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CLIO PIATKOWSKII, A MESOPELAGIC PTEROPOD NEW TO SCIENCE (GASTROPODA, OPISTHOBRANCHIA)

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ABSTRACT

A pteropod species new to science: *Clio piatkowskii* is described from benthopelagic samples taken in high Antarctic waters of the Weddell Sea. Comparisons with related species are made and its taxonomic place in the genus Clio is discussed.

RÉSUMÉ

Une espèce de ptéropode nouvelle pour la science: *Clio piatkowskii* est décrite apartir d'échantillons benthopélagiques prélevés dans les eaux des hautes latitudes de la Mer de Weddell. Des comparaisons sont faites avec des espèces apparentées, et la place de la nouvelle espèce dans le genre Clio est discutée.

KEY WORDS: Gastropoda, Pteropoda, *Clio*, taxonomy, plankton, Antarctica

INTRODUCTION

The discovery of a thecosomatous pteropod species new to science was not expected as this macrozooplankton group is frequently collected and intensively studied from both plankton and sediment samples all over the world. However, the deep waters of the antarctic Weddell Sea are mostly covered by ice, and infrequently sampled for macrozooplankton with adequate gear, thus they can still harbour unknown species. For the Thecosomata this proved to be the case as during the EPOS cruise (PS Ant.VII/4; EPOS Leg III) (Arntz et al., 1990) of the Alfred-Wegener-Institute, a hitherto unknown species was collected. Though at first sight the specimens seemed to represent *Clio recurva* (Childern, 1823), closer investigation proved that they are completely different from this and all other *Clio* species. The newly described species may be an endemic Antarctic species.

MATERIAL

The material was collected off Caird Coast in

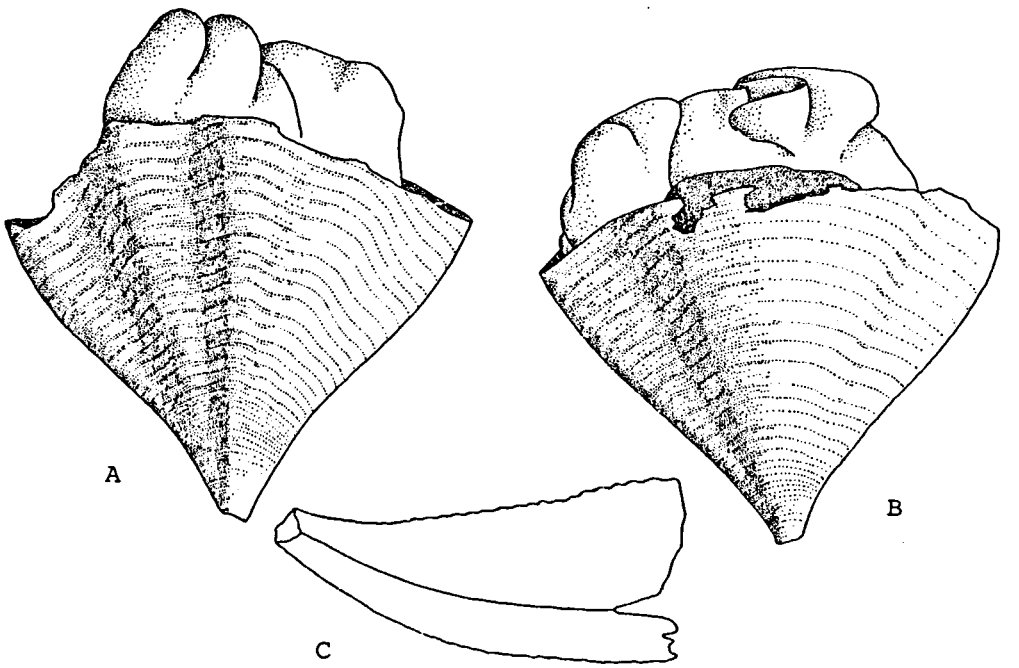

Fig.1. Holotype of *Clio piatkowskii* nov.spec.; A: dorsal view, B: ventral view, C:diagram of the lateral profile.

the eastern Weddell Sea, which is frequently covered by ice. One specimen was found in a RMT8 catch (mesh size 4.5 mm) from 1000-600 m depth; bottom-depth was 1200 m. A second specimen was collected with a Bentho-Pelagic trawl (mouth opening 20 x 25 m, mesh size 10 mm) at 666-690 m depth; bottom-depth was 700 m. The specimens were preserved in 4% formalin, one specimen was sectioned for a histological study. The material is stored in the collections of the Institute of Taxonomic Zoology, University of Amsterdam.

By chance, we came across a photographic slide of the species here described made by Dr. H. P. Marschall some years ago. It was collected in the Weddell Sea, the exact locality data for this third, not preserved, specimen are unknown.

TAXONOMY

The two specimens at our disposal belong to a species new to science for which the name *Clio piatkowskii* is proposed. The holotype is from a RMT8 sample, typical for a mesopelagic fauna as shown by the "presence of *Bathylagus* (Salmonoidei), *Atolla* (Medusae), and *Cyphocaris* (Amphipoda)" (pers. comm. Piatowski).

Clio piatkowskii nov. spec.
(Fig. 1 a-b)

Description. - In the holotype, shell length is 13.5 mm, width is 16 mm; in the paratype, that lost its shell, the body width is 12 mm (16 mm including the wings) the length is 13 mm (21 mm including the wings); its shell would have been slightly larger than that of the holotype. The shell is opaque. The lateral sides are sharp, not provided with a gutter shaped groove as is found in *C. recurva*, but with small irregularities on the edge due to imbricate protrusions of growth lines. The lateral sides are strongly diverging, the

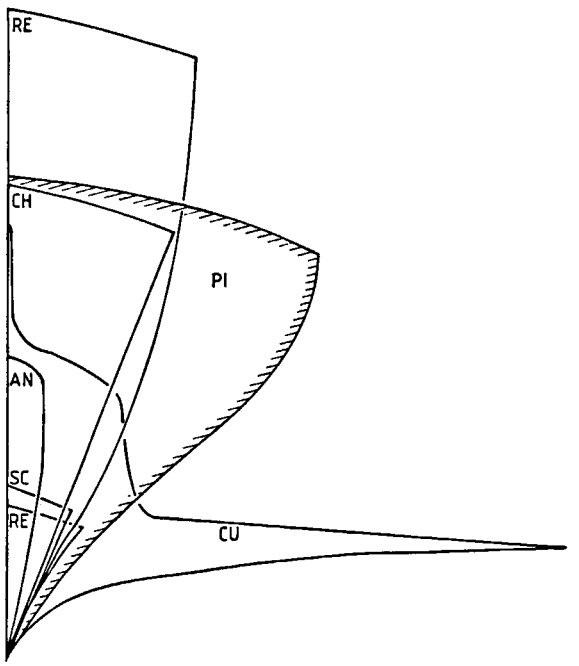

Fig.2. Diagram of shell shapes (left shell halves) of morphologically related species: *Clio pyramidata antarctica* (AN), *C. chaptali* (CH), *C. cuspidata* (CU), *C. piatkowskii* (PI), *C. recurva* in juvenile and adult stage (RE) and *C. scheelei* (SC).

top angle is about 70° which is more than in any other species of the genus *Clio* except for *C. cuspidata* (Bosc, 1802) (Fig. 2). The posterior part of the lateral sides is concave, in the photographed specimen the upper 20% of the lateral sides is straight, the anterior part is convex. Both ventral and dorsal sides show strong wave-like transversal striae, which are smaller and more narrowly spaced near the apex . The ventral side is slightly curved and provided with one central longitudinal rib. The curved dorsal side has three such ribs. The embryonic shell is unknown, as it was broken off. The transverse section through the shell is narrow, oval, and slightly asymmetrical as the dorsal side is somewhat higher vaulted than the ventral one. The aperture rim is damaged but the dorsal side in intact shells do not project over the ventral side as deduced from the growth line pattern.

The soft parts have the characters of a deep-sea thecosome: fleshy wings and posterior footlobe, dark purple colour of footlobe and lips, brown hue over the wings, large dorsal tentacles of which the right one has a sheath. The size of the posterior footlobe is relatively small compared to other deep-sea Thecosomata. The mantle gland consists of two narrow bands of cuboid cells and two very broad bands of zigzag cells.

Being of nearly the same size both specimens can be considered to be adults as they contained many developing eggs and larvae in the accessory sexual gland (Fig. 3). The different developmental stages are kept separately in different folds mainly in the part named G2 by Van der Spoel (1967) of the accessory sexual gland. This may prove that ovoviviparity in this species is further developed than in *C. recurva* where the different stages are not separated by folds and found mixed in the gland fold. The small gonad contains ripe ova and sperm, consequently self-fertilisation is not impossible. It is evident that the succession of male phase and female phase, which are separate stages in most *Clio* species, is lost as both male and female products are present in equal quantities.

The whole muscle system is very strongly developed. The columellar muscle is much larger than in any other *Clio* species and the thick muscles in the wings (Fig. 4) suggest that the species is a good swimmer. The fact that the animal seems unable to retract completely in its relatively small shell and the long neck region (see Fig. 5) which keeps the wings almost free from the shell aperture, is also in favour of a strong swimming capacity. In the neck region at the wing base a strongly developed cartilaginous-like connective tissue is found providing the area with stiffness. Another point of interest with regard to the mobility of the specimens is the fact that the intestine and gizzard are filled with diatoms and a few foraminiferans suggesting that feeding took place near the surface in the upper 100 m of the water column. A daily migration over about 1000 m is thus supposed to occur.

The radula formula is 1-1-1, the teeth resemble those of *C. chaptali*. The size difference between

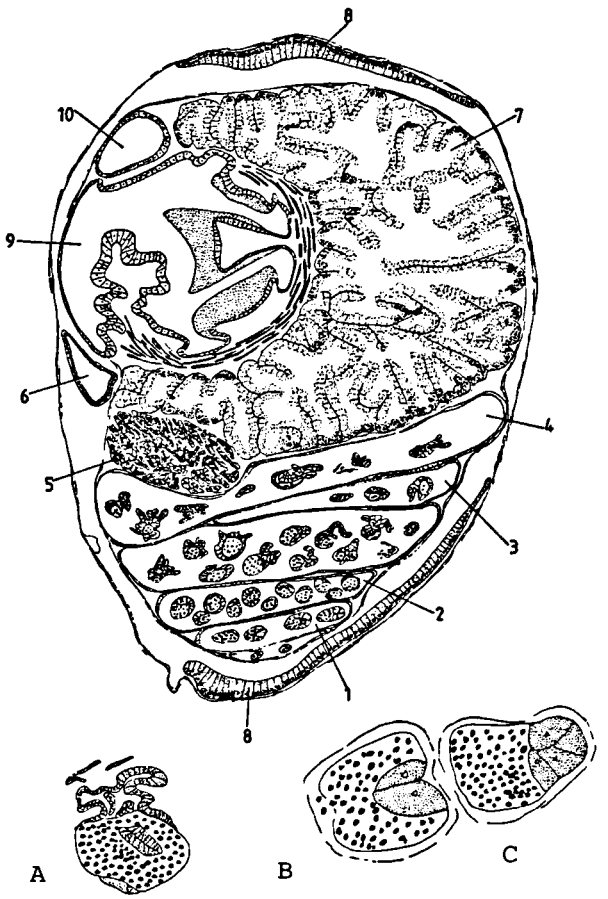

Fig.3. Diagrammatic representation of a histological cross-section through the middle part of the body showing the folds of the G2 of the accessory sexual gland filled with developing eggs and larvae; early blastula (B & C); a gastrula (A). 1: G2 fold with eggs and early blastula stages, 2: G2 fold with blastula stages, 3: G2 fold with gastrula stages, 4: G2 fold with larvae, 5: columellar muscle, 6: renal lumen, 7: liver, 8: mantle gland, 9: gizzard, 10: intestine.

the median and lateral teeth is greater in the latter, and not so extreme in the presently described species. The lateral plate is half as broad as the median one. The dentation on the median plate is somewhat stronger than in *C. chaptali* but this difference may be due to individual variation. As the radula was studied from histological slides no drawing or photograph can be provided.

Type locality: Weddell Sea: the holotype (ZMA 389028) was collected at PS ANT VII/4; Epos Leg III, St. 262, 10-2-1989, RMT(1+8); 600-1000 m depth, 74°31.1' S 29°20.3' W, bottom depth 1200 m; the paratype (ZMA. 389029) was collected at: PS ANT VII/4; Epos leg III, St. 260, 10-2-1989, B.P.Trawl; 666-690m depth, 74° 39.29' S 29°36.50' W, bottom depth 700 m.

Etymology. - The name is given in honour of the collector of this species, Dr. Uwe Piatkowski.

DISCUSSION

In figure 2 the shell contours of *Clio* species that have characters in common with the newly described species are given.

Clio piatkowskii differs from *C. polita* (Pelseneer,

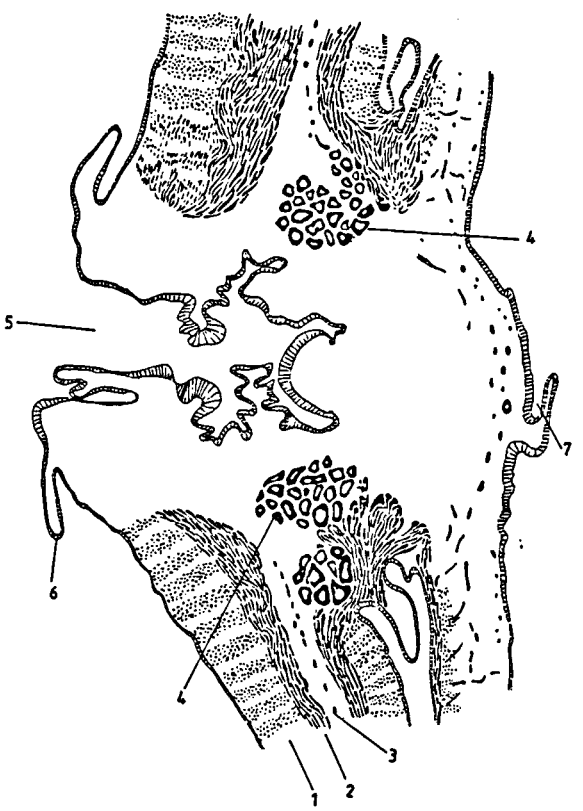

Fig.4. Diagrammatic histological cross-section through the neck region of the specimen showing the large muscles originating from the wings and the wing musculature.1: outer subectodermal wing muscle, 2: inner subectodermal wing muscle, 3: central wing muscle, 4: first branching of columellar muscle, 5: mouth, 6: lip, 7: seminal groove.

Table I. List of the species in the genus *Clio, Hyalocylis* and *Styliola* with discriminating characters.

Characters:	gutter shaped lateral sides	oval in cross section	half of lateral sides straight	wave-like striation	dorsally curved	swollen posterior footlobe	ovoviviparity
C. piatkowskii		x		x	x	x	x
C. recurva	x	x		x	x	x	x
C. orthotheca		x				x	
C. campylura		x	x		x	x	x
C. scheelei	x	x	x	x		x	
C. chaptali		x	x	x	x	x	x
C. polita		x	x		x	x	
C. cuspidata				x	x		
C. convexa	x		x				
C. p. fma antarctica			x	x			
C. p. fma lanceolata							
C. pyramidata s.l.			x				
Hyalocylis striata		x	x	x			
Styliola subula			x				

1888), *C. pyramidata* L., 1767, *C. orthotheca* (Tesch, 1948) and *C. campylura* (Tesch, 1948) in having wave-like transversal ribs. It differs from *C. recurva* and *C. scheelei* (Munthe, 1888) in having lateral sides without a groove. It differs from *C. cuspidata* in having no prolongations of the shell ribs and no triangular cross section. It differs from *C. chaptali* in having no entirely straight or slightly convex lateral sides, in being much broader (length/width ratio is about 0.8, it is 1.2 in *C. chaptali*) and in having a more simple structured mantle gland (cf. Tesch, 1946, 1948; Van der Spoel, 1967). The dark colour of wings and posterior footlobe found in the new species are not found in *C. chaptali* (cf. Tesch, 1948).

To divide the genus *Clio* into species groups is difficult. The species with wave-like transversal ribs, those with gutter shaped lateral sides and those with a triangular cross section through the shell seem to form separate groups but it is questionable whether any phylogenetic basis can be given to these groups. Development of the wave-like transversal ribs and gutter shaped lateral sides is an adapation giving the shell a greater rigidity. The strong supporting dorsal rib, giving the shell a triangular cross section, also contributes to shell rigidity. All shellcharacter-combinations are found in recent *Clio* species and some of the characters are also found in related genera as shown in Table I.

Ovoviviparity is found in *C. piatkowskii, C. chaptali, C. recurva* and *C. campylura* (cf. Tesch, 1946; 1947; Van der Spoel,1970) but it is not considered of phylogenetic importance as it occurs in different taxa as an adaptation to deep-sea life. The eggs are kept in the mantle or accessory gland where they develop into juveniles capable of active swimming. In different animal groups like Echinodermata, Fishes, Crustacea and Mollusca this ovoviviparity is considered a brood protecting mechanism in a realm of high predation pressure.

Though a resemblance of *C. piatkowskii* with *C. chaptali* is evident, morphological differences are obvious and the distribution of *C. chaptali* reaches only down to 20° S, with one exception of a sin-

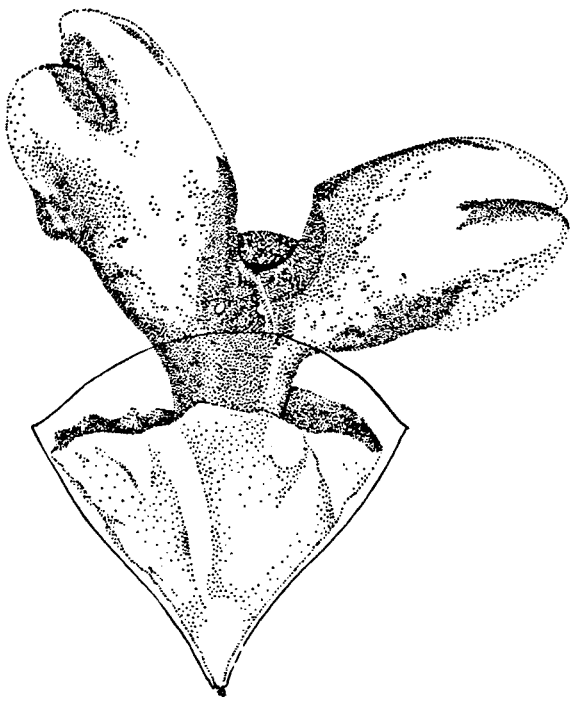

Fig.5. Living specimen, dorsal view, drawn after the photograph by H. P. Marschall. The shell is given only as contour.

gle record off Cape of Good Hope (Van der Spoel, 1967); so the present record is distinctly allopatric with the mentioned range. The record from 62°27' S 53°22' E of a "large *Clio*" (23 mm in length) given by Meisenheimer (1905) as *C. chaptali* may very well concern a record of *C. piatkowskii* as Meisenheimer is doubtful about the identification.

The other record of a large *C. chaptali* (20.5 mm in Tesch, 1948) is certainly correct as the lateral sides of this specimen are illustrated as being straight. *C. piatkowskii* is apparently a deep-sea species from below 60 m which also lives close to the sea bottom as it was collected by a trawl fishing mainly 10 m above the bottom.

The locality where *C. piatkowskii* was collected is remote from that of related species; *C. polita* is found as far south as approx. 50°S 50°W, *C. recurva* off Cape Horn (Van der Spoel, 1967), and *C. scheelei* off Cape Horn and in the Coral Sea (Newman & Greenwood, 1987) so that no sympatric distributions are found.

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