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The Classification of the Trilobite Subfamily, Centropleurinae.

By

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The family Paradoxidae was proposed by Emmrich in 1839 to contain the genera *Conocephalus*, *Ellipsocephalus*, *Anthes*, and *Paradoxides*[1]). It was not generally recognized by paleontologists during the nineteenth century, its type genus being usually placed by them in Salter's family, the Olenidae. Since 1900, however, students of trilobites have resurrected it to hold the genera *Paradoxides* and *Centropleura*.

As a student of Cambrian faunas, the writer has had occasion to study many species of *Paradoxides* and *Centropleura*. He has been led by his studies of these genera to believe that *Paradoxides* should be split into several genera, and that *Centropleura* should be broken up into three. This has seemed to him to necessitate the erection of two subfamilies within the family Paradoxidae. He has therefore proposed the subfamily Centropleurinae to include the species which have been placed by authors in the past in *Centropleura*[2]), and here proposes the new subfamily, Paradoxinae, for the species which have ordinarily been placed by authors in the genus *Paradoxides*.

As his original definition of the subfamily Centropleurinae was a very brief one, and did not include the division of the old genus, *Centropleura*, into the three genera into which he considers that it should be split up, and since he and Dr. Christian Poulsen are now describing a new species referable to one of these genera, it has seemed desirable to publish at this time this short statement concerning the subfamily and its members.

The writer proposes that the known species of Centropleurinae

[1]) Emmrich, H. F., Über die Trilobiten. Leonhard and Bronn, Neues Jahrbuch, 1845, p. 43.

[2]) Howell, B. F. Two new Cambrian trilobites from Vermont. Bull Wagner Free Inst. of Sci. of Philadelphia, vol. 7, 1932, p. 4—8.

should be grouped in the three genera, *Centropleura* ANGELIN, *Anopolenus* SALTER (which has in recent years been considered by authors to be included in *Centropleura*), and a new genus, which he is naming *Clarella,* in honor of Mrs. HOWELL.

Of these three genera, *Centropleura* is characterized by the possession of palpebral lobes that curve in an uneven arc and do not reach all the way to the rear corners of the cranidium. *Anopolenus* has palpebral lobes that curve in an even arc and extend all the way to the rear corners of the cranidium. *Clarella*'s palpebral lobes have a sinuous curvature, and reach almost to the rear corners of the cranidium.

Centropleura was erected as a genus by N. P. ANGELIN in 1854[1]). ANGELIN placed in his new genus at that time only a single species, *Centropleura lovéni*, which he had previously described as *Paradoxides lovéni*[2]), but which, on the establishment of the genus *Centropleura*, became the genotype of that genus; but he later added another species, *C. steenstrupi*[3]). *C. lovéni* is a Scandinavian form, and is one of the species which has its palpebral lobes curved in an uneven arc and ending in front of the rear corners of the cranidium. *C. steenstrupi*, also a Scandinavian species, has a sinuous palpebral lobe, and is therefore here referred to our new genus, *Clarella.*

In 1864 J. W. SALTER, who seems to have been unaware of the fact that ANGELIN had proposed the genus *Centropleura,* although he knew that he had described a trilobite as *Paradoxides lovéni,* proposed a new genus, *Anopolenus*, to hold a similar species, which his friend, Dr. HENRY HICKS, had found in Wales, and which he named *Anopolenus henrici*[4]). This species is therefore the genotype of *Anopolenus*. It and another Welsh species, which HICKS described in 1865 as *Anopolenus salteri*[5]), have the palpebral lobes curving in an even arc and reaching all the way to the rear corners of the cranidium. As he believes that species with this kind of palpebral lobe should be considered to be generically distinct from those in which the palpebral lobes curve in an uneven arc and do not reach to the rear corners of the cranidium, the writer considers that SALTER's

[1]) ANGELIN, N. P. Palaeontologia Scandinavica, 1854, p. 87.

[2]) ANGELIN, N. P. Palaeontologia Scandinavica, 1852, p. 2, pl. 3, f. 3.

[3]) ANGELIN, N. P. Palaeontologia Scandinavica, Appendix, 1878, p. 95, pl. 3 (em.), fig. 1 b, 1 c, 3, 5.

[4]) SALTER, J. W. On some new fossils from the Lingula-flags of Wales, Quart. Jour. Geol. Soc. London, vol. 20, 1864, p. 236, pl. 13, f. 4, 5.

[5]) HICKS, H. Note on the genus Anopolenus. Quart. Jour. Geol. Soc. London, vol. 21, 1865, p. 478—481.

genus is a valid one, although most authors (including the writer, himself) have been in the habit of referring these and all other species of the Centropleurinae to the older genus, *Centropleura*.

In 1872 HICKS described a third Welsh species, which he named *Anopolenus impar*, the palpebral lobes of which were sinuous and reached all the way to the rear corners of the cranidium[1]). This species is here referred to *Clarella* as *C. imparis*. In 1874 ELKANAH BILLINGS described as *Anopolenus venustus* a Newfoundland species which also had sinuous palpebral lobes that reached almost to the rear corners of the cranidium[2]). This species is here also referred to *Clarella*, and is made, as *Clarella venusta*, the genotype of that genus. A similar form, named *Centropleura pugnax*, the palpebral lobes of which were shorter than those of *imparis*, was described from England by Dr. V. C. ILLING in 1916[3]). It is here referred to *Clarella*, as *C. pugnacis*.

In 1932 the writer described a new species of *Centropleura*, *C. vermontensis*, from the St. Albans Formation of northwestern Vermont[4]).

All of these species came from strata of late Meso-Cambrian age. *Centropleura lovéni* and *Clarella steenstrupi* have been recorded only from the late Paradoxidian *Paradoxides forchhammeri* Zone of Scandinavia and from beds of similar age on Bennett Island, north of Siberia[5]). *Centropleura vermontensis* has been discovered only in beds of approximately the same age in Vermont. *Anopolenus henrici* and *Clarella pugnacis* are known from the late Paradoxidian Cambrian *Paradoxides davidis* Zone of Great Britain and Newfoundland[6]). *Anopolenus salteri* and *Clarella imparis* have been found only in the *Paradoxides davidis* Zone of Great Britain. *Clarella venusta* occurs only in the middle Paradoxidian *Paradoxides hicksi* Zone of Newfoundland. A new species of *Clarella*, from the middle Paradoxidian *Conocoryphe aequalis* Zone of Bornholm Island, Denmark, is described

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[1]) HICKS, H. On some undescribed fossils from the Menevian Group. Quart. Jour. Geol. Soc. London, vol. 28, 1872, p. 179, pl. 7, f. 8—11.

[2]) BILLINGS, E. Palaeozoic Fossils, vol. 2, 1874, p. 73, f. 42.

[3]) ILLING, V. C. The Paradoxidian fauna of a part of the Stockingford Shales, Quart. Jour. Geol. Soc. London, vol. 71, 1916, p. 430—431, pl. 37, f. 4.

[4]) HOWELL, B. F. Two new Cambrian trilobites from Vermont. Bull Wagner Free Inst. of Sci. of Philadelphia, vol. 7, 1932, p. 4—8.

[5]) HOHN, G. and A. H. WESTERGAARD. A Middle Cambrian fauna from Bennett Island. Mem. de l'Acad. des Sci. de l'U R S S, 8th series, Classe Physico-Mathematique, vol. 21, no. 8, 1929.

[6]) HOWELL, B. F. The Faunas of the Cambrian *Paradoxides* Beds at Manuels, Newfoundland. Bull. American Paleontology, vol. 11, no 43, 1925, p. 36 and 40.

in a paper by Dr. CHRISTIAN POULSEN and the writer in the present number of this journal (p. 220).

The family Paradoxidae, its two subfamilies, the Paradoxinae and the Centropleurinae, and the genera, *Centropleura*, *Anopolenus*, and *Clarella*, are then to be defined as follows.

Class Crustacea.
Subclass Trilobita.
Order Opisthoparia BEECHER.
Family Paradoxidae EMMRICH.

Cranidium large and expanded anteriorly, with several glabellar furrows, and with prominent palpebral lobes. Free cheeks of medium width, and bearing rather long genal spines. Hypostome subquadrate, but with the anterior corners extended somewhat at each side. Thorax long and rather narrow, with a narrow axis. Pygidium small.

Subfamily Paradoxinae, new subfamily.

Facial sutures cutting the brim in front so that the portion of the brim within them does not extend laterally much beyond the palpebral lobes. Pygidium elongate or subquadrate, spineless or with a single spine (or very rarely two spines) on each side.

Subfamily Centropleurinae HOWELL.

Facial sutures cutting the brim in front so that the portion of the brim within them extends widely laterally and the suture cuts far in toward the glabella behind this extended portion of the cranidium. A short anterior furrow, curving diagonally backward from the edge of the glabella, is present on each side of the glabella, in front of the other, more transverse, furrows. Pygidium subquadrate, wider than the pygidium of the Paradoxinae, and with two or more spines on each side.

Genus *Centropleura* ANGELIN.

Palpebral lobes curving in an uneven arc and not reaching all the way back to the rear corners of the cranidium. Genotype, *Centropleura lovéni* Angelin, of the *Paradoxides forchhammeri* Zone of Scandinavia and Siberia. Also includes *Centropleura vermontensis* HOWELL, of the *Centropleura vermontensis* Zone of Vermont.

Genus *Anopolenus* SALTER.

Palpebral lobes curving in an even arc and reaching all the way back to the rear corners of the cranidium. Genotype, *Anopolenus henrici* SALTER, of the *Paradoxides davidis* Zone of Great Britain

and Newfoundland. Includes also *Anopolenus salteri* HICKS of the *Paradoxides hicksi* Zone of Great Britain.

Genus *Clarella*, new genus.

Palpebral lobes having a sinuous curvature and reaching almost or quite to the rear corners of the cranidium. Genotype, *Clarella venusta* (BILLINGS), of the *Paradoxides hicksi* Zone of Newfoundland. Includes also *Clarella steenstrupi* (ANGELIN), of the *Paradoxides forchhammeri* Zone of Scandinavia, *C. pugnacis* (ILLING) and *C. imparis* (HICKS), of the *Paradoxides davidis* Zone of Great Britain, and the new species from the *Conocoryphe aequalis* Zone of Denmark described by Dr. POULSEN and the writer in the present number of this journal.

The Centropleurinae are thus known to have lived during the latter half of Paradoxidian Cambrian times. They were characteristic members of the late *Paradoxides hicksi*, the *Paradoxides davidis*, and the *Paradoxides forchhammeri* faunas of the north Atlantic Basin and (if we may judge from the presence of the remains of *Centropleura lovéni* on Bennett Island) of at least a part of the Arctic regions. They must have had early Paradoxidian Cambrian ancestors, through which they were descended from an ancestor common to the Paradoxinae and themselves; but where these ancestors lived we do not yet know. Perhaps it was in tropical seas. Or, possibly, when we learn more of the Cambrian life of the Arctic, we shall find that their home was near the North Pole. The unexpected discovery of a fauna containing a species of *Centropleura* on a lonely island in the frozen sea north of Siberia gives us a tantalizing glimpse of the Cambrian life of that vast and almost unknown region that whets our appetites for much more information concerning it — information which we hope that future scientific expeditions to the North may yet secure for us.