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THE SYSTEMATIC POSITION OF THE CRUSTACEAN GENUS *DEROCHEILOCARIS* AND THE STATUS OF THE SUBCLASS MYSTACOCARIDA

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The genus *Derocheilocaris* was considered by Pennak and Zinn (1943) to be so distinct from the previously described Crustacea that it could not be included in any of the known subclasses. They therefore proposed a new subclass,[1] the Mystacocarida, and stated (*ibid.*, p. 4) that it is closely related to the Copepoda.

The features which are said by Pennak and Zinn to distinguish the Mystacocarida from the Copepoda are: (1) the number of segments comprising the head, thorax, and abdomen; (2) the presence of a large labrum; (3) the structure of the appendages posterior to the second antennae; and (4) the location of genital pore. I do not believe that these supposed differences are in fact sufficiently well founded to justify the removal of *Derocheilocaris* from the Copepoda.

The segmentation of the Mystacocarida, said to be distinct from that of the Copepoda, is described as consisting of a head, a one-segmented postcephalosome, a four-segmented thorax, and a six-segmented abdomen. The adult copepod typically has a head, or cephalothorax, followed by 10 free segments, of which the first five are generally considered as thoracic. Although taxonomists have usually referred to the first free segment as the first thoracic segment, the maxillipeds are thoracic appendages here as else-

[1]Pennak and Zinn retain the Subclass Entomostraca and hence consider the groups Ostracoda, Copepoda, Mystacocarida, etc., as orders, while I prefer to consider this systematic level as that of the subclass and to abandon the use of the group Entomostraca.

where in the class (Lang, 1946, p. 5) and it seems best to consider the head as a cephalothorax and the first free segment as the second thoracic segment. The division between the thorax and the abdomen has now been generally defined as lying between the sixth thoracic somite and the genital somite. Thus the somite bearing the fifth pair of legs is the last thoracic segment and the genital somite is the first abdominal segment.[1] There are then five abdominal segments. This basic scheme undergoes extensive modification in many forms; various segments may become coalesced, and indeed in some parasitic species nearly all appearance of segmentation disappears. The fifth pair of legs disappears in the females of some species, while in other cases the preceding pair is lacking, with the fifth pair remaining although vestigial.

In view of the foregoing discussion, it appears reasonable to interpret the segmentation of *Derocheilocaris* as consisting of a head, a thorax with six free segments, the fifth leg having been suppressed, and an abdomen with five free segments. Considering the variation of the apparent segmentation among the previously known copepods and the fact that a number of larvae are known in which a line of articulation runs in front of the maxillipeds, the freedom of the first thoracic segment does not appear as sufficient ground for the separation of the genus from the Copepoda.

The labrum, while much larger than that usually found on adult copepods, presents no other unusual features and is not relatively larger than that of many larval copepods.

Concerning the appendages, Pennak and Zinn (1943, p. 3) state, "Except for the first and second antennae, the appendages of the Mystacocarida differ markedly from those of the Copepoda." This statement is true in the sense that the appendages do differ from those of other copepods, but a detailed examination, both of their figures and descriptions and of the three mounted specimens before me, does not reveal any differences which would necessarily exclude the group from the Copepoda.

The typical copepod mandible consists[2] of the praecoxa, bearing

[1] Pennak and Zinn's statement (*ibid.*, p. 3) that the genital pore of copepods is on the last thoracic segment is inconsistent with their adoption of the segmental nomenclature of Monk (1941), although there is considerable evidence that this segment, which I have here called the first abdominal segment, is actually the last thoracic segment.

[2] I follow the nomenclature of Lang (1946) and agree with Gurney's (1948) criticism of Heegard's (1947a, 1947b) objections to this system.

the cutting edges, and a segment, which probably represents a fusion of the coxa and basis, bearing a two-segmented endopod and a four- to five-segmented exopod.

This appendage, however, shows a wide range of variation within the group; the segments of the protopodite may be fused into a single segment, and the number of exopod segments varies from five to one, while the endopod may even disappear altogether. Pennak and Zinn do not illustrate or describe any articulation between praecoxa and the coxa-basis nor have I been able to see such an articulation in the mounted specimens before me. If this be correct, then the proximal segment of the mandible, the "basipod" of Pennak and Zinn (*ibid.*, p. 6), represents the fusion of the praecoxa and the coxa-basis, which bears a seven-segmented exopod and a two-segmented endopod. As the articulation between the praecoxa and the coxa-basis is often present on the first nauplius of copepods, while the full number of exopod segments only appear later, Pennak and Zinn's (*ibid.*) statement, "The mandibles are of the generalized larval type," is not entirely correct. So far as I am aware, a seven-jointed exopod has not been previously seen upon any copepod.

The maxillule or first maxilla exhibits a great variety of forms among the Copepoda, but it is now fairly well established that the protopodite is three-segmented. This protopodite primitively bears both an endopod and exopod. I am unable to agree entirely with the representation of this appendage on *Derocheilocaris* as shown by Pennak and Zinn (*ibid.*, pl. 2, fig. 4). It appears to me rather that their so-called second segment is part of the proximal segment and that the segment bearing the two inner lobes is the second segment (fig. 1). If this interpretation is correct, then the proximal segment may be considered as the praecoxa, the second as a fusion of the coxa and basis as indicated by the two inner lobes, the third as representing the segment which bears the exopod and endopod in such a form as *Pseudocalanus*, while the remaining three may be the exopod, the endopod having been lost. The simple linear form of this appendage bears a superficial resemblance to the maxillules of some species of *Augaptilus* and *Pseudaugaptilus*, but in these latter genera it appears to be the exopod rather than the endopod which has been lost.

The praecoxa of the maxilla of most Copepoda is very small or even indistinguishable, the coxa and basis are generally distinct, and each bears a pair of lobes or endites. There is never an

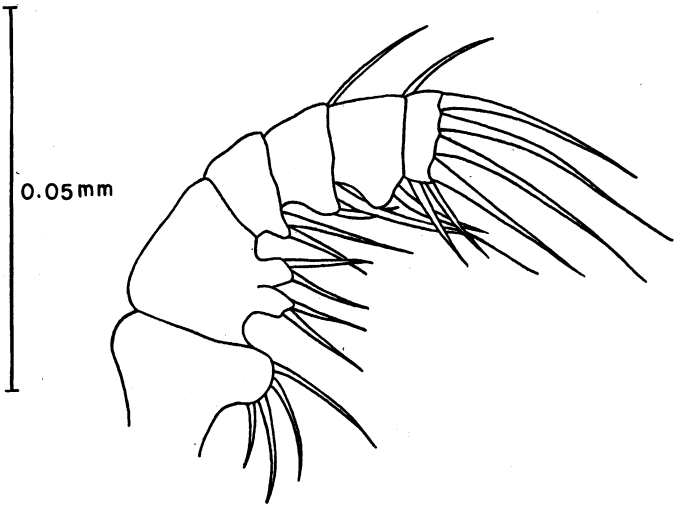

FIG. 1. Maxillule of *Derocheilocaris typicus* Pennak and Zinn.

exopod, and the endopod consists of from one to five segments. The four lobes on the second segment of the maxilla of *Derocheilocaris* most probably represent the endites of segments two and three, indicating that the first segment is an unusually large praecoxa, the second segment a fusion of the coxa and basis, while the distal four represent the endopod. The general aspect of this appendage is very similar to that of cyclopoid *Oithona*.

The maxilliped is very similar to that of the calanoid *Acartia*. The proximal segment probably represents the fusion of three propodite segments which may be indicated by the three lateral lobes. The small distal segments found on this type of maxilliped probably represent the endopod and not the exopod as stated by Pennak and Zinn.

The unsegmented uniramous swimming legs are similar in appearance to the fifth legs of various cyclopoids, but it is not clear from the setal arrangement whether they represent the exopod or the endopod, although the "small median notch" on the third leg mentioned by Pennak and Zinn (*ibid.*, p. 7) is somewhat more pronounced than shown on their figure and seems to define a small lobe on the inner side of the leg which may represent a vestige of the endopod. A number of other copepods exhibit as great or greater reduction of the legs as, for example, *Mytilicola osterae*.

The oviducts of the Copepoda open on the first abdominal segment, while Pennak and Zinn state that the oviduct of *Derocheilocaris* opens on the second[1] thoracic segment and write (p. 6), "The location of the genital pore on the ventral side of the first [*sic*] thoracic segment is indistinctly indicated by the presence of a broadly obtuse chitinous ridge which projects anteriorly and ventrally near the anterior margin of the segment" and (on p. 9), "a gonoduct could not be definitely distinguished." Presumably, then, the only reason for their arriving at their truly remarkable conclusion about the location of the pore was their failure to find any other pit or pore to which could be ascribed the function of a genital pore. When one considers that various pits frequently occur as part of the sculpturing of the exoskeleton of all Crustacea and that the genital pore on copepods is often very difficult to see, it does not appear that the evidence presented is sufficiently strong to support their contention. I have not been able to distinguish any structure upon the specimens at hand which could be confidently identified as the genital pore.

I fail to understand their description of the "yolk gland" and ovary but suppose that the former may refer to the spermatheca. A true yolk gland is not found among the Arthropoda, while the majority of female copepods have well-developed sperm receptacles.

There remains the question of the maturity of the specimens. The "immature ova" reported by Pennak and Zinn as occurring in some of their specimens does not necessarily demonstrate the maturity of their material, but I agree with Mrs. Mildred S. Wilson[2] that if the specimens are immature forms then they represent a very late stage in development and are probably very little different from the final adult stage.

As a result of the study discussed above, I propose that *Derocheilocaris* be considered as belonging to a new order of the Copepoda.

As the term Mystacocarida was introduced by Pennak and Zinn for a group coördinate with the Subclass Copepoda, I suggest that the copepod order that is proposed for the accommodation of *Derocheilocaris* be known as the Derocheilocarida.

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[1] Using the revised notation.

[2] Personal communication, May 7, 1947.

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