On the Egg-cases of some Port Jackson Sharks.

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(Plate XII.)

The Cestracions are of special interest in consequence of the vast antiquity of the family. Not only are they allied to Plagiostomes the remains of which exist in Palæozoic formations, but in the person of a living genus they date backwards to the Chalk, where they were associated, as they now are in Port Jackson, with the ancient mollusc *Trigonia*.

Five living species are known: these are:—*Cestracion Philippi*, Schneider, *C. zebra*, Gray, *C. japonicus*, Maclay and Macleay, *C. francisci*, Girard, and *C. galeatus*, Günther. In one species only—the first named—has any description or figure of the egg-case been published *. The original illustrations, being doubtless drawn from dry and distorted examples, are not very good, and from these later figures have been copied with their consequent errors.

Few particulars have been recorded as to the situations in which the living egg is usually laid, and but little definite information supplied as to the object of its peculiar form. Possessing facilities not possible to many investigators, I have collected what information I could, and have also been able to describe the hitherto unrecorded egg-case of our second species, *C. galeatus*.

The living eggs of Port Jackson Sharks are most abundant in spring (August and September), but are to be obtained throughout the summer. Empty cases are cast up on the beaches at all seasons, more especially after stormy weather. They are as common on the shores of New South Wales as are the sea-purses, or egg-cases of Dog-fishes, on English shores.

Last September (1894), Mr. Cecil W. Darley brought to me a living egg. The case was unlike any I had previously seen; from each of the basal terminations proceeded a very long filament, similar to those attached to the egg-cases of Dog-fishes (*Scyllium*). On making inquiries I discovered that such a condition was but little known, and it was suggested to me that this

* *Cf.* Duméril, Hist. Nat. Poiss. pl. 8.

was the normal state, the tendrils being afterwards broken off. A practical test dispelled this idea, for while the object was fresh or moist they could not be detached by using even considerable force.

On comparing this case with others of the usual type, I perceived that the contour was different, and suspected that we had here the egg-case of *C. galeatus*. Prof. Haswell also possessed a similar example, which he kindly placed in my hands, telling me that he thought it might prove to be distinct from that of *C. Philippi*.

Having since examined several living eggs of both species, it was found that all the simple cases contained embryos of *C. Philippi*, and all the stringed ones those of *C. galeatus*. It may be further mentioned that an example of the former species, in a tank at the Bondi Aquarium, deposited an egg without tendrils, and having the broad spirals to be mentioned later.

It appears that the eggs of *C. Philippi* are found in moderately shallow water, wedged in among rocks; whether they are actually dropped into the crevices we do not at present know; it is more probable that they are deposited on the sand at the bases of the rocks, into the fissures of which they are afterwards swept by the tide. They are so jammed crown outwards, that they can only be removed either by turning them round and withdrawing small end first, or by actually unscrewing them; both forces being most unlikely to occur under natural conditions. When empty they are somewhat more pliable, which may account for them then becoming loosened and cast ashore.

Although most rare upon the beaches, the eggs of *C. galeatus* prove to be not uncommon when sought for in their native habitat. Through the kindness of Messrs. Darley and Grimshaw, of the Harbour Department, I recently had the pleasure of searching for them fifty feet below the surface. Although not successful in obtaining specimens, I got an excellent idea of the general situation. In places immense masses of brown seaweed grow to the height of two or three feet so densely that scores of eggs may be securely concealed among them, protected by their likeness to seaweed in colour and texture. Mr. Cameron, the diver who kindly took me in charge, told me that he always finds the eggs in this weed, so attached by their long tendrils that it is scarcely possible to secure them whole, without cutting the

seaweed. In deep water they are freer from the violent disturbances, tending to detach them, to which the eggs of the more common species are subject.

The egg-cases of both species have the following points in common:—All parts are composed of a flexible horn-like substance of brown colour. The body consists of a chamber shaped like a pear; the coronal portion is compressed into a cervix through which the young Shark eventually escapes. From each side of this cervix, and integrally connected with it, arises a ribbon exactly resembling a strip of kelp. These ribbons are attached basally, their free edges turned towards the cervix and deflected considerably from the body. They pass round alternately and obliquely, and form the thread of a right-handed double screw, together making five or six turns to the base. These ribbons originate about half the width they quickly attain, and continue their course of even breadth, again narrowing on approaching the base.

The interior, as shown by a section, is wide and capacious; the fissure does not proceed to the base as is generally portrayed, but terminates some distance short of it; the inside is marked with oblique striæ corresponding with the direction of the spirals, and resembling the lines inside a vessel turned upon a potter's wheel.

The principal differences between the egg-cases of the two species may be thus recounted:—

C. Philippi, Pl. XII. figs. 1 & 2.—Of larger size; about six inches in length. The spirals are very broad and, in part, hide the body when viewed laterally; at the base they narrow quickly and terminate bluntly, and are not produced into tendrils. Beach-worn examples generally have the terminations more or less frayed.

C. galeatus, Pl. XII. fig. 3.—Of smaller size; about four inches and a half in length. The spirals are not very broad, and in no part hide the body completely; basally they become narrow and are produced into long flattened tendrils. In the most perfect specimen examined each tendril is ninety inches in length, and tapers to the slenderest thread, becoming tangled and knotted like a skein of silk. They are, however, very tough, and may be unravelled without fear of breaking. One of the tendrils terminates in a thickened tag (shown in the figure), which, although

doubtless an individual peculiarity, indicates that the tendrils are entire.

The appendages with which the eggs of Sharks are furnished serve to moor them in some suitable situation, otherwise they would be liable to be knocked about to the detriment of the contained embryo, or even washed ashore, where their destruction would be inevitable. The spiral appendages of *C. Philippi* are, as has been shown, no exception to the rule; the elastic flanges permit the egg to be forced further into a fissure, whence extraction is resisted by the free edges of the ribbon catching against the rock.

Although, in a lesser degree, the egg-case of *C. galeatus* possesses these spirals, they do not appear to have the same use; here attachment is effected by the entanglement of the tendrils among seaweed.

It may be of interest to inquire whether we are to regard the spirals or the tendrils as the primitive appendages. Seeing that *C. galeatus* possesses in its diminished spirals a useless appendage, it may be inferred that such spirals are a bequest from forms to whom they were serviceable. Also, since such a form as *C. Philippi* having larger and serviceable spirals lacks the tendrils, we infer that in *C. galeatus* the serviceable tendrils are a later development, and that the spirals, now rudimentary in function, are relics; so the feature in common between such an egg-case and those of the Dog-fishes appears to be a secondary and independently acquired character.

As before mentioned, very few theories have been advanced as to the advantage of the peculiar form of the Cestraciont's egg. An attractive explanation is offered by Mr. Grant Allen in one of his charmingly popular books *. His ingenious suggestion is as follows:—

"That well-known frequenter of Australian harbours, the Port Jackson Shark, lays a pear-shaped egg, with a sort of spiral staircase of leathery ridges winding round it outside, Chinese-pagoda wise, so that even if you bite it (I speak in the person of a predaceous fish) it eludes your teeth, and goes dodging off screw-fashion into the water beyond. There's no getting at this evasive body anywhere; when you think you have it, it

* 'Science in Arcady,' p. 169.

The underside of the abdomen I have not been able, in the single specimen in question, to examine in detail. It is, however, possible, by turning back the last pair of oostegites, to see the end of the thoracic sternites, here soft, with a little chitinous matter and a marked conical central papilla (Pl. XIV. fig. 9).

Behind this the thoraco-abdominal suture is evident, and the bases of the *first pair of abdominal appendages* are large and prominent.

The basal joint is bilobed, and bears the large curved plate which we have already noticed as overlapping the dorsal surface of the abdomen above and covering its ventral aspect. Its central region is more strongly calcified than the flexible membranous borders.

The inner angle of the basal segment bears also a true gill-plate lying over (ventral to) those of the succeeding four pairs of appendages, and resembling in form and structure the third lamella of appendages two to five.

The *typical abdominal appendage*, such as is found on segments two to five, has a short basal joint, moderately calcified and imperfectly subdivided, bearing three perfectly distinct lamellæ (Pl. XIV. fig. 10).

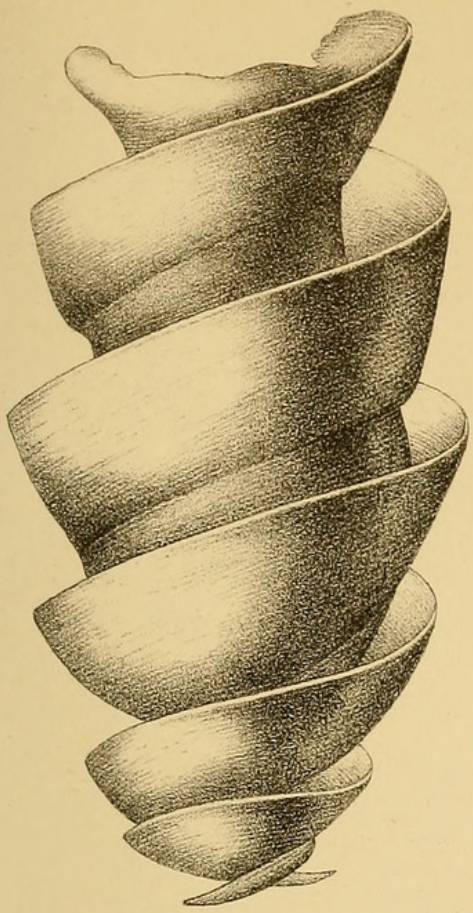
On the outside (ventral surface) is a delicate square plate attached to an outer calcification of the basal segment; it is very thin in texture, and the anastomosing blood-vessels are plainly visible.

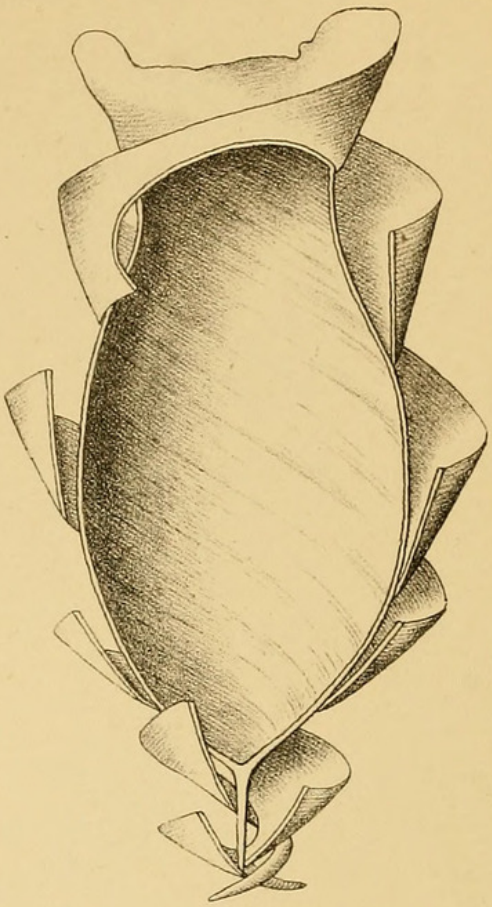
The middle or largest lamella is triangular in outline, and attached to the main portion of the basal joint: a glance at the dorsal surface shows, however, that it is not attached along the whole of the base, but only at a middle point in a deep sinus, so that its basal margin is markedly cordate.

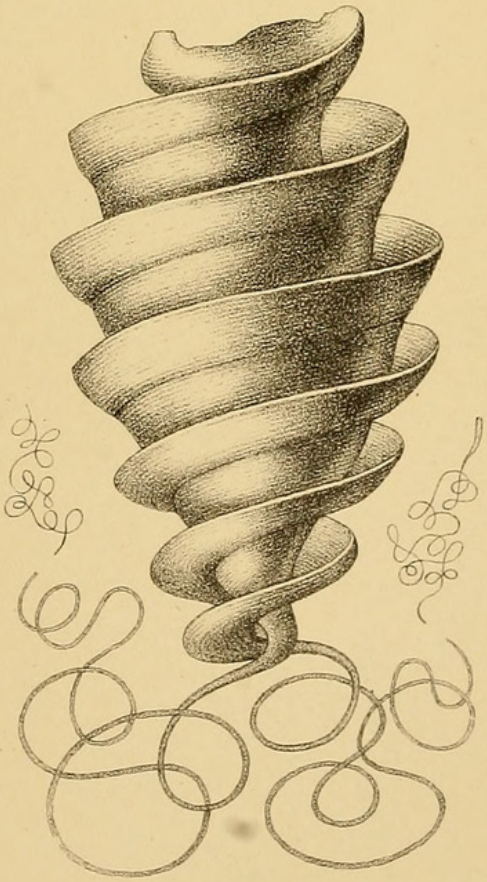
The third or smallest lamella is less than half the size of the last, of an oval shape, pointed at the distal end, and attached in the proximal region between two unequal forwardly extending lobes; so that it has the same cordate base as the middle lamella, but more irregular.

The third, fourth, and fifth abdominal appendages are all constructed on the type of the second, which I have chosen for description.

The sixth pair, which are so prominent in the larva, still retain the same structure—a basal joint with two flattened lamellæ. In the adult, however, the lamellæ are almost equal in size, narrow in proportion to their length, and devoid of setæ. The







E. Waite del.
A.R. Hammond lith.

Hanhart imp.

EGG CASES OF CESTRACION.

1. 2. C. PHILIPPI. Schneider. 3. C. GALEATUS, Günther.