygonal, chiefly hexagonal in transverse section, offer a delicate pattern, when the spicule is being focussed at different depths. A hilus is present as in the Sterrasters. We thus see a great resemblance in the structure and development of Sterrasters and Selenasters. The chief difference is that in the Sterrasters all rays start from a point, whilst in the Selenasters the rays start from a line." From this description, which is accompanied by several figures it becomes evident that the selenasters of HANITSCH are the same sort of spicules as the sterrasters of Placospongia described by KELLER and LENDENFELD. Moreover, we shall see that THIELE (1900 p. 72) was right in identifying Physcaphora with Placospongia.

Unaware of the paper of HANITSCH, LENDENFELD (1897 p. 51) called the spiculum under consideration "pseudosterraster." As the two names may easily create confusion, because the spicula are monaxons and not polyaxons, we prefer to use the new name, sterrospira, proposed by one of us (VOSMAER, 1902 p. 111). A detailed description and a few illustrations of the development of these sterrospirae are finally given by LINDGREN (1898 p. 362—364; Pl. 18, fig. 21—22). This author likewise was not acquainted with the paper of HANITSCH nor with that of LENDENFELD (1897). He is, therefore, wrong in supposing that neither a description nor sufficient illustrations existed concerning the sterrospira.

The observations of previous authors agree in the main points, and on the whole we can but confirm them. It is, therefore, superfluous to give detailed descriptions; our figures better illustrate our observations and easily show how far we agree with KELLER, HANITSCH, LENDENFELD and LINDGREN. On Pl. IV, fig. 5 α—ζ we have illustrated the mode of development for *Placospongia melobesioides*; in fig. 9 λ—σ, and on Pl. V, fig. 1 α—ϑ the same for *P. carinata*. For these two species there is neither in the mode of development, nor in the final result any marked difference. True, neither the early stages, nor the adult ones are always absolutely the same. But the differences are not bound to one species or the other. In the early stages differences are seen e. g. in the way of spinulation. If we compare fig. 1 α on Pl. V with fig. 5 α on Plate IV we see that in the former case the centre of the rod is almost destitute of spines, whilst these reach already a considerable length at the two extremities; whereas in the second case the rod is almost equally spined over its whole length. This difference in spinulation may be observed not only in the very first stages, but also later (Pl. V, fig. 1 β—δ). We have, for some time, believed, that this was something of a specific character, as the terminal spinulation is specially and very distinctly seen in *P. carinata*. But on the other hand it must be stated that in *P. carinata* equal spinulation likewise occurs (Pl. IV, fig. 9 λ—σ).

We have seen that, according to KELLER, the early stages of the sterrospirae are "spirasters," or "gekrümmte, dornige Stäbe;" and HANITSCH says that the axis is "nearly straight or slightly twisted." Evidently the twisted character is best seen in very early stages; the more the spines grow and fuse by soldering silica, the more difficult is it to observe the twist. And yet it can be observed in many cases even of almost fullgrown spicula. This can, however, better be seen in the preparations by allowing the spicula to roll slightly, than in drawings. [Cf. Pl. IV, fig. 9 π; fig. 15 β—δ. Pl. V, fig. 1 ε, ζ; fig. 2; fig. 3 β; fig. 5]. In very young stages it is easily seen, though the torsion is never great. Everybody will agree that such spicula as illustrated on Pl. IV, fig. 5 α, β; fig. 10 ζ, η; Pl. V, fig. 3 α; fig. 4, are, according to the old nomenclature "spirasters," or, according to our terminology spinispirae. There can hardly be any doubt that these are young sterrospirae, for in *P. melobesioides* no adult spinispirae occur and in *P. carinata* they are of another character than the adult "spinispirae." Moreover, we find a great many gradual transitions from young sterrospirae, having the shape of spinispirae, to the adult ones. Just as in adult spinispirae the twisted character is seen sometimes more, sometimes less distinctly, simulating simple, curved or almost straight, spined rods, so we find exactly the same in the spinispirae, which are but early stages of sterrospirae. We consider the sterrospirae of Placospongia as modifications of spinispirae, as spicula belonging to the group which one of us (VOSMAER l. c. p. 105) has called α-spiraxons, because in favourable cases and very accurate focussing this is certainly the case.

The remarkable appearance of the surface of adult sterrospirae is already observed by OSCAR SCHMIDT (1870 p. 72) and his observations are in the main confirmed by everybody. That there is variation with regard to the dimensions of the free portion of the spines, is certain. On Pl. V, fig. 1 η and ϑ we have given outlines of two sterrospirae from one and the same specimen (**311 b**). On the left hand side of the figures is drawn the surface view; on the right hand side in fig. 1 ϑ is drawn the view a little lower than the tops of the spines, i. e. about at their base. This is, however, only seen in some cases. The explanation of these different views seems to be this, that between higher, free portions of spines there are lower ones. Focussing at the top the lower ones are not seen, except sometimes the shadow of the sides, creating a network-design of smaller meshes within one larger mesh. Focussing at the base, they are all seen as closely packed circles. The side view in such cases is then as in fig. 1 ϑ on the right hand side.

Somewhat different in shape are the sterrospirae of *Physcaphora decorticans* Hanitsch, called by the author "selenasters," and those of *Placospongia graeffei* Ldfd., called by the author "pseudosterrasters." As far as we may judge from the statements of these two spongiologists, both selenasters and pseudosterrasters, are only elongated forms of sterrospirae, not spicula sui generis [1]).

Another peculiarity of the sterrospires of *Placospongia melobesioides* and *P. carinata* is that they are often coloured.

It is indeed astonishing that nobody has ever mentioned this fact. Not only is it — as far as we know — the only example of coloured spicula in Sponges, a fact very common in calcareous spicula of some Alcyonaria — but the colour of the Placospongia itself is due *only* to the colour of the sterrospirae. However, not every sterrospira is coloured, and the intensity of stain is not always the same, though there is not much difference in this respect. Roughly speaking we can say that there are sterrospirae, colourless like other spicula, and others which, seen under the microscope, have about the colour of a living red blood corpuscule. Both kinds are mixed, and the total colour of the sponge depends on the percentage of coloured sterrospirae. In "red" sponges this percentage is about 100%, in "white" specimens almost or quite 0% (**163 b**).

In a glass tube filled with dry, isolated [2]), coloured sterrospirae, these look in reflected light, like very fine sand of a flesh colour. When moistened they turn red. As the red colour of the sponge is only due to the sterrospirae, dried specimens will always look white or flesh-coloured; the red specimens will, after moistening, turn red, the others remain pale. Neither alcohol, nor potash, nor muriatic acid destroys the colour. The turning red of dry specimens by moistening is a physical, not a chemical phenomenon.

IV. THE SPECIES OF PLACOSPONGIA.

Five species are described as belonging to *Placospongia*; a sixth is called *Physcaphora decorticans*. These six species can, however, be reduced to three, viz. *Placospongia carinata*, *P. melobesioides* and *P. decorticans*.

1. *Placospongia carinata* (Bwk.) Rdl. Pl. I, fig. 1—4; Pl. II, fig. 5; Pl. IV, fig. 9—13; Pl. V, figs. 1, 5, 7—9, 11.

Running numbers: **163 a, 163 b, 311 b, 311 c, 311 e, 311 f, 577, 1004, 1458, 1500, 1848, 1850, 1852, 1854, 1855, 1856, 1857.**

Synonymy and literature.

Geodia carinata — *Placospongia carinata*.
1858 (*z*) Bowerbank pp. 308, 314. Pl. XXV, fig. 19; Pl. XXVI, fig. 10.
1861 Ehrenberg (tabul. view opposite p. 452).

1) Cf. about the identity of *Physcaphora decorticans* and *Placospongia graeffei* infra p. 15.

2) In spicula of a red specimen treated with muriatic acid, washed out and half dried, it is easy almost to isolate the sterrospirae. They are the first to sink to the bottom of the vessel; if the water is then drained off and almost evaporated, the shining white tylostyles can be most easily separated from the underlying reddish sterrospirae.

1864 Bowerbank pp. 234, 254. Pl. X, fig. 163.
1867 Gray p. 548.
1868 Gray p. 168.
1868 Bowerbank p. 132.
1874 (*z*) Bowerbank p. 298—299. Pl. XLVI. fig. 1—5.
1875 Bowerbank p. 295.
1879 (*y*) Carter p. 148—149.
1884 Ridley pp. 376, 481.
1888 Sollas p. 272—273. Pl. XL, fig. 7.
1897 Lindgren p. 485.
1898 Lindgren pp. 327—328, 365, 366, 368. Pl. 18, fig. 26*a—d, b'*.
1900 Thiele p. 72—73.

Placospongia intermedia Soll.
1888 Sollas p. 272—273.
1891 (*z*) Keller pp. 324, 326.
1897 Lendenfeld p. 52.
1898 Lindgren p. 365—368.

According to SOLLAS *P. intermedia* is distinguished from *P. carinata* 1° by the presence of the spheraster, and 2° by the absence of the "remarkable spiraster which characterises the latter species". We shall see below that the presence or absence of spherasters is not a constant character. Both in *P. carinata* and in *P. melobesioides* spherasters are never very abundant; in some specimens they are exceedingly rare and in some we failed to find them at all. — As to the "remarkable spiraster" of *P. carinata*, we found that there is no fundamental difference between forms with smooth spines and those in which the primary spines are provided with secondary ones in various ways (Cf. infra p. 12). It seems to us that the "spirasters..... distinguished by a short thick spire and large conical spines," and which SOLLAS says were found in *P. intermedia*, are nothing but our parenchymal spinispirae. If this be so, the conclusion must be that *P. intermedia* is synonymous with *P. carinata*.

Placospongia mixta Thiele.
1900 Thiele p. 72—73. Pl. III, fig. 25*a—e*.

This "new species" is made after a single incrusting specimen of three centimeters, and is said to form a connecting link between the "other species," possessing "ähnliche Spiraster wie *P. carinata* und ziemlich grosse Sphaeraster von der Art, wie sie SOLLAS von *P. intermedia*, merkwürdigerweise aber auch von *P. melobesioides* erwähnt." After what we said about the spherasters of *C. intermedia*, it follows that *P. mixta* is another synonym of *P. carinata*.

Locality and Depth.

Stat. 99. 6° 7'.5 N., 120° 26' E. 16—23 M. [1458].
Stat. 164. 1° 42'.5 S., 130° 47'.5 E. 32 M. [311 b, 311 c, 311 e, 311 f, 1004, 1848, 1850, 1852, 1854, 1855, 1856, 1857].
Stat. 213. Saleyer. up to 36 M. [577].
Stat. 250. Kur-Island. 20—45 M. [1500].
Stat. 273. Aru-Islands. 13 M. [163 a, 163 b].

For external appearance and general anatomy, see p. 2—6.

Spicula.

1. Tylostyle. (Pl. IV, fig. 9 α—κ; fig. 13 α—ζ). The tylostyles of *P. carinata* may be distinguished into corticalia and parenchymalia. The former occur in the peripheral portion of the grooves, the latter radiate in bundles from the axis to the cortex (Pl. IV, fig. 2). The parenchymalia terminate usually (but not always) somewhat obtusely (Pl. IV, fig. 9 ι, κ), whereas the corticalia terminate in a sharp point. THIELE states the same for "*P. mixta.*" — The following table shows the variety in size (in μ).

Specimen.	Cortical tylostyli.			Parench. tylostyli.	
	min.	max.	average.	max.	majority.
163 a	146	281	219	770	625
163 b	219	386	271	969	833
311 b	229	333	281		
311 c	219	292	260		
311 e	166	302	215	1125	770
311 f	198			1115	802
577	218	416	312	1250	1040
1428	301	405	343	1040	894
1500	260	426	343		

Neither SOLLAS nor LINDGREN makes any mention of two sorts of tylostyli, which nevertheless most certainly exist [1]). We have taken our measurements from the cortical tylostyli after transverse and longitudinal sections through the grooves. These measurements can be taken without serious difficulty; but the same cannot be said of the parenchymal tylostyles, as these occur in thick bundles. The length of these spicula, we have taken from preparations of isolated spicula. In how far in such cases certain spicula were cortical or parenchymal could not always be ascertained. Hence we have only given the maximum sizes, and an average of the majority. We learn from the above list that the cortical tylostyli vary between 146 μ. and 426 μ., whereas their average in the specimens gives 281 μ. The average of the parenchymal tylostyles varies between 625 μ. and 1040 μ. If then we are told by SOLLAS that the tylostyles are 1000 μ., whereas LINDGREN gives 780 μ., we conclude that these authors have measured parenchymal tylostyles only. On the other hand it is probable that the size given by SOLLAS for the tylostyles of the incrusting *P. intermedia* (470 μ.) is an average taken from a young specimen in which more small (i. e. cortical) tylostyles were present than long (parenchymal) tylostyles, which latter prevail in large, branching (adult) specimens. THIELE found for the small (cortical) tylostyles of *P. mixta* 200 μ. for the large (parenchymal) tylostyles 750 μ., a fact which agrees pretty well with our own observations.

1) THIELE (1900 p. 73) was the first to observe this for his *P. mixta*; he does not mention, however, the fact that the two sorts occur in different parts of the sponge.

2. Sterrospira. (Pl. IV, fig. 9λ—τ, ω—αα; fig. 14; fig. 15α—δ. Pl. V, fig. 1α—ϑ; fig. 7α—β; fig. 11). As stated before, there is a great difference in aspect between the early stages and the fullgrown spicula (Cf. p. 8). There is no striking and constant difference between the sterrospirae of *P. carinata* and *P. melobesioides*. Usually they are more or less kidney- or beanshaped, sometimes almost ellipsoidal; very frequently restricted in the centre of the "long" axis — i. e. *the* axis of the original young stage (spinispire). The size is less variable than in *P. melobesioides*.
3. Parenchymal spinispira. (Pl. IV, fig. 9ββ—ζζ; fig. 10α—ε; fig. 11β—γ; fig. 12β—γ; fig. 13η—ι). Although by far the great majority of these spicula occur in the parenchyma, a few may be found here and there in the grooves. They can easily be distinguished from the dermal spinispirae (microspirae) by their much larger size and quite different appearance. The spines are very long compared to the axis of the spiculum, and are very variable in shape. They are smooth or spined; the secondary spines are found either on the whole primary spine, or only at the top. As we observed manifold transitions between the smooth spines and those e. g. in specimen **1500** (Pl. IV, fig. 12γ) we cannot make specific distinctions on this account. Sometimes we found even in one and the same specimen spinispirae with smooth spines and others with secondary spines, e. g. in specimen **163 e** (Pl. IV, fig. 9ββ—ζζ), or spinispirae with secondary spines, placed irregularly, while others possess spines "subdivided near the end into simple or bifid cladi" as Sollas described for *P. carinata*; this is e. g. the case in specimen **1458** (Pl. IV, fig. 13η—ι).
4. Microspira. (Pl. IV, fig. 9υ—ψ; fig. 10ϑ—ν; fig. 11δ—κ; fig. 12α). The microspirae are smooth or slightly spined. They are very minute and a very high power is necessary in order to understand their true shape. They vary considerably in size and shape, as can be best demonstrated by the illustrations. Comparing however a large number of them it becomes evident that they are α-spiraxons, which in some cases become very much reduced; though never so far as to form anything like a spherule. Transitions between these spicula, which Sollas called microstrongyles, and those which the same author called spherules we have never met with, although we have paid special attention to them. (Cf. infra p. 15). We agree with Lindgren that Sollas described a part of the young stages of sterrospirae likewise under the name of microstrongyles. The true ones, for which we prefer to take the name microspirae, proposed by one of us (Vosmaer 1902 p. 110), belong to the typical dermalia; they occur as a thin sheet of about two layers at the outer surface of the sponge, distally from the cortical sterrospirae; this sheet is continuous over the grooves. In the distal portion of the cortex they literary fill up the spaces between the sterrospirae (Pl. V, fig. 11). As typical dermalia they line the peripheral canals, forming only a single layer, but a very dense one. In the deeper parts of the sponge they are less abundant in the walls of the canals; often it seemed to us that the excurrent canals have less microspires in their walls than the incurrent ones. At the sponge-surface as well as in the walls of the canals they are situated with their (longitudinal) axis parallel to the surface or the canal.
5. Spheraster. (Pl. IV, fig. 11α). In our specimens spherasters are rare or absent. It may be that in the latter specimens (**1458**, **1500**) spherasters are still present in other parts of the

sponge than those we took for microscopical examination, although this is not probable. They have the shape as described by SOLLAS for *P. intermedia*: "a spherical centrum covered with small tent-like spines". Spherasters occur as well in the parenchyma as in the cortex; in the latter case they generally occupy a peripheral place.

2. *Placospongia melobesioides* Gray. Pl. I, fig. 5—9; Pl. II, figs. 1—4, 6; Pl. III; Pl. IV, fig. 1—8; Pl. V, figs. 2—4, 6, 10, 12.

Running numbers: 660 a, 660 b, 660 c, 1033, 1847, 1849 a, 1849 b, 1851, 1853.

Synonymy and literature.

Placospongia melobesioides.
1867 (β) Gray p. 127—129, with woodcut.
1867 Gray p. 549.
1868 Gray p. 168.
1869 Wright p. 322.
1870 Schmidt p. 72; Pl. VI, fig. 15—17.
1875 Carter p. 198.
1879 (γ) Carter p. 148—149.
1879 (α) Carter p. 356.
1880 Carter p. 53—55.
1880 Schmidt p. 75.
1880 Sollas pp. 241, 245.
1881 (α) Carter p. 384.
1882 Carter p. 357—358; Pl. XII, fig. 33.
1886 Buccich p. 222.
1888 Sollas pp. CXLIII, CL, 271, 273.
1889 (α) Dendy p. 20.
1891 (α) Keller p. 324—326; Pl. XVIII, fig. 29—31.
1893 (β) Topsent p. 177.
1896 Kieschnick p. 534.
1897 Lendenfeld pp. 52—54, 152, 155, 159, 161, 169, 187—190, 229, 232. Pl. VI, fig. 47; Pl. VII, fig. 66.
1897 Lindgren p. 485.
1897 Topsent pp. 424, 433.
1898 Lendenfeld p. 207.
1898 Lindgren pp. 326—327, 361, 365—368. Pl. 18, figs. 21, 22, 27.
1898 Topsent p. 123.
1899 Thiele pp. 5, 9, 18. Pl. III, fig. 6*a*.
1900 Kieschnick pp. 574, 577; Pl. XLIV, fig. 2.
1900 Thiele pp. 56, 72.

[According to WRIGHT (1869 p. 322) *Acamas violacea* Duch. & Mich. is closely allied to *Placospangia melobesioides*; it seems to us that neither in the description, nor in the illustration in DUCHASSAING & MICHELOTTI's paper (1864), can any argument be found in favour of WRIGHT's view.]

Locality and Depth.

Stat. 43. 7° 12'.6 S., 118° 7'.7 E. Up to 36 M. [660 a, 660 b, 660 c].
Stat. 164. 1° 42'.5 S., 130° 47'.5 E. 32 M. [1847, 1849 a, 1849 b, 1851, 1853].
Stat. 240. 4° 12' S., 129° 20'.4 E. 9—45 M. [1033].

For external appearance and general anatomy, see p. 2—6.

Spicula.

1. Tylostyle. (Pl. IV, fig. 1 α—ϑ; fig. 2 α—δ; fig. 6 α—ζ; fig. 8 α—ε). On the whole the tylostyles of *P. melobesioides* resemble those of *P. carinata*. We can likewise distinguish cortical and parenchymal tylostyles, and also terminate the latter more obtusely (Cf. Pl. IV, fig. 2). For the size (in μ) the following table may be sufficient.

Specimen.	Cortical tylostyli.			Parench. tylostyli.	
	min.	max.	average.	max.	majority.
660 a	281	509	364	946	821
660 b	250	395	312		
660 c	197	353	291		
1033	270	385	322	1081	936
1849 a	218	437	322	1250	967
1849 b				1050	925

As in the case of *P. carinata*, previous authors did not distinguish cortical and parenchymal tylostyles, and the measurements of the tylostyles in general are, therefore, of little value for comparison with our observations.

2. Sterrospira. (Pl. IV, fig. 1 ι—λ; fig. 5 α—ζ; fig. 7 α, ζ—η, ι; Pl. V, fig. 2—4; fig. 6; fig. 10; fig. 12). We have seen in our general account of the sterrospirae how far they are distinguished from those of *P. carinata*. The greater variety in size which we pointed out p. 12 is best seen by comparing fig. 10 with fig. 12 on Pl. V.

3. Spherula. (Pl. IV, fig. 3; fig. 4; fig. 6 η. Pl. V, figs. 10, 12). Although variable in size as fig. 3 demonstrates, the spherules remain always very minute; they are smooth, roughened or even spined; in one case (1849 a) they often seemed to have the shape of an asterisk (Pl. IV, fig. 6 η). They replace the microspires of *P. carinata*; like them they are typicaliy dermal, lining the external sponge surface and the canals in the way described above for the microspires. It is a very remarkable fact that they occur abundantly in the parenchyma; not separately however, but in groups (Pl. V, figs. 13 and 14), as observed already by previous authors. We are inclined to believe that such groups represent early stages of development — perhaps they originate in a single cell — and are afterwards transported towards the periphery or the canals where they become isolated.

4. Spheraster. (Pl. IV, fig. 7 β; fig. 8 ϑ and $\varkappa$. Pl. V, fig. 10). Exactly as in *P. carinata* the spherasters in *P. melobesioides* are rare or absent. They are absent — at least we failed to find them — in 1849 b and 1033; on the other hand they are relatively frequent in 660 a and 660 b.

*3. *Placospongia decorticans* (Hanitsch) Thiele[1]).

Synonymy and literature.

Physcaphora decorticans — Placospongia decorticans.
1895 Hanitsch pp. 205, 214—216; Pl. XIII, fig. 2—3.
1900 Thiele p. 72 (*Physacophora decorticans* is apparently a misprint for *Physcaphora decorticans*).

Placospongia graeffei.
[1894 (♂) Lendenfeld p. 115.]
1897 Lendenfeld pp. 48—52, 152, 155, 158, 161, 163, 183, 187, 189, 229, 231, 235. Pl. VI, fig. 48; Pl. VII, fig. 61; Pl. VIII, fig. 88—92.
1900 Thiele p. 72.

Thiele has pointed out that the sponge described by Hanitsch under the name of *Physcaphora decorticans* is a Placospongia and identical with *Placospongia graeffei* of Lendenfeld. The latter author in 1894 only mentioned the name; therefore the specific name cannot be considered to date from 1894 but from 1897 and the name *decorticans* has consequently the priority.

It seems to us that there can be hardly any doubt as to the specific identity of *decorticans* and *graeffei*; but likewise no doubt, judging from what we know at present, that *P. decorticans* is a third species, differing from *P. carinata* and *P. melobesioides* as regards the shape of the sterrospira.

Carter and Keller are of opinion that *Placospongia carinata* and *melobesioides* form one species. Herein we differ from them. Both species have the same external appearance and the same general anatomy. Both possess tylostyles and sterrospirae to which may be added spherasters. On the other hand *P. carinata* has numerous parenchymal spinispirae, which are totally absent in *P. melobesioides*, and the dermal spiculum in *P. carinata* is a microspire, whereas in *P. melobesioides* it is a spherule. Keller says (l. c. p. 326): "Da ich bei dem von mir untersuchten Stück alle möglichen Kieselkörper auffinde, so muss ich die Artberechtigung von *P. carinata* und *P. intermedia* bezweifeln und halte sie für Varietäten von *P. melobesioides*." Lindgren (1898 p. 367—368) has correctly shown that the "für P. carinata typischen choanosomalen Spiraster" do not occur in Keller's specimen, which he considers as *P. melobesioides*. Keller states further (l. c. p. 325): "auch finde ich bei dem untersuchten Exemplar in verschiedenen Schnitthöhen bedeutende Unterschiede," viz. with regard to the spiculation. We have taken the trouble to isolate spicula of some of our specimens "in verschiedenen Schnitthöhen," but we found exactly the same set of spicula. Finally Keller says that transitions between spherules ("Mikrosphaere") and microspirae ("Mikrostrongyle, Stäbchen") are not rare ("nicht gerade selten"). In spite of the most careful examination with oil-immersion we never found any such transition.

1) Species with a * are not represented in the Siboga-Collection.

V. GEOGRAPHICAL AND BATHYMETRICAL DISTRIBUTION OF PLACOSPONGIA.

ATLANTIC. — Gulf of Mexico, Florida (Schmidt). — Puntas Arenas (Carter). — W. Coast of Portugal (Hanitsch). — Adriatic (Buccich, Lendenfeld).

PACIFIC. — "South Sea" (Bowerbank).

INDIC. — Mahé (Wright). — Gulf of Manaar (Carter). — Ceylon, Bass Rocks (Carter). — Gulf of Aden, Tadjoura (Topsent). — Red Sea (Keller).

INDIAN ARCHIPELAGO. — Borneo (Gray). — Ternate (Kieschnick). — Amboina (Topsent). — Strait of Casper (Lindgren). — Celebes (Thiele). — Torres-Strait (Ridley). — Straits of Malacca (Bowerbank). — Flores Sea (Siboga-Expedition Stat. 43, 213). — Sulu Sea (Siboga-Expedition Stat. 99). — Arafura Sea (Siboga-Expedition Stat. 164, 273). — Banda Sea (Siboga-Expedition Stat. 240, 250).

The greatest depth wherein Placospongia is found reaches 117 M. (?), according to CARTER; several are found in shallow water. The largest quantity is found by the Siboga on the W. Coast of New Guinea (Station 164) in a depth of 36 M.

Whereas *Placospongia decorticans* is found in the Adriatic and on the W. Coast of Portugal, *P. carinata* and *P. melobesioides* occur in the tropics between 30° N. and 20° S. of the aequator.

VI. SYSTEMATIC POSITION OF THE GENUS PLACOSPONGIA.

Well aware of the peculiarities of Placospongia, GRAY [1]) created for the new genus, the family Placospongiadae (1867 p. 549). He placed this family as nearest related to the Geodiadae under the order Sphaerospongiadae. Many authors, SCHMIDT, SOLLAS, TOPSENT, HANITSCH and even MINCHIN (1900 p. 148) believe in the close relation of Placospongidae and Geodidae. CARTER however, suggested, (1875 p. 198) that they were nearer to the Suberitidae. KELLER (1891 *a*) was the first to demonstrate that the "sterrasters" of Placospongia develop from "spirasters" and he placed the genus therefore to the "Spirastrellidae." Herein he is followed in the main points by LENDENFELD, THIELE, KIESCHNICK and DELAGE (1899 p. 170). It seems to us that there can be no doubt that Placospongia has nothing to do with Geodidae, that it does not belong to the Tetractinellida but to the Monactinellida, probably near to the Clionidae. The difinition of the genus may then be: Sponge incrusting or branching; the branches consist of a solid axis of sterrospirae, around which lies the soft parenchyma. Cortex hard, chiefly composed of sterrospirae. Stomata and procts situated in cortical grooves, which are destitute of sterrospirae. Spicula: 1° parenchymal tylostyles in radiating bundles; 2° cortical tylostyles at right angles to the surface; 3° sterrospirae; 4° the dermal spiculum is a spherule or a microspira; 5° parenchymal spinispirae in some species; 6° spherasters in some specimens.

1) Gray (1867) was the first, *not* SOLLAS (1888) as LENDENFELD (1894 *b* p. 114) erroneously suggests.

LIST OF REFERENCES.

1858 (α) BOWERBANK. Cf. Philos. Trans. R. Soc. London. CXLVIII.
1861 EHRENBERG. Cf. Monatsber. Akad. Berlin.
1864 BOWERBANK. Cf. Monogr. Brit. Spong. I.
1864 DUCHASSAING & MICHELOTTI. Cf. Natuurk. Verh. Maatsch. Haarlem. XXI.
1867 (β) GRAY. Cf. Proc. Zool. Soc. p. 127 etc.
1867 —— Cf. Proc. Zool. Soc. p. 492 etc.
1868 BOWERBANK. Cf. Proc. Zool. Soc.
1868 GRAY. Cf. Ann. & Mag. N. H. (4) I.
1869 WRIGHT. Cf. Quart. Journ. Microsc. Sc. IX.
1870 SCHMIDT. Cf. Grundz. Spong. Fauna Atl. Geb.
1874 (α) BOWERBANK. Cf. Proc. Zool. Soc. London.
1875 —— Cf. Proc. Zool. Soc. London.
1875 CARTER. Cf. Ann. & Mag. N. H, (4) XVI.
1879 (γ) —— Cf. Ann. & Mag. N. H. (5) III, p. 141 etc.
1879 (α) —— Cf. Ann. & Mag. N. H. (5) III, p. 284 etc.
1880 —— Cf. Ann. & Mag. N. H. (5) V and VI.
1880 SCHMIDT. Cf. Spong. Meerb. Mexico.
1880 SOLLAS. Cf. Ann. & Mag. N. H. (5) V.
1881 (α) CARTER. Cf. Ann. & Mag. N. H. (5) VII.
1882 —— Cf. Ann. & Mag. N. H. (5) IX.
1884 RIDLEY. Cf. Rep. Zool. Coll. Alert.
1886 BUCCICH. Cf. Bull. Soc. Adriat. Sc. Nat. Trieste. IX.
1888 SOLLAS. Cf. Challenger Rep. Zoology. XXV.
1889 (α) DENDY. Cf. Proc. R. Soc. Victoria. N. S. I.
1891 (α) KELLER. Cf. Zeitschr. Wiss. Zool. LII.
1893 (β) TOPSENT. Cf. Bull. Soc. Zool. France. XVIII.
1894 (δ) LENDENFELD. Cf. Biol. Centralbl. XIV.
1895 HANITSCH. Cf. Trans. Liverpool Biol. Soc. IX.
1896 KIESCHNICK. Cf. Zool. Anzeig. XIX.
1897 LENDENFELD. Cf. Nova Acta Acad. Leop. Carol. LXIX.
1897 LINDGREN. Cf. Zool. Anzeig. XX.
1897 TOPSENT. Cf. Rev. Suisse Zool. IV.
1898 LENDENFELD. Cf. Zool. Centralbl. V.
1898 LINDGREN. Cf. Zool. Jahrb. Abt. Sept. XI.
1898 TOPSENT. Cf. Bull. Soc. Scient. Ouest.
1899 DELAGE. Cf. DELAGE & HÉROUARD. Traité de Zoologie concrète.
1899 THIELE. Cf. Zoologica. Heft. 24.
1900 KIESCHNICK. Cf. Denkschr. Medic. Naturw. Ges. Jena. VIII.
1900 MINCHIN. Cf. Ray Lankester. Treatise on Zoology. Part. II. Porifera.
1900 THIELE. Cf. Abh. Senckenb. Naturf. Ges. XXV.
1902 VOSMAER. Cf. Versl. gew. vergad. Kon. Akad. Wetensch. Amsterdam.

EXPLANATION OF PLATES

PLATE I.

Fig. 1—4. *Placospongia carinata.*

Fig. 1 (311 b). Entire specimen, branched; about $^1/_2$ size.
Fig. 2 (1458). Entire specimen, covered here and there by corals and calcareous algae; nat. size.
Fig. 3 (1848). Entire specimen, incrusting in *a*, with lateral branches; nat. size.
Fig. 4 (577). Incrusting specimen; nat. size.

Fig. 5—9. *Placospongia melobesioides.*

Fig. 5 (1033). Portion of a branched specimen, with wide grooves; *a* holes, occupied by Balani; $\times 3^1/_2$.
Fig. 6 (660 c). Fragment of specimen with very indistinct grooves and carinae; nat. size.
Fig. 7 (660 a). Idem; *a* axis.
Fig. 8 (1847). Entire specimen, attached in the centrum, with two lateral branches; nat. size.
Fig. 9 (660 b). Incrusting specimen; nat. size.

Siboga-Expeditie VI[a] Vosmaer & Vernhout. Placospongia.

Vernhout phot.

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Fig. 8 (1847). Entire specimen, attached in the centrum, with two lateral branches; nat. size.
Fig. 9 (660 b). Incrusting specimen; nat. size.

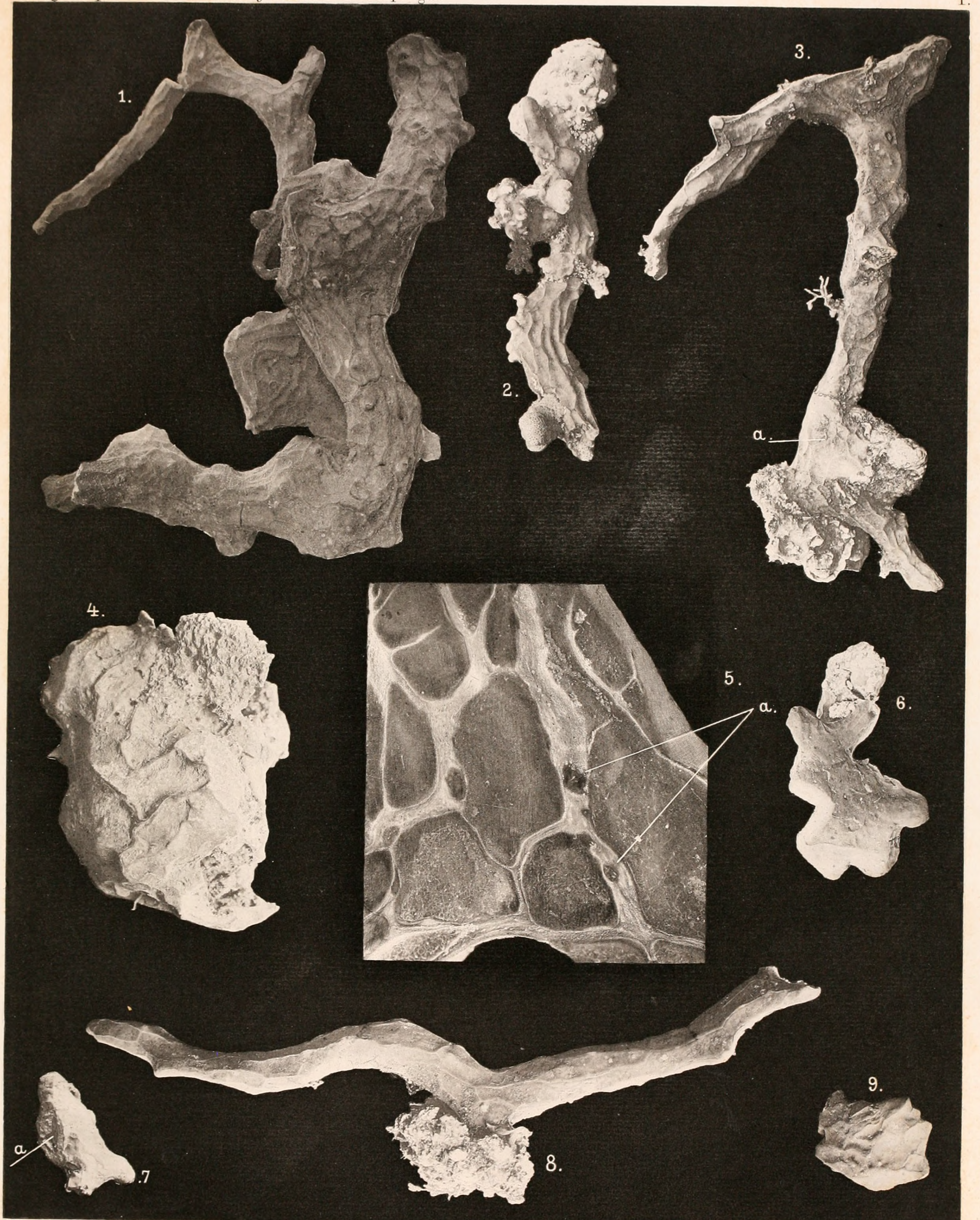

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PLATE II.

Fig. 1 (1033). *Placospongia melobesioides.* Cortical tissue of groove, transverse section; *a* concentrical fibres, *b* groups of longitudinal fibres; × 96.

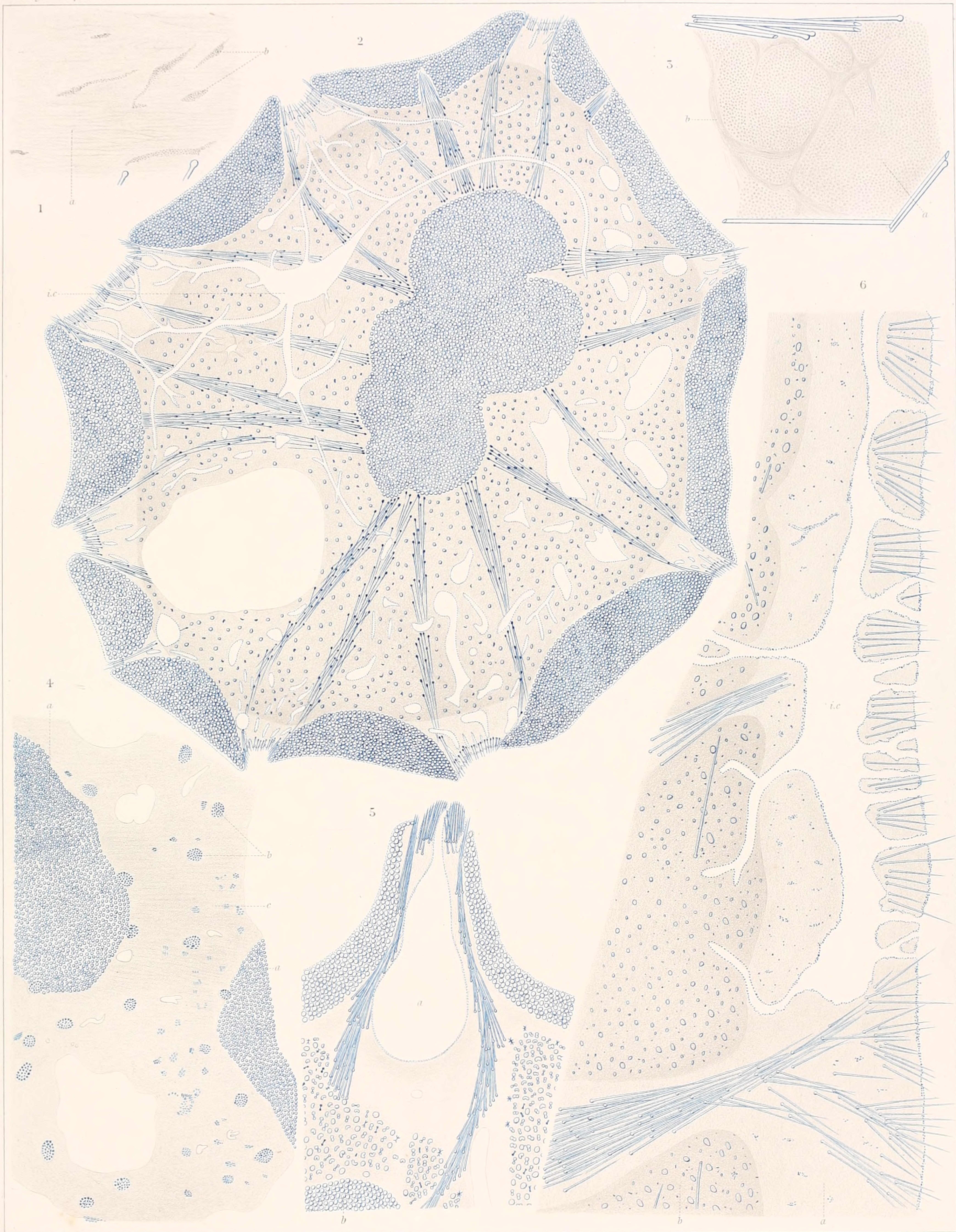
Fig. 2 (1033). *Placospongia melobesioides.* Transverse section through a branch; *i. c.* incurrent canal; × 14.

Fig. 3 (1033). *Placospongia melobesioides.* Cortical tissue of groove, longitudinal section; *a* concentrical fibres, *b* non-concentrical fibres; × 96.

Fig. 4 (1033). *Placospongia melobesioides.* Tangential section through cortex; *a* layer of sterrospirae; *b* radial bundles of tylostyles; *c* fibrous tissue of groove; × 14.

Fig. 5 (1458). *Placospongia carinata.* Transverse section through a portion of a branch; *a* supposed main excurrent canal with proct in longitudinal section; *b* axis; × 24.

Fig. 6 (1033). *Placospongia melobesioides.* Longitudinal (radial) section through a groove, showing the system of incurrent canals *(i. c.)*; *a* cortex; *b* parenchyma; × 48.



V & V fec.

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

PLATE III.

Portion of fig. 2 on Pl. II (corresponding with *i. c.*); *i. c.* incurrent canals; *e. c.* excurrent canals; *a.* axis; × 48.

V & V. fec.

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

PLATE IV.

Fig. 1—8. *Placospongia melobesioides.*

Fig. 1 (1033). α—δ Parenchymal tylostyles, ε—ϑ cortical tylostyles, ι—λ sterrospirae; × 96.

Fig. 2 (1033). α—β Portions of parenchymal tylostyles; γ—δ portions of cortical tylostyles; × 360.

Fig. 3 (1033). Spherules of different size; × 1000.

Fig. 4 (1033). Idem; × 1400.

Fig. 5 (1033). α—ζ Different stages of development of sterrospira; × 1000.

Fig. 6 (1849 a). α Tylostyle from the parenchyma; β tylostyle from the cortex; × 96. γ—δ Extremities of tylostyle α; ε—ζ cortical tylostyles; × 360. η Modified spherules; × 1400.

Fig. 7 (1849 b). α Early stage of sterrospira; β spheraster; × 1000.

Fig. 8 (660 a). α—β Parenchymal tylostyles; γ cortical tylostyle; × 96. δ—ε Portions of id.; × 360. ζ—η Sterrospirae; ϑ two spherasters; × 96. ι Young stage of sterrospira; ϰ spheraster; × 1000.

Fig. 9—15. *Placospongia carinata.*

Fig. 9 (163 a). α—ζ Parenchymal tylostyles; η—ϑ cortical tylostyles; × 96. ι—ϰ Portions of parenchymal tylostyles; λ—τ different stages of development of sterrospira; × 360. υ—ψ Microspirae; ω—αα two stages of development of sterrospira; ββ parenchymal spinispira; × 720. γγ Id. × 1000. δδ—ζζ Id. × 720.

Fig. 10 (311 b). α—δ Spinispirae; × 500. ε Id. × 1000; ζ—η probably early stages of sterrospira; × 1400. ϑ—ν Microspirae; × 1000.

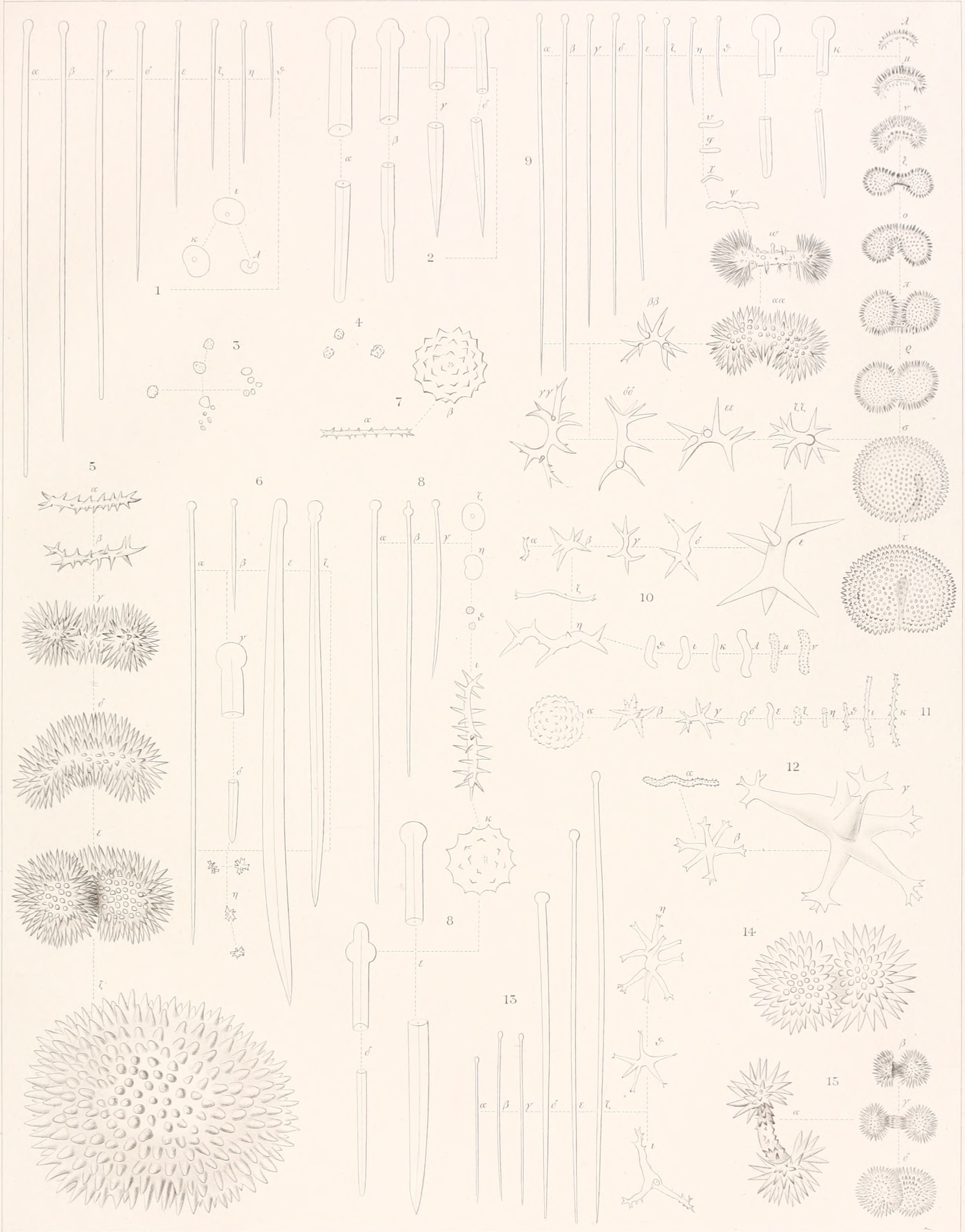
Fig. 11 (577). α Spheraster; β—γ spinispirae; δ—ϰ microspirae; × 500.

Fig. 12 (1500). α Microspira; × 1000. β Spinispira; × 500. γ Idem; × 1400.

Fig. 13 (1458). α—γ Cortical tylostyles; δ—ζ parenchymal tylostyles; × 96. η—ι Spinispirae; × 500.

Fig. 14 (163 b). Stage of development of sterrospira; × 1000.

Fig. 15 (311 b). α—δ Four stages of development of sterrospira; α × 1000; β—δ × 360.



V & V. fec.

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

PLATE V.

Fig. 1 (311 b). *Placospongia carinata.* α—ζ six stages of development of sterrospira; η and ϑ adult sterrospirae; the outline and the surface view only partly indicated; × 1400.

Fig. 2 (1849 a). *Placospongia melobesioides.* Early stage of sterrospirae; × 1000.

Fig. 3 (1849 a). Id. id. × 1000.

Fig. 4 (1849 b). Id. id. × 1000.

Fig. 5 (311 f). *Placospongia carinata.* Early stage of sterrospira; × 360.

Fig. 6 (1849 a). *Placospongia melobesioides.* Outline of adult sterrospira; × 360.

Fig. 7 (577). *Placospongia carinata.* Id.; × 360.

Fig. 8 (311 f). Id. α—γ Transverse sections through a branch; × 2.

Fig. 9 (311 f). Id. Longitudinal section through a part of a branch; nat. size.

Fig. 10 (660 a). *Placospongia melobesioides.* Transverse section through the distal part of the cortex; × 360.

Fig. 11 (163 b). *Placospongia carinata.* Id.; × 360.

Fig. 12 (1033). *Placospongia melobesioides.* Id.; × 360.

Fig. 13 (1033). Id. Portion of parenchyma with two young sterrospirae and six groups of spherules; × 360.

Fig. 14 (1033). Id. Portion of proximal part of cortex (groove) with a group of spherules.

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Voor de uitgave van de resultaten der Siboga-Expeditie hebben bijdragen beschikbaar gesteld:

De Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën.

Het Ministerie van Koloniën.

Het Ministerie van Binnenlandsche Zaken.

Het Koninklijk Zoologisch Genootschap »Natura Artis Magistra" te Amsterdam.

De »Oostersche Handel en Reederij" te Amsterdam.

De Heer B. H. DE WAAL, Oud-Consul-Generaal der Nederlanden te Kaapstad.

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1°. L'ouvrage du „Siboga" se composera d'une série de monographies.

2°. Ces monographies paraîtront au fur et à mesure qu'elles seront prêtes.

3°. Le prix de chaque monographie sera différent, mais nous avons adopté comme base générale du prix de vente: pour une feuille d'impression sans fig. flor. 0.15; pour une feuille avec fig. flor. 0.20 à 0.25; pour une planche noire flor. 0.25; pour une planche coloriée flor. 0.40.

4°. Il y aura deux modes de souscription:
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Dans ce dernier cas, le prix des monographies sera majoré de 25 %.

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