

NEW CEPHALASPIDS FROM CANADA.

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ABSTRACT.

Three new species, *Cephalaspis canadensis* and *Cephalaspis acadica* from the Lower Devonian of Campbelltown or Dalhousie, Province of Quebec, and *Cephalaspis patteni* from the Upper Devonian of Miguaska, Bay of Chaleur, Province of Quebec, are described and figured. The holotypes are in the Patten collection at Dartmouth College. A specimen of *Cephalaspis laticeps*, Traquair in this collection shows some details not included in the original description. Brief characterizations of the seven species of *Cephalaspis* from Canadian Devonian are given.

In the period from 1902 to 1912 the late Dr. William Patten of Dartmouth College made a number of trips to the region of the bay of Chaleur, bringing back a beautiful collection of *Bothriolepis*, a number of specimens of *Scaumenacia*, and a few specimens of other forms. Among these were five fairly complete shields of cephalaspids. One of these specimens was figured as restored in Doctor Patten's Evolution of the Vertebrates and their Kin, Fig. 234, page 357. Doctor Stensiö, speaking of this in a footnote in his Cephalaspids of Great Britain, states that it probably represents a new species. Study of the specimen and of the descriptions of Canadian Cephalaspids confirms this opinion. The nearest approach to it is *Cephalaspis laticeps*. As this type has not been figured Doctor Stephen of the Royal Scottish Museum kindly sent me a photograph of the type. Comparison with the Patten specimen indicates a different species, for which I propose the name *Cephalaspis patteni*. The horizon is upper Devonian, Miguaska, Bay of Chaleur, Province of Quebec. A second smaller specimen, thought at first to be a second specimen of *C. patteni*, appears to belong with *C. laticeps*.

The other specimens are larger. Two possess definite rostra and long cornua. In this they resemble *C. campbelltonensis*. Neither agrees entirely with this species. One specimen has a similar rostrum but is proportioned differently and the cornua are not incurved. The other has a more acute rostrum, longer, more acute, incurved cornua, and narrower proportions. The third specimen has the anterior margin either missing or too obscure to be made out and the cornua lacking, although parts of the pectoral sinuses are preserved.

Unfortunately the type of *C. campbelltonensis* is not available. Doctor Russell kindly sent me a photograph of a para-

type in the Museum of the Bureau of Mines at Ottawa, as well as squeezes of two small specimens, one of which may be a small *C. campbelltonensis*.

Cephalaspids have been classified in two sub-families (2), the Cephalaspinæ and the Kiaeraspinæ, but the chief diagnostic characters relate to the lateral fields and the nerves to these fields. The former are incompletely indicated and the



Fig. 1. *Cephalaspis patteni*. Ventral aspect. Cat. no. C1. Holotype.

latter are not available in these specimens. Therefore their inclusion as species of *Cephalaspis* is based on the older criteria of shield form and proportions.

Cephalaspis patteni n. sp., is represented by a part and counterpart of one individual Figs. 1 and 2, Cat. No. C1, Patten Collection. The ventral aspect is exposed, giving the ventral shield in large part, save in the oralo-branchial region, where the internal aspect of the dorsal shield is presented. The anterior portion is missing, so that the contour of the anterior margin is not known. The trunk is preserved in part, as well as portions of the pectoral appendages.

The shield, unless its anterior portion was unusual, was considerably broader than long, about 7.5 cm. at its widest point, under 3 cm. in length. The cornua are moderately long,

about 1 cm., about 0.6 cm. broad at the base, directed nearly straight backward. The pectoral sinuses are broad, with their anterior borders almost a straight line. The inner margins of the cornua also are nearly straight, the outer slightly convex. The interzonal part of the shield is broad and short, about 2 cm. broad by approximately 0.7 cm. long.

The available surface is somewhat rugose, ornamented with minute tubercles and what appear as fine striae. The margins of the pectoral sinuses are thickened, and appear as though

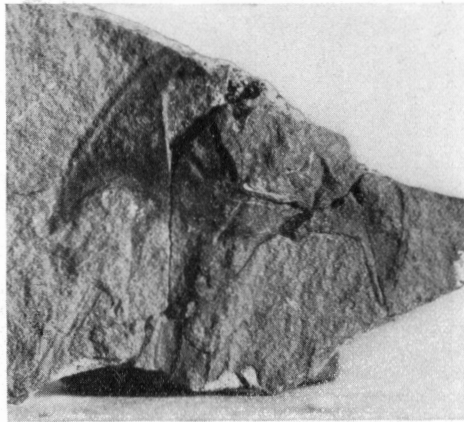


Fig. 2. *Cephalaspis patteni*. Counterpart of fig. 1.

made up of bundles of striae. What I have interpreted as the margin of the oralo-branchial chamber is similarly marked, as are also the lateral borders of the orbits. A sort of post-branchial bar with this same construction except that it is more prominent, is a striking feature of the specimen. Doctor Patten (1) figured this in his reconstruction as a "heavy bony ridge . . . that probably divides the oral from the branchial chamber." The margin of the shield is not denticulate, but the thickened border appears to be made up of striae.

The orbits are large and oval. The naso-hypophysial aperture lies between the anterior portions of the orbits, extending slightly anterior to them.

The trunk is longer than the shield, the preserved portion being about 4 cm. in length. The caudal fin is not preserved. The trunk is flattened ventrally, with the usual ventro-lateral ridges. These ridges are armored with a special row of short ridge scales, apparently similar to those of the British Cephal-



Fig. 3. *Cephalaspis canadensis*. Largely impression of ventrum except for central region, which is an impression of the inner aspect of the dorsal shield. Cat. no. C2. Holotype.

spids described by Stensiö (2). The squamation of the ventral surface of the trunk could not be made out, but that surface appears ornamented with minute ridges, running generally lengthwise. The lateral aspect of the trunk is not available, but a long dorsal fin can be observed. This fin shows fine rays. About a third of the distance back on the fin it was apparently thrown into a fold, emphasizing the flexible character of the structure in the living animal. The portion of the trunk just posterior to the shield is poorly preserved,

and it cannot be ascertained whether the entire dorsal fin is preserved, although its general contour suggests that its anterior extension could not have been much beyond that of the preserved portion. This is about 1.3 cm. posterior to the shield. The preserved portion of the fin is about 2.7 cm. in length.

Portions of both pectoral appendages are present. The squamation is difficult to make out, but in general the appearance is very similar to that of the general ventral surface of the shield. The dorsal field is not available in the specimen. The lateral fields appear to be faintly indicated, although so faintly that one cannot be positive as to their extent. They appear to have ended just anterior to the cornua, and to have been narrow, with no postero-median angle.

Two of the other specimens appear to differ from *C. campbelltonensis* sufficiently to indicate new species. For them I propose the names *Cephalaspis canadensis* and *Cephalaspis acadica*. The source of these specimens is not certain. In the drawer of the Patten collection in which they were stored was a label indicating that they were from Campbelltown and Dalhousie.

Cephalaspis canadensis n. sp., Cat. No. C2, Fig. 3, is preserved largely as an impression of the ventral aspect of the cornua, rostrum, and lateral portions of the shield, with the impression of the inner aspect of the dorsal shield in the region of the oralo-branchial chamber. Traces of the bone occur, sufficient to show the ornamentation of the ventrum, the polygonal areas of the middle layer of the dorsal shield, and near the posterior end of the shield a trace of the dorsal ornamentation.

The specimen is fairly large, long and narrow, measuring 7.8 cm. from the tip of the rostrum to the level of the anterior margins of the pectoral sinuses. (This length is given because the posterior margin of the shield is not preserved.) The breadth at that same level is 8.5 cm. There is a pronounced rostrum 2.2 cm. long and relatively narrow. The cornua are long, narrow, and incurved at the tip. The length of the left is 4.2 cm., its basal breadth 1.5 cm. The right is shorter and slightly broader in this specimen. The pectoral sinuses are broad.

The orbits are quite far back on the shield, disregarding the rostrum. Their outline is obscure. High, conical prominences occur anterior to each orbit. The dorsal and lateral fields are not preserved.

The ventral ornamentation is a pattern of fine striae

arranged as though marking out polygonal areas. This is especially well marked in the impressions of the cornua and rostrum, although toward the tip of either structure the pattern is lost, the striae becoming in the main parallel to the long axis of the cornua or rostrum. Near the posterior end of the shield a trace of the dorsal surface is preserved and shows a similar pattern of striae arranged in polygonal areas.

Cephalaspis acadica n. sp., Cat. No. C 3, Fig. 4, is similar to *C. canadensis* in being largely an impression of the ventral aspect of cornua, rostrum, and the lateral portions, but there is more of the bony structure of the dorsum preserved in the middle portion of the shield. The specimen is incomplete on the right side. In addition to the specimen as figured there are two small portions of the counterpart, one a portion of the left cornu, the other of the rostrum. The shield is incomplete posteriorly. The length from the tip of the rostrum to the level of the pectoral sinuses is 7.5 cm., the breadth at that same level about 12 cm.

The rostrum is prominent and broad. The cornua are moderately long and not incurved. Their inner margins are minutely denticulate. The pectoral sinuses are broad. Pronounced antorbital prominences are present. The orbits are large, oval, approximated, though less so than in *C. canadensis*, and are not as far back as in that species. The dorsal field appears to have been bounded by ridges which met behind it to form the occipital crista, as in *C. campbelltonensis*.

The ventral aspect of the cornua and rostrum are ornamented with rugae, the anterior border of the pectoral sinuses with fine striae, though not compactly aggregated as in *C. patteni*. The general dorsal and ventral surfaces show the same striated polygonal areas as does *C. canadensis*. The polygonal areas are relatively large.

The third large specimen, Cat. No. C 5, is preserved as a part and counterpart, chiefly of the middle portion of the shield. Whether or not it was rostrate could not be made out. The orbits are large, oval, and farther apart than in *C. campbelltonensis*, *C. canadensis*, or *C. acadica*. The ornamentation is similar to that of *C. acadica*, the polygonal areas about the same size. The dorsal field is large, but in the specimen not bounded by so definite a ridge as in *C. campbelltonensis* or *C. acadica*. The median crista appears to have been broad. The anterior of the trunk was preserved indifferently. The cornua are not available, but parts of the pectoral sinuses are, and these indicate minute denticulation of both median and lateral margins of the sinuses. Since the chief diagnostic char-

acters are missing this specimen cannot be assigned to any species at present.

The specimen of *C. laticeps*, Cat. No. C 4, is slightly smaller than the type. It is a part and counterpart very similar to that of *C. patteni*, except that it is complete anteriorly. The chief features shown by this specimen and not mentioned in the original description by Traquair (3) are: the middle layer polygonal areas of small size, the denticulation of the shield margin, and a feature shared by *C. patteni*, i.e., a post-bran-



Fig. 4. *Cephalaspis acadica*. Largely impression of ventrum of cornua and rostrum, of dorsal, inner aspect, in central region. Cat. no. C3. Holotype.

chial bar of aggregated striae and similar ornamentation of the margins of the pectoral sinuses and orbits.

With these new species the total number thus far described from Canada is seven, all of which come from Devonian strata of a relatively limited area. Briefly characterized these species are:

1. *C. campbelltonensis*, Whiteaves 1881, from the Lower Devonian of Campbelltown, Province of Quebec. Large, with an acutely rounded rostrum, moderately long, slightly incurved cornua with inner margins finely denticulate, broad at the base, and ornamented with fine reticulating rugae. Orbits circular to broadly ovate, sub-central, approximated. Rounded conical antorbital prominences and a conical but slightly elongated interorbital prominence. Dorsal field bounded by narrow ridges, each starting from a postorbital prominence and coalescing behind the

dorsal field to form the median crista. Outer surface smooth-polished in naked eye appearance, but minutely, irregularly pitted under the lens.

2. *C. dawsoni*, Lankester 1870, from the Lower Devonian of Gaspé. Small. Cornua prominent, sharp, not incurved. No rostrum. Pectoral sinuses broad. Trunk narrow. Margin of shield smooth. Ornamentation very fine, almost granular tubercles.

3. *C. canadensis* n. sp., Lower Devonian of Campbelltown or Dalhousie. Shield long, relatively narrow. Cornua long, sharp, incurved, without denticulate margins. Pectoral sinuses broad. Antorbital prominences high, conical. Orbits sub-central. Ornamentation incompletely known, but where known is of finely striated polygonal areas.

4. *C. acadica* n. sp., from Lower Devonian of Campbelltown or Dalhousie. Broad, large shield. Rostrum broad, prominent. Cornua moderately long, not incurved, inner margins minutely denticulate. Pectoral sinuses broad. Antorbital prominences high, conical. Orbits oval, approximated, nearly central. Ventral ornamentation of cornua and rostrum irregular rugae, of sinus margins fine striae, of general surface finely striated polygonal areas.

5. *C. jexi*, Traquair 1893, from Upper Devonian of Scaumenac Bay. Shield rounded in front. Cornua short, incurved, stout, inner margins denticulate. Orbits small, nearly central. Ornamented with minute, closely set tubercles in more or less concentric pattern, less closely set on cornua, where fine longitudinal striae also occur.

6. *C. laticeps*, Traquair 1890, from Upper Devonian, Scaumenac Bay. Small. Cornua short, slightly incurved, obtuse, with nearly straight inner margins. No rostrum. Orbits large, oval, approximated. Ornamented with small, smooth, polished tubercles, very closely set. Denticulate shield margin. Post-branchial bar.

7. *C. patteni* n. sp., Upper Devonian, Bay of Chaleur. Shield short, broad. Trunk long, with long dorsal fin. Cornua medium, with broad base. Pectoral sinuses broad, with nearly straight lateral and anterior margins. Interzonal part short, broad. Post-branchial bar, pectoral sinus margins, and lateral margins of orbits ornamented with closely set striae. Shield margin smooth. Anterior of shield unknown.

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