

1917

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Recommended Citation

Walter, Otto (1917) "Notes on a Decapod Crustacean from the Kinderhook Shale at Burlington," *Proceedings of the Iowa Academy of Science*, 24(1), 119-125.
Available at: <https://scholarworks.uni.edu/pias/vol24/iss1/22>

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NOTES ON A DECAPOD CRUSTACEAN FROM THE
KINDERHOOK SHALE AT BURLINGTON.

OTTO WALTER.

The specimen which is the subject of this paper is the same as the one noted by Professor Stuart Weller in his article on "The Succession of Fossil Faunas in the Kinderhook Beds at Burlington, Iowa."¹ The specimen was collected in an argillaceous shale,—bed number 1 of the paper cited,—and was among the material illustrating the fauna of that bed submitted to Doctor Weller by Professor Calvin and Professor Udden. In Weller's paper, page 69, the specimen is referred with some doubt to *Palaeopalaemon newberryi* Whitfield, with a note that it "is probably the same crustacean that Whitfield identified from Cascade," now a part of the city of Burlington. Weller further comments that "it is by no means certain that the Burlington specimens are identical with the types of the species or even that they belong to the same genus." Whitfield had obtained his Burlington specimen from Dr. A. S. Tiffany of Davenport, Iowa. According to his description it differs in perfection from the one here discussed in having abdominal segments and telson both well preserved, while the cephalo-thorax is much less perfect.² In spite of its imperfections Whitfield believed it to be identical with his type specimen *P. newberryi* described³ some years before from the Erie shale at Leroy, Ohio, and re-described by Hall and Clarke.⁴ The Erie shale is late Upper Devonian in age⁵ and is thus somewhat older than the bed in which the Burlington specimens occur.

The cephalo-thoracic portion only is preserved in the specimen at hand but this part exhibits features not heretofore noted in this class of remains. The dorsal and lateral regions of the cephalo-thorax are quite perfect and admit of a certain degree

¹Iowa Geological Survey, Vol. X, pp. 63-79, 1900.

²Amer. Geologist, Vol. IX, p. 237, 1892.

³Amer. Jour. Sci., 3d Ser., Vol. XIX, pp. 40-42, pl. (circulated) figs. 1-3, 1880; also Ann. N. Y. Acad. Sci., Vol. V, p. 505, Pl. XII, figs. 19-21, Dec., 1890, and Geol. Ohio, Vol. VII, p. 461, Pl. VIII, figs. 19-21, 1893.

⁴Pal. New York, Vol. VII, p. 203, Pl. XXX, figs. 20-23, 1888.

⁵Geol. Survey Ohio, 4th series, Bull. 15, p. 115, 1912.

of accuracy in description but the appendages are either wholly wanting or are represented by the proximal segments alone.

The sides of the shrimplike cephalo-thorax are so strongly compressed that the postero-lateral portions of the branchiostegite are subparallel; the sides are longer below than above. The postero-ventral angle of the right branchiostegite is perfect, that of the left is partly broken. Transversely the dorsum is highly arcuate as far forward as the rostrum, which ends in a short spine; longitudinally the dorsum is very gently arched. The surface of the specimen is smooth, glossy, or polished in appearance and marked by greater and lesser punctæ. The greater punctæ are not very numerous and can be seen with the naked eye; the lesser punctæ are very numerous and can be seen only with the aid of a microscope. The region of the ophthalmic segment or the rostral region is not arcuate but flattened and slopes gently to the dorso-lateral angle.

Extending from the posterior end of the cephalo-thorax to the transverse gastric sulcus there is a dorsal carina bearing a narrow mesial threadlike keel; anterior to the transverse gastric sulcus it is continued as a low lamellar crest and terminates in a short, laterally compressed rostral spine. The hepatic sulcus (or sinus) begins at the base of the antenna, extends backwards along a slightly curved line for a distance of six millimeters thence bends abruptly upward at a right angle to the dorsal carina, for a space of four millimeters whence it bends forward in a short curve, then back upon itself postero-dorsally at a sharp angle, and finally, after describing a short semi-circle, it passes anteriorly along the side of the dorsal carina as the gastro-dorsal groove. (See Plate Va, figure 1, *gd.*). There is but one spine on each side of the cephalo-thorax; each is located at the antero-lateral angle of the cephalic carapace and on a level with the base of the rostral spine. From this lateral spine a shallow but distinct groove extends backward to within a millimeter of the hepatic sulcus and its course is almost parallel to the ventral margin of the cephalic carapace,—the two being approximately 1.5 mm. apart. This groove bears a delicate threadlike ridge along its bottom. Beyond the hepatic sulcus and about 1 mm. dorsally a similar groove continues nearly to the end of the cephalo-thorax, its course being practically parallel to the dorsal carina. This may be called the cardiaco-branchial groove. It is

situated along a broad angle and with its elevated edges gives superficially the appearance of a ridge. Anteriorly the groove has a low but well marked rim or edge on either side and these rims become more prominent and the groove less so until at the posterior end the two rims blend into a ridge or carina and the median groove becomes obsolete. (Figure 1, lc.) Extending from a point slightly anterior to the midlength of the dorsum and at right angles to it is a short shallow transverse gastric sulcus; it reaches half way to the cardiaco-branchial groove or ridge and is deepest in the middle and decreases in depth towards both ends. Beginning at the anterior end of the cardiaco-branchial carina a broad rounded ridge extends postero-dorsally past the ventral end of the transverse gastric sulcus to a dorso-median point immediately posterior to the midlength of the cephalo-thorax. This ridge or carina the writer will call the "cervical ridge" as opposed to the common cervical groove of modern decapods. The portion of the cervical ridge between the transverse gastric sulcus and the dorsal end bears a fine mesial sinus. Running one millimeter dorsally and parallel to the anterior portion of the cervical ridge from the hepatic sulcus to the transverse gastric sulcus there is a deep gastro-hepatic sulcus. Two millimeters from the ventral margin of the cephalo-thorax and beginning at the postero-ventral apex of the hepatic sulcus there is a strong marginal carina which tends to coalesce with the free margin toward the posterior end. The entire free margin of the cephalo-thorax is slightly thickened and the ventral part of it bears a small sub-marginal groove. The portion of the branchiostegite from the marginal carina downward is inwardly inclined.

The eye stalks are partly preserved. The one on the right side has a height of 5 mm.; the left, 1 mm. A part of a laterally compressed peduncle of the right antennule is visible. The antennæ are not shown but the proximal portions of well developed antennal scales are present forming a continuous shelf beneath the antennules. The line of demarcation has been obliterated but this condition may have been brought about by the process of substitution and by the great pressure exerted upon the thin inner margins of the scales which may have been partly imbricated at the time of entombment. Each scale has a prominent outer sub-marginal groove which probably represents the main

axis of support. The dorsal surface of each scale bears a trace of a delicate diagonal pattern.

Extending forward from the antero-ventral side of the cephalic region are two long subcylindrical processes which are broken off anteriorly and somewhat swollen near their proximal ends. The part of the left member which is preserved has a length of 17 mm. and its greatest diameter (dorso-ventral) is 5 mm. Their surfaces are polished and punctate. Whether these appendages represent the first joints of the antennæ, segments of extremely large maxillipeds, or the first (or second) pair of proximal segments of the first pair of pereopods the writer is unable to determine. From their comparatively large size it is probable that they are parts of the first pair of pereopods. Compare, for example, the first pair of pereopods of the modern form *Sabinea princeps* Smith.⁶ The remaining thoracic appendages are represented by their proximal segments only and these are preserved so poorly and in such a way that the number can not be determined with accuracy. One of them has a length of 4 mm. and a diameter of 2 mm.; others are larger but less well defined. On the ventral surface near the posterior end there is exposed a fragment which may be a part of an abdominal pleura or a part of the telson that may have become impressed on the under side of the thorax while in a flexed position. The hardness of the matrix makes it difficult to learn its exact character.

Measurements: Total length of the specimen, 5 cm.; dorsal length of the cephalo-thorax, 32 mm.; greatest width, 12 mm.; height of carapace, 13 mm.; distance of antero-lateral spine from the rostral spine 7 mm.; greatest distance across the base of antennal scales, 8 mm.

This specimen agrees with the genus *Palæopalæmon*, Whitfield, in that the cephalo-thorax is narrow and shrimplike as well as keeled on the back and sides but it differs from it in being rostrate. The appendages which Whitfield has called antennæ are here considered as parts of the first pair of pereopods. The presence of a larger number of sulci and carinæ and of a right and left spine as well as the antennal scales further differentiate our specimen from *P. newberryi*. Indeed, the characters just pointed out are suggestive of the modern family Crangonidæ

⁶For figure see Bull. Mus. Comp. Zool., Vol. XXIV, No. XVII, p. 38, pl. VIII, fig. 1. Cambridge, 1893.

rather than of the family Palæmonidæ. The first pair of legs strikingly suggest those of *Sabinea princeps*, mentioned above, while the large antennal scales are also characteristic of the Crangonidæ. However, in the absence of more complete material and, too, for the lack of a more appropriate genus for its reception the writer prefers tentatively to refer the specimen to the old genus Palæopalæmon. It is felt, moreover, that the characters pointed out are sufficiently different and important to deserve specific recognition and consequently the specific name *iowensis* is offered.

The specimen is in the paleontological collections of the State University of Iowa. It was preserved in an exceedingly hard nodule of pyritic shale, a part of which has been removed with sharp instruments and much patience.

The writer wishes to express his sincere appreciation to Prof. A. O. Thomas for the opportunity of studying this specimen and for his assistance with the literature and with valuable suggestions.

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EXPLANATION OF PLATE V A.

Palacopalaemon iowensis Walter.

Figure 1. Diagrammatic sketch; left lateral view, enlarged.

- a* proximal part of antennule
- es* eye stalk
- gd* gastro-dorsal sulcus
- hs* hepatic sulcus
- ts* transverse gastric sulcus
- cr* cervical ridge
- x* part of pleura (?) or telson (?)
- gs* gastro-hepatic sulcus
- m* thickened margin of carapace
- sg* sub-marginal groove
- sc* marginal carina
- lc* cardiaco-branchial carina
- as* antennal scale
- rm* first joint of right first pereopod
- lm* first joint of left first pereopod
- ta* thoracic appendages
- rs* rostral spine

Figure 2. Right lateral view, natural size.

Figure 3. Left lateral view, times ten-sevenths natural size.

Figure 4. Dorsal view; about ten-sevenths natural size.

