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Some Observations on the Subject of Burrowing of Rocks by Urchins, in Response to the Observations of MM. Cailliaud and Lowry. A translation of *Quelques observations au sujet de la perforations des roches par les oursins, en réponse aux observations de MM Cailliaud et Lory*

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Translator’s note:

Deshaye’s comments contain some references to material that is not found in Lory’s communication. Its organization suggests it was provided to the Secretary after the session.

Gérard Paul Deshayes (May 13, 1795 – June 9, 1875) was a French geologist and conchologist born in Nancy. took the degree of *bachelier ès lettres* in Paris in 1821 to study natural history. He became a professor of natural history in the Muséum National d'Histoire Naturelle. He was known for his studies on the fossil molluscs of the Paris Basin. In 1839, he went to Algeria for the French government, and spent three years in explorations and collecting molluscs.

Gérard Paul Deshayes

M. Cailliaud just sent the Society a specimen of ferruginous sandstone with demi-spherical holes, close together and unequal, in each of which is found an individual *Echinus lividus.*

According to this observer and several others who have visited either the coasts of Britanny or those in the environs of Biarritz, there are very large surfaces excavated in the same why in rocks of different nature and even in soft granite, according to the recent observations of our scholarly colleague, M. Lory.

These excavations, comparable in general to those of a template, are for the most part inhabited by *Echinus lividus* and nearly always the size of the urchin is proportional to the hole in which it lodges.

These circumstances have led MM. Cailliaud, Lory and other naturalists to think that these holes inhabited by the urchins were excavated by these animals.

We cannot share this opinion at this time. For us to accept it, it would be necessary that they support it by direct and complete observations of the manner by which the urchin can attack a strong rock and excavate a fairly deep cavity to live there. Until the requested observation is made, we have more than one objection to present against the opinion that we have just raised.

If *Echinus lividus* on the coasts of Brittany and the environs of Biarritz, as M. Boubée observes, live in regular holes in the rock, elsewhere it lives in a different way. Thus, in the Mediterranean, where this species is abundant, no observers have mentioned facts similar to those reported by MM. Cailliaud and Lory. Moreover, it is that the observations made by M. Mather and ourselves prove that in this sea the species in questions lives in crevices, in natural cavities in the rocks and hidden among the marine plants. Especially on the coasts of Algeria that we have explored, we have never seen burrowing as reported by M. Cailliaud. And rocks of all kinds and hardness go into the sea. Moreover, when we have observed the way of life of *Echinus*, we do not understand how and why it excavates a hole that, once abandoned, could not be found again by the individual that dug it.

We have observed the urchins at Calle, Bone, Cherchel, Arzew, Oran, etc, in different conditions, sometimes in small basins uncovered momentarily, sometimes in quiet bottoms, in small bays or shallow crevices, sometimes finally on shores in calm weather. We have always seen these animals attached to solid surfaces by their long, suckered pedicels, moving in all directions, most often with the mouth turned toward the solid surface that supports them as they move, nonchalantly and indifferently, sometimes on one side, sometimes on the other, stopping if they find something appropriate to eat. At the least movement of the water, the urchin stops searching and hides. If we can follow it in the crevices, in the rocky hollows, where sometimes numerous individuals accumulate, we see them quickly flee in all directions and, once escaped from the hand, we have difficulty in catching them.

This continuous movement that we have seen in *Echinus lividus* and other species of the same genus is scarcely similar to what we see on the coasts of Brittany, where it necessary for these animals to remain for a very long time in the same place to dig the hole where they live. And, however we conceive it, movement is more necessary than rest to an animal that feeds on debris of all kinds on all sides, as we see easily when we open their stomach and intestine. If the urchin has periods of rest, it is probably during spawning or growth.

The facts that we just reported lead us to believe that the holes excavated on the coasts of Brittany are not the work of *Echinus lividus*. In fact, there is no example of individuals of the same species that have different behaviors from one sea to another, from one place to another. The

organization of an animal implies its way of life. It is not up to it to have an act as important as excavating a place of habitation or not. All individuals of the same species would have the ability to burrow everywhere they are. True burrowing animals are everywhere the same, regardless of the class to which they belong. There are burrowing sponges, annelids, and mollusks. Everywhere the same species act and burrow in the same manner in the Ocean as in the Mediterranean. If *Echinus lividus* had itself the ability to burrow, it could not live without exercising this function. Moreover, this function is completely individual. It begins when the animal is born; it ends when it dies. The work of one is nearly never beneficial to another, while according to MM. Cailliaud and Lory, an individual urchin begins a hole that, soon abandoned by it would be continued and enlarged by a succession of individuals that would come to remain for some time. All this seems to us outside the laws that subordinate the acts of animals to their organization. Before accepting it, it is prudent to wait for more complete and conclusive observations.

We have yet to examine this important question. What are, in urchins, the instruments with which they cold excavate solid rock?

The urchin has a test on the surface of which are numerous calcareous spines that are not very solid. From the ambulacral pores, the animal protrudes long, slender pedicels that end in a small sucker. These pedicels have the size of a needle or a large hair. Finally, the animal has at the center a mouth armed with five teeth solidly enclosed in a bony apparatus formed of five similar parts, articulating with the test and having powerful muscles. These are the only parts with which the urchin could act on external bodies.

Some persons have suggested that the urchin digs with its spines. In this case, the spines of the base would be either broken, or abraded, or at least blunt. We see them however in the best state of preservation in individuals found in the holes. Moreover, how could these spines dig a solid rock with their slow and weak movements? It would be necessary for the animal to have a movement of rotation and abrasion. And for that, it would necessary to have a force of adherence to the underly body. They lack this force.

A scholarly academician, in presenting to the Institute an excavated rock with urchins in the holes, suggests that the rock is excavated by the suckers of the pedicel. These organs, in attaching to the rocks, would remove particles from it, grain by grain. How can we believe that these suckers, scarcely as large as the head of a pin could tear away the grains of strong sandstone, or even soft granite, or of a compact calcareous rock? We thus presume that it is not the agent the animal uses to attack the rock.

There remains the jaw.

As it is constituted, the jaw could surely serve to scrape the stone to remove particles. This could be done all the better because the teeth have the property of quick and indeterminate growth. But there are several objections. First, if the animal gnaws the rock with the teeth, it can do it only very slowly, the movements of the jaws being naturally slow and of a weak extent. It would thus be necessary to spend all its life scraping the rock. The observations that we have reported above demonstrate this is not the case. Finally, it happens that there are a fairly large number of holes occupied by urchins whose surface is completely or in large part covered with calcareous crusts that attach to all underwater bodies. These crusts are intact beneath the urchins and irrevocably show that the individual presently in the hole has not attacked them. Otherwise the crusts would show traces. It is still necessary to add that if the urchin burrows, and if in order to burrow it remains a long time in the same hole, its presence alone is sufficient to prevent the crust from growing and from covering the surface of its hole. Finally, in order to excavate a demi-spherical hole with its jaw, the *Echinus lividus* would have to move over the entire surface of its hole because

its jaw, being at the center of a convex surface can make only a shallow depression of a concave surface. To enlarge its hole regularly, it is thus necessary that the animal must act on the whole surface. In this case, it seems to us that the hole would have a slightly different geometrical form. We repeat again, the crust we just talked about could not have been produced.

The specimens of sandstone, granite, and limestone, excavated with holes in which urchins have been found, are not for us sufficient proof that the urchins have the capacity to produce the holes:

1° Because individuals of the same species in the Ocean and in the Mediterranean do not have the same capacity.

2° Because if nature had organized this urchin to be a burrower, it would be a burrower everywhere and always.

3° Because the urchin does not appear to have instruments appropriate for excavating solid rock.

4° Finally, because, if the urchins burrow, the holes where it is found would not be covered in part or completely with an accidental crust.