SIBOGA-EXPEDITIE.

Siboga-Expeditie

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)

BOEKHANDEL EN DRUKKERIJ

VOORHEEN

E. J. BRILL

LEIDEN

Siboga-Expeditie
VI a[1]

THE

PORIFERA OF THE SIBOGA-EXPEDITION

II

THE GENUS SPIRASTRELLA

BY

Dr. G. C. J. VOSMAER
Professor in Leyden

With fourteen plates

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II.

THE GENUS SPIRASTRELLA

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I. DEFINITION OF THE GENUS SPIRASTRELLA.

The genus *Spirastrella* was established by OSCAR SCHMIDT (1868 p. 17) for a "nova species" (*S. cunctatrix*), characterised by possessing "in der Rindenschicht eine eigenthümliche Art von strahligen Kieselkörperchen, deren Strahlen spiralig gestellt sind". These spicules are now called spinispirae[1]). RIDLEY (1884 p. 467) accepted the new genus and correctly said that it must receive all "those free compact Suberitidae, with skeleton spinulate, whose flesh-spicule is a modified stellate...."[2]) RIDLEY & DENDY gave (1886 p. 490) a short diagnosis of the genus, which they fundamentally retained in the Monaxonida of the Challenger (1887 p. 229): "Sponge usually massive. Megasclera all monactinal, stylote or tylostylote. Microsclera spined spirulae, occurring mainly as a dermal crust". The authors state, that the genus contains many species, to which "the Challenger adds three new ones". In 1888 (p. 57) and 1890 (p. 398) LENDENFELD slightly modified the diagnosis. KELLER (1891 *α* p. 322—323) defines *Spirastrella* as follows: "Krustige oder massige Spongien mit wenig cavernösem Gewebe, welche in äusseren Habitus an Suberites erinnern. Spongin spärlich oder fehlend. Megasklere sind tylostyl. Mikrosklere

1) VOSMAER 1902 p. 108.

2) It is clear what RIDLEY meant; I have shown, however, that the spicule under consideration is **not** a modified aster (1909 *α* p. 642—648).

sind als Spiraster vorhanden, welche eine besondere Rindenschicht erzeugen können. Übergänge von Spiraster zu Aster bisweilen vorhanden. Kanalsystem nach dem vierten Typus". In 1897 (p. 217) LENDENFELD again modified the diagnosis: "Massige oder Krusten-bildende, freie, nicht bohrende Spirastrellidae mit einfacher, nicht wabiger oder papillöser Oberfläche und glattrandigen Osculis. Mit tylostylen Megascleren und Spirastern, dornigen Microrhabden, oder Amphiastern". TOPSENT (1898 β p. 100 and 1900 p. 107) adopts on the whole the definition of RIDLEY & DENDY adding, however, that the megascleres sometimes are "tornotes". With exception of the latter clausule most authors agree with him. No one, however, till now has undertaken to enumerate which sponges described by previous authors should be received by the genus *Spirastrella*. Nor do we find much about the anatomy of single species, still less about comparative anatomy. Apart from good (or bad) descriptions of the skeleton and its spicules, we hardly find anything about the soft parts and the canalsystem. Whereas KELLER says that (in *S. decumbens*) it is built "nach dem vierten Typus", LENDENFELD states that (in *S. bistellata*) the mastichorions are "kuglig oder oval" and that "sie münden direkt mit weiter Öffnung in die ausführenden Kanäle, welche ungefähr ebensoweit als die einführenden sind". Any distinct illustration, demonstrating how the author supposes that things are, is absolutely wanting. I thought it, therefore, useful to try to fill the gap since I had such a rich material at my disposal as the Siboga brought to light. It has shown me once more how valuable it is to collect as many specimens as possible — as will be shown hereafter. But I wish to draw attention also to another fact, which I strongly recommend future collectors to take to heart: I mean the necessity of not only preserving many specimens in the strongest alcohol, but also of rapidly drying specimens. The majority of sponges we find in our musea are in the dry state. For identification it is often necessary to be able to compare them with likewise dried specimens. The external aspect may undergo such changes, that a prima vista a dried and an alcohol-specimen sometimes hardly resemble each other.

As far as I can judge I found in the Siboga collection 40 or 50 bottles, containing together about 80 specimens, which I believe to be Spirastrellae; in addition there are about ten dry specimens. Some of these I thought I could identify with sponges described by former authors: BOWERBANK, CARTER, DENDY a. o. At a closer examination I found, however, considerable differences in spiculation, where the external appearance showed the most striking resemblance and vice versa. I thought it advisable in order to settle the question, to pay a visit to the British Museum. I feel greatly indebted to my friends S. F. HARMER and R. KIRKPATRICK for the kind way they received me and the great help they gave me in putting the wanted specimens at my disposal. Nor shall I forget my visit to the nestor of spongiologists, my old friend Canon A. MERLE NORMAN in Birkhamstead, to whose liberality I owe several valuable preparations. The result has been, that in most cases I could consult the type specimens and compare them with the Siboga Collection. All in all I carefully examined more than 125 specimens; I arrived at the conclusion that, with a few exceptions, they represent but one single species. Indeed an exceedingly variable species. A priori nobody would have said so who saw the various specimens; not even I who again and again arrived at the conclusion that sponges vary ad infinitum. As is shown in the lists, given hereafter, there are, described, as far as I know, 36 species of *Spirastrella*; about 8 species, placed into other genera ought to be included; hence we have 44 species. Some of these are quite insufficiently described to allow us to form an opinion; others cannot remain under *Spirastrella* because of their spiculation. Of the remaining 34 there are two, *S. coronaria* and *S. spinispirulifer*, about which it is open to discussion whether they are to be considered as species of our genus or as belonging to a separate genus. The rest, according to me, represent specimens of one species: *S. purpurea*.

Provisionally we may give the following diagnosis of the genus:

Sponge encrusting; or cushion-shaped, with or without tuberculiform to digitiform or conical processes; or massive, irregularly spherical. Canal system eurypylous. Skeleton mainly composed of bundles of styles or (and) tylostyles. Typically there is a dermal crust of spinispirae, but in some cases these spicules are exceedingly scarce or even wanting altogether.

It seems to me beyond doubt that the nearest ally of *Spirastrella* is the well-known genus *Cliona*. Whereas the latter begins its post-larval life by boring into calcareous matter, *Spirastrella* never does so. Both genera agree in their typical spiculation: tylostyles (resp. styles) and spinispirae; they agree also in the fact that the latter spicules may become scarce and finally disappear. This is very disappointing for dogmatical taxonomists; but it is a fact with which I am acquainted since long and to which I believe TOPSENT first drew attention in 1888. If I state, that I learned this truth more than twenty-five years ago, when in Naples I studied the development of a certain Desmacidonid sponge, it is by no means to make a desperate trial for priority, but to show how the phenomenon is not a speciality of *Cliona* and *Spirastrella*, and how TOPSENT and myself independently arrived at the same result. RIDLEY suggested (1884 p. 468) whether *Cliona* and *Spirastrella* justified a generic separation. I think the answer must be affirmative. In spite of TOPSENT (1909 p. LXX) I likewise retain *Poterion* as a genus. All three are closely allied, but they are generically different. I am quite satisfied that TOPSENT admits my short statement, that *Poterion* begins its life as a "boring sponge". I may add now, that in the course of my investigations I discovered that at least once it is found in its boring state by other authors, viz. by RIDLEY & DENDY and described by them (1887 p. 224—229) under the name *Cliona dissimilis*. TOPSENT seems to me, however, "plus royaliste que le Roy" if he calls the Neptune's cup "*Cliona patera*". Am I wrong if I suppose that TOPSENT never examined well preserved alcohol-specimens of *Poterion*? I cannot discurs the matter fully now, as long as I have not yet published my observations after good sections of *Poterion*, and I can only say that there are sufficient anatomical grounds to keep *Poterion* and *Cliona* apart. I beg my French colleague to postpone his judgement, hoping for a little more clemency than in the case of the identity of *Cliona celata* and *viridis*, the arguments wherefore he frankly states to wait for "sans la moindre confiance".

Cliona, *Spirastrella* and *Poterion* all have in common that they are highly polymorph according to circumstances. In their early youth the first and the third live in holes made by themselves in calcareous matter; the second covers as a thin coat foreign objects, as it seems likewise prefering calcareous matter, as Coralline Algae, (old) Corals etc.; it does not bore holes, but it insinuates itself in every fissure or gap, which happens to be formed on the surface. If circumstances are favourable the three genera may grow beyond their substratum and reach considerable sizes. In this respect *Cliona* the least, unless *Raphyrus hixonii* of LENDENFELD (1886 p. 562) turns out to be a "free" *Cliona*. In this latter state the genus forms irregularly spherical masses and never assumes a proper shape, nor processes of any length or characteristic shape. *Poterion* on the contrary typically forms cups, showing a distinct difference on its outer and inner wall: the incurrent apertures are on one side, the excurrent ones on the other; a very remarkable feature, to which RIDLEY & DENDY draw attention in their description of *Cliona dissimilis*. Perhaps the most striking feature of *Spirastrella* lies in the marked tendency to form digitate processes, which may entirely change the external appearance. Even if there were no other characters I should consider these sufficient to keep the three genera separated.

II. LIST OF SPECIES DESCRIBED AS BELONGING TO SPIRASTRELLA.

(chronologically).

1868 *Spirastrella cunctatrix* O. S. Cf. p. 9.

1875 *Spirastrella vidua* O. S. p. 120. Since THIELE (1903 α pp. 393, 395) found that in addition to the spicula mentioned, acanthostyli occur, and that the "Walzensternen" are of a peculiar character, this species can no longer remain under *Spirastrella*.

1884 *Spirastrella congenera* Rdl. Cf. p. 12.

1884 *Spirastrella decumbens* Rdl. Cf. p. 12.

1884 (α) *Spirastrella pulvinata* (Bwk.) Rdl. Cf. p. 11.

1884 *Spirastrella punctulata* Rdl. Cf. p. 14.

1884 *Spirastrella purpurea* (Lmk.) Rdl. Cf. p. 8.

1884 *Spirastrella transitoria* Rdl. Cf. p. 14.

1884 *Spirastrella vagabunda* Rdl. Cf. p. 14.

1886 *Spirastrella massa* Rdl. & Dy. Cf. p. 17.

1886 *Spirastrella neocomiensis* Hinde, p. 437. Fossil.

1886 *Spirastrella papillosa* Rdl. & Dy. Cf. p. 17.

1886 *Spirastrella solida* Rdl. & Dy. Cf. p. 17.

1888 *Spirastrella australis* Ldfd. p. 57. Description without any illustration. It is impossible to form an opinion about this sponge.

1890 (α) *Spirastrella aculeata*. Tops. p. 69; see also TOPS. 1892 p. 217 and 1904 (α) p. 114. The sponge possesses oxea in stead of styli or tylostyli. For this reason I provisionally do not admit it in the genus *Spirastrella*.

1894 *Spirastrella coronaria* Tops. p. 29.

1896 *Spirastrella cylindrica* Kieschn. Cf. p. 21.

1896 *Spirastrella dilatata* Kieschn. p. 534; see also THIELE 1900 p. 70. Insufficiently described to form an opinion.

1897 *Spirastrella areolata* Dy. Cf. p. 21.

1897 *Spirastrella aurivilli* Lindgr. Cf. p. 21.

1897 *Spirastrella bistellata* (O. S.) Ldfd. Cf. p. 8.

1897 *Spirastrella carnosa* Tops. Cf. p. 22.

1897 *Spirastrella corticata* Dy. p. 255; see also CARTER 1879 (α) p. 330. DENDY seems to wish to bring CARTER's *Latruncula* (sic) *corticata* to the genus *Spirastrella*. As, however, the sponge under consideration possesses oxea and no styli or tylostyli, I prefer not to include it into *Spirastrella*.

1897 *Spirastrella fibrosa* Dy. p. 254—255. Judging from a microscopical preparation I examined in the British Museum, I believe this sponge does not belong to *Spirastrella*.

1897 *Spirastrella robusta* Dy. Cf. p. 22.

1897 *Spirastrella semilunaris* Lindgr. Cf. p. 23.

1897 *Spirastrella spinispirulifer* Dy. p. 251. Provisionally I do not include this species into the genus *Spirastrella*, the spinispirae possessing quite another character. Perhaps it is identical with *S. coronaria*.

1898 *Spirastrella insignis* Thiele. Cf. p. 23.

1898 *Spirastrella panis* Thiele. Cf. p. 24.

1899 *Spirastrella inconstans* (Dy.) Thiele. Cf. p. 18.

1900 *Spirastrella lacunosa* Kieschnick, p. 575. Insufficiently described; no illustration. See also: 1905 DRAGNEWITSCH p. 13 and 1909 HENTSCHEL p. 386.

1900 *Spirastrella minax* Tops. Cf. p. 20.

1900 *Spirastrella spiculifera* Kieschnick, p. 575. Insufficiently described; no illustration.

1905 *Spirastrella tentorioides* Dy. Cf. p. 24.

1906 (β) *Spirastrella bonneti* Tops. Cf. p. 25.

1909 *Spirastrella digitata* Hentschel. Cf. p. 25.

III. LIST OF SPECIES, DESCRIBED UNDER DIFFERENT NAMES BUT BELONGING TO SPIRASTRELLA.

(chronologically).

1815 *Alcyonium purpureum* Lmk. Cf. p. 7.

1862 *Tethya bistellata* O. S. Cf. p. 8.

1864 *Suberites bistellatus* O. S. Cf. p. 8.

1870 *Chondrilla phyllodes* O. S. pp. 26, 78, 88; Pl. VI, fig. 1. Evidently no *Chondrilla*; probably a *Spirastrella*. I refrain from deciding whether or not it is identical with *S. purpurea*. See also: 1877 (α) SCHULZE, 1879 (α) CARTER, 1881 CARTER, 1882 CARTER, 1889 (α) DENDY, 1889 TOPSENT, 1894 TOPSENT, 1896 (γ) TOPSENT, 1902 VOSMAER.

1872 *Hymeniacidon angulata* Bwk. Cf. p. 10.

1872 *Hymeniacidon pulvinatus* (sic) Bwk. Cf. p. 11.

1879 (α) *Spongia dysoni* Crtr. Cf. p. 11.
1882 *Suberites capensis* Crtr. Cf. p. 12.
1885 *Suberites wilsoni* Crtr. Cf. p. 15.
1887 (α) *Suberites inconstans* Dy. Cf. p. 18.
1887 *Suberites trincomaliensis* Crtr. Cf. p. 20.
1892 *Hymedesmia bistellata* (O. S.) Tops. Cf. p. 8.
1892 (α) *Hymedesmia tristellata* Tops. Perhaps identical with *H. bistellata.*
1897 *Suberites spirastrelloides* Dy. Cf. p. 23.
1897 (ε) *Vioa florida* Ldfd. Cf. p. 23.
1897 *Vioa papillosa* (Rdl. & Dy.) Ldfd. Cf. p. 17.
1897 *Vioa solida* (Rdl. & Dy) Ldfd. Cf. p. 17.
1906 (β) *Cliona wilsoni* (Crtr.) Tops. Cf. p. 15.
1906 (β) *Hardwickia purpurea* (Lmk.) Tops. Cf. p. 7.

IV. DESCRIPTION OF SPIRASTRELLA PURPUREA (LMK.) RDL.

Running numbers: [1] 92, a–l. 98. 143. 179. 210. 245. 300. 305, a–d. 410. 426, a–d. 565. 612, a–d. 614, a–b. 638. 658. 764. 801. 931, a–b. 944, a–b. 948, a–d. 964, a–b. 966, a–b. 977. 1005. 1031. 1045. 1047. 1075. 1092. 1103. 1117. 1141. 1211. 1260. 1341, a–d. 1365. 1391. 1402. 1403. 1418. 1421. 1447. 1455, a–c. 1480. 1610. 1631. 1945. 1947*. 1949*. 1950*. 1952*. 1971*. 1975*. 1988*. 2030*. 2031*. 2032*. 2049*.

A. Synonymy and Literature.

1815 *Alcyonium purpureum* Lmk.
1862 *Tethya bistellata* O. S.
1864 *Suberites bistellatus* O. S.
1868 *Spirastrella cunctatrix* O. S.
1872 *Hymeniacidon angulata* Bwk.
1872 *Hymeniacidon pulvinatus* (sic) Bwk.
1879 (α) *Spongia dysoni* Crtr.
1882 *Suberites capensis* Crtr.
1884 *Spirastrella congenera* Rdl.
1884 *Spirastrella decumbens* Rdl.
1884 (α) *Spirastrella pulvinata* (Bwk.) Rdl.
1884 *Spirastrella punctulata* Rdl.
1884 *Spirastrella purpurea* (Lmk.) Rdl.
1884 *Spirastrella transitoria* Rdl.
1884 *Spirastrella vagabunda* Rdl.
1885 *Suberites wilsoni* Crtr.
1886 *Spirastrella massa* Rdl. & Dy.
1886 *Spirastrella papillosa* Rdl. & Dy.
1886 *Spirastrella solida* Rdl. & Dy.
1887 (α) *Suberites inconstans* Dy.

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1) Those marked with an asteric are dried.

1887 *Suberites trincomaliensis* Crtr.
1896 *Hymedesmia bistellata* (O. S.) Tops.
1896 *Spirastrella cylindrica* Kieschnick.
1897 *Suberites spirastrelloides* Dy.
1897 *Spirastrella areolata* Dy.
1897 *Spirastrella aurivillii* Lindgr.
1897 *Spirastrella bistellata* (O. S.) Ldfd.
1897 *Spirastrella carnosa* Tops.
1897 *Spirastrella robusta* Dy.
1897 *Spirastrella semilunaris* Lindgr.
1897 (ε) *Vioa florida* Ldfd.
1897 *Vioa papillosa* (Rdl. & Dy.) Ldfd.
1897 *Vioa solida* (Rdl. & Dy.) Ldfd.
1898 *Spirastrella insignis* Thiele.
1898 *Spirastrella panis* Thiele.
1899 *Spirastrella inconstans* (Dy.) Thiele.
1900 *Spirastrella minax* Tops.
1905 *Spirastrella tentorioides* Dy.
1906 (β) *Spirastrella bonneti* Tops.
1906 (β) *Cliona wilsoni* (Crtr.) Tops.
1906 (β) *Hardwickia purpurea* (Lmk.) Tops.
1909 *Spirastrella digitata* Hentschel.

I. *Alcyonium purpureum* — *Spirastrella purpurea* — *Hardwickia purpurea*.

[1811 Fourcroy & Vauquelin p. 354—356].
1815 Lamarck p. 332.
1816 Lamarck p. 402.
1816 Lamouroux pp. 321, 358.
1824 Lamouroux p. 34.
1836 Lamarck p. 608—609.
1875 Carter p. 197.
1879 (γ) Carter p. 149.
1882 Carter p. 352; Pl. XII, fig. 28*a*—*c*.
1884 Ridley p. 470—471.
1885 Carter p. 114.
1889 (α) Dendy p. 5.
1906 (β) Topsent p. 570—574.

LAMARCK was the first to describe *Alcyonium purpureum* (1815): "Habite les mers de la Nouvelle Hollande. PÉRON et LESUEUR. Espèce très singulière, dont la substance, tant interne qu'externe, est d'un pourpre foncé, un peu violet ou lie-de-vin, et paroît propre à la teinture [1]). Elle forme de large plaques, épaisses de 10 à 12 millimètres, fermes, poreuses et comme spongieuses intérieurement, ayant leur surface assez lisse. On prétend qu'on ne trouve ce polypier qu'à une grande profondeur".

CARTER made some observations on this sponge after a specimen in the British Museum, belonging to the "Lamarck Collection". It is probably this specimen which is (fortunately still

1) This latter observation LAMARCK obviously made after a research of FOURCROY & VAUQUELIN. LAMOUROUX tells us (1816 p. 321) that after the death of the French chemist FOURCROY a paper was found on this subject, being an analysis of a "production marine" dredged in the neighborhood of "Cap l'Ewin" (Australia). LAMOUROUX saw the object at PÉRON's, who brought it to France; after his death it came in the "Museum d'Histoire naturelle". LAMOUROUX adds that LAMARCK "l'a nommée Alcyonium purpureum". The article of FOURCROY & VAUQUELIN is published later (1811) in the Annales du Museum.

in a good state) present in the Museum and to which I have given the mark **B. M. 12** [1]). It corresponds in every respect with CARTER's description — a piece "3 inches long and 1 inch square". CARTER calls it "carmine-coloured" and states that the spicules are tylostyles and spinispirae. We may take it therefore for granted that **B. M. 12** represents a piece of LAMARCK's type. The fullest description of LAMARCK's *Alcyonium purpureum* is given by TOPSENT, who states to have examined the "holotype" from the "Jardin des Plantes", represented by two "plaques très inégales". TOPSENT says p. 572: "Le plus bel échantillon de *Spirastrella purpurea* ne représente lui-même qu'une portion d'Éponge, quelque chose comme une tranche du bord progressivement aminci d'une Éponge largement évasée". The greatest thickness of this piece is 24 mm. One side is not perforated and shows "de tubérosité radiales qui diminuent d'importance du côté marginal et s'y réduisent à de faibles bosselures". The other side has "une surface égale et se perce d'orifices aquifères punctiformes visible à l'oeil nu et très nombreux, les intervalles qui les séparent étant de 1 millimètre seulement en moyenne . . . . . Une écorce d'environ 0 millim. 55 d'épaisseur limite le corps. Elle se compose en majeure partie d'un feutrage compact de tylostyles qui s'enchevêtrent dans tous les sens, mais, du côté externe, elle se termine par une croûte de spirastres épaisse de 0 millim. 11 à 0 millim. 14. Des tylostyles, tous dressés verticalement, traversent cette croûte; leurs pointes dépassent d'ailleurs à peine la surface générale qui, par conséquent, demeure lisse. L'interieur de l'Éponge est ferme, spongieux, non caverneux". Unfortunately TOPSENT does not give us any illustration of the spicules. He states, however, that CARTER's figures give a wrong impression of the shape of the tylostyles, as well as of the spinispirae. I draw attention to the fact that TOPSENT correctly observed that the spines of the smaller spinispirae are often not simply conical, pointed but show some "épines cylindriques terminées par un bouquet d'épines secondaires minuscules".

The name *Spirastrella purpurea* for LAMARCK's *Alcyonium purpureum* was first used by RIDLEY (l. c. p. 570). TOPSENT confirmed the correctness of this name; at the same time he mentioned the name *Hardwickia purpurea*, which is, however, a mere manuscript-name (on the label of the specimen in Paris) and consequently of no use.

II. *Tethya bistellata* — *Suberites bistellatus* — *Hymedesmia bistellata* — *Spirastrella bistellata*.

1862 Schmidt p. 45—46; Pl. VII, fig. 1.
1864 Schmidt p. 36.
1868 Schmidt p. 17.
1880 Czerniawsky p. 70.
1880 Schmidt p. 77.
1882 Carter p. 348.
1888 Sollas p. 438—439.
1892 Topsent p. 59.
1892 (*a*) Topsent pp. XVII, XXVII.
1896 Topsent pp. 123, 125.
1897 Dendy p. 255.
1897 Lendenfeld pp. 55—58, 152, 156, 163, 164, 166, 168, 169, 176, 183, 189, 231, 232, 238, 239. Pl. VI, fig. 59; Pl. VII, fig. 65; Pl. IX, fig. 120—122.

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1) A complete list of these marks is given at the end of the chapter on the synonymy of *S. purpurea*.

1898 Lendenfeld p. 207.
1898 Topsent pp. 123, 124, 129.
1898 (β) Topsent p. 110.
1900 Topsent pp. 5, 10, 12, 108, 113, 125—129; Pl. III, figs. 13 and 16.
1902 (β) Topsent p. 330.
1902 Vosmaer p. 106 [Engl. translat. from 1902 β].
1902 (β) id. p. 170.
1909 Vosmaer p. 637—644 with one Plate.
1909 (α) id. [Engl. translat.] p. 642—648.

SCHMIDT described in 1862 a new sponge which he named *Tethya bistellata.* In 1864 he changed the name into *Suberites bistellatus.* TOPSENT correctly observed that it was neither a *Tethya* nor a *Suberites*; however, I demonstrated in 1909 that this author was wrong in calling the sponge *Hymedesmia bistellata,* but that it belonged to the genus *Spirastrella.* In my paper from 1909 I could not bring forward my arguments to identify the sponge with LAMARCK's *Alcyonium purpureum*; I therefore used the name LENDENFELD applied viz. *Spirastrella bistellata.* To the specimen I mentioned in 1909 (α) p. 643 as "*Suberites bistellatus* O. S. Origin. Schmidt" I have given in this paper the mark **G. M. 73**. In Canon NORMAN's rich collection I found a specimen, named by TOPSENT *Hymedesmia bistellata,* from Banyuls; the nestor of spongiologists was so kind as to offer me a fragment, which bears now the mark **M. N. 44**.

According to LENDENFELD (l. c. p. 55) this sponge is identical with *S. decumbens* Rdl. and according to TOPSENT (1900 p. 12) *S. bistellata* of LENDENFELD is identical with *S. cunctatrix* O. S., but not with *T. bistellata* O. S. I believe, as I have stated before, that LENDENFELD was right in identifying his *Spirastrella bistellata* with SCHMIDT's *Tethya bistellata.*

[Cf. *S. decumbens, transitoria* and *semilunaris*].

III. *Spirastrella cunctatrix.*

1868 Schmidt pp. 17, 42, 43; Pl. III, fig. 8.
1879 (α) Carter pp. 356, 357, 360; Pl. XXIX, fig. 12.
1881 (α) Carter p. 384.
1882 Carter pp. 348, 349, 351.
1884 Ridley pp. 468, 623.
1886 Carter p. 112—116.
1886 (α) Carter p. 463.
1887 Carter pp. 62, 75.
1887 Ridley & Dendy pp. 229, 231.
1889 (α) Dendy p. 21.
1892 Hinde & Holmes p. 223.
1894 (α) Topsent pp. 39, 44.
1897 Dendy p. 252—253.
1898 Thiele p. 43.
1900 Topsent pp. 8, 12, 101 (woodcut), 108, 110.
1902 (β) Topsent pp. 328, 330, 333, 363.
1902 Vosmaer p. 105.
1902 (β) Vosmaer p. 169.
1909 Hentschel p. 382—383.
1909 Vosmaer p. 643.
1909 (α) Vosmaer p. 647.

Schmidt wrote in 1868 that he had given in his first "Supplement der Spongien des Adriatischen Meeres" (1864), an illustration of a curious form of spicule belonging to a Sponge from Cyprus. Other specimens of it were dredged in Algiers and the Sponge was called *Spirastrella cunctatrix*. The spicule under consideration is what we now call a spinispira. Carter at various occasions described other specimens of *S. cunctatrix*, which in many respects differ rather from Schmidt's specimen. I have examined several of Carter's specimens in the British Museum. The one registered 86. 12. 15. 250 bears my number **B. M. 10** and is illustrated on Pl. III, fig. 3; the specimen registered 86. 12. 15. 251 has my number **B. M. 13**; both are determined by Carter and possibly represent the two specimens Carter described in 1886 (p. 113—114). Later Carter described two "varieties", *robusta* and *porcata*. The type of the former is registered in the British Museum 86. 12. 15. 352; it corresponds to my number **B. M. 16**; another specimen (86. 12. 15. 353) is marked **B. M. 3**. The variety *porcata* is registered 86. 12. 15. 351 and bears my number **B. M. 1**. These five specimens differ a good deal in external appearance and in the dimensions of the spicules (Pl. X, figs. 2, 3, 4, 6 and 7). Whereas the surface of **B. M. 13** is covered with warty elevations, we see in **B. M. 1** "a number of thick rugae"; in **B. M. 10** both characters are united. Whereas in **B. M. 16** the tylostyli are rather slender, they are rather stout in **B. M. 3** and **B. M. 13**. The largest spinispirae of **B. M. 3** are very robust, rather thick and short; some resemble indeed the characteristic spicules of *S. bistellata* (Pl. X, fig. 7). Schmidt came to the same result with his specimens; he writes (1868 p. 17): "Die Formen (viz. of the spinispirae) mit verkürzter Axe ähneln den Doppelsternen von *Suberites bistellatus* ...." Of course Carter was very well aware of all these differences; still he did not hesitate in uniting his specimens with Schmidt's *S. cunctatrix*.

Between Sumbawa and Flores (Stat. 310) the Siboga dredged more than a dozen specimens of a sponge (**92 a–l**), which corresponds in almost every respect to the specimens Carter identified with *Spirastrella cunctatrix* O. S. We saw above that Carter's specimens show considerable differences; we observe the same variability in the Siboga specimens. **B. M. 1** and **B. M. 13** differ a good deal in external appearance, but they agree pretty well in spiculation (Pl. X, figs. 3 and 6 respectively). The sections of **B. M. 3** and **B. M. 16** look like fine cork; those of **B. M. 10** and **B. M. 13** are more fibrous. Similar differences may be observed in the Siboga specimens; these differences on one side and those of Carter's specimens on the other side are certainly not larger than those of the latter inter se. In addition to the above mentioned specimens the Siboga brought home another one, **426 d**, which is doubtless identical with **92 a–l**. They all agree in external appearance and in spiculation with *Spirastrella cunctatrix* O. S. in the enlarged sense Carter took it.

[Cf. *S. papillosa*, *panis* and *insignis*].

IV. *Hymeniacidon angulata.*

1872 Bowerbank p. 632, 633, 635; Pl. XLIX, fig. 1—7.
1882 Carter p. 352.
1884 Ridley p. 469.
1889 (*z*) Dendy p. 16.

BOWERBANK states to have received eight specimens of *Hymeniacidon angulata*, three of which are preserved in the British Museum. They are all in the dried state. The type-specimen, illustrated by BOWERBANK, I have designated **B. M. 8**; the co-types are marked **B. M. 21** and **B. M. 29**. No doubt BOWERBANK was right in considering the three specimens as belonging to one species. Still, there are certain differences, which are rather striking. Compare e. g. BOWERBANK's illustration of **B. M. 8** with mine of **B. M. 29** (Pl. II, fig. 5). These differences, which did not escape BOWERBANK, are present as well in external appearance as in spiculation. I want to draw attention to the fact that in **B. M. 21** a slight indication of "tubes" is visible on the surface, whereas in **B. M. 8** en **B. M. 29** one or two of the openings are somewhat slit-like — features, which are characteristic for certain specimens of our sponge. The length, the diameter and the shape of the tylostyles differ somewhat in the three specimens (Pl. XIII, fig. 1—3).

The specimens **612 a**, **964 a** and **966 a** of the Siboga Sponges resemble on the whole BOWERBANK's *Hymeniacidon angulata* in external appearance as well as in spiculation, taking into account that the former are preserved in alcohol, the latter dry.

[Cf. *Suberites inconstans*].

V. *Hymeniacidon pulvinatus*. — *Spirastrella pulvinata*.

1872 Bowerbank p. 126—127.
1882 Carter p. 350.
1884 (*z*) Ridley p. 187.
1887 (*z*) Dendy p. 156.
1889 (*z*) Dendy p. 16.

BOWERBANK described a "new species", *Hymeniacidon pulvinatus*, which is probably "the largest recent species known to naturalists". The sponge was found by Mr. DYSON, who told BOWERBANK "that the summit of the largest specimen was just below the surface of the water, and that he passed one of the oars down by the side of the sponge and found that it was 8 feet in height, and that they chiselled off the top of the sponge with the oars, and cut it into three pieces for the convenience of packing it". BOWERBANK received two specimens — both of course fragments; they measured resp. 73.5 × 85 cm. and 67.5 × 52.5 cm. Other specimens (from other localities?) in BOWERBANK's collection measured only 20 × 30 cm. and 10 × 15 cm. I saw a specimen in the British Museum belonging to the BOWERBANK collection and found near Belize; it is labelled *Spirastrella pulvinata*, probably by RIDLEY, who established the name (l. c. p. 187): "I have labelled the magnificent specimens on which the species is based, now in the British Museum, as above" (viz. *Spirastrella pulvinata*). It is to the very large specimen that my number **B. M. 7** refers. CARTER called this sponge *Spongia dysoni*.

[Cf. infra].

VI. *Spongia dysoni*.

1879 (*z*) Carter p. 348; Pl. XXIX, fig. 11.
1882 Carter p. 350.
1889 (*z*) Dendy p. 22.

CARTER writes in 1882 p. 350: "*Spongia Dysoni* Bk. This is the name on the largest specimen of this sponge in the British Museum, presented in 1862. = *Hymeniacidon pulvinatus*, Bk., on a small specimen of the same species presented in 1872 . . . . . . It is still undescribed; but there are many specimens of it in the British Museum under my running n^0 457, the two largest of which are flat species, registered n^{os} 66. 5. 24. 12 and — 13, labelled '*Spongia Dysoni*', the former in size 20 × 25 × 4$^1/_2$, and the latter 33$^1/_2$ × 27$^1/_2$ × 8 inches in their greatest dimensions". My number **B. M. 4** refers to the latter.

Obviously CARTER ascribes the name *Spongia dysoni* to BOWERBANK; however, as far as I know BOWERBANK never published this name, but called the sponge *Hymeniacidon pulvinatus* (Cf. supra). The fragments I examined on the spicules, both of *S. dysoni* (**B. M. 4**) and *H. pulvinatus* (**B. M. 7**) show slight differences (Pl. XI, fig. 3 and 4). Both sponges came from Belize. The question is whether the fragments belonged to one or to two specimens. That they are specifically identical seems to me beyond doubt. Moreover, since I believe both to represent gigantic specimens of *Spirastrella purpurea*, the question is of less importance.

VII. *Suberites capensis.*

1882 Carter p. 350.
1886 Carter p. 114.
1889 (*a*) Dendy p. 23.

The sponge is described by CARTER in 1882; but as the same author in 1886 states that "it can hardly be considered more than a variety of the latter", viz. *Spirastrella cunctatrix*, we may safely accept this.

VIII. *Spirastrella congenera.*

1884 Ridley pp. 375, 469—470; Pl. XLIII, fig. *d—d'*.
1905 Dendy p. 122.

The type of RIDLEY's *Spirastrella congenera* is registered in the British Museum '81. 10. 21. 257; I will designate it as **B. M. 20**. According to DENDY it is "probably a mere variety" of *S. vagabunda*; RIDLEY himself said that it is "undoubtedly nearly related to it". The difference lies in the fact that the spicules are larger in the former than in the latter. I agree, however, with DENDY that there is no difference of specific value. Indeed, if we compare fig. 5 on Pl. XI, representing spicules of RIDLEY's type-specimen of *S. vagabunda* with fig. 1 on Pl. XII, illustrating those of the type of *S. congenera* there is rather a difference in size. If we take, however, into consideration *S. vagabunda* var. *gallensis* (Pl. XI, fig. 6), we find this specimen forming a transition between the two extremes, which makes it hardly possible to distinguish "species". A comparison of **B. M. 20** with **S. E. 948 a–f** only strengthens me in my view.

IX. *Spirastrella decumbens.*

1884 Ridley pp. 375, 470—471, 624; Pl. XLIII, fig. *c*.
1887 Ridley & Dendy pp. 229—230, 247, 256; Pl. XLV, fig. 12—12*g*.
1891 Keller pp. 5, 12; Pl. I, fig. 6—7.
1891 (*a*) Keller pp. 323—324, 367; Pl. XVIII. figs. 27, 28, 32, 33.
1897 Lendenfeld p. 55.

1897 Topsent pp. 425, 440.
1898 Topsent p. 124.
1900 (*a*) Kirkpatrick pp. 128, 134—135.
1900 Minchin p. 43.
1900 Topsent p. 128.
1909 Hentschel p. 385.

Ridley's type is fortunately preserved in the British Museum; my number **B. M. 27** refers to this type, registered '82. 2. 23. 278. A second specimen in the British Museum, to which I gave the number **B. M. 38**, is the type of a "variety" described by Ridley & Dendy in the Challenger Reports; it is registered '87. 5. 2. 97. Finally there is a third specimen, **B. M. 39**, registered in the British Museum '98. 12. 20. 21. It is the specimen described by Kirkpatrick as var. *robusta*, specimen 1, viz. the one "forming a thin yellow crust on a shell". Ridley stated (l. c. p. 470) about *S. decumbens*: "This species appears to be more nearly allied in its spiculation *S. (Alcyonium) purpurea* Lamarck, than to any other Indo-Pacific species, but it differs from it in wanting the magnificent crimson color of that form, in its encrusting habit (*purpurea* being massive), in the inferior diameter of the shaft of the spinulate and the superior length of the spinispirular spicule . . . . ." However, are these differences of specific value? I believe not, since by the two other specimens, found afterwards, viz. **B. M. 38** and **B. M. 39** the original character is slightly modified. The "variety" described by Ridley & Dendy (**B. M. 38**) is not merely encrusting, but is said to consist "of a number of stout, irregular, anastomosing trabeculae, forming together a sessile, cavernous mass. In the second place Ridley and Dendy state (l. c. p. 229): "there are also slight differences in the proportions of the spicules between our specimen and the type". [Compare figs. 1 and 2 on Pl. VIII]. The authors arrive at the conclusion that "there are no differences sufficient to justify us in separating the two specifically". The absence of the "crimson" color can hardly furnish us with an argument, since we have in "*Suberites wilsoni*" Crtr. an example that this color may be absent as in *S. wilsoni* var. *albidus*. Now there are in the Siboga-collection some specimens which perfectly correspond to *Spirastrella decumbens*, in external appearance and in spiculation. The encrusting character is conspicuous in **1031**, **1455 a–c** and **1945**; the spicules of the latter two are figured on Pl. VIII (figs. 5 and 3). Specimen **1421**, the spicules of which are to be seen in fig. 6, externally resembles more the Challenger-specimen of *S. decumbens* (**B. M. 38**), whereas in spiculation it comes nearer **B. M. 27**. Comparing them all together we find that *decumbens* and *purpurea* are hardly different "species". The greatest difference lies in the size of the largest spinispirae. We will see, however, that even on this account no distinction can be made. For *S. decumbens* is not only allied to *S. purpurea*. Specimen **1480** indeed is a transition between encrusting forms like **1455**, **1945** and pyramidal forms like **426 a–c**. The latter are closely allied to — in fact identical with — *Suberites wilsoni*. Comparing the size of the large spinispirae of this sponge (Pl. X, fig. 5) with those of *S. purpurea* and "*S. decumbens*", we feel the supposed specific difference vanish more and more, in fact disappear. Indeed, either one has to consider "*S. decumbens*" as identical with *S. purpurea* or make different species from *S. decumbens*-type (**B. M. 27**), *S. decumbens* var. (**B. M. 38**), *S. decumbens* var. (**B. M. 39**), *S. purpurea* (**B. M. 12**) and the specimens **1031**, **1455**, **1945**, **1421**, **1402**, **1480**, **426 a–c** etc. The first seems to me at present the better device.

X. *Spirastrella transitoria.*

1884 Ridley pp. 589, 623; Pl. LIV, fig. *q—q'*.
1905 Dendy p. 122.

The type of *Spirastrella transitoria* is registered in the British Museum '82. 10. 17. 68*a*; it corresponds with my number **B. M. 30**. Ridley says that this "species appears to be most nearly related to the form termed by Mr. Carter . . . . . 'Spirastrella cunctatrix, variety', from Mauritius''. It differs from it by the colour and by the shorter spinispirae, which are "extremely concentrated, composed of only one entire bend . . . .''; the spicule is "almost in the form of the stellate . . . .'' Since we know how variable the spinispirae of our sponge are, the difference can hardly justify a specific separation. *S. transitoria* forms, with regard to the spinispirae, an extreme of the various specimens of *cunctatrix* and *bistellata*, which on the other side are also allied to *decumbens*.

XI. *Spirastrella punctulata.*

1884 Ridley pp. 589, 623—624; Pl. LIV, fig. *p—p'*.
1905 Dendy p. 122.

The type of *Spirastrella punctulata* is registered in the British Museum '82. 10. 17. 35*a* and bears my number **B. M. 28**. Ridley identifies it with "Suberites, ? sp. Underscribed. Mauritius'' of Carter (1882 p. 352). The author states (l. c. p. 624) that "it is nearly related to *Hymeniacidon angulata* of Bowerbank . . . . . and *vagabunda* and *decumbens* . . . .'' but it is distinguished readily from all by its very short spinispirular spirule''. Dendy suggests that it is "perhaps'' a mere variety of *S. vagabunda*. Indeed there is no reason for specifical separation; neither in external appearance, nor in spiculation can I find specific differences.

XII. *Spirastrella vagabunda.*

1884 Ridley pp. 375, 468, 469, 624; Pl. XLIII, fig. *e—e'*.
1900 Thiele pp. 71, 80; Pl. III, fig. 23.
1905 Dendy p. 122—125.
1909 Hentschel p. 384.

Ridley described his *Spirastrella vagabunda* after two specimens, found near West Island and Thursday Island in the Torres Straits. Both specimens are now in the British Museum. The former is registered 82. 2. 23. 307 and bears my number **B. M. 36**; the latter, registered 82. 2. 23. 243, has my number **B. M. 41**. A third specimen Ridley distinguished as *S. vagabunda* var. *tricomaliensis*, corresponding to my number **B. M. 24**. This variety refers to the "*Suberites*, ? sp. underscribed. Trincomalee'' of Carter (1882 p. 352).

Our knowledge of *Spirastrella vagabunda* was greatly enlarged by Dendy, who examined "a number of specimens which, while differing greatly in external form, agree so closely in spiculation'' that he was obliged "to regard them merely as varieties of one and the same species . . . .'' Dendy distinguishes, in addition to var. *tricomaliensis*, three other varieties, viz. *tubulodigitata*, *fungoides* and *gallensis*. Dendy's type specimens (spirit) are all in the British

Museum. Var. *tubulodigitata*, registered HERDMAN Coll. '07. 2. 1. 27 corresponds to my number **B. M. 17**; var. *fungoides*, '07. 2. 1. 25 to **B. M. 19** and var. *gallensis*, '07. 2. 1. 26 to **B. M. 14**.

According to RIDLEY the species is "nearly allied to *Hymeniacidon angulata* of BOWERBANK ..... but has a skeleton-spicule of twice the diameter of the spinulate found in that species". RIDLEY further states that "the spicules show no striking variation in size; the length of the spinulate varies from .55 to .63 millim. in different specimens; its breadth and the size of the flesh-spicule are almost constant". These statements can hardly be kept, as the following table shows.

Specimens.	Tylostyles.	
	length.	max. diameter.
B. M. 36	167—517	17
B. M. 41	193—633	20
B. M. 24	180—567	15
B. M. 17	185—600	10
B. M. 19	190—590	20
B. M. 14	210—543	22

Now I find the following variation in the three specimens of *Hymeniacidon angulata*:

Specimens.	Tylostyles.	
	length.	max. diameter.
B. M. 8	317—550	12
B. M. 21	250—550	15
B. M. 29	300—550	10

Consequently I believe it is impossible to distinguish *S. vagabunda* specifically from *H. angulata*; at least not on account of the size of the tylostyles, after all the only distinction on which RIDLEY based the difference.

The examination of specimens in the British Museum especially **B. M. 17** and **B. M. 24** showed me that the Siboga specimens 948 a–f are identical with them, agreeing as they do in external appearance as well as in spiculation and structure.

[Cf. *S. congenera* and *punctulata*].

XIII. *Suberites wilsoni.* — *Cliona wilsoni.*

1885 Carter p. 113—114.
1886 Carter p. 116.
1889 (*z*) Dendy p. 24.
1897 Dendy p. 247.

1900 Mac Munn p. 337—349; Pl. 16.
1903 Cotte p. 504.
1906 (β) Topsent p. 570—571.

There are several specimens of *Suberites wilsoni* in the British Museum. I found two specimens from Port Phillip Heads. As the type of CARTER is taken the larger one, registered '86. 12. 15. 107; this corresponds to my number **B. M. 33**. The other specimen, which may be considered as a co-type I numbered **B. M. 32**; it is registered '86. 12. 15. 108. In 1886 CARTER described a var. *albidus*, which "only seems to differ from *Suberites Wilsoni* in the absence of colour". This specimen is registered in the British Museum '86. 12. 15. 256; it corresponds to my number **B. M. 15**. In the fourth place I examined a specimen registered '86. 12. 15. 255, to which I have given number **B. M. 22**.

CARTER says (1885 p. 114): "This is the species to which I have alluded in the 'Annals' for 1882 (Vol. XI, p. 350) [1]) as being 'without flesh-spicule', thus differing, among other things, from the specimen of *Alcyonium purpureum* Lam. ...." What are these "other things"? CARTER does not speak about it, and I can only find a difference in shape. Comparing *Alcyonium purpureum* (**B. M. 12**) with *Suberites wilsoni* (**B. M. 32** and **B. M. 33**) I find a striking resemblance in texture, surface and color. I think we all agree that the shape — ceteris paribus — is hardly of specific value in this case; the more so as *A. purpureum* is only known in fragments. Of more value is the difference in spiculation. However, it is not true, that *S. wilsoni* is without "flesh-spicules", for I did find spinispirae in specimen **B. M. 32** (Pl. X, fig. 5), although I did not find them in **B. M. 33**. In the "variety" *albidus* Carter did not find spinispirae either, but I did. I likewise found them, though scantily, in **B. M. 22**. For these reasons I consider *Suberites wilsoni* identical with *Alcyonium purpureum*. There seems to be no ground for calling *Suberites wilsoni* "plus exactement" *Cliona wilsoni* as TOPSENT suggests, unless one wishes to unite the genera *Spirastrella* and *Cliona*. Comparing the various specimens one certainly finds differences in spiculation. Especially the size and frequency of the spinispirae are variable. **B. M. 32** possesses comparatively large spinispirae (Pl. X, fig. 5). Those of **B. M. 15** are small and slender (Pl. XII, fig. 3), those of **B. M. 22** (Pl. XII, fig. 4) on the contrary rather compact, resembling more the spinispirae of LAMARCK's type (Pl. VIII, fig. 7). Taking into account what other specimens of *Spirastrella* taught me, I consider the above differences not of specific value.

In many respects the specimens **1045**, **426 a**, **426 b** and **426 c** resemble *Suberites wilsoni*, in others they differ considerably. But we saw above how very variable *S. wilsoni* is; and yet CARTER did not separate the specimens specifically. The variability goes so far that the spinispirae may disappear entirely as in **B. M. 33**. The same variability we observe in the Siboga specimens mentioned above; in all I found spinispirae, but these are exceedingly variable in size and also in frequency. On the whole the spicules in the Siboga specimens are larger than those in the specimens of *S. wilsoni*. However, I find transitions in **1988**. All this suggests a specific identity between them.

[Cf. *Spirastrella massa* and *areolata*].

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1) Misprint for Vol. IX.

XIV. *Spirastrella massa.*

1886 Ridley & Dendy p. 490—491.
1887 Ridley & Dendy pp. XXX, XLV, 230, 245, 256; Pl. XLV, fig. 14—14*k*.
1889 (β) Lendenfeld p. 467.

The type of *Spirastrella massa* is registered in the British Museum '87. 5. 2. 33; it bears my number **B. M. 31**.

There is a great resemblance, externally, between this sponge and the two specimens of *Suberites wilsoni* **B. M. 32** and **B. M. 33**, if we abstract from the difference in color. The texture likewise shows resemblance; only there is much more sand and débris in the latter, in so far as the areniferous composition in the latter is seen almost throughout the sponge, whereas in the former it is conspicuous only at the lower parts. RIDLEY & DENDY said (1887 p. 230—231) that "perhaps the two most remarkable characteristics . . . . . are its singularly massive external form and the shape of the megasclera". I think in both characters *Spirastrella massa* agrees pretty well with *Suberites wilsoni*. The near relation is decidedly still more striking if we realize that some specimens of *Suberites wilsoni* (**B. M. 15**) are not carmine-red, but have the same buff color as *Spirastrella massa*. RIDLEY & DENDY state further that *S. massa* approaches *S. cunctatrix* in spiculation, although in the latter the "microsclera are of decidedly more robust growth". Of course it is; although there are important differences, I should say the spinispirae come nearer those of *Suberites wilsoni* than those of *Spirastrella cunctatrix*. I am inclined, therefore, to consider the difference between *massa* and *wilsoni* not to be of specific value. Indeed the former connects the latter with **426 a–c**.

XV. *Spirastrella papillosa.* — *Vioa papillosa.*

1886 Ridley & Dendy p. 491.
1887 Ridley & Dendy pp. XLVIII, 232, 233, 245, 257, 259; Pl. XLI, fig. 5; Pl. XLV, fig. 11—11*g*.
1897 Dendy p. 252—253.
1897 Lendenfeld p. 163.
1898 Thiele p. 43.

The specimen in the British Museum to which I have given number **B. M. 37** represents the type of RIDLEY & DENDY; it is registered '87. 5. 2. 31. LENDENFELD applied the name *Vioa papillosa*, for which there is no ground. According to DENDY (1897 p. 252) some specimens of *Spirastrella cunctatrix*, and more especially the variety *porcata* are specifically identical with *Spirastrella papillosa*. Moreover he believes (l. c. p. 253) that other specimens of *S. cunctatrix* are probably a variety of *S. papillosa*, for which he coins the name *porosa*. These statements sufficiently prove the close relation between *S. cunctatrix* and *S. papillosa*. Specimens **426 d** and **92 a–l** of the Siboga collection are identical with *S. papillosa*, and in other respects with *cunctatrix*. The more reason to consider *papillosa* and *cunctatrix* as identical.

XVI. *Spirastrella solida.* — *Vioa solida.*

1886 Ridley & Dendy p. 491.
1887 Ridley & Dendy pp. XLVII, XLVIII, LXI, 231, 232, 247, 256. Pl. XLI, fig. 7; Pl. XLV, fig. 13—13*e*.

1897 Lendenfeld p. 163.
1897 Lindgren p. 484.
1897 Topsent pp. 425, 440.
1898 Lindgren p. 325.
1905 Dendy p. 124.
1909 Hentschel p. 385.

The type in the British Museum is registered '87. 5. 2. 103, which corresponds with my number **B. M. 26**. LENDENFELD called the sponge *Vioa solida*, for which I fail to see a reason. In external appearance it resembles certain specimens of *S. vagabunda*. Also DENDY wrote (l. c. p. 124): "In the possession of the occasionally much elongated spirasters this variety (viz. *S. vagabunda fungoides*) resembles RIDLEY and DENDY's *Spirastrella solida* . . . . . which should perhaps be regarded merely as another variety of *S. vagabunda*". It is worth while to observe that in addition to the set of spicules, figured by RIDLEY & DENDY, occasionally still longer, but also stouter spicules occur (Pl. XII, fig. 5), which shows a relation to specimens which possess these in greater quantity. In the specimens **426 a–c** of the Siboga collection which certainly form only one species, we see in **426 a** robust spinispirae tolerably abundant, in **426 b** and **426 c** they are far from abundant. In external appearance *S. solida* comes nearer to **426 d**, in spiculation nearer to **426 c**. On the other side are *massa* and *solida* nearly allied.

XVII. *Suberites inconstans.* — *Spirastrella inconstans.*

1887 (*z*) Dendy p. 154—157. Pl. IX, figs. 1, 1*a*, 2; Pl. X.
1899 Thiele p. 10—11. Pl. I, fig. 3—3*a*; Pl. V, fig. 4.
1900 Thiele p. 71.
1902 Sollas p. 216—217; Pl. XIV, fig. 3.

DENDY described three varieties of *Suberites inconstans*, which he named *globosa*, *maeandrina* and *digitata*. The author examined two specimens of var. *globosa*, a "single specimen" of var. *maeandrina* and three specimens of var. *digitata*; consequently together six specimens. I found in the British Museum only four specimens. Since the two others were probably returned to the Madras Museum, my friend KIRKPATRICK was kind enough to write to the direction of this Museum, begging to procure me photo's of the specimens of *Suberites inconstans* which we supposed to be the two, returned by the British Museum. The superintendent, Mr. HENDERSON kindly answered our request by sending photographs. However . . . . . not of two but of five specimens. In stead of six we thus had nine specimens. Since DENDY positively asserts to have seen only five specimens, the question arrises: which are these? This question is not without importance and I thought it my duty to try to solve the puzzle. With the help of KIRKPATRICK, DENDY and Mr. THURSTON, formerly superintendent of the Madras Museum, help for which I wish to thank these gentlemen, I came to the following result.

1. *S. inconstans* var. *globosa*. The type-specimen, figured by DENDY (l. c. Pl. IX, fig. 1) is registered in the British Museum '87. 8. 4. 2; it bears my number **B. M. 25**.

Among the photo's from Madras there is one of a specimen, labelled "*Suberites inconstans* Dendy. Var. *globosa*. Pámban"; to this specimen I have given the number **M. M. 60**. Since DENDY wrote (l. c. p. 155): "there are two specimens of this variety (viz. *globosa*), agreeing fairly closely with one another in external form", we may take it for granted that this N⁰ 60 is the co-type, named by DENDY.

2. *S. inconstans* var. *maeandrina*. DENDY's type-specimen, figured by him (l. c. Pl. X, fig. 1) is in the British Museum, registered '87. 8. 4. 1; it bears my number **B. M. 9**. DENDY speaks quite definitely of "the single specimen". Consequently is the specimen in the Madras Museum to which I have given the number **B. M. 59** and which seems to be named "*Suberites inconstans* Dendy. Var. *maeandrina*. Pámban", not determined by DENDY. We were unable to make out who did it.

3. *S. inconstans* var. *digitata*. The type-specimen, figured by DENDY on Pl. IX, fig. 2, is registered in the British Museum '87. 8. 4. 3, corresponding to my number **B. M. 23**. DENDY says (l. c. p. 155): "There are three specimens which I refer to this variety (viz. *digitata*). They differ considerably from one another in external appearance, but all of them show a more or less strongly marked tendency to form digitate processes". Now there is another specimen in the British Museum, registered '87. 8. 4. 4, which I will designate with **B. M. 11** (Pl. II, fig. 2). KIRKPATRICK writes to me that this is probably the co-type of which DENDY writes that "the digitate processes are almost obsolete". I am willing to accept KIRKPATRICK's suggestion.

The second co-type is probably the one I mark **M. M. 62** (Pl. IV, fig. 1). About this specimen I learn by letter from KIRKPATRICK: "The specimen of *digitata* returned to Madras is almost certainly N⁰ 62 . . . . . the one of the Museum three of which DENDY says: 'one has the digitate processes very broad and irregular and with a very uneven corrugated surface'. Now the other two Madras *digitata* specimens (according to the photo's) have a smooth surface". Again in this respect I agree with KIRKPATRICK.

THIELE described in 1899 some specimens of a very variable sponge, in which he found, in addition to tylostyles, small spinispirae. He is of opinion, that his sponges are identical with DENDY's *Suberites inconstans* and proposes, consequently, the name *Spirastrella inconstans* (Dy.). Finally, in 1900, THIELE suggests the identity of *S. inconstans* and *S. vagabunda*. In fact there is much to say in favour of this suggestion; many specimens of the Siboga-material form transitions between *vagabunda* and *inconstans*. DENDY's *Suberites inconstans* var. *digitata* likewise forms a transition between *inconstans* and *vagabunda*. DENDY says of it (l. c. p. 155): "They differ considerably from one another in external appearance, but all of them show a more or less strongly marked tendency to form digitate processes". Whereas the type (**B. M. 23**) possesses long and distinctly digitate processes, one of the co-types (**B. M. 62**) "has the digitate processes very broad and irregular", while in the other (**B. M. 11**) "the digitate processes are almost obsolete". The difference between DENDY's fig. 2 on Pl. IX representing **B. M. 23** and my illustrations Pl. II, fig. 2 (**B. M. 11**) and Pl. IV, fig. 1 (**B. M. 62**) are very considerable indeed. Now DENDY writes (1905 p. 123) about *Spirastrella vagabunda* var. *tubulo-digitata*: "In this variety the sponge consists of hollow, finger-shaped processes or 'fistulae' rising from a sandy base . . . . ." About *S. vagabunda* var. *trincomaliensis* Dendy says: "It consists of a massive base rising up into a few short, stout, finger-shaped processes". To some of the Siboga specimens the description of *S. vagabunda* is just as well applicable as that of *S. inconstans*; e. g.: **638, 1103, 1211** (Pl. II, fig. 4), **1260, 1610** etc. In **1341 a** (Pl. II, fig. 3) one or two processes have more the character of those in *vagabunda*, others resemble more *inconstans*. In *S. inconstans* var. *globosa* and *S. inconstans* var. *maeandrina* the texture is said to be "hard and woody", which can certainly not be said of the brittle var. *digitata* (**B. M. 23**). The same differences we find in *vagabunda*. The color in *S. vagabunda* var. *trincomaliensis* is said to be "nearly black, with a greenish tinge"; in var. *tubulodigitata* it varies "from light to dark grey"; in var. *fungoides* and var. *gallensis* it is "pale yellowish-grey". On the other hand Dendy states that the color in all the three varieties of *S. inconstans* is "brownish orange". But Thiele says (1899 p. 10) about *S. inconstans*: "Die meisten Exemplare haben im trockenen Zustande eine orangebraune Farbe, wie auch Dendy angiebt, davon weicht das zuletzt erwähnte Exemplar durch bedeutend dunklere graubraune Farbe ab. . . . ." Judging from the Siboga specimens I came to the same conclusion. Several of the specimens which are doubtless identical with Dendy's *S. inconstans* possess that remarkable yellowish or orange tinge, which corresponds better to Saccardo's ochraceus or ferrugineus than to luteus or aurantiacus. Some, however, are pale yellowish (**1341 b**), or pale yellowish-grey (**98**). On the other hand some of the specimens which are doubtless identical with *vagabunda* are dark brown, whereas others are pale yellowish, sometimes even with "ferrugineus" spots. If we then find that in spiculation they all agree on the whole, but all differ in details and that numerous gradual transitions are found, it becomes more and more evident that *vagabunda* and *inconstans* can not be specifically distinguished.

We saw before that the Siboga specimens **612 a**, **964 a** and **966 a** may be considered identical with *Hymeniacidon angulata* Bwk. On the other hand it cannot be denied that these specimens are closely allied to, nay identical with *Suberites inconstans* var. *globosa* and var. *maeandrina*; the same is true for **98**, **931 a–b**, **964 b**, **966 c**, **977** etc. Consequently *H. angulata* and *S. inconstans* are identical. But it can as little be denied that **1971**, **1975**, **2049** are identical with *S. inconstans* var. *digitata* (**B. M. 11** and **B. M. 23**); further it is beyond doubt that the former three are identical with **1365**.

XVIII. *Suberites trincomaliensis*.

1887 Carter p. 74—75; Pl. VI, fig. 7—8.
1889 (α) Dendy p. 24.
1905 Dendy p. 122—123.

Carter mentioned in 1882 a "*Suberites*" from Trincomalee; we have seen that Ridley considered this sponge as a variety of *Spirastrella vagabunda*. Carter, however, believes it to be a special species and called it (1887) *Suberites trincomaliensis*. I agree with Ridley and with Dendy in rejecting the "species".

XIX. *Hymeraphia minax*. — *Spirastrella minax* [1]).

1888 Topsent p. 141—142; Pl. VI, fig. 7.
1890 Topsent p. 200.
1892 (α) Topsent p. XVII.

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1) The name *Spirastrella minax* occurs for the first time in Topsent's paper 1892 (α). But here as well as in 1894 (β) and 1896 it is nothing but a name. It was only in 1900 that the author explained that *S. minax* and *H. minax* were synonyms.

1894 (β) Topsent p. 8—9.
1896 Topsent pp. 115, 125.
1900 Topsent pp. 5, 10, 21, 107—110; Pl. III, fig. 8.
1909 Hentschel p. 385.

I am sorry to say that we know little about this sponge. TOPSENT openly states (1900 p. 109): "je n'ai pas fait une étude anatomique approfondie de *Spirastrella minax*". In the second place it must be acknowledged, that the illustrations and the descriptions of the spinispirae in the papers 1888 and 1900 are rather different. Externally the sponge does not show anything in which it differs from other "species" of the genus. Nor do we find any specific character in the arrangement of the spicules. TOPSENT states that *S. minax* "se distingue de ces congenères par l'ensemble de ses caractères: par sa forme encroûtante et hispide, par l'abondance excessive et par la configuration et les dimensions de ses microsclères". Now we have seen, that *S. purpurea* in the sense I take it is often encrusting, that the quantity of spinispirae is exceedingly variable and that the same is true for the shape and size of these spicules. True, all the specimens described to form thin crusts possess, in addition to minute spinispirae, robust ones, whereas the encrusting *S. minax* is said to possess minute spinispirae only. This seems to be for TOPSENT the chief reason of separating his sponge from *S. cunctatrix*. But in this latter sponge the size of the large spinispirae is rather variable. Since we know of many cases in which the number of large spinispirae is highly reduced, I think it hardly advisible to consider *S. minax* as a separate species.

XX. *Spirastrella cylindrica.*

1896 Kieschnick p. 534.
1900 Thiele pp. 56, 60, 70. [Pl. III, fig. 23].

The description given by KIESCHNICK is certainly inadequate. THIELE reexamined a specimen with the result that he identifies it with *S. vagabunda*. Indeed, as far as can be judged from the descriptions *S. cylindrica* seems to be something between *S. vagabunda* and *S. inconstans*.

XXI. *Spirastrella aurivillii.*

1897 Lindgren p. 484.
1898 Lindgren pp. 322, 323, 370, 377. Pl. 17, fig. 11; Pl. 18, fig. 4; Pl. 19, fig. 22*a*—*c*, *c'*, *c''*.

According to the descriptions and illustrations LINDGREN gives of this "species" the Siboga specimens **1075** and **1403** fully agree with *S. aurivillii*. As these specimens are nothing but young stages of trop. *digitata* I cannot accept LINDGREN's sponge as a separate species.

XXII. *Spirastrella areolata.*

1897 Dendy p. 255—257.

The largest specimen (dry) of DENDY's *Spirastrella areolata* is registered in the British Museum '07. 8. 8. 3; it bears my number **B. M. 2**. As it shows most distinctly the areolation we may take this specimen as the type, and I have, therefore, illustrated it in fig. 4 on Pl. III.

Dendy says that in spirit the surface is "more or less areolated or at least warty", and that in the dry specimen "the areolation is extremely distinct, especially where the cortex is least contracted . . . ." And further: "Where the surface is much contracted the polygonal outlines between the areolae became much less distinct, and the surface may even appear simply warty". In comparing this specimen with *Suberites wilsoni* var. *albidus* (**B. M. 15**) and the *Spirastrella cunctatrix* (**B. M. 13**) we see that the multangular ridges which are visible on the greater part of the surface of **B. M. 2**, are not quite absent in **B. M. 15**. Only there is not such a regularity; we observe on some places an irregular network of ridges and a few more tubercles than in **B. M. 2**. Finally in **B. M. 13** we observe a quantity of tubercles or warts, whereas in some parts of the surface hardly anything uneven is to be seen. To a certain extent we find the same in another specimen of *S. cunctatrix*, viz. **B. M 10**. In other respects *Spirastrella areolata* stands between *cunctatrix* and *wilsoni*, e. g. in consistence and in spiculation. In *wilsoni* the spinispirae are small and slender (**B. M. 15**) or somewhat stouter (**B. M. 22**); in *areolata* I find between small-sized spinispirae a few which are five or six times as long and stouter; in some specimens of *cunctatrix* the large-sized spinispirae differ still more from the small-sized (**B. M. 16**); in others finally, the large-sized are really gigantic compared to the small-sized (**B. M. 3**). All these reasons are for me sufficient to consider the three "species" as specifically identical.

XXIII. *Spirastrella carnosa.*

1897 Topsent pp. 425, 441—442.
1900 (*a*) Kirkpatrick pp. 128, 134.

Topsent described a "new species", "*Spirastrella carnosa*" without, however, giving any illustration. This makes it rather difficult to judge whether we have really to do with a new species. Two other species are mentioned from the same locality (Amboina), viz. *S. solida* and *S. decumbens*. The "new species" *S. carnosa* "se distingue des autres espèces du genre par sa mollesse, par la faiblesse relative de ses tylostyles, par la rareté et l'exiguité de ses spirasters". All these characteristics are of a relative nature, express only a more or less of a certain character. In some specimens of "*Suberites inconstans*" there are plenty, in others only a few spinispirae, again in others these spicules seem to be even quite absent. Some are brittle, others are tough or hard like cork or wood. Such characters are not sufficient for specific distinction.

Kirkpatrick believed to have found back Topsent's *S. carnosa*; he described a specimen, which is registered in the British Museum '98. 12. 20. 22 and which I will mark **B. M. 35**. In this specimen the tylostyli and spinispirae are somewhat larger, but the latter are likewise "rare and very fine". This specimen is certainly not specifically distinct from say *S. solida*, which on its turn is identical with *S. vagabunda*.

XXIV. *Spirastrella robusta.*

1897 Dendy p. 253—254.

The name *Spirastrella robusta* is simply made for *S. cunctatrix* var. *robusta* of Carter. It follows from what I wrote above that I fail to see the necessity of rising this "variety" to a "species".

XXV. *Spirastrella semilunaris.*

1897 Lindgren p. 484.
1898 Lindgren pp. 323—324, 370, 377; Pl. 18, fig. 23*a*—*c*, *c'*.
1900 (α) Kirkpatrick p. 134.

Spirastrella semilunaris resembles, according to LINDGREN, *S. decumbens*; it differs by the supposed absence of the dermal minute spinispirae. Since I found these spicules in RIDLEY's type (**B. M. 27**) there is not the slightest reason left for erecting a new species.

XXVI. *Suberites spirastrelloides.*

1897 Dendy p. 247—248.

Under this name DENDY described a sponge as "n. sp." from Port Phillip Heads. The author, however, adds: "I have little doubt that this species is identical with Mr. CARTER's *S. wilsoni*, var. *albidus*, though in the absence both of proper description and specimen of the latter it is impossible to be certain . . . . . The absence of the very remarkable and characteristic color of *S. wilsoni* appears to be sufficient reason for specific distinction in this case". As stated before, I could examine the type-specimen of *S. wilsoni* var. *albidus* (**B. M. 15**). Careful observations showed me that traces of the red color are indeed visible. Adding this to the remarks made above I cannot find sufficient ground for erecting a "new species" for *S. wilsoni* var. *albidus* as DENDY proposed.

XXVII. *Vioa florida.*

1897 (ε) Lendenfeld pp. 95, 108—110, 130, 131; Pl. X, fig. 78—105.
1898 Lendenfeld p. 207.

There is among the Siboga Sponges a specimen (**1047**) which in external appearance as well as in spiculation so closely resembles *Vioa florida* of LENDENFELD, that I do not hesitate and I daresay nobody would, to identify both. On the other hand this specimen **1047** is by many transitions in every respect most closely allied to specimens which are decidedly identical with *Suberites inconstans* and its varieties. Consequently I consider *Vioa florida* as identical with *Suberites inconstans*. LENDENFELD writes (l. c. p. 110) that a characteristic feature of *V. florida* lies in the shape of the spinispirae, with their peculiar spinae. "Diese Dornen sind zylindrisch, terminal etwas verbreitert und tragen auf ihren Terminalflächen eine Anzahl feinster Dörnchen. Nur mit starken Öl-Immersionen lassen sich letztere erkennen: mit Trockensystemen betrachtet erscheinen die Dornen unregelmässig lappig und haben ein Efflorescenz-artiges Aussehen. Darauf bezieht sich der Speziesname *florida*". Now I am convinced that this is not a specific characteristic of *florida*, for I find exactly such spinispirae in many of my specimens of the Siboga (**92 a**, **92 b**, **1005**, **1045**, **931 b**, **614 a** etc. etc.). Moreover TOPSENT states (1906 β p. 573) that exactly the same peculiarity occurs in LAMARCK's type-specimen of *Alcyonium purpureum*.

XXVIII. *Spirastrella insignis.*

1898 Thiele p. 43. Pl. II, fig. 5; Pl. VIII, fig. 18*a*—18*c*.
1906 (β) Topsent p. 575.

In external appearance specimens **1947** and **1949** of the Siboga material very much resemble the illustration THIELE gives of his *Spirastrella insignis*. Now those specimens are closely allied to *S. areolata*; all three are devoid of the very large, robust spinispirae. But *areolata* as well as **1947** and **1949** are also allied to *cunctatrix* which generally possesses abundantly those robust spinispirae. On the other hand THIELE's specimen in some respects resembles itself *cunctatrix*. Indeed, taking all into consideration it becomes highly probable that *S. insignis* is identical with *S. cunctatrix*. I hope to show by comparison of the whole mass of specimens I examined, that this is not only probable but that it is true.

XXIX. *Spirastrella panis*.

1898 Thiele pp. 43—44, 62. Pl. II, fig. 3—4; Pl. VIII, fig. 19*a*—19*d*.

The author mentions three varieties of this "new species" viz. *rugosa*, *massalis* and *anamensis*. Between the former and *S. insignis* I cannot see any difference of specific value. THIELE states further (l. c. p. 43) that one of his varieties (which?) "in der Nadelform sich *Spirastrella cunctatrix* nähert, während die Form . . . . . der von *Spirastrella papillosa* R. u. D. ähnlich ist". Now *cunctatrix* and *papillosa*, as stated before, are so closely allied that I believe them to belong to one and the same species. Many specimens of the Siboga Spirastrellae resemble in external appearance and in spiculation both *panis* and *cunctatrix*. The fact is that they are not specifically to be distinguished from each other, nor from *cunctatrix*, *papillosa* or *panis*.

XXX. *Spirastrella tentorioides*.

1905 Dendy p. 125—126; Pl. V, fig. 7.
1909 Hentschel p. 383—384.

The type of DENDY's *Spirastrella tentorioides* is registered in the British Museum '07. 2. 1. 124 and received my number **B. M. 18**.

DENDY writes p. 126: "Considering the extraordinary variation which the species of *Spirastrella* exhibit, alike in external form and in the arrangement of pores and vents, I should hardly have considered characters of this nature alone sufficient to justify the establishment of a new one, but should have regarded this form as yet another variety of *Spirastrella vagabunda*. We have here, however, a stout form of the spiraster which is, perhaps, not represented in any of the varieties of that species, and this fact, taken in conjunction with the other characters, seem to me to justify a specific separation". In discussing the specific value of *S. areolata* I hint at the little specific value that can be attached to the presence or absence of "stout" spinispirae. We will see hereafter that even in this respect *Spirastrella* shows all gradual transitions in different specimens. Consequently the value for specific distinction diminishes, and I do not hesitate to accept DENDY's suggestion about the identity of *S. tentorioides* and *S. vagabunda* a. o. In many respects *S. tentorioides* resembles *S. inconstans*. At least I find in the Siboga specimens some which are undoubtly identical (specifically) inter se, on the other hand strikingly agree partly with *S. inconstans* partly with *S. tentorioides*.

XXXI. *Spirastrella bonneti.*

1906 (β) Topsent pp. 570, 571, 573—575.

Topsent describes a "new species" under the name *Spirastrella bonneti.* It is a great misfortune that we have here again to do with a "new species" the description of which is not accompanied by figures. As far as can be judged from this description the shape is cushion-like, provided with numerous "conules" of 5—10 mm. These cones are "rattachés les uns aux autres par des brides membraneuses minces". This feature reminds us of *S. insignis* and of some specimens of *S. panis* of Thiele. In this connection it is worth while to draw attention to the fact that Topsent says about the megasclera: "Ils rappellent un peu les styles de *Spirastrella insignis* Thiele, mais ils mesurent seulement 0 millim. 3 à 0 millim. 33 de longueur...." And about the microsclera the author writes: "Il existe aussi une certaine similitude entre ces spicules et les microsclères correspondants de *Spirastrella insignis*, mais des spirasters de *S. Bonneti* l'épaisseur ne dépasse pas 0 millim. 0045, ni la longueur 0 millim. 023". As often stated before and as I will more fully explain hereafter, it is impossible to make specific distinctions in *Spirastrella* on account of the size of the spicules. And since I unite *S. insignis*, *panis*, a. o. with *wilsoni*, *purpureum*, *areolata* a. o. on one side and with *cunctatrix* on the other side, it consequently follows that I believe *S. bonneti* to be nothing but a specimen of *A. purpureum* of Lamarck.

XXXII. *Spirastrella digitata.*

1909 Hentschel p. 385—386; Pl. XXII, fig. 7 and woodcut.

"Ein massiger Schwamm mit Fortsätzen von fingerförmiger, keulenförmiger, lappiger oder knolliger Gestalt...... Die Oberfläche ist etwas rauh, die Farbe im trockenen Zustande hell-orange-braun, innen fast weiss". Comparing this description and the illustration with specimens of the Siboga-material I find it marvellously in accordance with **S. E. 2049**. In spiculation the sponge differs in so far as the styli or tylostyli are stouter in my specimen, whereas the spinispirae are much more slender. In this respect the sponge approaches *Suberites wilsoni* (**B. M. 22**) and others. There seems to me no doubt as to the identity of Hentschel's *S. digitata* with my trop. *tubulifera*; it forms a transition between this tropus and trop. *pyramidalis* — once more a proof of the impossibility at present to distinguish species.

To resume the conclusions we arrive at by the above considerations, we find that a quantity of specimens belonging to the genus *Spirastrella* may be identified with "species" previously described, and that some of these "species" are mere synonyms. Thus we have already established the following points.

1° Identical with *Spirastrella cunctatrix* are: **92 a–l**, **426 d**, *S. papillosa*, *S. panis* and *S. insignis*.

2° Identical with *Spirastrella decumbens* are: *S. bistellata*, *S. transitoria*, *S. semilunaris*, **1031**, **1455 a–c**, **1945**, **1402** and **1421**.

3° Probably identical with *Suberites wilsoni*: *Alcyonium purpureum*, *Spirastrella areolata*, *S. massa*, *S. bonneti*, *Hymeniacidon pulvinatus*, 426 a–c, 1045, 1949.

4° Identical with *Spirastrella vagabunda*: *S. congenera*, *S. punctulata*, *S. solida*, *S. carnosa*, *S. tentorioides*, 948 a–f.

5° Identical with *Suberites inconstans* var. *globosa* and var. *maeandrina*: *Hymeniacidon angulata*, *Vioa florida*, 98, 612 a, 931 a–b, 964 a–b, 966 a–b, 977 and 1047.

6° Identical with *Suberites inconstans* var. *digitata*: 1365, 1971, 1975, 2049.

Consequently we have six groups, which each contain several "species". At any rate we should have to reduce the number of these "species" to six, or, admitting DENDY's views in considering "*globosa*" (resp. "*maeandrina*") and „*digitata*" as mere "varieties" of *S. inconstans*, only five. The Siboga collection contains, however, a number of other specimens which form connecting links; herewith a specific distinction becomes impossible. It cannot be denied, however, that on the whole the "species" of each group are mutually closer related than with others. I do not wish to consider these groups as "varieties", since this term, vague as it is, is not always used in the same sense. For similar reason I will rather avoid to apply the term "forma" LINDGREN (1898) speaks of a forma libera and a forma excavans in the case of *Spirastrella aurivillii*. As I am of opinion that the species of the genus *Spirastrella* do not perforate calcareous matter, are not boring sponges, it might give new confusion in using the term forma in our case. BIDDER suggested (1902 p. 381) the word "metamp" for certain cases in which specimens were different from the type species. If I am not mistaken, BIDDER wishes to apply the term metamp for the case one has reason to suppose that the difference is due to external circumstances, such as temperature, constitution of the medium, the bottom of the sea etc. and that the variation is not congenital. In our case this is exactly what for the moment cannot be made out. Under such circumstances it seemed to me better to use the indifferent term *tropus*[1]). Thus for instance, *Spirastrella cunctatrix*, *papillosa*, *panis*, *insignis*, 92 a–l, 426 d belong to one tropus; *Suberites wilsoni*, *Alcyonium purpureum*, 426 a–c, 1045 to another.

We have seen before that the specimens of the latter tropus belong to one species, the oldest name of which is *Alcyonium purpureum*, which RIDLEY correctly replaced by *Spirastrella purpurea*. And since no other specific name of specimens of another tropus has priority this is t h e name for our sponge. For I have demonstrated that many of the other "species" are identical with LAMARCK's sponge and we will find still more arguments herefor in the course of this paper. For the sake of convenience I will state now already that I distinguish seven tropi, which I call *tegens*, *tuberosa*, *digitata*, *pyramidalis*, *tubulifera*, *concrescens* and *glaebosa*.

To tropus *tegens* belong: *decumbens*, *bistellata*, *semilunaris*, 1031, 1455 a–c, 1945, a. o.

To tropus *tuberosa*: *cunctatrix*, *papillosa*, *insignis*, 92 a–l, 426 d, a. o.

To tropus *digitata*: *vagabunda*, *congenera*, *punctulata*, 948 a–f, a. o.

To tropus *pyramidalis*: *wilsoni*, *areolata*, *purpurea*, 426 a–c, 1949, a. o.

To tropus *tubulifera*: *inconstans* var. *digitata*, 1365, 1971, 1975, a. o.

To tropus *concrescens*: *florida*, 305 a–d, 612 b–d, 1047, 1341 a–c, a. o.

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1) τρόπος, direction, sort, manner, character, peculiarity.

To tropus *glaebosa*: *inconstans* var. *globosa* and var. *maeandrina*, *angulata*, 964 a–b, 966 a–c, 98, 612 a, a. o.

I shall now have to show that not only *cunctatrix*, *papillosa*, 92 a–l etc. (trop. *tuberosa*) cannot be specifically separated, as little as *wilsoni*, *dysoni*, *areolata*, 426 a–c etc. (tropus *pyramidalis*), but that specimens of one tropus gradually pass into those of another, nay that some specimens might be placed in one tropus as well as in another. If this fact be demonstrated, it will be evident, that the tropi as such do not represent as many species.

What are the chief differences, by which specimens like *cunctatrix* or 426 d (tropus *tuberosa*) are distinguished from, say 426 b–c, *wilsoni*, etc. (trop. *pyramidalis*)? At first sight it seems easy enough to say what is the difference between *cunctatrix* and *wilsoni*, viz. the presence or absence of spinispirae. However: the type of *wilsoni* (**B. M. 33**) is destitute of spinispirae altogether. But in other specimens of *wilsoni* (**B. M. 15, B. M. 22, B. M. 33**) spinispirae occur; I lay stress on the fact that in all these three specimens the size and the shape of the spinispirae are different, as is shown on Pl. X, fig. 5 and on Pl. XII, figs. 3 and 4.

One of the characteristic spicules of *cunctatrix* is the large robust spinispira. All the specimens of *cunctatrix* in the British Museum possess these spicules (Pl. X, fig. 6 ι–λ; fig. 7 α–ζ etc.). Comparing these figures with the spinispirae of *wilsoni* **B. M. 15** and **B. M. 22** the difference strikes us at once. But this difference is not so conspicuous between *wilsoni* **B. M. 32** (Pl. X, fig. 5 ϑ–λ) and *cunctatrix* **B. M. 10** (Pl. X, fig. 2 $\varkappa$–ν). Careful examination of the spinispirae of several specimens, both of *cunctatrix* and of *wilsoni* teaches us how very variable they are and we finally arrive at the conclusion that the difference between some specimens of *cunctatrix* and *wilsoni* is certainly not greater than that of various specimens either of the one or the other. The difference between the spinispirae of the above mentioned specimens (Pl. X, figs. 2 and 5) is not larger than between the former (**B. M. 10**) and another *cunctatrix*, say **B. M. 3**; on the contrary [Cf. Pl. X, figs. 2 and 7]. If this be so, how shall we distinguish *cunctratrix* and *wilsoni* as two different species? It is surely quite impossible on account of the robust spinispirae, after all the most important character. An examination of the tylostyli leads to the same conclusion. If we try to find a distinctive character in the external appearance or structure, we meet with exactly the same difficulties. On Pl. III, fig. 5 I have illustrated specimen 92 c and in fig. 1 specimen 426 b; they are typical examples of trop. *tuberosa* and trop. *pyramidalis* respectively. The external appearance of these two forms is quite different. In the former we see an ellipsoid mass more or less regularly covered with tubercles or warts; in the latter there is a large pyramidal cone provided with smaller cones on the slope, especially at the base. However, there are many transitions: in 92 a, 92 b, 92 d, 92 i some cylindro-conical elevations of various size are visible, which are devoid of tubercles. On the other hand we see in 426 d several low warts, in 426 c only one or two, in 426 a and 426 b none. Likewise we observe that *cunctatrix* **B. M. 13** is covered with numerous tubercles all over; in **B. M. 10** (Pl. III, fig. 3) the tubercles are distinct, but they are localised and large areas of the sponge surface are entirely devoid of them. **B. M. 1** is "pyramidal in form . . . with a smooth surface"; still it is called *cunctatrix*". — If we examine longitudinal sections of 426 a–c we see a wide central canal, which narrows towards the top. Such large central canals are not seen in 426 d or 92 a–l;

moreover we find the parenchyma compacter in the latter specimens (trop. *tuberosa*) than in the former (trop. *pyramidalis*). But we know by THIELE (1898 p. 43) that in *S. panis* (which we identified with 92a–l; cf. p. 25) is "merkwürdig . . . das verschiedene Verhalten der Kloaken, die bei manchen Exemplaren recht bedeutende Grösse erreichen, bei anderen kleiner sind und bei noch anderen ganz zu fehlen scheinen". We see, consequently, that neither the external appearance, nor the structure, nor the spiculation furnishes specific characters; the extremes differ considerably, but they are united by all possible transitions.

There is a great external resemblance between on one hand 426a and 426c which we saw belonged to trop. *pyramidalis*, and on the other hand 948a and 948f, belonging to trop. *digitata*. They differ on account of the total absence of robust spinispirae in the latter. We found, however, in the above mentioned cases of *wilsoni* and *cunctatrix* that these spicules are very variable and even disappear. Moreover we see that there is a considerable difference with regard to their frequency. Robust spinispirae are abundant in 426d; compared herewith they are not very frequent in 426a and 426b; still less frequent they are in 426c. Also they are less developed in the latter. The presence or absence of these spicules is, therefore, not of specific value. It is beyond doubt that 948a–f are all identical. Longitudinal sections across the entire sponge show, however, many differences. In 948a and 948e we find a rather massive tissue with comparatively narrow central canals, the whole making the impression of contraction. Similar sections through 948b or 948g show a looser parenchyma and wider canals, entirely resembling sections of 426a–c, as can be seen on Pl. V, figs. 1 and 3. In addition to the large central canal, secondary canals are visible, more or less parallel to the former. We can follow step for step how nearly 426a–c and 948a–f are allied; and the same we see between some specimens of 948a–f and 426d. Consequently we find it impossible to separate 948a–f specifically from 426a–c or 426d. As to the shape of the processes we see the same gradual transitions. In the main, pyramidal process of 426a the ratio between the height and the diameter at the base is about 6 : 8; in 948d it is 6 : 3; but in 948e it is 6 : 5, in 948f 6 : 6 etc. The processes are generally conical, but not always; they may be cylindrical or even somewhat broadened at the top, thus resembling *S. tentorioides*. DENDY hesitated to consider this "species" as another "variety" of *vagabunda*, because of the presence of stout spinispirae in the former. I believe the distinguished spongiologist would have had less scrupules if he had been acquainted with the above facts. Indeed *S. tentorioides* by its structure, especially by the arrangement of the main canals comes nearer *S. vagabunda*. But by its spinispirae it forms a link between 948a–f and 426a–c, a form which might be placed among trop. *digitata* as well as among trop. *pyramidalis*. Taking all together we arrive at the conclusion that *digitata*, *tuberosa* and *pyramidalis* are three tropi but one single species.

Spirastrella solida (B. M. 26) externally closely resembles 426d; it differs in this respect from *S. papillosa* only by less prominent tubercles. RIDLEY & DENDY say that the robust spinispirae, which are found in *papillosa* (and also in 426d) do not occur in *S. solida*. However, I found such spicules here and there in the very type, B. M. 26. We saw already that this sort of spinispirae, abundant in 426d, are less frequent in 426a and 426b, still less in 426c; we have in B. M. 26 an example in which they are really very rare.

We have seen above that *S. decumbens* is identical with *S. bistellata* and that specimens 1031, 1455 a–c, 1945 from the Siboga collection belong to the same species. We saw likewise that through B. M. 38 the specimens 1402 and 1421 are just as well forms of trop. *tegens*. But the latter two show incipient papillae, by which they form transitions to trop. *pyramidalis* or trop. *digitata*. Consequently the species of trop. *tegens* can not be separated from those of trop. *pyramidalis* or trop. *digitata*. Moreover we have in 1480 a form which might be placed within *tegens* just as well as within *pyramidalis*; to the former it is related by its spinispirae, to the latter by its processes. Specimens 410 and 300 on the other side show nearer relation to *tegens*, possessing hardly any processes and more resembling thick cushion-shaped specimens of this tropus, whereas they entirely miss the robust spinispirae and in this respect are closer related to trop. *pyramidalis*. If we do so the pyramidal shape of this tropus is no more constant Indeed all is fluctuating.

Between trop. *digitata* and trop. *pyramidalis* there are numerous transitions; 410 and 1092 resemble each other strikingly, but in 410 some spinispirae are larger and formed like those of 426 a–c (Pl. IX, fig. 3), whereas 1092 only possesses small ones. Typical forms of trop. *pyramidalis* possess, in addition to the ordinary small spinispirae, others which are slightly thicker or longer (Pl. XII, fig. 3); in this respect 1403 ought do be considered as trop. *pyramidalis*, the spinispirae exactly resembling those of *S. wilsoni* B. M. 15. But they resemble at the same time those of *S. vagabunda* B. M. 24 (Pl. XI, fig. 7). Externally 1403 and 1075, from the same locality, resemble each other very much; their spinispirae show slight differences, the latter are more like those of B. M. 24. It is certainly impossible to separate as different species: *wilsoni* B. M 15, *vagabunda* B. M. 24, 1403 and 1075.

Specimen 1947 has the external appearance of *Suberites inconstans* var. *digitata* (B. M. 11); with regard to the tylostyles they agree; but in the former abundantly I find small spinispirae, in the latter none. Specimen 1949, from the very same locality as 1947, possesses still lower processes than the latter. It has, as we have seen, large portions on the surface which correspond to *S. areolata* B. M. 2; moreover we find spinispirae which are like those of 426 a–c. The sponge in some respects ought to be considered as trop. *tubulifera*, in others as trop. *pyramidalis*. Specimen 1988 shows similar spinispirae (Pl. IX, fig. 8) and in external appearance it connects again 1949 with trop. *pyramidalis*. Such specimens like 1947, 1949 and B. M. 11 clearly show that the two tropi are not specifically different.

Ridley has already stated that *Spirastrella vagabunda* is closely allied to *Hymeniacidon angulata* Bwk. We have seen above that on the other side the latter is indeed identical with *Suberites inconstans* Dy. Dendy showed how variable this sponge is and we need not further discuss the specific identity of trop. *concrescens*, *glaebosa* and *tubulifera*. Summa summarum we arrive at the conclusion that all the above mentioned specimens and "species" belong to one single, exceedingly variable species *Spirastrella purpurea*. We may distinguish certain groups of specimens formed by the same tropus; to such a tropus belongs a number of specimens typically, others are again somewhat modified and form transitions to other tropi. These may be characterised as follows:

Trop. *tegens*[1]). Incrusting, tending to become thicker, thus forming cushions or thick trabeculae. Surface glabrous, hence more or less shining or glossy. Structure pretty compact. In addition to small spinispirae, robust ones occur. Typical representatives are: *Spir. decumbens* (B. M. 27, B. M. 38, B. M. 39); *Spir. bistellata* (G. M. 73); 1031, 1455 a–d; 1945. Here may be included, though not as typical forms: *S. transitoria* (B. M. 30), *S. semilunaris*, 1402, 1421.

Trop. *tuberosa*. Massive, more or less broad-conical. Surface with numerous tubercles or papillae, sometimes with rugae; subglabrous, hence somewhat glossy. Structure pretty compact. In addition to small spinispirae, very large, robust ones occur, forming a cortical crust. Typical representatives are: *Spirastrella cunctatrix* (B. M. 1, B. M. 3, B. M. 10. B. M. 13, B. M. 16), *S. panis, S. insignis, S. papillosa*, 92 a–l, 426 d. *S. cunctatrix* described by SCHMIDT is said to be incrusting, and as such forms a transition to trop. *tegens*. SCHMIDT states that the spinispirae are often short and thick, resembling those of his *Suberites bistellatus*. This is also the case in *Spir. cunctatrix* B. M. 3; herein we have another suggestion for the specific identity between trop. *tegens* and trop. *tuberosa*.

Trop. *pyramidalis*. Typically the shape is pyramidal, at the base often provided with conical or digitate processes. At the top of the pyramid there generally is a small opening which leads in a main central wide canal. Surface subglabrous, somewhat shining. Often distinctly purple or carmin-red. The larger spinispirae are exceedingly variable in shape and size; they may be very scarce, even disappear. Typical representatives are: *Suberites wilsoni* (B. M. 15, B. M. 22, B. M. 32, B. M. 33), 426 a–c. The shape of *Alcyonium purpureum* is unknown; probably not pyramidal but "massive, cushion-like", as BOWERBANK states about *Hymeniacidon pulvinatus*. If this be so there is reason to include specimens like 300, 410 etc. within the tropus. We may also include: *Spir. areolata, S. massa* and *S. bonneti*; further 1949, 1988, 1950, 1480, 1045. Characteristic is further that the tylostyli often form thick bundles, especially towards the periphery, thus simulating a cortex.

Trop. *digitata*. Massive; from a broad base digitate processes tend to grow up; these may be short and thick, giving to the sponge a more massive appearance or elongated, fingershaped. The robust spinispirae we saw still frequently present in trop. *pyramidalis* are always wanting. The small spinispirae form a superficial crust. Like in typical specimens of trop. *pyramidalis* their is a large, central canal; generally we find secondary large canals around the central one. Typical representatives are: *S. vagabunda* (B. M 17, B. M. 19, B. M. 14, B M. 24, B. M. 36, B. M. 41, *S. congenera* (B. M. 20), *S. punctulata* (B. M. 28), 948 a–f. More or less modified are 614 a–b, 143, 1117, 1391, 1610, 1631. Very likely *S. solida*, *S. tentorioides*, *S. carnosa* have to be included here. As stated before it is a mere question of taste whether 1403 and 1075 shall be included in trop. *digitata* or in trop. *pyramidalis*. With *S. wilsoni* B. M. 15 they are closely allied in respect to the spinispirae.

Trop. *tubulifera*. Typically start from a broad base digitate or cylindrical processes. In these processes a wide central canal is visible, which opens at the top with a wide mouth.

1) tego, I cover.

The opening may be narrowed or quite shut by contraction. Parallel to the central canal are secondary ones, resembling the state of things in trop. *vagabunda*. Texture comparatively compact. Surface not shining, but, by the presence of projecting tylostyles, velvet-like or hispid. Color generally yellowish. No robust spinispirae; small spinispirae not forming a dermal crust, often scarce or absent. Tylostyli rather stout. Typical representatives are: *Suberites inconstans* var. *digitata* (B. M. 23), 1365, 1971, 1975, 2049. In the other specimens we see low processes (B. M. 11), still lower and undistinct in 1947, which is, however, undoubtedly identical with it. Probably are 638, 1211, 1260, M. M. 61, M. M. 62, M. M. 63 to be included here. By 1947 and B. M. 11 trop. *digitata* is allied to trop. *pyramidalis* (1949).

Trop. *concrescens*. The most characteristic feature of trop. *concrescens* is the marked tendency of the processes to fuse together. We find this tendency likewise in trop. *tubilifera* but here it is less conspicuous. Whereas the central canals in typical *tubulifera*-specimens is very wide and the process more or less cylindrical, we observe in trop. *congrescens* central canals which are of an intermediate size between those of trop. *tuberosa* and those of trop. *tubulifera*; the ratio between the diameter of the central canal and the process is about as it is in many specimens of trop. *digitata*. Another characteristic feature seems to be the tendency the processes show to become club shaped (Pl. I, fig. 3). In 1341 a we have an interesting specimen, showing processes of very different shape: one is digitate like often in trop. *tubulifera* and in trop. *digitata*; another is more or less club shaped (Pl. II, fig. 3). In 612 d it is seen how neighbouring clubs fuse together (Pl. I, fig. 3), whilst a part of their stems remain separate. In 1047 the processes are almost entirely fused; this specimen agrees with LENDENFELD's figure of "*Vioa florida*". For the rest *concrescens* and *tubulifera* have the same characters: yellowish color, often stout tylostyli and not abundantly furnished with spinispirae. It is worth while to draw attention to the fact that in 1047 there is a distinct dermal crust of spinispirae, like we find in trop. *digitata* a. o. Typical representatives are: 305 a–d, 612 b–d, 1341 a–d, 1047, *Vioa florida* Ldfd. Perhaps may be included: 179, 210, 1141.

Trop. *glaebosa* [1]). Irregularly spherical or cake-like masses, without digitate processes. Surface uneven, minutely hispid, showing numerous comparatively large openings or pits with irregular outline, not unfrequently slit-like, meandering. Color generally yellowish. Tylostyli often rather stout; spinispirae small sized, often very scarce or absent. Typical examples are: *Suberites inconstans* var. *globosa* and var. *maeandrina* (B. M. 9, B M. 25), 98, 612 a, 931 a–b, 964 a–b, 966 a–c, *Hymeniacidon angulata* Bwk. (B. M. 8, B. M. 21, B. M. 29). Included in this tropus can be: 245, 764, 1418, 1447, 2030, 2031, 2032, M. L. B. 135, M. L. B. 136. We will see hereafter that trop. *concrescens* almost imperceptibly passes into trop. *glaebosa*; and as the former is likewise in many ways related to trop. *tubulifera* and trop. *digitata*, we find all our six tropi, in spite of enormous differences, representing but one species.

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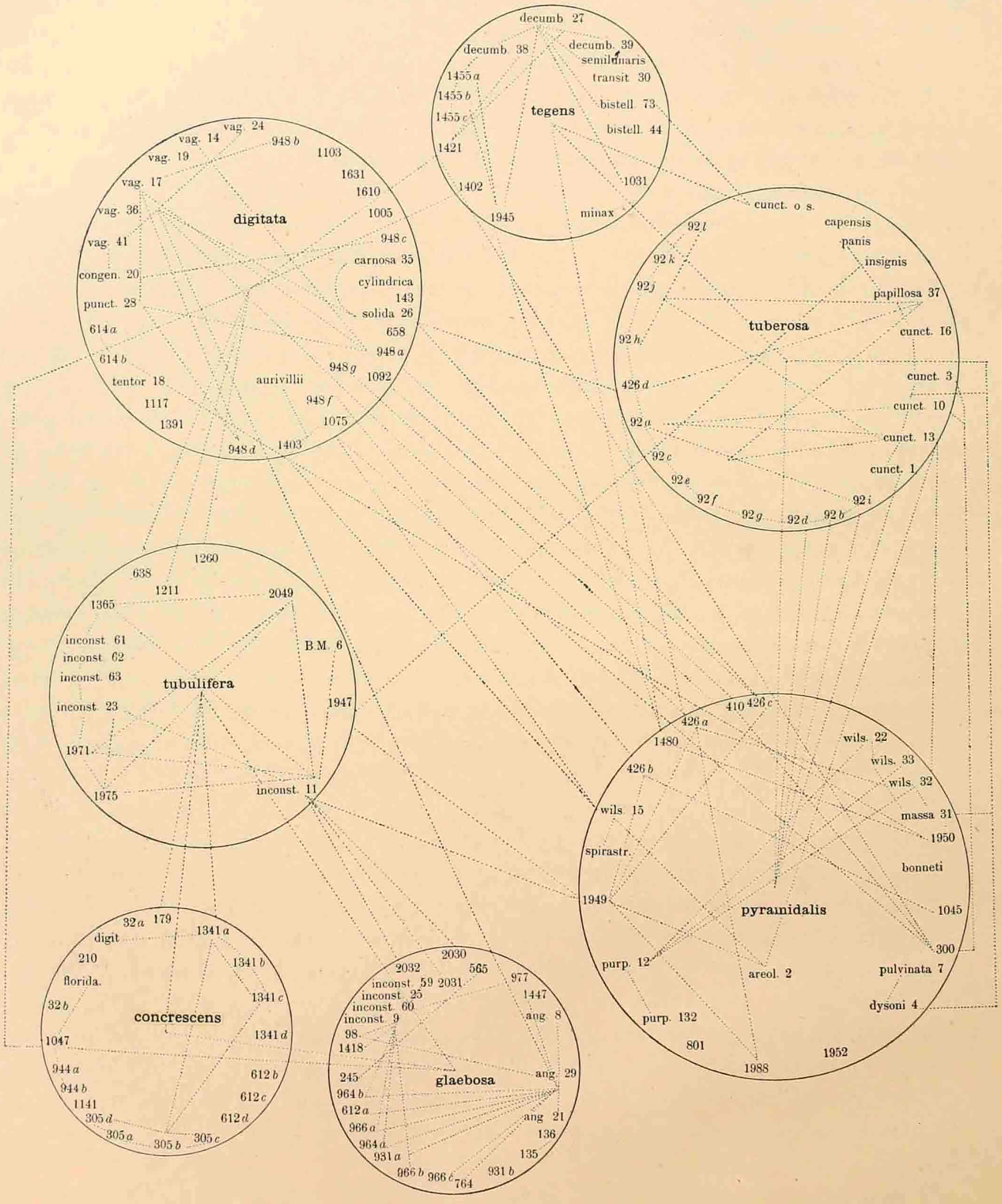
1) glaeba, lump.

In the following table I have tried to give a graphical view of the way the different specimens are related.



Reference of running numbers.

[The specimens from the British Museum are marked **B. M.**, from Museum Normanianum **M. N.**, from the Graz Museum **G. M.**, from the Leiden Museum **M. L. B.**, from the Madras Museum **M. M.** Those from the Siboga Expedition **S. E.** (our without letter)]

B. M. 1. *Spirastrella cunctatrix* var. *porcata* Crtr.
B. M. 2. *Spirastrella areolata* Dy. Type.
B. M. 3. *Spirastrella cunctatrix* var. *robusta*. Crtr.
B. M. 4. *Spongia dysoni*. Crtr. Type.
B. M. 6. *Spirastrella* with M.S. name in Brit. Mus.
B. M. 7. *Spirastrella pulvinata* (Bwk.). Rdl.
B. M. 8. *Hymeniacidon angulata* Bwk. Type.
B. M. 9. *Suberites inconstans* var. *maeandrina* Dy. Type.
B. M. 10. *Spirastrella cunctatrix* det. Carter.
B. M. 11. *Suberites inconstans* var. *digitata* Dy. Probably co-type.
B. M. 12. *Alcyonium purpureum* Lmk. Very likely type.
B. M. 13. *Spirastrella cunctatrix* det. Carter.
B. M. 14. *Spirastrella vagabunda* var. *gallensis* Dy. Type.
B. M. 15. *Suberites wilsoni* var. *albidus* Crtr. Type.
B. M. 16. *Spirastrella cunctatrix* var. *robusta* Crtr. Type.
B. M. 17. *Spirastrella vagabunda* var. *tubulodigitata* Dy. Type.
B. M. 18. *Spirastrella tentorioides* Dy. Type.
B. M. 19. *Spirastrella vagabunda* var. *fungoides* Dy. Type.
B. M. 20. *Spirastrella congenera* Rdl. Type.
B. M. 21. *Hymeniacidon angulata* Bwk.
B. M. 22. *Suberites wilsoni* Crtr.
B. M. 23. *Suberites inconstans* var. *digitata* Dy. Type.
B. M. 24. *Spirastrella vagabunda* var. *trincomaliensis*.
B. M. 25. *Suberites inconstans* var. *globosa* Dy. Type.
B. M. 26. *Spirastrella solida* Rdl. & Dy. Type.
B. M. 27. *Spirastrella decumbens* Rdl. Type.
B. M. 28. *Spirastrella punctulata* Rdl. Type.
B. M. 29. *Hymeniacidon angulata* Bwk.
B. M. 30. *Spirastrella transitoria* Rdl. Type.
B. M. 31. *Spirastrella massa* Rdl. & Dy. Type.
B. M. 32. *Suberites wilsoni* Crtr. Co-type.
B. M. 33. *Suberites wilsoni* Crtr. Type.
B. M. 35. *Spirastrella carnosa* det. Kirkpatrick.
B. M. 36. *Spirastrella vagabunda* Rdl. Type.
B. M. 37. *Spirastrella papillosa* Rdl. & Dy. Type.
B. M. 38. *Spirastrella decumbens* var. Rdl. Type.
B. M. 39. *Spirastrella decumbens* var. *robusta* det. Kirkpatrick. Type.
B. M. 41. *Spirastrella vagabunda* Rdl. Type.
M. N. 44. *Hymedesmia bistellata* det. Topsent.
M. M. 59. *Suberites inconstans* var. *maeandrina*.

M. M. 60. *Suberites inconstans* var. *globosa* Dy. Probably co-type.
M. M. 61. *Suberites inconstans* var. *digitata.*
M. M. 62. *Suberites inconstans* var. *digitata.* Probably co-type.
M. M. 63. *Suberites inconstans* var. *digitata.*
G. M. 73. *Suberites bistellatus* O. S. Type.
M. L. B. 132. *Alcyonium purpureum* Lmk. Probably type.
M. L. B. 135. Undetermined specimen in the Leyden Museum.
M. L. B. 136. Undetermined specimen in the Leyden Museum.

B. Locality and Depth of the Siboga specimens.

Station.	Latitude.	Longitude East.	Depth in meters.	Locality.	Bottom.	Running number.
7	7° 55′.5 S.	114° 26′	15 and more	Near reef of Batjulmati (Java).	Corals and stones.	1211.
33			22 and less	Bay of Pidjot, Lombok.	Mud, coral and coralsand.	179. 638.
37			27 and less	Sailus ketjil, Paternoster- [Islands.	Coral and coralsand.	1341 a–d.
50			up to 40	Bay of Badjo, W. C. of Flores.	Mud, sand and shells.	614 a–b.
53			up to 36	Bay of Nangamesi, Sumba.	Coral sand.	1047.
64			up to 32	Kambaragi-bay, Tanah [Djampeah.	Coral, coralsand.	1117.
71			up to 32	Makasser and surroundings.	Mud, coral, sand with mud.	931 a–b, 964 a–b, 1391.
78			about 2	Lumu-Lumu-shoal, Borneo- [bank.	Coralreef.	1031.
79a	2° 38′.5 S.	117° 46′	54	Borneo-bank.	Fine coralsand.	1421.
86			36	Off Dongala, Palos-bay, [Celebes.	Fine, grey mud.	305 a–d.
99	6° 7′.5 N.	120° 26′	16—23	Off North Ubian.	Lithothamnion bottom.	1075, 1403, 1455.
115			reef	East side of Pajunga I. [(Kwandang).	Coralreef.	98, 210.
131			reef	Off Beo, Karakelang Islands.	Coralreef.	764, 1260, 1418.
144			45	North of Damar-Island.	Coral bottom and Litho- [thamnion.	801, 966 a–c, 1447.
149			about 2	Fau Island near Gebé Island.	Mud.	1365, 1971, 1975, 2049.
162			18	Between Loslos and Broken- [Islands.	Coarse and fine sand, with [clay and shells.	944 a–b, 948 a–d, 1103, 1402.
163			29	West entrance Selee-strait.	Sand, stone, mud.	1005.
193			reef	East Coast of Sula Besi.	Coralreef.	245, 565, 2030, 2031, 2032.
213			reef	Saleyer-Island.	Coralreef.	300, 410, 1945.
225			reef	Lucipara-group.	Coralreef.	1950.
240			9—45	Banda.	Sand, coral, Lithoth.-bank [(18—36 M.).	977.
258			22	Kei-Islands.	Lithothamnion, sand, coral.	1092.
272			reef	Dobo, Aru-Islands.	Coralreef.	1141.
282	8° 25′.2 S.	127° 18′.4	27—54	Between Nusa Besi and N. E. [Timor.	Sand, coral, Lithothamnion.	143, 1045, 1610, 1947, 1949, 1952.
303			up to 36	Haingsisi, Samau-Islands.	Lithothamnion.	658, 1480.
310	8° 30′ S.	119° 7′.5	73		Sand, with few pieces of [dead coral.	92 a–l, 426 a–d.
311			up to 36	Sapeh-bay, E. C. of Sumbawa.	Mud and sand.	1631.
313			up to 36	Sapeh-bay, E. of Dangar Besar.	Sand, coral, mud.	612 a–d.

C. Geographical and bathygraphical distribution of specimens previously described.

a. Geographical distribution.

ATLANTIC. Madeira (BOWERBANK, *Hymeniacidon angulata*). Channel, Le Portel, Luc, Roscoff (TOPSENT, *Spirastrella minax*). Mediterranean, Banyuls, Massa de Oro (TOPSENT, *Spirastrella minax*).

INDIC. Red Sea, Suakin (KELLER, *Spirastrella decumbens*). Sansibar, LENDENFELD, *Vioa florida*. Mauritius and Mozambique (RIDLEY, *Spirastrella punctulata*). South Africa, Port Elisabeth (CARTER, *Suberites capensis*). Gulf of Manaar, (DENDY, *Spirastrella vagabunda* var. *trincomaliensis*, var. *fungoides* and var. *tubulodigitata*). Ceylon (DENDY, *Spirastrella vagabunda* var. *fungoides*, var. *tubulodigitata* and var. *gallensis*; also **B. M. 6**). Trincomalee (CARTER, *Suberites* sp. **B. M. 24**). Madras (DENDY, *Suberites inconstans*). King Island, Burmah (CARTER, *Suberites trincomaliensis*). Christmas Island (KIRKPATRICK, *Spirastrella carnosa*). Torres Straits, Thursday Island, West Island (RIDLEY, *Spirastrella vagabunda* and *congenera*). Sharks Bay (HENTSCHEL, *Spirastrella tentorioides* and *digitata*). Koombana Bay (HENTSCHEL, *Spirastrella cunctatrix*. "Cap l'Ewin" [= Cape Leeuwin] (LAMOUROUX [1]), *Alcyonium purpureum*.

PACIFIC. Java Sea (LINDGREN, *Spirastrella aurivillii*). Celebes (THIELE, *Spirastrella inconstans*). Ternate (KIESCHNICK, *Spirastrella cylindrica*). Amboina (TOPSENT, *Spirastrella carnosa*).

We learn from this list, compared with the numerous localities in which the Siboga dredged, that *Spirastrella purpurea* (in the sense I take it) is widely spread, but chiefly occurs in tropical or subtropical regions, and that the Indic and the Malay Archipelago are the places where it grows best.

b. Depth.

We possess but little information about the depth in which our sponge was found. BOWERBANK says about *Hymeniacidon angulata* that it lives in low water; RIDLEY states that *Spirastrella punctulata* occurs between tide-marks. LAMARCK speaks of "grande profondeur". Further statements are:

7—9 (13) M. (RIDLEY, *Spirastrella vagabunda* and *congenera*).
7—8 M. (HENTSCHEL, *Spirastrella tentorioides* and *digitata*).
14—18 M. (HENTSCHEL, *Spirastrella cunctatrix*).
15 M. (KELLER, *Spirastrella decumbens*).
32 M. (RIDLEY & DENDY, *Spirastrella solida*).
68 M. (RIDLEY & DENDY, *Spirastrella massa*).

Taking into account the Siboga specimens, we see that the sponge seems to live in comparatively shallow water, the greatest depth being 73 M.

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1) Cf. supra p. 7.

D. External appearance.

Pl. I—IV.

Spirastrella purpurea (Lmk.) Rdl. is a very interesting sponge because of its extraordinary variability. Dendy showed to what extent "*Suberites inconstans*" and "*Spirastrella vagabunda*" are variable; and yet these are but members of a larger series. The species varies in shape, color, size as well as in texture, in the general arrangement of the canal system and the spiculation. Specimens like **1403** (Pl. I, fig. 5), **300** (Pl. I, fig. 1), **944 a** (Pl. I, fig. 2), **98** (Pl. I, fig. 4), **612 d** (Pl. I, fig. 3), **948 c** (Pl. I, fig. 7), **B. M. 11** (Pl. II, fig. 2), **B. M. 29** (Pl. II, fig. 5), **1341 a** (Pl. II, fig. 3), **B. M. 2** (Pl. III, fig. 4), **B. M. 10** (Pl. III, fig. 3), **426 b** (Pl. III, fig. 1), **92 c** (Pl. III, fig. 5), **M. M. 62** (Pl. IV, fig. 1) do not resemble each other very much — even less in reality than on the reproduction.

As stated before I believe *Spirastrella aurivillii* Lindgr. and *Vioa florida* Ldfd. to be identical with the sponge under consideration. Admitting this as granted, the sponge would begin its post-larval life by boring into calcareous material like *Cliona* does. Lindgren (1898 p. 323) says about the "forma excavans" of *S. aurivillii*: "Weite Gänge und Höhlungen in Korallen bohrend". Lendenfeld (1897 ε p. 108) writes about *V. florida*: "Der Schwamm bohrt sich in alte Korallenskelette und andere, aus kohlensaurem Kalk bestehende, fossile und recente Bildungen ein, und bildet im Innern derselben annährend polyedrische, 1—15 mm. weite Kammern".

However, I arrived at another conclusion. I do not think *S. purpurea* ever bores in the way *Cliona* does. I fully admit, that the sponge substance Lendenfeld and Lindgren found in holes of corals etc. really belonged to the sponges they described; but they did not prove that the holes were formed by the sponge. As far as I could see *S. purpurea* grows in and fills up the holes made by other organisms. It does not perforate the calcareous material but uses preexisting holes. It may be that under certain circumstances the sponge can dissolve the material gradually, but I never found a system of "canals" and "chambers" continuous with the external parts as we easily find in *Cliona*. I examined series of microscopical sections of decalcified specimens; I always found *S. purpurea* covering partly the outside of say *Lithothamnion*, partly between the irregular deeper places, partly in holes etc. which were obviously not made by the sponge. The calcareous Algae etc. are all covered or perforated, resp. more or less destroyed or broken up by numerous organisms: ascidans, worms, polyps, Bryozoa, other sponges, perforating Algae (and Fungi?) and other plants, like we find them also in shells or stones perforated by *Cliona*. Carefully removing thin incrustations of *S. purpurea*, one either finds the substratum smooth and undamaged, or eroded and mixed with numerous calcareous débris. In some specimens I found small yellowish spots, distinctly detached from the pure white algae. Of course I took them first for the holes filled and made by our *Spirastrella*; but by closer examination and careful preparation none of them turned out to contain *Spirastrella* the yellowish spots being the tops of some vegetable organism (Alga or Fungus?) which could be traced down for a couple of millimeters. Thus the substratum is broken up by numerous organisms; in **1455** (Pl. IV, fig. 6) I found a *Thoosa* destroying the *Archaeolithothamnion*, in addition to Fungi a. o. but not the slightest indication that *Spirastrella* was perforating. Either

— in decalcified preparations — the sponge turned out to cover the branches and spaces between the branches of the alga as a crust, closely fitting to its surface, or it was growing between débris, consequently by and by enveloping the latter. In this connection it is perhaps worth while to draw attention to LENDENFELD's statement that *V. florida* "bohrt sich in alte Korallenskelette". I believe, therefore, that our sponge does not perforate its substratum, probably hardly dissolves the lime, but of course may enter preexisting holes. As far as I can see *Spirastrella purpurea* begins its post-larval life by incrusting.

Such incrusting stages are known from trop. *tegens*. I cannot yet decide whether the specimens I included here perhaps grow out afterwards to forms with digitate processes or to massive forms. Provisionally I unite the incrusting Spirastrellae in this group. At any rate it seems pretty sure that the crust, originally very thin, may become thicker, as we see in "*S. decumbens*" and in some Siboga specimens. There are in this collection several specimens which correspond to RIDLEY's *Spirastrella decumbens*. The original type (B. M. 27) is said to form crusts of 0.5—10 mm. thickness. "General surface level (except where affected by the inequalities of the substance to which it is attached), glabrous". Later authors [1]) usually describe *S. decumbens* as incrusting. The specimen described by RIDLEY & DENDY (B. M. 38) seems to be more than a mere crust; it is considered older, the original "as only a young specimen". The specimens from the Siboga, mentioned above form crusts of about 1 mm. thickness, which may increase in places where they fill so to say holes or deepenings of the substratum. Specimen 1031 is incrusting a coralline alga (*Goniolithon?*), which on its turn seems to cover an old piece of coral. Specimens 1455 a–d [2]) likewise grow over and between a coralline alga (*Archaeolithothamnion?*); they cover it for a great part (Pl. IV, fig. 6). Numerous other animals and plants are to be found in addition to *Spirastrella*; some are attached to it, others perforate and destroy it, again others freely live in holes either of the substratum or of the sponge. Thus we see e. g. Molluscs, Bryozoa, Corals, Annelids, Tunicates etc. fixed to the *Archaeolithothamnion*; we find the latter perforated and partly almost entirely destroyed by *Thoosa* and boring Algae or Fungi; we see finally Errantia and Ophiurids more or less hidden in the holes. Of course there exists a hard struggle for life between all these organisms, which is very interesting to study. By the destruction of perforating organisms and other agentia numerous débris are formed, which are used by other animals as material for solidating their dwellings; an amount of débris remains dispersed on the general surface, till our *Spirastrella* gets hold of them, grows over them and envelopes them. Where our sponge finds a half destroyed portion of calcareous matter, a pit, a hole etc. it creeps into it and fills it, but, as stated before, never perforates itself. Hence we frequently find calcareous and other débris in the parenchyma of the sponge or stuck to its surface. Considerable portions of the sponge surface are, however, free and the crust shows there the characteristic smooth, glabrous, shining or glossy appearance (Pl. IV, fig. 6). The external appearance of 1945 (Pl. III, fig. 2) very much resembles that of 1455 a–d; it incrusts a piece of coral, covered with a coralline alga, forming a block of about 9 by 15 cm.

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1) See for literature p. 12—13.

2) The four specimens are very likely fragments of one and the same specimen.

with a thickness of about 5 cm. The sponge crust is 1—10 mm. thick and leaves less surface of the substratum free than 1455. Specimen 1421 consists of three or four pieces evidently broken from one piece. It is again growing on coral or coralline algae, but the substratum in many places disappeared, probably being destroyed in the way we saw in 1455. The result is that in some parts a kind of trabeculae is formed, which however clearly shows to have originally been incrusting, the diameter of the trabeculae like the crust measuring 2—5 mm. (Pl. V, fig. 14). Only in this way can I explain the aberrant shape of this specimen, which corresponds remarkably well with the "variety" (**B. M. 38**) Ridley & Dendy describe (1887 p. 229). They say, that the Challenger dredged a fine specimen, "consisting of a number of stout, irregular, anastomosing trabeculae, forming together a sessile, cavernous mass . . . ." It is clear that this specimen 1421 is no more a mere crust; in 1402 the process is gone still farther. Both in 1402 and 1421 the first traces are visible of free elevations or papillae. They gradually lead to specimens like 300 (Pl. I, fig. 1) 410, 1092, 1391 by evolution of two things: becoming thicker and producing processes. Very remarkable in this respect are 1075 and 1403 (Pl. I, figs. 8 and 5 respectively). Only small portions of the crust are visible, but the processes are comparatively large; in 1075 one of these (broken off) measures 3 to 4 cm. (Pl. I, fig. 9). We see at the same time that the shape of these processes is rather variable. Lindgren's *S. aurivillii* has much the same appearance. Still a step farther from the original crust are 614 a and 614 b. They represent irregular lumps; but in the whole appearance of the processes 614 a–b resemble 300, 410 etc. The specimens 300, 410 and 1945 all come from the same locality ("Saleyer", station 213); on the other hand 1455, which externally and anatomically is so alike 1945, is found "off North Ubian". Judging from the external appearance the above mentioned specimens are obviously most closely allied. Anatomically we see, however, considerable differences: large robust spinispirae in 1945, none in 300; a thick, shining pseudo-cortex in the latter, nothing of it in the former etc. etc. We have demonstrated, however, that all this does not give us the right to distinguish species. Schmidt says (1864 p. 36) that "*Suberites bistellatus*" forms incrustations, resembling leaves, "deren Nervatur oft täuschend durch das oberflächlich verlaufende Wassergefässsystem dargestellt wird". Lendenfeld (1897 p. 55) has likewise observed these superficial, tangential canals and states: "Die Haut, welche diese Kanäle bedeckt, ist auch im lebenden Schwamme häufig etwas eingesunken; in Weingeistexemplaren ist dieselbe so stark versenkt, dass man an ihrer Stelle tiefe Furchen sieht". I found the same in a specimen from Naples (described in MS.) and also in 1031. In other specimens nothing of this arrangement is visible.

Specimens like e. g. 1092 and 1391, forming cakes or cushions with a tendency to produce conical or digitate processes most gradually lead to typical specimens of trop. *digitata*, such as 948 a–f and *S. vagabunda*. In 948 c e. g. the processes have about the same size and appearance as the larger one in 1075 (Compare Pl. I, figs. 7 and 9). Ridley (1884 p. 468) says of *S. vagabunda*: "massive, attached by broad base, tending to grow up into large nodular elevations.... General surface slightly verrucose (in spirit), more so in large dry specimens". Dendy has shown afterwards (1905) that the sponge is exceedingly variable in every respect. As to the external one of his four "varieties" "consists of a massive base rising up into a few short, stout, finger-shaped processes", another "consists of hollow, finger-shaped processes or "fistulae" rising from a sandy base to a total height of about 50 millims". In these terms typical specimens of trop. *digitata* are very well characterised (Pl. I, fig. 6—9). We have about the same features in *S. congenera*, *S. punctulata* and *S. solida*. The surface is generally more or less shining, not hispid, sometimes more even, another time somewhat corrugated vertically. In several respects such specimens which I bring together as trop. *digitata* resemble typical specimens of trop. *pyramidalis*. In the former the processes are on the whole more prominent, being longer; in the latter we can distinguish one or two chief processes as a pyramidal cone with a varying number of much smaller, secundary ones (Pl. III, fig. 1). The shape of the processes in trop. *digitata* is generally distinctly digitate; in *pyramidalis* both primary and secundary processes tend to lateral compression. The specimens **426 a** and **426 b** show this very plainly. In **426 c** there are less processes — only a few just at the base. In **1045** there are no secundary processes at all. The characteristic pyramidal shape we find also in some specimens of *Suberites wilsoni* e. g. **B. M. 22** and in *Spirastrella areolata* (**B. M. 2**); these are, like **1045**, destitute or almost destitute of secundary processes.

Ridley & Dendy described a sponge, which they called *Spirastrella papillosa*. They say (1887 p. 232): "Sponge . . . . massive, erect, sessile; shape conical, broad at the base and tapering gradually to an obtuse apex, where are situated several large oscula . . . . The entire surface, except in the immediate neighbourhood of the oscula, is covered with numerous, closely placed papillae of considerable size . . . ." At the end of the description the authors state: "the peculiar warty appearance of the surface seems to be the most characteristic feature of this species . . . ." We have seen that the specimens **92 a–l** and **426 d** are identical with it. Whereas the Challenger dredged only a single specimen the Siboga brought home more than a dozen and so we have a better conception of the real character. They are all massive, but they are by no means always broadest at the base. Specimen **92 c** (Pl. III, fig. 5) is more or less oval; **92 e** and **92 l** have a more conical shape. Not unfrequently they have more than one top (**92 a**, **92 b**, **92 d**, **92 i** and **92 j**). The greater part of the surface is covered with papillae or tubercles, giving to the sponge the warty appearance. However, the various specimens possess this feature in different degrees; thus in **92 b** and **92 d** the turbercles are comparatively low and few; in **92 c** and **92 e** they are high and numerous. *Spirastrella cunctatrix* **B. M. 13** externally resembles the Siboga specimens; likewise some parts of **B. M. 10** (Pl. III, fig. 3). Intermediate between these distinctly warty specimens and typical specimens of trop. *digitata* are **614 a** and **614 b**. But also in another respect we find transitions between them. The surface in trop. *digitata* often exhibits rugae, which we do not find typically in trop. *tuberosa*. But it must be remembered that Carter says (1886 p. 115) of *S. cunctatrix* var. *porcata* (**B. M. 1**) that the surface "presents a number of thick rugae running from the base towards the apex . . . ." Indeed, the external appearance of *S. cunctatrix* **B. M. 1** is quite different from that of *S. cunctatrix* **B. M. 13**. But in *S. cunctatrix*, **B. M. 10** (Pl. III, fig. 3) we find the characters of both united.

However different such specimens like **92 c** (Pl. III, fig. 5), **426 b** (Pl. III, fig. 1), **948 c** (Pl. I, fig. 7), and **1945** (Pl. III, fig. 2) may be, we learn by the above statements that they gradually pass into each other. The original crust, by becoming thicker and enveloping its substratum forms thick cushion-shaped or even lumpy, irregularly spherical masses. In both cases processes may project from the general surface; these are sometimes nothing but low tubercles or papillae, in other cases they grow out to comparatively long digitate processes. We have seen already that these processes can become still higher and, instead of being digitate are cylindrical or club-shaped. We have seen also that this mode of growth can be followed step by step; that e.g. 1211 (Pl. II, fig. 4) has the appearance of say 948 a and 948 c (Pl. I, figs. 6 and 7) although for anatomical reasons (arrangement of tylostyles) it comes nearer specimens of trop. *concrescens* or trop. *tubulifera*. We have seen likewise how in 1341 a we have a specimen with very different processes (Pl. II, fig. 3). We observe very long processes in 1341 a–d, 1365, 1971, 1975, 2049 (Pl. IV, fig. 8) a. o. In such specimens the processes became the most prominent feature. We see the same in *Suberites inconstans* var. *digitata* B. M. 23. In some cases these processes become club-shaped as in 612 b–d (Pl. I, fig. 3). As stated before, there is often a tendency in the processes to fuse with its neighbours. Again we can follow step by step what may be the result of it. In 612 b three more or less club-shaped processes start from a flat irregular base; in addition there a low processes, papillae or mere tubercles. The three larger ones, although so close together that the clubs almost touch each other, are, however, not fused. In 612 d (Pl. I, fig. 3) five processes have their clubs fused together; in 612 c we observe two thick stems, evidently consisting of the lower parts of fused processes, whilst the clubs form one big mass together. Such specimens gradually pass into 612 a (Pl. IV, fig. 9), which consists of one massive piece, a typical representative of trop. *glaebosa*. The specimens 1341 a–d are interesting for the diversity of shape the processes exhibit. In 1341 d they are all club-shaped; one is free, the others have coalesced with their clubs, resembling 612 d, described above. In 1341 a (Pl. II, fig. 3) we find one process club-shaped, another (smaller one) digitate, a third one broadening towards the top, where they end in flattened, lobed portions, surrounding a cup-like depression. Specimen 1341 b resembles on the whole 1341 a; specimen 1341 c is a fragment representing only the top (Pl. IV, fig. 7). At the broken (proximal) part it is one piece; towards the top it consists of more or less fused processes, surrounding again a valley. It is clearly seen how the processes gradually coalesce. The specimens 305 a–d (Pl. II, fig. 1) on the whole resemble 612 a–d. In 1047 all the processes are fused to one erect, flattened mass, with several irregular "oscula", very much resembling the figure Lendenfeld gives of his *Vioa florida* (1897 (ε) Pl. II, fig. 78).

We have seen in the example of 612 a–d how by fusion of processes again massive forms may originate. Once acquainted with this mode of growth, there is no difficulty in explaining forms like 98, 1418, 977, 964 a–b, 966 a–b. All such forms are beyond doubt identical with Dendy's *Suberites inconstans* var. *globosa* and var. *maeandrina*. It seems to me that there is no need to distinguish these two "varieties", since the meandering figures are so to say only accidental. In most specimens of trop. *glaebosa* there are portions of the surface which show the peculiar, slit-like, irregular openings, which give rise, if there are many together, to the meandering figure (Pl. I, fig. 4). The chief difference between massive, irregularly spherical forms like the above mentioned and 92 a–l, 426 d, 614 a–b etc. lies in the fact that the former show a quantity of irregular openings on the surface, which, as we will see, are for the greater part nothing but shallow or deep depressions, being places where no fusion took place. They can be compared to the depressions on the top we mentioned (p. 40) in 1341 a and 1341 c. I suppose that in the same way the openings on the surface have to be explained in *Hymeniacidon angulata* a. o.

As to the curious design we find on the surface of *S. areolata* (Pl. III, fig. 4), we have already demonstrated that this is probably more due to shrinking by drying than a peculiar character. If we compare *Spirastrella cunctatrix* B. M. 13 with *Suberites wilsoni* B. M. 15 and *Spirastrella areolata* B. M. 2, which are all three in the dried state, we have before us an instructive series: in the first chiefly tubercles, in the second irregular lines, in the third multangular ridges prevailing. In *S. cunctatrix* B. M. 10 we have the tubercles of B. M. 13, the lines of B. M. 15 and the areolated appearance of B. M. 2 united in one single specimen. In 1949 and 1988 (both dry!) we observe the same[1]).

In several specimens the surface is glabrous or subglabrous and rather glossy. We find it on the whole in specimens of trop. *tegens*, trop. *pyramidalis*, trop. *digitata* and trop. *tuberosa*, whereas we do not see it in specimens of trop. *concrescens*, trop. *glaebosa* and trop. *tubulifera*, which are more or less hispid by slightly projecting tylostyli. It is, however, not a rule without exceptions.

The size of *Spirastrella purpurea* differs as much as the shape. In the following table I have arranged the specimens according to the tropi.

Specimen	Author	Size in centimeters (height first)	Remarks
1945	. . . . .	[9 × 15 × 5 (thickness)]	crust; 1—10 mm. thick
B. M. 33	Carter	38 × 13 × 25	
B. M. 15	Carter	15 × 13 × 18	
B. M. 2	Dendy	19 × 11 × 20	
426 c	. . . . .	7 × 7 × 7	
426 b	. . . . .	9 × 10 × 12	
1988	. . . . .	8 × 12 × 14	
B. M. 7	Bowerbank	240 cm. high	
92 a	. . . . .	9.5 × 6 × 11.5	
92 b	. . . . .	11 × 8 × 15.5	
92 c	. . . . .	15 × 8 × 10	
92 d	. . . . .	12 × 5.5 × 10.5	
92 e	. . . . .	7.5 × 5 × 7.5	
92 f	. . . . .	9 × 5.5 × 9.5	
92 g	. . . . .	8 × 4.5 × 9	
92 h	. . . . .	10 × 7 × 7	
92 i	. . . . .	12 × 4.5 × 12	
92 j	. . . . .	7 × 4.5 × 6.5	
92 k	. . . . .	4 × 2.5 × 3.5	
92 l	. . . . .	9.5 × 4.5 × 7.5	
426 d	. . . . .	7 × 4 × 5	
B. M. 37	Rdl. & Dy.	15 × 10 (× 10?)	
B. M. 16 (?)	Carter	17.8 × 15 × 20	
Spirastrella insignis	Thiele	24 × 19 × ?	
Spirastrella cunctatrix	Carter	7.6 × 7.6 × 23	
Spirastrella cunctatrix	Carter	9 × 9 × 5	

1) The same phenomenon I often observed in massive forms of *Cliona celata*.

Specimen	Author	Size in centimeters (height first)	Remarks
Spirastrella vagabunda . .	DENDY	5	
Spirastrella fungoides. . .	DENDY	8.8 × 4.7 × 4.7	
Spirastrella congenera. . .	RDL. & DY.	3.5 × 2.5	
Spirastrella solida	RDL. & DY.	8.8 × 5.4	
Hymeniacidon angulata . .	BOWERBANK	6 × 19 × 30.5	
Hymeniacidon angulata . .	BOWERBANK	4 × 9 × 11	
Suberites inconstans var. *globosa* (**B. M.** 25?) . . .	DENDY	(20?) × 16 × 16	
Suberites inconstans var. *maeandrina* (**B. M.** 9) . . .	DENDY	(20?) × 30 × 30	
964 a	. . . . .	18 × 13 × 13	
964 b	. . . . .	12 × 8 × 8	
966 a	. . . . .	5 × 7 × 19	
98	. . . . .	13 × 5 × 7	
305 a	. . . . .	9 (height of processes)	
305 b	. . . . .	10 (height of processes)	
305 c	. . . . .	13 (height of processes)	
612 b	. . . . .	5.5 (height of processes)	
612 c	. . . . .	8 (height of processes) (breadth at top 12)	
1341 a	. . . . .	19 (height of processes)	
Suberites inconstans var. *digitata* (**B. M.** 23)	. . . . .	15.5 × 15 × 5	diam. of proc. average 17 mm.
1975.	. . . . .	30 (height of processes)	diam. of proc. 20—30 mm.

As to the color, DENDY says that his specimens of *Suberites inconstans* are (dried!) light brownish orange; about the same is stated by THIELE. On the whole my specimens of trop. *tubulifera*, trop. *concrescens* and trop. *glaebosa* are likewise yellowish (ochroleucus, ochraceus, fulvus, sometimes more ferrugineus). My specimens of trop. *tegens* come nearer to melleus; those of the other tropi are generally latericius, badius, castaneus and such shades; but 426 a and 426 b are melleus and 1365 on the other hand is between fuligeneus and castaneus. Of course the color of dried specimens is of little value; still less that of spirit specimens. I mention it only because of the fact, stated above, that in some tropi the color is usually yellowish, in others generally brownish. TOPSENT states, that *S. minax*, when alive, is "rouge, rosée, jaune d'ocre, jaune pale". The single specimen I found in Naples was in the living state between incarnatus and testaceus. The most remarkable color we met with in *Spirastrella purpurea* is the famous purper color; we see it in various shades, now more carmin-like, then more violet (atropurpureus, purpureus, vinosus etc.). Such colors are known to occur in *S. bonnetti* (Topsent), *Suberites wilsoni* (Carter), *Alcyonium purpureum* (Lamarck, Topsent). As stated before there is a trace of it to be seen in the brownish var. *albidus* of CARTER's *S. wilsoni* (**B. M.** 15). I find in some specimens of 92 a–l, which on the whole are between badius and latericius, a distinctly purplish tinge (atropurpureus). Whether this purplish color, which we see in several specimens of *S. purpurea* is formed by the sponge or due to other organisms is not certain. At any rate it is a highly remarkable color because of its resistence.

It is as distinct and bright in dried specimens (**B. M. 12, M. L. B. 132, M. L. B. 22**) as in such which are preserved in spirit (**B. M. 32, B. M. 33**). As suggested by RAY LANKESTER it is called spongioporphyrin by MAC MUNN (1900). [Cf. infra].

Previous authors of course remarked a curious feature in the appearance of our sponge, viz. the agglomeration of foreign, mostly calcareous objects on the surface, more especially at the base. We will see that such calcareous débris and sand often occur also inside the sponge. If it is true that *Spirastrella purpurea* begins its post-larval life by growing over and between corals and coralline algae in the way we described it above (p. 37) the fact is easily explained. [Cf. infra].

E. Anatomy.

Pl. IV, figs. 2, 3, 8 and 9. Pl. V—XIV.

It may be expected a priori that *Spirastrella purpurea* in its general anatomy is as variable as it is in its external appearance. It is evident that the system of canals, the arrangement of the spicules, the concistency of the parenchyma etc. are different in different stages of development; that all these systems of organs have another aspect in thin crusts than in cushion-shaped forms or in massive, spherical forms or in such with longer or shorter processes. In fact we will see, as we occasionally already noticed, that the skeleton is very variable, that in some instances there are large canals visible, in others not.

It is exactly because of this enormous variability that it seems advisable to describe a couple of typical examples before we can give a comparative anatomy of the various modifications of *Spirastrella purpurea*.

1. Description of the anatomy of a typical example of tropus *tegens*.

I will choose for this purpose specimen **1945**. If a section at right angles to the surface is made of a carefully decalcified portion, we see with the naked eye a number of holes, indicating the places where calcareous matter of the substratum was before decalcification. If the calcareous substratum is an uninjured, healthy coralline alga, large portions of the cellulose tissue remain visible in its natural shape. But in other parts, where the plant is destroyed by boring organisms, an amount of débris of all sizes remained. In sections of decalcified specimens such places will look like empty holes. Bordering these holes, resp. covering the algae, corals etc. the sponge substance is seen, which, to the naked eye does not show conspicuous holes or canals. Slightly magnified, the latter become visible (Pl. V, fig. 9). If we magnify our section a little more, it is easy to recognize that these holes and canals belong to the canal system of the sponge, and that this cannot be said of the larger holes, mentioned above. In fig. 1 on Pl. VI I have given a portion of the section of Pl. V, fig. 9, now magnified about fifty times. The small apertures, which are seen on the sponge surface (Pl. V, fig. 22) appear to be for a great part incurrent openings, stomata, which lead by short canals into wider reservoirs (Pl. VI, fig. 1, *i*). These reservoirs run almost parallel to the sponge surface, often unite with other similar ones and give off narrower canals at about right angles. Some of the latter ramify and communicate with mastichorions [1]); others run deeper into the sponge, leading to a second system of wider canals, parallel to the surface. (This process may even happen once more). From this second (or third) system of reservoirs, which often winds itself like a serpent through the deeper parts of the sponge, again narrower canals start which do or do not ramify and which are surrounded by mastichorions, with which they communicate. On the other hand the mastichorions open with wide apopylae in other canals, which so to say interdigitate with the former (Pl. VI, figs. 1 and 2). The system, consequently, is eurypylous. The excurrent canals unite and form larger canals, from which numerous smaller ones start and finally end at the sponge surface with procts, which have about the same size as the stomata. The canals are distinctly lined with pinacocytes; on the external sponge surface, however, I could not find undoubted cells, but in many places I saw something like a cuticula. The parenchyma of the sponge represents a tissue which in many respects resembles the so-called reticular or lymphoid connective tissue. In this tissue with the many efferent and afferent canals are situated the mastichorions, which form characteristic groups of various size (Pl. VI, fig. 1). The whole area where these groups of mastichorions occur, i. e. the choanosome is marked off from the ectosome by an undulating line. In places of the choanosome where few mastichorions occur and in the ectosome the whole tissue is less stained, which is due to the greater distance of the cells. Of these we find a great diversity: close under the peripheral crust of spinispirae fusiform cells prevail, situated with their long axis parallel to the sponge surface. In the second place we find comparatively large cells, each with a large vacuole (Pl. VI, fig. 3); then a quantity of scleroblasts of various size, containing spinispirae in different stages of development (Pl. VI, fig. 4). In addition there are amoeboid cells etc. The tissue of the ectosome is continued around the vertical bundles of tylostyles. Only it contains less cells, in fact chiefly fusiform cells with their long axis parallel to the bundles and probably also connective tissue fibres. From the base of the sponge crust bundles of tylostyles start and run almost perpendicularly; they sometimes branch dichotomously. Towards the periphery they diverge and form conical brushes or tufts, slightly projecting beyond the sponge surface. In addition we find a few tylostyles in tangential direction or irregularly dispersed. In the main bundles almost all the apices look towards the periphery. The bulk of large and minute spinispirae forms a superficial crust (Pl. VI, fig. 1); but throughout the whole parenchyma they may be found, sometimes again more profusely at the base, i. e. where the sponge touches its substratum. The spicules are kept together in bundles by a periapt [2]). In some places it seems that the spicules are kept together by a deeply straining homogeneous substance which I will call spongine, although it must not be forgotten that all so called substances are certainly not identical. It often gives the impression as if a layer of spongine covers the substratum from which layer short perpendicular lamellae are given off; in some of these spicules are imbedded and form an irregular network at the base of the sponge. This layer should then correspond with the layer KELLER described (1891, α p. 323) for *Spirastrella decumbens*.

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1) 1902 (α) VOSMAER & VERNHOUT p. 4.
2) 1905 (α) VOSMAER & WIJSMAN p. 23.

2. Description of the anatomy of a typical example of tropus *tubulifera*.

For this purpose I take specimen 1365. A longitudinal section through the axis of a process shows us a large central canal opening with a wide mouth at the top (Pl. V, fig. 11). In the canal we see with the naked eye numerous rugae; between these we observe some small openings which partly communicate with longitudinal canals in the wall of the tube, as indicated in the drawing by the sonde. Thin longitudinal sections, examined with a low power teach us that these secundary longitudinal canals have very different diameters and that some of them communicate with the main central canal even at the very top of the process (Pl. V, fig. 18). In addition to these canals the naked eye discovers numerous very small openings, partly dispersed irregularly, partly in a series close under the sponge surface. The substance of the parenchyma looks consequently rather compact; something like a cortex is hardly visible. Thin transverse sections show, mutatis mutandis, the same distribution of canals (Pl. V, fig. 19). If we look at the sponge surface with a pocket lense we observe innumerable small apertures (Pl. V, fig. 21). These are, at least partly not incurrent but excurrent apertures, procts. It is, however, probably that they represent partly, stomata. Since we found in 1945 no difference in size or structure between stomata and procts we cannot be astonished to find the same in the specimen under description. The most striking thing in 1365 is that the large central canal seems not to be an excurrent canal and consequently the large opening at the top of the process not an "osculum". By and by I will give several arguments for this more or less perplexing statement. One argument I will give at once, being based on the examination of a series of sections.

In the shape of the mastichorions we have an index to determine at which side the water enters and at which it leaves these organs. Pekelharing and the present writer showed[1]) in which way the choanocytes may act as valves. According to our views the opening, which is generally considered the efferent one and which is known as apopyle, must forcibly be the excurrent aperture of the mastichorion indeed. Hence the canal which communicates herewith is an excurrent one; the others are consequently of an incurrent nature. Now I found that canals, for the above reasons declared to be incurrent, communicate with the large central cavity. We saw that in this cavity openings are found of various diameter. But in addition to these — visible to the unassisted eye — other ones occur, some of which are very small and are only seen with the aid of the microscope. All these openings lead into a system of canals and lacunae which terminate in ultimate incurrent canals (Pl. VII, fig. 1, *i*). Around the final branches are situated mastichorions, which on the other hand communicate by wide apopylae with excurrent canals. Again we find here some of these canals forming an interdigitating system. And again we find, as in 1945 the mastichorions situated in groups. In those cases these groups occur near the central tube as illustrated in fig. 1 on Pl. VII, the excurrent canals unite into some much wider canals (*exc.*), from which again narrower canals start, which ramify and finally open with small, but numerous procts on the sponge surface.

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1) 1898 *a* p. 15.

The parenchyma (Pl. VII, figs. 3 and 4) is of the same sort as in 1945 viz. lymphoid, forming a reticulum of very fine fibres and flat cells with extremely thin membranous expansions. In this ground-tissue cells of various aspects occur, now more, then less. Seen with low power the membranous expansions simulate threads; seen with higher power and after carefully focussing it becomes evident, that the branching thread-like prolongations are indeed the optical sections of membranes [1]). This tissue is especially well visible around the larger canals in the central parts and of course lining the central canal. Whereas in other parts it is confused by numerous cells of various description — amoebocytes, thesocytes etc. — or by spicules, both these elements are scarce or absent in the neighbourhood of large canals and the central canal. Among those cells we find elongated fusiform cells, probably contractile; but also we find thread-like cells with very much elongated nuclei (Pl. VII, fig. 2), having absolutely the character of true muscle-cells; they may reach a length of $^1/_3$ mm. Now these cells are abundant in the tissue lining the central canal; here they are found in bundles, concentrically arranged, but also radially (Pl. VII, fig. 4). They are easily recognised by their characteristic, rod-like nuclei. All the canals seem to be covered by pinacocytes. The external surface I believe to be protected by a kind of cuticula, the mother-cells of which I could not distinguish with certainty.

The skeleton is formed by longitudinal bundles of tylostyles, elliptic or flattened on transverse section. In the wall of the tube we find three or four bundles: one close under the lining tissue of the central canal, one at some distance from the external surface and one or two in the middle. The bundles may give off branches with anastomose with other main longitudinal bundles. At more or less regular intervals the latter send off bundles in radial direction; these give rise finally to the diverging superficial tufts or brushes, the spicules of which are generally shorter than those of the main skeleton. In some places tylostyles are seen irregularly dispersed in the meshes of the main reticulum. Spinispirae are absent. In 1945 we saw the ectosome strengthened by a crust of spinispirae and some tylostyles; in 1365 only the latter are present, but they are far more numerous, slightly projecting and hence making the surface more or less hispid. I did not find any trace of spongine. Whether the groups of large, ellipsoid, sometimes fusiform thick cells with coarse granules, accompanying the main bundles of tylostyles have anything to do with the formation of spicules or other elements of the bundles, I could not make out. It is, however, probable.

3. Specimens of different tropi compared.

If we make a longitudinal section through a digitate process of a typical example of tropus *digitata*, e. g. 948 g, we see a large central canal, surrounded by a crumb of bread like substance, which is perforated by canals of various diameter, running in different directions (Pl. V, fig. 1). The central canal is generally filled with a muddy substance, containing débris of little shells, Foraminifera etc. We find these likewise in the larger peripheral canal as is shown in Fig. 2, which represents a transverse section of 948 b. If these objects are removed and thus the inner wall of the canal cleaned, the latter is seen to possess concentric folds or

1) See about this tissue VOSMAER, 1908 (*α*) p. 41.

rugae, especially conspicuous towards the top of the process (Pl. V, fig. 1 and 4); these rugae correspond to those we saw in 1365 (Pl. V, fig. 11). In the transverse section (fig. 2) the central canal is seen to be surrounded by narrower canals some of which are often still rather wide; in addition to these canals numerous very narrow ones are just perceptible to the naked eye. I find this arrangement likewise very conspicuous in some specimens of "*S. vagabunda*", more especially in **B. M. 17** and **B. M. 19**. Exactly like we found it in 1365 the central canal shows openings in its wall, by which there is communication with other canals. Soundings and series of sections prove, that at least some of the main peripheral canals communicate with the central one as is shown by the arrows in fig. 1. The larger canals can be followed almost through the whole length of the process and come very near to the base of it. A remarkable feature of these specimens is that their lumen generally increases towards the lower parts, the external aperture on the top being very small in comparison to the diameter of the canal say half way the process. Microscopical sections of such specimens teach us how much space is taken by these main canals (Pl. V, figs. 12 and 13). The chief difference between such sections and those of 1365 lies in the fact that the larger peripheral canals in the former may reach a greater diameter than in the latter as is easily seen by comparing figs. 13 and 19.

A similar longitudinal section through a typical example of tropus *pyramidalis*, e g. 426a (Pl. V, fig. 3) shows, mutatis mutandis, the same. Again we find a wide central canal, diminishing in lumen towards the top. Next to this main canal are others, narrower but still comparatively wide, running more or less parallel to the central one and in direct communication with it. The structure of the wall with its rugae is like in 948g.

In fig. 2 on Pl. IV I give an illustration of the longitudinal section of an example of tropus *concrescens* (305d). Here we see two central canals of about the same diameter (a third one is present in the other moiety). It is clearly seen that the diameter is again decreasing towards the top and the concentric rugae are present like in 948b, 948g, 426a etc. Whereas in 948g the central canal opens at the top of a process with a small aperture, which is, however, distinctly visible to the naked eye no such apertures are to be seen in 305d. Here the main canals are formed by confluence of a few narrower ones, as is shown in fig. 2 (Pl. IV) on the left hand side. In 305a we have a specimen consisting of several processes partly fused at the top. A longitudinal section through one of the "clubs" shows, that several narrow canals are confluent till two main central canals are formed, which afterwards fuse again (Pl. V, fig. 5). Transverse sections through the stem (Pl. V, fig. 20) show us the now single central canal (*a*), lined by soft transparent tissue, and some narrower canals (*b*) around it. The section strongly reminds us of what we saw in 1365 (Pl. V, fig. 19).

In more massive specimens of tropus *glaebosa*, like e. g. 931b (Pl. V, fig. 6) we see fundamentaly the same as in 305a and 305d; the canals marked with arrows 1, 2 and 3 correspond to the main central canals of the above mentioned specimens. They possess the same structure and are likewise formed by confluence of some smaller canals. In a still more massive specimen of the same tropus, viz. 612a (Pl. IV, fig. 9) similar longitudinal canals are visible; they are, however, narrower, compared to the diameter of the whole sponge and there is more soft tissue around the lumen.

A longitudinal section of a representative of tropus *tuberosa* (92 a) finally, exhibits again some main canals, surrounded with still more transparent tissue (Pl. IV, fig. 3), but for the rest resembling 612 a.

We saw that in 1365 there is one very wide central canal, opening at the top of a long process with a wide mouth. In other specimens of the same tropus and doubtless identical with it, we find, however, more than one large central canal. Likewise, e. g. in 1975 (Pl. IV, fig. 8). This corresponds, consequently, whith what we found in the other tropi. A difference lies in the fact, that both in 1975 and in 1365 the opening at the top is wide, whereas in the other specimens it is narrow. We find, however, that this is of no fundamental signification. For in 1365, 1971, 1975 and 2049 we find that some processes open at the top with a wide mouth, others with a narrow one (Pl. V, fig. 10); again others are closed.

Carter, Dendy, Ridley & Dendy and others of course mentioned these wide canals, which they consider to be exhalant and consequently they call the openings "oscula". It is well known that we find such central canals in the majority of Sponges. Of several cases it is demonstrated, that the said canal is the main excurrent canal or cloaca and the mouth the so-called osculum. We ought not to forget, however, that in numerous other cases it is not demonstrated, neither by serial sections nor by observation of the living animal. In the case of 1365 I came, as stated above, to the conclusion that the wide central canal is an incurrent one. From the above given statements may be deducted that those central canals in the mentioned specimens are homologous formations and consequently likewise of an incurrent nature.

In collaboration with my friend Pekelharing I have tried to give an explanation, or at least a possible hypothesis for the origin of the water-current in Sponges. We demonstrated (1908 *α* p. 15), that the water, leaving the mastichorions in some way or other arrives in the cloaca and escapes in the direction of minor resistence, which is in the cases we considered, towards the "osculum". We then proceed: "thus in the central tube the water will obtain a certain velocity, which, once established, acts as the flying-weel of an engine. Obviously the absence of flagella in the central tube is of great advantage. Every irregularity *here* would only diminish the effect of the flying-weel". Now we saw in *Spirastrella purpurea* that in almost every case the mouth of the central canal is smaller than its general diameter. We saw that in some cases this is due to contraction; but in others (305 a, 305 d) the central canal shows a ramification of narrower canals near the periphery, a phenomenon not to be explained by contraction. Such contrivances, instead of producing in the central tube a locus minoris resistentiae for the water current, would establish the contrary. As stated above, every irregularity in the tube would diminish the effect of the flying-weel; in *S. purpurea*, we see rugae or diaphragms instead of smooth walls. In the third place we find the large canals frequently full of débris (Cf. supra and Pl. V, fig. 2); a quantity of these are much too large to have passed through the mastichorions.

The above considerations gave me some doubt as to the excurrent nature of the large central canals. It would be of high interest to observe these sponges in the living state. However, these are pia vota and will probably long remain so. Consequently we have to try to make out by serial sections whether a canal is excurrent or incurrent, an exceedingly puzzling business, which generally demands much time and much patience.

In the shape of the mastichorions we have an index to determine at which side the water comes in and where it flows out. PEKELHARING and I showed (l. c.) in which way the choanocytes of the mastichorions may act as valves. According to our views the opening which is called apopyle must forcibly be the excurrent opening of a mastichorion. Consequently the canal, which communicates with the apopyle, is the excurrent canal, that on the other side the incurrent one. In a specimen with wide central canal (1365) I now tried to make out the course of both the excurrent and incurrent canals and, as stated above, I came to the conclusion that the wide central canals communicate with the incurrent canals and that the excurrent canals finally open at the sponge surface by means of a large quantity of small openings (Pl. VII). This involves that the wide central canal is incurrent, not excurrent.

I need not say that it is only after long hesitation that I dare state this. Also I state it with all possible reserve, being convinced that it is highly necessary that others confirm it for this or for other sponges. I can only say that in the case under consideration I cannot explain things otherwise, but I admit of course that I can be misled by my preparations. I don't wish to pretend yet, that in some sponges the wide central canal is surely incurrent, but I do think it worth while to stimulate other spongiologists to pay attention to it and to settle the question either in one sense or the other. I may add that I have myself tested other sponges and that in one or two other cases I found similar things as in *S. purpurea*.

If I am right that the course of the water really is as described for 1365, in which case there is not a cloaca with wide mouth, does this throw over the hypothesis emissed by PEKELHARING and myself? By no means. For I believe that in *Spirastrella purpurea* the water current is not or not always effected by the action of the flagella of the choanocytes only. My conception of the large central canal is that it represents a reservoir, belonging to the incurrent system. We saw in 1365 that the wall of the canal is provided with well developed muscle cells, which for the greater part are arranged concentrically. If these cells contract, the lumen of the canal will diminish. We likewise saw that the lumen at the periphery generally is smaller, either because of narrower canals, or because it is contracted. Finally we saw that the opening or openings may be shut. Suppose this to be the case; if then the muscle cells contract and therewith the lumen is lessened the water will be driven into the smaller incurrent canals respectively the mastichorions etc. In this connection it is worth while to remark that the total amount of mastichorions compared to the total sponge volume is small (Pl. VII, fig. 1).

We arrived at the conclusion, that the large central canals and some of the peripheral ones belong to the incurrent system and that, consequently, their narrow or wide openings at the top of the processes are not "oscula". This does not involve that all the larger openings we see in certain specimens are incurrent apertures. In specimens belonging to tropus *glaebosa* we remark on the sponge surface a greater or smaller amount of comparatively large openings (Pl. I, fig. 4; Pl. II, fig. 5; Pl. V, figs. 6 and 7). Longitudinal sections through such openings teach us that in these massive, more or less spherical specimens the greater part if not all of the openings do not correspond with wide canals of the nature described above (Pl. V, figs. 6 and 8). In the second place we see, that some of them lead into comparatively deep holes or furrows, others into very shallow ones. The structure of the wall is entirely different from that seen to be the case in the "central" (incurrent) canals; it corresponds, on the contrary, rather with that of the external surface. I saw this distinctly in **931 b**, where the position and amount of spinispirae is in both the same. In both we find the yellowish pigment-cells (?). As far as I could trace the canal system doubtlessly excurrent canals communicate with those holes. They must consequently be considered as belonging to the excurrent system. The apertures of the ultimate excurrent canals open here, like in **1365** etc., by means of small procts, which are perhaps slightly larger than the (incurrent) stomata on the free outer surface. The holes act as cloacae; the often irregular terminal openings might be called oscula. Thus we see that in such specimens at least part of the numerous large openings on the surface are not in-, but excurrent ones. I find exactly the same arrangement in **1047** and others. As stated before, this specimen **1047** strikingly resembles *Vioa florida* of LENDENFELD. This author says (1897 ε p. 108): "Von dieser Kruste erheben sich dann mächtige, zapfenartige Papillen, welche . . . . zu zylindrischen Körpern auswachsen . . . . welche . . . . an ihrem abgerundeten Distalende eine Anzahl grosser, unregelmässiger Löcher besitzen . . . . von denen weite Röhren ins Innere des Schwammes hinabziehen. Diese Röhren sind nicht Oscular-röhren sondern blosse Einsenkungen der äusseren Schwammoberfläche". It is evident what LENDENFELD means and that his "Einsenkungen" of the external surface correspond to the holes I described above. In so far I fully agree with LENDENFELD and can but confirm his correct observation. But according to my views there is no evidence against their cloacal nature or, in LENDENFELD's terminology, against their being "Oscular-röhren". Also I do not think they are really "Einsenkungen", due to deepenings or excavations of the surface, but places which remained open between fused neighbouring processes. We saw that a characteristic feature of tropus *concrescens* is the tendency neighbouring processes exhibit to fuse. The examples I have given are evident; however, this fact once acknowledged, we see the tendency likewise in specimens of other tropi, indiscreminately in specimens with long or with short processes. This mode of growth fairly explains the irregularity or the outline they often show and the shallowness or depth of the "holes"; hence it not unfrequently occurs, that the pits are contorted, slitlike etc., giving finally the "meandering grooves or elongated pits" which DENDY said to be characteristic for his *Suberites inconstans* var. *maeandrina*. In fact we find the coalescens of neighbouring parts, leaving grooves, pits, furrows etc. between them in numerous specimens, belonging to different tropi; thus e. g. in **B. M. 11** (Pl. II, fig. 2), **1447** (Pl. IV, fig. 4), in "*Spirastrella insignis*", in *S. panis* var. *massalis*, in **1949, 1947, 1975**, in **B. M. 23, M. M. 63, 1341 c, 305 c, 612 c**, in "*Vioa florida*", in **1047, 98, B. M. 9, M. M. 60, M. M. 59, 1447** etc. etc. A very interesting example of this formation we have in **944 a** and **944 b**. Seen from above **944 b** shows pits like those in other specimens (Pl. IV, fig. 5). But we see on the left hand side of the drawing a short cylindrical process with a large central cavity. In **944 a** (Pl. I, fig. 2) we see several rather long cylindrical processes with a large central cavity. At first sight one might compare these to the similar processes in specimens of tropus *tubulifera*. Closer examination, however, teaches us that the wall of the cavity resembles, the external surface at least at the top, and we learn by microscopical sections that the structure is indeed the same. In other words, these cavities turn out not to be homologous with the central canals of 1365, 1975 etc. but with the interstitial cavities of 931b etc.; they are, consequently, cloacal cavities. In fact 944a has rather delicate processes [1]), corresponding to those of trop. *digitata* and *tubulifera*, which may fuse in a way that the space between them remains larger than their own diameter.

In many cases I found such interstitial spaces inhabited by an Ophiurid (Pl. V, fig. 8; Pl. I, fig. 2; Pl. IV, fig. 5). I am inclined to believe that this Ophiurid (*Ophiactis savignyi* Müll. & Troschel) [2]) will be found, if not in every interstitial cavity, certainly in the majority of them. Since we know how *Eupagurus* by its continual movements keeps open a cavity in *Suberites domuncula*, it may be suggested, that in the same way *Ophiactis* is for a good deal responsable for the large size of the interstitial cavities in *Spirastrella purpurea* (Cf. infra).

To resume: there are in *Spirastrella purpurea* large canals in the centre of the processes, which are to be considered as incurrent water-reservoirs and which possess at the top of the process an opening. This opening as well as the lumen of the central canal can be narrowed or closed by contraction of muscle cells. Apart from these incurrent openings, other ones are found in several cases: they generally appear as the mouths of interstitial cavities (grooves or pits), sometimes as terminal openings of more or less cylindrical elevations, thus simulating the incurrent apparatus, in fact belonging to the excurrent system.

On the external surface of some specimens one sees, with the naked eye, irregular spots (Pl. V, fig. 23), which are more or less transparent. Microscopical sections show that we have to do here with cavities, covered by a thin layer of tissue; hence the semitransparent appearance. Seen with low power in strong light numerous small apertures become visible (Pl. V; figs. 21 and 22). These small apertures are either stomata or procts; I hardly find a difference in size, so that these are not distinguishable from each other. Especially not because the size varies according to the state of contraction and in many specimens the apertures are invisible because they are closed. I cannot tell whether in- and excurrent apertures are localised; but it seems certain that in case the sponge possesses an incurrent reservoir, nevertheless stomata may be present at the outer sponge surface. At any rate the stomata lead by short narrow canals into wider canals, more or less parallel to the surface; the latter probably correspond to "subdermal-cavities". They communicate with similar superficial cavities and the deeper canals, giving off branches to the mastichorions (Pl. VI, fig. 1). These are situated in groups and are not very numerous, often even rather scarce, except in incrusting (young?) specimens. The system is euripylous (Pl. VI, fig. 2). On the whole the excurrent part of the canal system is very much like the incurrent one, as we have seen in the examples described above, viz. 1945 and 1365. We find it so, mutatis mutandis, in all the different tropi. The stomata as well as the procts communicating through short narrow canals with wider ones, which often unite with other similar

1) The specimen shows these processes on the side opposite to the one which is photographed.

2) Determined by Prof. Koehler.

systems. Such communicating systems of canals often run parallel to the surface in the neighbourhood of the latter as we saw in 1945 (Pl. VI, fig. 1). This seems especially to be the case in the incurrent system. Therefore I believe the network of canals shown in fig. 1 on Pl. XIV to be incurrent. As stated before, we find in such specimens of trop. *tuberosa* central canals, surrounded by transparent tissue, which canals I believe to be equivalent to the incurrent reservoirs of 1365 etc. Here, however, the canals are widely open, whereas in 92 a–l (trop. *tuberosa*) they are constricted.

4. The soft parenchyma.

In a former paper (1908 *a*, p. 40) I drew attention to a sort of lymphoid or adenoid connective tissue, composed of a reticulum of flat cells with membraneous processes. I stated this tissue in *Poterion* and *Cliona* to surround the main canals and suggested that it probably is widely spread in Sponges. Sections through specimens of tropus *tuberosa* (92 a–l) exhibit exactly the same transparent tissue (Pl. IV, fig. 3). Careful observation of sections of various thickness, stained in various ways and taken from different specimens, have tought me, that almost the whole parenchyma is of this kind. It has, however, a very different aspect in different places and different specimens. In fig. 6 on Pl. VI I have marked one of the canals with an *x*. In fig. 7 this place is magnified a hundred times; one clearly sees now that the parenchyma between larger and smaller canals is composed of a reticulum, the meshes of which have different sizes. Just as we find gradual transitions from the largest canals to the smallest visible with low power, so we find that there are likewise transitions in lumen between such small canals and the meshes. If we now look with higher power at a certain canal or large mesh, e. g. the place marked *y* in fig. 7, we find again smaller meshes and we clearly see that they are formed by membraneous expansions of cells (fig. 8). Such cells generally possess ellipsoid nuclei and ramifying processes which are not threads but membranes. Between these cells all sorts of other cells may occur and I believe also connective tissue fibres. The size of the membrane cells is variable; hence the aspect of the tissue will be different. In fact, the difference depends on the size of the cells and accordingly on the size of the meshes, but also on whether many or few other cells occur. It will also make a great difference whether there are mastichorions in the neighbourhood or not and finally it will depend on the quantity of spicules. However, as far as I can see, the structure of the whole parenchyma is fundamentally the same.

Now we have already mentioned, that various contractile elements occur. Obviously the aspect of the lymphoid tissue will also depend on the state of contraction of such elements, say the muscle cells. This is plainly seen in the tissue surrounding larger canals, especially in those, which I called reservoirs. In specimens like 948 b or 1365 the lumen of the central canal is wide; the tissue surrounding it so far as it is practically without spicules forms but a narrow band, if seen in section (Pl. VII, fig. 1); the concentrically placed muscle cells are fully expanded, and the tissue itself is consequently contracted. The meshes between the flat membraneous cells show their long axes to lie concentrically (Pl. VII, fig. 4). We find quite another aspect if we compare such a section with one of a specimen the lumen of the central canal of which is half way diminished by partial contraction of the concentric muscle cells. (Pl. VI, fig. 9). Here the meshes are likewise elongated, but now the long axis is perpendicular on the axis of the canal lumen. Between these extremes we find cases that the parenchyma is in normal condition, i. e. not under the influence of pulling muscles. Consequently the meshes will not show a markedly long axis as is to be seen in fig. 8 on Pl. VI.

If we compare this remarkable tissue with tissues of which the histological structure is known, it comes nearest to the socalled adenoid or reticular connective tissue, as was first suggested to me by my friend PEKELHARING. After the studies of BIZZOZERO and RANVIER the tissue of lymph glands and similar structures, is composed of collagenous fibres with flat membraneous cells, forming very thin membraneous processes. Between these numerous other cells, in casu lymphocytes, are situated. In the tissue described above we find exactly the same; only the membraneous cells are a good deal larger. My sponges are preserved in strong alcohol and I could not try various methods of fixation and maceration. I feel, however, some right in applying the statements of histologists on the tissue of *Spirastrella* by comparing sections of, say, lymph glands with those of the sponge under consideration. It is true that I have not been able to isolate the elements and so I cannot prove that collagenous fibres occur. But I am almost sure not to be mistaken, if I declare fine threads on and between the flat cells to be connective tissue fibres. In some places I believe the fibres to be more numerous; such places are seen as darker spots, owing to the greater quantity of fibres. Of course the fibres do not stain darker, but they fill the meshes and consequently the whole looks darker. Such is e. g. the case at the periphery and arround and between the bundles of tylostyles. The difference between the tissue in such places and that in others is exactly like the difference in tissue of the fibrous capsula of a lymph gland and the tissue itself.

In preparations stained with acid fuchsin there are always more "fibres" to be seen than in those with some ordinary nucleus-stain. This is of course an argument in favour of the fibrous nature; if these were folds or thread-like processes of cells there would be no explanation for the phenomenon. At any rate it is a connective tissue with very little intercellular substance. It gives the impression of the large membraneous cells forming a sort of syncytium; at least I was unable to see separations, unless a transverse line I once observed, is to be explained as a line of demarcation. Not having living material at my disposal I could not try to produce such lines by silver nitrate, as RANVIER has done for the cells of the lymph glands. In addition to these flat cells, other cells occur, e. g. amoebocytes, myocytes, pigment-cells, scleroblasts etc. Some of these cells are illustrated in figs. 9 and 10 on Pl. VI. Whereas such cells are dispersed throughout the whole parenchyma others are localised, forming long fusiform strings as can be seen in every longitudinal section (Pl. VI, fig. 5*d*); they appear in transverse sections as more or less rounded clustres (Pl. VI, figs. 6 and 7*d*). The fusiform strings are generally found in connection with the main bundles of tylostyles. The nuclei of these large cells have an ellipsoid shape and stain darkly; therefore and because of their appearance in groups, packed closely together these "dark cells" are easily seen even with low power. The shape of the cell is somewhat elongated, with the long axis parallel to the long axis of the group. In sections stained with HEIDENHAIN's iron-haematoxylin the nucleoli appear black; in addition we see numerous black granules in the centre; whether these belong to the nucleus or are situated around it I am not sure of; I believe the latter to be the case since I found some granules beyond the nucleus, more towards the periphery (Pl. VI, fig. 12). What are these cells? Their position in most specimens, accompanying the bundles of tylostyles might suggest that they are scleroblasts. I failed however to find one case in which a young tylostyle was to be seen inside it. On the other hand it struck me that between the cells packed together in fusiform strings numerous fibres were always visible. Often longitudinal stripes were visible between one nucleus and the following, resembling on the whole the pictures FLEMMING [1]) gives of the developement of fibres in the peripheral parts of cells. I believe indeed that the cells under consideration are the mother cells of the connective tissue fibres which are numerous between and arround the tylostyles in a bundle. I feel the more inclined to believe that these fusiform cells with their large ellipsoidic nuclei are fibroblasts, as we may call them, since everywhere at the periphery of the sponge, where similar cells occur, situated with their long axes parallel to the surface, the same abundance of fibres occurs.

As stated above, true muscle cells occur, especially in the tissue surrounding the large central canals. These cells are at once distinguished from other cells by their elongated, rod-like nucleus (Pl. VII, figs. 2, 4 and 6). The cells are thread-like (fig. 2) and generally occur in bundles as is shown by figs. 4 and 6. The majority of these cells are situated in concentric layers near the lumen of the large central canals. But some other bundles occur perpendicular to the former (fig. 4). If the concentric muscle cells are dilated, the radial ones contracted, the tissue lining the canal will be contracted and the rugae mentioned above will be distinctly seen (Pl. V, figs. 4 and 11). Longitudinal sections show the wall of the canal festoned (Pl. V, figs. 12 and 18; Pl. VI, fig. 5). If on the contrary the concentric muscle cells contract, the rugae will form membraneous diaphragma's; the more they are contracted the narrower the canal will be. This we see on a large scale in the large central canals, but also in other canals.

Little is known about the remarkable, purplish color some specimens exhibit. MAC MUNN (1900) showed that "this pigment is characterised by possessing a very well-marked banded absorption spectrum, and by certain other characteristics which distinguish it from other pigments which have been hitherto described". The most remarkable feature is that it is not soluble in alcohol, benzol, ether, chloroform, ammonia; nor is it destroyed by exposure to air. Consequently we see specimens preserved in alcohol or dried as brightly colored as the living specimen. TOPSENT remarked (1906 β p. 573): "la substance colorante impregne tous les tissus, mais une coupe montée au baume met en évidence, nombreuse dans l'écorce, des cellules plus intensément colorées que tout ce qui les entoure". As far as I can see only the first part of this sentence is true; a microscopical section through **B. M. 33** shows all the various cells equally stained, the nuclei as well as the cytoplasma, nucleoli etc. The nuclei and nucleoli being thicker and more compact naturally look somewhat darker. And so do places, where cells are situated

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1) FLEMMING in Hertwig's Handb. Entw. Lehre. III, p. 6.

in closer contact, or possess bigger nuclei. This is e. g. the case at the periphery; but it likewise occurs in other places.

5. The skeleton.

A. Spicules. Pl. VIII, fig. 1—7; Pl. IX, fig. 1—9; Pl. X, fig. 1—7; Pl. XI, fig. 1—7; Pl. XII, fig. 1—12; Pl. XIII, fig. 1—4; Pl. XIV, fig. 2.

The complete skeleton of *Spirastrella purpurea* is composed of tylostyli (resp. styli) and spinispirae [1]). In many cases, however, the latter are very scarce; not unfrequently they were even found to be absent. It is, of course, possible that the spinispirae are in such cases in reality not absent, only exceedingly scarce. This may be concluded from the facts that 1⁰ we generally examine only a little fragment of the whole sponge and 2⁰ I often found them to be present in the very same specimen in which other authors did not find them. As a proof how scarce they sometimes are, may be mentioned that e. g. in one preparation of **S. E. 245** I found one or two spinispirae, in another of the same specimen not a single one; this fact stands by no means alone. These statements teach us that, if we examine specimens like **1971, 1975, 2049, B. M. 11** and **B. M. 23**, which in their whole habitus seem to be identical, but some of which possess spinispirae, others not, we have no right to separate them specifically on account of the absence or presence of spinispirae. Now this is exactly what we frequently see. Dendy does not mention spinispirae in his *Suberites inconstans* var. *globosa* and var. *maeandrina*; but I actually found them in the very types, though the spicules in the former are very rare indeed. The Siboga specimens **98, 931, 964 a–b, 966 a–b** are doubtlessly identical with Dendy's above named sponge; they all possess spinispirae. The Siboga specimens **2030, 2031, 2032** are three fragments, very likely from the same individual; in **2031** and **2032** I did, in **2030** I did not find spinispirae.

I. Megascleres.

The megascleres are typically distinct tylostyli; a few styli, however, generally are present at the same time. In some cases other sorts of megasclera are met with viz. oxea and strongyla. It is doubtful whether the former belong to the sponge. (Cf. infra).

The size and the shape of the *tylostyli* are exceedingly variable. If we compare the slender tylostyli of **1945** (Pl. VIII, fig. 3 *α–ε*) with the stout ones of **1418** (Pl. XII, fig. 10 *α–ε*) the difference appears to be so great that it might be taken as of specific value. The same variation we find in others. Dendy's *Spirastrella vagabunda* **B. M. 17** (Pl. XI, fig. 1 *α–η*) has slender tylostyli, whereas the same author's *Spirastrella vagabunda* **B. M. 14** (Pl. XI, fig. 6 *α–ζ*) has very stout ones. Dendy of course correctly did not specifically distinguish the two, for he found several transitions. In *Spirastrella vagabunda* **B. M. 41** (Pl. XI, fig. 5 *α–ζ*) and **B. M. 24** (Pl. XI, fig. 7 *α–ζ*) both, slender and stout spicules occur; moreover they are not so stout as in **B. M. 14**. Consequently Dendy did not consider *Spirastrella congenera* Rdl. as a different

1) The term is used in the sense proposed by me in 1902 p. 108.

species, although its tylostyles are considerably larger (Pl. XII, fig. 1 *α–ι*). If we follow Dendy in taking **B. M. 17** (Pl. XI, fig. 1), **B. M. 14** (Pl. XI, fig. 6), **B. M. 19, B. M. 36, B. M. 24** (Pl. XI, fig. 24), **B. M. 41** (Pl. XI, fig. 5) as so many specimens of *Spirastrella vagabunda* Rdl. and uniting with them *Spirastrella congenera* **B. M. 20** (Pl. XII, fig. 1), *Spirastrella punctulata* **B. M. 28** and *Spirastrella solida* **B. M. 26** we have no reason to exclude other "species" on account of the size of the tylostyli.

Of course one might forward the opinion, that Dendy was wrong in uniting them and that the specimens with slender tylostyli belong to one, those with stout ones to another species. Against this may be said, that the more specimens one examines, the more difficult it becomes to separate them, because one finds innumerable transitions. In order to have an aperçu I divided the specimens at my disposal into three groups; I united those the tylostyles of which were stout in another. The remainder forms a group the specimens of which either possess both slender and stout spicules or tylostyles which are neither especially slender, nor very stout. This group is, consequently, composed of transitional forms. Arranged in this way we come to the following list.

Tylostyles slender.	Tylostyles stout.	Intermediate.
B. M. 1 *cunctatrix.*	B. M. 14 *vagabunda.*	B. M. 6
B. M. 2 *areolata.*	B. M. 19 *vagabunda.*	B. M. 9 *inconstans.*
B. M. 3 *cunctatrix.*	B. M. 20 *congenera.*	B. M. 11 *inconstans.*
B. M. 4 *dysoni.*	B. M. 26 *solida.*	B. M. 12 *purpurea.*
B. M. 7 *pulvinata.*	B. M. 36 *vagabunda.*	B. M. 18 *tentorioides.*
B. M. 8 *angulata.*	M. L. B. 135	B. M. 21 *angulata.*
B. M. 10 *cunctatrix.*	M. L. B. 136	B. M. 23 *inconstans.*
B. M. 13 *cunctatrix.*	143	B. M. 24 *vagabunda.*
B. M. 15 *wilsoni.*	210	B. M. 25 *inconstans.*
B. M. 16 *cunctatrix.*	245	B. M. 28 *punctulata.*
B. M. 17 *vagabunda.*	305 c	B. M. 30 *transitoria.*
B. M. 22 *wilsoni.*	612 b	B. M. 35 *carnosa.*
B. M. 27 *decumbens.*	764	B. M. 37 *papillosa.*
B. M. 29 *angulata.*	931 b	B. M. 38 *decumbens.*
B. M. 31 *massa.*	1005	B. M. 41 *vagabunda.*
B. M. 32 *wilsoni.*	1211	M. N. 44 *bistellata.*
B. M. 33 *wilsoni.*	1341 d	92 a–l
B. M. 39 *decumbens.*	1391	98
G. M. 73 *bistellata.*	1418	M. L. B. 132 *purpurea.*
948 a	1447	179
1031	1631	300

Tylostyles slender.	Tylostyles stout.	Intermediate.
1103	2049	410
1455 c		426 a–d
1945		612 a
1952		612 d
		614 a
		638
		964 a
		966 a
		977
		1045
		1047
		1075
		1092
		1117
		1141
		1260
		1365
		1402
		1403
		1421
		1480
		1610
		1947
		1949
		1950
		1971
		1975
		1988
		2030
		2031
		2032

Of all these I possess camera-drawings at the same scale. This collection clearly showed me the impossibility of a separation on account of the tylostyles. The specimens of the third list in fact form all desirable transitions. Of course it was impossible to have all these drawings reproduced and I therefore took only some samples. My original drawings and preparations are however at the disposal of any spongiologist, who wishes to convince himself of the truth of my statement.

Generally the tylostyles are slightly curved. The variation of the base and the apex, the shape of the "head" (phyma)[1]) and all such details are better seen in the illustrations than any description can give. The length of the spicules varies between 150 and 800 μ; the maximal diameter between 5 and 23 μ. For details see the tabular view on p. 60[2]).

The development of the phyma is variable; on the whole it is distinctly present, but in almost every preparation some spicules hardly possess it and the tylostyle becomes a style. The apex is likewise variable and not unfrequently it is not pointed but rounded of. Finally it occurs that thus both ends are rounded of so as to form strongyla. I found a few of these e. g. in specimens **B. M. 12, B. M. 15, B. M. 16, B. M. 22, B. M. 31, M. L. B. 132**; further in **210, 305 c, 966**. In **305 a** there is a remarkable variety of style or strongyla (Pl. XIV, fig. δ–ε), which I did not find in any other specimen. As the illustrations show, they are often very short and thick, much thicker than the tylostyles. I cannot make out what these formations are. As we find transitions to ordinary tylostyles I feel rather inclined to consider them as (pathologically?) modified tylostyles. I don't know anything about the way how the latter originate in our sponge; whether built up by one cell or by more than one. It is often supposed that such spicules "grow" normally as long as the socalled central canal remains "open". It is possible that in **305 a** by some agens this canal is shut very early, at a time that the mother-cell or mother-cells is or are still able to produce more layers of silica over the original "embryonic" spicule and in this way give rise to the curious spicules. As I did not only find them plentifully in the preparations of isolated spicules but also in the sections of the sponge, it seems to me hardly admissible that they are corpora aliena. It is worth our while to remark that the successive concentric layers of silica are much more conspicuous in these abnormal spicules than in the normal ones; and secondly that in **305 a** several obvious abnormalities in the spicules occur. Although I did not find these spicules in other specimens, at least not to such an extent, it must be remarked that sometimes a thicker, bluntly terminated spicule occurs, as e. g. in **210** and **305 c** (Pl. XIV, fig. 4).

Another question is in how far *oxea* may belong to the complete set of spicules of *Spirastrella purpurea*. I found them in preparations of **B. M. 8, B. M. 19, B. M. 23, B. M. 27, B. M. 31** and in **1341 d, 1391, 1402, 1945**. They have always quite another character than the tylostyles or its modifications, and they are always scarce. I believe, therefore, that they do not belong to the sponge under consideration, but are foreign, as so often occurs. I feel the more inclined to consider them as corpora aliena since in **1391** I found also a few acanthoxea, and in **B. M. 44** strongyla, oxea, acanthoxea and tetraxons; all however in very small quantity.

The fact that in addition to tylostyli other spicules occur (oxea, styli or strongyla) is not new, for previous authors mention the same. Thus, e. g. Ridley & Dendy say (1887 p. 231) about *Spirastrella massa* (**B. M. 31**) that it "is also remarkable for the great irregularity in

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1) I propose the term "phyma" for the swollen base of a tylostyle.

2) I have taken into account only my own measurements, which are calculated in the same way. This is done as follows. The drawings are made with aide of an Abbe camera. With the same combination of lenses, length of tube etc. drawings were made of the lines of a micrometer; the real distance of two lines known, it is easy to calculate how many times the drawing is enlarged. A quantity of drawings are made with Edinger's projecting apparatus (new system of Leitz); the calculation is of course the same.

the shape of the megasclera; these are often very abnormal in appearance and may even (though rarely) become oxeote . . . ." THIELE found strongyla in *Spirastrella insignis* and *panis*. Although on the whole I believe the oxea to be foreign, in **B. M. 31** they resemble modified tylostyli. At all events the tylostyle seems to be the typical megasclere; this is in accordance with the statements of the majority of previous authors.

II. Microscleres.

Perhaps even more variable than the tylostyli are the spinispirae. We have seen before that they are sometimes very scarce and may even be absent. In specimens where they occur, there are always minute ones; in others we find larger spinispirae as well, and in many cases they are very robust or very long. I could not make out the question whether in such cases we have to do with two sorts of spinispirae or not. So much is certain that the larger ones have been small in the beginning, and that in several cases we find every possible intermediate size between the smallest and the largest specimens. Under these circumstances it seems to me better to treat them as one sort and to take into account only what is actually observed. As it would be totally wrong to exclude e. g. **1365** and **1971** from *Spirastrella* because no spinispirae are found, it would be as wrong to make a specific difference between specimens with or without robust spinispirae, again because of the manifold transitions. We have seen that in habitus **B. M. 10** and **B. M. 13** are intermediate between **92 a–l** and **300**; but in the latter robust spinispirae are absent. **B. M. 10** likewise is a link between **92 a–l** and **1949**; the larger spinispirae of the latter are of an intermediate size. On the whole we find the robust form of spinispirae in specimens of trop. *tegens* and trop. *tuberosa*; they are absent in trop. *digitata*, trop. *glaebosa*, trop. *concrescens* and trop. *tubulifera*; in trop. *pyramidalis* they are present or absent. In the three specimens of *Spirastrella decumbens* I examined, there is a considerable difference in the size of these spicules: in **B. M. 38** and **B. M. 39** (Pl. VIII, figs. 2 and 4) they are larger and thicker than in **B. M. 27** (Pl. VIII, fig. 1). In the two specimens of *bistellata* we find the same difference: in **G. M. 73** (Pl. XII, fig. 9) they have about the size and shape of *decumbens* **B. M. 38**, whereas in **M. N. 44** (Pl. XII, fig. 8) they are again still larger. Moreover they are, especially in the latter, more compact (resembling "Doppelsterne). An intermediate condition we find in *Spirastrella transitoria* **B. M. 30** (Pl. XII, fig. 6). In **426 a–d** we have another interesting series; in **426 d** (Pl. IX, fig. 6) we find a large quantity of very robust spinispirae; in **426 a** (Pl. IX, fig. 4) these spicules are considerably smaller; the same is true for **426 b** and **426 c** (Pl. IX, figs. 5 and 7). Moreover they are in the latter not so abundant by far.

After all what has been said about this question in the course of this paper, I suppose these examples are sufficient; they might easily be augmented. Consequently, if we do not want to consider the various spinispirae we find here, as so many different sorts, we are led to see in them one sort, which is modified into endless variations. The spinispirae may become very large and robust; striking examples hereof we find in: **B. M. 38** (Pl. VIII, fig. 2 $\varkappa, \mu$); **B. M. 39** (Pl. VIII, fig. 4 μ); **426 d** (Pl. IX, fig. 6 β, γ, ζ); **B. M. 3** (Pl. X, fig. 7 γ—ζ); **G. M. 73**

(Pl. XII, fig. 9 ι—λ); **1031** and others. They are still very large, but somewhat modified in the following specimens: large, but relatively longer than in the first group in **1455 c** (Pl. VIII, fig. 5 γγ—εε); **1421** (Pl. VIII, fig. 6 ζ—ϑ); **B. M. 27** (Pl. VIII, fig. 1 φ); **B. M. 37, B. M. 38** (Pl. VIII, fig. 2 λ); **1945** (Pl. VIII, fig. 3 π—σ); **1480** (Pl. IX, fig. 1 ο—ρ); **426 c** (Pl. IX, fig. 7 δ); **1949** (Pl. IX, fig. 9 α—γ); **426 a** (Pl. IX, fig. 4 η—ι); **426 b** (Pl. IX, fig. 5 λ—ν); **426 d** (Pl. IX, fig. 6 δ, ε); **92 a** (Pl. X, fig. 1 ξ—τ); **B. M. 10** (Pl. X, fig. 2 λ—ν); **B. M. 1** (Pl. X, fig. 3 ν, ο); **B. M. 16** (Pl. X, fig. 4 η—κ); **B. M. 13** (Pl. X, fig. 6 η—λ); **B. M. 3** (Pl. X, fig. 7 α—η); **B. M. 20** (Pl. XII, fig. 1 μ). On the other hand we find specimens, which are large, but comparatively shorter than in the first group in: **B. M. 12** (Pl. VIII, fig. 7 α—δ, ι); **426 d** (Pl. IX, fig. 6 γ); **92 a** (Pl. X, fig. 1 ν); **B. M. 10** (Pl. X, fig. 2 κ); **B. M. 3** (Pl. X, fig. 7 κ, λ); **B. M. 26** (Pl. XII, fig. 5 α); **B. M. 30** (Pl. XII, fig. 6 β—ζ); **M. N. 44** (Pl. XII, fig. 8 δ—η); **G. M. 73** (Pl. XII, fig. 9 κ); **1421, 1945, B. M. 38**. Again quite different look the large and very elongated, hence slender spinispirae as e. g. occur in: **1480** (Pl. IX, fig. 1 σ, τ); **426 b** (Pl. IX, fig. 5 ϑ—ι); **426 a** (Pl. IX, fig. 1 ε—ζ); **1949** (Pl. IX, fig. 9 δ—ε); **1988** (Pl. IX, fig. 8 α—ε); **426 c** (Pl. IX, fig. 7 α—γ); **410** (Pl. IX, fig. 3 ζ, η); **B. M. 13** (Pl. X, fig. 6 υ); **B. M. 1** (Pl. X, fig. 3 ο); **B. M. 26** (Pl. XII, fig. 5 ϑ); **B. M. 20** (Pl. XII, fig. 1 κ—ι). If we compare the figures mentioned above, we see that they gradually pass into each other. Moreover we see that they are united by transitions to the smaller spinispirae till we finally come to the very minute ones. These transitions are likewise observed by previous authors in many cases.

We have stated before (p. 23), that the peculiar spinispirae LENDENFELD described of "*Vioa florida*" are by no means restricted to that "species"; they are also found by TOPSENT in "*Alcyonium purpureum*". I found them in several specimens: **B. M. 12, B. M. 24, B. M. 27, B. M. 38, 92 a** (Pl. X, fig. 1 χ, ψ); **305 a, 426 a, 1455 c** and others.

The following tables illustrate the different sizes tylostyli and spinispirae reach in *Spirastrella purpurea.*

NAME.	Author or number.	Tylostyli or styli.		Spinispirae		Remarks.
		length.	max. diam.	small.	large.	
Spirastrella decumbens	RIDLEY	350	9.5	25		
S. decumbens var.	RDL. & DY.	400	. . . .	28		
S. decumbens var. *robusta*	KIRKPATRICK	432	. . . .	8—12	48	
S. decumbens	id.	507	. . . .	8—12	36	
S. decumbens	B. M. 27	250—500	10	10	. . .—38*	*excl. spines.
S. decumbens	B. M. 38	273—467	17	. . .—15	. . .—38*	*id.
S. decumbens	B. M. 39	220—410	10	. . . .	. . .—40*	*id.
S. decumbens	KELLER	300—380	5	20—25		
Tethya bistellata	SCHMIDT	+	. . . .	. . . .	+	
Spirastrella bistellata	LENDENFELD	420—580	13.5	5—15	30—50	
Hymedesmia bistellata	TOPSENT	500	. . . .	12 (?)	65 (?)	
Suberites bistellatus	G. M. 73	. . .—567	10	7.5	. . .—50*	*incl. spines.
Hymedesmia bistellata	M. N. 44	283—600	17	. . . .	. . .—62.5*	*incl. spines.
Spirastrella transitoria	RIDLEY	900	16	16*	. . . .	*incl. spines.

Name.	Author or number.	Tylostyli or styli.		Spinispirae.		Remarks.
		length.	max. diam.	small.	large.	
S. transitoria	B. M. 30	217—683	18	. . . —27.5*	. . . —57**	*very slender; **incl. spines!
S. purpurea	S. E. 1031	210—490	10	7—12	. . . —50*	*incl. spines.
S. purpurea	S. E. 1402	250—517	16.5	10	. . . —57*	*id.
S. purpurea	S. E. 1421	260—430	12	10	. . . —37.5*	*excl. spines.
S. purpurea	S. E. 1455 c	260—380	9	7	. . . —40*	*id.
S. purpurea	S. E. 1945	260—427	7	7.5	. . . —25*	*id.
S. semilunaris	Lindgren	432	. . . .	10	48*	*incl. spines.
S. cunctatrix.	Schmidt	+	. . . .	. . . .	30—46	
S. cunctatrix.	Hentschel	375—590	7	+	24—47	
S. cunctatrix.	Carter	840	. . . .	. . . .	50*	*incl. spines.
S. cunctatrix var. *robusta*	id.	440	. . . .	. . . .	46 × 26*	*id.
S. cunctatrix var. *porcata*	B. M. 1	200—483	9	10	. . . —42.5*	*incl. spines; comparatively slender.
S. cunctatrix var. *robusta*	B. M. 3	. . . —530	11.5	8—25*	. . . —52.5**	*slender; **incl. spines.
S. cunctatrix.	B. M. 10	200—517	8	12	. . . —50*	*incl. spines; comparatively slender.
S. cunctatrix.	B. M. 13	183—400	10	10	. . . —52*	*id. id.; in addition robust ones.
S. cunctatrix var. *robusta*	B. M. 16	300—533	7	10	. . . —52*	*id. id. id.
S. papillosa	Rdl. & Dy.	300—500	. . . .	+	50	
S. papillosa	Dendy	200—460	. . . .	. . . .	50*	*incl. spines.
S. papillosa	B. M. 37	210—550	17	. . . —22.5	. . . —55*	*incl. spines; rather robust.
S. panis	Thiele	350—550	. . . .	10—20	40	
S. insignis.	id.	400—550	. . . .	30	40—70 (?)	
S. purpurea	S. E. 426 d	217—527	16.5	14	40—85*	*incl. spines.
S. purpurea	S. E. 92 a	200—586	19	14	. . . —60*	*incl. spines.
S. purpurea	S. E. 92 c	233—600	16.5	13	. . . —60*	*id.
S. purpurea	S. E. 92 d	230—550	16	12.5	. . . —70*	*id.
S. purpurea	S. E. 92 e	200—500	15	. . . .	. . . —55*	*id.
S. purpurea	S. E. 92 f	183—533	20	. . . .	. . . —55*	*id.
S. purpurea	S. E. 92 g	183—566	16	. . . .	. . . —62*	*id.
S. purpurea	S. E. 92 h	200—583	19	. . . .	. . . —82*	*id.
Suberites wilsoni	Carter	315	6	—	—	
S. wilsoni	B. M. 22	200—283	8	5—12.5*	—	*excl. spines; not slender.
S. wilsoni	B. M. 33	217—333	8	—	—	
S. wilsoni	B. M. 32	233—367	10	. . . —30*	—	*excl. spines.
S. wilsoni var. *albidus*.	B. M. 15	150—433	8	6—25*	—	*excl. spines; slender.
Spirastrella purpurea	Ridley	. . . . .	13	16		
S. purpurea	Topsent	330—350	10	. . . —30		
Alcyonium purpureum.	B. M. 12	283—367	12	. . . —20*		*excl. spines; rather robust.
A. purpureum	M. L. B. 132	220—367	13	. . . —20*		*id. id.
Spirastrella areolata.	Dendy	400	. . . .	15	60*	*incl. spines.
S. areolata.	B. M. 2	300—483	7.5	5—20*	. . . —40*	*incl. spines; slender.
S. pulvinata	B. M. 7	267—367	10	+*	. . . .	*very rare.
Spongia dysoni	Carter	+	. . . .	17		
S. dysoni	B. M. 4	240—365	9	7.5	. . . —35*	*incl. spines.
Spirastrella massa	Rdl. & Dy.	450	. . . .	9.5	. . . —44*	*slender.
S. massa	B. M. 31	170—450	5	7.5	. . . —50*	*id.
S. minax	Topsent	200—700	13	20—25		
S. bonneti	id.	330	. . . .	23*	. . . .	*not frequent
S. purpurea	S. E. 426 a	140—600	18	. . . .	{ . . . —55* { . . . —25**	*slender; **rather robust.
S. purpurea	S. E. 426 b	190—683	20	7.5—25	{ . . . —30* { . . . —80**	*rather robust; **slender.

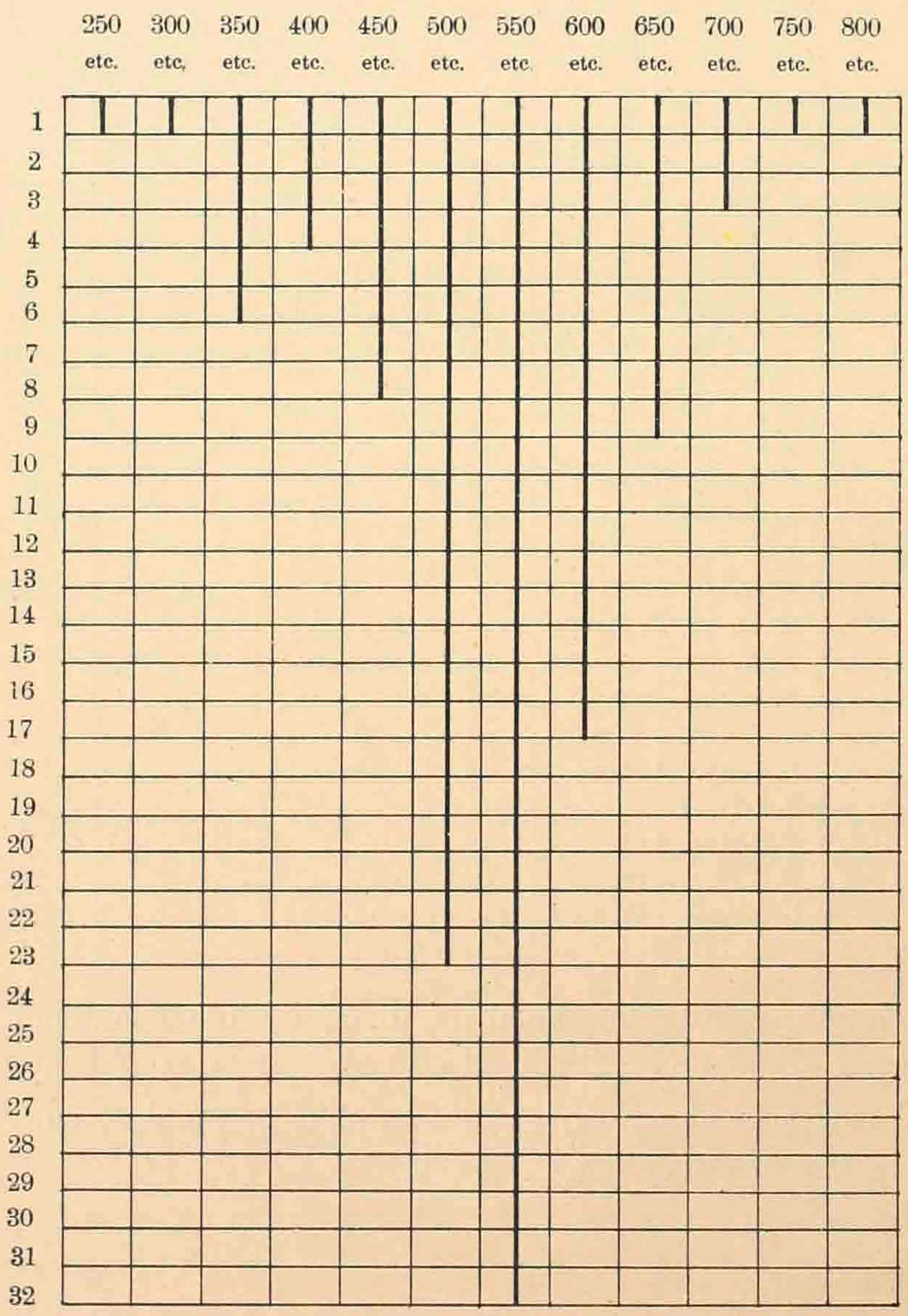
Name.	Author or number.	Tylostyli or styli.		Spinispirae.		Remarks.
		length.	max. diam.	small.	large.	
S. purpurea	S. E. 426 c	167—600	14	7.5	...—35* ...—52**	*rather robust; *slender.
S. purpurea	S. E. 300	152—583	19	...—30		
S. purpurea	S. E. 410	206—666	17	...—40*		*slender; a few ones rather stout.
S. purpurea	S. E. 1045	185—550	13	5—10	—	
S. purpurea	S. E. 1480	183—710	12.5	13—55		
S. purpurea	S. E. 1947	267—633	15	...—15.5		
S. purpurea	S. E. 1949	200—667	13	...—55*		*slender.
S. purpurea	S. E. 1950	180—667	13	5—33*		*id.
S. purpurea	S. E. 1952	167—600	11	8—16		
S. purpurea	S. E. 1988	140—425	13	12—65*		*slender.
Spirastrella vagabunda.	Ridley	550—630	20	...—32		
S. vagabunda var. *trincomaliensis* . .	Dendy	620	. . . .	12		
S. vagabunda var. *fungoides*	id.	500	. . . .	...—48		
S. vagabunda var. *gallensis*.	id.	500	. . . .	12		
S. vagabunda var. *trincomaliensis* . .	B. M. 24	180—567	15	10—21.5		
S. vagabunda var. *gallensis*.	B. M. 14	210—543	22	5—10		
S. vagabunda var. *fungoides*	B. M. 19	190—590	20	6—20		
S. vagabunda var. *tubulodigitata* . .	B. M. 17	185—600	10	7.5—20		
S. vagabunda.	B. M. 36	167—517	17	...—20		
S. vagabunda.	B. M. 41	193—633	15	...—22.5		
S. congenera	Ridley	800 (?)	. . . .	...—56*		*slender.
S. congenera	B. M. 20	173—540	30	12—42.5		
Suberites trincomaliensis	Carter	643	. . . .	...—25		
Spirastrella punctulata.	Ridley	400	. . . .	20		
S. punctulata.	B. M. 28	200—533	15	...—33		
S. tentorioides	Dendy	...—660	. . . .	8—48		
S. tentorioides	Hentschel	240—672	10	11—15* 22—40*		*excl. spines.
S. tentorioides	B. M. 18	183—580	16	10—47.5*		*often rather stout.
S. solida.	Rdl. & Dy.	...—700	. . . .	13—56		
S. solida.	B. M. 26	167—600	18	7.5—47.5		
S. carnosa	Topsent	330	. . . .	6—16*	. . . .	*rare.
S. carnosa	Kirkpatrick	528	. . . .	18*	. . . .	*id.
S. carnosa	B. M. 35	167—470	18	...—23		
S. purpurea	B. M. 6	150—527	17	...—42		
S. purpurea	S. E. 143	193—583	16.5	...—35		
S. aurivilli	Lindgren	...—672	. . . .	...—40		
S. purpurea	S. E. 614 a	170—633	17	7.5—25		
S. purpurea	S. E. 948 a	160—660	10	...—20		
S. purpurea	S. E. 1005	187—617	20	5—20		
S. purpurea	S. E. 1075	150—658	10	7.5—33		
S. purpurea	S. E. 1092	160—606	10	6—10		
S. purpurea	S. E. 1117	160—570	12	6—20		
S. purpurea	S. E. 1391	183—600	20	7.5—17.5		
S. purpurea	S. E. 1610	200—800	18	...—37.5		
S. purpurea	S. E. 1631	190—745	23	9—17.5		
S. purpurea	S. E. 1403	166—700	12	...—14		
Vioa florida	Lendenfeld	200—650	. . . .	5—15		
Spirastrella purpurea	S. E. 179	140—580	14	...—30		
S. purpurea	S. E. 210	160—533	18	7.5—16		

Name.	Author or number.	Tylostyli or styli.		Spinispirae.		Remarks.
		length.	max. diam.	small.	large.	
S. purpurea	S. E. 305a	500	. . . .	15—60*		*slender.
S. purpurea	S. E. 305c	200—567	23	17—22.5		
S. purpurea	S. E. 612b	123—590	20	+*	. . . . . .	*exceedingly rare.
S. purpurea	S. E. 612d	133—450	15	+*	. . . . . .	*rather rare.
S. purpurea	S. E. 944a	180—500	17	. . . —20		
S. purpurea	S. E. 1047	170—500	17	10—20		
S. purpurea	S. E. 1141	183—567	13	. . . —25		
S. purpurea	S. E. 1341d	140—540	19	. . . —24		
Suberites inconstans var. *globosa*. . .	Dendy	570				
S. inconstans var. *globosa*	B. M. 25	200—583	15	+*	. . . . . .	*very rare.
S. inconstans var. *maeandrina* . . .	B. M. 9	163—550	19	9—15		
S. inconstans.	M. L. B. 135	183—567	21	. . . —13		
S. inconstans.	M. L. B. 136	183—683	23	. . . —40*	. . . . . .	*slender.
S. inconstans.	Thiele	. . . —600	. . . .	15—20		
Hymeniacidon angulata	Bowerbank	533	. . . .	+		
H. angulata	B. M. 8	317—550	12	10—30		
H. angulata	B. M. 21	250—550	15	12.5—37.5		
H. angulata	B. M. 29	300—550	10	7.5—25		
Spirastrella purpurea	S. E. 98	173—520	20	10—27.5		
S. purpurea	S. E. 245	200—520	20	+*	. . . . . .	*exceedingly rare.
S. purpurea	S. E. 612a	200—573	17	. . . —22.5		
S. purpurea	S. E. 764	160—600	20	. . . —30		
S. purpurea	S. E. 931b	167—593	23.5	15—30		
S. purpurea	S. E. 964a	166—520	20	7.5—20		
S. purpurea	S. E. 966a	133—483	12.5	6—20		
S. purpurea	S. E. 977	150—610	20	9—24		
S. purpurea	S. E. 1418	183—567	23	12.5—27.5		
S. purpurea	S. E. 1447	200—580	30	15—25		
S. purpurea	S. E. 2030	250—550	13	—		
S. purpurea	S. E. 2031	133—583	18	. . . —22		
S. purpurea	S. E. 2032	166—667	25	10—12.5		
Suberites inconstans var. *digitata* . .	B. M. 11	237—517	15	+*	. . . . . .	*exceedingly rare.
S. inconstans var. *digitata*	B. M. 23	153—583	17	10—22.5		
Spirastrella purpurea	S. E. 638	160—660	23	. . . —20		
S. purpurea	S. E. 1211	208—600	27	. . . —30		
S. purpurea	S. E. 1260	160—630	22	. . . —27.5		
S. purpurea	S. E. 1365	150—533	14	—		
S. purpurea	S. E. 1971	280—567	15	—		
S. purpurea	S. E. 1975	167—600	17	+*	. . . . . .	*very rare.
S. purpurea	S. E. 2049	177—583	17	. . . —12.5*	. . . . . .	*very rare.
S. digitata.	Hentschel	225—700	12	12—16		

Eliminating from these lists the numbers given by other authors because they are calculated in different ways, we find for the others, which I measured myself all in the same way, that the maximal length of the tylostyli varies between 283 and 800 μ. Arranged according to the size we come to the following list.

Maximal length of tylostyli. (in μ).	Frequency of occurence.	Maximal length of tylostyli. (in μ).	Frequency of occurence.	Maximal length of tylostyli. (in μ).	Frequency of occurence.	Maximal length of tylostyli. (in μ).	Frequency of occurence.
283	1	470	1	567	7	633	3
333	1	483	3	570	1	658	1
365	1	490	1	573	1	660	2
367	4	500	5	580	3	666	1
380	1	517	4	583	7	667	3
400	1	520	3	586	1	683	3
410	1	527	2	590	2	700	1
425	1	530	1	593	1	710	1
427	1	533	5	600	10	745	1
430	1	540	2	606	1	800	1
433	1	543	1	610	1		
450	2	550	8	617	1		
467	1	566	1	630	1		

If we put together sizes from 250 μ and more, but less than 300; from 300 μ and more, but less than 350 μ etc., we can dress the following tabel:

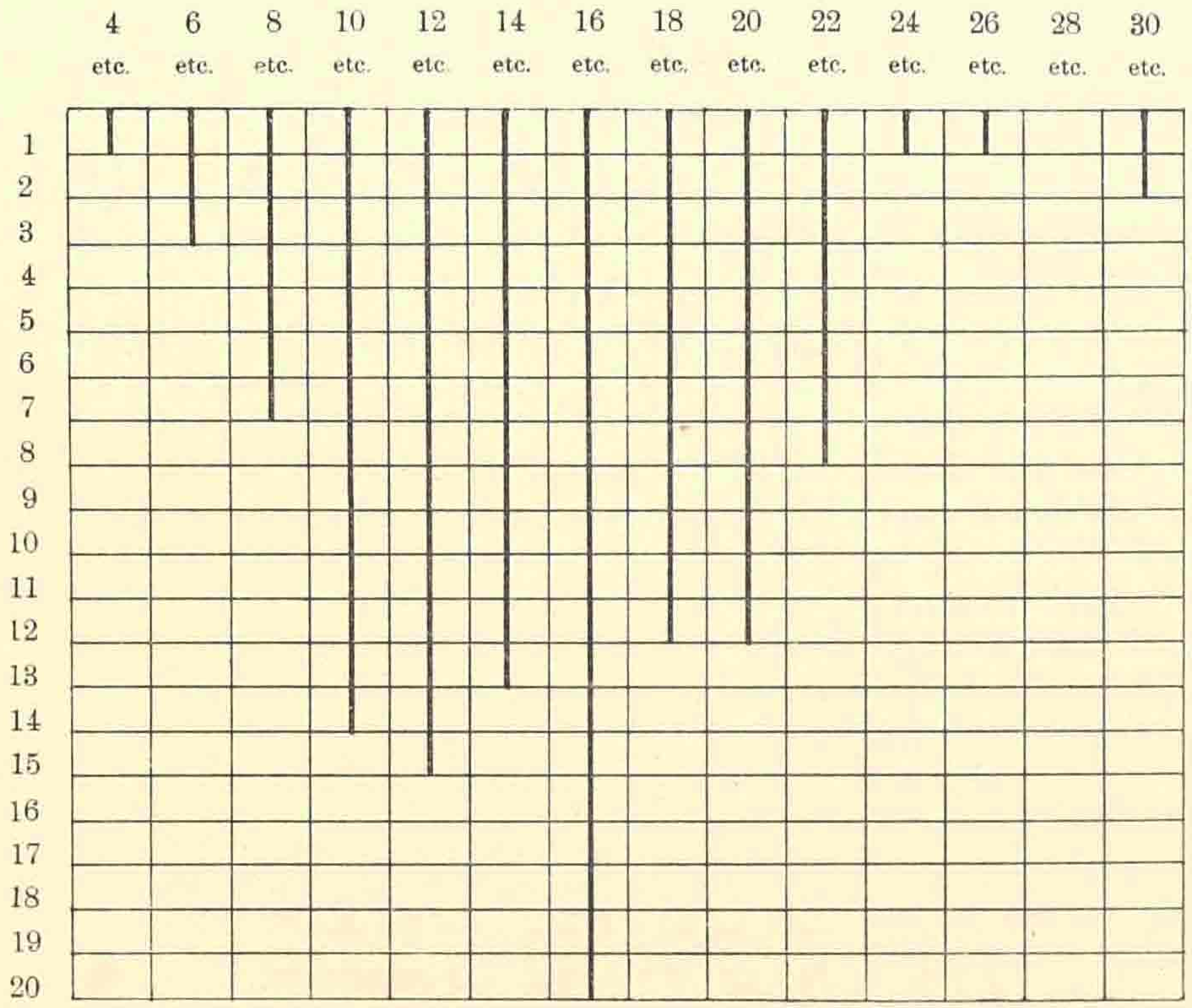


Consequently the maximal length of tylostyles reaches in about 33°/₀ cases 550 μ and more, but less than 600 μ and in about 75°/₀ cases 500 μ and more, but less than 650 μ. Further we see that a length of less than 350 μ and more than 700 μ seldom occurs. Whensoever the number of measurements we dispose of is but little, it is evident that gradual transitions occur and that the limits are large.

The diameter of the tylostyles likewise varies considerably. The maximal diameter varies between 5 and 30 μ, as the following table shows.

Maximal diam. of tylostyli. (in μ).	Frequency of occurence.	Maximal diam. of tylostyli. (in μ).	Frequency of occurence.	Maximal diam. of tylostyli. (in μ).	Frequency of occurence.	Maximal diam. of tylostyli. (in μ).	Frequency of occurence.
5	1	11.5	1	16.5	4	23	5
7	2	12	6	17	13	23.5	1
7.5	1	12.5	2	18	7	25	1
8	4	13	7	19	5	27	1
9	3	14	3	20	11	30	2
10	12	15	10	21	1		
11	1	16	3	22	2		

If we put together sizes of 4 μ and more, but less than 6 μ, of 6 μ and more, but less than 8 μ etc. we find the following.



Thus, in about 20°/₀ cases the maximal diameter reaches 16 μ and more, but less than 18 μ and in about 85°/₀ cases 10 μ and more, but less then 22 μ. Less than 6 μ and more than 24 μ seldom occurs. Again we find large limits, but all possible transitions.

B. Arrangement of the spicules.

It may be expected a priori that, where the elements of the skeleton are so variable, the latter as a whole, i. e. the arrangement of the spicules will likewise show variation. Generally we find in more or less massive specimens a diffuse skeleton, with no distinct spiculo-fibre, as e. g. Ridley & Dendy described for *Spirastrella massa*, *solida*, *papillosa* etc. Indeed this seems to be the case; but if we compare it with more regular forms, we learn that in fact always some main bundles of tylostyli can be distinguished, with so-called secundary fibres at about right angles to them. In the meshes of massive irregularly shaped specimens we always find spicules in all directions and this gives to the whole the appearance of a more or less dense reticulation. At the periphery the tylostyles are usually smaller and project a little, more or less regularly, forming as a rule distinct brushes or tufts. In specimens which form crusts, there are distinct bundles of spicules starting from the substratum at about right angles and expanding brush-like at the periphery — in longitudinal section fan-like. We see this arrangement distinctly e. g. in 1945; we find there at the same time that the bundles may branch dichotomously (Pl. VI, fig. 1). In conical or digitate processes we find likewise longitudinal main bundles, branching and anastomosing. They give off small branches towards the periphery, where they terminate in brushes; the main longitudinal bundles likewise terminate in a brush (Pl. VI, fig. 5 and Pl. VII).

In specimens where spinispirae occur these spicules form a peripheral crust. If large and minute spinispirae are present, the crust is formed by three or four layers of robust spinispirae, mostly situated parallell to the surface, with some few spicules at right angles to it; such layers are then distally covered by a layer of minute spinispirae. This arrangement is undoubted in 1455 a–c and 1945. The main mass of spinispirae always occurs at the sponge surface; but in the whole of the parenchyma they may occur without any definite order.

The more the spinispirae become scanty or disappear, the more distinct are tylostyles, placed perpendicularly to the surface and finally wholly replace the former. In many cases they may become so densely packed that they form a pseudo-cortex, which is clearly visible to the naked eye, often very thick and somewhat glossy in appearance (Pl. V, figs. 1, 3, 15 and 16).

The question whether in *Spirastrella purpurea* we have to speak about a true cortex or not I cannot answer for the moment. We had better leave the question open. So much is certain that we may distinguish an ectosome from a choanosome. In this ectosome we often find one or more layers of spinispirae; in addition to these spicules we find tylostyles, perpendicular to the surface and generally smaller than those of the main skeleton. If spinispirae are absent, the tylostyles may entirely so to say fill the ectosome. The tissue of the ectosome is distinguished from that of the ectosome, because the cells are situated farther from each other and consequently it is less stained. Moreover we often find fibres and long fusiform cells. It is, however impossible to draw a sharp line of demarcation between ectosome and choanosome.

Symbiotic animals.

As in almost every sponge numerous animals live in our *Spirastrella* or between its processes. Thus I frequently found Annelids living in the canals and also, as we saw before, an Ophiurid (*Ophiactis savignyi*). This is nothing remarkable; but I want to draw attention to a small sort of Cirripedia. My friend Dr. P. P. C. Hoek, whom I begged to determine the species, writes to me that it is "either identical with or very nearly related to *Balanus declivis*, Darwin, which hitherto is known from the West Indus only". It seems to me probable that the presence of this little *Balanus* is one of the causes of the club-shaped appearance of the specimens infested with it, a phenomenon to be compared with the modification in shape *Stephanoscyphus mirabilis* Allm. so often produces. The latter polyp seems also to occur in *Spirastrella*. In some specimens of our sponge I found numerous cells, which I do not believe to belong to the sponge but to represent symbiotic Protozoa. They strongly remind us of Cnidosporidia. Unfortunately I have not been able to decide the question.

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CORRIGENDA

p. 5, *Spirastrella lacunosa* and *spiculifera* of KIESCHNICK date from 1898 and not from 1900.

EXPLANATION OF PLATES

PLATE I.

Spirastrella purpurea (Lmk.) Rdl.

(Photo's after the original specimens).

Fig. 1. **S. E. 300.** Cake- or cushion-shaped specimen seen from above. Natural size.

Fig. 2. **S. E. 944 a.** Side view. At *a* one of the tubes, longitudinally cut; at the bottom an ophiurid (*b*). Natural size.

Fig. 3. **S. E. 612 d.** Side view; the basis almost entirely covered with fragments of shells and other calcareous matter. *a* Holes of barnacles. Natural size.

Fig. 4. **S. E. 98.** Specimen seen from the top. Natural size.

Fig. 5. **S. E. 1403.** Coralline alga partly covered with *Spirastrella*; *a* young processes. Natural size.

Fig. 6. **S. E. 948 d.** Side view of a process, probably torn off from a large specimen. Natural size.

Fig. 7. **S. E. 948 c.** Fragment with three processes. Natural size.

Fig. 8. **S. E. 1075.** Coralline alga partly covered with *Spirastrella,* somewhat older than **S. E. 1403** (Fig. 5), possessing large processes. One of these is torn of at *a* (compare next figure). Natural size.

Fig. 9. id. Side view of the process belonging to specimen **1075**. Natural size.

Goedeljee phot.

PLATE II.

Spirastrella purpurea (Lmk.) Rdl.

(Photo's after the original specimens).

Fig. 1. **S. E. 305 c.** Side view. Natural size.

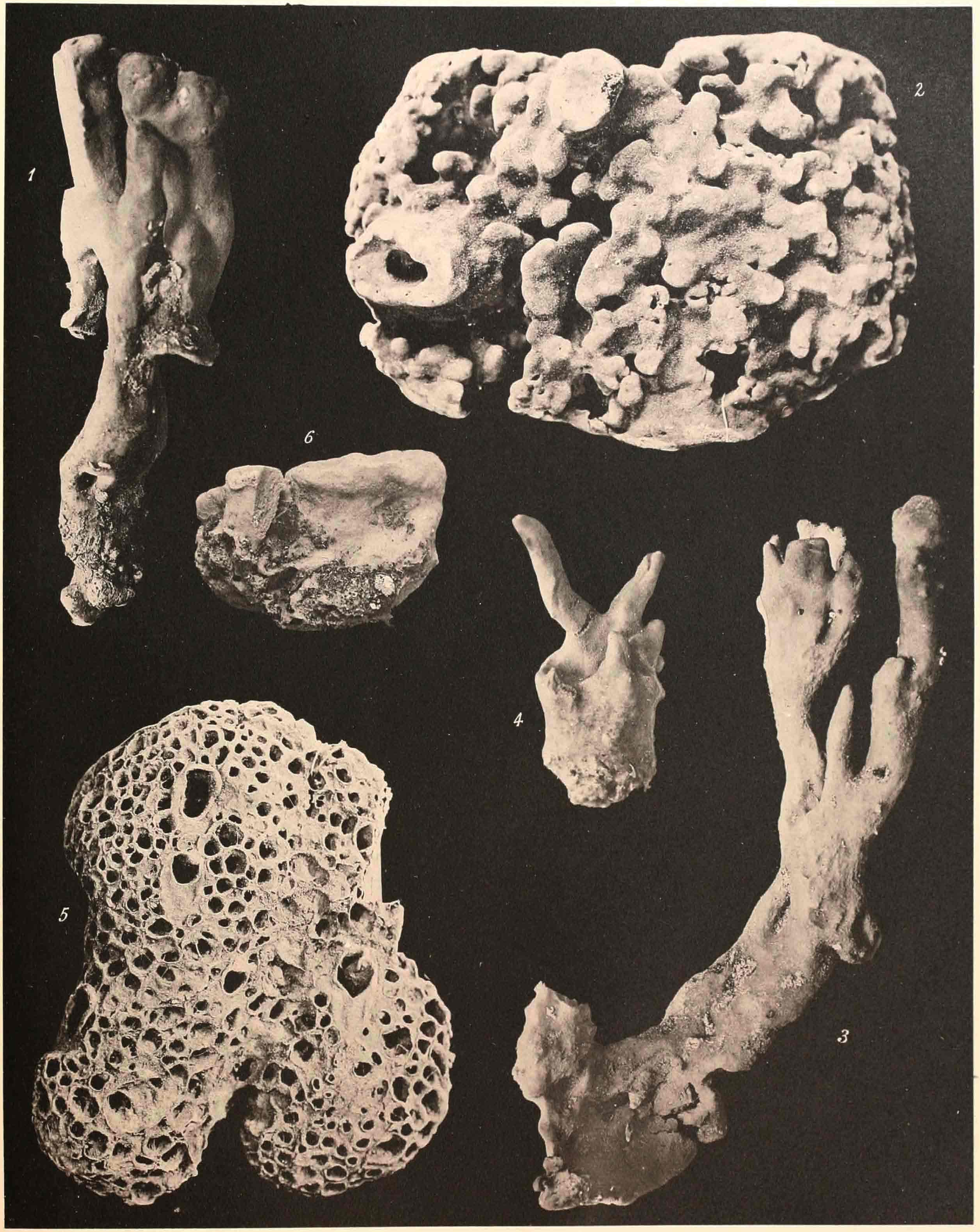
Fig. 2. **B. M. 11.** *Suberites inconstans* var. *digitata* Dy. Probably one of the co-types. Seen from above, after a dry specimen. Natural size.

Fig. 3. **S. E. 1341 a.** Side view. Natural size.

Fig. 4. **S. E. 1211.** Side view. Natural size.

Fig. 5. **B. M. 29.** *Hymeniacidon angulata* Bwk. Seen from above, after a dry specimen. Natural size.

Fig. 6. **S. E. 1447.** Side view. [Compare fig. 4 on Pl. IV]. Natural size.



Figs. 2 and 5 Highley, cet. Goedeljee phot.

PLATE III.

Spirastrella purpurea (Lmk.) Rdl.

(Photo's after the original specimens).

Fig. 1. **S. E. 426 b.** Side view. Natural size.

Fig. 2. **S. E. 1945.** Coralline alga almost entirely covered by *Spirastrella*; in some parts the sponge again covered by fragments of shells etc. Natural size.

Fig. 3. **B. M. 10.** *Spirastrella cunctatrix*. Crtr. After a dry specimen. Natural size.

Fig. 4. **B. M. 2.** *Spirastrella areolata* Dy. After the dry type-specimen. Natural size.

Fig. 5. **S. E. 92 c.** Side view. Natural size.

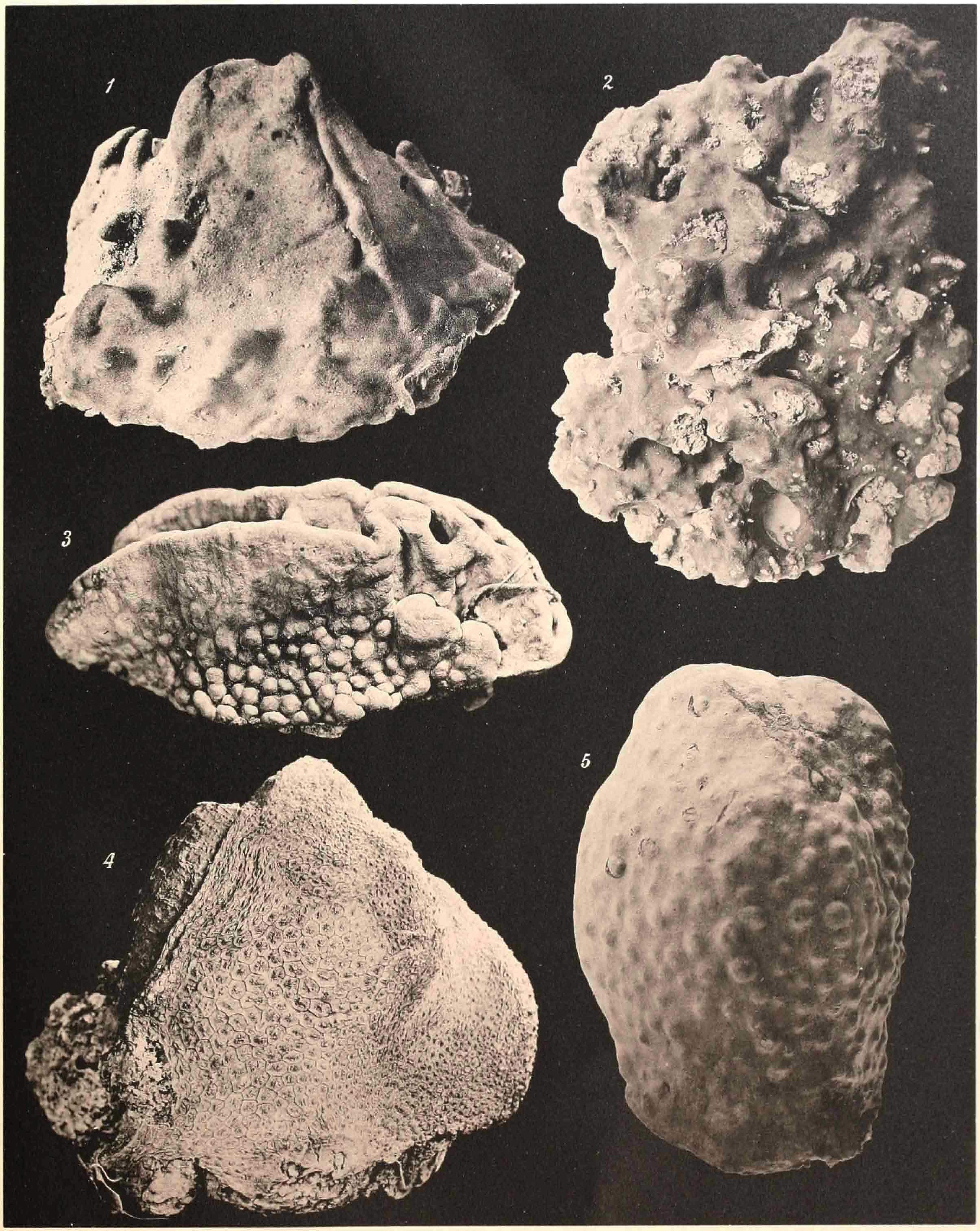


Fig. 1 Goedeljee; Figs. 2 and 5 Vernhout; Figs. 3 and 4 Highley phot.

PLATE IV.

Spirastrella purpurea (Lmk.) Rdl.

(Photo's after the original specimens).

Fig. 1. **M. M. 62.** After a (dried) specimen in the Madras Museum, labelled *Suberites inconstans* var. *digitata*, probably one of the co-types.

Fig. 2. **S. E. 305 d.** Longitudinal section; two main central canals. On the left hand side (*a*) the canal is distinctly seen to ramify. Natural size.

Fig. 3. **S. E. 92 a.** Longitudinal section, showing two or three main, more or less longitudinal canals (*a*); in *b* a branch of such a canal transversely cut. Natural size.

Fig. 4. **S. E. 1447.** The specimen seen from above. [Compare Pl. II, fig. 6]. Natural size.

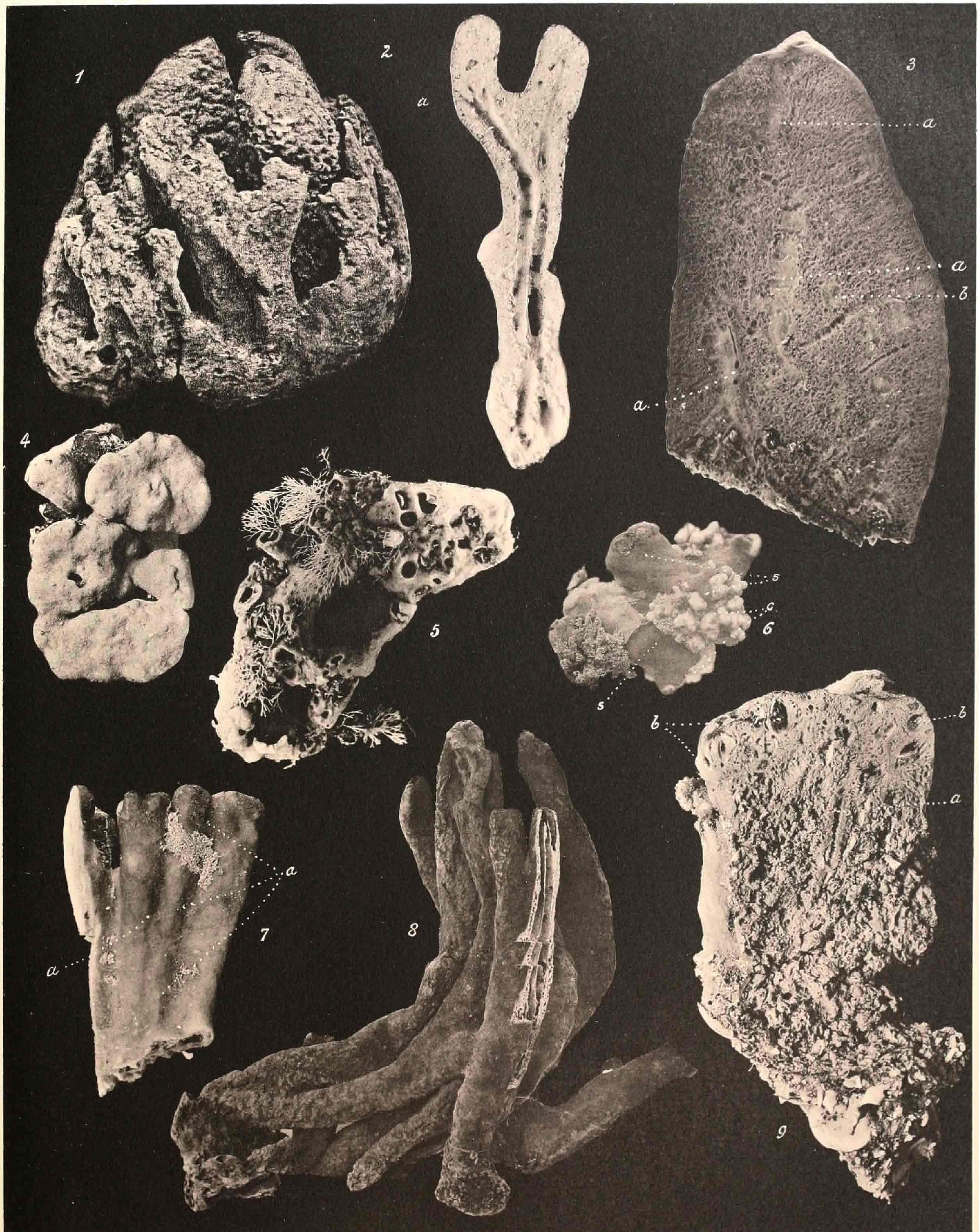
Fig. 5. **S. E. 944 b.** The specimen seen from above. About $^4/_5$ natural size.

Fig. 6. **S. E. 1455 a.** The specimen seen from above. *c.* Uncovered coralline alga; *s.* sponge-crust. Natural size.

Fig. 7. **S. E. 1341 c.** Side view. At *a* are faint furrows, the last vestige of originally separated, now fused processes. Natural size.

Fig. 8. **S. E. 1975.** After a dried specimen. In one of the processes one side is cut away in order to show the main central canals, three of which are seen to open at the top. About $^2/_5$ natural size.

Fig. 9. **S. E. 612 a.** Longitudinal section. At *a* a main canal is seen; *b* holes with barnacles. Natural size.



Figs. 2, 4 and 9 Goedeljee; Figs. 3, 5, 6, 7 and 8 Pynacker Hordijk phot.

PLATE V.

Spirastrella purpurea (Lmk.) Rdl.

Anatomy.

Fig. 1. S. E. 948 g. Longitudinal section through a process. The arrows indicate the course of canals; *a* central canal; *b* pseudo-cortex. Natural size.

Fig. 2. S. E. 948 b. Transverse section through a process; *a* central, *b* peripheral canal filled with mud and detritus. Natural size.

Fig. 3. S. E. 426 a. Longitudinal section through the pyramidal sponge; *a* central canal; *b* pseudo-cortex. Natural size.

Fig. 4. S. E. 948 g. Inner surface of the central canal, showing the system of rugae. Slightly magnified.

Fig. 5. S. E. 305 a. Longitudinal section; *a* central canal with rugae. At *b* this canal is seen to originate by confluence of several narrower canals. Natural size.

Fig. 6. S. E. 931 b. Longitudinal section; the arrows 1, 2, 3 indicate the course of main canals; *e. e.* depressions between fused processes. Natural size.

Fig. 7. S. E. 966 a. Part of the surface. Natural size. [Cf. Fig. 8].

Fig. 8. id. Longitudinal section following the line A B of Fig. 7. At the bottom of the hole is nestled an Ophiurid, *Ophiactis savignyi.*

Fig. 9. S. E. 1945. Portion of a section at right angles to the surface. The black parts represent the places where in life was situated the substratum. Magnified 4 or 5 times. [Cf. Fig. 1, Pl. VI].

Fig. 10. S. E. 1971. Longitudinal section through the top of a process. The central canal (*a*) is seen to be nearly shut at the top, leaving but a minute aperture *b*. After a dry specimen. Natural size.

Fig. 11. S. E. 1365. Longitudinal section through the top of a process. The central canal shows a very distinct system of rugae. Natural size.

Fig. 12. S. E. 948 b. Longitudinal section through the top of a process; *a* central, *b* peripheral canal; × 4 à 5.

Fig. 13. S. E. 948 b. Transverse section through a process; *a* central, *b* peripheral canal; × 4 à 5.

Fig. 14. S. E. 1421. Longitudinal section. Natural size.

Fig. 15. S. E. 300. Longitudinal section. Natural size.

Fig. 16. id. Longitudinal section through a process; *a* central canal; *b* foreign (inclosed) object. Natural size.

Fig. 17. S. E. 614 a. Longitudinal section through a papilla; *a* central canal; × 4 à 5.

Fig. 18. S. E. 1365. Longitudinal section through the top of a process; *a* central, *b* peripheral canal; × 4 à 5.

Fig. 19. id. Transverse section through a process; the place between the straight lines corresponds to fig. 1 on Pl. VII; the place marked * is magnified in fig. 3 on Pl. VII, the one marked ** in fig. 4 on Pl. VII; × 4 à 5.

Fig. 20. S. E. 305 a. Transverse section through the stem of a club; *a* central, *b* peripheral canal; *c* hole of *Balanus*; × 4 à 5.

Fig. 21. S. E. 1365. Surface view; stomata or procts; × 20.

Fig. 22. S. E. 1945. Surface view; stomata or procts; × 20.

Fig. 23. S. E. 948 g. Surface view; irregular spots, more or less transparent, showing the cavities close under the surface. Natural size.

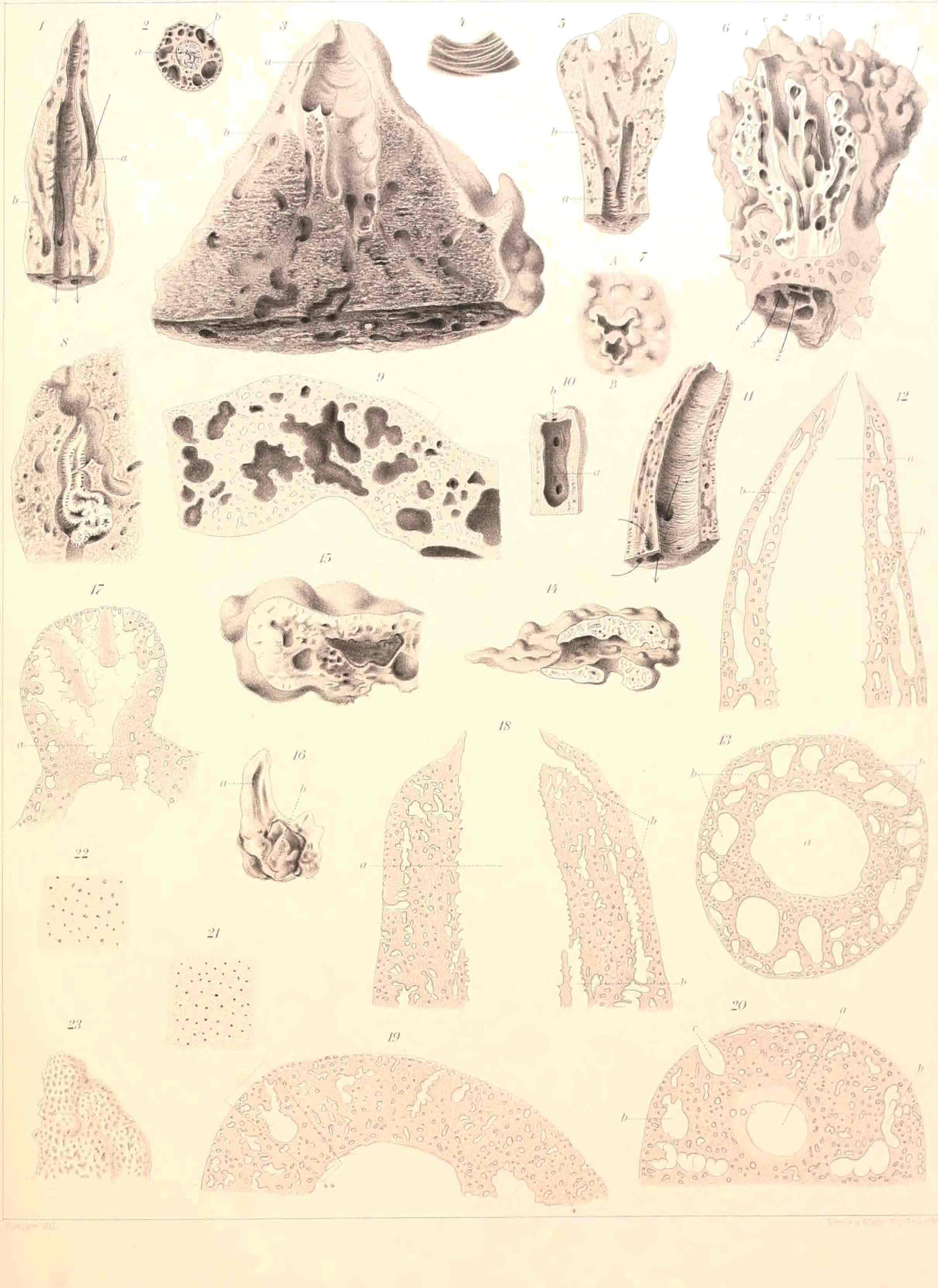


PLATE VI.

Spirastrella purpurea (Lmk.) Rdl.

Anatomy.

Fig. 1.	**S. E. 1945.**	Portion of the section from Pl. V, fig. 9; × 50.
Fig. 2.	id.	Three mastichorions in communication with in- and excurrent canals (*i* and *e*); highly magnified (Zeiss, oil-imm. Oc. 4).
Fig. 3.	id.	Cells with large vacuoles; Zeiss, oil-imm. Oc. 4.
Fig. 4.	id.	Scleroblasts; id.
Fig. 5.	**S. E. 948 b.**	Longitudinal section through one upper portion of a process (one side), showing the arrangement of canals and spicules; *a* lumen of central canal (cf. Pl. V, fig. 12, *a*); *b* peripheral canal (cf. Pl. V, fig. 12, *b*); *c* rugae in section (cf. Pl. V, figs. 1 and 4); *d* strings of fibroblasts; × 20.
Fig. 6.	id.	Portion of a transverse section through a process (cf. Pl. V, fig. 13); *a* central; *b* peripheral canals; *c* ruga; *d* fibroblasts; *x* (cf. fig. 7); × 20.
Fig. 7.	id.	Portion of fig. 6; the canal marked *x* corresponds to that in fig. 6; *y* (cf. fig. 8); × 100.
Fig. 8.	id.	Portion of fig. 7; the canal marked *y* corresponds to that in fig. 7; *t*. sections of tylostyles; × 500
Fig. 9.	**S. E. 305 a.**	Portion of the tissue surrounding the central canal (*a* in fig. 20, Pl. V). The concentric muscle cells are partly contracted and the membrane consequently stretched. The meshes between the flat cells have their long axes perpendicular on the canal-axis.
Fig. 10.	**S. E. 948 b.**	Cells from the parenchyma; amoebocytes (?); haemat. eosine; × 500.
Fig. 11.	**S. E. 948 b.**	Cells from the parenchyma; Heidenhain; × 500.
Fig. 12.	**S. E. 948 b.**	Cells from the parenchyma, situated in fusiform strings (figs. 5 and 6*d*); transverse section; Heidenhain; × 500.

G.C.J. Vosmaer del. Werner u. Winter, Frankfurt a/M.

PLATE VII.

Spirastrella purpurea (Lmk.) Rdl.

Anatomy.

Fig. 1. **S. E. 1365.** Portion of a transverse section (cf. Pl. V, fig. 19), combined from a few sections of a series; *c. c.* central canal; *e.* and *exc.* excurrent canals; *i.* incurrent canals; *l. b.* longitudinal bundles of tylostyles; *m.* group of mastichorions; *r. b.* radial bundles of tylostyles; × 50.

Fig. 2. id. Muscle-cell; × 400.

Fig. 3. id. Portion of parenchyma (cf. Pl. V; fig. 19); × 400.

Fig. 4. id. Portion of parenchyma (cf. Pl. V; fig. 19); × 400.

Fig. 5. **S. E. 1945.** Tylostyles imbedded in a darkly stained (haemaet. eos.) substance, probably spongin; × 400.

Fig. 6. **S. E. 1365.** Portion of a bundle of muscle-cells, one of which shows the nucleus; haemaet. eos.; oil-imm. Zeiss, Oc. 4.

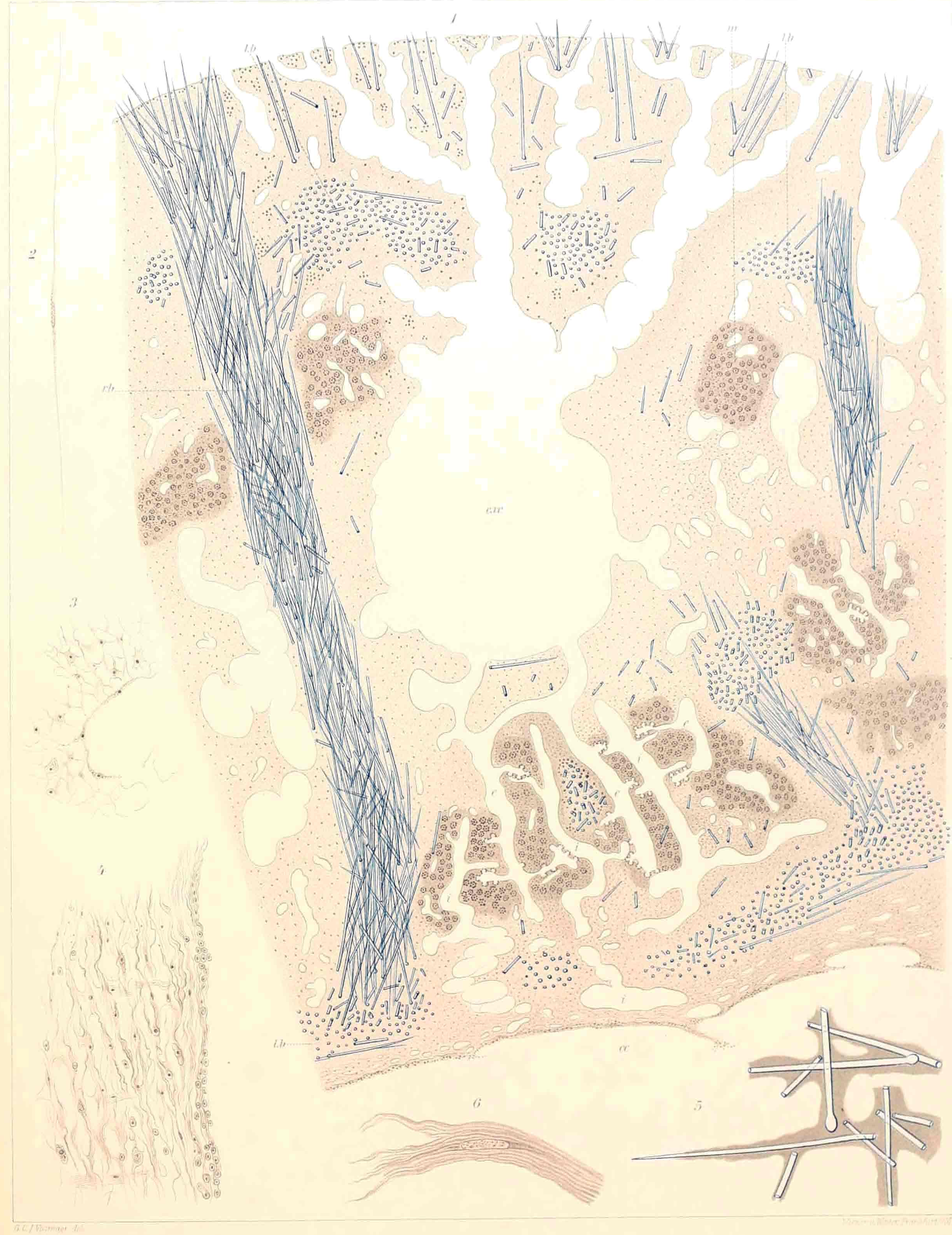
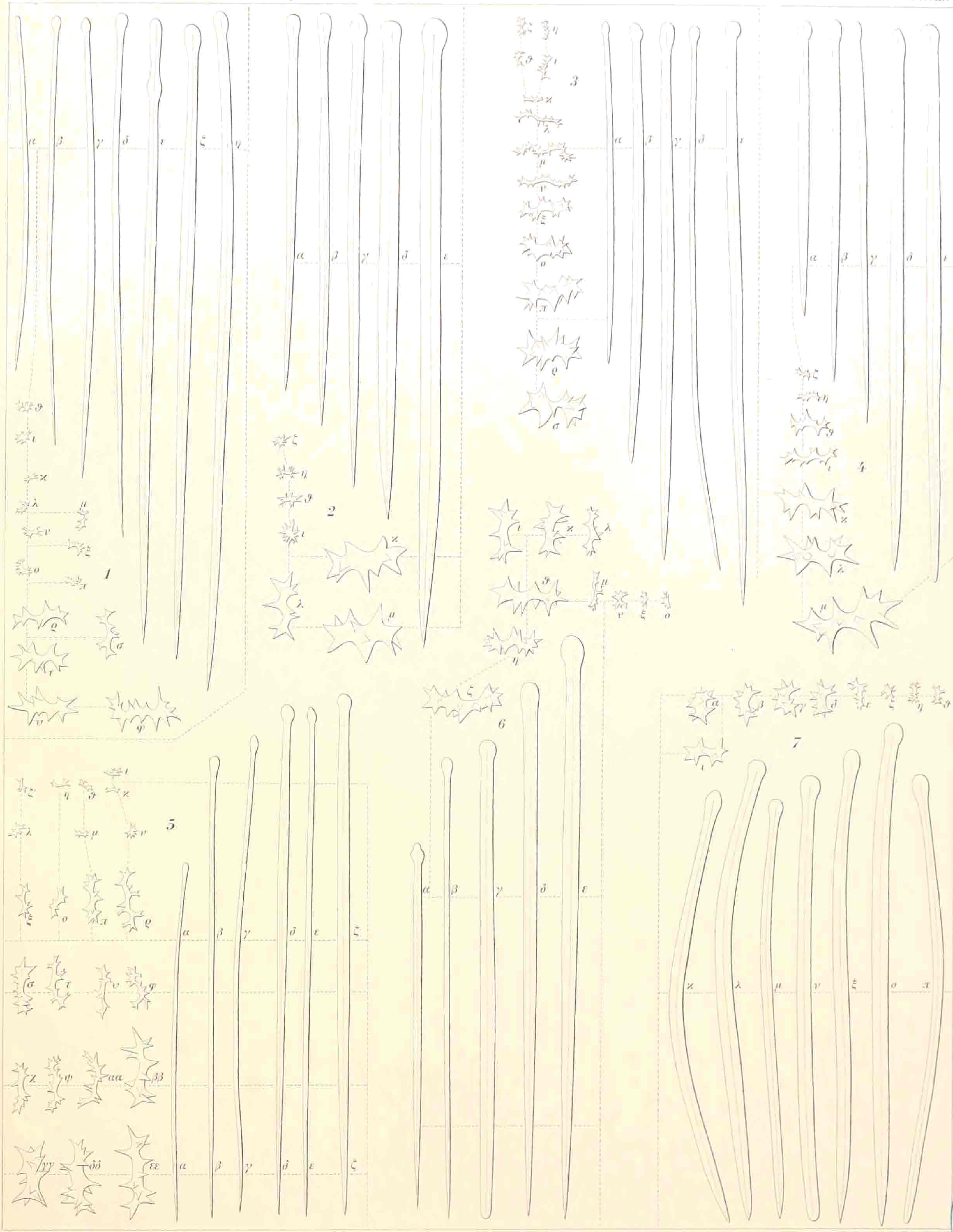

1
2
3
4
5
6
l.b
m
l.b
r.b
car
cc
l.b

PLATE VIII.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **B. M. 27.** *Spirastrella decumbens* Rdl. α—η Tylostyli; × 300. ϑ—φ Spinispirae; × 400.
Fig. 2. **B. M. 38.** *Spirastrella decumbens* Rdl. var. Rdl. & Dy. α—ε Tylostyli; × 300. ζ—μ Spinispirae; × 400.
Fig. 3. **S. E. 1945.** α—ε Tylostyli; × 300. ζ—σ Spinispirae; × 400.
Fig. 4. **B. M. 39.** *Spirastrella decumbens* Rdl. var. *robusta* Kirkp. α—ε Tylostyli; × 300. ζ—μ Spinispirae; × 400.
Fig. 5. **S. E. 1455 c.** α—ζ Tylostyli; × 300. ζ'—εε Spinispirae; × 400.
Fig. 6. **S. E. 1421.** α—ε Tylostyli; × 300. ξ—ο Spinispirae; × 400.
Fig. 7. **B. M. 12.** *Alcyonium purpureum* Lmk. α—ι Spinispirae; × 400. κ—π Tylostyli; × 300.



Vosmaer dir.

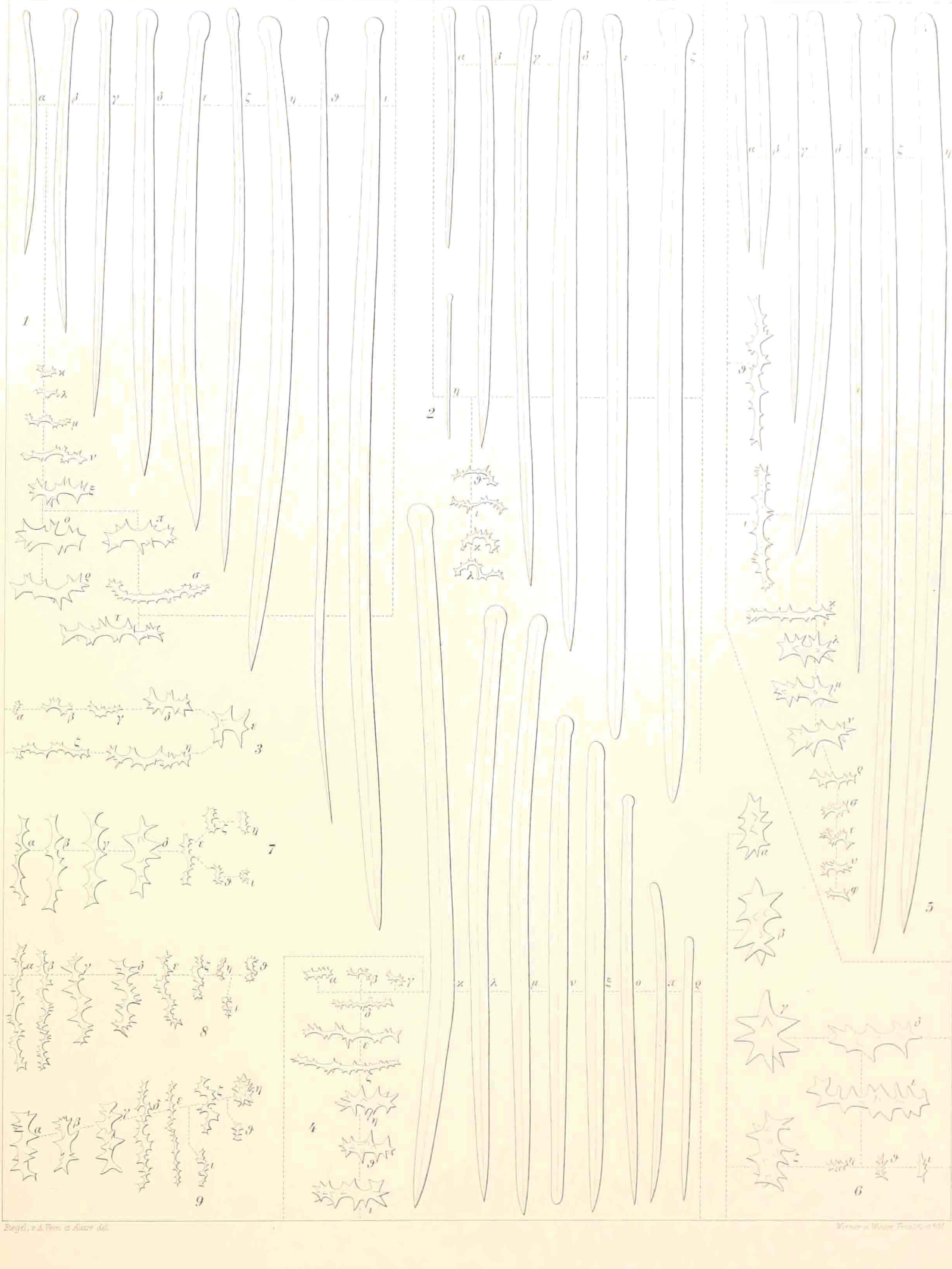
Werner u. Winter, Frankfurt ᵃ/M.

PLATE IX.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **S. E. 1480.** α—ι Tylostyli; × 300. κ—τ Spinispirae; × 400.
Fig. 2. **S. E. 300.** α—η Tylostyli and styli; × 300. ϑ—λ Spinispirae; × 400.
Fig. 3. **S. E. 410.** α—η Spinispirae; × 400.
Fig. 4. **S. E. 426 a.** α—ι Spinispirae; × 400. κ—ρ Tylostyli and styli; × 300.
Fig. 5. **S. E. 426 b.** α—η Tylostyli and styli; × 300. ϑ—φ Spinispirae; × 400.
Fig. 6. **S. E. 426 d.** α—ι Spinispirae; × 400.
Fig. 7. **S. E. 426 c.** α—ι Spinispirae; × 400.
Fig. 8. **S. E. 1988.** α—ι Spinispirae; × 400.
Fig. 9. **S. E. 1949.** α—ι Spinispirae; × 400.



Riegel, v. d. Veen & Auer del. Werner & Winter, Frankfurt a/M.

PLATE X.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **S. E. 92 a.** α—ϑ Tylostyli and styli; × 300. ι—τ Spinispirae; × 400. υ—Φ Id. a little less magnified. χ—ψ Minute spinispirae with "denticulated" spines; Zeiss, oil-immersion, ocul. 12.

Fig. 2. **B. M. 10.** *Spirastrella cunctatrix* Crtr. α—ζ Tylostyli; × 300. η—ν Spinispirae; × 400.

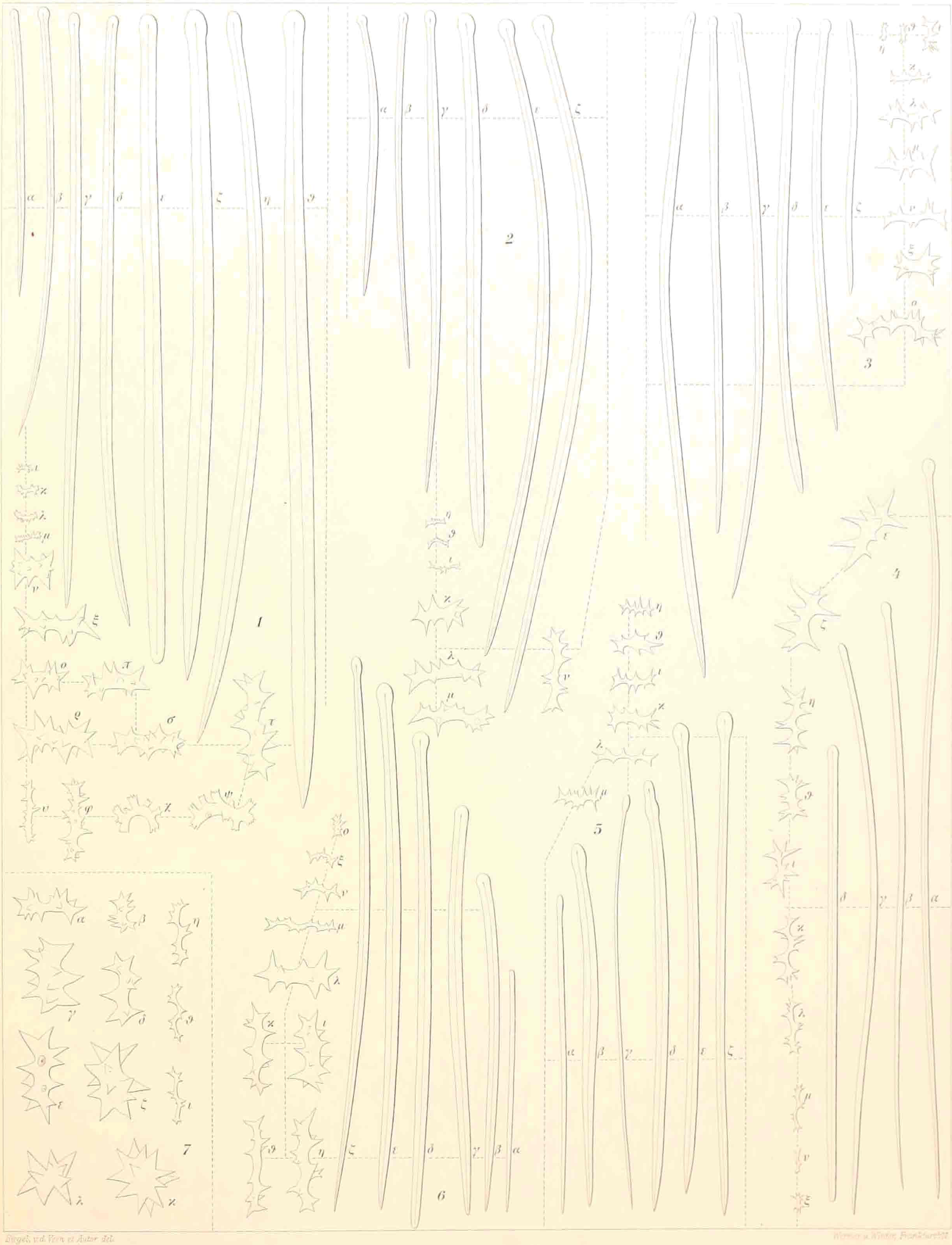
Fig. 3. **B. M. 1.** *Spirastrella cunctatrix* var. *porcata* Crtr. Type. α—ζ Styli and tylostyli; × 300. η—o Spinispirae; × 400.

Fig. 4. **B. M. 16.** *Spirastrella cunctatrix* var. *robusta* Crtr. Type. α—δ Stylus and tylostyli; × 300. ε—ξ Spinispirae; × 400.

Fig. 5. **B. M. 32.** *Suberites wilsoni* Crtr. Co-type. α—ζ Tylostyli; × 300. η—λ Spinispirae; × 400.

Fig. 6. **B. M. 13.** *Spirastrella cunctatrix* Crtr. α—ζ Styli and tylostyli; × 300. α—o Spinispirae; × 400.

Fig. 7. **B. M. 3.** *Spirastrella cunctatrix* var. *robusta* Crtr. α—ι Spinispirae; × 400.



Engel, v.d. Veen et Autor del. Werner u. Winter, Frankfurt M.

PLATE XI.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **B. M. 17.** *Spirastrella vagabunda* var. *tubulodigitata* Dy. Type. α—η Styli and tylostyli; × 300. ϑ—ν Spinispirae; × 400.

Fig. 2. **S. E. 948a.** α—δ Spinispirae; × 400. ε—μ Styli and tylostyli; × 300.

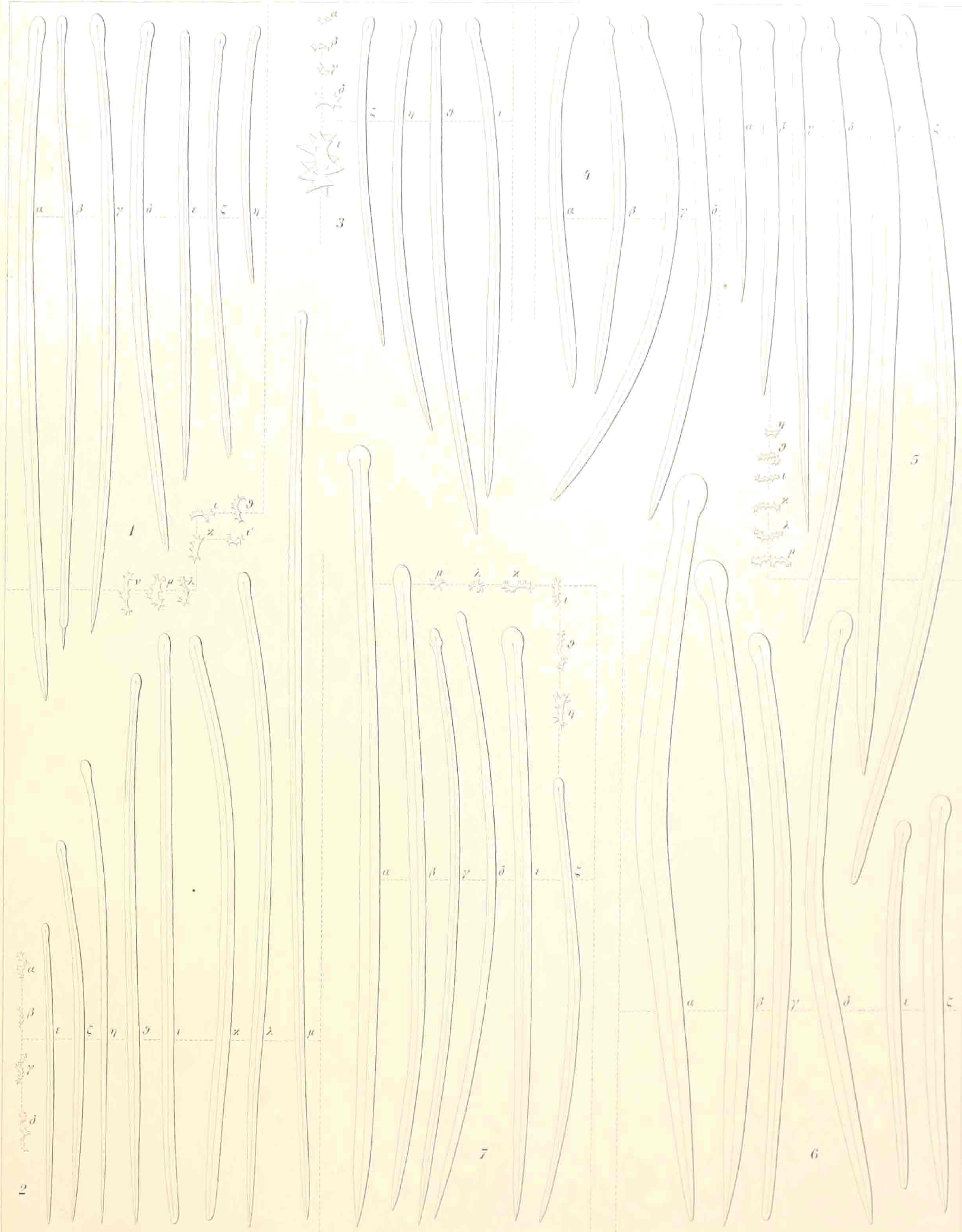
Fig. 3. **B. M. 4.** *Spongia dysoni* Crtr. Type. α—ε. Spinispirae; × 400. ζ—ι Tylostyli; × 300.

Fig. 4. **B. M. 7.** *Spirastrella pulvinata* Bwk. α—δ Tylostyli; × 300.

Fig. 5. **B. M. 41.** *Spirastrella vagabunda* Rdl. Type. α—ζ Tylostyli; × 300. η—μ Spinispirae; × 400.

Fig. 6. **B. M. 14.** *Spirastrella vagabunda* var. *gallensis* Dy. Type. α—ζ Tylostyli; × 300.

Fig. 7. **B. M. 24.** *Spirastrella vagabunda* var. *trincomaliensis* Rdl. = "*Suberites? sp.*" Crtr. (1882). Type. α—ζ Styli and tylostyli; × 300. η—μ Spinispirae; × 400.



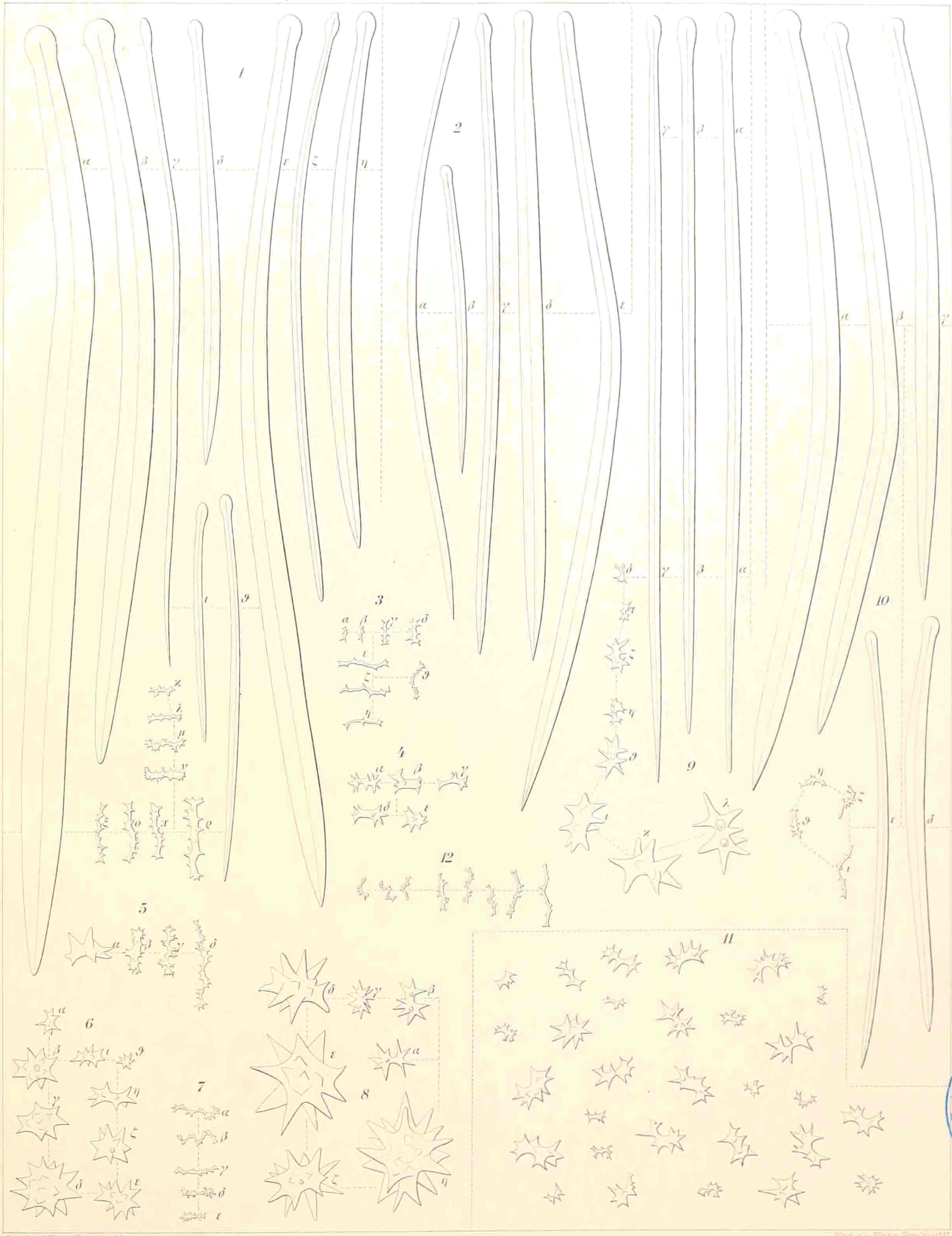
Bergel, v. d. Vaart & Vosmaer del. Werner u. Winter, Frankfurt a/M.

PLATE XII.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **B. M. 20.** *Spirastrella congenera*; type. α—ι Tylostyli; × 300. κ—ρ Spinispirae; × 400.
Fig. 2. **B. M. 25.** *Suberites inconstans* var. *globosa*; type. α—ε Styli and tylostyli; × 300.
Fig. 3. **B. M. 15.** *Suberites wilsoni* var. *albidus*; type. α—ϑ Spinispirae; × 400.
Fig. 4. **B. M. 22.** *Suberites wilsoni.* α—ε Spinispirae; × 400.
Fig. 5. **B. M. 26.** *Spirastrella solida*; type. α—δ Spinispirae; × 400.
Fig. 6. **B. M. 30.** *Spirastrella transitoria*; type. α—ι Spinispirae; × 400.
Fig. 7. **B. M. 23.** *Suberites inconstans* var. *digitata*; type. α—ε Spinispirae; × 400.
Fig. 8. **M. N. 44.** *Hymedesmia bistellata.* α—η Spinispirae; × 400.
Fig. 9. **G. M. 73.** *Suberites bistellatus.* α—γ Tylostyli; × 300. δ—λ Spinispirae; × 400.
Fig. 10. **S. E. 1418.** α—ε Tylostyli; × 300. ζ—ι Spinispirae; × 400.
Fig. 11. **M. L. B. 132.** *Alcyonium purpureum*; spinispirae; × 400.
Fig. 12. **S. E. 1075.** Spinispirae; × 400.



Bugel, v.d. Veen & Vosmaer del. Werner u. Winter, Frankfurt a/M.

PLATE XIII.

Spirastrella purpurea (Lmk.) Rdl.

Spicula.

Fig. 1. **B. M. 8.** *Hymeniacidon angulata* Bwk. Type. α—λ Tylostyli; × 300. μ—ψ Spinispirae; × 400.

Fig. 2. **B. M. 21.** *Hymeniacidon angulata* Bwk.; co-type. α—ϑ Tylostyli; × 300.

Fig. 3. **B. M. 29.** *Hymeniacidon angulata* Bwk.; co-type. α—ζ Tylostyli; × 300.

Fig. 4. **S. E. 964a.** α—η Tylostyli; ϑ style; ι—κ tylostyli; λ style; μ—π tylostyli; × 300. ρ—χ Spinispirae; × 400.

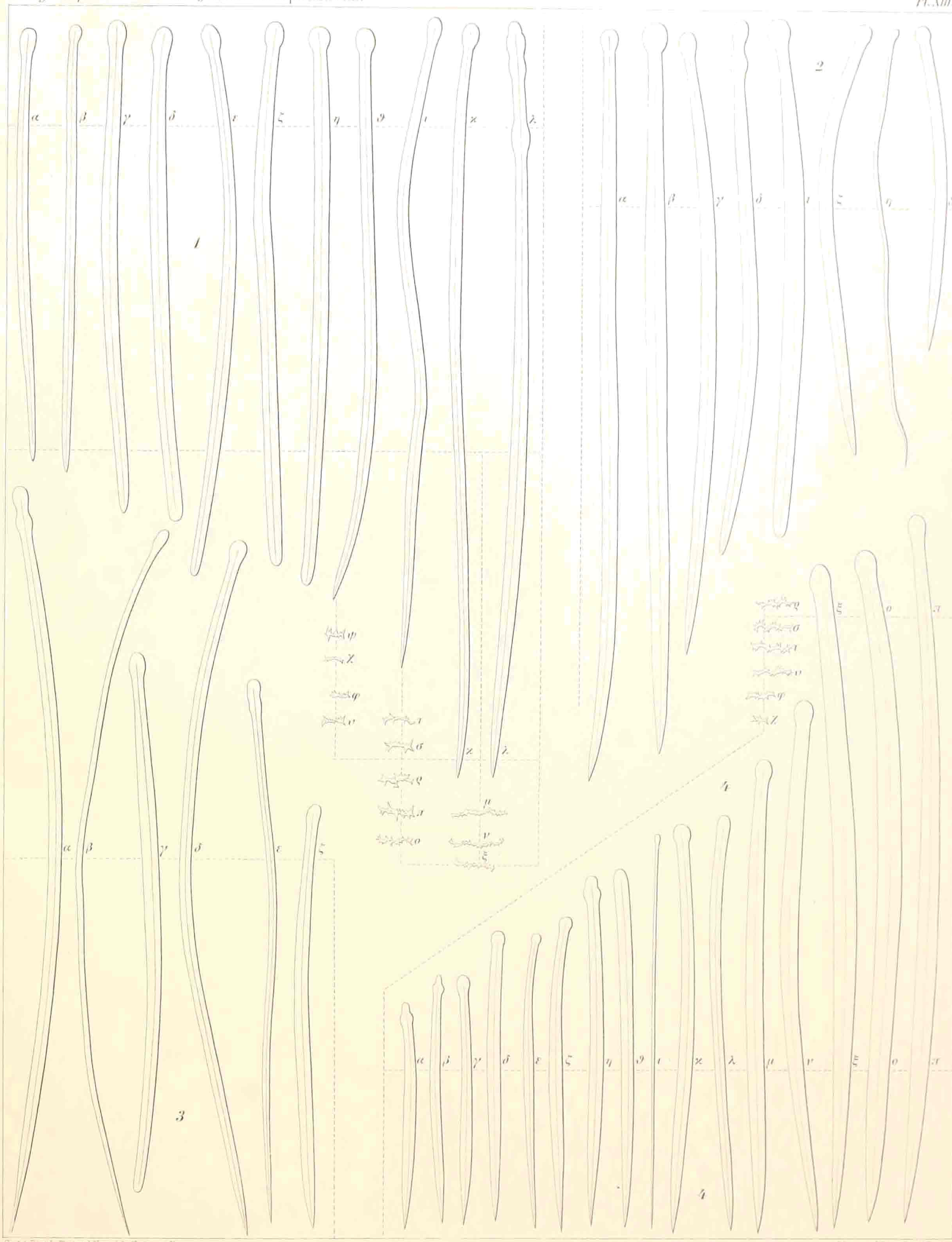


PLATE XIV.

Spirastrella purpurea (Lmk.) Rdl.

Fig. 1. **S. E. 92a.** Section perpendicular to the sponge surface; combined from a series in order to show the course and communication of superficial canals. The parenchyma is represented by a greyish tint; $\times$ 100.

Fig. 2. **S. E. 305a.** α—η Ordinary styles and tylostyles; ϑ—$\delta\delta$ abnormal tylostyles (?); $\times$ 300. $\varepsilon\varepsilon$—$\varkappa\varkappa$ Spini-spirae; $\times$ 400.

Fig. 3. **S. E. 948b.** Portion of parenchyma between two canals *c. c.*; $\times$ 400.

Fig. 4. **S. E. 305c.** Abnormal tylostyle; $\times$ 300.

RÉSULTATS DES EXPLORATIONS
ZOOLOGIQUES, BOTANIQUES, OCÉANOGRAPHIQUES ET GÉOLOGIQUES
ENTREPRISES AUX
INDES NÉERLANDAISES ORIENTALES en 1899—1900,
à bord du SIBOGA
SOUS LE COMMANDEMENT DE
G. F. TYDEMAN
PUBLIÉS PAR
MAX WEBER
Chef de l'expédition.

*I. Introduction et description de l'expédition, Max Weber.
*II. Le bateau et son équipement scientifique, G. F. Tydeman.
*III. Résultats hydrographiques, G. F. Tydeman.
IV. Foraminifera, F. W. Winter.
*IV*bis*. Xenophyophora, F. E. Schulze.
V. Radiolaria, M. Hartmann.
*VI. Porifera, G. C. J. Vosmaer et I. Ijima [1]).
VII. Hydropolypi, A. Billard.
*VIII. Stylasterina, S. J. Hickson et Mlle H. M. England.
*IX. Siphonophora, Mlles Lens et van Riemsdijk.
*X. Hydromedusae, O. Maas.
*XI. Scyphomedusae, O. Maas.
*XII. Ctenophora, Mlle F. Moser.
*XIII. Gorgonidae, Alcyonidae, J. Versluys, S. J. Hickson, C. C. Nutting et J. A. Thomson [1]).
XIV. Pennatulidae, S. J. Hickson.
*XV. Actiniaria, P. Mc Murrich [1]).
*XVI. Madreporaria, A. Alcock et L. Döderlein [1]).
XVII. Antipatharia, A. J. van Pesch.
XVIII. Turbellaria, L. von Graff et R. R. von Stummer.
XIX. Cestodes, J. W. Spengel.
*XX. Nematomorpha, H. F. Nierstrasz.
*XXI. Chaetognatha, G. H. Fowler.
XXII. Nemertini, A. A. W. Hubrecht.
XXIII. Myzostomidae, R. R. von Stummer.
XXIV[1]. Polychaeta errantia, R. Horst.
XXIV[2]. Polychaeta sedentaria, M. Caullery et F. Mesnil.
*XXV. Gephyrea, C. Ph. Sluiter.
*XXVI. Enteropneusta, J. W. Spengel.
*XXVI*bis*. Pterobranchia, S. F. Harmer.
XXVII. Brachiopoda, J. F. van Bemmelen.
XXVIII. Polyzoa, S. F. Harmer.
*XXIX. Copepoda, A. Scott [1]).
*XXX. Ostracoda, G. W. Müller.
*XXXI. Cirrhipedia, P. P. C. Hoek [1]).
XXXII. Isopoda, H. F. Nierstrasz.
XXXIII. Amphipoda, Ch. Pérez.
*XXXIV. Caprellidae, P. Mayer.
XXXV. Stomatopoda, H. J. Hansen.
*XXXVI. Cumacea, W. T. Calman.
*XXXVII. Schizopoda, H. J. Hansen.
XXXVIII. Sergestidae, H. J. Hansen.
* XXXIX. Decapoda, J. G. de Man et J. E. W. Ihle [1]).
*XL. Pantopoda, J. C. C. Loman.
XLI. Halobatidae, J. Th. Oudemans.
*XLII. Crinoidea, L. Döderlein et Austin H. Clark [1]).
*XLIII. Echinoidea, J. C. H. de Meijere.
*XLIV. Holothurioidea, C. Ph. Sluiter.
*XLV. Ophiuroidea, R. Köhler.
XLVI. Asteroidea, L. Döderlein.
*XLVII. Solenogastres, H. F. Nierstrasz.
*XLVIII. Chitonidae, H. F. Nierstrasz.
*XLIX[1]. Prosobranchia, M. M. Schepman [1]).
*XLIX[2]. Prosobranchia parasitica, H. F. Nierstrasz et M. M. Schepman.
*L. Opisthobranchia, R. Bergh.
*LI. Heteropoda, J. J. Tesch.
*LII. Pteropoda, J. J. Tesch.
LIII. Lamellibranchiata. P. Pelseneer et Ph. Dautzenberg.
*LIV. Scaphopoda, Mlle M. Boissevain.
LV. Cephalopoda, L. Joubin.
*LVI. Tunicata, C. Ph. Sluiter et J. E. W. Ihle.
LVII. Pisces, Max Weber.
LVIII. Cetacea, Max Weber.
LIX. Liste des algues, Mme A. Weber.
*LX. Halimeda, Mlle E. S. Barton. (Mme E. S. Gepp).
*LXI. Corallinaceae, Mme A. Weber et M. Foslie.
*LXII. Codiaceae, A. et Mme E. S. Gepp.
LXIII. Dinoflagellata. Coccosphaeridae, J. P. Lotsy.
LXIV. Diatomaceae, J. P. Lotsy.
LXV. Deposita marina, O. B. Böggild.
LXVI. Résultats géologiques, A. Wichmann.

Siboga-Expeditie

THE PORIFERA OF THE SIBOGA-EXPEDITION

II

THE GENUS SPIRASTRELLA

BY

G. C. J. VOSMAER

With fourteen plates

Monographie VIa^1 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)

BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

Publié Novembre 1911

* Les numéros avec un astérique ont déjà paru ceux marqués 1) seulement en partie

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.

M. B. te Amsterdam.

The Elizabeth Thompson Science Fund.

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