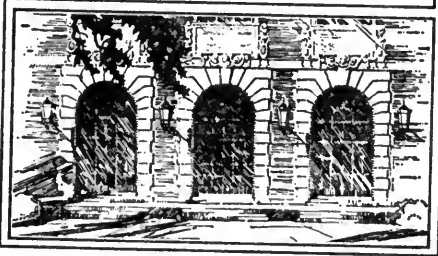


LIBRARY OF THE
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

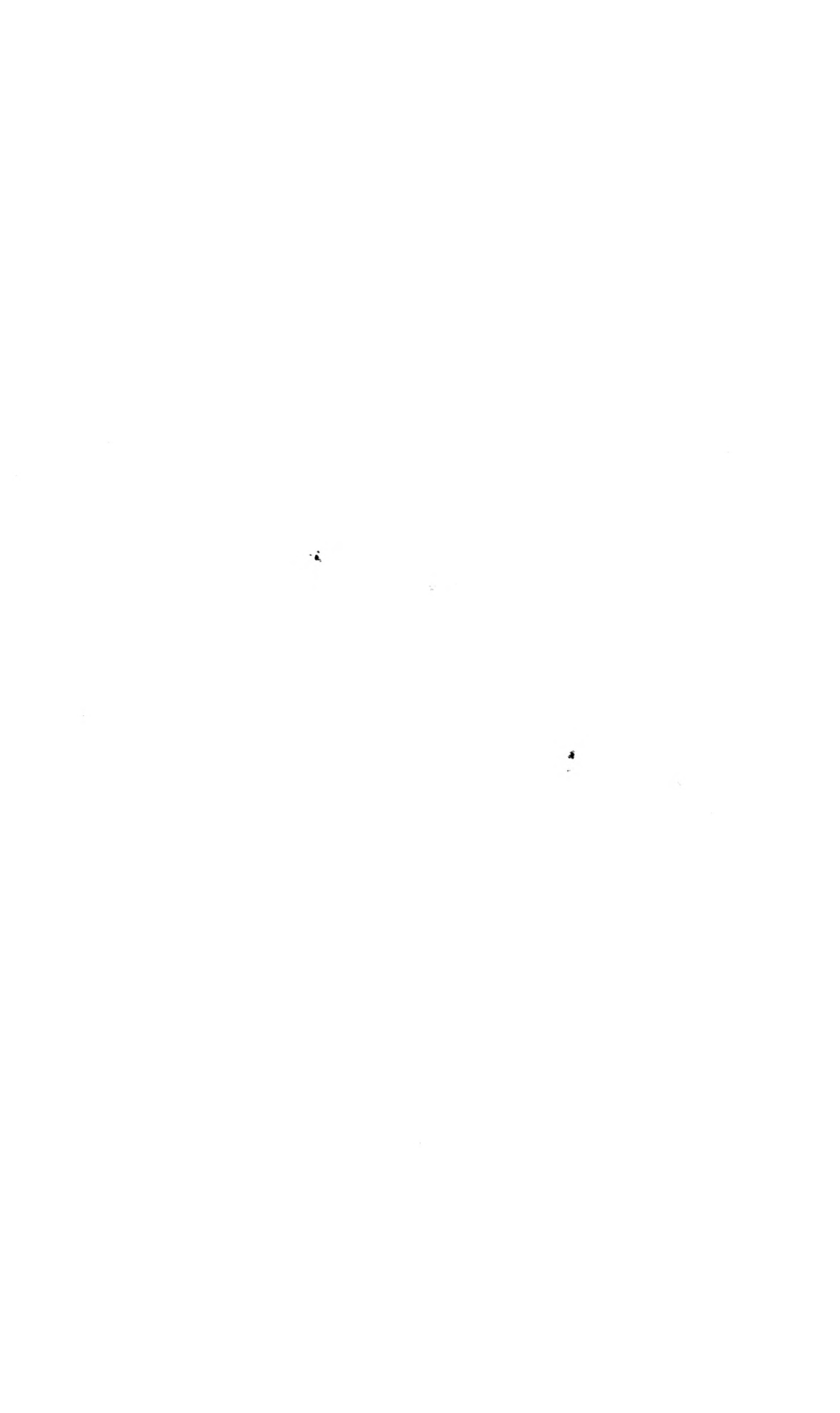
550.5
FI
v. 14-15

JAN 2 1975



GEOLOGY

UNIVERSITY OF
ILLINOIS LIBRARY
AT URBANA-CHAMPAIGN
GEOLOGY



0.5
14
9

FIELDIANA • GEOLOGY

Published by
CHICAGO NATURAL HISTORY MUSEUM

Volume 14

JANUARY 27, 1966

No. 9

A Revision of the Families and Genera of the Stylonuracea (Eurypterida)

ERIK N. KJELLESVIG-WAERING
RESEARCH ASSOCIATE, DEPARTMENT OF GEOLOGY

The genus *Stylonurus* was first made known by Page in 1855 in a report to the British Association. In the first edition of his famed *Advanced Text-Book of Geology* (1856, p. 135, fig. 2), he figured and named the single specimen as *Stylonurus powriensis*, a name which he altered to *Stylonurus powriei* in the second edition of his *Text-Book* (1859, p. 181, fig. 3). If the genus *Stylonurus* is to date from 1856 when Page first proposed it with *S. powriensis* as obvious type species by monotypy, then the original name of the species must be used, since the genus could not have been proposed without a type species. The nearly whole specimen came from the Lower Devonian Old Red Sandstone of Scotland, and revealed long, slender legs without the characteristic paddles which characterized the hitherto known eurypterids. In the later publication, Page described another *Stylonurus* as *S. spinipes* (1859, p. 181, fig. 1) from the Silurian of Scotland. It is curious, and not entirely understandable, that the specific name *Stylonurus powriensis* Page (*S. powriei*) became established in the literature, but *Stylonurus spinipes* Page did not, although it was redescribed on the basis of the same specimen by Woodward (1866-78 [1872], pp. 129-131, pl. XXIV, fig. 1) as *Stylonurus logani* Woodward. There is no question that Page's *Stylonurus spinipes* 1859 has clear priority over *Stylonurus logani* Woodward, 1872. It would be inconsistent to accept the name *Stylonurus powriensis* Page (*S. powriei*) and not *Stylonurus spinipes* Page when both were equally well figured and "described." The type of the latter is an important specimen and the species became in fact better known than the genotype. Since *Stylonurus spinipes* Page will be referred to repeatedly below, I wish to emphasize its validity.

Library of Congress Catalog Card Number: 66-17467

No. 1001

169

THE LIBRARY OF THE
SEP 27 1967
UNIVERSITY OF ILLINOIS

GEOLOGY LIBRARY

Further species of what we consider Stylonuracea today were established in 1859, both in Huxley and Salter's great monograph and in Hall's equally important work. Laurie, in 1892, added the new genus *Drepanopterus* from a large suite of stylonuroids from the Silurian Gala-Tarranon beds of Scotland. It was not until the celebrated monograph of Clarke and Ruedemann in 1912 that a serious attempt was made to subdivide the "stylonurids" into several generic and sub-generic categories. *Dolichopterus* was recognized as a genus and the "true stylonurids" (those without paddles) were divided into four definite groups, which were considered subgenera: (1) *Stylonurus* (*Stylonurus*), (2) *Stylonurus* (*Tarsopterus*), (3) *Stylonurus* (*Ctenopterus*), (4) *Stylonurus* (*Drepanopterus*) and a fifth group which they considered "Indeterminate species."

Clarke and Ruedemann, however, still considered *Dolichopterus* and *Stylonurus* as part of the family Eurypteridae. Diener in 1924 recognized the obvious and major differences between *Stylonurus* and its subgenera on the one hand and members of the family Eurypteridae on the other, and erected the new family Stylonuridae Diener.

In 1951 Størmer, in an important paper, established the family Rhenopteridae on the significant basis of the ventral shield of the carapace and the form of the metastoma. In all outward appearance—that is, dorsally—the Rhenopteridae could well have been mistaken for Stylonuridae were it not for the very different underside. As in scorpions, considerable and increasing evidence is being accumulated, indicating that the major morphological differences of taxonomic importance are to be found on the ventral surface. This applies not only to higher taxa but to species and subspecies.

Several other families were added to what became known as the superfamily Stylonuracea Diener, 1924 (*nom. transl.* Størmer, 1951 [*ex* Stylonidae, 1924]). Størmer gave new names to some of Clarke and Ruedemann's 1912 genera which were junior homonyms, among them changing *Tarsopterus* to *Tarsopterella*. Later, other families were added to the Stylonuracea, namely, Dolichopteridae Kjellesvig-Waering and Størmer, 1952; Hibbertopteridae Kjellesvig-Waering, 1959 and Woodwardopteridae Kjellesvig-Waering, 1959.

I have for many years considered that the family Stylonuridae, and in particular the genus *Stylonurus*, was a catch-all for practically anything that had stylonuroid legs: that is, legs in which the last pair lacked the flat paddle so characteristic of the other eurypterids. In using the ventral shield and the metastoma as the main distinction between families, as Størmer did with respect to the

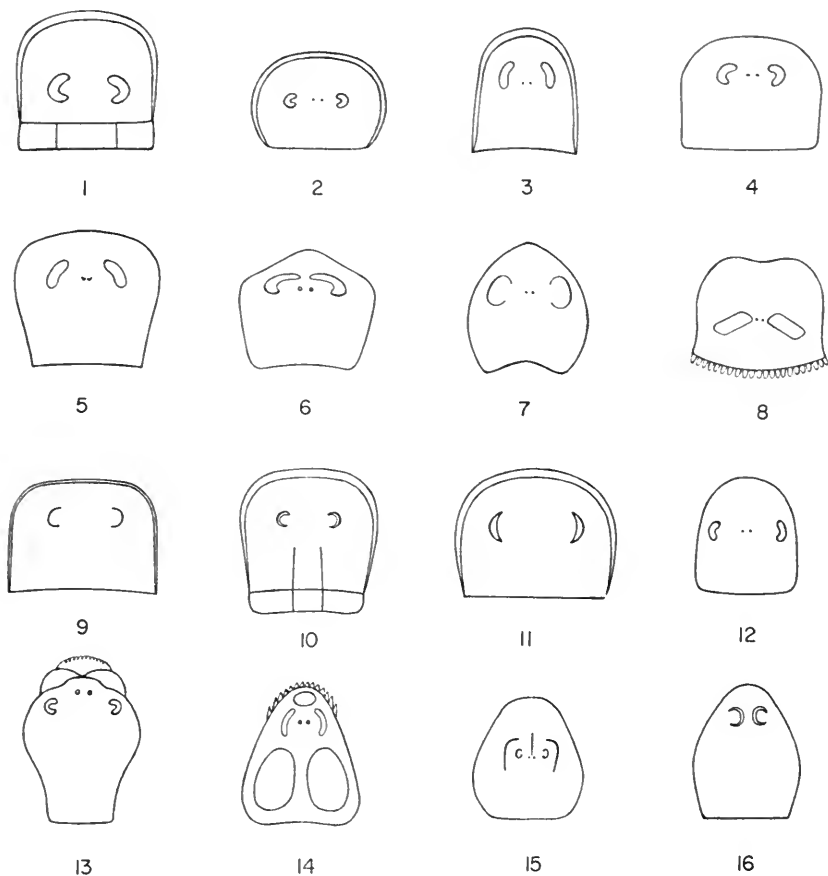


FIG. 95. Schematic diagrams of the carapaces of the genera of the families Stylonuridae, Pageidae, Drepanopteridae, Kokomopteridae, Rhenopteridae and Laurieipteridae. 1, *Stylonurus*; 2, *Parastylonurus*; 3, *Stylonuroides*; 4, *Stylonurella*; 5, *Brachyopterus*; 6, *Brachyopterella*; 7, *Clarkeipterus*; 8, *Melbournopterus*; 9, *Kokomopterus*; 10, *Pagea*; 11, *Drepanopterus*; 12, *Rhenopterus*; 13, *Laurieipterus*; 14, *Ctenopterus*; 15, *Hallipterus*; 16, *Mazonipterus*.

Rhenopteridae, it is obvious that many of the species presently placed in the family Stylonuridae differ widely and show so little affinity that continued grouping under a single family (or mainly, a single genus) is not consistent, judicious or desirable. In the Scorpionida, the sternum, the structure homologous with the eurypterid metastoma, is of great phylogenetic and taxonomic importance for the separation of families (see Petrunkevitch, 1916, pp. 600-608). We have in the past used the ventral shield and metastoma as essen-

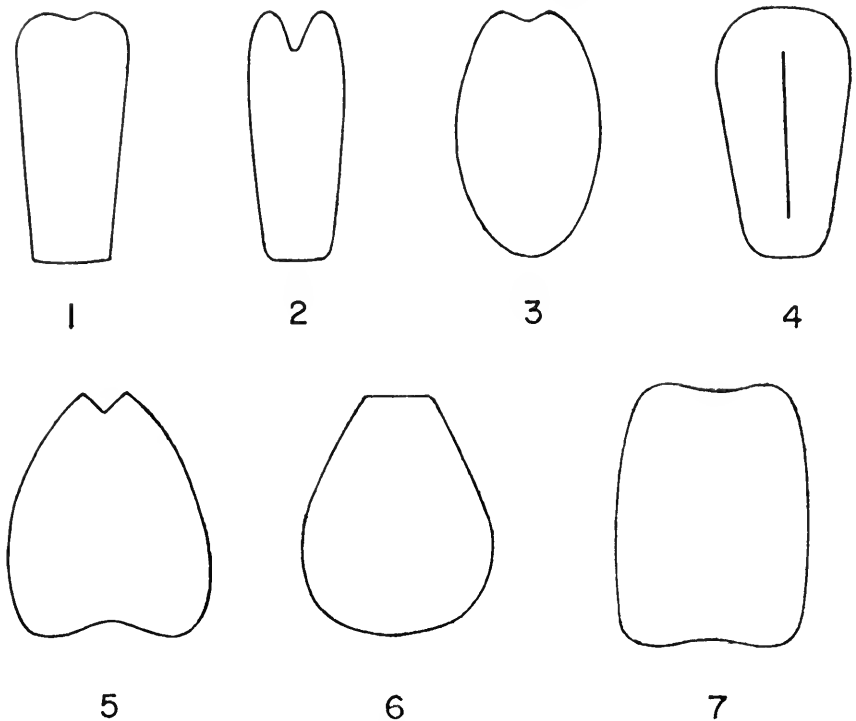


FIG. 96. Diagrammatic outlines of the metastomas of most of the families of the Stylonuracea (excluding Carboniferous and Permian families): 1, *Dolichopteridae*; 2, *Stylonuridae*; 3, *Drepanopteridae*; 4, *Pageidae*; 5, *Kokomopteridae*; 6, *Rhenopteridae*; 7, *Laurieipteridae*.

tial characters for the separation of families in the other non-stylonuroid eurypterids. Størmer was the first to apply this criterion for separation of the Rhenopteridae from the Stylonuridae—a step that is correct, progressive and a definite contribution to a better taxonomy.

With this thought in mind, it becomes obvious that the family Stylonuridae needs radical revision on a world-wide basis, necessitating the description of new families and genera. In general, therefore, I shall use the structure of the prosomal ventral shield and the shape of the metastoma as criteria for the separation of families. Genera are based on the shape of the carapace, shape and position of the eyes, the type of opisthosoma and the size, shape and count of the podomeres. Unfortunately, for some unknown reason the opercula of the Stylonuracea are little known, and knowledge of these in the future will be of considerable importance toward a better classification.

Descriptions of all families and genera of the Stylonuracea are included here, as well as lists of the species referred to each genus. The families included are: Dolichopteridae, Stylonuridae, Pageidae, Drepanopteridae, Kokomopteridae, Rhenopteridae, Lauriepteridae, Woodwardopteridae, and Hibbertopteridae.

SYSTEMATICS

Order **Eurypterida** Burmeister, 1845

Suborder **Eurypterida** Burmeister, 1845

Superfamily **Stylonuracea** Diener, 1924

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

Genus **Dolichopterus** Hall, 1859

Diagnosis.—Dolichopteridae of medium size; test apparently smooth except for circular scales on certain appendages; prosoma subquadrate; lateral eyes situated close to anterolateral angles; ocelli centrally located; ventral doublure unknown; chelicera unknown, probably small, simple; second to fourth paired appendages stout, increasing in length posteriorly, spinous; fifth and sixth paired appendages with supplementary flat lobes on distal joints, ultimate joint forming a large claw in the fifth, and a broad, greatly enlarged lobe (paddle) in the sixth appendage, lateral margin of paddle slightly serrate; metastoma narrow, cordate anteriorly, truncated at base; male median appendage very long, two-jointed; female appendage very small, not well known; no appreciable contraction of metastoma; posterior tergites produced into wing-like epimera; telson spike-like (Kjellesvig-Waering and Størmer, 1952, p. 660).

Type species.—*Eurypterus (Dolichopterus) macrocheirus* Hall, 1859.

Distribution.—New York, Pennsylvania, Ohio, Saaremaa (Oesel), U.S.S.R., and England.

Stratigraphic range.—Ordovician to Devonian.

The following species are recognized for this genus:

<i>Dolichopterus antiquus</i> Ruedemann, 1942	Ordovician	New York
<i>Dolichopterus asperatus</i> Kjellesvig-Waering, 1961	Devonian	Ohio

<i>Dolichopterus bulbosus</i> Kjellesvig-Waering, 1961	Siluro-Devonian	England
<i>Dolichopterus herkimerensis</i> Caster and Kjellesvig-Waering, 1956	Silurian	New York
<i>Dolichopterus jewetti</i> Caster and Kjellesvig-Waering, 1956	Silurian	New York
<i>Dolichopterus lancmani</i> (Delle), 1936	Devonian	U.S.S.R.
<i>Dolichopterus macrocheirus</i> Hall, 1859	Silurian	New York
<i>Dolichopterus siluriceps</i> Clarke and Ruedemann, 1912	Silurian	New York
<i>Dolichopterus størmeri</i> Caster and Kjellesvig-Waering, 1956	Silurian	Oesel

Genus *Strobilopterus* Ruedemann, 1935

Diagnosis.—Dolichopteridae of medium size; test covered with pustules and semi-lunar scales; prosoma semiovate; compound eyes submarginal; ocelli unknown; ventral doublure unknown; sixth appendages with movable, supplementary flat lobes on distal joints, ultimate joint forming large, flat lobe; distal joints and lobes forming paddle with strongly serrate margin; metastoma very narrow, cordate at anterior end; base unknown; male median appendage very long, consisting of one undivided joint; metasoma contracted past first tergite; telson unknown (Kjellesvig-Waering and Størmer, 1952, p. 660).

Type species.—*Pterygotus princetonii* Ruedemann, 1934.

Distribution.—Wyoming.

Stratigraphic range.—Lower Devonian.

Remarks.—*Strobilopterus princetonii* (Ruedemann) remains as the only known species.

Genus *Ruedemanniapterus*, new genus

Diagnosis.—Dolichopteridae of small size; distinctly stylonuroid in general aspect; carapace longer than wide; considerably wider in front than behind, making base of carapace narrowest part; eyes large, with narrow arcuate visual area, and large palpebral lobes located anteriorly and intramarginally on the carapace; axes of eyes parallel; ocelli located midway between, or grouped with the lateral eyes; prosomal appendages unknown except the sixth which are greatly elongated, subcylindrical legs having the last three joints flattened into numerous, narrow, leaf-like supplementary lobes; mesosoma very narrow; integument mainly smooth.

Type species.—*Dolichopterus stylonuroides* Clarke and Ruedemann, 1912.

Derivation of name.—Named in honor of Rudolf Ruedemann whose many contributions to our knowledge of the Chelicerata are basic and well known to all who work in this group.

Distribution.—Eastern New York.

Stratigraphic range.—Ordovician.

Remarks.—*Ruedemannipectus* seems to be an interesting connecting genus between the Dolichopteridae and Stylonuridae. The distinctly elongated carapace and narrow mesosoma, as well as the narrow sixth leg, resemble features of some of the Stylonuridae. However, the development of a paddle, although narrow, with numerous supplementary lobes, probably should designate this genus as one of the Dolichopteridae. As it is obviously a connecting genus, good arguments for it being a stylonurid can also be advanced. *Brachyopterus* Størmer, 1951, has a carapace which in general shape resembles *Ruedemannipectus*, although the position of the eyes and the stylonurid type of legs make further comparison unnecessary.

A number of other eurypterids which have aroused uncertainty as to their generic affinities can now be referred to the genus *Ruedemannipectus*. These include *Dolichopterus latifrons* Clarke and Ruedemann, 1912, from the Ordovician Schenectady shales of Schenectady, New York, and *Dolichopterus breviceps* Clarke and Ruedemann, 1912, from the Ordovician Normanskill shale of Catskill, New York.

Genus *Tarsopterella* Størmer, 1951

Diagnosis.—Medium-to-large dolichopterids, outer surface with strongly developed knobs and scales; prosoma broadly subrectangular, slightly concave in front; lateral eyes small; opisthosoma with pronounced epimers; prosomal legs unknown, except fragments of last leg which indicate presence of a wide paddle, possibly dolichopteroid (diagnosis modified from Størmer, 1955, pp. 38-39).

Type species.—*Stylonurus scoticus* Woodward, 1864.

Distribution.—Scotland and Germany.

Stratigraphic range.—Devonian.

Remarks.—The two podomeres preserved on the left side of the holotype are flat structures indicating the presence of a paddle. On the other hand, Størmer (1955, p. 39) believes that the legs were probably stylonuroid. The overall aspect of the eurypterid could in-

dicate that it is either a dolichopterid or one of the stylonuroids. The ornamentation is more typical of such stylonuroids as *Hallipterus*. Nevertheless, the flattened podomeres indicate that if *Tarsopterella* is a stylonuracean, it should probably be referred to the Dolichopteridae. This is done here with considerable misgivings until the ventral side is known or some more prosomal appendages are found of this highly spectacular eurypterid. It is not precluded that *Tarsopterella* may not belong among the Eurypteracea.

The following species are recognized:

<i>Tarsopterella scoticum</i> (Woodward), 1865	Devonian	Scotland
<i>Tarsopterella laticeps</i> Størmer, 1936	Devonian	Germany

Family **Stylonuridae** Diener, 1924

Diagnosis.—Ventral shield and metastoma unknown; eyes located in posterior half of carapace, opisthosoma undifferentiated, trilobation present; last two legs very long.

The above family diagnosis is based on the type species of *Stylonurus* as restricted here. However, if genera such as *Stylonuroides*, *Stylonurella*, *Parastylonurus*, *Brachyopterus* and *Brachyopterella* are used in the diagnosis, then a much better and more complete diagnosis can be made. I suspect, however, that some of these genera will be found eventually to have no significant affinities with the type genus. It is almost certain that further revisions in the diagnosis of the family will be forthcoming with discovery of additional material. With these reservations in mind, the diagnosis of the family may further include:

Diagnosis.—Ventral shield with epistoma; metastoma very narrow, with deep triangular notch or deeply cordate anteriorly, and with base truncated.

It should be noted that when the underside of *Stylonurus powriensis* Page, the genotype, is known, genera such as *Parastylonurus*, *Stylonuroides*, *Stylonurella*, *Brachyopterus*, *Brachyopterella*, and others here included in the Stylonuridae, may well be found to belong to other and distinct families.

The following genera are recognized for this family:

<i>Stylonurus</i> Page, 1856
<i>Stylonurella</i> , new genus
<i>Stylonuroides</i> , new genus
<i>Parastylonurus</i> , new genus

Brachyopterus, Størmer, 1951

Brachyopterella, new genus

Clarkeipterus, new genus

Melbournopterus, Caster and Kjellesvig-Waering, 1953

(?) *Dorfopterus*, Kjellesvig-Waering, 1955

Genus *Stylonurus* Page, 1856, emended

Diagnosis.—Stylonuridae of medium size, prosoma subquadrate, lateral margins slightly rounded outward to reach greatest width at midsection, anterolateral angles rounded; eyes arcuate, located in posterior half of prosoma; podomere-count unknown, but the last two legs are greatly elongated, the last one extending to at least the twelfth tergite; opisthosoma wide, short, trilobated, and without differentiation into a pre- and post-abdomen; metasoma grades into the long telson without differentiation; underside unknown.

Type species.—*Stylonurus powriensis* Page, 1856.

Distribution.—Scotland, Pennsylvania (?) and New York (?).

Stratigraphic range.—Devonian.

Remarks.—The above diagnosis is an emendation, but based only on the type species. However, it is necessary because *Stylonurus*, as was the case with the genus *Eurypterus* (Kjellesvig-Waering, 1948, p. 4; 1958, p. 1107), has become a convenient entity to which to refer practically any eurypterid with stylonuroid legs. Species have been referred to this genus on the basis of characters conforming to those of the type species in only the most general way, serving to place them in the superfamily Stylonuracea. This criticism is not aimed at any particular worker in the eurypterids, and it includes myself as much as anyone else.

Page, in his original description (1856, p. 135), described the genotype as "quaint-looking," and indeed it is, remaining as unique and enigmatic today as it did over one hundred years ago. The characters distinguishing *Stylonurus* from other stylonurids are not only the position of the eyes in the rear of the carapace, and the shape of the carapace, but more importantly the distinct trilobation, not only of the mesosoma as in some other eurypterids (*Megalograptus*, *Mixopterus*), but also of the metasoma, a feature not found elsewhere except in the recently described *Pagea* of Waterston (1962), and the Woodwardopteridae, both considerably different eurypterids. Even without the presence of trilobation, the short, wide opisthosoma, without the slightest trace of differentiation, is a significant feature. The

underside of the genotype would likely be of great interest and perhaps as surprising as the dorsal.

Basing the generic differences on the carapace, position of the eyes and type of opisthosoma, I recognize several genera which previously had been included in the genus *Stylonurus*. These are *Brachyoptrella*, *Parastylonurus*, *Stylonuroides* and *Stylonurella*. Unfortunately, the genus *Stylonurus* remains with only one species, the genotype. Other fragmentary specimens are questionably assigned.

It is significant to recall that Clarke and Ruedemann, in their division of the stylonuroids in 1912, recognized the dilemma of the holotype and wrote, "Only a single specimen, not very favorably preserved in sandstone, has been recorded and although Page's not very correct figure and explanation have been followed by Woodward's elaborate description and careful illustration, this genotype is still incompletely known. Indeed, when the investigation of a considerable number of species revealed to us the presence of divisions of undoubted subgeneric rank, it remained doubtful with which of these the genotype belongs and which of the divisions therefore represents *Stylonurus sensu stricto*." (1912, p. 278). The divisions given here should help to alleviate this confusion, although problems still remain.

The species recognized for this genus are:

<i>Stylonurus ? ensiformis</i> Woodward, 1864	Devonian	Scotland
<i>Stylonurus powriensis</i> Page, 1856	Devonian	Scotland
<i>Stylonurus ? shaffneri</i> Willard, 1933	Devonian	Pennsylvania
<i>Stylonurus ? wrightianus</i> Dawson, 1881	Devonian	New York

Genus *Stylonuroides*, new genus

Diagnosis.—Stylonuridae of small size; carapace elongated-parabolic, longer than wide, surrounded by conspicuous wide marginal rim; eyes elongated-reniform, with axes parallel, and located so that their posterior borders are in the anterior half of the carapace; ocelli situated approximately midway between the eyes; third walking leg (IV) short, and with single opposable spines; fourth and fifth walking legs (V, VI) devoid of spines, except at the terminal end of the last leg which has either two flat spines or structures that might be interpreted as narrow supplementary lobes; podomere-count: ?-?-?-8?-9.

Type species.—*Stylonurus dolichopterooides* Størmer, 1934.

Distribution.—Norway and New York.

Stratigraphic range.—Ordovician and Siluro-Devonian.

Remarks.—*Stylonuroides* can easily be distinguished from all other stylonurids by the very long carapace and reniform eyes, as well as the details of the termination of the last walking leg. It is, as the species name of the genotype indicates, and as Størmer (1934, p. 103) has pointed out, another link between the Dolichopteridae and the Stylonuridae, a further step in the transition from species such as *Ruedemannipterus stylonuroides* (Clarke and Ruedemann). However, the long carapace and reniform eyes, a considerable departure from the usual greatly arcuate eyes of the stylonurids, may well reveal some affinities with the family Rhenopteridae.

The following species are recognized for the genus:

<i>Stylonuroides dilichopteroides</i> (Størmer), 1934	Siluro-Devonian	Norway
<i>Stylonuroides limbatus</i> (Clarke and Ruedemann), 1912	Ordovician	New York

Genus *Stylonurella*, new genus

Diagnosis.—Stylonuridae of small size; subquadrate prosoma, approximately as long as wide, slightly constricted at midsection; eyes parallel, arcuate, anteriorly located, intramarginally, about midway in the anterior half of the carapace; ventral shield with epistoma, but metastoma unknown; first two appendages also unknown, third and fourth prosomal legs very short, last two walking legs very long; podomere-count: ?-?-7?-8-9-9?; metasoma very narrow, non-trilobed, tapering.

Type species.—*Stylonurus spinipes* Page, 1859 (= *Stylonurus logani* Woodward).

Distribution.—Scotland, Norway, New York and Pennsylvania.

Stratigraphic range.—Ordovician, Silurian and Devonian.

Remarks.—Although this was one of the earliest described stylonuroids, made known not long after the description of the genotype of *Stylonurus*, it bears no close (generic) affinities to that genus. The differences between this genus and *Stylonurus* are numerous and outstanding. *Stylonurus* has eyes placed on the posterior half of the carapace whereas *Stylonurella* has them anteriorly located. Perhaps of even greater importance is the wide opisthosoma with trilobation of *stylonurus* as against the narrow terete mesosoma without any trace of trilobation in *Stylonurella*. The differences of *Parastylonurus* also are numerous and obvious. The quadrate form of the carapace

of *Stylonurella* differs greatly from the subrounded, wider than long, carapace of *Parastylonurus*.

In the shape of the carapace and position of the eyes, *Stylonurella* has a resemblance to *Kokomopterus*, however the altogether different type of prosomal appendages is a difference that precludes the necessity for further comparison.

Recognized species for this genus are:

<i>Stylonurella arnoldi</i> (Ehlers), 1935	Upper Devonian	Pennsylvania
<i>Stylonurella modestus</i> (Clarke and Ruedemann), 1912	Ordovician	New York
<i>Stylonurella otisius</i> (Clarke), 1907	Silurian	New York
<i>Stylonurella ruedemanni</i> (Størmer), 1934	Siluro-Devonian	Norway
<i>Stylonurella spinipes</i> (Page), 1859	Silurian	Scotland

Genus *Parastylonurus*, new genus

Diagnosis.—Stylonuridae of small to medium size; prosoma rounded-quadrate; wider than long, with lateral eyes, arcuate and located on anterior half of the carapace; metastoma very long, with deep triangular notch or deeply cordate and with base truncated; first three walking legs very short with single opposable spines on each joint; last two walking legs very long, reaching to the last tergite; podomere-count: ?-?-7?-8-9-9; ornamentation consists of scales; opisthosoma narrow, undifferentiated; telson spike-like.

Type species.—*Stylonurus ornatus* Laurie, 1892.

Distribution.—Scotland, England, New York and Pennsylvania.

Stratigraphic range.—Ordovician, Silurian and Devonian.

Remarks.—*Parastylonurus* includes more forms previously included in the genus *Stylonurus* than do the other genera described here. However, in my opinion, the development of distinct trilobation in the genus *Stylonurus* sets that genus irrevocably apart from the species that are here referred to *Parastylonurus*. The position of the eyes is also a major generic difference.

The following species are recognized:

<i>Parastylonurus</i> ? <i>beecheri</i> (Hall), 1884	Devonian	Pennsylvania
<i>Parastylonurus macrophthalmus</i> (Laurie), 1895	Silurian	Scotland
<i>Parastylonurus</i> ? <i>megalops</i> (Salter), 1859	Siluro-Devonian	England
<i>Parastylonurus myops</i> (Clarke), 1907	Silurian	New York, Pennsylvania

<i>Parastylonurus ornatus</i> (Laurie), 1895	Silurian	Scotland
<i>Parastylonurus rusti</i> (Ruedemann), 1926	Ordovician	New York

Genus *Brachyopterus* Størmer, 1951

Diagnosis.—Stylonuridae of small size; prosoma with greatest width anteriorly, length equivalent to greatest width, base narrower than anterior, rounded anteriorly; eyes elongated-reniform, with axes slightly converging; first leg developed as grasping organ, all other legs very stout, with few spines, stylonuroid but not excessively developed; opisthosoma short, relatively broad, undifferentiated; metasoma tapering into clavate, spike-like telson. (Modified from Størmer, 1951, p. 416.)

Type species.—*Brachyopterus stubblefieldi* Størmer, 1951.

Distribution.—Wales.

Stratigraphic range.—Ordovician.

Remarks.—There is no other genus known that warrants comparison, or, indeed at our present state of knowledge, reveals any close affinities with this very unusual genus; but see *Remarks* following the discussion of *Brachyopterella*.

Genus *Brachyopterella*, new genus

Diagnosis.—Stylonuridae of small size; carapace pentagonal, with little or no marginal rim and with concave base; eyes oblique, close-set, placed anteriorly on the carapace, very long, banana-shaped, and with axes converging and crossing a short distance in front of the eyes; ocelli placed well forward between the eyes; epistoma well developed; legs increasing gradually, the first three with short opposable spines at the end of each joint, the last two walking legs longer but without spines; podomere-count: 3?-7-8-8-9-?; metastoma unknown; ornamentation smooth on carapace, legs partly covered with granulations.

Type species.—*Stylonurus pentagonalis* Størmer, 1934.

Distribution.—Norway.

Stratigraphic range.—Ordovician (?), Siluro-Devonian.

Remarks.—The genotype has been included in the Middle Ordovician genus *Brachyopterus*. However, the differences are much too great to include the Norwegian form with the latter. The shape of the carapace, and the altogether different type of eyes, as well as their

location, preclude the need for any comparison. There are no other stylonuroids with the characteristics of *Brachyoptere*lla.

The species that are referred to this genus are:

<i>Brachyoptere</i> lla ? <i>magna</i> (Clarke and Ruedemann), 1912	Ordovician	New York
<i>Brachyoptere</i> lla <i>pentagonalis</i> (Størmer), 1934	Siluro-Devonian	Norway

Genus *Clarkeipterus*, new genus

Diagnosis.—Stylonuridae of small size; carapace longer than wide, suboval, pointed anteriorly, with the base considerably narrower than the greatest width, which is at midsection, base concave; eyes crescentic, large, located slightly in front of the middle of the carapace, axes of eyes slightly convergent anteriorly, palpebral lobes very large and circular, attached by narrow bridge to the carapace at the inner part of the eyes; ocelli midway between the eyes; marginal rim either not present or very narrow; ventral shield mostly unknown but bordered by an unsutured marginal rim; no ornamentation present.

Type species.—*Dolichopterus* ? *testudineus* Clarke and Ruedemann, 1912.

Derivation of generic name.—Named in honor of John M. Clarke for his many contributions to our knowledge of the Eurypterida.

Distribution.—Scotland (?), New York.

Stratigraphic range.—Silurian.

Remarks.—Except for the Dolichopteridae, nearly all the Stylonuracea are found in argillaceous or sandy sediments, but *Clarkeipterus* is one of the few exceptions as it occurred in a calcareous-magnesian mud. *Clarkeipterus* is extremely rare; it is known from only one specimen, though a very well preserved one, from the famous Bertie waterlime (Fiddlers Green dolomite) of Herkimer County, New York. The genotype has been doubtfully referred to *Dolichopterus* or *Brachyopterus* by authors, including myself, but it seems preferable now that the carapace should be relegated to the redefined family Stylonuridae, because of the crescentic eyes. There is little purpose in comparing this genus with any others as it is unique.

The following species are recognized:

<i>Clarkeipterus</i> ? <i>knoxae</i> (Lamont), 1955	Silurian	Scotland
<i>Clarkeipterus</i> <i>testudineus</i> (Clarke and Ruedemann), 1912	Silurian	New York

Genus **Melbournopterus** Caster and Kjellesvig-Waering, 1953

Diagnosis.—Stylonuridae of small size; prosoma campanulate, emarginate in front, and fringed with flat movable spines along the base; lateral eyes subrectangular, oblique, close together, with interposed ocelli in the posterior half of the carapace.

Type species.—*Melbournopterus crossotus* Caster and Kjellesvig-Waering, 1953.

Distribution.—Australia.

Stratigraphic range.—Silurian.

Remarks.—Only a single specimen of the type of this strange genus has been reported. Curiously, it is one of the few stylonuroids which, like *Stylonurus*, has the eyes in the posterior part of the carapace.

Genus **Dorfopterus** Kjellesvig-Waering, 1955

Diagnosis.—Telson very long and styliform, with peculiar reticulated pattern of ornamentation.

Type species.—*Dorfopterus angusticolis* Kjellesvig-Waering, 1955.

Distribution.—Wyoming.

Stratigraphic range.—Early Devonian.

Remarks.—Specimens recently collected by Robert H. Denison and Eugene S. Richardson, Jr., of Chicago Natural History Museum, show that this is a gigantic eurypterid and that the reticulated pattern of ornamentation is clearly developed on the opisthosomal tergites.

Family **Pageidae**, new family

Diagnosis.—Stylonuracea with ventral shield having well developed epistoma; metastoma coffin-shaped, truncated at both anterior and posterior ends.

Type genus.—*Pagea* Waterston, 1962.

Remarks.—The Pageidae differ from the other families that retain an epistoma, namely the Stylonuridae and Laurieipteridae, in the coffin-shaped metastoma, as against the long, deeply-notched metastoma of the Stylonuridae, and the broadly subrectangular one in the Laurieipteridae. The trilobation, although considered here a generic character, may well be of higher taxonomic importance. The family is monotypic at present.

Genus *Pagea* Waterston, 1962

Diagnosis.—Medium-sized stylonuroid eurypterid; shape of prosoma probably subrectangular, lateral eyes arcuate, in the anterior half of the prosoma, subcentral; anterior margin of prosoma straight; third and fourth prosomal appendages bearing a double row of numerous flat spines, fifth and sixth prosomal appendages simple, keeled, tapering, sixth appendage reaching as far as the pretelson; podomere-count: ?-?-?-7-9-10; abdomen unusually slender with lateral epimeres on the postabdominal segments, axial furrows (trilobation) present on all abdominal segments; telson long, styliform, keeled. (Modified from Waterston, 1962, pp. 937-938.)

Type species.—*Pagea sturrocki* Waterston, 1962.

Distribution.—Scotland and Wales.

Stratigraphic range.—Devonian, Lower Old Red Sandstone.

Remarks.—This remarkable and unique eurypterid differs so widely from all others that comparison is superfluous. The unusually narrow opisthosoma, with trilobation, is unknown in any of the other genera of the Stylonuracea. It appears likely that trilobation in a narrow form such as this may be connected with strengthening the presumably highly flexible opisthosoma. However, this is not true of the trilobation in *Stylonurus powriensis* Page, a species which is noteworthy for its wide and heavily constructed opisthosoma. The podomere-count, ?-?-?-7-9-10, is of considerable generic importance in my opinion, and it differs from those of other Stylonuracea.

Two species are recognized for the genus:

Pagea sturrocki Waterston, 1962

Devonian

Scotland

Pagea symondsii (Salter), 1857

Devonian

Wales

Pagea symondsii (Salter) reveals the same shape of carapace, with eyes located at the same position, as well as having the wide anterior marginal rim. Although the holotype is a dorsal impression, both Salter (in Huxley and Salter, 1859, pl. X, fig. 1) and Woodward (1866-78, pl. XXI, fig. 4) show two diagonal depressions which very likely are the reflection of the epistomal sutures; thus *P. symondsii* (Salter) must have had the same wide epistoma that Waterston found in *P. sturrocki*.

Family **Drepanopteridae**, new family

Diagnosis.—Stylonuracea with metastoma ovoid, its anterior cordate, and posterior rounded; ventral shield unknown.

Type genus.—*Drepanopterus* Laurie, 1892.

The family Drepanopteridae differs from the Stylonuridae, with which it has always been associated, in the important feature of the entirely different-shaped metastoma. In contrast to the elongated, narrow metastoma of the Stylonuridae, deeply notched anteriorly and truncated at the posterior end, that of the Drepanopteridae comprises an unusual, "Eurypteridae-like" metastoma, namely, ovate and anteriorly cordate.

At present the family remains monotypic, and definitely known only from Scotland in Silurian beds, and possibly in the Devonian. A questionable occurrence has been recorded from the Ordovician of New York.

Genus *Drepanopterus* Laurie, 1892

Diagnosis.—Drepanopteridae of small size; prosoma horseshoe shaped, narrower at base than at the rounded lateral margins; wide marginal rim; eyes arcuate, located at midsection; prosomal appendages stout, increasing gradually in length posteriorly and devoid of spines except for possible spurs (?) on the ends of central joints of the posterior (VI) leg; this leg (VI) terminates in a flattened, slightly expanded, falcate joint, and reaches only to the anterior part of the postabdomen; metastoma ovoid and cordate at the anterior end; opisthosoma completely undifferentiated, wide and tapering into a clavate or wedge-shaped telson; opercula not well known; ornamentation comprises scale-like markings and pustules.

Type species.—*Drepanopterus pentlandicus* Laurie, 1892.

Distribution.—Scotland and New York (?).

Stratigraphic range.—Ordovician ?; Silurian; Devonian ?

Remarks.—*Drepanopterus* reveals characteristics which recall the Eurypteridae in many respects. This was first suggested by Peach to Laurie (1892, p. 161). The Drepanopteridae reveal characteristics, such as the ovoid metastoma, which distinguish them from the rest of the Stylonuracea, but show affinities to the Eurypteridae through the Dolichopteridae, and such genera as *Onychopterella* of the Eurypteridae. However, the development could just as well have been reversed. These evolutionary trends between the two groups are important to keep in mind when future discoveries in Ordovician and Cambrian rocks may possibly resolve the problem of the early phylogeny of this group.

The following species are recognized for the genus:

<i>Drepanopterus</i> (?) <i>abonensis</i> Simpson, 1951	Devonian	Scotland
<i>Drepanopterus</i> <i>bembicoides</i> Laurie, 1899	Silurian	Scotland
<i>Drepanopterus</i> <i>lobatus</i> Laurie, 1899	Silurian	Scotland
<i>Drepanopterus</i> <i>pentlandicus</i> Laurie, 1895	Silurian	Scotland
<i>Drepanopterus</i> ? <i>ruedemanni</i> (O'Connell), 1916	Ordovician	New York

Family **Kokomopteridae**, new family

Diagnosis.—Stylonuracea with band-like ventral shield of the prosoma, without epistoma; metastoma broadly pyriform, very wide posteriorly and notched anteriorly and with a broad emargination at the posterior end.

Type genus.—*Kokomopterus* new genus.

The differences between this family and others are significant. It resembles the Rhenopteridae in the band-like ventral shield and lack of epistoma. However, the totally different metastomas are sufficient for separation, and further comparison with that family as well as the other Stylonuracea is considered superfluous. At present the family is monotypic and is known only from the Silurian of Indiana.

In comparison with the Drepanopteridae, the difference lies in the ovate, anteriorly cordate metastoma as against the altogether different-shaped structure described above for the Kokomopteridae. Previously, the type species of *Kokomopterus* (*K. longicaudatus* [Clarke and Ruedemann]) had been mistaken for a *Drepanopterus*.

Genus **Kokomopterus**, new genus

Diagnosis.—Kokomopteridae of small size; carapace subquadrate, slightly wider than long, lateral margins parallel; eyes arcuate, with axes parallel, and located in the anterior half of the carapace, considerably apart from one another; ventral shield probably consisting of an undivided plate, with narrow marginal rim; prosomal legs stylo-nuroid, but increasing posteriorly in a gradual manner; podomere-count: ?-?-?-8-9-9; the second to fifth legs armed with single, unequal, opposable spines; last leg without spines and reaching to the eleventh opisthosomal tergite; all legs terminate in single spine; metastoma broadly pyriform, with narrow notch at anterior end and broadly but slightly emarginate at the posterior; opisthosoma differentiated into a preabdomen of seven tergites and a much narrower postabdomen of five, of which the twelfth tergite is long, rectangular

and with sides nearly parallel; male operculum unknown; female operculum short, composed of one undivided joint with slightly rounded margins that comprises most of the appendage, and a short triangular termination that is divided into two parts, each of which forms a narrow triangular prong (see fig. 97); telson very narrow, spike-like, forming a conspicuous attenuation in comparison to the metasoma; ornamentation consists of fine to coarse scales and mucrones.

Type species.—*Stylonurus (Drepanopterus) longicaudatus* Clarke and Ruedemann, 1912.

Derivation of name.—Named from the area of Kokomo, Indiana which has furnished the famous Kokomo eurypterid fauna.

Distribution.—Indiana.

Stratigraphic range.—Upper Silurian.

Remarks.—The genus *Kokomopterus* differs from *Drepanopterus* in having a subquadrate carapace with anteriorly located eyes as against a horseshoe shaped carapace with eyes located at midsection. The opisthosoma of *Kokomopterus* has a clearly differentiated pre-abdomen as contrasted with the opisthosoma of *Drepanopterus*, which

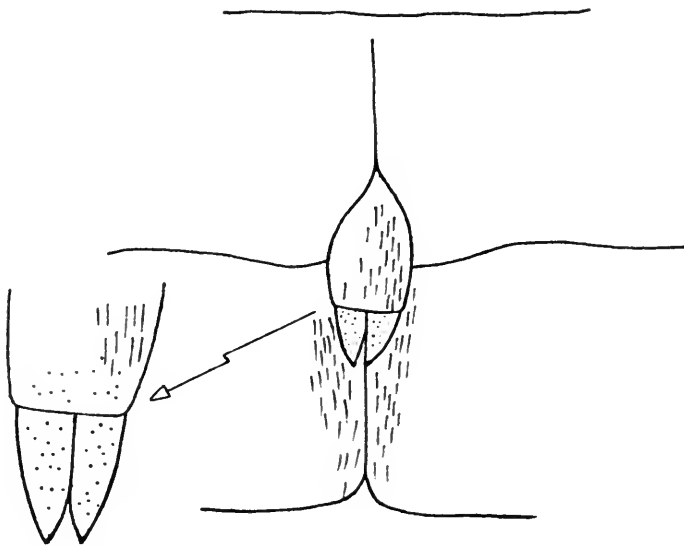


FIG. 97. Female (Type B) operculum of *Kokomopterus longicaudatus* (Clarke and Ruedemann) from the Silurian Kokomo dolomite of Kokomo, Indiana. The mid-line represents the transverse suture. There were no deltoid plates developed. The inner part of the opercular plates and the median organ were covered with setae.

is entirely undifferentiated. In the latter the tergites of the metasoma are very wide and conical and almost grade into the wide (anteriorly), wedge-shaped or clavate telson. A very important difference lies in the presence of spines in the fourth walking leg of *Kokomopter* as compared to the non-spinous character of the same leg in *Drepanopterus*. The last podomere of the fifth or last walking leg in all species of *Drepanopterus* terminates in a falcate, and presumably flattened, slightly expanded spine as against the narrow conical shape of the corresponding leg in *Kokomopter*. The metastomas, of course, are entirely different.

One species is recognized for the genus:

Kokomopter longicaudatus
(Clarke and Ruedemann) 1912

Silurian

Indiana

Part of the generic description and the basis for family separation are derived from new data. A specimen from the Silurian Kokomo dolomite, at Yeoman Quarry, Kokomo, Indiana, which was collected by W. P. Leutze in 1959 and kindly presented to me (No. 74 temporarily in my collection), reveals many details of considerable taxo-

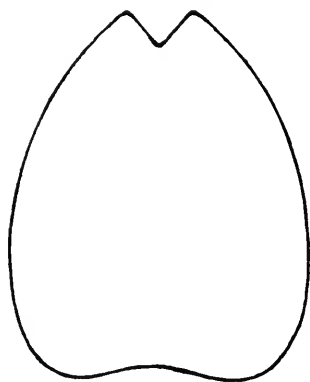


FIG. 98. Metastoma of *Kokomopter longicaudatus* (Clarke and Ruedemann) from the Silurian Kokomo dolomite of Kokomo, Indiana.

nomic importance. The overall length of the specimen is estimated at 11 cm. The most interesting feature is the shape of the metastoma, which is roughly oval, with a narrow notch at the anterior and a broad base which is slightly cordate or emarginate (see fig. 98). It measures 8.1 mm. in length and 7.2 mm. in greatest width (see fig. 95). The female, or Type B (see fig. 97), operculum is well preserved, showing even such details as the setae. The appendage is small, about one-third the length of the operculum, and consists of an un-

divided, rather broad lanceolate joint, with two triangular joints at the distal end. A transverse suture occurs at the midsection of the opercular flaps. The lanceolate joint, as well as the surrounding parts of the operculum, are very hirsute, being covered with dark brown tactile setae. The fine punctation that occurs on the triangular points likely represents sites where the setae had broken away. The carapace measures 19.4 mm. in length with an estimated width of 26.0 mm. The ventral shield apparently comprises an undivided, or non-sutured, plate of 6 mm. in width at the anterior part. There is no trace of an epistoma, or of sutures, although the preservation of this part does not allow complete confidence. The prosomal appendages of this specimen are too poorly preserved for description. The dorsal side of the specimen, however, retains the original coloration as is common with the eurypterids of the Kokomo assemblage. The specimen is shiny, fairly dark brown; but curiously it reveals a narrow, very dark brown line, over one millimeter wide, that runs through the center of the dorsal length of the opisthosoma. This is not to be mistaken for a suture as it is definitely a color distinction. This is the first instance of a purely colored ornamentational pattern known in the stylonuroids. The dorsal side is covered with scales, most of which are semi-lunar in shape; others become rather pointed. The doublures of the tergites are heavily hirsute.

Family **Rhenopteridae** Størmer, 1951

Diagnosis.—Stylonuracea with ventral shield having median suture, but no epistoma; metastoma pyriform, slightly concave anteriorly, broadly rounded posteriorly.

The family remains monotypic and is known only from the Devonian of Germany and possibly New York.

Genus **Rhenopterus** Størmer, 1951

Diagnosis.—Carapace longer than wide, rounded anteriorly, and with lateral eyes reniform, located slightly in front of midsection; first two (or three) pairs of walking legs with spines, last two pairs without spines; male appendage short, with two distal spurs; podomere-count: ?-7-8-8-9-9.

Type species.—*Rhenopterus diensti* Størmer, 1951.

Distribution.—Germany and New York (?).

The following species are recognized for this genus:

<i>Rhenopterus diensti</i> Størmer, 1936	Devonian	Germany
<i>Rhenopterus latus</i> Størmer, 1936	Devonian	Germany
<i>Rhenopterus</i> ? <i>macCarthyi</i> (Kjellesvig-Waering), 1934	Devonian	New York
<i>Rhenopterus tuberculatus</i> Størmer, 1936	Devonian	Germany

Family **Laurieipteridae**, new family

Diagnosis.—Stylonuracea with ventral shield having well developed epistoma; metastoma broadly sub-rectangular, slightly emarginate anteriorly and posteriorly.

Type genus.—*Laurieipterus*, new genus.

Remarks.—The Laurieipteridae is composed of the genera *Laurieipterus*, *Ctenopterus*, *Hallipterus* and *Mazonipterus*, all of which are characterized by unusually long carapaces, and were generally grouped together, more or less, under the genus *Ctenopterus*. Laurie, however, as early as 1899 (pl. 2, fig. 3), had revealed the unusual rectangular metastoma, and this was verified by Waterston (1962, p. 145, text-fig. 3) who also worked out the details of the ventral shield.

The family Laurieipteridae is easily separated from all the other families of the Stylonuracea. In comparison with those families which have a developed epistoma, namely, the Stylonuridae and Pageidae, the greatest dissimilarity lies in the altogether different metastomas. That of the Stylonuridae is very narrow and deeply notched anteriorly, whereas in the Pageidae it is "coffin-shaped," or elongated, with the anterior wider, and both anterior and posterior ends truncated. This is in sharp contrast to the broad sub-rectangular metastoma of the Laurieipteridae.

Genus **Laurieipterus**, new genus

Diagnosis.—Laurieipteridae of medium-size, carapace enormously elongated, very narrow at the base but with the lateral margins greatly expanded at midsection; anterior rounded with ornamentation of crenulations; lateral eyes small and arcuate, anteriorly located and well apart; ocelli located in front of the lateral eyes; legs powerful and not excessively long; podomere-count: ?-?-7-8-8-8; spines developed on all but last two walking legs, which are completely bare, the spines increasing in length along the posterior side of each joint; ventral shield with well developed epistoma and with triangular transverse

line clearly separating the anterior rostral area from the inclined rear of the shield; opisthosoma is unknown except as fragments.

Type species.—*Stylonurus elegans* Laurie, 1899.

Derivation of generic name.—Named in honor of Malcolm Laurie for his many original contributions to our knowledge of Eurypterida and Scorpionida.

Distribution.—Scotland.

Stratigraphic range.—Silurian, Gala-Tarannon.

Remarks.—*Laurieipterus* differs greatly from the other genera of the Laurieipteridae, and comparison is needed only with *Ctenopterus*, the genus under which this strange eurypterid had been included since the Clarke and Ruedemann monograph of 1912. Firstly, the carapaces are very different; that of *Laurieipterus* is highly bulbous at midsection with an extremely narrow base, as against the anteriorly converging carapace of *Ctenopterus* with its wide base and unusual cheek pouches. The latter has a greatly different arrangement of the spines of the anterior legs, and has one podomere more on the last two legs. There are numerous other differences not necessary to detail here (see Clarke and Ruedemann, 1912, p. 286; Laurie, 1899, p. 580, and Waterston, 1962, p. 143).

Genus *Ctenopterus* Clarke and Ruedemann, 1912

Diagnosis.—Laurieipteridae of small size; carapace elongated oval, longer than wide, and with widest part in posterior fourth, narrowing anteriorly to less than half the width, anterior margin prominent and ornamented with fringe of spines; lateral eyes elongated arcuate, with median ocelli approximately midway between; two oval cheek-like ridges are on each side of the carapace; first and second appendages unknown, third and fourth very long and armed with slender, paired spines of even length, the last two walking legs extremely long, the sixth reaching to the twelfth tergite, these two legs terete and bare of spines, all legs terminating in a pointed, conical joint; podomere-count: ?-?-8-8-9-9; metastoma unknown; preabdomen slender, but well differentiated from the postabdomen; opercula not well known; telson presumably a long spike; ornamentation highly variable, consisting of pustules and scales.

Type species.—*Stylonurus cestrotus* Clarke, 1907.

Distribution.—New York.

Stratigraphic range.—Silurian.

Remarks.—The differences between *Ctenopterus* and *Laurieipterus* have been described above in discussion of the latter genus. In comparison with *Hallipterus* and *Mazonipterus* the differences lie in the position and characteristics of the eyes and the altogether different ornamentation.

Only one species is recognized for the genus *Ctenopterus*:

Ctenopterus cestrotus (Clarke), 1907

Silurian

New York

Genus *Hallipterus* Kjellesvig-Waering, 1963

Diagnosis.—Laurieipteridae of large size; carapace subelliptical, longer than wide, truncated at the base and surrounded by a prominent but unornamented marginal rim; lateral eyes very small, arcuate, close-set and centrally located on the carapace and separated by a prominent median ridge with large ocelli located at the posterior extremity; conspicuous orbital ridges surround the lateral eyes anteriorly and laterally; the ornamentation comprises coarse elongate and confluent pustules arranged in concentric lines particularly prominent on the anterior of the carapace; chelicera simple, elongated; first walking leg with flat movable spines; rest of appendages and opisthosoma unknown.

Type species.—*Stylonurus excelsior* Hall, 1883.

Distribution.—New York and Pennsylvania.

Stratigraphic range.—Upper Devonian.

Remarks.—This genus of gigantic eurypterids is composed of two famous species, *Hallipterus excelsior* (Hall) of New York and *H. lacoonus* (Claypole) of Pennsylvania, and is well known through the famous restorations of Beecher, and later of Clarke and Ruedemann. Unfortunately, these well known restorations, except for the carapace and first legs, were based mainly on the opisthosoma and appendages of other Stylonuracea. Differences between this genus and *Laurieipterus* or *Ctenopterus* have been discussed under the *Remarks* on those genera.

Genus *Mazonipterus* Kjellesvig-Waering, 1963

Diagnosis.—Stylonuridae of medium size; carapace very elongated, with lateral eyes arcuate and placed anteriorly on the carapace; greatest width of carapace occurs midway; palpebral lobe attached to carapace by a narrow bridge on outer-posterior part of lobe;

marginal rim very narrow, simple, not ornamented; ornamentation smooth; no other parts known.

Type species.—*Mazonipterus cyclophthalmus* Kjellesvig-Waering, 1963.

Distribution.—Illinois and Czechoslovakia (?).

Stratigraphic range.—Middle Pennsylvanian (Illinois); Lower Carboniferous? (Czechoslovakia.)

Remarks.—There is a marked resemblance of this form to *Laurieipterus* and *Ctenopterus*, but the very different type of eyes precludes further comparison. It should be noted that in the holotype, the ventral shield had been reflected through, although preservation did not permit detailed description; it is important to record that the triangular transverse line, marking off the anterior rostral area from the inclined posterior part, as in *Limulus*, and in *Brachyoptere*lla, *Laurieipterus*, and other Stylonuracea as well, was discernible. It might therefore be rather safe to speculate that this genus retained an epistoma.

The genus comprises one species, with another doubtfully included:

<i>Mazonipterus cyclophthalmus</i> Kjellesvig-Waering, 1963	Pennsylvanian	Illinois
<i>Mazonipterus</i> (?) <i>ostraviensis</i> (Augusta and Příbyl), 1951	Lower Carboniferous	Czechoslovakia

Family Woodwardopteridae Kjellesvig-Waering, 1959

Diagnosis.—Stylonuracea of medium size; outer surface covered with coarse scales and tubercles; prosoma campanulate, with stylo-nuroid appendages increasing in size posteriorly; first and second tergites greatly developed, the others normal in length.

Type genus.—*Woodwardopterus* Kjellesvig-Waering, 1959.

The family is considered to include two genera, *Borchgrevinkium* and *Woodwardopterus*.

Genus *Borchgrevinkium* Novojilov, 1959

Diagnosis.—Carapace elongated-parabolic; eyes unknown; legs mainly unknown, except basal (?) joints, which are highly spinous, undifferentiated; mesosoma with first two tergites longer than the rest of the mesosomal tergites; opisthosoma undifferentiated, with trilobation, caused by two ridges, present from the third to the tenth tergites; pretelson with dorsal forked area and telson short and styli-

form; underside practically unknown; ornamentation is composed of squamous sculpturing.

Type species.—*Borchgrevinkium taimyrense* Novojilov, 1959.

Stratigraphic range.—Lower Devonian (Upper Silurian?).

Distribution.—Southwest Taimyr, Siberia, U.S.S.R.

Recognized species.—*Borchgrevinkium taimyrense* Novojilov.

Remarks.—The five walking legs preserved, regardless of whether they represent the basal, middle or distal podomeres, clearly designate this very peculiar and interesting eurypterid as a stylonuracean, and thus with affinities with the Woodwardopteridae rather than the Mycteropidae, which are considered a family of the Mixopteracea.

Genus **Woodwardopterus** Kjellesvig-Waering, 1959

Diagnosis.—Woodwardopteridae of medium size, outer surface covered by coarse scales and tubercles; prosoma campanulate; eyes and ocelli unknown; prosomal appendages without spines but with supplementary lobes developed on anterior legs; first and second tergites greatly developed; opisthosoma trilobate in posterior part; telson unknown.

Type species.—*Eurypterus scabrosus* Woodward, 1887.

Stratigraphic range.—Lower Carboniferous.

Distribution.—Scotland.

Recognized species.—*Woodwardopterus scabrosus* (Woodward), 1887.

Family **Hibbertopteridae** Kjellesvig-Waering, 1959

Diagnosis.—Ventral shield of two plates, joined anteriorly by suture, no epistoma; metastoma trapezoidal, cordate anteriorly with median posterior suture and narrowing anteriorly.

The family includes the two genera *Hibbertopterus* and *Campylocephalus*.

Genus **Hibbertopterus** Kjellesvig-Waering, 1959

Diagnosis.—Hibbertopteridae with broad semi-circular prosoma and with centrally located arcuate eyes with narrow visual area and surrounded by annular cuticular thickening (orbital ridges).

Type species.—*Eurypterus scouleri* Hibbert.

Distribution.—Scotland, Ireland (?), Pennsylvania (?), Czechoslovakia (?) and South Africa (?).

Stratigraphic range.—Lower Carboniferous; Upper Devonian (?).

The following species are recognized:

<i>Hibbertopterus ? hibernicus</i> (Baily), 1872	Devonian	Ireland
<i>Hibbertopterus ? minutisculptus</i> (Peach), 1907	Lower Carboniferous	Scotland
<i>Hibbertopterus ? potens</i> (Hall), 1884	Pennsylvanian	Pennsylvania
<i>Hibbertopterus ? salmi</i> (Stur), 1877	Lower Carboniferous	Czecho- slovakia
<i>Hibbertopterus scouleri</i> (Hibbert), 1836	Lower Carboniferous	Scotland
<i>Hibbertopterus ? seawardi</i> (Strand), 1926	Carboniferous	South Africa
<i>Hibbertopterus ? stevensoni</i> (Etheridge, Jr.), 1876	Lower Carboniferous	Scotland

Genus *Campylocephalus* Eichwald, 1860

Diagnosis.—Hibbertopteridae with subelliptical prosoma, narrow at base and broadest at midsection; compound eyes reniform, without annular cuticular thickening, located in posterior half of prosoma.

Type species.—*Limulus oculatus* Kutorga, 1838.

Distribution.—Urals, U.S.S.R.

Stratigraphic range.—Upper Carboniferous-Permian.

Recognized species for this genus:

<i>Campylocephalus oculatus</i> (Kutorga)	Permian (?)	U.S.S.R.
-------------------------------------------	-------------	----------

REFERENCES

- BAILY, W. H.
1866-72 in Woodward, H. Monograph of the British Fossil Crustacea, etc., Paleontographical Soc., part 4, pp. 148-151; pl. 28, figs. 16, 17, 17a; text figs. 45-48.
- CASTER, K. E., and E. N. KJELLESVIG-WAERING
1953. *Melbournopterus*, A New Silurian Eurypterid from Australia. Jour. Pal., 27, no. 1, pp. 153-156, pl. 20, text-figs. 1-2.
- CLARKE, J. M.
1907. The Eurypterid shales of Shawangunk Mountains in eastern New York. N. Y. State Mus., Bull. 107, pp. 295-326, 10 pls.
- CLARKE, J. M., and R. Ruedemann
1912. The Eurypterida of New York. New York State Mus., Memoir 14, pp. 1-439, 88 pls., 121 figs.
- ETHERIDGE, R., JR.
1877. On the Remains of a Large Crustacean, probably indicative of a New Species of *Eurypterus*, or allied Genus (*Eurypterus? stevensonii*), from the

Lower Carboniferous Series (Cement-stone Group) of Berwickshire. Quart. Jour. Geol. Soc., London, **34**, pp. 223-228.

HALL, J.

1884. Note on the Eurypteridae of the Devonian and Carboniferous Formations of Pennsylvania. Second Geol. Surv. Penna., vol. PPP, 6 pls.

HUNLEY, T., and J. W. SALTER

1859. On the anatomy and affinities of the Genus *Pterygotus* (Huxley) and description of new species of *Pterygotus* (Salter): Mem. Geol. Survey, U. K., Monogr. 1, 105 pp., 16 pls.

KUTORGA, S.

1838. Beitrag zur Kenntnis der organischen Überreste des Kupfersandsteins am westlichen Abhange des Urals. St. Petersburg, pp. 1-38, pls. I-VII.

KJELLESVIG-WAERING, E. N.

1948. The Mazon Creek Eurypterid. A Revision of the Genus *Lepidoderma*. Illinois State Mus., Sci. Papers, **3**, no. 4, 46 pp., 8 pls., 1 text fig.

1955. *Dorfopterus*, A New Genus of Eurypterida from the Devonian of Wyoming: Jour. Pal., **29**, no. 4, pp. 696-697, 2 text figs.

1958. The genera, species and subspecies of the Family Eurypteridae, Burmeister, 1845. Jour. Pal., **32**, no. 6, pp. 1107-1148, 6 pls., 27 text figs.

1959. A taxonomic review of some Late Paleozoic Eurypterida. Jour. Pal., **33**, pp. 251-256, pl. 38.

1963. Pennsylvanian invertebrates of the Mazon Creek Area, Illinois. Eurypterida. Fieldiana: Geol., **12**, no. 6, pp. 85-106, figs. 44-56.

KJELLESVIG-WAERING, E. N., and L. STØRMER

1952. The *Dolichopterus-Strobilopterus* Group in the Eurypterida. Jour. Pal., **26**, no. 4, pp. 659-661, 2 figs.

LAURIE, M.

1892. On some Eurypterid Remains from the Upper Silurian Rocks of the Pentland Hills. Trans. Royal Soc. Edinburgh, **37**, pt. 1, no. 10, pp. 151-161, 3 pls.

1899. On a Silurian scorpion and some additional Eurypterid Remains from the Pentland Hills. Trans. Royal Soc. Edinburgh, **39**, pt. 3, pp. 575-590, pl. i-v.

NOVOJLOV, N.

1958. *Polystomurum størmeri* new genus and species of Eurypterida from the Devonian of the region of Voronell. Mat. Princip. Paleont. (Moscow), no. 2, pp. 47-50, 2 figs., 1 pl.

1959. Mérostomates du Dévonien inférieur et moyen de Sibérie. Ann. Soc. Géol. Nord, **88**, pp. 243-258, pl. 12-13; 6 text figs.

1962. Fundamentals of Paleontology. Eurypterida, pp. 404-422, figs. 1189-1219.

PAGE, D.

1856. Advanced Text-Book of Geology. First Edition. Edinburgh and London.

1859. Advanced Text-Book of Geology. Second Edition. Edinburgh and London.

PEACH, B. N.

1907. Note on a Specimen of *Glyptoscorpis* from the Coal Measures of Airdrie, the Property of Robert Dunlap of Baillieston. Geol. Soc. Glasgow Trans., **13**, pt. 1, pp. 1-3, 1 fig.

PETRUNKEVITCH, A.

1916. The shape of the sternum in Scorpions as a systematic and a phylogenetic character. Amer. Naturalist, **1**, pp. 600-608, 4 figs.

STØRMER, L.

1934. Merostomata from the Downtonian Sandstone of Ringerike, Norway. Skrifter utgitt av Det Norske Videnskaps-Akademie i Oslo, I Matem.-Naturvid, Klasse, 1933, no. 10, 125 pp., 12 pls., 39 figs.
1936. Eurypteriden aus dem rheinischen Unterdevon. Preuss. Geol. Landesanst., Abh. N.F., H. 175, 74 pp., 12 pls., 10 figs.
1951. A new Eurypterid from the Ordovician of Montgomeryshire, Wales. Geol. Mag., 88, pp. 409-422, 2 text-figs.
1955. Treatise on Paleontology, Part P, Arthropoda 2; Chelicerata with sections on Pycnogonida and Palaeoisopus. (Part on Eurypterida: pp. 23-41, figs. 17-30.)

STRAND, E.

1926. Miscellanea nomenclatoria. Zool. et Pal. Arch. Naturgesch, v. 92 A.H. 8, pp. 30-75.

STUR, D.

1877. Die Culmflora der Ostrauer und Waldenburger Schichten.—Abhandl. d. Geol. R. Anstalt in Wien Bd. VIII, Heft 2, Wien.

WATERSTON, C. D.

1962. *Pagea sturrocki* gen. et sp. nov., A new Eurypterid from the Old Red Sandstone of Scotland. Palaeontology, 5, pt. 1, pp. 137-148, pl. 20, 4 text-figs.

WOODWARD, H.

- 1866-78. A Monograph of the British Fossil Crustacea belonging to the order Merostomata: Palaeont. Soc., 263 pp., 36 pls., 80 figs.
1877. On a new species of *Eurypterus* from the Lower Carboniferous shales of Glencartholm, Eskdale, Scotland. Geol. Mag., n.s., 4, pp. 481-484, pl. xiii.

UNIVERSITY OF ILLINOIS-URBANA

550 SFI C001
FIELDIANA. GEOLOGY CHGO
14-15 1960/65



3 0112 026616034