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A new forma of the species *Clio pyramidata* Linnaeus, 1767
and a new resting-stage of *Clio pyramidata* Linnaeus, 1767
forma *sulcata* (Pfeffer, 1879) (Gastropoda, Pteropoda)*

by

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Several species in the genus *Clio* LINNAEUS, 1767 are considered by the author as forms of one polytypic species *Clio pyramidata* LINNAEUS, 1767 (VAN DER SPOEL, 1962). The following forms belong to this polytypic species:

- | | | | |
|---|---------------------------------------|-------|----------------------------------|
| 1 | <i>Clio pyramidata</i> LINNAEUS, 1767 | forma | <i>pyramidata</i> LINNAEUS, 1767 |
| 2 | " | " | " |
| 3 | " | " | " |
| 4 | " | " | " |
| 5 | " | " | " |
| 6 | " | " | " |
| 7 | " | " | " |
- 2 " " " " " *convexa* (BOAS, 1886)
3 " " " " " *lanceolata* (LESUEUR, 1813)
4 " " " " " *martensii* (PFEFFER, 1880)
5 " " " " " *excisa* n. forma
6 " " " " " *sulcata* (PFEFFER, 1879)
7 " " " " " *antarctica* (DALL, 1908)

Since most of these forms (1, 4, 6 and 7) are always accepted as species it is very well possible that the new form described in this paper will be considered by some scientists as a new species too. However, it is better that, until more is known about this group of animals, forma should be used.

The new form was found in a collection of Pteropods, which were studied by J. J. TESCH shortly before his death in 1954. The spirit specimens of the new form were labelled "*Euclio excisa*". From this label, with the new name *excisa*, it may be concluded that TESCH was of the opinion that the specimens in the sample represent a new species. The full text on the label was:

"57°31'S 02°56' W
27/28 XII 1947
A 804 *Euclio excisa*"

Since no published or unpublished description, by TESCH, is available, and no one else has described the form mentioned it will be done below.

The characters of the new forma *excisa* completely agree with those of the

*) Received March 21, 1963.

polytypic species *Clio pyramidata* as given below. The embryonic shell is almost identical in all the forms. The cross-section through the shell becomes more and more triangular towards the aperture. A longitudinal swelling on the ventral side of the shell and some longitudinal ridges on the dorsal side are always present. The swellings appear only at some distance from the apex. The lateral ridges of the ventral side are almost lacking near the apex. The lateral ridges never end in free processes as in *Clio cuspidata* (Bosc, 1802). The maximum width of the shell, in all the forms, is always found at the aperture. The shell is straight and never curved in all the forms. The forms pass into one another gradually. When full-grown, only the forma *antarctica* is recognizable without difficulty. However, in this form the shape of the cross-section is also very variable. The anatomy of the animals belonging to this polytypic species too is much the same.

The forms most closely related to the new forma are *sulcata*, *convexa* and *martensii*. This relation is based on the shape of the shell. The forms *sulcata* and *convexa* are in all probability closely related, whereas the form *martensii* is closely related to the form *antarctica* (cf. VAN DER SPOEL, 1962¹⁾). The two first mentioned forms belong to another group in the polytypic species than the two last mentioned. As the new form shows no affinity to the form *antarctica* it is presumably correct to consider the new form as belonging to the group of *sulcata* and *convexa*. The resemblance in shape between the form *martensii* and the new form may be explained by the fact that both of them live in the same area. The temperature, for example, and through this the viscosity of the water in which the animals live, may have led to this parallel development.

DIAGNOSIS: the course of the lateral ridges of the ventral side of the shell in the new form is concave near the embryonic shell, convex in the central part and finally straight, parallel with the axis of the body. The caudal part of the shell of the form *martensii* somewhat resembles that of the new form, but the lateral ridges of the ventral side are never parallel with the axis of the body. These lateral ridges are somewhat more developed than in the other forms and likewise the swelling on the ventral side is more pronounced. The four ridges on each dorso-lateral level are also more developed. These characteristics render the shell of the new form broader and stronger than those of the other forms discussed. Except for the shape of the lateral ridges and the development of the sculpture no striking differences exist between the shell of the new form and those of the other forms in the polytypic species.

From the holotype (Fig. 1) the broad appearance of the adult shell is clearly visible; the embryonic shell (Fig. 1 C) is similar to that of the other forms in the species *Clio pyramidata*.

When comparing the anatomy of the new form and the form *sulcata* a difference in the pallial gland is seen, corresponding to the difference in

¹⁾ In this paper the following correction should be made: pag. 191, line 3, for: "expedition at 24°00' N 35' W" read: "expedition at 24°00' N 20°35' W".

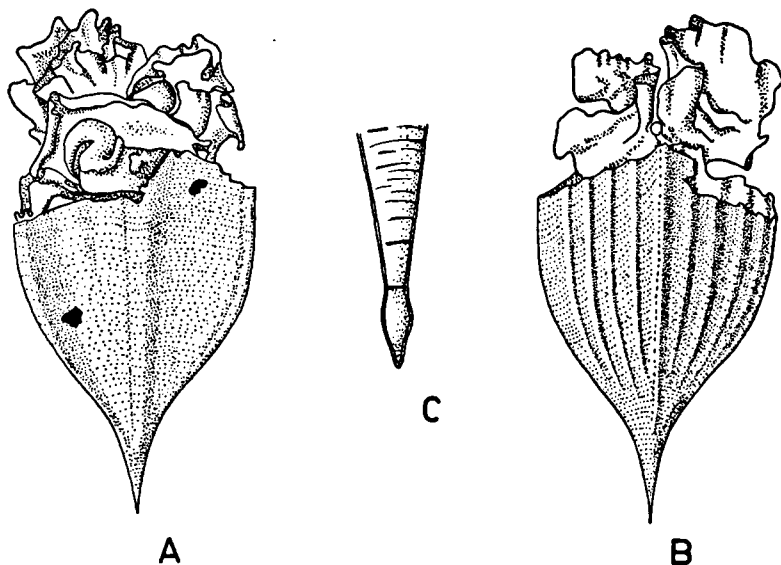
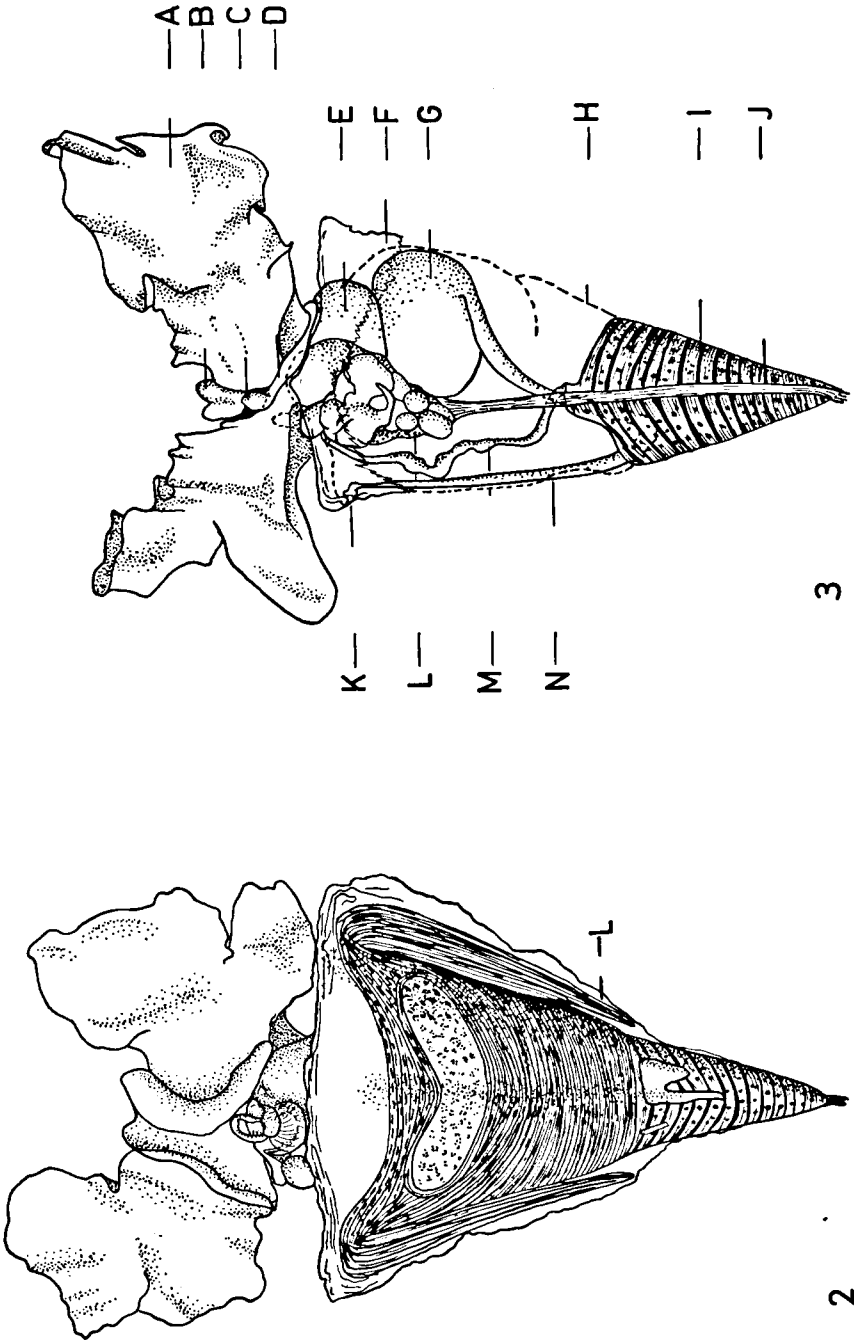


FIG. 1. A *Clio pyramidata* LINNAEUS, 1767 forma *excisa* n.forma. Holotype, ventral view. Length of shell 18.5 mm.
B Same specimen, dorsal view.
C Embryonic shell of the same specimen, more enlarged.

shape of the shell. As no sufficient data are available on the anatomy of the forms *martensii* and *convexa* it was not possible to include these in the discussion here. In the form *sulcata* the pallial gland is trapezoid in shape, while in the new form two lobes are attached to the two upper corners of the trapezoid shaped gland (Fig. 2). These two lobes fill up the space between the ventral and dorsal shell parts where the lateral ridges bend outwards. The pallial gland is composed of four bands and the two lobes are connected with the anterior and most caudal one.

When the liver is removed (Fig. 3) it appears that the gonad and the gonadoduct are of the same shape in the new form and the form *sulcata* (cf. MASSY, 1920). The alimentary duct, the gizzard and the copulatory organ have the same shape and course as in the forma *sulcata*. MASSY (1920) gave a description and figures (3, a, b and c) of the anatomy of *sulcata*. In figure c the copulatory organ is depicted and indicated with "o", in the text it is said that "o" are the ova. In my opinion the latter is not quite correct as the ova, when present, are in a much looser contact with the animal than the organ indicated with "o" by MASSY. Moreover, it is quite clear that it is not spherical bodies which are shown but rather a coiled tube. In all probability the tube is the copulatory organ, and if this is correct it is clear that no difference exist in the copulatory organs of the form *sulcata* and the new form. From the dorsal and ventral views of the copulatory organ (Fig. 4 A and 4 C) it is evident that it is a coiled tube and



not ova. The organ (Fig. 4 A) is lying near the accessory gland, where the columellar muscle bifurcates into the branches of the wings. When both the copulatory organ and the columellar muscle are removed the esophagus with the central nervous system becomes visible (Fig. 4 B). The central nervous system (Fig. 4 D) shows only a small difference in shape with, for example, that of the form *pyramidata*; this difference is, however, not a striking one. The pedal ganglia, the buccal ganglia, the statocysts and the nerves attached to this central nervous system are the same as in the form *pyramidata*. The esophagus, the gizzard, and the teeth in the gizzard, the mantle and the form of the wings and the lips surrounding the mouth are the same as those in the form *sulcata*.

Therefore it seems evident that the new form belongs to the polytypic species *Clio pyramidata*, and that the new form is not an aberrant stage of one of the other forms in the species.

In the Table I some measurements are given dealing with the holotype and paratypes of the new forma *excisa*.

Table I.

	Length of the shell	Width of the shell	Length of the body
Holotype	18,5 mm	10,0 mm	23,5 mm
Paratypes			
Smallest	17,0 mm	9,0 mm	19,0 mm
Largest	20,0 mm	11,0 mm	24,0 mm
Average	17,4 mm	9,2 mm	21,1 mm

The colour of all the specimens preserved in spirit is brownish-red. Some paratypes have the typical strong and broad shell and there are some which have a greater resemblance to the form *sulcata*. The last mentioned ones have the lateral ridges of the ventral side not parallel to the axis of the body near the aperture.

The holotype as well as the twenty-six paratypes are preserved in the Rijksmuseum van Natuurlijke Historie at Leiden.

In the same sample in which the new forma *excisa* was found some

FIG. 2. *Clio pyramidata* LINNAEUS, 1767 forma *excisa* n.forma.

Paratype (now dessected), without shell, ventral view.

Length from caudal top to wing tips 19 mm.

L Lateral lobes of the pallial gland.

FIG. 3. Same specimen as in previous figure; shell, mantle and liver removed. Dorsal view.

A wings

B posterior footlobe

C cephalic lobe

D seminal groove

E accessory gland

F fragments of the mantle

G gizzard

H original outline of the liver

I gonad

J musculus columellaris

K anus

L copulatory organ

M gonadoduct

N intestine

specimens of the form *sulcata*, were present. Of these, three are in an aberrant stage. In a previous paper (VAN DER SPOEL, 1962) the resting-stage of the forms *antarctica* and *lanceolata* are described, and also an intermediate-stage of the form *sulcata*. The latter is rather well developed and shows two wings, a posterior footlobe and a mantle. In a real resting-stage only two lobes at the lateral sides and two at the anterior end of the body are seen. The first two are the still undeveloped wings, the latter two are filled with reserve food; they disappear when the animal is in the normal stage again.

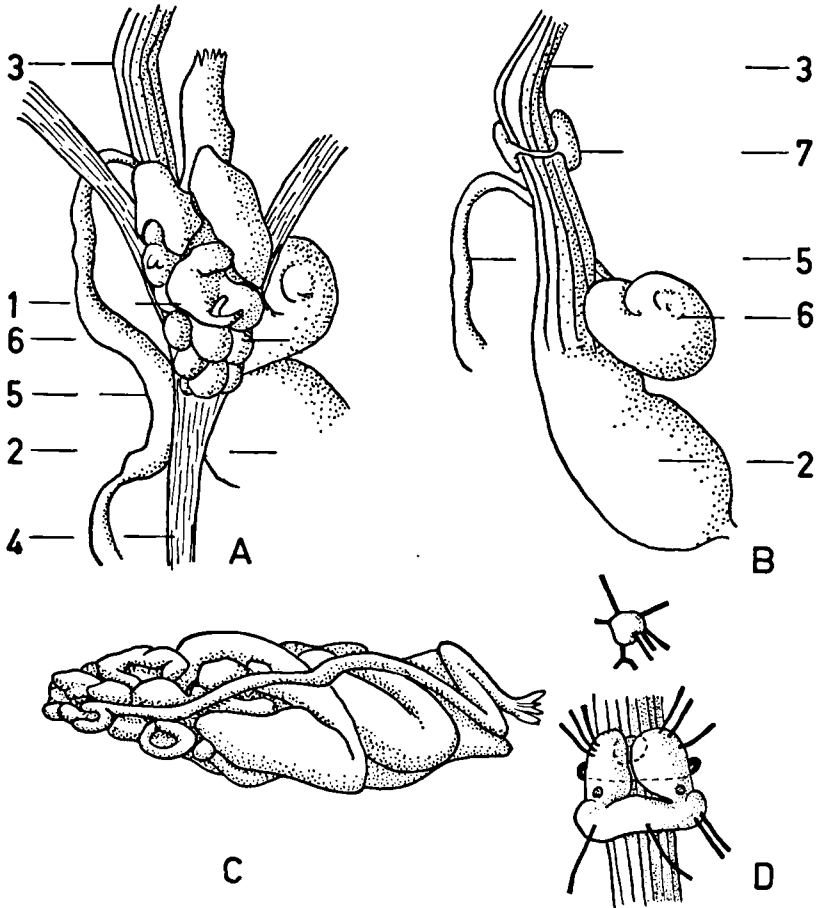


FIG. 4. A Copulatory organ of animal in previous figure, dorsal view.
1 copulatory organ 4 musculus columellaris
2 gizzard 5 gonaduct
3 esophagus 6 accessory gland
B Gizzard and esophagus of same animal, dorsal view. Explanation of figures
the same as in A.
7 central nervous system
C Copulatory organ of same animal, ventral view.
D Central nervous system of same animal, ventral view.

No other organs are seen at the surface of the body. In the resting-stage of the form *antarctica* the dorsal side of the body was in contact with the *dorsal* side of the shell (VAN DER SPOEL, 1962), whereas the dorsal side of the body was in contact with the *ventral* side of the shell in the resting-stage, of the form *lanceolata*.

Two of the aberrant animals are in a resting-stage completely comparable with the resting-stage of the form *lanceolata*. The two lobes at the anterior end of the bodies, both flattened out in dorso-lateral direction are present. In each animal the two still undeveloped wings are seen at the right and the left side of the body, they are bent and in contact with the ventral side of the body. From the situation of the wings and the fact that the smallest cranial lobe is at the left when the shell is seen in dorsal view, it is clear that the ventral side of the body is in contact with the dorsal side of the shell. The same arrangement is found in the form *lanceolata*. The surface of the body is as bulbous as that of the aberrant forms described in the previous paper and so it may be concluded that a great store of reserve food must be present, as the bulbous surface is caused by large cells with reserve food under the skin. The organs normally present in the full grown animal e.g. the mantle, the heart, the anus and the mouth are not yet developed.

The length of these two animals was 13,5 resp. 11,0 mm after fixation and the length of the shells was 20,0 resp. 16,0 mm. The relation of the length of the body and the shell in these animals demonstrates that they were more developed and specialized before the resting-stage transformed the specimens. The great store of reserve food also indicates that the resting-stage has not developed directly from the egg.

The only difference between the aberrant animals described previously and the animals in the present sample (Fig. 5 C) is that the wings are not equally developed in the last ones.

The third aberrant animal in this sample is in an intermediate-stage between the resting-stage and the full grown form. It should be noticed that this animal is not as far developed as the one of the form *sulcata* (VAN DER SPOEL, 1962). The animal in the present sample is completely surrounded by its wings which are folded in several directions. When the wings are bent to the left and the right side of the body (Fig. 5 A) the top of the body is seen as a large round part with a bulbous surface. The two lobes at the anterior end of the body are damaged and almost invisible. In the centre of the body a lobe protrudes from the surface, between the wings in a caudal direction. This lobe probably represents an, as yet, undeveloped posterior footlobe. Ventrally to this lobe, and in the median line, a fold is seen which may be the beginning of the mantle. The columellar muscle, as in all the aberrant animals, is seen at the caudal end of the body. The animal is certainly an intermediate-stage between the resting-stage and the full grown form. The store of reserve food is still present in the rounded anterior end of the body, as is seen from its bulbous surface. The wings are not only larger than those of a real resting-stage and more folded (Fig. 4 B) but also thicker. The embryonic shells of the three aberrant animals are identical with those of the form *sulcata*.

The length of the third aberrant animal is 11,5 mm after fixation; the shell is too much damaged to give its length.

All the material described in this paper was collected by Dr. W. VERVOORT on his cruise with the MS "Willem Barendsz".

The author is very grateful to Dr. C. O. VAN REGTEREN ALTENA for

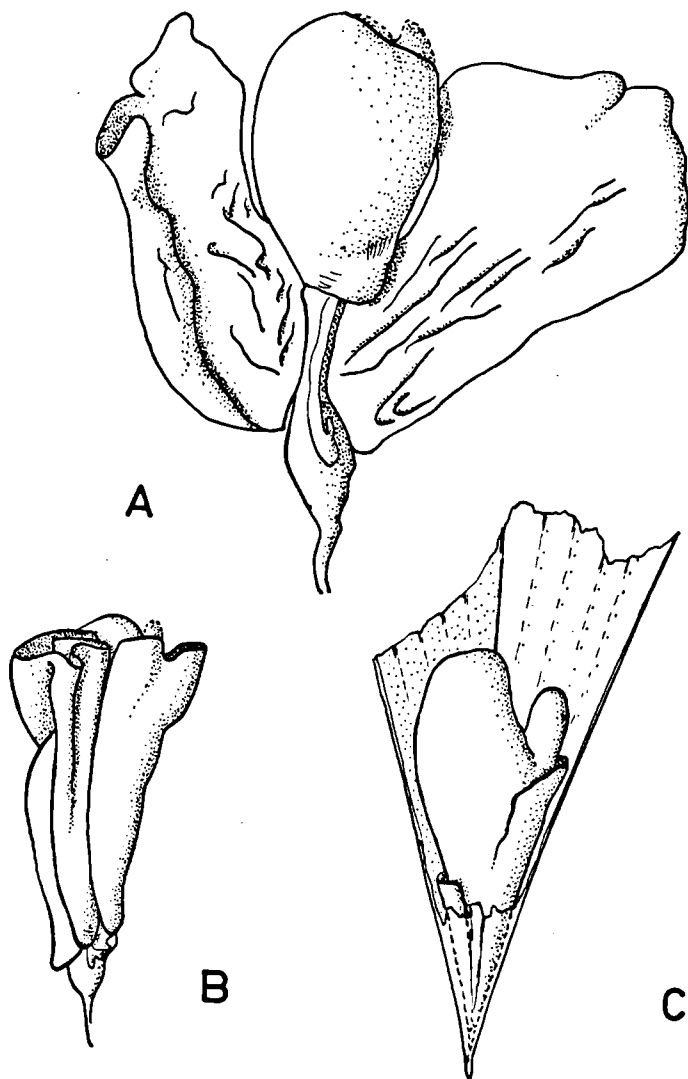


FIG. 5. A *Clio pyramidata* LINNAEUS, 1767 forma *sulcata* (PFEFFER, 1879) in an intermediate-stage, without shell, with wings turned sideways. Length of body 11,5 mm.

B Same animal with wings in original position, ventral view without shell.

C *Clio pyramidata* LINNAEUS, 1767 forma *sulcata* (PFEFFER, 1879) in a resting-stage, ventral view. Length of shell 20 mm.

permitting him to study the specimens of the Rijksmuseum van Natuurlijke Historie at Leiden. My thanks are due to Mrs W. S. S. VAN DER FEEN-VAN BENTHEM JUTTING for critically reading the manuscript and to Dr. H. VAN DER SCHALIE for kindly correcting the translation.

SUMMARY

A new form is described in the polytypic species *Clio pyramidata* LINNAEUS, 1767. This new forma *excisa* was found at 57°31' S 02°56' W and it is related to the forms *convexa* (BOAS, 1886) and *sulcata* (PFEFFER, 1879). The shape of the shell of the new form *excisa* shows a great resemblance to the shape of the shell of these two forms and also a resemblance is present to the shape of the shell of the form *martensii* (PFEFFER, 1880). This resemblance, however, may indicate a relationship as well as a parallel development. The new forma and the form *martensii* live in the same area, so that the chemo-physical characteristics of the water may have caused a parallel development. As indicated in a previous paper, the polytypic species *Clio pyramidata* consists of several forms which can be divided into two groups, one with the form *antarctica*. (DALL, 1908) as the most southern form and the other one with the form *sulcata* as the most southern one. As the new form shows a relation in shape with the forms *sulcata*, *convexa* and *martensii* and not with the form *antarctica*, it seems correct to suppose that the new form *excisa* belongs to the same group in the polytypic species in which the forms *sulcata* and *convexa* are placed.

In the same sample some specimens of the forma *sulcata* were present, and among these, two were in a resting-stage and one in an intermediate-stage. A real resting-stage in the forma *sulcata* was never found before.

RÉSUMÉ

Une forma nouvelle de l'espèce polytypoïde *Clio pyramidata* LINNAEUS, 1767 est décrite. Cette nouvelle forma *excisa* a été récoltée à 57°31' S 02°56' O. Il y a de la ressemblance entre les formes *convexa* (BOAS, 1886) et *sulcata* (PFEFFER, 1879) et la nouvelle forma. La forme de la coquille de la forma *excisa* ressemble beaucoup à celle de ces deux formes et aussi à celle de la forma *martensii* (PFEFFER, 1880). Cette ressemblance avec *martensii* s'est réalisée peut-être soit par un développement parallèle soit par une parenté. La forma nouvelle et la forma *martensii* furent trouvées dans le même lieu. On se demande si les qualités chimico-physiques de l'eau puissent avoir causé un développement parallèle. Dans une publication antérieure j'ai déjà démontré que l'espèce polytypoïde *Clio pyramidata* se compose de plusieurs formes qu'on peut diviser en deux groupes, un dont la forma *sulcata* vit le plus au sud et l'autre dont la forma *antarctica* (DALL, 1908) se trouve le plus au sud. Il n'y a aucune ressemblance entre la nouvelle forma et la forma *antarctica*, bien qu'il y en ait avec les formes *sulcata*, *convexa* et *martensii*; ainsi il me semble juste de supposer que la nouvelle forma appartient au groupe des formes *sulcata* et *convexa*.

Dans le même coup de filet dans lequel la nouvelle forma fut trouvée,

quelques spécimens de la forma *sulcata* étaient présents. Parmi ceux-ci deux animaux furent trouvés dans une phase de repos et un dans un état intermédiaire entre une phase de repos et une phase adulte et active. Auparavant une vraie phase de repos n'a jamais été trouvée de la forma *sulcata*.

LITERATURE

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