Thoughts on the Spongidæ
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THOUGHTS ON THE SPONGIDÆ,

With reference to the American Sponges of the fresh water group, with some account of them in detail.

By Henry Mills, Buffalo, N. Y.

Our first ideas of a sponge are obtained from what we find under that name as an article of commerce; but as these ideas are wholly inadequate to the understanding of sponge life, it seems desirable that a few words on the whole family of sponges should preface my remarks on the fresh water group. Although the vital organization of all sponges, as far as known, is essentially the same, yet the skeleton, the part which attracts our attention by its bulk and outline is found in various shapes, and is made up of different chemical elements and combinations.

The domestic sponge, being merely the cleansed fibrous skeleton of a comparatively small group of what are known in science as sponges, presents a very different appearance as we see it displayed for sale, from that which it presents in its original state. In the dried form the matrix, representing the flesh of the sponge, with all its vital elements, has been decomposed and washed out, leaving nothing but the skeleton that gave support to the other parts, assisting them in their various functions.

This group is of marine origin, and is the only one whose skeletons are entirely free from spicula. The skeletons of a large portion of marine sponges are, however, partly of spicula, and partly of fiber. Some of these spicula are calcareous, while the greater part are silicious. They are of many different forms, and fill many offices in the economy of the sponge, some being, it appears, for defence and protection, others, to give strength in various ways. Some marine sponges so closely resemble those of fresh water in their general construction as often to be mistaken for them by the uninitiated, and in former times they were grouped together in classification. The whole of Bowerbanks' Sub-order Three is silicious; the *Isodyctia* resembling the *Spongilla* or fresh water sponges. The vital organization of each group, while found to be essentially the same, differs some in strength. It is said to be greatest in those which secrete carbonate of lime as the earthy basis of their skeletons, and least in those that secrete no earthy matter, as in the sponges of commerce, while those secreting silex take an intermediate position.

For many years in the early history of sponges naturalists were undecided as to whether they were of animal or vegetable character. In proportion, however, to the advancement in the perfection of the microscope, their true animal character has been revealed. Early in the eighteenth century, Marsigli, and subsequently, Ellis, Solander, Montague and Lamark, intimated their animal origin, but it was left to Dr. Grant, Bowerbank, Carter, and Dujardin and others, to produce actual proof of their animality. In 1848, Mr. Carter of England, in his history of the Bombay fresh water sponges gave such additional proof in this direction as to leave no room for doubt. Subsequent observers and experimenters have confirmed his conclusions by the actual observation of the living animal, as well as by chemical analyses, as compared with other animals and animal products. The web of spiders, and the products of the silk worm, as well as the loricæ of many smaller animals, are found to be identical in composition with the fiber of the sponge. In the "Cavendish edition" of "Lehman's Physiological Chemistry," published thirty years ago, occur these words under the head "Fibroin." "Sponge is, as is well known, the dry skeleton of an animal belonging to the *Poriferæ*, Grant, and named *Spongia officinalis*, Linn. Its chemical constitution affords one of the arguments why the *Spongia* should be classed among animals and not among plants, since in the vegetable kingdom we nowhere meet with a substance in the slightest degree resembling fibroin." The author further states that the sponge of commerce consists of twenty atoms of fibroin, one atom of iodine, and five of phosphorus.

Dr. Bowerbank, in following the same line of investigation, made analyses of animals he had long suspected to be identical in component parts with those of the skeletons of Spongiadæ. At this point he called to his aid an eminent chemist, Mr. Bowdler Buckton, who at his request made comparative analyses of two species of zoophytes, *Sertularia operculata*, and *Flustra officinalis*, with fibers of sponge, and of raw silk. In his report which appears in "*Philos. Trans.*" for 1863, page 740, he says: "All the bodies contain the same, or a very similar animal principle, which I suppose identical with Müller's fibroin." Müller and Crookwit's analysis of silk and sponge, copied from Bowerbank, vol. i., page 65, may not be out of place here, and will show that the two bodies scarcely differ in composition.

FIBROIN FROM SILK.		FIBROIN FROM SPONGE.			
Carbon,	48.5	Carbon,	46.5	to	48.5
Hydrogen,	6.5	Hydrogen,	6.3	"	6.3
Nitrogen,	17.3	Nitrogen,	16.1	"	16.1
Oxygen, Sulphur, Etc., etc.	27.7	Oxygen, Sulphur, Phosphorus, Iodine,	31.1	"	29.1
	100.0		100.0		100.0

It will be seen from these analyses that the common term "horny fiber" is not the most appropriate, and Dr. Grant rejected it altogether, as subsequently did Bowerbank, both writers, however, agreeing to call the substance "keratode" by way of distinction, whether it occurs in the elastic fibrous skeleton of the true sponge, or in the Halichondraceous tribe of the Spongiadæ, where it is subordinate to the spicula in the construction of the skeleton, and appears more in the form of an elastic cementing medium. Continuing his investigation with regard to those sponges whose skeletons are made up wholly or in part of spicula, Bowerbank found the result of his experiments favorable to the conclusion that the same chemical elements enter more or less into the composition of the skeletons of all the sponge family. Although the same elements do not appear in like proportions in the skeletons of all the groups, yet all the elements found in any of them have their representatives in the animal kingdom. As the skeleton of *Spongia officinalis* has its correspondence in the animals and animal products already referred to, so the spicula in other sponges have their correspondence in the bones of animals. At the same time it may be remembered that some animals, though of a much higher type than sponges, have spicula in their dermal covering precisely similar to those of some of the sponges. Some of these animals are described and figured in the *History of the British Nudibranchiate Mollusca* by Alder and Hancock, part 7, page 48. The calcareous spicula of the Gorgoniadæ and some of the Dorididæ may be mentioned as conspicuous examples. While, as already stated, the skeletons of a large portion, perhaps the larger portion, of marine sponges are made up wholly or in part of silicious spicula, it must be understood that all the fresh water sponges have their skeletons of this character. It is well known by geologists that the sponges, as a whole, have formed a powerful agency in the production of the flinty strata of the earth's crust, yet just how much of the rock-forming element enters into a given amount of sponge spicula has not been noticed. Bowerbank made experiments in this direction for another purpose, and found that the amount of silex is not the same under all circumstances. He says, in effect, that where the spiculum is simply designed to give strength and firmness to the skeleton, the whole interior soon becomes filled with silex, but when elasticity and toughness are required, the deposit is specially adapted to the requirements of the occasion.

Following the course of observation and experiment pursued by Bowerbank, I find the results interesting and instructive, and that his statements are verified in a great degree. He says in substance: "In the early stage of their development, the spicula consist of a double silicious membrane, one inside the other, between which the contents of the spiculum are deposited, and in this condition they, the spicula, present an internal cavity very nearly the size of their external diameter. The silex and other elementary matter is deposited by the inner surface of the outer membrane, and by the outer surface of the inner tubular membrane, so that the contents are not continuous and homogeneous, as is thought by some. He concludes that the filling between these membranes has chiefly the same elementary character, especially in their earlier stages, as the skeleton of *Spongia officinalis*.

Prof. H. J. Clark speaks of some of the spicula as horny spicula, showing that he did not regard them as wholly silicious. By the use of moderately high powers I have witnessed the two membranes, with the space between them, with great clearness. In very young growing sponges the spicula are exceedingly small, and exhibit certain bulbous inflations, sometimes half-way between the extremities, at other times approaching one of the ends. On some occasions I have seen two on the same spiculum. I have seen also what appeared to be the beginning of a spiculum in the form of an elongated bulb, without any spicular extension. My friend Potts, of Philadelphia, informs me that he has seen the same several times in a globular form. In these inflations the two membranes and space between were sometimes very conspicuous, and I have no doubt but they are a part of the process of formation, as they entirely disappear as the spicula attain maturity.

In order to test the character of spicula under heat, I submitted a piece of robust but rather immature sponge to the flame of a spirit lamp, which soon charred the contents of the spiculum and rendered it opaque, but left the outer silicious coat transparent. In many cases the internal tubular membrane was more conspicuous than before. Spicula from the same sponge were heated almost to fusion by the blow-pipe, giving results altogether unlooked for.

FIG. 1 shows the outlines of spicula subjected to the heat of the blow-pipe.

Most of the spicula were rendered opaque except at the extreme ends. The greater portion of them were much widened, and many were inflated and burst asunder by the gases set free by the combustion of the enclosed contents. Some of these presented the appearance of a cornucopia, others, of a bell with the tubular membrane in position reminding one of the clapper of the bell. A specimen from the Yellowstone river without statoblasts was submitted to the same process with like results, except that some of the spicula were inflated at one end only, presenting the appearance of a thermometer tube and bulb. Thespicula were not equally afffected by the burning, which would suggest at least a diffference in their component elements. Whether the element which burned in the less mature spicula had turned into solid silex in the older ones so as to resist the action of heat, is a problem which can only be solved by the most accurate analysis of the different spicula. In those most affected by the burning only a very small portion of silica remained.

In April last, while in Philadelphia, my attention was called to a sponge which had grown in some water-mains in that city. The rather large iron pipes had been found by Mr. Edward Potts to be encrusted on the inside with sponge so mixed up with metallic oxide as to appear more like iron rust than sponge. The kind of sponge was *Meyenia Leydyi*, a species plentiful in the Schuylkill. On examination under the microscope, it was found that the proper and normal formation of the spicula was greatly interrupted. The iron in which it was embedded had interfered with the deposition of the contents of the spiculum. The tubular membrane was in many cases quite conspicuous, while in a few there was a distinct longitudinal incissuration extending the length of the spiculum. It appears that the iron did not stop the growth of the sponge, but only interfered with its proper development.

From the foregoing experiments and observations we conclude that the formation of the spicula of sponges, varying in shape, and occurring in different parts of the sponge, and under different circumstances as they do, is a mystery not to be fully accounted for by any known process. The fact that they never anastomose, as does the fleshy mass of the sponge when in contact with itself or an-another, proves that they are organic, and that all attempts to account for their formation by crystalization are unwarrantable.

The fact of the animal nature of sponges being conceded, a great step towards the understanding of the true character of the vital elements entering into their complex life was attained. But, as knowledge comes by slow degrees, it appears that the subject was for a long time after, even in the minds of some who were leaders in this line of thought, involved in much obscurity and vagueness of expression. The sponge was spoken of by many as an animal, breathing and obtaining nutriment through the system of canals it was known to possess. Notwithstanding that many eminent observers, including Grant, Dujardin, and Carter, had announced the discovery of the mono-ciliated sponge cells, and that Dr. Bowerbank himself had seen some of these cells in *Grantia compressa*, yet we find the latter still using words indicating that he did not fully apprehend the office of the cells, and that he still considered the sponge an individual instead of a complex organism. He says (vol. i., p. 109): "The pores in the Spongiadæ are the orifices or mouths through which the animals breathe and imbibe their nutriment." And again: "In these sponges, therefore, each mouth appears to be furnished with a separate œsophagus, if I may be allowed the term, connecting it with a stomach-like cavity common to a group of mouths above it; a system of organization strikingly in unison with that of a higher class of animals." These words, although from a truly great man, whose monograph on the British Spongiadæ will always remain a monument to his persevering industry and knowledge of the sponges, cannot be construed to convey correct ideas of the structure of the object under consideration, as will appear more fully as we proceed.

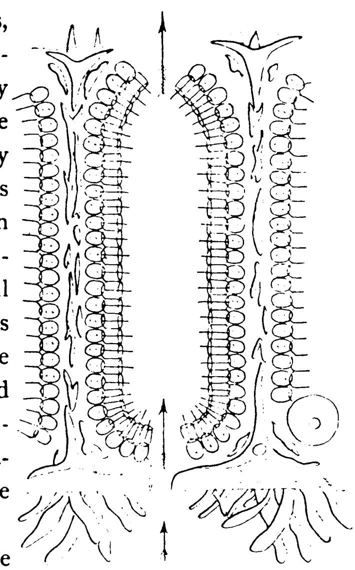

Fig. 2 shows an ampullaceous sac with flagellate monads.

Although the existence of the mono-ciliated cells referred to had been noticed, and their office and character described to a great extent by other observers, and as occurring in several species, yet to Felix Dujardin belongs the credit of first indicating the close relationship between them and the ordinary Flagellate Infusoria. Tearing to pieces a living fresh water sponge of the Lacustrian type, he found the living particles singly or in groups floating in the water. In some of these he found vibratile filaments, or flagella similar to those found on the Flagellate Infusoria. Carter and Huxley at this time added much to the details made known by Dujardin. Mr. Carter, for a long time a resident in India, having opportunity to study fresh water sponges in their strongest forms, discovered the monad in the small spherical chambers excavated as it were in the mass of sarcode, to which chambers he gave the name of "Ampullaceous sacs." The monads in these sacs were ultimately found to be attached by their posterior ends to the cell or sac, with their flagella inward, so that they face each other. By simultaneous action of the flagella in the sac a stream of water is set in motion through the sac, entering on one side and flowing out on the other. These sacs are united by a series of pore-like apertures, these by tubular canals, and these again are united with each other and are finally debouched upon the larger excurrent apertures or oscula.

As a result of these investigations and discoveries a better knowledge of the structure of the fresh water sponges was attained. The vital elements of the whole family were now considered to be essentially the same, and each sponge, instead of being an animal, was found to be in reality a compound colony of almost infinitesimal monociliated monads, acting in concert and drawing in through the pores, water containing the food and oxygen necessary for the maintenance of the life of the whole. Mr. Carter discovered in connecnection with the monad cells the existence of the so-called "earlike points" as projecting to an even distance on either side of the base of the whip-like cilium, and also the capability of these cells to take in solid food. This he fully demonstrated by the application of some coloring agent, as indigo or carmine, and the result was confirmatory of the animal character of the cell.

In the years 1866 and 1868, Prof. H. James Clark of the Pennsylvania Agricultural College, after a long and painstaking investigation with reference to the form and composition of these ciliated sponge cells, found a close correspondence between them and certain new forms of Infusoria which he had discovered and described for the first time. These Infusoria comprised four species belonging to two newly instituted genera, *Codosiga* and *Salpingœca.* These minute forms are each provided at the anterior end with a delicate funnel-shaped expansion of the sarcode possessing an extraordinary amount of plasticity, which in its normal condition of expansion surrounds the base of the flagellum.

Codosiga, he says, possesses a highly flexible, extensile, retractile, membraneous collar, at the anterior end of the body. Upon this structural element Prof. Clark bestowed the title of the "collar," and hence "collar-bearing monads." On comparison of these Infusoria with the ciliated elements of the sponge under examination, he recognized that when viewed with a sufficiently high power, the sponge exhibited a type of organism identical with that which obtained in the collar-bearing monads. Thus it is shown that a sponge is really a compound colony of flagellate zooids aggregated within the structureless sarcode, which forms the body of the sponge, having correspondence in regard to collar and flagellum, with certain Choano-flagellate Infusoria, of which the genera *Codosiga* and *Salpingœca* of Prof. Clark are types; in the matter of living within the gelatinous matrix, approaching in some respects many Vorticellidæ, and finding their analogue in *Protospongia Hœkeli*, discovered by Saville W. Kent while writing the fifth chapter of his *Manual of Infusoria.*

As already intimated, the sponge animal is exceedingly minute, and can only be seen by the use of the most approved apparatus, and under the most favorable circumstances. Not only must the objectives be good—not necessarily of the highest angle, in my opinion—but the stage and stand must be such as can be used evenly and without false motion, even when using a magnification of 2,500 diameters. The animal to be examined is delicate in form and organization, and extremely sensitive to disturbance, and is, in some of its phases, of the character and consistency of an *amœba.* Unfortunately for observation, the organic structure of a sponge, even in its early history, has more thickness than the working distance of an objective of sufficient power to see the animals *in situ.* The only way is to pick the sponge to pieces on the slide, and take a small fragment for inspection under thin cover-glass. This process, though it breaks up the canals, and mixes the organisms with the disturbed sarcode, so that perhaps nothing can be distinguished but a wriggling mass of minute life, is yet the only way left to us. It is only by isolating the particles, and by repeated efforts under the most favorable circumstances, that we can hope to obtain a sight of these small but wonderful creatures.

Much of the plan of organization of the sponge can be learned.

however, by persevering efforts with young and very small specimens, which can be found in the early summer months. Sponge of last year's growth may sometimes be found in the spring, and if transferred to a glass jar of water, will soon begin to show signs of life by the appearance of a grayish film covering the surface of the sponge and anything to which it may be attached. Around the margin of pieces examined with the microscope will be seen the glairy, gelatinous amœboid membrane constituting the dermal covering of the sponge. Along this margin, and at almost regular distances from each other, will be found small fasciculi of spicula bristling the outline, presenting a formidable barrier to parasites and other intruders. The spicula are arranged at different angles like stacked muskets, and are held in position by the dermal covering already referred to, which, in the language of another, is stretched out over the points of the projecting spicula, after the manner of a tent canvass extended upon the ends of its supporting poles.

On watching the margin of an active specimen there may be seen particles of matter flowing in and out of the orifices, and frequently what is more interesting, a small tubular finger-like process,—technically called the chimney,—projecting from the sponge. This is an extension of the thin dermal covering, and is probably the result of pressure from the outflowing current. These fingers may sometimes be seen by the naked eye, or with a very low power of the microscope. By the use of a higher power on the surface of the sponge we may see the minute apertures, and the passage of floating particles inwardly, which are transmitted through the various channels till finally they make their exit through the unusually large terminal opening at the end of the tube. On one tube examined a long time there were several apertures, at each of which was a whirling of particles similar to that caused by the cilia of a rotifer. The terminal opening in one case was too small to allow the particles to flow out. From some source which I could not discover, small spicula were floated down the current, but not always parallel to the axis of the tube. When the length of the spiculum was greater than the width of the opening, the spiculum lodged, and they accumulated till a number of them were piled up like driftwood, and then from the pressure of the excurrent fluid burst through the opening and were dispersed. On applying my eyes to the microscope after a few moments' absence from this specimen, I found the opening to have become very large, and the water and floating particles in a perfect whirl that I could not at first account for. From a long distance in the watch-glass every particle of the coloring matter that I had put in was drawn to the opening, and then whirled off with great force. The tube was so hyaline that I could focus down and see the inner surface of the other side, yet no motion of cilia or granules could be detected with a magnification of 700 or 800, linear.

The only essential difference between the fresh water sponges and some of the marine appears to be the presence in the former of large seed-like bodies called statoblasts. They are a kind of non-sexual reproductive organ, apparently for the purpose of continuing the species through the vicissitudes to which fresh waters are exposed during winter. They are for this reason sometimes called winter eggs, as are similar bodies belonging to the Polyzoa. The statoblasts in sponges vary in size from the one-twentieth to the one-eightieth of an inch in diameter, and are plainly visible to the naked eye. The process of their formation is believed to be somewhat in this manner: As the sponge advances toward maturity, certain amœboids prevalent in the younger portions of the sponge mass together in convenient places, and when sufficiently advanced toward the state in which they are to remain, begin to secrete the coverings and protecting spicula, in the midst of which they are enveloped, in the same way that the loricæ of Infusoria and Polyzoa are secreted. They are globular in form, varying slightly in the different species, and are found most profusely scattered irregularly through the older portions of the sponge. On the approach of warm weather in the ensuing summer, these same amœboids, changed now, it appears, to real sperm cells, or resting spores, make their exit through the foramen of the statoblast provided for their escape, to originate a new sponge. The foramen is, in some cases, prolonged by a tube, from the end of which proceed certain cirrous growths, resembling tentacles.

The sponges with these peculiarities are found only in the genus *Carterius*,—(formerly *Carterella*). The genus comprises three species at present, all peculiar to this country. These are ***Carterius tubi-***

sperma, Mills, *C. tenosperma*, Potts, and *C. latitenta*, Potts. *C. tubisperma* has the longest tube of any known statoblasts, while *C. tenosperma* has short tubes, but the longest tendril-like processes. In this species they are slender but strong filamentous threads, pervading the whole sponge, and holding it together in a compact mass. The processes of *C. latitenta* are not quite as long, but they are wider, and ribbon-like. The walls of statoblasts of this genus, like others of the same type, are strengthened by birotulate spicula, the shaft passing through the wall, the proximate rotula supporting the inner surface of the wall, the outer one supporting the outer surface, and in many cases extending a little beyond, thus roughening the surface of the statoblast. The rotulæ in this and many other genera are toothed, and in some cases terminate in slightly recurved hooks. In the *Hetero-meyenia*, a genus founded by Mr. Potts, the birotulates consist of shafts of very unequal lengths, and as the proximate ends of each support the inner surface of the wall, the ends of the longest series reach out far beyond the other. This is remarkably exemplified in *H. longistilis*, Mills, a species sent to me by Mr. Wolle, and containing, I believe, the longest shafts to the birotulate known. The hooks of the projecting spicula are well adapted to keep the statoblast in position while the tubes and filamentous threads referred to hold the sponge together, so that it may withstand, for a time at least, any violent action of the water without being broken up.

I once found on the banks of Niagara River, late in November, a specimen of *C. tubisperma* that had been rolled into a ball, rather than broken to pieces by the surge as it would have been but for the tubes and processes which held it together. I have emphasized these characteristics for the purpose of correcting an error that prevails in some of our best microscopic works. In the latest edition of one of these, *Carpenter on the Microscope*, occur these words in reference to the statoblasts: "These seed-like bodies, which answer to the encysted state of many protophytes, are met with in the substance of the sponge, chiefly in winter, and after being set free through the oscula they give exit to their contained amœboids, each of which may found a new sponge." The objectionable phrase in this sentence is, "set free through the oscula," which cannot be correct for many reasons, some of which are obvious from the foregoing remarks, and for the reason that in very small specimens the oscula are too small for the exit of so large and rough a body as the statoblast. Besides, the statoblasts in the sponge are surrounded on all sides by strong skeleton spicula and sarcode, and cannot be liberated without breaking up the fabric. The genus *Spongilla* presents even stronger proof of the immobility of the statoblasts while the sponge remains intact. In *S. fragilis*, the statoblasts are massed together compactly, and are cemented to the object upon which the sponge grows so firmly that it requires a knife or other sharp instrument for their removal. In Dr. Bowerbank's article on *Gemmules*, vol. i., page 145, he quotes Dr. Grant describing these bodies as appearing first in October and November as opaque yellow spots visible to the naked eye, and without any definite form, size, or distribution, excepting as they are most abundant in the deeper parts of the sponge. When they have obtained a fully developed condition they separate from the parent sponge, and pass out of the fœcal orifices and float around for a period, till they attach themselves to some fixed body; they then spread themselves out into a thin transparent convex film, and when two come together in a watch glass, they unite and originate a new sponge.

It is uncertain what sponge the writers had in mind when this was penned. The first part of the quotation seems to refer to the statoblasts of a fresh water sponge, as these are found more plentifully in October and November than at any other time. They appear then in the deeper parts of the sponge as opaque yellow or yellowish bodies, and are visible to the unassisted eye, and, as I can find no description of a marine sponge in which this would be true, I conclude that some species of fresh water sponge was under consideration. The latter part of the quotation evidently refers to some marine sponge, though Bowerbank admits that he never witnessed the phenomenon referred to. The whole paragraph seems to be a confusion of ideas relating to the statoblasts of the fresh water sponge, and the so-called gemmule of the marine sponge. I find two or three genera of marine sponges in which bodies having some resemblance to the fresh water statoblasts are found, as in *Geodia* and *Pachymatisma*, but, instead of being found in the deeper parts of the sponge, they are found all together just under the dermal covering, and not only in October and November, but, it is reasonable to suppose, at all seasons of the year, judging from the wide distribution of these genera, and the equable temperature of the water in which they are found.

The fresh-water sponges of this continent, though only partially known, are both numerous and interesting, widely differing in some of their forms from any found in the old world, as in the genus already referred to, and others. We find early mention by Bowerbank and Carter of sponges from the water-pipes of Boston, and from the Schuylkill and other rivers of North America. Bowerbank, in his first volume, speaks of knowing eight species from South America. These were described in most part under the genus *Spongilla*, in the species *S. fluviatilis*, and *S. lacustris*, terms at first signifying merely whether found in river or lake, but now this distinction is practically obsolete, except as expressive of the forms which are typical as then understood. Since Mr. Carter's classification in 1880, the term *Spongila* has been used to distinguish his first genus.

Mr. Edward Potts, of Philadelphia, has been successful in the discovery of many species in and around Fairmount Park. His contributions to the Society of Natural Sciences in Philadelphia have added much to our knowledge of the sponges of America. Mr. B. W. Thomas, of Chicago, has also done excellent service by his persevering efforts in mounting spicula in a most artistic manner; also in the discovery of some new forms. My own efforts have been rewarded by the discovery of some new species, and varieties hitherto undescribed. Species previously known only in one locality have been found to be distributed over a wide territory. *Carterius tubisperma*, Mills, for some time found only in Niagara River, was found last year by myself in Iowa, Illinois, and Franklinville, N. Y. *C. latitenta*, Potts, has been found in Indiana and Niagara River, as well as in Philadelphia. I found a very strong form of *Tubella Pennsylvanica*, Potts, in Florida during the past winter, differing somewhat from the types of the species found in the vicinity of Philadelphia, by the presence of a much thicker coat of micro-cell structure surrounding the statoblast.

Varieties of *S. fragilis* and of *Meyenia fluviatilis*, differing considerably from the typical forms, but not sufficiently divergent to warrant the forming of new species, have been mounted and put away for future reference. On the tenth of September of last year I found a sponge in Bear Creek, Benton Co., Iowa, that gave me great pleasure. It was of a bright emerald-green color, and attached to the fibrous roots of a tree which had run into the bend of the creek where the water had little, if any, motion. The specimen proved on examination to be similar in the arrangement of the birotulates in the wall of the statoblasts to that described before the Scientific Society of Prague, on the 12th of October, by Dr. Franz Vedjovsky, and named by him *Ephydatia amphizona*.

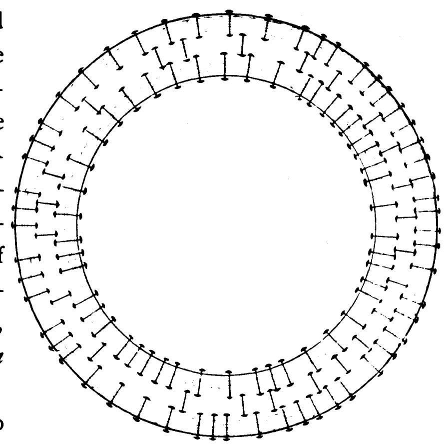

FIG 3 shows relation of birotulate spicula in Pleiomeyenia.

I subsequently found two other species having the same arrangement of birotulates, one in a branch of the Calumet River, near Chicago, and the other in Ischua Creek, Franklinville, N. Y.* All the species were found in sluggish or motionless water, which fact is opposed to the theory advanced by Dr. Marshall in the *Royal Microscopical Journal* for April. He supposes the double or treble series of silicious birotulates in the statoblast are for the purpose of increasing its specific gravity, so that it may the more readily sink, and not be carried off by a rapidly flowing stream. He thought, therefore, that sponges of this character would be found only in

* With these three distinct forms I propose a genus *Pleiomeyenia* from Gr. *Pleion*, more, and *Meyenia*, from "Meyen," who, in 1839, first announced the presence of birotulate spiculæ in the outer walls of the statoblasts of the sponges then known as *Spongilla fluviatilis*, which are described as having the outer rotulæ supporting the external membrane, and the inner one performing the same office for the inner membrane (or more properly, surfaces). That is, the walls of the statoblasts of these sponges were strengthened by one zone or row of birotulate spicula. Since Mr. Carter's classification these and all of the same type have been included in the genus *Meyenia*. The sponges now under consideration and described in this paper have more than one row in the wall, and are, therefore, designated *Pleiomeyenia*. See *Am. Mon. Mic. Jour.*, v., 41.

swiftly running waters. I deem it unwise to form conclusions one way or the other till we know more of these sponges and their habitats. The sponges which I found in Florida during the past winter consist of several species in four genera. The St. John's River, extending as it does through two or three hundred miles of semi-tropical climate, and emptying into the ocean at Jacksonville, affords a fine field for the student in this branch of natural history. Large specimens of sponge could be seen on the spiles at the docks as I passed up the river on the steamer. As early as the tenth of February, I could see quite a lot of sponge on the ribbon-grass, *Valisneria spiralis.* Although at this early season it was immature, it was yet so plentiful as to ensure a rich harvest to one who could linger with a small-boat to collect it. On my return to Palatka I gathered fine specimens of a new species. Other specimens found in some of the small lakes which abound in Florida have added to my list, and will be described at the close of this paper.

Two specimens sent to me by Prof. Wolle soon after the Elmira meeting of the Society will now be described. The first of these was found on Mount Everett, 2,400 feet above tide-water. This I have named *Meyenia Everetti.*

Meyenia Everetti, ***n. s.*** Sponge found by Prof. Wolle on Mount Everett, at an elevation of 2,400 feet above tide-water, attached in a filamentous form to sticks in shallow water. Statoblasts few in number; diameter, $\frac{1}{33}$ of an inch, nearly globular. Skeleton spicula slender, slightly curved, smooth acerate; length, from $\frac{1}{110}$ to $\frac{1}{150}$ of an inch, sharp pointed. Birotulates of statoblast, length of shaft varying from $\frac{1}{300}$ to $\frac{1}{380}$ of an inch. Rotulæ well defined, dentate teeth slightly recurved; sponge peculiar by the presence of small birotulate spicula from $\frac{1}{1250}$ of an inch in length of shaft, scattered uniformly throughout the dermal covering.

Heteromeyenia longistylis, ***n. s.*** Also sent to me by Prof. Wolle. Specimen very small and few statoblasts. Statoblasts globular $\frac{1}{53}$ of an inch in diameter; skeleton spicula smooth, slightly curved, acerate; length, $\frac{1}{98}$ inch. Short birotulates spined; length, $\frac{1}{340}$ of an inch. Long birotulate, shaft smooth, slightly curved; length, $\frac{1}{200}$. Rotulæ deeply dentate, recurved.

Heteromeyenia Ryderi, *Variety.* Sponge massive; found in small lake near DeLand, Florida. Skeleton spicula; length, $\frac{1}{100}$ of an inch, nearly straight, slightly spined, abruptly pointed. Statoblast globular, $\frac{1}{50}$ of an inch in diameter, a thin coriaceous covering fitting closely to the birotulate spicula. Long birotulate, length of shaft $\frac{1}{320}$ of an inch, varying somewhat; rotulæ small, irregular, with recurved hooks, shaft spinous, spines generally recurved. Short birotulate, length of shaft about $\frac{1}{600}$ of an inch, shaft straight, smooth, amphidiscs sharp and well defined, equal, slightly toothed. A few small dermal spicula, birotulate.

Another variety of the same species was found in a small, narrow creek of fresh water, seven miles from St. Augustine.

Pleiomeyenia Calumeticus, n. s. Sponge massive, found in apparently still water in Calumet Creek, near Chicago. Statoblasts globular, $\frac{1}{50}$ of an inch in diameter. Outer wall of statoblast $\frac{1}{800}$ inch in thickness. Skeleton spicula smooth, slender, acerate, slightly arcuate; length of spicula $\frac{1}{100}$ to $\frac{1}{120}$ inch, varying somewhat. Birotulate of statoblast small, and in two or three series in the wall of statoblast. Rotulæ dentate, shafts smooth.

Pleiomeyenia Walkeri, n. s. Sponge massive, in large pieces varying in color from green to buff. Skeleton much more robust than former specimen. Statoblasts, $\frac{1}{45}$ in diameter; globular. Birotulates in wall of statoblasts in two or three series; rotulæ toothed. Skeleton spicula large, pointed, smooth, slightly curved; length, average $\frac{1}{75}$ of an inch, varying slightly.

Named for Dr. Walker, Franklinville, N. Y.

Pleiomeyenia Spinifera, n. s. Sponge emerald-green, massive and encrusting. Found in slowly running water, Benton Co., Iowa. Statoblasts globular, $\frac{1}{50}$ inch in diameter; compact. Skeleton spicula, average length, $\frac{1}{100}$ of an inch. Robust, roughly spined, slightly curved, rather abruptly pointed. Birotulates small, shaft short, discs toothed, arranged in two or more series in wall of statoblast.

Meyenia subdivisa, n. s. Sponge encrusting and massive; found on spiles of dock at Palatka, Florida, and other parts of the St. John's River. Statoblasts mostly globular, $\frac{1}{45}$ inch in diameter. Birotulates, length $\frac{1}{625}$ to $\frac{1}{680}$ of an inch, shafts stout; spinous. Rotulæ toothed, spines of shaft and teeth of rotulæ divided at the termini. Skeleton spicula, robust, smooth, arcuate, pointed. Length of spicula $\frac{1}{80}$ to $\frac{1}{100}$ of an inch. This sponge grows very large and clean, and the spicula proved good.

Meyenia Millsii. Sponge massive; found in small lake near DeLand, Florida. Statoblasts globular, compact; $\frac{1}{54}$ inch in diameter. Skeleton spicula, slightly spined, robust, slightly arcuate, acerate; length, $\frac{1}{88}$ inch. A few small, slender spicula, sharp pointed. Birotulates well defined; rotulæ equal, not deeply dentate; shaft $\frac{1}{500}$ to $\frac{1}{600}$ of an inch in length, nearly straight. Small dermal spicula; shaft straight, lozenge-shaped termini.

This sponge was sent from Florida to Mr. Potts, of Philadelphia, for him to describe and name if he chose. He considered it quite new, and named it as above, without description.