

ART. IX.—NOTES ON THE FRESH WATER SPONGES OF NOVA SCOTIA. BY A. H. MACKAY, B. A., B. SC.

WHEN examining the diatomaceous deposits of our lakes, we always found present in greater or less abundance the silicious spicules of fresh water sponges. In some of the material examined there appeared to be even a greater amount of silica deposited as sponge spicules than as diatom cells. A search for the origin of this spicular deposit, has revealed, up to date, the existence of *four* genera containing *nine* species of fresh water sponges, which form a part of the living fauna of Nova Scotia. In the summer of 1884, in company with Hector McInnes, Esq., of the Pictou Academy, and John H. MacKay, Esq., Principal of the River John High School, we made a most enjoyable exploration of the physical and natural history characters of the lakes in the basin of the East River of Pictou and beyond the watershed of the Province on the upper sources of the St. Mary's on the Atlantic slope. We constructed rafts when necessary, so as to be able to take soundings of their depths, and dredgings from various parts of their bottoms. This paper is simply an outline and classification of the species of *spongillina* found on this expedition.

Fresh water sponges are generally rather inconspicuous objects. The first reference to them in a printed work appears to have been made in 1696. Linnæus described two species in 1745, under the names *Spongia lacustris* and *S. fluviatilis*. In 1816 the name *spongilla* was given the genus by Lamarck. In 1839, Meyen pointed out the peculiar spiculation surrounding the "seed-like" bodies of one of these two species (our *Meyenia fluviatilis*, see slides 26 and 27). In 1840 Hogg demonstrated that these "seed-like bodies" germinated and reproduced the spongilla. In 1867 Carter established the "animality" of these sponges. Lieberkuhn and Bowerbank, by means of the spiculation of what the latter called "ovaries,"

definitely distinguished between the two known forms at that time, naming them respectively *Spongilla lacustris* and *fluviatilis* (now, *Meynia fluviatilis*). The macroscopic characters of fresh water sponges are often so variable or ill-defined that a microscopic examination of the general structure of the reproductive gemmule which Carter denominates a "statoblast," is necessary to make sure of its identity. Accordingly, Carter, in 1881, divided the fresh water sponges then known to science into five genera, each of which is distinctly characterized by the spiculation.

In Canada, Sir William Dawson, of McGill, in 1863, sent a specimen of freshwater sponge to Bowerbank, who described it under the name of *S. Dawsoni*. In 1875, George M. Dawson, son of Sir William, described four additional sponges as new to Canada and science. Although these are not likely to rank as species in the future system of classification, they mark a good step in the advance of our knowledge of these organisms by one whose energy and encyclopædic knowledge of Canadian Natural History have done much, and promise to do still more, in bringing our Dominion under the notice of the scientific world.

Our freshwater sponges are, so far as observed, generally greenish, poriferous or variously channelled masses, of a rather soft, but not fluid sarcode, supported by a skeleton of silicious spicules, or needles, approximating the one hundredth of an inch in length, variously combined to form a mesh-work structure, which may assume the contour of thin or thick encrusting layers, even or lobed, in some species branching erect, or creeping in slender filaments. The statoblasts which appear to mature before winter, commonly in the basal portion of the sponge, are more or less spherical, smaller than the head of a pin, variable as to size and mode of aggregation, and contain a mass of free cellular germinal matter, which is enclosed by a strong chitinous membrane, with a small variously formed and directed aperture. The chitinous coat is surrounded by an outer structure, generally densely charged with a regularly arranged investing layer of characteristic spicules, in most species bearing no resemblance either in form or size to the skeletal spicules.

It is upon the distinct and invariable characters of this statoblast spiculation that the modern genera are based. Some sponges have a third class of spicules on the surface and in the interstitial spaces or flesh. They are always slender, and very much smaller than the skeletal spicules. Nearly all the sponges taken in Nova Scotia have been of some shade of green when living and exposed to the influence of light. When attached to the under side of stones so as to be excluded from the light, they become whitish. When dried rapidly, most of the sponges shrink considerably, yet preserve their approximate form and colour without decomposition. Exposure to light, however, soon destroys the green of the dried sponge. The great bulk of the specimens secured have been taken from water varying from a few inches to seven or eight feet. Specimens have been taken from between thirty and forty feet of water by the dredge. They grow attached to submerged pieces of wood, bark, weeds, stones, gravel, and even on ferruginous concretions. Water liable to become turbid is unfavourable to their development. The largest specimen was one of *Meyenia fluviatilis*, taken from a depth of seven or eight feet, in the Garden of Eden Lake, Pictou County, on the 1st of August. It was encrusting a small branch of about one inch in thickness, which was projecting from a submerged tree. It was fusiform in contour,—the greatest diameter being four inches, and its length twenty-seven inches. During winter these sponges generally die, and the most of their spicules are scattered in the neighboring deposits. The statoblasts are also often drifted about, and germinate the following spring when a congenial environment is found.

We give the following systematic outline descriptions of the species collected:

Genus I. SPONGILLA.

Statoblasts, more or less spherical, single or aggregated in larger masses about the size of a head of a pin, invested with linear spicules, straight or curved, cylindrical or acerate, more or less spined and arranged tangentially to the chitinous coat of the statoblast,

I. *S. fragilis*. Leidy.

Sessile, encrusting. Statoblasts in extensive basal layers, with apertures extended into generally curved tubules, directed outwards, or aggregated into compound spherules of three or four or more single statoblasts in a common cellular investment with spicules, cylindrical, roundish truncate, spined and generally slightly curved.

Described first by Leidy, 1851; by Bowerbank as *S. Lordii* from British Columbia in 1863; by Dybowski as *S. Siberica* in Russia. The varying forms with aggregated or compound statoblasts, were described as *Var. Segregata*, by Potts; but he says a wider experience has induced him to give it up. It is this form which has been described from the Ottawa, by Dr. G. M. Dawson, in 1875, as *S. Ottawaensis*. His "large irregular ovaria" are the compound statoblasts to the structure of which he does not allude. These forms are frequently found encrusting submerged twigs, stones, &c., in the lakes of Nova Scotia. (See slides 20 and 21.)

2. *S. lacustris* *Var. Dawsoni*, Bk.

Generally branching. Besides the skeletal spicules there are present minute, spined, fusiform dermal arcuates. Statoblast spicules, cylindrical, spined and more or less curved.

This is a variety of the European *S. lacustris*. The first Canadian species was described by Bowerbank in 1863 as *S. Dawsoni*. Next we find *S. lacustroides*. Then as its specific identity with the European form become apparent, we find *S. lacustris* var. *lacustroides* Potts, and *S. lacustris* var. *Americana* Carter. We suggest the propriety of retaining Bowerbank's specific as the varietal name. We have a specimen from Sir William Dawson, collected by H. M. Ami in the Ottawa, which is nearly identical with the European *S. lacustris*.

One of the most common of Nova Scotian fresh water sponges. (See slides 22 and 23.)

3. *S. Mackayi*, Carter.

Sessile, encrusting, with many large compound statoblasts prominent through the thin layer of flesh. Large gemmules $\frac{1}{12}$ inch in diameter consisting of about 16 statoblasts, apertures turned inward, supported by a mass of heavily spined acerate spicules of various sizes, intercrossing. Spines sometimes as long as the spicule is broad, very irregular in size and situation, skeletal spicules longer and all parts more slender. Described by Carter, in the "Annals and Magazine of Natural History." London, January, 1885. The species is not uncommon in Nova Scotia lakes. Its spicules appear to exist in the diatomaceous deposits of the lakes which supply the water system of Halifax; specimens of which we have received from Professor Lawson of Dalhousie College. Carter has described similar spicules as abundant in the diluvial deposits of the Altmühl Valley in Bavaria. (See slides 24 and 25.) It is very near *S. igloiformis* of Potts.

Genus II.—MEYENIA.

Statoblasts surrounded by minute *birotulate* spicules.

4. *M. fluviatilis*, Carter.

Massive encrusting, sometimes extensively lobular. Birotulates small and star-like, the shaft connecting the rayed discs about equal to diameter of rays.

Varieties of this species (with some adventitious spicules) have been described by Dr. G. M. Dawson in the Canadian Naturalist of Sept., 1875, as *S. stagnalis* and *S. asper-ri-ma*. This species, like its old European comrade, *S. lacustris*, is one of our most common sponges. (See slides 26 and 27).

5. *M. Everetti*, Mills.

Sessile, encrusting. Statoblast birotules 3 to 4 times longer axially than those of *M. fluviatilis*, with the more numerous rays incurved. Flesh spicules present as minute slender birotules with incurved barb-like rays. Discovered for the second time in the lakes of Pictou County. The only habitat previous-

ly known is a lake on Mount Everett, Berkshire Co., Mass., U. S. A., 1800 or 2000 feet above the sea. The flesh spicules of this species have been observed in the diatomaceous deposits of the lakes which supply the city of Halifax with water. (See slides 28, 29 and 30).

Genus III.—HETEROMEYENIA.

Statoblast birotules of two orders, one long, the other short.

6. *H. Ryderi*, Potts.

Rather massive with lobular protuberances. Long birotules, with scattered spines on shaft and few incurved, nearly barb-like, rays. Short birotules, with small shaft enlarging towards the large finely-toothed discs. (For structure and spiculation see slides 31, 32 and 33). Very abundant in MacKay's Lake, Pictou Co.

7. *H. argyrosperma*, Potts.

Sessile, encrusting. Large birotules more than twice the size of those of *H. Ryderi*, rays more hook-like. Small birotules about half the length; few rays irregularly hooked; shaft with stout scattered spines. In Garden of Eden Lake, Pictou Co., and adjacent lakes.

8. *H. Pictovenssis*, Potts.

Sponge light green, massive, encrusting; texture very compact; spicules non-fasciculated, persistent; surface mostly smooth and firm to the touch. Statoblasts very scarce, spherical; crust thick.

Skeleton spicules cylindrical, short, robust, rounded or abruptly terminated; entirely spined,—spines conical at the centre of the spicule, elsewhere generally curving towards each extremity; rounded terminations of spicules covered with short spines, though frequently a single large spine or acute termination is seen at one or both extremities.

Birotulates of the longer class surrounding the statoblasts, rather numerous, one-half longer than the others; shafts con-

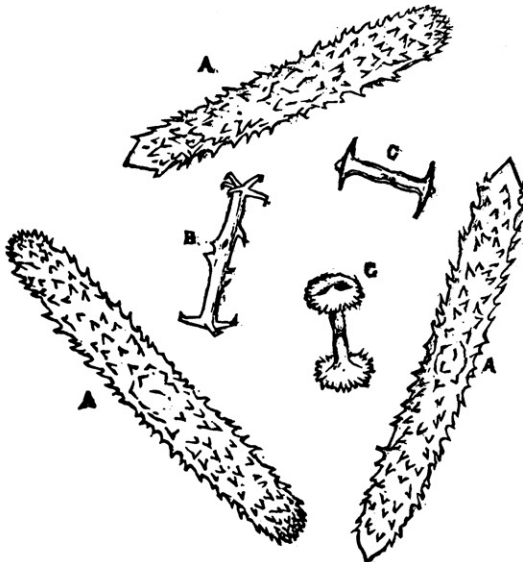
spicuously fusiform or largest at the centre, where are found one or more long spines. Their rotules consist of three to six irregularly placed rays, recurved at the extremities.

Berotules of the shorter class abundant, and compactly placed around the statoblasts; shafts mostly smooth, though sometimes bearing a single spine; irregularly cylindrical, but rapidly widening to support the rotules, which are large, umbonate, nearly flat, and finely lacinulate at their margins; occasionally bearing spines.

Measurements.—Skeleton spicules 0.0075 inch long, by 0.00075 inch thick; length of long birotulates 0.0021 inch; of short birotulates 0.0012 inch; diameter of disc of latter, 0.0009 inch.

The above description is substantially that of Mr. Potts, who described the species before the Philadelphia Academy of Natural Sciences, at its meeting of February 24th, 1885.

This most beautiful of all our sponges was originally found in the lakes of the watershed of the Province, between Pictou, Guysboro' and Antigonish, August, 1884. It has since been observed in the lakes and streams of Halifax County.



HETEROMEYNIA PICTOVENSIS, Potts.

- A.—Skeleton spicules.
- B.—Long birotulate.
- C.—Short birotulate.

Genus IV.—TUBELLA.

Statoblast spicules with a rotule on one end only of the shaft, or inequirotulate.

9. *T. Pennsylvannica*, Potts.

Thin encrusting; rotule a very small circular entire disc, with the short central shaft attached on one side. Rare. Found in two lakes in the East River basin.

NOTE.—During the Summer 1885, the author extended the known range of the most of these species to the lakes of Halifax County, Nova Scotia, and to the lakes of the Island of Newfoundland.