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DESCRIPTION OF A SILURIAN PHYLLOPOD MANDIBLE WITH RELATED NOTES

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Messrs. J. Mann and A. Lees, of Oak Lawn, Illinois, have recently donated to the Museum two specimens (part and counterpart) of a mandible referred here to a new species of *Ceratiocaris*. The mandible was found in the Leethaylus shale, Upper Lockport group (Niagaran), near Blue Island, Illinois, within one hundred feet of *Ceratiocaris markhami* Roy (1935, fig. 29a-e). The specimen is completely carbonized but much of the carbonized material has been broken away.

The writer wishes to acknowledge his indebtedness to both the donors for giving him the opportunity of describing this rarely found fossil, and takes pleasure in naming it after one of the donors, Mr. Lees.

The drawings are by the Staff Illustrator of Field Museum, Mr. Carl Gronemann.

Ceratiocaris leesi Roy sp. nov. Fig. 33a and b.

Description.—Transversely elongated, widest anteriorly; posterior end roundly pointed. General outline somewhat resembles that of a mitre with the "tooth" row forming the base. Upper and lower margins rounded, giving a rim-like appearance; both broadening anteriorly; the upper one arching and ending in a narrow pointed projection which overhangs the "tooth" row, the lower one curving slightly inward and meeting the anterior margin to form a triangle. Anterior or oral margin thickest, supporting seven toothed ridges, the uppermost of which is the longest, then decreasing uniformly in size downwards. The elongated base, representative of the propodite, is not well preserved. Its central portion is missing and its posterior end, the position for the external articular process, may or may not have been outlined (see fig. 33a and b) correctly.

Dimensions.—Length and width at the center 22.5 mm. and 10 mm. respectively.

Remarks.—No record of gastric teeth or mandibles of phyllopod crustaceans in geologic literature is to be found prior to 1843. In that year J. E. Portlock first figured the gastric teeth, dextral and sinistral, of *Dithyrocaris* from Tyrone or Londonderry, Ireland (pl. 12, fig. 6, of Portlock's report and fig. 33c¹ of this paper). On page 315 (Portlock, 1843) he states, "Fig. 6 represents bodies which are frequently found on the specimens of this crustacean, and in this instance together, as represented in the figured specimen, they each exhibit a single row of tubercles, and were in all probability connected with the masticatory apparatus, which it is probable, therefore, was highly developed in this large species."

Following the report of Portlock, several other teeth of *Dithyrocaris*, presumably all gastric, have been found, in comparative abundance, at Campsie and East Kilbride, Lanarkshire, Scotland, and at Orchard Quarry, near Thornliebank, Renfrewshire, Scotland. These teeth have been described and illustrated by Woodward (1865, pp. 401-404, pl. 11) and more adequately by Jones and Woodward (1898, pp. 194-198, pl. 26, figs. 1-44).

The "teeth" of *Ceratiocaris* (from Lesmahagow, Lanarkshire) were first reported by J. W. Salter in 1860. He observes (1860, p. 155): "A further exploration in the same rich deposits at Lesmahagow, where *Ceratiocaris* occurs . . . has disinterred the rostrum, hard jaws, and also the antennae or some of the thoracic appendages of the animal. The last are obscure, but were detected by Professor Huxley, who also found a clearly articulated hinge uniting the two flaps of the carapace. This is a very important character, and will remove *Ceratiocaris* from any very near alliance with *Nebalia*, from which also the solid jaws, like those of *Apus* . . . tend further to separate it."

Salter's brief report was supplemented by more adequate explanation and illustrations by Woodward (1865, pp. 401-404). Referring to plate XI of his paper Woodward states (p. 401): "Fig. 1 represents a perfect carapace of *Ceratiocaris*, at the anterior end of which (at *a*) the two opposing mandibles may be seen in their proper place,² compressed on the surface of the left valve. A detached

¹ Copied from a figure which was drawn more accurately from the original specimen by Jones and Woodward (1898, pl. 26, fig. 44). A facsimile of Portlock's figure is also given by Woodward (1865, pl. 11, fig. 8).

² The mandibles were not in their proper place as was explained later by Jones and Woodward (1888, p. 147). In normal position they would be opposed to each other horizontally. That they appear as being opposed one to the other vertically is due to the compression of the carapace, and to their being squeezed against the inside of the valves.



FIG. 33. *a, b*, *Ceratiocaris leesi* Roy sp. nov. Mandible (part and counterpart). F.M. No. P23676. Natural size. *c-e*, Gastric teeth of *Dithyrocaris* (Jones and Woodward, 1898, pl. 26, figs. 23, 43, and 44): *c*, Sinistral lying on dextral; *d*, Sinistral; *e*, Dextral. *f-l*, "Teeth" of *Ceratiocaris*: *f*, Chevron-shaped regular cusps; *g, h*, Cusps longer at one end; *i*, Cusps with more flexuous connecting ridge; *j*, Cusps regularly alternate; *k*, Cusps irregularly alternate; *l*, Cusps in single row.

mandible (fig. 2) from the same locality as fig. 1 (Upper Ludlow Rock, Lesmahagow, Lanarkshire) is represented in the plate of the natural size." On page 402, he further states: "That these detached fossil remains are the teeth¹ of crustaceans there cannot now be the least doubt; for, in addition to the evidence afforded by the remains of the allied genus *Ceratiocaris* (pl. XI, fig. 1), and by the fragment of *Dithyrocaris* (pl. XI, fig. 6), one needs only to compare the gastric teeth of the common lobster (*Homarus vulgaris*), figured in our plate (fig. 12), with the most perfect teeth of *Dithyrocaris* (figs. 3, 3b), to see the striking similarity between them, both in general form and in minuter details."

The most important paper on the present subject, "The Gastric Teeth of *Ceratiocaris*" was published by Jones and Woodward in 1888. The paper is an excellent survey of all the important specimens known from Bohemia, Scandinavia and Great Britain and contains two important conclusions reached by the authors as the result of their comparative studies. These may be stated as follows:

- I. The "teeth" are divisible into two distinct groups:
 - (a) Gastric teeth. Thick and solid.
 - (b) Mandible. Trenchant character of cutting edges; broad, compressed, transversely elongated bases of attachment.
- II. The "teeth" have at least six different forms.²
 - (a) Cusps, chevron shaped, regular in size (fig. 33f).³
 - (b) Cusps longer at one end of the tooth than at the other (fig. 33g and h).³
 - (c) Cusps with a more flexuous connecting ridge (fig. 33i).³
 - (d) Cusps in two parallel rows, but somewhat alternate (fig. 33j).³
 - (e) Cusps irregularly alternate in two rows (fig. 33k).³
 - (f) Cusps in a single row (fig. 33l).³

As to the first conclusion, my own inference has been the same but I have hesitated to express it because of lack of actual specimens to make a comparative study. With regard to the second, the authors, it appears, have based their groupings on criteria which have frankly many possibilities of error. It is difficult to believe

¹ It is quite apparent that up to this time at least, no special effort was made to differentiate between mandibles and gastric teeth. Frequently, both organs were included in the general term "teeth."

² The authors have included mandibles in differentiating these forms. See II (b).

³ These figures refer to the figures reproduced in the present paper. Fig. 33f (Jones and Woodward, 1888, pl. VI, fig. 8); g and h (Jones and Woodward, 1888, text figs. 5, 6); i (Jones and Woodward, 1888, pl. VI, fig. 10c); j (Barrande, 1872, pl. 31, fig. 21); k (Jones and Woodward, 1888, text fig. 4a); l (Jones and Woodward, 1888, pl. VI, 9b).

that a single genus would possess six widely different forms of teeth. No such parallel exists among living forms. The gastric teeth or the mandible of the lobster, *Homarus*, or of the crayfish, *Astacus*, show but little variation, irrespective of the species to which they belong. The same holds true of fossil forms. The gastric teeth of *Dithyrocaris* (Jones and Woodward, 1898, pl. 26, figs. 1-44, and fig. 33c-e of this paper) found at widely separated localities do not show any appreciable variations. The evident conclusion, therefore, is that some of the teeth that have been identified with *Ceratiocaris* because they were found in association with other remains of *Ceratiocaris* are not referable to this genus. These teeth must have come from other crustaceans which have not left any remains other than teeth. This and other factors which have impeded proper identification may be summed up as follows:

- (1). Commingling of gastric teeth of more than one genus.
- (2). Commingling of gastric teeth and mandibles whose bases have not been preserved or whose cutting edges have been worn or blunted, thus causing them to simulate gastric teeth.
- (3). Relative age of individuals.
- (4). Conditions under which fossilization has taken place.

The above factors at once create a situation which does not admit of identifications that can be relied on. They, further, definitely imply that unless and until other specimens of the various types of teeth hitherto identified with *Ceratiocaris* are found in such intimate association with remains of individuals as to leave no doubt that they are referable to those individuals, there can be no escape from the confusion now existing.

It has been mentioned in the beginning that the mandible from Blue Island was found a short distance from *C. markhami*. I have, nevertheless, hesitated to identify it with that species for the reason that the mandible is relatively too large, and hence can hardly be referred to *C. markhami* unless it is assumed that the latter has not reached its adult stage. There is, however, no valid reason for such assumption. Structurally, *C. markhami* shows all the features hitherto regarded as characterizing an adult specimen (S. K. Roy, 1935, pp. 142-144).

Fossil mandibles of Paleozoic phyllopod crustaceans are not of common occurrence. The mandible here figured and described is the only one yet recorded from the Silurian of North America. Whitfield (1896, pl. 13, fig. 5, and pl. 14, figs. 1-4) has figured five supposed mandibles from the Lower Helderberg (Devonian)

of Wisconsin, three of which are referred to *Ceratiocaris monroei* Whitfield, and two to *Entomocaris telleri* Whitfield. Whitfield's specimens have massive cusps and lack entirely the trenchant character of the sharp cutting edges of mandibles. There is a possibility that they are gastric teeth which have retained their zygo-cardiac ossicles. The fact that mandible-like organs have been found attached to the ventral surface of the anterior region of the carapace does not necessarily imply that they are mandibles. Gastric teeth, sinistral and dextral, may easily become detached from the pyloric ossicle and, dropping out of the stomach (during its decomposition) become lodged inside the valves of the carapace, occupying the position of mandibles.

The mandible described in this paper, with the exception of its elongated base, compares very favorably with the two from Lesmahagow, Lanarkshire (Jones and Woodward, 1888, text figs. 5 and 6). The toothed ridges of all three specimens are strikingly similar, and, judging from the similarity of the bases of the Scottish specimens, it seems highly probable that the base of the present one might have been somewhat distorted.

Horizon and locality.—Lecthaylus shale, Upper Lockport group (Niagaran), Blue Island, Illinois.

P23676 Field Museum.

Holotype.

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