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On the Characters of the Crustacean Genus
Bathynella Rejdovsky.

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INVERTEBRATE
ZOOLOGY
Crustacea

On the Characters of the Crustacean Genus *Bathynella*,
Vejdovsky. By W. T. CALMAN, B.Sc., University College,
Dundee. (Communicated by Prof. D'ARCY W. THOMPSON,
C.B., F.L.S.)

[Read 1st June, 1899.]

(PLATE 20.)

IN a memoir on the fauna of certain wells, published in 1882 *, Prof. Vejdovsky described under the name *Bathynella natans* a minute crustacean of very remarkable characters, of which two examples were obtained from a well in the city of Prague. Prof. Vejdovsky placed it at the end of his memoir as a species *incertæ sedis*, merely noting its superficial resemblance to a minute gammarid and giving no further discussion of its systematic position. No additional specimens of this interesting form have been obtained, and I am not aware that, with the exception of a passing remark by Moniez, any reference has been made to it by subsequent writers or any opinion expressed regarding its affinities †.

* 'Thierische Organismen der Brunnenwässer von Prag,' 1882. I am indebted to my friend Dr. Chas. Chilton for calling my attention to this memoir.

† Since the above paper was read I have learned that Prof. Vejdovsky published in 1898 a short paper in the Bohemian language dealing with the systematic position of *Bathynella* (S.B. K. böhm. Ges. Wiss., math.-nat. Cl.

By the great kindness of Prof. Vejdovsky I have been enabled to make a re-examination of the unique existing specimen of *Bathynella*, which he has sent to me for the purpose. The specimen, which is mounted as a microscopic preparation in canada balsam, is, unfortunately, not in a good state of preservation, being much shrivelled and lacking the greater part of antennules and antennæ as well as part of the uropods. The following account is taken from Prof. Vejdovsky's description, supplemented in one or two points from my own observations.

Bathynella (Pl. 20. fig. 1) is described by Prof. Vejdovsky as resembling in general appearance the minute copepods of the genus *Canthocamptus*. The body is, in the present state of the specimen, about .75 mm. long*, and consists, according to the original account, of (1) a cephalic region bearing two pairs of antennæ, mandibles, and at least two more pairs of mouth-appendages; (2) a thoracic region of seven free somites each bearing a pair of biramous appendages; and (3) an abdomen of six somites, of which the first and second bear small appendages while the last carries two pairs of caudal plates. It appeared to me, on examining the original specimen, that there were indications of an additional somite in the abdominal region, and on mentioning my belief to Prof. Vejdovsky, he informed me that he had actually seen this somite in the living animal and sent me one of his sketches in which it was plainly figured. The presence of this somite, as Prof. Vejdovsky himself remarked in sending me the sketch, is very important for the settlement of the systematic position of the animal, for it enables us to readjust the delimitation of the regions of the trunk in such a way as to bring their segmentation into precise accord with the normal arrangement for the Malacostraca.

Prof. Vejdovsky implicitly referred the segmentation of the body to the type characteristic of the Arthrostraca, in which the first thoracic somite, bearing the maxillipeds, is fused with the head. Were this the case we ought to find four pairs of buccal

1898, xiv. 2 pp.). The author informs me that he has there expressed the opinion "das *Bathynella* eine besondere Stelle zwischen den Arthrostraken einnehmen dürfte, und vielleicht eine neue Ordnung 'Pleopodophora' repräsentirt."

* Vejdovsky gives the total length as about 1 mm.

appendages, namely, mandibles, first and second maxillæ, and maxillipeds. As a matter of fact, however, the closest scrutiny of the undissected specimen shows only two pairs of appendages (maxillæ) behind the mandibles, and I believe accordingly that the maxillipeds are represented by the succeeding pair of conspicuous appendages, those, namely, which are borne upon the first free somite. Assuming that these represent the first thoracic appendages, the eighth and last pair will then be represented by what Vejdovsky has considered to be the first abdominal pair; that is to say, precisely those on which the male genital ducts appear to open, as in the great majority of the Malacostraca. And the additional abdominal somite, of the presence of which we are now assured, still leaves us with the normal number of six abdominal somites.

The two pairs of *antennæ* are short, composed of few joints not differentiated into peduncle and flagellum. The first pair, or antennules, are uniramous and consist of eight joints. The second pair are seven-jointed, and bear a small unjointed exopod, on the second joint. There is no trace of *eyes*.

The *mandibles* have a serrated cutting-edge and a strong two-jointed (or perhaps three-jointed) palp tipped with two stout curved spines. The two pairs of *maxillæ* are large, but nothing can be seen of their structure.

The first seven pairs of *thoracic limbs* (Pl. 20. fig. 3) are of nearly uniform structure. The main axis of the limb in each case is six-jointed. The small coxal joint bears on its outer face a small flattened vesicular appendage interpreted as a branchial plate or epipod. The epipod appears to be borne on a short peduncle, from which it is separated by a transverse articulation or suture. The second or basal joint is long, and carries near its distal end an exopod *, composed of two joints in the case, probably, of the first five pairs and of one joint on the sixth and seventh. The main axis of the limb is continued by a slender endopod of four joints, scantily supplied, like the exopod, with setæ. I cannot now find an epipod on the first pair of thoracic limbs (maxillipeds), but it is figured by Vejdovsky, and these appendages do not appear to differ in any other respect from the succeeding pairs. The eighth segment behind the head, described

* Vejdovsky, by an oversight, refers to this as "ein innerer Ast." It is in fact, as his figures show, on the outer side of the limb.

by Vejdovsky as the first abdominal, but here regarded as the last thoracic somite, bears a pair of short appendages. These are described as consisting of two branches, an inner two-jointed stem, and an outer "penis-like process," the latter being apparently connected with the male genital duct. The appendages in question are now, unfortunately, so shrivelled that nothing can be made out as to their structure, but the position of the "penis-like process" on the *outer* side of the limb is so unusual that we are led to suspect some error in this part of the description.

The appendages of the first abdominal somite (second abdominal of Vejdovsky) are uniramous and two-jointed. The four succeeding somites appear to lack all trace of appendages. The last segment of the body bears terminally two pairs of "Schwanzplatten," a dorsal and a ventral. The ventral pair are described as consisting of two joints, each with a row of stout curved setæ along its distal edge, and of a small unjointed exopod inserted near the distal end of the first joint. These appendages, of which only the basal parts are now preserved, are clearly the uropods or appendages of the sixth abdominal somite; but it is not quite so easy to interpret the dorsal pair of "caudal plates." These might be regarded as the two halves of a deeply divided telson, such as occurs in many Amphipods, but their cylindrical form and the fact that each is very distinctly divided into two segments seem rather to suggest a comparison with the "caudal furca" characteristic of Phyllopod, Copepod, and other Eutomotraca, and which also occurs in *Nebalia* and in some larval Malacostraca.

The presumed *gonads*, which have been already referred to, are described as a pair of tubular organs lying in the abdomen, each expanding in the last thoracic somite into a vesicular dilatation which in turn appeared to communicate with the "penis-like process." There can be little doubt that these organs constitute the male generative system. No other internal organ could be distinguished save a pair of oval "glandular" bodies of unknown significance, lying in the last somite of the abdomen.

Reviewing the characters here summarized, it seems plain, in the first place, that *Bathynella*, in spite of its minute size, must be referred to the Malacostraca. The number of the somites,

the position of the genital apertures, the characters of the thoracic limbs, and the presence of appendages on the terminal somite of the abdomen, appear to afford conclusive evidence on this point. The possibility that it may be a larval form, as Moniez * has suggested, is excluded if the identification of the genital apparatus be correct; but it may be remarked that, as a larva, *Bathynella* would be no less unique than as an adult crustacean.

Assuming for the present that we have to deal with an adult form, it is clear that it cannot be received into any of the divisions of the Malacostraca as commonly defined. The apparent similarity to the Arthrostraca in the segmentation of the body, which led its discoverer to compare it to an amphipod, disappears when it is recognized that the first thoracic somite is free from the head and that the appendages carried by it are not specialized as maxillipeds but resemble the succeeding thoracic limbs.

The presence of natatory exopods and of external epipods on most of the thoracic limbs are further characters not shared by any of the Arthrostraca. The other divisions of the Malacostraca agree in possessing a carapace with which one or more of the thoracic somites are usually united dorsally. While some of them show isolated characters in common with *Bathynella*, as, for example, the free first thoracic somite of *Nebalia* and some Stomatopods, the natatory thoracic exopods of Schizopoda, Cumacea, and some Decapods, the undifferentiated maxillipeds of Euphausiidae, and the plate-like epipods of Stomatopods, these resemblances are accompanied by differences so profound that there can hardly be any question of immediate affinity.

While our ignorance of many points in the structure of *Bathynella*, more especially as regards the mouth-parts, precludes for the present any definite conclusion as to its precise systematic position, the characters already ascertained sufficiently show that we have to do with a very peculiar and isolated type without close affinities to any of the recognized divisions of the Malacostraca. It appears to me, however, that some light may be thrown on its relationships by a comparison with the anomalous "schizopod" *Anaspides tasmania* of Mr. G. M.

Thomson *, the characters of which I have lately discussed † at some length, calling attention to its affinity with the Palæozoic *Gampsonychidæ* and their allies.

Anaspides (Pl. 20. fig. 2) agrees with *Bathynella* in having no carapace, in possessing natatory exopods and plate-like epipods on the thoracic limbs, and in the fact that the maxillipeds are not greatly different from the succeeding appendages. Like *Bathynella*, *Anaspides* was originally described as having eight free segments in the thorax; but I have pointed out that the so-called first thoracic somite is marked off from the cephalic region not by an articulation but by a groove on the integument, and that this groove probably represents the line of junction of the mandibular somite with that of the first maxillæ. *Anaspides* therefore differs from *Bathynella* and agrees with the Arthrostraca, in possessing only seven free somites in the thoracic region. In many other characters *Anaspides* shows important differences from *Bathynella*: the antennules are biramous, there are two epipodial lamellæ on each of the thoracic legs (Pl. 20. fig. 4) (except the last pair), the second or basal joint of the thoracic legs is unusually small, while it is large in *Bathynella*, the abdomen carries a complete series of appendages, the telson is simple and undivided.

Assuming, however, as I think we may fairly do, that such characters as the small size of *Bathynella*, the absence of eyes, the simple form of all the appendages and the reduced number of joints in most of them, are due to degeneration correlated with its subterranean habitat, there would seem to be adequate grounds for suggesting that *Bathynella* is at all events less distantly related to *Anaspides* than to any other existing Crustacean.

Many of the characters in which *Anaspides* agrees with the Palæozoic *Gampsonychidæ* are also shared by *Bathynella*; and in some points, such as the presence of a free first thoracic somite and of only a single series of epipods, the latter may even approach some of the fossil forms more closely than does *Anaspides*.

* Trans. Linn. Soc. (2), Zool. vi. (3).

† Trans. Roy. Soc. Edin. xxxviii. pt. iv. no. 23.

EXPLANATION OF PLATE 20.

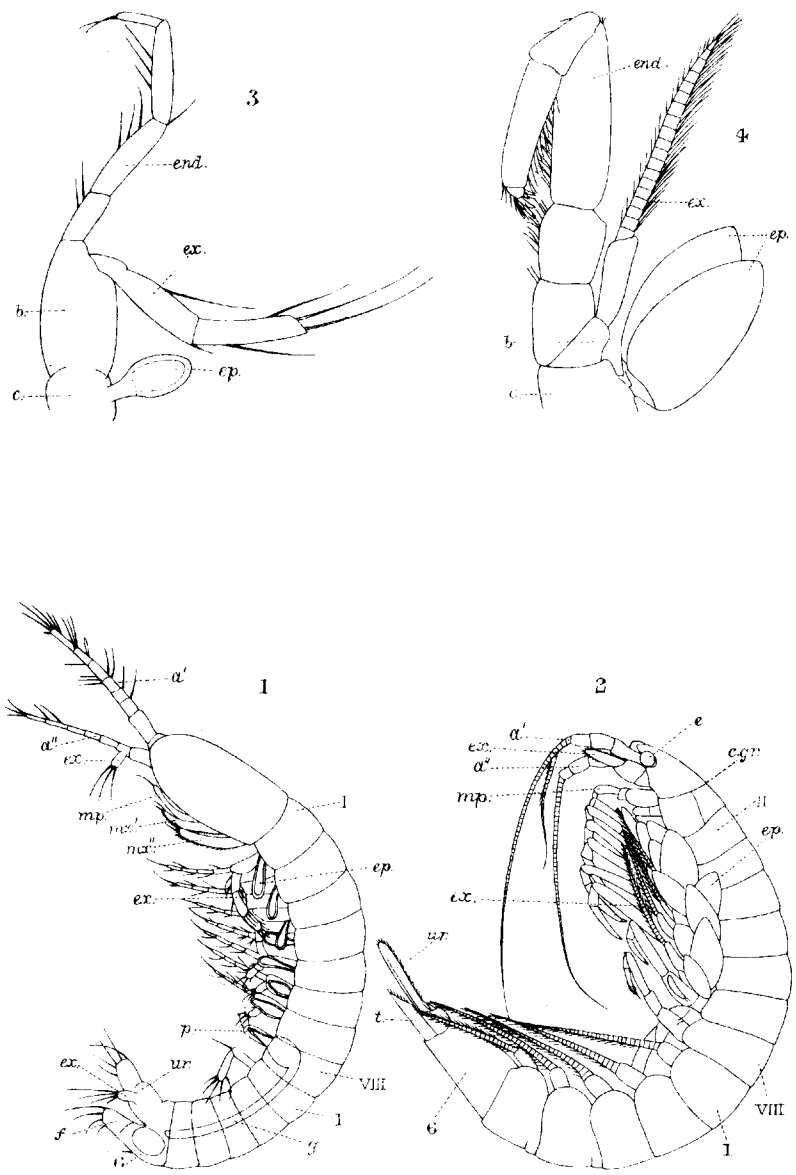
Fig. 1. *Bathynella natans*, Vejd. (Altered from Vejdovsky.) $\times 100$.

This figure was constructed from Prof. Vejdovsky's published figure and from observations on the preserved specimen. It conforms accurately (except that the abdominal segments appear a little shorter) with an original sketch (taken from the living animal) subsequently sent me by the author.

2. *Anaspides tasmaniae*, G. M. Thomson. $\times 3$. (Original.)
3. Third thoracic limb of *Bathynella*. (Original.)
4. Third thoracic limb of *Anaspides*. (Original.)

Reference Letters.

- a', a''*. First and second antenna.
 - b*. Basal joint of thoracic leg.
 - c*. Coxal joint of thoracic leg.
 - c.gr.* "Cervical groove" of *Anaspides*, marking off so-called "first thoracic somite."
 - e*. Eye.
 - end.* Endopod of thoracic leg.
 - ep.* Epipod of thoracic leg.
 - ex.* Exopod.
 - f.* Caudal furca of *Bathynella*. (Dorsal caudal-plate of Vejdovsky.)
 - g.* Supposed testis.
 - m.p.* Mandibular palp.
 - mx', mx''*. First and second maxillæ.
 - p.* "Penis-like process" of last thoracic limb.
 - t.* Telson.
 - ur.* Uropod.
 - I. First thoracic somite, bearing maxillipeds.
 - II. Second thoracic somite.
 - VIII. Last thoracic somite.
 - 1-6. Abdominal somites.
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W.T.C. del.

M.P. Parker lit.

1, 3. BATHYNEPTA NATANS, Vejdovsky
2, 4. ANASPIDES TASMANIÆ, Thomas.