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## Eurypterids of the Devonian Holland Quarry Shale of Ohio

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In contrast to the Silurian, the North American Devonian deposits have not yielded a rich fauna of eurypterids, although the list of known species is continuously growing. The occurrence of eurypterids in the Holland Quarry shale, a lens locally underlying the Sylvania sandstone at the base of the Devonian in Lucas County, Ohio (see Carman, 1960), adds materially to our relatively meager knowledge of Devonian forms in North America.

The eurypterids in this Lower Devonian deposit are preserved as patches of integument up to four inches in diameter, although most patches cover no more than one or two inches. The preservation of these fragments is excellent, and permits study of minute details in structure and ornamentation. The eurypterids are intimately associated with numerous fishes and land plants in a dark gray to black bituminous shale with numerous single grains of coarse, round, frosted quartz sand, and clusters of these sand grains in pockets, along with small light-gray mud pellets (phosphatic?), some sulphur specks, selenite crystals, pyrite and coaly or carbonized streaks which probably represent mineralized plants. The fishes included are pteraspids, cyathaspids and arthrodires (see Denison, 1960). The pterygotids are by far the most common eurypterids present.

It is of interest to note again the intimate association of primitive fishes with eurypterids. In this bed, the pointed teeth of the large pterygotid chelicerae are very worn. The ends are rounded and all traces of the longitudinal ridges are worn off from the distal ends of the teeth.

It might be well to speculate on the prey on which these chelicerae were abraded. Besides the common fishes and eurypterids, no ani-

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mal remains are present. It is difficult to explain the intimate association of fishes and eurypterids not only in this black shale but also throughout the Silurian and Devonian sections other than by the conclusion that one served as prey for the other. In the Ohio Devonian, the pterygotids surpassed five feet in length (from the anterior of the carapace to the end of the telson) and were armed with stout and formidable chelicerae which, with their strong teeth, served as excellent grasping organs. Also, the pterygotids were active swimmers, as suggested by the flattened body and great telsonic flipper. In contrast to these active swimmers, the associated eurypterids, namely, *Dolichopterus asperatus* and *Syntomopterus richardsoni*, had simple, small chelicerae not serviceable as weapons of either defense or predation; both were probably benthonic forms, crawling on the mud but perhaps capable of swimming to a limited extent. These could well have been prey to the fishes and, indeed, to the large pterygotids. However, in this shale the fishes are the only animals with a covering rigid and hard enough to abrade the tough pincer-teeth of the pterygotids.

The numerous and persistent instances of the intimate association of pterygotids with primitive fishes throughout Silurian and Devonian time, as well as the presence of the greatly abraded teeth in the pterygotids herein described, point to the tentative conclusion that the fishes were a source of food to the great pterygotids.

The four forms from the Ohio Lower Devonian are different from any of the described North American species. In particular, there is no basis for comparison with the eurypterids of the Lower Devonian Beartooth Butte (listed above as "Wyoming"), as each species is quite different. The same is true of a comparison with the Lower Devonian of the Rhineland, Germany (Størmer, 1936). The Ohio Lower Devonian eurypterid fauna retains such Silurian elements as *Erettopterus* and *Dolichopterus*, two genera previously unknown above the Silurian. *Pterygotus* (*Pterygotus*) *carmani* likewise shows closer relationship to Silurian than to Devonian forms. The Downtonian eurypterids of the Welsh borderland seem to bear closest resemblance to the Ohio forms. The Downtonian is considered Devonian by some authors, although it has been recognized for many decades as a transition zone between Silurian and Devonian. Our knowledge of Devonian and even Downtonian eurypterids is still far from complete, and correlations on the basis of these fossils are not desirable at the present time. Undoubtedly, the highly specialized eurypterids will constitute good index fossils when more is known of their occur-

rences. They do so in parts of the Upper Silurian of New York, where the various specific ranges are well known.

The list of North American eurypterids of the Devonian is as follows:

<i>Adelophthalmus approximatus</i> (Hall and Clarke)	Upper Devonian?	Pennsylvania
<i>Ctenopterus</i> (?) <i>lacoana</i> (Claypole)	Upper Devonian	Pennsylvania, New York
<i>Dolichopterus asperatus</i> , n. sp.	Lower Devonian	Ohio
<i>Dorfopterus angusticollis</i> Kjellesvig-Waering	Lower Devonian	Wyoming
<i>Erieopterus latus</i> (Ruedemann)	Lower Devonian	Wyoming
<i>Grossopterus inexpectans</i> (Ruedemann)	Middle Devonian	New York
<i>Pterygotus</i> ( <i>Erettopterus</i> ) <i>serratus</i> n. sp.	Lower Devonian	Ohio
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>atlanticus</i> Clarke and Ruedemann	Middle Devonian	New Brunswick
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>carmani</i> n. sp.	Lower Devonian	Ohio
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>elleri</i> Ruedemann	Upper Devonian	New York
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>gaspensis</i> Russell	Middle Devonian	Quebec
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>howelli</i> Kjellesvig-Waering and Størmer	Lower Devonian	Wyoming
<i>Pterygotus</i> ( <i>Pterygotus</i> ) <i>montanensis</i> Ruedemann	Upper Devonian	Montana
<i>Rhenopterus</i> (?) <i>macCarthyi</i> (Kjellesvig-Waering)	Middle Devonian	New York
<i>Strobilopterus princetonii</i> (Ruedemann)	Lower Devonian	Wyoming
<i>Stylonurus arnoldi</i> (Ehlers)	Upper Devonian	Pennsylvania
<i>Stylonurus beecheri</i> (Hall)	Upper Devonian	Pennsylvania
<i>Stylonurus</i> (?) <i>wrightianus</i> (Dawson)	Upper Devonian	New York
<i>Syntomopterus richardsoni</i> , n. sp.	Lower Devonian	Ohio

The ecological conditions are discussed by Dr. Denison in his paper on fishes (1960, p. 610) and will not be repeated here.

Class **Merostomata** Dana, 1852

Subclass **Eurypterida** Burmeister, 1843

Superfamily **Eurypteracea** Burmeister, 1845

Family **Pterygotidae** Clarke and Ruedemann, 1912

Genus **Pterygotus** Agassiz, 1839

**Pterygotus** (**Pterygotus**) **carmani**, new species

Figures 35-42

This large eurypterid is the most common element of the Lower Devonian eurypterid fauna of Lucas County. Most of the patches

of integument retaining typical *Pterygotus* ornamentation probably belong to this species, although part may be referable to the rarer *Pterygotus (Erettopterus) serratus* (see p. 87). The species is based on three incomplete chelicerae, the gnathobases of two coxae, a metastoma, and a pretelson. Fragments described herein indicate a form that reached an overall length of body, exclusive of the long chelicerae, of more than five feet, a size not unusually large for the genus.

The holotype (PE5105) comprises fragments of an articulated chelicera retaining the proximal part of both rami (see fig. 35). Two of the specimens designated as paratypes (PE5106 and PE5107) retain the base and ramus of the chelicera, as well as parts of the fixed and free rami (see figs. 36 and 37). A reconstruction of an almost complete chelicera is therefore possible (see fig. 38).

The hand of the chelicera comprises a rather slender, rectangular structure, without any trace of ornamentation. The rami are slender, and the free ramus is slightly more curved. The distal ends are missing in our specimens. On the inner edge of the rami are a number of teeth, all of which are curved backward and are stout and unusually short. Part of this general stoutness of the teeth is due to conspicuous wearing, as the distal part of each tooth has been rounded off as if by an abrasive. However, part of the general stout aspect is inherent. The majority of the teeth are small, with several large, thick teeth interspersed. The central, or principal, tooth of the free ramus (no. 1 in figs. 35-38) is the largest, and is represented by a curved, thick structure. Nearly opposite this tooth is a similar but smaller tooth (no. 3). In front of this tooth is another one, half as large (no. 4). This combination is present on all chelicerae of this species.

Each tooth is longitudinally marked by narrow ridges, which generally are described in the literature as striations, anastomosing furrows, or fine longitudinal furrows. In reality, these structures are longitudinal ridges strengthening the individual tooth and are not furrows or striations. The longitudinal ridges are worn off at the distal end of most teeth in the present specimens.

The hand of specimen PE5107 measures 18.5 mm. at midsection; the large tooth (no. 3) is 3 mm. long by 2.2 mm. wide; the ramus, opposite the no. 3 tooth, is 6.3 mm. wide. In the holotype (PE5105) the free ramus opposite the no. 1 tooth is 14.5 mm. in diameter, and the principal tooth, which has been broken out, measures 9.1 mm. in length and 6.3 mm. at the base. Paratype no. PE5106 is approximately the same size as paratype PE5107.





FIG. 35. Holotype of *Pterygotus* (*Pterygotus*) *carmani*, n. sp., PE5105. Part of a chelicera; natural size.



FIG. 36. Paratype of *Pterygotus* (*Pterygotus*) *carmani*, n. sp., PE5106. Part of a chelicera;  $\times 2$ .



FIG. 37. Paratype of *Pterygotus* (*Pterygotus*) *carmani*, n. sp., PE5107. The fixed ramus of a chelicera;  $\times 2$ .

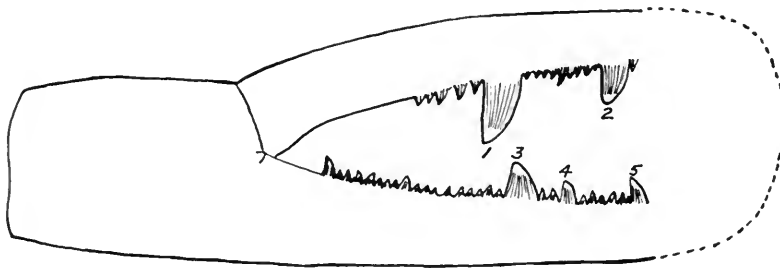


FIG. 38. Composite of known parts of chelicera of *Pterygotus* (*Pterygotus*) *carmani*, n. sp.; natural size.

The gnathobase of the coxa of the swimming legs (figs. 39, 40) comprises a row of triangular, curved teeth, progressively smaller from anterior to posterior. A complete gnathobase (fig. 40) reveals that the anterior tooth is largest, and that 13 teeth are present. Another, but larger, gnathobase (fig. 39) is incomplete and lacks the anterior two teeth. The width of the gnathobase illustrated (fig. 40; specimen PE5109) is 20.3 mm.; the first tooth is 3.5 mm. in length



FIG. 39. *Pterygotus (Pterygotus) carmani*, n. sp., paratype, PE5110;  $\times 3.5$ . Part of gnathobase of coxa of swimming leg. Ruled line, one centimeter.



FIG. 40. Gnathobase of coxa of swimming leg of *Pterygotus (Pterygotus) carmani*, n. sp., paratype, PE5109. Shading indicates preserved patches of test. Ruled line, one centimeter.

and 2.7 mm. in width. The incomplete structure in figure 39 (specimen PE5110) is 21.5 mm. in width.

The gnathobase of the coxa of one of the walking legs (PE5113) measures 17 mm. in width; it bears at least 18 teeth, of which the second tooth is the largest and measures 5.5 mm. in length. The teeth are slender and pointed and become exceedingly slender in the posterior part of the gnathobase.

The metastoma is represented by a single specimen (PE5112 *a* and *b*) in which the posterior third is missing. It is an ovoid-cordate plate, deeply indented on the anterior margin and reaching its greatest width slightly anterior to the midsection. It is covered with large scales, more prominently developed on the anterior part. The metastoma is 41.0 mm. in greatest width with an estimated length of 55.0 mm. (see fig. 41).

The mesosoma is undoubtedly represented by many of the fragments found throughout the black shale but these cannot be determined as belonging certainly to *P. carmani*. Another pterygotid, *P. (Erettopterus) serratus*, which has similar ornamentation, is asso-



FIG. 41. Metastoma of *Pterygotus (Pterygotus) carmani*, n. sp., paratype, PE5112;  $\times 1.4$ .

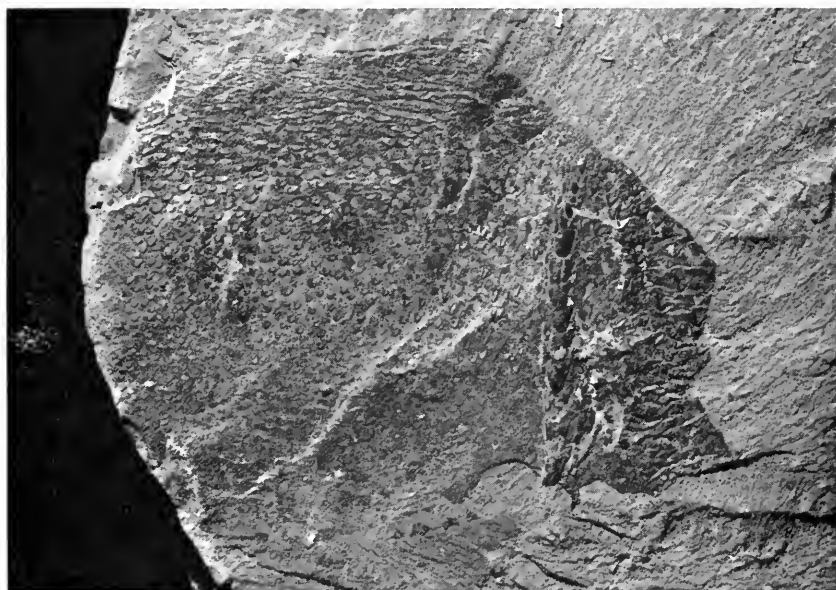


FIG. 41, a. *Pterygotus (Pterygotus) carmani*, n. sp., paratype, PE5118 a, part of a pretelson;  $\times 1.25$ .

ciated. The last two tergites of the metasoma, however, can be described. The twelfth tergite, or pretelson (fig. 41, *a*), reveals through the midsection an elevated ridge that becomes more prominent pos-



FIG. 42. Dorsal side of eleventh tergite of *Pterygotus (Pterygotus) carmani*, n. sp., paratype, PE5119;  $\times 2.2$ .

teriorly. In the anterior part, this ridge comprises three to four elongated scales which grade into a simple, greatly thickened, elongated scale which occupies the entire ridge at the posterior part of the pretelson. The scales on the lateral parts of the pretelson are densely packed, large, semilunar or concentric in outline on the anterior part of the tergite, grading into more scattered and more sharply pointed scales. On the sides of the central ridge and at the base of the tergite the scales become more elongated. The pretelson is 58.0 mm. long. The preceding tergite, likewise, has a ridge of large scales on its posterior part (see fig. 42). The largest scale is 4.5 mm. long and 5.0 mm. wide. The telson is unknown.

*Remarks.*—*Pterygotus (Pterygotus) carmani* differs greatly from other species of the genus. From the New York Silurian *Pterygotus (Pterygotus) cobbi* Hall, and *Pterygotus (Pterygotus) juvenis* Clarke and Ruedemann and from the Bohemian *Pterygotus (Pterygotus) barrandei* (Semper) it differs in the much stouter and less well-developed

cheliceral teeth, and in a considerably different arrangement of these teeth. From the New York Devonian *P. (Pterygotus) elleri* Ruedemann and the Montana Devonian *P. (Pterygotus) montanensis* Ruedemann, the stout, short teeth of *P. (Pterygotus) carmani* are sufficient to distinguish the Ohio form.

The species has been named in honor of Dr. J. Ernest Carman, Ohio State University, who discovered the fish-eurypterid fauna of the Holland Quarry shale.

The holotype (PE5105) and paratypes (PE5106–PE5112, PE5118 and PE5119) are in the collections of Chicago Natural History Museum.

### ***Pterygotus (Erettopterus) serratus*, new species**

#### Figure 43

The species is based on a single well-preserved, complete, free ramus of the chelicera. Inward bowing at the distal end indicates that it is the free ramus of the left chelicera. The specimen is broken through the midsection into two parts. Figure 43 is a composite of both parts ( $\times 4$ ).

The ramus is a short, stout structure tapering into a curved distal end. The inner margin, armed with teeth, is inclined with respect to the almost straight outer margin, resulting in an overall tapering form. The teeth are short and stout, in keeping with the overall robust aspect of the stem. These teeth are mostly of fairly uniform size, mainly lanceolate to rhomboidal, but some are truncated, giving a nearly quadrate appearance. The two distal teeth are badly worn but apparently were the largest. Wear is also apparent on the succeeding three teeth. No longitudinal ridges ("striations") occur on any of the teeth. The distal end is slightly curved inward; that is, in normal position the end would be curved inward toward the oral opening. The free ramus is estimated to have been 27.5 mm. long on the base and is 5 mm. wide at midsection.

*Remarks.*—The subgenus *Pterygotus (Erettopterus)* is poorly represented in North America but is well known in Scotland, England, and Saaremaa (Oesel). The form above described is the first record of the subgenus in the Devonian of North America. *P. (Erettopterus) serratus* differs greatly from the common *P. (Erettopterus) bilobus* (Salter) of the upper Silurian of Scotland in having the chela much thicker and in having short, stout teeth in contrast to the slender, curved teeth of the latter. From *P. (Erettopterus) osiliensis* Schmidt, the

common Oesel form, it differs in the much stouter chela as well as the more prominently developed teeth. It may be easily distinguished from the associated *P. (Pterygotus) carmani* in the altogether different type of chela, as well as in the lack of prominent ridges ("striations") on the teeth. The latter characteristic serves to distinguish both forms even in small fragments of the teeth.

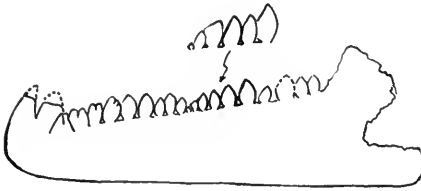


FIG. 43. Holotype of *Pterygotus (Erettopterus) serratus*, n. sp., PE5104. Free ramus of chelicera;  $\times 4$ .

The holotype (PE5104 *a* and *b*) is in the collections of Chicago Natural History Museum.

Superfamily **Stylonuracea** Diener, 1924

Family **Dolichopteridae** Kjellesvig-Waering and Størmer, 1952

Genus **Dolichopterus** Hall, 1859

**Dolichopterus asperatus**, new species

Figures 44–47

This interesting species is based on a partial prosoma and three paddles of the swimming legs which indicate a form unlike any of the described dolichopterids. One of the paddles (PE5114) has been selected as the holotype.

The prosoma is represented by one specimen (PE5117) indicating an individual approximately 70 cm. in length. The specimen retains only the left side of the prosoma, with a faint outline of part of the left lateral eye, and without trace of the ocelli; figure 44 illustrates the parts known. The prosoma is rounded along the outer lateral angles and along the anterior margin. Anteriorly the lateral margins converge slightly. The margins are bounded by a narrow but pronounced ornamented rim which gives this form a distinctive appearance. This marginal rim is composed of a single row of flat, oblong, elevated structures (see fig. 44, *a*); it is narrow at the genal angles and is not developed on the posterior edge. Apart from this ornamented rim, the prosoma is smooth.

The compound eyes are not preserved except for the barely perceptible anterior margin of the left eye and a slight elevation that

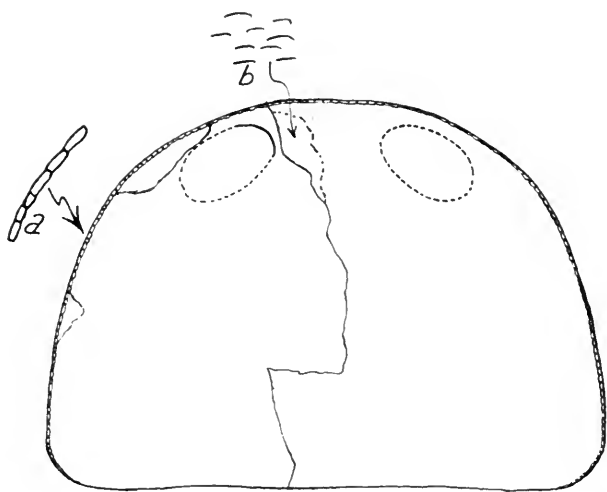


FIG. 44. Restoration of prosoma of *Dolichopterus asperatus*, n. sp., based on a paratype, PE5117; natural size.

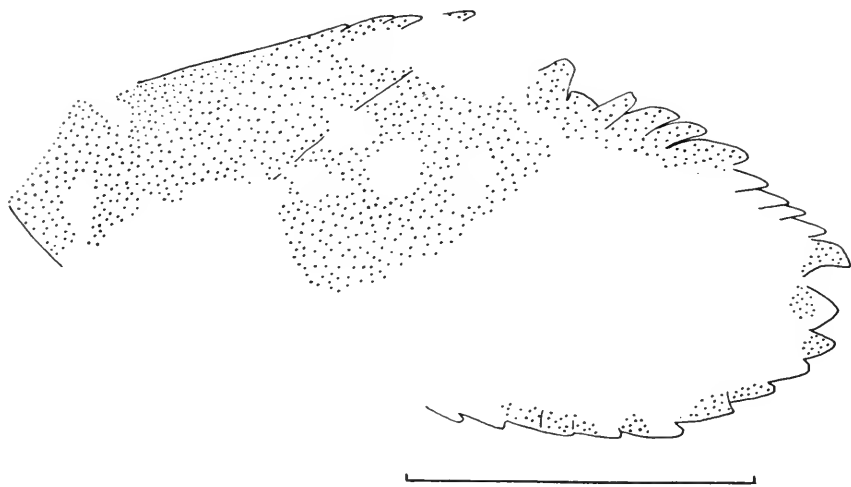


FIG. 45. Holotype of *Dolichopterus asperatus*, n. sp., PE5114. Paddle of swimming leg. Shading indicates preserved patches of test. Ruled line, one centimeter.

may represent the eye node. The node is probably arcuate, and the palpebral lobe covers most of the eye.

The prosoma measures 69 mm. in length, 79 mm. in width behind the compound eyes, and 99 mm. in width along the base. The compound eye node is 28.0 mm. long and possibly 10 mm. wide. It is 6.5 mm. from the anterior margin, 9.0 mm. from the lateral margin, and 50.0 mm. from the base of the prosoma. The preceding measurements are estimated. The marginal rim measures 0.8 mm. in width. The doublure along the base of the prosoma is 5.1 mm. wide.

A fragment of the ventral shield, or doublure, of the prosoma is present on the anterior part of the specimen. The part preserved is not sufficient to warrant description except to note that ornamentation is present. This consists of flat, slightly curved to linear scales parallel to the rim, with their crests pointing toward the marginal rim.

The fact that the scales point to the marginal rim indicates the independence of the ventral plates and the dorsal shield. This condition is better emphasized by *Syntomopterus richardsoni*. The doublure is rather wide and measures 21 mm. in width in the anterior part.

The distal part of the swimming legs is well represented by three specimens which further reveal this form as a distinct species. The holotype (PE5114) and two paratypes (PE5115 and PE5116) retain the seventh and eighth joints. These joints (together) form a semi-elliptical structure with numerous serrations, particularly on the last joint. Supplementary lobes are present, but their outline is impossible to detect. On specimen PE5116 a supplementary joint line occurs along the posterior distal part, and serrations were superimposed along the extreme end and also on the anterior part of the joint (see fig. 47), indicating supplementary lobes. The distinctive feature of the species is, however, the small but conspicuous row of spine-like projections that border the joints. These serrations vary in size within the species. The holotype measures 12 mm. in width at the seventh joint and 11.1 mm. at the eighth. The greatest width of specimen PE5115 is 11.8 mm.

*Remarks.*—This is the first reported occurrence of the genus in Devonian beds. It differs from all Silurian dolichopterids in the presence of the chain-like marginal rim of the prosoma, and particularly in the fine serrations that border the swimming leg paddles. It is a distinctive and easily recognizable species.

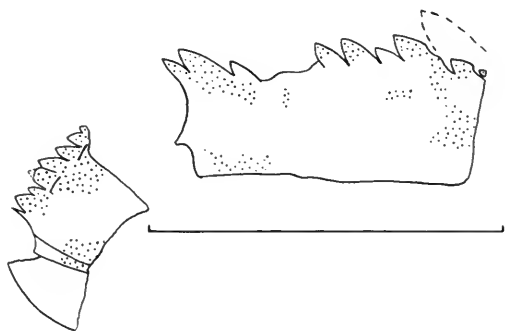
The holotype (PE5114) and paratypes (PE5115–PE5117) are in the collections of Chicago Natural History Museum.





FIG. 46. Paddle of swimming leg of *Dolichopterus asperatus*, n. sp., paratype, PE5115. Shading indicates preserved patches of test. Ruled line, one centimeter.

FIG. 47. Distal end of paddle of swimming leg of *Dolichopterus asperatus*, n. sp., paratype, PE5116. Shading indicates preserved patches of test. Ruled line, one centimeter.



### Family *Stylonuridae* Diener, 1924

#### Genus *Syntomopterus*, new genus

The prosoma is paraboloidal, very wide, straight along the base, and bordered with a wide marginal rim. The ventral shield is very narrow and band-like, and without sutures. The compound eyes, located slightly behind midsection, are crescentic, small, and close-set. The ocellar mound is located opposite the anterior part of the compound eyes. Ornamentation comprises large wart-like pustules, elongated and pointed at the margins.

Type species: *Syntomopterus richardsoni*, new species.

*Remarks.*—*Syntomopterus* differs greatly from other genera of the *Stylonuridae*. In some respects, particularly in the form of the cephal-

alothorax and the nearly centrally located eyes, *Syntomopterus* resembles some of the species included under *Erieopterus* in the family Eurypteridae. However, the arcuate eyes, with the wide palpebral lobe, located behind the middle of the cephalothorax, as well as the anterior position of the ocellar mound, the flat, wide marginal rim, the narrow, unjointed ventral shield and the pattern of the ornamentation, which is much like that of *Stylonurus megalops* (Salter), precludes its inclusion in that family and aligns it in the family Stylonuridae.

The wide, paraboloidal cephalothorax is in marked contrast to other Stylonuridae. However, the cephalothorax of *Stylonurus myops* Clarke, of the Silurian Shawangunk sandstone of New York, reveals similar widening, although the form is different from that of *Syntomopterus*. The New York Silurian *Erieopterus pustulosus* (Hall) has much in common with this form. In all references (Hall, 1859, p. 413; Pohlman, 1882, p. 41; and Clarke and Ruedemann, 1912, p. 201) the authors have described and figured the compound eyes as being the *Eurypterus* type of reniform eyes and not the arcuate type found in *Syntomopterus*. It is possible that the palpebral lobe has been broken out in the specimens described, though there is no reason to believe that those authors would not have noted that easily recognizable condition. The eyes of *E. pustulosus* are placed in front of midsection, whereas those of *Syntomopterus* are behind. The ornamentation of *E. pustulosus* is in some respects strikingly like that of *Syntomopterus* although it differs greatly in the presence of pointed scales; it also lacks the wide, flat, marginal rim of the latter—an important difference.

I recently studied the types of the British Downtonian *Stylonurus megalops* (Salter), and it was mainly on that basis that I arrived at the conclusion that the Ohio form was probably a stylonurid. The compound eyes are somewhat similar in having the wide palpebral lobes, but, above that, the ornamentation on the cephalothorax and on the wide marginal rim is of the same type, although not as pronounced or as densely distributed as in *Syntomopterus richardsoni*. The similarity, however, ends with the ornamentation, as the form of the cephalothorax and the position of the eyes are entirely different.

Few eurypterid genera have the compound eyes situated on the posterior half of the cephalothorax. Some that have are the Australian Silurian *Melbournopterus* and the Scottish Devonian *Tarsopterella*, both of which are included in the Stylonuridae.

**Syntomopterus richardsoni**, new species

Figures 48-53

This unusual species is based on the holotype (PE5120) and three paratypes (PE5121, PE5122, PE5123) which together retain all details of the prosoma, the doublure, and fragments of the tergites. It is a pleasure to name this unique species in honor of Dr. Eugene S. Richardson, Jr., Curator of Fossil Invertebrates at Chicago Natural

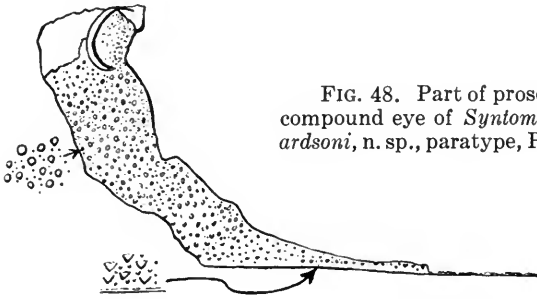


FIG. 48. Part of prosoma and left compound eye of *Syntomopterus richardsoni*, n. sp., paratype, PE5121;  $\times 4$ .



FIG. 49. Compound eye of *Syntomopterus richardsoni*, n. sp., paratype, PE5121;  $\times 8$ .

History Museum, who has contributed considerably to my study of the Eurypterida.

The prosoma is very wide, forming an almost perfect parabola, and is straight along the base. The lateral eyes are small and crescentic, and are covered by a conspicuous palpebral lobe; they are located slightly behind the center of the carapace and closer to each other than to the lateral margins (see figs. 48-50, 52). The ocelli are probably very small, as they were not detected. The ocellar mound, upon which the ocelli would be situated, was, however, preserved, and this occupies a nearly central position on the carapace, midway between and anterior to the center line of the compound eyes. A wide, prominent, flat marginal rim surrounds the carapace, becoming narrower toward the genal angles (see figs. 50, 51).

The ornamentation is highly distinctive and can be recognized even in small fragments in the black shale (see figs. 48, 50, 52). On the prosoma the central and posterior-central parts consist of scat-

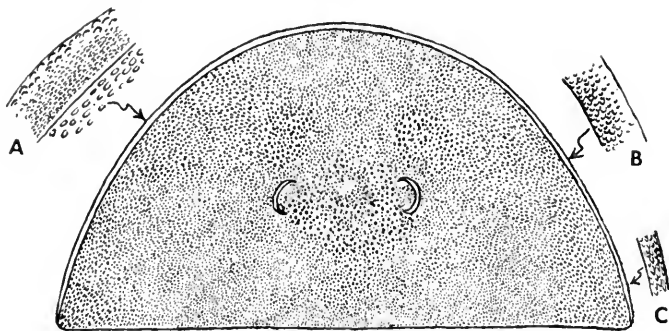


FIG. 50. Reconstruction of prosoma of *Syntomopterus richardsoni*, n. sp., drawn mainly from holotype, PE5120;  $\times 2$ . A: Ventral side of marginal rim of doublure. The large elongated pustules are on the dorsal shield, seen from the inside. B, C: Dorsal side of marginal rim.

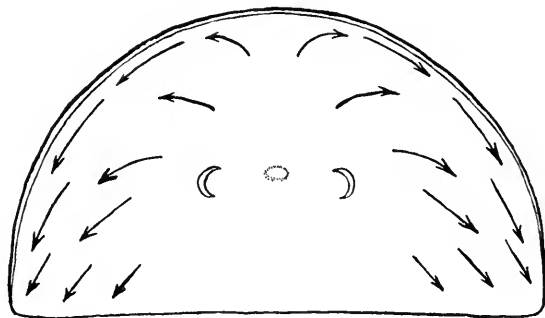


FIG. 51. Diagram of prosoma of *Syntomopterus richardsoni*, n. sp., to show general direction of axis of elongated pustules, forming flow of ornament pattern. Prosoma restored to approximate natural dimensions.

tered wart-like, round pustules of various sizes. Anteriorly, toward the marginal rim, these pustules are slightly elongated, and around the marginal rim they become more elongated, or elliptical (see fig. 50, A), grading into pointed, elongated scales in the region of the genal angles. This results in a "flow-like" pattern from a point anterior to the lateral eyes, around both sides of the prosoma to the genal angles (see fig. 51), a pattern which is characteristic of many Stylonuridae such as *Ctenopterus*, *Melbournopterus*, *Stylonurus*, and *Tarsoptereella*, and which accentuates the double "pouch-like" structures of the prosoma in these genera.

The ornamentation of the marginal rim, however, contrasts greatly with that present on the rest of the carapace. Here the pattern is

totally different, consisting of small crescentic scales which point anteriorly at the anterior part of the rim, but become orientated posteriorly to follow the rim around the carapace until they grade into pointed scales at the genal angles (see fig. 50, B, C). The ornamentation of the palpebral lobe comprises much smaller pustules than are found on the rest of the carapace (see figs. 48–50).

The ventral shield is a flattened, narrow and unjointed band, rounded at the periphery and with ornamentation quite unlike that



FIG. 52. Fragment of left side of prosoma of *Syntomopterus richardsoni*, n. sp., paratype, PE5121;  $\times 4$ . The dark area is the palpebral lobe, which is covered with smaller pustules than the rest of the prosoma.

of the dorsal marginal rim. At the inside of the rim this comprises closely packed semilunar scales, which grade into thicker and less well-defined, scattered scales toward the margin. At a given position on the margin the scales on the ventral rim point outward, whereas those of the dorsal rim point toward the rear of the prosoma (see fig. 50, A, B, C). This condition accentuates the independence of the two rims and indicates that the dorsal rim of the prosoma and ventral shield apparently are separate and distinct structures meeting at a suture (not seen) on the periphery. This suture is suggested by the totally different ornamentation. No sutures were noted dividing the ventral shield into plates.

The holotype consists of two counterparts and is a nearly complete prosoma, lacking only a small area of the left genal angle. Measurements could be made, therefore, with considerable accuracy.



FIG. 53. Ornamentation on posterior part of prosoma of *Syntomopterus richardsoni*, n. sp., holotype, PE5120;  $\times 2.5$ . A portion of front margin may be seen at upper left of specimen.

#### MEASUREMENTS

Holotype	MM.
Prosoma length . . . . .	30.3
Prosoma width behind eyes . . . . .	53.0
Prosoma width at base . . . . .	58.0
Compound eyes located on prosoma:	
From anterior margin . . . . .	14.5
From posterior margin . . . . .	11.3
From lateral margin . . . . .	17.5
Distance between eyes . . . . .	10.5
Length of eye . . . . .	3.5
Width of visual area . . . . .	1.0
Width of palpebral lobe . . . . .	2.0
Width of rim at anterior of carapace . . . . .	1.2
Paratype PE5121 (figs. 48, 49, 52)	
Length of compound eye . . . . .	3.5
Distance from eye to posterior margin . . . . .	15.6

Two paratypes (PE5122 and PE5123) retain parts of some of the tergites, probably from the metasoma. These have the same pustular ornamentation that occurs on the prosoma. On the posterior edge

of each tergite, however, is a single fringe of large, crescentic, flat scales. One of the tergites measures 10.5 mm. in incomplete length.

*Remarks.*—This species differs greatly from all other associated forms, and can easily be distinguished from them by the distinctive ornamentation, which enables identification from small fragments. The very wide prosoma, having a length-width ratio of 5.2:10, is unusual for the Stylonuridae but recalls forms such as *Erieopterus latus* (Ruedemann), *E. pustulosus* (Hall), and *E. brewsteri* Woodward, of the family Eurypteridae. The diagnostic crescentic eye is, however, a structure not present in any of these. Comparison with other forms is superfluous on a species basis as the distinctive characteristics described above will separate this form from all other eurypterids.

The holotype (PE5120 *a* and *b*) and paratypes (PE5121, PE5122 and PE5123) are in the collections of Chicago Natural History Museum.

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