Citation:

Vosmaer, G.C.J., Observations on the Genus Spirastrella, in:
KNAW, Proceedings, 13 II, 1910-1911, Amsterdam, 1911, pp. 1139-1146

three different divisions of the Tertiary on the Balik Papan Bay:

Mentawir strata	L. sumatrensis var. minor, L. neodispansa var. minor, L. glabra, Lepidosemicyclina polymorpha.
Pulu Balang-strata (Sungei Blakin)	L. acuta, L. flexuosa, L. sumatrensis, Lepidosemicyclina thecideaeformis.
Pamaluan-strata	L. aff. formosa, L.? neodispansa.

The stratigraphical succession thus obtained does not entirely agree with the one given by H. DOUVILLÉ. It is true that with us in the oldest strata occur simple forms of the type L. formosa, but beside these immediately forms of the type O. neodispansa are found, which according to DOUVILLÉ must be much younger. On the Sungei Blakin occur then beside each other forms with strongly and feebly pronounced skeleton-columns (O. flexuosa) forms of the type of L. sumatrensis, and forms with one single, large, central wart, which according to DOUVILLÉ should occur in separate horizons. The same holds for the youngest strata, the Mentawir-strata.

It is however remarkable, that in the oldest level the simplest forms occur, that in the middle level the number of species is greatest, and that in the youngest level, which cannot be much older than the dying-out-period of the genus, two minor forms occur, whilst of a third species very peculiar variations are found.

Zoology. — "*Observations on the Genus Spirastrella*". By Prof. G. C. J. VOSMAER.

(Communicated in the meeting of March 25, 1911).

OSCAR SCHMIDT established (1868) the genus *Spirastrella* for a "new species" of Siliceous Sponge, the chief character of which was said to be that it possessed an "eigenthümliche Art von strahligen Kieselkörperchen, deren Strahlen spiralig gestellt sind." We now know that that sort of spicules is by no means of rare occurrence, and that it does not represent a special form of polyaxons, but of monaxons; such spicules are now called spinispirae. In addition to these spicula the skeleton of *Spirastrella* is composed of tylostyles or also of styles. Since SCHMIDT described his *Spirastrella cunctatrix,* various authors have mentioned numerous "species"; all in all about 44. But of these, ten are to be cancelled at once, either because they do not belong to our genus at all, or because they are quite inadequately described, so that they are not recognisable.

75*

In the rich collection of the Siboga Expedition I found about a hundred specimens of Siliceous Sponges, which I believe belong to the genus *Spirastrella*. I examined them as carefully as circumstances allowed; moreover I studied about forty specimens from other localities, chiefly types of previous authors and for the greater part deposited in the British Museum. The result of this research is that I am convinced that we have to do with an uncommonly variable species; 32 of the 34 "species", described by previous authors, and all the specimens of the Siboga collection belong to one single species, which, according to the rules of priority, has to be called *Spirastrella purpurea* (Lmk.) Rdl.

If we look at the specimens macroscopically, we at once see differences so great, that any one would expect to have to distinguish a number of "species". Sometimes they appear as thin encrustations on old pieces of coral, coralline algae etc., sometimes as thicker cakes with warty elevations. Another time they are club-shaped, or cylindrical with finger-shaped terminations, or cones, or pyramids. Others again have an irregularly spherical shape and form massive lumps. The colour is pale or bright yellowish, brown, grey; sometimes bright carmine red. Among the encrusting forms some are no more than 1 or 2 mm. thick; on the other hand we find massive specimens of 12 by 18 cm.; nay Bowerbank mentions one, which reached a height of almost 2.5 meters. The surface is even, or provided with warty or digitiform elevations; smooth or hispid.

However, if we more carefully examine the specimens and then try to classify them into groups, we soon come to difficulties and we find e.g. specimens which might be placed in one group as well as in another. Thus we find that some crusts are on the whole very thin, but nevertheless show here and there thicker regions; in fact we see the thin crusts gradually pass into thick cakes, or into specimens with warts, tubercles or finger-like processes. In some cases these processes have all about the same size; in other cases there is one main process with a number of smaller ones around it, gradually leading in this way to pyramidal cones with or without a few secondary processes at the base. Again in other cases the cylindrical processes are so long and numerous that they form the most characteristic feature of the sponge. Moreover, we may observe another phenomenon, viz. that neighbouring processes coalesce; in fact we see e.g. clubshaped specimens pass into spherical, massive forms.

From this state of things results the impossibility of making "species" on account of the external appearance; the extremes are united by all possible connecting links.

How is it now with the internal structure? The answer to this question is that we find here similarly great differences, but likewise all gradually passing into each other. This is true as well with regard to the canal system, as to the structure of the parenchyma and the skeleton, even with respect to the elements of the latter, viz. the spicules. I do not wish to discuss now these points in extenso; I will give a couple of examples, as I did regarding the external habitus.

It is characteristic for *Spirastrella* that the skeleton consists of longitudinal bundles of spicules, chiefly tylostyles, branching towards the periphery; between these bundles, but more especially forming a superficial crust, we find the well known spinispirae. It is a remarkable fact, that this represents the *complete* skeleton; under certain circumstances, however, the spinispirae may become very scanty and may even disappear altogether. In the latter case the character from which the genus has received its name, is absent [1]). In the papers of almost every spongiologist we find that species are distinguished e. g. on account of the size of the spicules. In our case the size of the tylostyli shows considerable differences. The maximal length I found in my specimens to oscillate between 280 and 800 μ, whereas the maximal diameter varies between 5 and 30 μ. Nevertheless, the extremes are united by all possible intermediate stages; no limits can be drawn for specific distinction. There are, however, certain sizes which prevail. The maximal length is in about 33 °/₀ cases 550 μ and more, but less than 600 μ; in about 75 °/₀ cases 500 μ and more, but less than 650 μ. Cases of less than 350 μ or more than 700 μ are rare. And so I found in 20 °/₀ cases the maximal diameter of the tylostyli 16 μ and more, but less than 22 μ. I seldom found it less than 6 μ or more than 24 μ.

Still more striking are the differences of the spirispirae. We have already seen that these characteristic spicules sometimes occur in great abundance, at another time are exceedingly scanty. Thus I found in some specimens that one microscopical preparation of spicules, isolated by means of hydrochloric or nitric acid, contained a couple of spinispirae, whereas another slide of the very same specimen contained not a single one. DENDY found in his *Suberites inconstans* var. *globosa* and var. *maeandrina* no spinispirae. I was able to examine DENDY's types in the British Museum and did find them. Such facts are by

[1]) This phenomenon is by no means seldom in the animal kingdom. It may perhaps be compared with the absence of a chorda in certain Chordata. The more so as I have reason to believe that the said spicules are present in larval or young stages, but afterwards disappear.

no means standing alone; they are examples of very numerous cases. This implies, however, that, if in certain specimens, externally corresponding, in one we find spinispirae, in another not, we have not the slightest right to establish new species or genera on account of the presence or absence of spinispirae. It is beyond doubt that DENDY's sponge is not a *Suberites* but a *Spirastrella.*

Now we find spinispirae of every description [1]). In many specimens of *Spirastrella purpurea* we find in addition to minute (but full grown) spinispirae of say 8—10 μ length, large robust ones of about 12 μ in diameter by a length of 75 μ. In other specimens such giants are missed altogether. At the beginning of my investigations I believed I should be able to find specific characters on this account. But I was forced to give up this view; for those large spinispirae sometimes measured a good deal less than stated above, or they possessed the length but not the diameter. In this respect again we find gradual transitions. These facts and the fact, that robust spinispirae are sometimes abundant, sometimes scarce or absent, teach us that we cannot yet establish species on account of the presence or absence of large spinispirae in addition to the minute ones. We have as little success if we try to distinguish species by certain microscopical details. LENDENFELD described a "new species" because of the fact that the spines of the spinispirae did not terminate in a sharp point, but showed a curious very minute denticulation. I found, however, on carefully studying the spicules with oil-immersion, that the "Efflorescenz-artiges Aussehen" appears in numerous specimens of the most various external appearance.

Summa summarum: we have to face the dilemma either of considering all the examined specimens as one species, or to establishing almost as many species as we examine specimens. I for my part do not hesitate which way to go. At present, at all events we still know very little about the comparative anatomy of Sponges and hardly anything about their comparative embryology. And yet these lowest Metazoa deserve to be studied carefully. Although they throw but little light on phylogenetic questions, and perhaps will never do so because they are an aberrant branch of Metazoa, in other respects I am convinced the Parazoa are certainly of general importance. For instance on account of their tissues. But the field of Spongiology is unexplored except by a few specialists. Not quite without reason, for there are many traps.

[1]) Since it is impossible, for the moment, to make out whether we have to do with one or with more sorts of spicules, I consider them for convenience' sake as one kind.

If we can accept but one species of *Spirastrella,* the question arises whether perhaps certain groups of specimens point to a closer relationship to each other? Is it possible to distinguish groups according to the depth or to certain properties of the bottom on which they are found? The first question can be answered in a positive sense, the others not yet. Indeed I believe that about seven such groups may be distinguished, although by no means sharply, as they are all intimately connected. But if we unite a certain number of specimens which seem to be nearly related to each other, into groups and try to bring them into connection with their conditions of life, we soon find that hardly any conclusion can be drawn. For there are specimens from the same locality which do not belong to the same group; consequently we cannot speak of so-called local varieties.

The general structure of *Spirastrella purpurea* is, in spite of great differences, still fundamentally the same for various specimens. I will give a sketch of one form, viz. of a specimen corresponding to DENDY's *Suberites inconstans* var. *digitata.* A longitudinal section through one of the long finger-shaped processes shows us a central, more or less cylindrical cavity, generally opening at the top of the process. Such wide central canals are often met with in Porifera. The terminal opening is usually called "osculum" and the canal is considered to be of an excurrent nature. Indeed it is observed in many living Sponges that a current of water flows out from the "osculum", the water entering through numerous little apertures on the sponge surface. Microscopical examination of such Sponges has shown that the latter apertures communicate with "flagellated chambers". These chambers on the other side communicate again with a system of cavities, which open into the central canal, mentioned above. Now we know that the shape of the flagellated chambers and the position of the choanocytes determine the direction of the water-current. Consequently we can conclude from the shape of the chamber, which of the communicating cavities is excurrent, and which is incurrent. The whole canalsystem can thus be reconstructed by studying series of sections. This has been done for several Sponges, but not as yet for the majority. Since it was found in certain cases, that the large central canal belonged to the excurrent system, the conclusion was drawn per analogiam for other cases, that the said canal is excurrent.

However, in *Spirastrella purpurea* certain features seemed an obstacle to considering the central canal as a "cloaca". True, in several specimens the canal opened with a comparatively wide mouth, but in others the aperture is rather small. Moreover the canal is in most cases narrower at the top than lower down, and in many cases it is clearly seen, that the wide central canal towards the top of the process branches into a number of much narrower ones. Finally I found that the wall of the canal is not smooth, but shows several transverse rugae. Such a canal, according to the theory of PEKELHARING and myself, would be very little adapted to act as a cloaca. In view of all this I thought it necessary to reconstruct the canal system by means of series of sections. The result has been, that I found the positively excurrent canals not to communicate with the central cavity, but exactly the contrary: the incurrent canals communicate with it. Consequently, the central canal is not a cloaca but an incurrent reservoir. Numerous minute apertures (stomata) lead into a system of canals, which open in the central cavity, which also may communicate directly with the surrounding medium by means of a comparatively wide opening at the top of a process. From this reservoir canals start and enter, ramifying, the parenchyma; they ultimately communicate with the flagellated chambers or mastichorions as I have called them. As the canal system is eurypulous, the mastichorions open with a wide apopyle in the excurrent lacunae or canals, which finally likewise open at the sponge surface with small apertures, procts.

There is still another interesting feature in the canal system of *Spirastrella purpurea*. It is generally accepted that the principium movens for the watercurrent is to be sought for exclusively in the flagella of the choanocytes. In our sponge a second factor appears: in the wall of the larger canals, more especially of the central canal, numerous undoubtful muscle cells occur; they are situated in concentrical and in radial bundles. In the rugae we find the former in maximal dilatation. If on the other hand the concentric muscle cells contract the rugae are stretched out to a kind of membraneous diaphragms with the result that the lumen of the canal becomes considerably narrower. In some specimens this is in fact the case. Suppose that the terminal aperture has first closed, water must forcibly be pressed into the canals which lead to the inner parts and in this way the current-producing power of the flagella helped. In this connection it is worth while to remark that the total quantity of mastichorions is comparatively small.

The parenchyma is almost entirely composed of a remarkable tissue to which I more than once have drawn attention and which can best be compared with lymphoïd connective tissue. It consists of flat cells with delicate membraneous processes, forming together a sort of syncytium. At least I could not distinguish cell limits. In this way a reticulum is formed, the meshes of which are very different in size. In addition to these cells, fibres occur beyond doubt; perhaps also a kind of elastic fibres. For the rest we find cells of various description: amoebocytes, thesocytes, fusiform cells etc. The canals are lined with flat cells, which have exactly the character of the first mentioned cells; they may be considered as endothelium.

The skeleton is mainly formed by bundles of tylostyles. In encrusting specimens these bundles stand vertically on the substratum; they ramify generally towards the periphery and at any rate terminate in brushes. The spicules of the latter are usually smaller than the tylostyles of the main bundles. In massive specimens or those with finger-shaped processes long longitudinal bundles run through the parenchyma, here and there ramifying, occasionally anastomosing. These main bundles give off smaller branches towards the periphery; these as well as the main bundles terminate in more or less projecting brushes. Hence the sponge surface is now rather hispid, then smooth. On the whole we can say that the number of superficial tylostyles is in reverse ratio to the number of spinispirae. If the latter are abundant they form a "dermal" crust. If in addition to minute spinispirae robust ones occur, this crust is composed of one or two distal layers of the former and 2—5 proximal layers of the latter.

In many specimens with well developed longitudinal bundles, strings of darkly stained cells are seen at once in every preparation. These cells are more or less fusiform, possess a large nucleus and a large "nucleolus". They are found in close connection with the bundles of tylostyles. Most probably these cells are fibroblasts; they are the cells which form the connective tissue fibres, which strengthen the bundles of tylostyles by binding together the spicules. This tissue I have called periapt [1]); herein occur, in addition to fibres, fusiform cells etc. These fibroblasts which thus give rise to the fibres, are not always situated in such conspicuous strings; but they may be found everywhere, where fibres are to be formed or are normally present.

The occurrence of spinispirae, the arrangement of the canal system, the whole anatomical structure of *Spirastrella,* all suggests a close relationship to the so-called Boring Sponges, belonging to the genus *Cliona.* The two genera are, however, distinguished from each other by the fact that *Cliona* perforates calcareous matter (shells, corals, coralline algae etc.), whereas *Spirastrella* does not bore. Several speci-

[1]) Proceed. Kon. Akad. Wetensch. 1905, p. 23.

mens of the Siboga collection are encrusting and sections of decalcified specimens simulate a boring sponge; in reality *Spirastrella* does not itself perforate, but easily fills up holes and slits of a calcareous substratum, destroyed by other organisms. As such I found e.g. *Thoosa* and certain Fungi [1]).

Physiology. — "*The action of strychnine on the Central Nervous System. The segmental, strictly localized strychnine-intoxication of the dorsal spinal mechanisms: a contribution to the dermatomery of the hind leg in dogs.*" By Dr. J. G. DUSSER DE BARENNE. (Communicated by Prof. C. WINKLER).

(Communicated in the meeting of February 25, 1911).

In a former communication [2]) I endeavoured to prove that the theory, as if strychnine-tetani may have their origin in an intoxication by this alkaloid of the dorsal, co-ordinatory spinal mechanisms, is to all probability an erroneous one.

The application of the poison exclusively on the dorsal surface of the medulla, *never* gives rise to tetani as its consequence, but always to another complex of symptoms, which was described by me as the *Syndrome of strychnine-intoxication of the dorsal spinal mechanisms*:

1. Subjective disturbances of sensibility, most probably presenting a paraesthetical character.

(Finding their expression in the frog by "Abwischbewegungen", in the dog by licking and biting the skin).

2. Hyper-reflectory actions.

3. Spontaneous muscle-shocks, viz. arising without any exterior cause being observable, but still for the greater part proceeding in a reflectory manner.

Already with the first experiments it became evident that, whilst this complex of symptoms in itself is constant and characteristic, the skin-field in which these disturbances of sensibility (both subjective and objective ones) occur, is variable as to place and extension,

[1]) Extensive descriptions accompanied by illustrations, will appear in the Results of the "Siboga-Expeditie", which is in the press.

[2]) DUSSER DE BARENNE, Die Strychnin-wirkung auf das Zentralnervensystem. II. Folia neurobiologica. Band V, Heft I, 1911. Provisory communication in Zentralblatt f. Physiologie. Band XXIV. N⁰. 18, 1910.