AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

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Edited by Professor T. Harvey Johnston,
University of Adelaide.

VOL. X. PART 7.

ECHINODERIDA

BY

PROFESSOR T. HARVEY JOHNSTON,
UNIVERSITY OF ADELAIDE.

WITH SEVEN TEXT FIGURES.

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REPORT ON THE ECHINODERIDA

By T. Harvey Johnston, Professor of Zoology, University of Adelaide.

(Text Figures 1–7.)

Introduction.

Though very few specimens belonging to the Echinoderida (Kinorhyncha) were obtained from material collected by the Australasian Antarctic Expedition of 1911–1914, they are of special interest in view of the extremely few records of their occurrence beyond certain European seas. There appear to have been only four findings of the group in the Southern Hemisphere, each represented by a single individual. Of the four known specimens from this vast region, one was found amongst material collected in 1885 at Zanzibar; one was taken at each of two stations on the continental shelf off Kaiser Wilhelm Land, Antarctica, while the "Gauss" was drifting imprisoned in the pack ice during January and February, 1903; the fourth was obtained, also by the "Gauss" Expedition, in shallow water at Observatory Bay, Kerguelen, in January, 1902. These four individuals were reported on by Zelinka (1913) in his magnificent paper in the Reports of the German South Polar Expedition. The Zanzibar specimen was described as *Echinoderes ehlersi*, closely resembling a European form, *E. dujardini*. The remaining three were found to belong to a new genus of Echinoderida Cyclorhagae, *Campyloderes*, the two Antarctic specimens being described as *C. vanhöffeni*, and the Kerguelen worm as a variety of it, var. *kerguelensis*. The latter name requires amendment to *kerguelenensis*. Zelinka stated that over one hundred residues from "Gauss" collections had been examined, the resulting three specimens being found in coarse sandy debris.

All the residues remaining from dredging and littoral collections made by the Mawson Expedition, after material had been distributed to specialists for report, was forwarded to me by the Director of the Australian Museum, Sydney, for further overhaul. Many of the samples came originally from various parts of the Antarctic continental shelf, extending from shallow and deeper waters in Commonwealth Bay, King George V Land, westward to Queen Mary Land, near the "Gauss" Antarctic Stations, but Echinoderids were not found in them. About a dozen bottles of material scraped from the under surface of stones just below low tide mark at the northern end of Macquarie Island, by Mr. H. Hamilton, on various occasions during 1911 and 1912, were also searched. Two specimens were found in one jar and one in each of three other collections. These five worms all belonged to the same species, and subsequent examination showed that they were referable to *Campyloderes* and closely related to Zelinka's species. The known range of the genus is now widely extended to the eastward, the localities for the three forms being in the Antarctic and Southern oceans.

Zelinka (1908, 136) drew attention to the outstanding features of the southern Echinoderida, and erected a new genus and sub-order (Xenosomata) to receive them. A detailed account was reserved for publication in the "Gauss" Reports (1913), and

thanks to its excellence, a careful comparison of his species and the Macquarie Island material is possible. Some additional details were made known by Zelinka in his Monograph (1928) which unfortunately does not appear to be available in Australian libraries, but some of the figures, as well as those of the earlier papers, have been reproduced by Remane (1929; 1930) in his account of the group. One of Zelinka's specimens was obtained from material from a depth of 385 metres, all other known Echinoderids living in shallow or littoral regions.

The author desires to acknowledge his indebtedness to the excellent accounts of the Echinodera published by Remane (1928; 1929–1930), which have been very helpful in view of the lack of opportunity to consult Zelinka's Monograph. The terminology used by Zelinka and Remane is utilised in this account.

Campyloderes macquariae n.sp.

(Text figures 1–7.)

Of the five specimens obtained, four were in a contracted condition, only the larger scalids projecting forwards through the neck region. The remaining individual

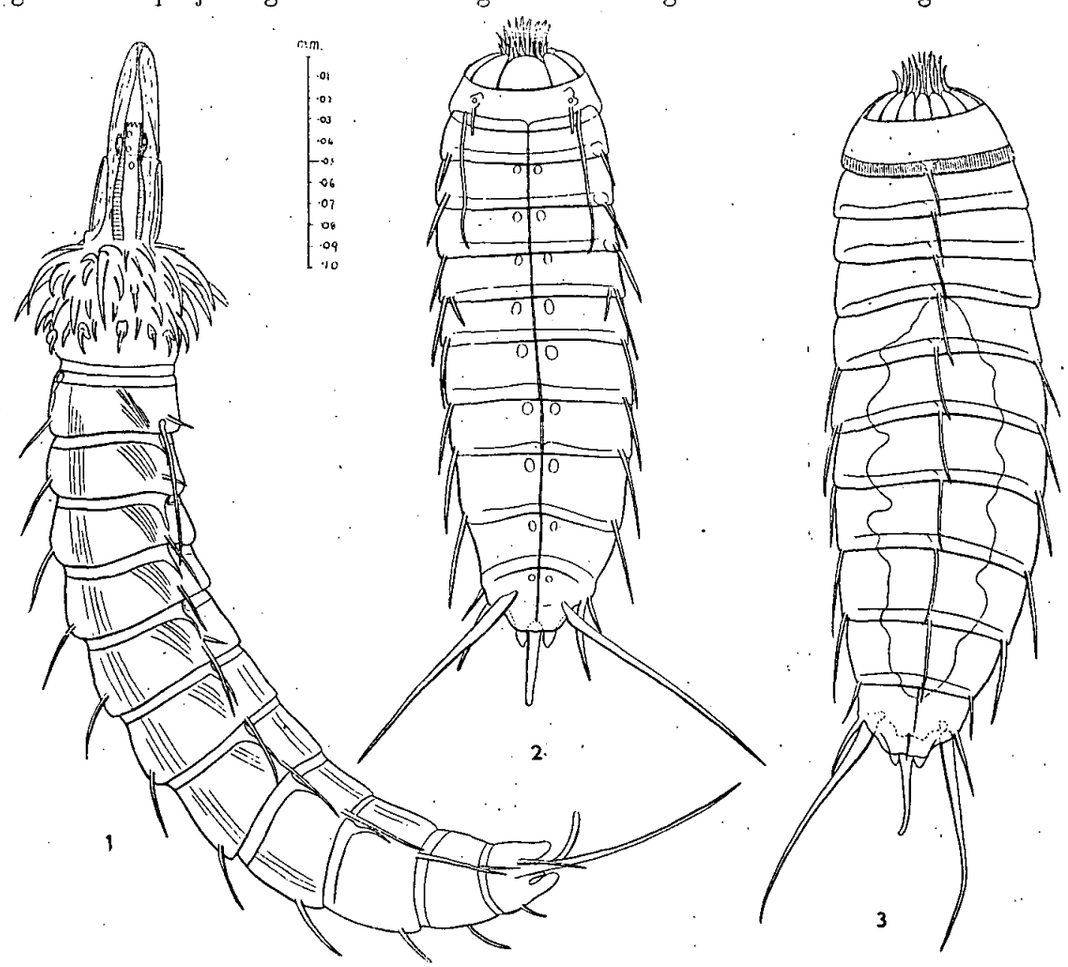

Figure 1. Side view of abnormally extended specimen—Figure 2. Ventral view of another specimen.
Figure 3. Dorsal view of a third specimen. *All drawn to the same magnification.*

was markedly extended, no doubt from osmotic pressure, so that the total length was greatly increased; most of the segments did not overlap, and the pharynx was protruded well in front of the everted head.

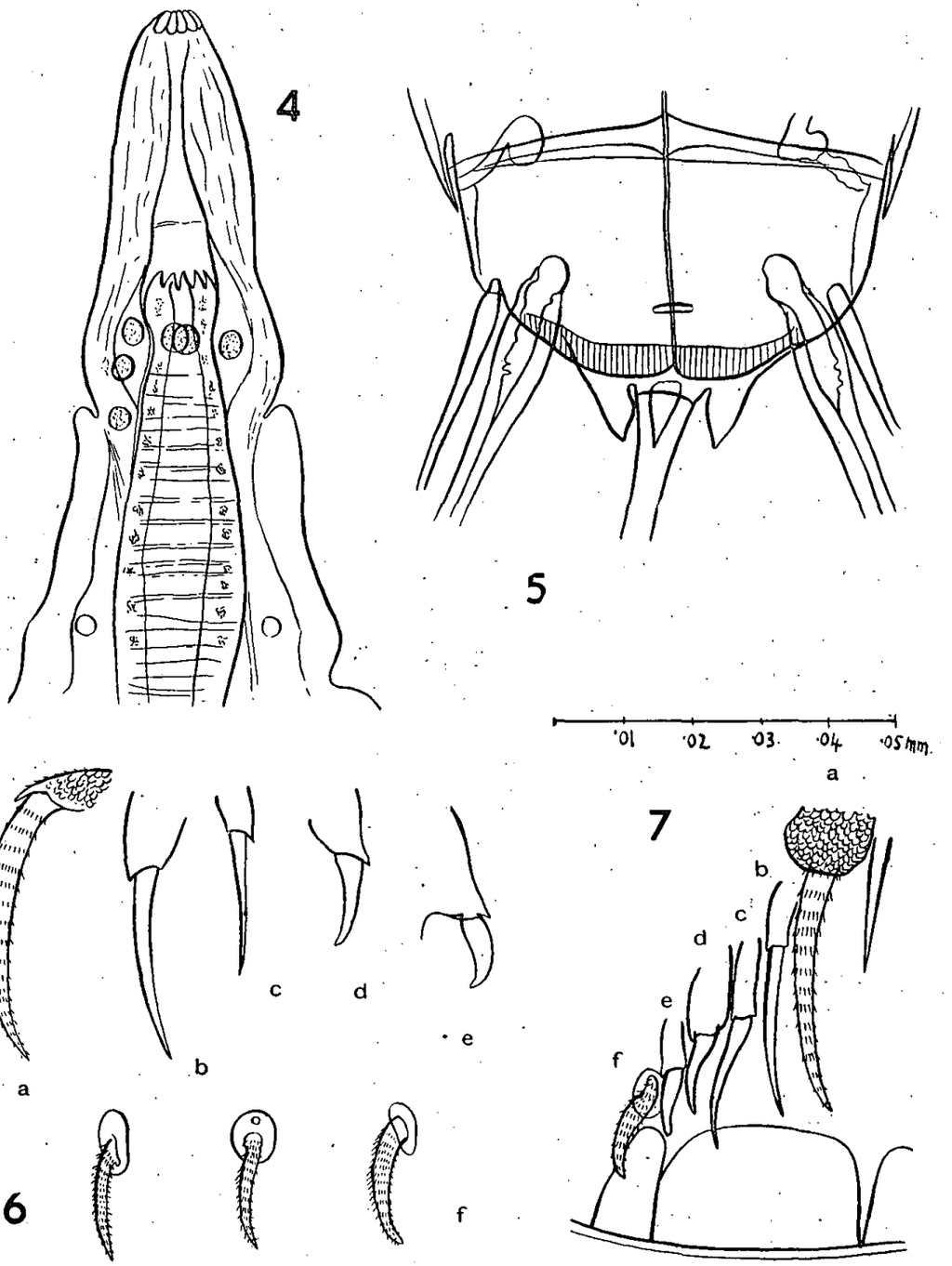

Figure 4. Everted pharyngeal region—Figure 5. Posterior end, ventral view—Figure 6. Scalids: a, first series; b, second; c, third; d, fourth; e, fifth—"bird claw" type; f, sixth—trichoscalids—Figure 7. A group of scalids, showing their relation to one another and to the neck. *All figures drawn to same scale.*

Most specimens were about 0·287 mm. long by 0·09 to 0·10 mm. in maximum breadth (ratio of maximum length to greatest breadth being 2·8–3·2 : 1), the length being measured from the anterior end of the neck segment to the free end of the triangular processes of the terminal segment. If the length of the first or head segment of the specimen in which it is extruded be added, then the animal would apparently be about 0·34 mm. long. Since the head is so frequently retracted in preserved members of the group, its length is not taken into account when stating the length of an Echinoderid unless the fact is definitely mentioned. The widest region (0·09–0·10 mm.) is in the vicinity of the seventh to ninth segments, the breadth decreasing gradually forwards, and rather more rapidly posteriorly. The body is approximately circular in section in the earliest segments, but in most of the others it is rather flattened, while the ventral plates meet to form a projecting angle, so that when seen in side view, the maximum dorsoventral diameter may be 0·07 mm. The abnormally elongate animal measured 0·53 mm. in length. All measurements were made while the specimens were lying in glycerin and without a cover glass.

The first segment or head is about 0·05 mm. long by 0·07 mm. broad (excluding the projecting scalids; 0·094 if these be included), circular in transverse section and narrowed to 0·06 mm. at its junction with the neck. It bears rows of scalids resembling closely those of *E. vanhöffeni* in form and arrangement. The first series consists of ten large curved structures arising from a rather wider basal portion whose distal edge projects somewhat, and on its outer part may form a short spine-like scale. The base is about 0·017–0·02 mm. long and is considerably swollen. Its outer aspect bears a covering of very numerous, extremely minute, inbricate scales which, when seen in side view, resemble closely-set cilia. The measurements given for the length of the bases of all scalids is only approximate because of the difficulty in securing exactness. The scalid itself is 0·042 mm. long and has a sabre-like form. It bears very numerous minute hairs arranged in transverse bands, about 0·002 mm. apart, these rows extending from the base almost to the tip. The free extremity of the first scalid reaches back to the level of the anterior part of the trichoscalids which constitute the last series of scalids.

The remaining scalids (and their bases) diminish in size in succeeding rows. Those of the second row are about 0·030 mm. with a base ·01 mm. long and are arranged in series of two between each of the scalids of the first row. Then there follow numerous smaller scalids apparently in three more or less defined rows (scalids 3–5) whose members diminish in length and become less scythe-like but more claw-like, the hooks of those constituting the series (scalid 5) in front of the trichoscalids having a somewhat broadened portion which narrows rapidly into a curved, rather blunt, point, the form being slightly different from that described and figured by Zelinka. Those of the third row measure 0·022, with a base ·013 mm. long; those of the fourth row 0·012 with a base ·013 mm. long; and those of the fifth row ·009 mm. long, with a base ·011 mm. in length The sixth row is formed by the ten trichoscalids each arising from a considerably widened, well chitinised, more or less rounded or elliptical, base which projects freely below the proximal portion of the scalid. The scalid itself is rounded in section, tapers to a fine

point, and measures about 0·018 mm. long. It bears abundant minute hairs arranged, as in the largest scalids, in transverse, or perhaps spiral, closely set, rows. The base measures 0·007 to ·009 mm. in length, and about 0·003–·004 mm. in width.

Immediately in front of the first row of scalids and alternating with them, is a series of ten stiff bristles about 0·018 mm. long, projecting outwards. The arrangement of the scalids on the head of *C. vanhöffeni* is indicated by Zelinka (1928; Remane 1929, fig. 216). The diameter of the aperture through which the mouth cone becomes protruded, is about 0·033 mm.

The second, or neck segment, which constitutes the closing apparatus, possesses fourteen plates, or plakids, consisting of a wide median ventral, six pairs of laterals, and a dorsomedian which seems to be the narrowest of the series. The relative sizes of these laterals apparently agree with those figured by Zelinka (1913) though rather smaller. The breadth of the various plakids at their bases is approximately as follows: median dorsal 0·007; first lateral ·009; second ·007; third ·015; fourth ·01; fifth ·015; and the median ventral ·028 mm. The length is about 0·017 mm. in each case.

The third segment, unlike all the succeeding segments, has an undivided ventral plate. It measures about 0·063 mm. wide at its anterior border, and 0·08 at its posterior edge, the length being 0·024 mm. In the distended specimen, it has a dorsoventral diameter of 0·063 in its mid-region. Its dorsal spine is 0·027–0·030 mm. in length. The pair of very long lateral bristles, like those described by Zelinka, arise near the junction of the tergite with the sternite. Each measures 0·07–·083 mm. long, lies close to the ventral surface, and extends directly backwards as far as the end of the sixth segment or even the anterior part of the seventh. In one specimen one of these bristles was slightly distorted as figured by Zelinka, but in the others they were slightly curved. The ratio of the length of this spine to the body length of the contracted worm, was 1 : 3·4–3·7. Arising inwardly and a little anteriorly from the base of each of these very long bristles, is a short "klebrohr" or adhesive tube, 0·002 mm. long and projecting ventrally and posteriorly. In the distorted animal, the tube projects almost directly ventrally, somewhat as figured by Zelinka. In front of each tube the outline of the corresponding adhesive gland can be seen.

The fourth, fifth and sixth rings are more or less similar to each other. Their anterior and posterior widths are 0·075–·080 and 0·082–·090; 0·08–·09; and 0·085–·097; 0·082–·09 and 0·09–·097 mm. respectively. The lengths are 0·022; 0·022; and 0·025–·027 mm. respectively. Their slightly curved dorsal spines are 0·030–·035; 0·030–·036; and 0·038–·042 mm. respectively. Their lateral spines measure 0·022; 0·03–·036; and 0·037–·039 mm. in length respectively. Each ventral plate is subdivided and meets the tergal ventrally immediately inwardly from the series of lateral spines. The line of contact of these sternal plates with one another forms a marked structure along the midventral surface from the fourth to the terminal segment.

Segments which succeed the sixth are longer, the breadth also increasing in the next few rings, and their sternites are broader so that the tergo-sternal junction approaches more nearly to the edge of the worm and the lateral spines project more freely from the margin of the body.

The seventh is 0·087–·09 mm. in width anteriorly, and 0·090–·095 mm. posteriorly. Its dorsal spine is 0·037 mm. long, and the laterals 0·04. Arising inwardly from the base of each of the latter is a small spine, 0·018 mm. long, which is directed postero-ventrally in the case of the distended specimen.

Segments 8, 9 and 10 possess a similar length, 0·030–·032 mm., but show a slight diminution in width, becoming 0·085–·090 at the posterior end of the tenth ring. Their dorsal setae measure 0·038; 0·037–·042; and 0·04–·044 mm. respectively. Their lateral spines are 0·038–·040; 0·038–·046; and ·047 mm. long respectively.

The eleventh and twelfth resemble the tenth, but are progressively narrowed and their dorsal setae measure 0·034 and ·030; and the lateral spines 0·045–0·050 and 0·02–·027 mm. respectively. The laterals of the twelfth, when present, are very slender.

The thirteenth ring is much narrower, being 0·055–·057 mm., wide anteriorly, and 0·048 posteriorly. Its dorsal spine is about 0·023 mm. in length. The laterals are 0·037–·039 mm. long and much stouter than the rest of the series. Their bases are slightly swollen, gradually narrowing to the terminate in a pointed end. As in Zelinka's species, the ventral part of this segment shows a median indentation where the sternal plates meet.

The last section of the worm, regarded by Zelinka as constituting a fourteenth segment, but probably only a process of the thirteenth, bears the prominent median spine and the two relatively very long lateral terminals. The median is rather stout, curved ventrally, and measures 0·050–·052 mm. Its tip is bluntly rounded. There is an elongate triangular or conical cavity in its basal region. The lateral terminal spines measure 0·123–·13 mm., their ratio to body length being 1 : 2·2–2·3. They are slightly swollen at the base and gradually diminish in diameter, terminating in a hair-like extremity. They have a slight ventral curvature. Judging from the positions assumed in the different specimens, Zelinka's view that these spines are probably movable, appears to be correct. In the basal portion there is a cavity somewhat different in shape from that in *C. vanhöffeni*. This cavity has some marked irregularities on its outer distal surface, beyond which is the long and extremely narrow canal penetrating the spine for some distance. The terminal segment bears dorsally two more or less triangular processes, one on either side of the median spine. In form they are intermediate between those of *C. vanhöffeni* and *C. kerguelenensis*. A deep narrow indentation occurs between segment 13 and the final one, but there is no thickened ring.

Near the posterior border of all segments except the first and second, there is present dorsally an ornamentation similar to that described by Zelinka, the delicate longitudinal series of minute dots resembling a palisade. This is interrupted in the mid-dorsal line, leaving a clear region from which arises the dorsal spine. Just in front of the latter in most segments are two small, more or less elliptical, symmetrically placed, highly refracting depressions. Very delicate hairs appear to be present on the hind margin of each segment dorsally.

Ventrally there is a similar palisade-like ornamentation on the posterior margin of each segment, but in this case the band is interrupted laterally to form a free space from which arises the corresponding lateral spine. The cuticular thickening in each ring is quite similar to that described by Zelinka; as also is the modification where the thickened anterior and ventral portions of the tergal plates meet the sternal plates.

The digestive system was recognisable. The fully extended specimen allowed one to recognise an elongate, broadly-rounded mouth cone devoid of styli, but possessing a few (perhaps 10) leaf-like processes about 0·004 mm. long and about half as wide, becoming narrowed anteriorly. These are difficult to distinguish and are poorly chitinised. They surround the mouth, within which is a narrow canal widening posteriorly where it meets the pharynx. Surrounding the cone, some distance behind the level of the anterior end of the pharynx and just behind the brain, is a definite fold devoid of any spine-like structures, this ring and groove marking, apparently, the limit of the true mouth cone.

The pharynx has a layer of rather large cells as well as marked circular muscle fibres. At the free extremity is a series of small triangular tooth-like structures which are not specially chitinised and whose points are directed forwards and inwards. The length of the pharynx was not determined, but apparently, when the animal is fully retracted, its posterior end extends to about the rear margin of the sixth segment, as it was in this region that the very large intestine was seen to commence in one specimen. The intestine appeared as an elongate sac, nearly 0·2 mm. long, with sacculate margins and a maximum breadth (in segments 8–10) of 0·065 mm. Within segment 13 it becomes narrower greatly, there being a short rectum terminating in the anus which lies near the junction of the 13th and terminal segment.

The gonads in one specimen were seen to extend forwards into the fifth segment and to terminate in the twelfth. The gonoducts open laterally in the anterior region of the thirteenth segment, or perhaps at the junction with the twelfth. Accessory genital spines were not recognised, though it might be mentioned that in some specimens there appeared to be no lateral spines on segment 12—perhaps a sexual character.

The brain is similarly placed to that in *Echinoderes*, surrounding the pharynx just in front of the level of the fold at the base of the mouth cone. Associated with the

brain are rounded well-defined structures similar in form and arrangement to those figured by Greef (Remane 1929, 215, fig. 235) for *Echinoderes canariensis*. These have been regarded as accessory eyes. No trace of pigmented eyes was seen.

The specimens from Macquarie Island differ from the typical *C. vanhöffeni* from the Antarctic in the dimensions of the worms as well as of the various setae, in the very small and slender lateral setae of the twelfth segment, in the form of the terminal bristle, and in the form of the end processes. Zelinka gave few measurements for his Kerguelen specimen (which he attributed to a distinct variety) as many of the setae were damaged. He referred to certain differences, such as the shorter and stouter lateral and dorsal bristles, the rounded termination of the end bristle, the slightly different body proportions, the much shorter laterals of the thirteenth segment, and the quite distinct form of the end processes. In all of these features Zelinka's variety, which should be regarded as a distinct species, *C. kerguelenensis*, approaches very closely to *C. macquariae*, the main difference (apart from lengths of the bristles or setae, most of which were not measured by Zelinka because of their damaged condition) being that in the form of the end processes. It is not unlikely that the Kerguelen and Macquarie Island specimens may belong to the same species.

The type and paratype material is deposited in the Australian Museum, Sydney.

Zelinka (1907, 135, 136; 1908, 631; 1913, 425; 1928) drew attention to the modification of the thirteenth ring whose posterior region was stated to be segmented off into a more or less independent fourteenth ring, all other known Echinoderids possessing only thirteen. He erected the sub-order Xenosomata and family Mesitoderidae to receive *Campyloderes*. The family name must be changed to Campyloderidae as Remane (1928; 1930) has done. The separation of the end segment from the thirteenth is not a striking feature under the microscope, as there is no thickening of the cuticle in the vicinity of the junctions. It is here suggested that the presence of the well-developed terminal bristle may be responsible for this pseudosegmentation.

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