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ART. III.—*Notes on, and a new Species of Subterranean* Crustacea.

By CHARLES CHILTON, M.A.

[*Read before the Philosophical Institute of Canterbury, 5th October*, 1882.]

Plate IV.

*Corrections and Additions to previous Paper.**

IN my previous paper I have stated that the well from which the Crustacea were obtained was "not more than twenty-five feet deep." I have since found that this is considerably too much, it is really only sixteen or seventeen feet deep; since then, however, the well has been filled in, so that it is now practically the same as though the pipe had been simply driven into the ground as in an artesian well.

The Crustacea still continue to come up, though not so frequently as before, and they now vary more, sometimes coming up pretty abundantly while at other times they are very scarce; and while previously *Calliope subterranea* (female) used to be much more abundant than any of the other species, it now, though still more abundant than the others, does not preponderate over them nearly so much as before. Next come *Crangonyx compactus* and *Cruregens fontanus* which occur in about equal numbers, while *Gammarus fragilis* is now the rarest of all.

From another pump about two or three chains from the first, I have obtained a few specimens of *Calliope subterranea* (female), and from a third pump about a mile and a half distant I got a single specimen of *Gammarus fragilis*, and I have heard of similar animals being seen from another pump about a mile distant from the first one, but I have not seen specimens from this well. These facts seem to show that the Subterranean Crustacea are fairly well distributed in the district.

All these wells are sunk in a bed of gravel which lies immediately under the surface soil. Through this gravel water continually percolates, and can always be found at the depth of a few feet from the surface, the depth varying according to the situation, the dryness of the season, the state of the neighbouring River Eyre, etc. I do not think that there is anywhere any large connected quantity of water, but I believe that the Crustacea live in the water which percolates through the interstices between the stones in the bed of gravel.

With regard to the origin of these *Crustacea* one can as yet only conjecture. Their nearest allies appear to be marine in their habitat. *Cruregens fontanus* would, but for the absence of the last pair of thoracic legs, come under the genus *Paranthura*, the species of which, as well as of the allied genus *Anthura*, are all marine. Besides *Cruregens fontanus*, I have obtained

* "On some Subterranean *Crustacea*," "Trans. N.Z. Inst.," vol. xiv., p. 174.

another Isopod (described in the latter part of the paper) whose nearest allies are marine. *Calliope subterranea* is inconclusive, for we have in New Zealand one marine and one fresh-water species ; it is, however, not at all near to *C. fluviatilis* the fresh-water species, and certainly has not arisen out of that species.

Gammarus fragilis, again, does not prove anything, for though in New Zealand we have only one species, a marine one, in Europe some species are marine and some fresh-water. The genus *Crangonyx* contains only two species besides *C. compactus*, mihi, one *C. subterraneus* from a well in England, the other *C. ermanni* from warm springs in Kamschatka ; its nearest allied form, however, is a marine genus, *Gammarella*.

On the whole, both the Isopoda and the Amphipoda are so distinctly marine and their fresh-water representatives in New Zealand so few, in fact only two, *Calliope fluviatilis* and *Idotea lacustris*, that it is difficult to believe that the subterranean fauna, which, so far as at present known, contains five species, could have arisen from any other than the marine fauna.

Cruregens fontanus.—Since writing my previous paper I have obtained a great number of specimens of this species—between 40 and 50—and they all agree in having the last thoracic segment small and without appendages, so that there can no longer be any doubt that the form I have described is the adult form.

In living specimens the heart can be distinctly seen through the transparent integument. It is elongated and extends from the middle of the fifth abdominal segment anteriorly, reaching nearly to the middle of the sixth thoracic segment. The anterior end of the heart is narrower than the posterior part, and the posterior end is rounded. There appear to be three openings through which blood flows into the heart ; one is on the left side in the second abdominal segment ; the other two are on the right side, one in the seventh (last) thoracic segment, and the other in the third abdominal segment. These openings appear to be provided with valves of some kind. Blood passes out through the anterior end of the heart, in the median line of the body, and flows forwards to supply the various parts of the body.

In my previous paper I have stated that the only blind Isopoda inhabiting wells or caves that I could find mention of were two species of a genus, *Cæcidotea*, found in the Mammoth Cave of Kentucky and in the Wyandotte Cave ; since then I have found two others mentioned, but I have not been able to get descriptions of them ; they are *Titanethes albus*, Schiödte, which inhabits caves of Carniola* and *Typhloniscus steinii*.† ‡

* See "Nature," 18th April, 1872, p. 484.

† See "Trans. Linn. Soc.," 2nd ser., vol. I., pt. i., p. 24 (footnote).

‡ Others are mentioned in the Zoological Records for 1879 and 1880.

I have now to add another obtained from the same well as the other Subterranean Crustacea that I have described.

Genus **Phreatoicus**, (*novum*).

Body long, sub-cylindrical, laterally compressed. Upper antenna short, lower long, with flagellum. Mandible with an appendage. First pair of legs subchelate, others simple; first *four* pairs articulated to body at the anterior ends of their segments and directed forwards, last *three* articulated at posterior ends of their segments and directed backwards. Abdomen long, of six distinct segments, last joined to telson. Sixth pair of pleopoda biramous, styliform. Telson large, sub-conical.

Phreatoicus typicus, sp. nov. Pl. IV.

Eyes not visible. Upper antenna about half as long as the peduncle of the lower antenna, consisting of about eight joints, peduncle not distinguishable from the flagellum, last three or four joints thicker than the preceding. Lower antenna about three-fourths as long as the body, peduncle of five joints, first two short, third longer but not so long as the fourth, fifth nearly as long as the third and fourth together. First pair of legs subchelate, propodos rather small, palm oblique, defined by densely haired knob; finger strong, hairy; next three pairs of legs subequal, rather stout; last three longer, setose, increasing regularly in length from before backwards. First segment of pereion only about half as long as the second, remainder subequal. Pleon two-thirds as long as pereion, first segment small, next three subequal, fifth large, about as long as the preceding three together, the second, third, fourth and fifth segments having the integument produced inferiorly, and the inferior edge fringed with short stout setæ. Sixth segment joined to telson and bearing a pair of biramous pleopoda; peduncle longer than rami, outer ramus shorter than inner. Telson large, sub-conical, deeply concave below, inferior edge irregularly serrate and fringed with very short setæ; regularly rounded above, extremity projecting backwards, with short setæ on tip, and a stout one on each side of the base.

Colour—transparent.

Length, about half an inch.

Hab. Pump at Eyreton.

Additional remarks on structure:—

The upper antenna (pl. IV., fig. 2) is peculiar in having the last three or four joints considerably thickened, the thickening being chiefly due to the increased thickness of the integument. Small simple auditory cilia are found on the under side of the antenna (fig. 2 *a*).

The lower antenna (fig. 3) has already been sufficiently described.

The mouth parts are shown in position in fig. 4. In front is the labrum (*a*), the end of which is densely beset with fine setæ projecting radially from the tip as centre. When dissected out the labrum appears to consist of two plates each more or less triangular (fig. 6).

The mandible is strong, it bears a three-jointed appendage, second joint the longest, third fringed on one side with setæ projecting perpendicularly to the joint and increasing regularly in size towards the distal end of the joint. There is a large molar tubercle, the end of which seems to bear rows of short setæ.

The cutting end of the mandible consists of two sharp teeth, one longer than the other; below this there is a movable portion also ending in sharp teeth, and below this again a double row of strong setæ. (See fig. 5.)

The first maxilla (fig. 7) consists of two plates, the outer longer than the inner, bearing at the end strong setæ, some of which are branched, the outer edge and inner portion thickly covered with long very fine setæ; the inner lobe bears on the rounded end several long setæ, somewhat separated from each other, each plumose more especially towards the end; the distal and inner portions thickly covered with fine setæ similar to those on the outer lobe.

The second maxilla (fig. 8) consists of a stout basal portion bearing three overlapping plates: on the outer plates are long setæ, each bearing short pieces projecting at right angles to the seta. (See fig. 8*a*.)

On the third and inner plate are long plumose setæ, and on the inner edge of the base is a row of long plumose setæ similar to those on the inner lobe. The whole of the inner lobe, the inner portions of the two outer lobes, and some parts of the base, are covered with fine setæ similar to those on the first maxilla.

The maxillipede (fig. 9) bears at the base an irregularly rounded plate (fig. 4 *f*) which probably is homologous with a similar plate found in *Idotea* and *Limnoria*; the basal joint is long, its inner edge towards the distal end is fringed with long plumose setæ, and there is a lobe apparently connected with the first joint; this lobe bears plumose setæ on the inner edge, and simple setæ on the outer side and distal end. The other joints of the maxillipede present nothing remarkable, and their form can be best understood from the figure.

The coxæ of all the legs can be readily seen to be simply the basal joints of the legs. In the first four pairs of legs the coxa projects slightly forwards, and is tipped with a few short setæ; in the last three pairs it projects backwards similarly. (See fig. 11.)

In the first pair of legs the distal end of the meros is produced anteriorly and is fringed with setæ, the carpus is longer than broad and has a tuft of setæ on the inner edge, the propodos is not very large; in the centre of the palm are a few short hairs set on the tip of small teeth-like projections. The other legs present nothing remarkable; the last three are abundantly covered with long stout setæ (see fig. 11); in all the dactylos is slender and the end forms a distinct claw having setæ arising at its base (fig. 11*a*).

In the pleon a somewhat remarkable feature is presented by the segments (except the first) having the integument produced downwards as in the first three segments of the pleon in Amphipoda, thus forming lateral shields protecting the pleopoda. The first pair of pleopoda differs from the others; it consists of a small basal joint bearing two oblong plates, the large one having a few setæ at the end (fig 12). It appears to form an imperfect operculum for the other pleopoda. In the others there is a basal joint as before; from this spring two lobes, the smaller oval with margin entire, the larger sub-oblong, inner edge fringed with simple setæ and bearing at the end another small joint fringed with plumose setæ (fig. 13).

The sixth segment of pleon is united to the telson, its inferior edge bears four strong slightly curved setæ. The sixth pleopod is more like one of the last three pairs of pleopoda in Amphipoda than anything I know of among the Isopoda; the upper surface of the peduncle is broad and slightly concave, the outer upper edge fringed with setæ, while the inner upper edge is straight. At the end of the peduncle there is one strong seta below and two or three above, the rami are sharply pointed and bear both stout setæ and longer fine hairs (fig. 14).

Throughout the whole of the body and the appendages the integument is covered with very short setæ arranged more or less regularly in interrupted rows. These setæ are very small and can scarcely be seen without a $\frac{1}{4}$-in. objective (fig. 15). Besides this along the dorsal surface are scattered a few long fine hairs.

The alimentary canal is generally full of black matter of some kind,—food, I suppose,—and hence can be readily seen through the transparent integument. It is shown in fig. 1.

The animal I have thus described is interesting and important, because it combines characters belonging to different groups. In the elongated form of the body, in the antennæ and in the plate at the base of the maxillipede, it resembles *Idotea*, it differs very much from this genus, however, in the form of the abdomen and in the fact that the mandible has an appendage. In this latter respect and in the cylindrical elongate body it resembles *Anthura* and *Paranthura*, and it thus to a certain extent serves to connect the *Anthuridæ* with the *Idoteidæ*. In the long abdomen composed of separate segments it differs both from the *Anthuridæ* and the

Idoteidæ and approaches the *Tanaidæ*. The legs consist of an anterior series of four, and a posterior series of three, and this, according to the figures given by Bate and Westwood, appears to be the case with the *Tanaidæ*. This peculiarity is also possessed by the Amphipoda to which *Phreatoicus* has a considerable superficial resemblance due chiefly to the flattened form of the body, best seen in the abdomen, and to the fact that the segments of the pleon have the integument produced downwards, but also to the Amphipodan facies of the legs and the last pair of pleopoda.

The precise place of *Phreatoicus* in any system of classification cannot as yet be indicated with certainty, but one thing is made clear by the discussion, viz., that *Phreatoicus*, possessing as it does affinities to several distinct groups, must be of very considerable antiquity.

The occurrence of this species has been somewhat remarkable. Ever since January, 1881, I have collected or had collected for me all the Crustacea that were observed to come up; nothing new was found until the beginning of September, 1882, when a single specimen of *Phreatoicus* was obtained, and in the short time since then six other specimens have been found.

DESCRIPTION OF PLATE IV.

Phreatoicus typicus.

Fig. 1. Lateral view of the animal × 5.

2. Upper antenna × 30 ; *a*, auditory cilium from the same, more highly magnified.
3. Base of lower antenna × 13.
4. Side view of the head, showing the mouth organs in position, × 15 ; *a*, labrum ; *b*, mandible with appendage ; *c*, the two lobes of first maxilla ; *d*, second maxilla ; *e*, maxillipede with *f*, the rounded plate at its base.
5. Mandible, view of inner side × 30.
6. Labrum × 30.
7. First maxilla × 30.
8. Second maxilla × 30 ; *a*, seta rom middle lobe of same, more highly magnified
9. Maxillipede × 30.
10. Distal portion of first thoracic leg × 30.
11. Seventh thoracic leg × 13 ; *a*, end of same × 30.
12. First pair of pleopoda × 13.
13. Second pair of pleopoda × 15.
14. Extremity of abdomen, side view, × 14.
15. Portion of the integument × 120.
