

ART. VII.—NOVA SCOTIAN ECHINODERMATA.—BY THE REV. D.
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IN our recent Studies of Marine Invertebrates, we have been led to give some attention to the admirable collection of Nova Scotian Echinodermata in our Provincial Museum. We propose to give the results in this paper.

Of the Sub-kingdom Anneloidea, Class I, Echinodermata, we have the following *Orders* represented :

- 1st.—Crinoidea.
- 2nd.—Ophiuroidea.
- 3rd.—Asteroidea.
- 4th.—Echinoidea.
- 5th.—Holothuroidea.

The first of these is represented by

Comatula or Antedon Specimens.

Of this we have two specimens which were presented to the Museum by Sir C. Wyville Thomson, of H. M. S. "Challenger." They were dredged on the LaHave Banks from a depth of 75 fathoms. This is a modern representative of the ancient Crinoids, which flourished in Nova Scotia, largely at Arisaig, in the Lower and Upper Silurian Periods, and to a less extent in the Lower Carboniferous, e. g., East River, Pictou. For examples see our Museum Collections.

Our *Antedon* specimens are in the mature state. When young they were on stalks and fixed. Then their resemblance to our Silurian Crinoids was sufficiently obvious. Now their resemblance is not so striking. It is only when examined critically that this is manifest. Their present aspect is feather-like. Hence a "common name"—"Feather Star." Their body is cup-shaped and pentagonal. From each side proceeds a double ray—arm. The mouth lies between. The rays are each fringed with a

double row of *pinnulae*—20 rows in all. This is the inferior or ventral side. On the other dorsal side is a multitude of *Cirri*, by which the Crinoid anchors itself and clings to other bodies. These cirri are characteristic and distinguish species. The joints of ours are plain, the terminations are *single claws*. The joints of arms and cirri have central perforations like those of other Crinoids, "St. Cuthbert's Beads." Three *foramenifera* adhere to one of the cirri which we have examined.

The next ORDER is represented by two families. 1. *Asterophytidae*. 2. *Ophiuridae*. Of the Asterophyton the body is large. From this proceed five arms which divide and subdivide until the number can only be conjectured. The back has 5 rays (ridges) which differ in character and constitute different species. The common form, with us, has been named *Asterophyton Agassizii*. Of this we have *three* specimens. *Two* others and a small *one* from Cape Breton make at least *two* other species. They are all now curled up and have a "basket-like" appearance. They have received a common name—"basket fish."

The second family, *Ophiuroidea*.

The body of these is discoidal. It is covered with granules, spines, or scales. Pedicellariæ are wanting. This contains all the viscera. From it proceed five—*exceptional six*—slender arms. They are simple and without prolongations from the stomach. Unlike the *Asteridæ*, these are unexcavated and without ambulacral grooves. The mouth is in the centre of the lower part of the body. It has a masticating apparatus, and is surrounded by tentacles. The mouth is also the anal aperture. The arms are each composed of four rows of calcareous plates. The lateral ones have well developed spines. These are very numerous. The arms are very brittle, hence they have received the common name "brittle stars." They are serpentine, and hence the family name, *Ophiura*. In our harbor we recognize two genera: 1st. *Ophioglypha*, *species, robusta*. This is the form with which we are best acquainted. It abounds in the centres of our boulders. Vide preceding Paper. 2nd. *Ophiopholes*; *species, aculeata*; received from the U. S. Fish Commission, 1877. These are very beautiful.

The third order is *Asteroidea*.

Like the Crinoidea, this is a very ancient order in Nova Scotia. One of our first Arisaig fossils was *Palæaster-parviusculus*. Billings. This *tiny* aster is in a boulder found near Arisaig Pier. We cannot locate it *exactly*. It is doubtless as old as the Clinton ledge, from which we have the best *Crinoidea* in our Museum—"Arisaig Collection." Its size equals that of the youngest of the "Common Starfish" in our suite of specimens. This is half inch. It is figured and described in Dawson's *Acadian Geology*, pp. 597-8. It has five rays, and shows the under side; two of the rays are defective. We quote from Nicholson's *Geology* a description of the Starfish, page 164:—

The body is star-shaped or pentagonal and consists of a central body or "disc," surrounded by five or more lobes or "arms," which radiate from the body, are hollow and contain prolongations of the viscera. The mouth is inferior and central in position, the arms either central or dorsal. The skeleton is composed of a vast number of calcareous plates or ossicula, united together by the coriaceous perisome, so as to form a species of chain armour. Besides these the integument is abundantly supplied with spines, tubercles and "pedicellariæ." Lastly, the radiating ambulacral vessels run underneath a species of internal skeleton, occupying the axis of each arm and composed of a great number of bilateral "vertebral," or calcareous plates, which are movably articulated to one another and are provided with special muscles by which they are brought together or drawn apart." Our common species is *Asterias vulgaris*. This attains to a large size. One of our Museum specimens measures 17 inches. This has five rays. Of another species—*Asterias polaris*—we have two specimens having six rays. The size of these is 12 inches. When devouring a mussel or oyster they bring the disc and mouth to the juncture of the valves, clasp the valves with their rays, and then deliberately raise the body, opening the valves and extracting the inmate by suction. We have witnessed the operation in our aquarium, where we had young star fish, and small mussels placed together. In the United States department of the Fish-

eries Exhibition a large number of star fishes caught in the act of swallowing oysters were exhibited.

We have also *Crenaster-papposus*; the "Sun Star" of the Family *Solasteriadae* and *Hippasteria phrygiana*, the "Cushion Star" of the Family *Astropectenidae*.

The fourth order is *Echinoidea*.

Of this order we have a representative of the Family *Echinidae*; *Echinus drobrachienses*, our common sea urchin. This differs from the preceding in having the animal enclosed in a test of spherical form which bristles all over with spines of different sizes. When alive and in the aquarium, the spines, which have a "ball and socket" movement, are seen moving in all directions. Beyond these stretch the tentacles, which protrude from ten perforated zones. These, too, are in motion ready to catch any creature of convenient size and proper for food that may come within reach. This is thereby conveyed to the mouth, which occupies a central position below. This differs from that of the other echinoderms which we have already described, in having teeth. There are *five* of these arranged as a pentagon. They are set in jaws of equal number, which may be seen on opening the test. This masticatory apparatus is known as "Aristotle's Lantern." The anus is on the summit. When the spines are removed the structure of the test is then observable. The spines are beautifully formed. Their structure can only be properly seen by the microscope. They have sockets which fit the tubercles with which the test is ornamented. The perforations from which the tentacles protruded are now distinctly seen. The test is composed of calcareous plates, which are nicely fitted together and firmly cemented. These plates have names according to their position and functions. Certain ones surround the mouth, the oral, and also the anus, the anal. The latter are surrounded by the genital plates, which are five in number and of pentagonal form. Each of these has a perforation. One of them is larger than the others. This has a spongy, minutely perforated tubercule, like the rose of a watering pot—the "madre poriform tubercule." Wedged in between the plates and occupying the summits of the ambulacral areas are five smaller

plates—the “ocular plates.” Each of these is perforated, to accommodate the “ocellus” or eye. The mechanism and design of the whole is admirable—perfect.

The next family is *Clypeastridae*.

Of this we have one representative—*Echinarachnius parma*—(sand dollars.) Our specimens of these were collected from the sand flats of Cow Bay and Clam Bay. Their form is discoidal. The accommodation for the creature seems scanty. They are covered with minute spines. Their mouth is under, central, on the flat side. The anus is central, on the upper convex side. Like the Echinus they have five teeth. Unlike they do not project. You have to look into the mouth to see them. In the Echinus the ambulacral apertures extend from pole to pole. In our Clypeaster they are only on the convex side, where they are arranged in stellar form—five rays—having the anus for a centre. They burrow in the sand. Only tests can be seen on the surface. When the sea is ebbing, circular depressions in the wet sand, mark their existence. Our specimens vary in size from $\frac{1}{2}$ inch to $2\frac{1}{2}$ inches.

The fifth order is *Holothuroidea*.

These are known as “Sea Cucumbers,” Trepangs and “Beches-de-mer.” They are the most highly organized of the Echinoderms. These are well represented in our Harbor and Bedford Basin Collections. We have notable examples of the Family Dendrocherotæ.

1. *Psolus phantapus*.

Our specimen is an unusually large one. It measures from the oral to the anal opening along the middle of the disc 8 inches; its girth is 6 inches. The length of the disc is $3\frac{1}{2}$ inches. There are two rows of feet along either side and another along the middle; along the back from the oval to the anal opening it measures $4\frac{1}{2}$ inches. The tail and neck and mouth rise above the back, giving it a saddle shape. Its color is *brownish*. A Chinaman who loves a trepang as much as a bird's nest would gloat over it. We have had many specimens of the common size—none approaching to this one.

2nd. *Cuvieria Fabricii* is represented by one large and three smaller ones. This is clad with a coat of mail, calcareous plates, thickly tubercled—imbricated. One of these was caught in Bedford Basin. It was living, with tentacles fully spread; its colour was a brilliant red. It was very beautiful; we were sorry when it died. The plates overlap, having rounded free edges toward the medium line of the back. The ventral disc has two rows of feet extending along the sides. There is no median line. The largest specimen is 4 inches in length and $2\frac{1}{2}$ inches in breadth. A common name is "Sea Orange."

3rd. *Pentacta frondosa*—"Sea Cucumber." Of this we have four specimens. They are very much contracted and do not afford any satisfactory measurement. Their colour is faded purple. The tentacles of three of them appear. The tube feet are distributed over the quarter part of the body. The skin is very tough. Portions of this were dissolved in caustic potassa. Irregular forms only survived. The tentacles of one were treated in the same manner with a like result, excepting, certain foreign bodies which are very beautiful. Of these we recognize the familiar *diatoma vulgare* in various forms of fission. Some of these are very striking and instructive. There is another form which we also encounter very frequently. In the present case some are perfect. These resemble a wheel with 6 and 7 spokes without the felloes. The centre is polygonal. We consider this also to be a marine diatom.

4th. *Trochostoma (Molpadia) oolitica*. This is a rare "Holothurian." Our specimen is the only one we have seen except in figures. It was caught in our harbor in 1873 by Captain C. D. Grant, of the brigantine Strickland, and presented to the Museum. I regarded it as a great curiosity and preserved it carefully in alcohol. When fresh it was of a lovely purple colour. This changed considerably in the alcohol. It has a circular mouth, a long neck, and an oval body with a short tail. Its length from the oval to the anal opening is $6\frac{1}{2}$ inches; the greatest girth is 6 inches.

When the naturalists of the U. S. Fish Commission were in

Halifax in 1877, Mr. Verrill identified it and labelled it *Molpadia oolitica*.

Danielssen and Koren, in *Holothurioidea* of the Norwegian North Atlantic Expedition, 1876-1878, include this Holothurian in their genus *Trochostoma*—Gr. *Trochos*, a wheel, and *Stoma*, a mouth, of which *Trochostoma Thomsoni* is the type.