

sometimes elliptical, no matter which of the two species we are examining.

If we then notice, as I have been able to do, what is the sex of the animal, we observe that all the individuals having the mouths of their shells broad and more or less rounded are males, and that those occupying the shells with ovoido-conical, that is to say laterally compressed, orifices are females.

It is true that between these two forms of orifice a few intermediate ones occur, but they generally approach the rounded shape and belong to young male individuals, or, at least, to those in which the copulatory organ is not very greatly developed. These differences in the shape of the orifice are due to the larger or smaller size of the spadix, which, situated on the right side of the buccal bulb, eventually equals the latter in bulk and requires a somewhat considerable space to contain it, while it even thrusts the bulb a little to the left. The presence of these two organs, placed side by side, thus gives to this portion of the body a breadth almost as great as that of the region situate on the level of the eyes.

In the female nothing of the kind takes place; the tips of all the tentacles can converge towards the same point without any difficulty, and this gives to the whole an elongate conical shape.

The last whorl of the *Nautilus* shell is consequently found to be more swollen in the males, while in the females it is more elliptical and has a slight tendency to be carinate; we may further add that the rim of the shell is a little more undulating in the females than in the males.

The appearance of the hood likewise varies according to the sex; it is necessary, however, to make allowance for the effects produced upon the tissues by the preservative fluids, and especially by the state of extension in which the animal was at the moment of being plunged into these fluids. If the animal was strongly retracted when it was placed in alcohol, its hood, instead of having a regular shape, is more or less twisted upon itself, in which case it is a matter of some difficulty to detect the sexual differences that may be exhibited by this portion of the body.

In the male the hood is broader, and, as Van der Hoeven very justly remarks, its breadth exceeds that of the female hood of equal length by nearly two centimetres; it follows from this condition that the lateral margins of the hood almost entirely conceal the eyes and the tentacles in the males, while in the opposite sex, since the hood is less extended transversely, the eyes, as well as the first pair, or sometimes the first two pairs, of tentacles, are quite uncovered. It may also be mentioned that in the females the margins of the hood are more sinuous and more incurvate at the level of the eyes.

As regards the mantle, which in the male, according to Van der Hoeven, is shorter and leaves the eyes almost uncovered, while according to the same author it extends higher up in the female, this organ did not exhibit these differences in the individuals that I

examined. If in some of these the mantle enveloped the pedal region to a smaller extent, this seemed to me to be entirely due to the bad condition of the visceral mass, which, pressing upon the bottom of the sac, caused the whole to recede from the pallial investment.

In the present note I pass over the sexual characters based upon the number, structure, and position of the tentacles, since it is my intention to deal with them shortly, and also because I would now insist only upon the characters that can be determined almost without the necessity of extracting the specimen from its shell.

These variations in the shape of the last whorl of the shell in *Nautilus macromphalus* and *N. pompilius* naturally lead us to inquire whether these indications could not be utilized in palæontology.

In the course of his investigations upon ammonites d'Orbigny put forward the theory, in 1841, that the variations in the size of the shell in these cephalopods, observed in the same species and among individuals of the same diameter, might be due to sexual differences; in his opinion the more swollen shells should belong to females.

This idea has been adopted by several naturalists, among whom I would mention especially P. Reynès. M. Douvillé likewise appears to entertain the same opinion.

M. Munier-Chalmas, the learned professor of the Sorbonne, while admitting the sexual dimorphism of the ammonites, which he regards as dibranchiate cephalopods allied to *Spirula*, does not entirely adopt d'Orbigny's point of view. To the differences in size he adds the presence in the males of jugal apophyses, which he considers to be wanting in the females. In an important note on "the possibility of admitting a sexual dimorphism in the ammonites," published in December 1892 in the 'Comptes rendus des séances de la Société géologique de France,' he shows that groups of ammonites may be considered as the males of other groups which would be the females (thus *Oecotraustes* would be the male of *Oppelia*, *Normanites* the male of *Cadomites*, &c.).

Without following this geologist into the study of the variations which he points out in a large number of types of Ammonitidæ, I would remark that, according to my observations upon ten specimens of *Nautilus* preserved in spirit, and also according to those made upon a very large number of shells belonging to the two most widely distributed species, *Nautilus pompilius* and *N. macromphalus*, the differences that are found to exist in the dimensions of the shell, although quite appreciable, are never very considerable, and that, as I have already stated, it is the shell of the male that, with an equal diameter, exhibits the larger size, contrary to that which, according to the geologists, is observed in the ammonites.

It would be of some interest to pursue investigations of this kind in the group of fossil Nautilidæ, in order to see whether in the shells of these cephalopods there do not exist variations in size sufficiently



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