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REVISION OF NON-CYRTOSYMBOLINID TRILOBITES FROM THE TOURNAISIAN-NAMURIAN OF EURASIA

(REWIZJA TRYLOBITÓW, PRÓCZ CYRTOSYMBOLINAE, Z TURNEJU-NAMURU EURAZJI)

BY
HALSZKA OSMÓLSKA

(WITH 9 TEXT-FIGURES, 2 TABLES AND 22 PLATES)

WARSZAWA 1970

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INTRODUCTION

It is well known that in the Carboniferous period trilobites were represented by only 3 families of Proetacea: Proetidae SALTER, 1864, Brachymetopidae PRANTL & PŘIBYL, 1950 and Otarionidae RICHTER & RICHTER, 1926. Not many years ago, Carboniferous proetid trilobites were all placed in one family, the Phillipsiidae OEHLERT, 1886. This systematics was recently criticized by HESSLER (1963, 1965) and by HAHN & HAHN (1967), as a result of which the former „Phillipsiidae" are now assigned to several subfamilies, all within the family Proetidae. Investigation of the European Carboniferous trilobites was undertaken as early as the begining of 19th century, and the works of MARTIN (1809) and FISCHER VON WALDHEIM (in EICHWALD, 1825) were among the first to describe the Carboniferous proetids. During the almost 150 years that have elapsed since then, the Carboniferous trilobites of Europe and Asia have been described by various authors and the literature on this subject embraces about 80 papers. Unfortunately, very often the papers dealing with the systematics of the Carboniferous trilobites, especially the older ones, were written without seeing other collections, their authors being misled by the many inaccurate descriptions and illustrations of their predecessors.

During preparation of the study on the Polish non-cyrtosymbolinid Carboniferous trilobites it soon became obvious that they could not be properly understood without considerable research on the previously described material. Only by re-examining the primary types, or topotype specimens of the type species, could the status of some genera be elucidated. The same was true at the species level; the geographic and stratigraphic range of some widely known species could be determined only after studying the holotypes, and designating neotypes or lectotypes. The starting point for this research was the revision of the genera occurring in Poland. Later, it was extended to include some other, closely related genera. The material described in the present monograph covers various collections of Carboniferous trilobites from Great Britain and Eire, housed in numerous museums in these countries, the collection from Belgium, housed in the Royal Institute of Natural Sciences in Brussels, the collections from the European and Asiatic parts of the U. S. S. R., housed in the TSHERNYSHEV'S Museum in Leningrad, and the collections from Poland. The Polish material covers the collection from the Cracow region collected and described by JAROSZ (1909, 1913) as well as that collected by Dr. ST. CZARNIECKI, both housed in the Institute of Geological Sciences, Polish Academy of Sciences in Cracow; the collection of Dr. H. ŻAKOWA from Lower Silesia, housed in the Geological Institute in Warsaw, and the author's collection from the Holy Cross Mountains (Góry Świętokrzyskie), housed in the Palaeozoological Institute, Polish Academy of Sciences in Warsaw. The data on the Carboniferous trilobites from other European countries, as well as from North America and Australia discussed in the present paper, are based on the relevent literature.

The majority of genera included in the present paper are limited to the Lower Carboniferous (Tournaisian-Namurian) and only occasionally are the genera of wider stratigraphic

range considered. The present investigation has enabled the author to give an outline of the geographic and stratigraphic range of these genera. However, it was not possible to draw definite conclusions as to their value as index fossils. The present paper is, for the most part, based on the specimens coming from the old collections, and very often the stratigraphic position of the specimens is questionable. The present author's first aim was to bring some order into the recent data on the most common representatives of the Carboniferous proetids, which she hopes will be a help in the proper determining of these trilobites. A detailed, stratigraphic subdivision of the Carboniferous beds, based on trilobites, will be possible in the future, when correctly dated material is available.

Many of the specimens examined in the present work were already described by previous authors, who usually gave their measurements; therefore, in many cases, their dimensions are here omitted. For these species and subspecies where the original descriptions are sufficient, only diagnoses are given here, together with the present author's comments. The terminology used in this paper is the same as that accepted in the Treatise on Invertebrate Paleontology (1959).

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* *

The following abbreviations are used in the present paper:

Z. Pal. — Palaeozoological Institute, Polish Academy of Sciences, Warsaw, Poland
ZNG — Institute of Geological Sciences, Polish Academy of Sciences, Cracow, Poland
IG — Geological Institute, Warsaw, Poland
BM — British Museum (Natural History), London, Great Britain
GSM — Geological Survey and Museum, London, Great Britain
Ox. — University Museum, Oxford, Great Britain
SMC — Sedgwick Museum, Cambridge, Great Britain
RSM — Royal Scottish Museum, Edinburgh, Great Britain
HMG — Hunterian Museum, Glasgow, Great Britain
AGM — Art Gallery and Museum, Glasgow, Great Britain
IRB — Royal Institute of the Natural Sciences, Brussels, Belgium
TML — Tshernyshev's Museum, Leningrad, USSR.

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GENERAL PART

SYSTEMATICS OF THE CARBONIFEROUS PROETIDS

The adequacy of the family Phillipsiidae OEHLERT, 1886, to cover the majority of Carboniferous and all Permian trilobites which are assigned to it, has often been questioned in recent years. The artificial nature of this family, which comprises genera of different origin, was first pointed out by HESSLER in 1963. He suggested that the genera assigned so far to Phillipsiidae should be assigned instead to several subfamilies of the Proetidae SALTER, 1864. Earlier, in 1953, four new subfamilies (Griffithidinae, Ditomopyginae, Phillipsiinae, Anisopyginae) were erected by HUPÉ. However, he still placed them within the family Phillipsiidae, thus stressing their phylogenetic independence of Proetidae. More recently HAHN and HAHN (1967), following HESSLER, put forward a proposal for a new arrangement of the late Palaeozoic trilobites within the family Proetidae. These authors accepted HUPÉ'S systematics in part. According to them, the family Proetidae comprises ten subfamilies (Phillipsiinae, Griffithidinae, Proetinae, Dechenellinae, Proetidellinae, Tropidocoryphinae, Cyrtosymbolinae, Cornuproetinae, Drevermanniinae, Cummingellinae). The systematics accepted in the present paper conforms, in general, to the classification of HAHN and HAHN (1967), but the erection of two new subfamilies is proposed, namely: Crassiproetinae n. subfam. and Thaiaspinae n. subfam. For the "*Paladin*-Gruppe" of HAHN and HAHN (1967), distinguished by them within the subfamily Griffithidinae, the present author retains the name of Ditomopyginae introduced by HUPÉ in 1953. This group is distinctly separated from the typical representatives of the Griffithidinae, such as the genera *Griffithides*, *Cyphinioides* and others.

On re-examination of the classical material of Carboniferous trilobites from Great Britain and the USSR, which includes many type species and type specimens, the present author came to the conclusion that the composition of certain of the subfamilies of Carboniferous trilobites proposed by HAHN and HAHN (1967) should be readjusted.

The presently accepted systematics of the Devonian and Carboniferous trilobites is basically different from the classification adopted for the early Palaeozoic trilobites. While that of the latter is, with few exceptions, binominal, or trinominal (genus, species, subspecies), the systematics of the Devonian and Carboniferous trilobites is most often tetranominal (genus, subgenus, species, subspecies). These discrepancies in the use of the methods of classification are not justified by the morphology of the trilobites, which did not undergo any basic changes at the boundary between the Silurian and Devonian. They arise solely from the different conceptions of the individual authors dealing with these trilobites.

RICHTER and RICHTER, who laid the foundation of the systematics of Devonian and Carboniferous trilobites, made extensive use of subgeneric taxa. This conception of the systematics was accepted by many authors, the present author included, e.g. PŘIBYL (1950), MAKSI-

MOVA (1955), CHLUPAČ (1961*a*, 1961*b*, 1966), G. HAHN (1963, 1964*a*, 1964*b*, 1965*a*, 1965*b*, 1966, 1967*a*, 1967*b*), R. HAHN (1968*a*, 1968*b*), HAHN and HAHN (1967, 1968*a*, *b*, *c*), OSMÓLSKA (1963, 1968*a*).

In the present paper subgeneric taxa are not used, for the present author is now of the opinion that the subgenus is not only extremely artificial, especially in palaeontology, but also most inconvenient, leading, as it does, to the already-mentioned creation of multinominal names. The subgenera in, for example, the subfamily Cyrtosymbolinae, or in any of the other Carboniferous trilobite subfamilies, are sufficiently differentiated to warrant their recognition as independent genera. The fact that certain species within one genus seem closer to one another than to others is quite understandable, and it is not necessary to emphasize this by their assignment to different subgeneric taxa. Equally useful, in such cases, is to separate groups of species, as practiced by some authors, this having the advantage of not complicating the nomenclature.

In the opinion of the present author, there are not sufficient grounds for considering e.g. *Mirabole* OSMÓLSKA, 1962, closer to *Phillibole* RICHTER & RICHTER, 1937, than to *Liobole* RICHTER & RICHTER, 1949. The two former were recognized by HAHN and HAHN (1967) as subgenera of the genus *Archegonus* BURMEISTER, 1843, the latter standing as an independent genus. A similar objection may be raised in the case of the genera *Breviphillipsia* HESSLER, 1963, and *Elliptophillipsia* HESSLER, 1963, which according to HAHN and HAHN (1967) are related to *Phillipsia* PORTLOCK, 1843, being subgenera of the latter, while *Eocyphinium* REED, 1942, and *Piltonia* GOLDRING, 1955, are considered as independent genera. In fact, *Elliptophillipsia* differs considerably in the character of its short pygidium from almost all Phillipsiinae, while *Piltonia* and *Eocyphinium* are very close to each other and to *Phillipsia* s. str. in their cephala as well as in their pygidia.

Many similar examples may be quoted both from the papers of the present author and those of other authors. Thus, the practice of creating subgenera (based on the subjective recognition of certain features as diagnostically more important than others), while often not reflecting the real relationship between the individual trilobite groups, results in the loss of the main purpose of palaeontological classification, that is, convenience.

The present author is not, in principle, against the use of the subgeneric taxon in palaeontology. In her opinion, it should be applied with caution, rather as an exception than as a rule. Erection of subgenera may be justified in those cases in which a certain, comparatively small group of species exhibits certain common features which may be important for phylogeny, while still retaining features characteristic for a given genus. However, it should be remembered that phylogenetic lines, established for extinct groups of animals, are more or less hypothetical and depend on the quantity of the material and the state of its preservation.

The classification adopted in the present paper for the family Proetidae is given below. Subfamilies which do not include the Carboniferous genera are here omitted. The pre-Carboniferous genera, which are not considered in the present paper, are placed in subfamilies after RICHTER, RICHTER and STRUVE (1959) and are left in the form quoted there (i.e. with the subgeneric names).

Superfamily Proetacea SALTER, 1864
Family Proetidae SALTER, 1864
Subfamily Proetinae SALTER, 1864

Proetus (*Proetus*) STEININGER, 1831
Proetus (*Cyphoproetus*) KEGEL, 1927
Bollandia REED, 1943
Pudoproetus HESSLER, 1963
Reediella n. gen.
?*Isbergia* WARBURG, 1925
?*Unguliproetus* ERBEN, 1951
?*Proetides* WALTHER, 1942

Subfamily Crassiproetinae n. subfam.

Crassiproetus STUMM, 1953
Conophillipsia ROBERTS, 1963

Subfamily Dechenellinae PŘIBYL, 1946

Dechenella (*Dechenella*) KAYSER, 1880
Dechenella (*Basidechenella*) RICHTER, 1912
Dechenella (*Paradechenella*) RICHTER, 1912
Dechenella (*Monodechenella*) STUMM, 1953
Dechenella (*Praedechenella*) MAKSIMOVA, 1952
Schizoproetus RICHTER, 1912
Linguaphillipsia STUBBLEFIELD, 1948
Lacunoporaspis YOLKIN, 1966
Dechenelloides GANDL, 1968
Benesovella CHLUPAČ, 1969
Bitumulina n. gen.
?*Palaeophillipsia* SUGIYAMA & OKANO, 1944

Subfamily Cyrtosymbolinae HUPÉ, 1953

Cyrtosymbole RICHTER, 1913
Calybole RICHTER & RICHTER, 1926
Archegonus BURMEISTER, 1843
Typhloproetus RICHTER, 1913
Waribole RICHTER & RICHTER, 1926
Phillibole RICHTER & RICHTER, 1937
Cystispina RICHTER & RICHTER, 1939
Cyrtoproetus REED, 1943 (= *Archegonus* (*Angustibole*) HAHN, 1965; = *Archegonus* (*Phillibolina*) GANDL, 1968)
Liobole RICHTER & RICHTER, 1949
Cyrtodechenella RICHTER & RICHTER, 1950
Carbonocoryphe RICHTER & RICHTER, 1950
Diacoryphe RICHTER & RICHTER, 1951
Mirabole OSMÓLSKA, 1962
Spatulina OSMÓLSKA, 1962
Belgibole HAHN, 1963
Weania CAMPBELL, 1963
Elliptophillipsia HESSLER, 1963
Griffithidella HESSLER, 1965
Gitarra GANDL, 1968
Spinibole CHLUPAČ, 1966
Pseudowaribole HAHN & HAHN, 1967 (= *Cyrtosymbole* (*Geigibole*) GANDL, 1968)
Phillibolina OSMÓLSKA, 1968 (non *Archegonus* (*Phillibolina*) GANDL, 1968)
Pseudospatulina HAHN & HAHN, 1968

Subfamily Cummingellinae HAHN & HAHN, 1967

Cummingella REED, 1942
Liobolina RICHTER & RICHTER, 1951
Moschoglossis GOLDRING, 1958
Richterella HESSLER, 1965
Weberiphillipsia n. gen.
?*Breviphillipsia* HESSLER, 1963

Subfamily Phillipsiinae OEHLERT, 1886

Phillipsia PORTLOCK, 1843
Eocyphinium REED, 1942
Piltonia GOLDRING, 1955

Subfamily Griffithidinae HUPÉ, 1953

Griffithides PORTLOCK, 1843
Neoproetus TESCH, 1923
Paraphillipsia TOUMANSKAYA, 1953
Permoproetus TOUMANSKAYA, 1935
Exochops WELLER, 1936
Cyphinioides REED, 1942
Particeps REED, 1943
Kathawaia GRANT, 1966
Kulmiella HAHN & HAHN, 1968
?*Paragriffithides* REED, 1942
?*Microphillipsia* RUGGIERI, 1959

Subfamily Ditomopyginae HUPÉ, 1953

Ditomopyge NEWELL, 1931
Pseudophillipsia GAMMELLARO, 1892
Anisopyge GIRTY, 1908
Neogriffithides TOUMANSKAYA, 1935
Paladin WELLER, 1936
Sevillia WELLER, 1936
Humilogriffithides INAI, 1936
Vidria WELLER, 1944
Timoraspis HAHN & HAHN, 1967
?*Ameura* WELLER, 1936
?*Delaria* WELLER, 1944

Subfamily Thaiaspinae n. subfam.

Thaiaspis KOBAYASHI, 1961
Thigriffithides HESSLER, 1965

DIAGNOSTIC IMPORTANCE OF SOME TRILOBITE CHARACTERS

Most of the trilobite specialists base their generic and specific determination on the characters of the cephalon, regarding them as more important than those of the pygidium. However, as far as the Carboniferous proetids are concerned, the features observed on the pygidia are, in the present author's opinion, very important diagnostically, especially on the genus level. The present author during her studies on the Eurasian Carboniferous trilobites had the opportunity of examining very large collections, including many species of such genera as: *Cummingella* REED, 1942, *Phillipsia* PORTLOCK, 1843, *Eocyphinium* REED, 1942, *Paladin* WELLER, 1936. Quite often she noticed that it is easier, at the generic level, to identify isolated pygidia than the cephala, which are usually more variable within one genus. For the purpose of generic determinations, the most important characters of the pygidium are: the general shape and convexity, the pygidial border and the pattern of ribs, i.e. whether the rib-bands are equally developed, or one band is distinctly overgrown by the other. On the base of the pygidial features it is also easier to detect the possible phylogenetic relations between the genera. In such closely related genera as *Phillipsia* and *Eocyphinium*, *Weania* CAMPBELL, 1963 and *Belgibole* HAHN, 1963, *Bollandia* REED, 1943 and *Reediella* n. gen., for example, the characters of the pygidia show their relationship more clearly than do the cephala (e.g. Pl. X, Fig. 11*a-b*; Pl. XII, Figs 11, 13). For specific determination the pygidia are less critical than the cephala, since they provide a more limited number of possible feature-combinations.

Some cephalic characters, which are often regarded as of great importance for systematics of Carboniferous trilobites, should be carefully reconsidered:

The shape of the glabella, which usually has a decisive significance even for the subfamily rank, is sometimes misleading. In the collection studied, there are two closely related species of *Weania* CAMPBELL, 1963, which differ strongly in the shape of the glabellae: *W. librovitchi* (WEBER, 1937) has a conical glabella typical for the Cyrtosymbolinae, while *W. anglica* OSMÓLSKA, 1970 has a glabella so distinctly shortened in front of S_3, and cut off anteriorly, that if this single character were the only one taken into account, the species would have to be assigned to the Proetinae SALTER, 1864, or Cornuproetinae RICHTER & RICHTER, 1956.

Another cephalic character, which may be confusing, is *the medial preoccipital lobe*. It was believed to be of generic value in Carboniferous trilobites (e.g. in *Eocyphinium* REED, 1942, *Cyphinioides* REED, 1942, *Ditomopyge* NEWELL, 1931). However, a detailed examination of the European species of *Paladin* WELLER, 1936, allowed the present author to observe that the medial preoccipital lobe occurs, in a more or less distinct form, in some of its species (e.g. *Paladin maillieuxi* (DEMANET, 1938), while it is absent in others (e.g. in *Paladin czarnieckii* n. sp.). Moreover, the medial preoccipital lobe can be pronounced in some individuals and absent in others within the same species (e.g. *Paladin trigonopyge* OSMÓLSKA, 1968); sometimes it is developed in the young individuals, but it is obsolete in adult forms (e.g. *Paladin cuspidatus* (REED, 1943)). The medial preoccipital lobe was generally considered to characterize late Carboniferous and Permian trilobites. But though this structure is indeed most widespread among Permian trilobites, it may be found also in early Carboniferous trilobites such as: *Bitumulina bitumulata* (WEBER, 1932), *Piltonia mugodjarica* (BALASCHOVA, 1956) from Tournaisian beds, and *Griffithides acanthiceps* WOODWARD, 1883, from Viséan deposits.

A pronounced medial preoccipital lobe seems to be only one way in which the posterior part of the glabella is strengthened. A second way was observed by the present author in some species of *Paladin* (e.g. *Paladin eichwaldi* FISCHER V. WALDHEIM, 1825). In this case, the posteromedial portion of the glabella has a thickened exoskeleton. This thickenings takes place on the

inner side of the exoskeleton, while the surface of the exoskeleton does not show any distinct changes (Text-fig. 1 *A*, *B*). A „strengthening" of the posterior region of the cephalon was already observed by the present author in the Carboniferous species *Liobolina apodemata* OSMÓLSKA, 1962 (cf. OSMÓLSKA, 1962).

Lateral occipital lobes — which are common in representatives of the subfamily Dechenellinae PŘIBYL, 1946 — are also found in such typical Cyrtosymbolinae genera as *Liobole* RICHTER & RICHTER, 1949 and *Cyrtoproetus* REED, 1899. Lateral occipital lobes occur also in

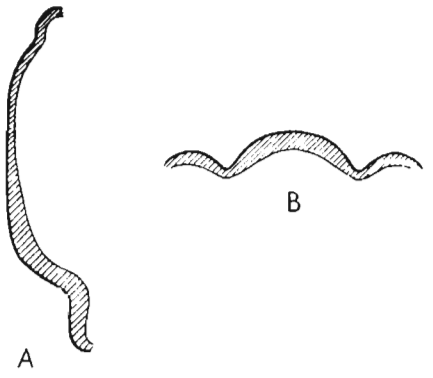


Fig. 1

Paladin eichwaldi parilis (REED): *A* longitudinal section, *B* transverse section, showing thickening of the carapace in the posterior part of glabella

Proetinae SALTER, 1864, but even within the genus *Proetus* STEININGER, 1831 they may be distinctly developed (*P. concinnus* [DALMAN, 1826]) or almost obsolete (*P. prox* RICHTER & RICHTER, 1956). Thus it does not seem reasonable to consider this character as of significant value for a high taxonomic rank (generic or subfamilial).

Generic value has been ascribed to the *position of the anterior border*, whether it is placed in front of, or under the glabella. However, this character may change from species to species, even within one genus, as is the case in representatives of *Paladin*, where all transition stages can be found between "in front of glabella" and "under glabella". Moreover, the position of the anterior border changes during the ontogenetic development, and in the genera in which it is covered by the glabella (i.e. in *Cummingella* REED, 1842, *Griffithides* PORTLOCK, 1843, a. o.), it is situated in front of it in young, though not necessarily larval, individuals.

In those forms in which the anterior border is covered by the glabella, two types may occur, and a distinction should be made between them. In some cases, e.g. in *Cummingella* REED, 1942 and *Particeps* REED, 1943, the anterior border, in its migration under the glabella moves downwards, which means that its dorsal surface changes from an upward-facing position to a forward-facing position (Text-fig. 2*A-C*). In other genera, such as *Eocyphinium* REED, 1842 and *Reediella* n. gen., the anterior border turns upwards and fuses with the frontal lobe of the glabella; in this case, its ventral side is facing forwards, the dorsal one being attached to the glabella. Here, the exposed surface of the anterior border may become deeply furrowed, and may bear the so-called "subcranial furrow" (GOLDRING, 1955), the furrows being but the deepened terrace lines which usually occur on the doublure of the trilobite cephalon (Text-fig. 2A_1-C_1). An enrolled specimen with the "subcranial furrow" developed according to the above-described pattern, has not been found, thus the question of whether it plays the same role as the subcranial furrow in Phacopidae, is still open. It should be added here that a furrow

of similar character to that found along the anterior border, was found by the present author along the margin of pygidium in *Piltonia buchtarmensis* (MAKSIMOVA, 1961) as well as in *P. altaica* (WEBER, 1937). Both species are typical of *Piltonia* and have the "subcranial furrow" well

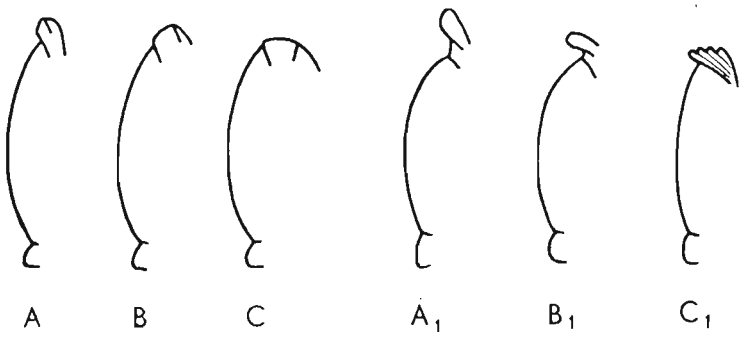


Fig. 2
Downward migration of the anterior border: A *Phillipsia*, B *Cummingella*, C *Particeps*. Upward migration of the anterior border: A_1 *Pseudowaribole*, B_1 *Weania*, C_1 *Eocyphinium*. (A-C and A_1-C_1 do not represent any phyletic line).

developed, however the anterior border, though already upturned, is still separated from the glabella by the preglabellar field. It seems probable that in these cases, the marginal pygidial furrow and the "subcranial furrow" were related and might have played the role of a clasp.

STRATIGRAPHIC AND GEOGRAPHIC RANGE OF THE CARBONIFEROUS PROETID SUBFAMILIES

In the late Palaeozoic, close to the boundary between the Devonian and the Carboniferous, the trilobite family Phacopidae HAWLE & CORDA, 1847, became extinct. The last of its representatives are, however, present in the Lower Tournaisian (Tn1a) in Belgium (RICHTER & RICHTER, 1933, CONIL & PIRLET, 1967), as well as in the Lower Tournaisian (Kassin Beds) of Asia (Central Kazakhstan). The representatives of the family Proetidae SALTER, 1864, were not eliminated at this time, and though some subfamilies become extinct before the end of the Devonian (RICHTER & RICHTER, 1951), a number of them survived:

1. **Proetinae** SALTER, 1864 — The genus *Pudoproetus* HESSLER, 1963 is known from the uppermost Devonian and Lower Mississippian (Kinderhookian — Osagean) in USA, as well as from the passage beds and the Lower Tournaisian in Asia. Exclusively Carboniferous genera of this subfamily — *Bollandia* REED, 1943 and *Reediella* n. gen. — occur in the Tournaisian and Viséan of Europe, as well as in the Lower Tournaisian of Asia. The remaining Proetinae genera have been found only in rocks of Frasnian or earlier age.

2. **Crassiproetinae** n. subfam. — Of the two genera here assigned, *Crassiproetus* STUMM, 1953, is reported from the Middle Devonian of the USA, but its close relative *Conophillipsia* ROBERTS, 1963, occurs in the Tournaisian of Australia and in the Tournaisian (and perhaps in passage beds) of Asia.

3. **Dechenellinae** PŘIBYL, 1946 — The majority of the genera of this subfamily became extinct in the Middle Givetian. However, in the South Urals a species of *Dechenella* s. str. has been found (MAKSIMOVA, 1965) in Frasnian deposits, which prolonge the range of this genus.

A gap still exists between the Devonian and Carboniferous representatives of this subfamily. The oldest of the latter, *Bitumulina* n. gen., from the Tournaisian of the Mugodzhars, clearly shows its dechenellinid character and has as its successor the morphologically close genus *Linguaphillipsia* STUBBLEFIELD, 1948, known from the Tournaisian and Viséan of Eurasia and Australia. The third Carboniferous genus of this subfamily is the recently described *Dechenelloides* GANDL, 1968, from the Upper Tournaisian of Germany.

4. **Cyrtosymbolinae** HUPÉ, 1953 — Only three genera of this very large subfamily pass beyond the boundary of the Devonian into the Carboniferous. They are: *Pseudowaribole* HAHN & HAHN, 1967, from the uppermost Devonian and Tournaisian of Europe, the genus from which most probably came the new radiation of the Cyrtosymbolinae in the Lower Carboniferous; *Typhloproetus* RICHTER, 1913, known from the Upper Devonian, and possibly also from the Dinantian of Europe, and *Waribole* RICHTER & RICHTER, 1926, found from the Famennian to the Viséan in Eurasia. The remaining genera assigned to this subfamily are either Devonian or Carboniferous exclusively. These latter do not pass the upper boundary of the Viséan in Eurasia and Middle Osagean in USA. The genera of this family were supposed to be associated in the Lower Carboniferous with the goniatite facies. However (comp. p. 21) they are quite often found also in the „Carboniferous Limestone" facies.

5. **Cummingellinae** HAHN & HAHN, 1967 — All the genera assigned to this subfamily are so far reported only from the Carboniferous, but are not found higher than the Namurian in Eurasia and the Lower Chesterian in USA. The oldest genera — *Moschoglossis* GOLDRING, 1958, *Liobolina* RICHTER, 1951, and *Weberiphillipsia* n. gen. appear in the Lower Tournaisian — the two first mentioned in Europe, the third one in Asia and Australia. The most primitive genus here seems to be *Weberiphillipsia*, which from the point of view of the structure of its pygidium resembles some representatives of Cyrtosymbolinae, while at the same time showing a typical cummingellinid cephalon. This genus, or some forms related to it, could be considered as ancestral to the Cummingellinae. The most persistent genera of this subfmily are *Cummingella* REED, 1942, in Eurasia, and *Richterella* HESSLER, 1965, in North America, their range covering nearly the total range of the subfamily.

6. **Griffithidinae** HUPÉ, 1953 — This subfamily includes both Carboniferous as well as Permian genera. On the other hand, among the Carboniferous genera only *Cyphinioides* REED, 1942, is known to occur higher than the Namurian — being found in the Moscovian of Europe. Thus, the possibility exists that the Permian representatives were derived from a different stock, and suggests a polyphyletic origin of the subfamily. The Carboniferous Griffithidinae are found in Eurasia and in North America as well, while the Permian representatives are so far known only from Eurasia and Australia.

7. **Phillipsiinae** OEHLERT, 1886 — In spite of concepts which have so far prevailed, genera related to *Phillipsia* s. str. are very few in number, and this subfamily covers, additionally to the nominal genus, only *Eocyphinium* REED, 1942 and *Piltonia* GOLDRING, 1955. *Phillipsia* PORTLOCK, 1843 seems to be restricted to the territory of Europe, and is, in general, a genus characteristic of the Tournaisian, found, although rarely, also in the Lower Viséan. *Piltonia* is the genus which shows the most primitive features in this subfamily and its early Tournaisian species known from Asia (as well as the Osagean species in North America) clearly indicate the cyrtosymbolinid origin of the Phillipsiinae. The genus last mentioned gave rise to *Eocyphinium*, known from the Tournaisian to the Namurian in Europe and the late Kinderhookian in USA, and the two genera are extremely close to each other. Though the younger species of *Piltonia*, as well as those of *Eocyphinium*, are very similar to *Phillipsia*, especially in the structure

of the pygidium, *Piltonia* cannot be regarded as a forerunner of *Phillipsia* and the latter derived probably from some other, more advanced genus than the early *Piltonia*.

8. **Ditomopyginae** HUPÉ, 1953 — This subfamily ranges throughout nearly the whole Carboniferous (excluding its beginning) and the Permian in Eurasia and USA. Its oldest known genus *Paladin* WELLER, 1936 appears in the Upper Viséan and became extinct in Moscovian in Europe, while in USA it starts in the Upper Osagean and continues up to Atokan. Its successor — *Ditomopyge* NEWELL, 1931, present in Eurasia and in USA during the Upper Carboniferous and Permian, gave rise to the new radiation of the proetid trilobites. *Paladin* shows close resemblance to the representatives of the two subfamilies — *Linguaphillipsia* of the Dechenellinae and *Thigriffithides* of the Thaiaspinae n. subfam. It was derived, according to HAHN and HAHN (1967), from the latter genus. However, in the present author's opinion, the similarities in the structure of the pygidium between *Paladin* and Dechenellinae, as well as in the cephala are so striking (comp. p. 129) that a relationship to some forms close to *Linguaphillipsia* or *Bitumulina* seems more probable.

9. **Thaiaspinae** n. subfam. — The subfamily is represented by two genera only, both of them monotypic. *Thaiaspis* KOBAYASHI, 1961, is so far known from the Middle or, perhaps, Upper Carboniferous of the Northeastern Asia, while *Thigriffithides* HESSLER, 1965, is from the late Kinderhookian of USA. The peculiar structure of the cephala within this subfamily sets them apart from all known Carboniferous trilobites, and the present author does not see at the moment any possibility of indicating their possible ancestors.

CARBONIFEROUS TRILOBITES IN EURASIA

British Isles

Lower Carboniferous deposits, containing trilobite faunas, range in Eire and Great Britain from the Tournaisian to the Namurian (C_1—E_2). The trilobites are here connected both with the shale and the limestone facies. In British Isles the investigations were carried out mainly by MCCOY (1844, 1847, 1855), PHILLIPS (1836), PORTLOCK (1843), WOODWARD (1877, 1883-1884, 1901), KING (1914, 1924), REED (1899, 1942, 1943*a*, 1943*b*), STUBBLEFIELD (1946, 1952) and most recently by GOLDRING (1955, 1958).

The majority of the British material described in the present paper comes from the old collections, thus very often the information about the statigraphic position of the specimens is very vague, and mostly given as the „Carboniferous limestone". As a result, until new material is collected, most of the trilobites here described have a limited value for stratigraphy. Wherever possible, the present author has given her suggestions about the tentative age of the specimens, basing this on the available geological literature.

Generally speaking, it may be stated that the genus *Phillipsia* does not cross the boundary between the Lower and Middle Viséan, the majority of the specimens coming from Tournaisian deposits. To the present author's knowledge, no species of *Cummingella* was found in the British Isles in the Tournaisian and the Namurian. Thus, in contrast to the USSR, this genus is limited to the Viséan. Though the majority of the specimens of *Cummingella* come from limestone deposits, some rare specimens were found in shales (i.e. in Bundoran, Donegal, Eire). The genera *Particeps* REED, 1943 and *Paladin* WELLER, 1936, are, in Great Britain, characteristic of the Upper Viséan and Lower Namurian. *Particeps* has, so far, not been found either in Northern Ireland

or in Eire. Both genera are common elements in the Yoredale facies of the Askrigg Block, as well as in the Middle and Upper Limestone Group of Northumberland and in the Lower and Upper Limestone Group of Scotland.

Belgium

Carboniferous trilobites from Belgium were described by DE KONINCK (1842—1844), RICHTER and RICHTER (1933, 1939), DEMANET (1838), GOLDRING (1958), and G. HAHN (1963, 1964*b*, 1964*c*). Unfortunately, the classic material described by DE KONINCK has been lost. The present author was able to study a large collection of trilobites (Upper Tournaisian, Tn 3*b*, *c*) collected by ROLLAND in the vicinity of Soignies and Antoing, and it seems to include some of the species which were described by DE KONINCK. Also DEMANET's (Upper Viséan, V 3*c*) collection (1938) from Bioul was available to the present author. In these collections the genera: *Phillipsia* PORTLOCK, 1843, *Cummingella* REED, 1942, *Piltonia* GOLDRING, 1955, *Paladin* WELLER, 1936 and *Griffithides* PORTLOCK, 1843 were present, and their representatives, excluding these of the *Griffithides*, are redescribed in the present paper. The investigations allow the present author to state that the genus *Cummingella* was already present in Western Europe in early Carboniferous/Tournaisian times. Besides the genera of the Carboniferous Proetidae SALTER, 1864, here mentioned, the rare genus *Belgibole* HAHN, 1963, was reported from Belgium, being known so far to be present outside Belgium only in the USSR (the Viséan of the Urals).

Germany

The majority of the Carboniferous trilobites described from the territory of West and East Germany are assigned to the subfamily Cyrtosymbolinae, and are usually associated with the goniatite facies (RICHTER & RICHTER, 1937, 1949, 1950, 1951; G. HAHN, 1965*b*, 1966, 1967*a*; R. HAHN, 1968; HAHN & HAHN, 1968*b*; SCHWARZBACH, 1962; GANDL, 1968).

Among the non-cyrtosymbolinid proetid genera *Cummingella* REED, 1942, *Linguaphillipsia* STUBBLEFIELD, 1948, *Liobolina* RICHTER & RICHTER, 1951, *Gitarra* GANDL, 1968, *Dechenelloides* GANDL, 1968, *Kulmiella* HAHN & HAHN, 1968, were reported from deposits ranging from Tournaisian to the Upper Viséan (HAHN & HAHN, 1968*b*, *c*, *d*; WEYER, 1965; KNÜPFER & WEYER, 1967; GANDL, 1968).

France

Only a few Carboniferous trilobites were described from this country, among them *Brachymetopus* from the Tournaisian and *Paladin* (?) from the Viséan (JULIEN, 1896).

Czechoslovakia

All the Carboniferous trilobites described from Czechoslovakia come from the Moravian Karst and Slovakia. In addition to the numerous Cyrtosymbolinae, rare representatives of: *Piltonia*, *Moschoglossis* and *Cummingella* were described from the Tournaisian deposits (CHLUPAČ, 1961, 1966). From the Lower Namurian a number of *Paladin* representatives were described (SMĚTANA, 1916; PATTEISKY, 1930, 1933; REHOŘ & REHOŘOVA, 1959; PŘIBYL, 1951;

BOUČEK & PŘIBYL 1960), all of them close to those found in Upper Silesia (SCHWARZBACH, 1936). From the Namurian B-C the genus *Eocyphinium* is reported (= *Phillipsia margaritifera* ROEMER, 1870 in BOUČEK & PŘIBYL, 1960), which is surprising, as this genus has been so far not known higher than the Lower Namurian. Also the age of *Cummingella* and *Bollandia* species from the Dobsina region, given as the Westphalian B (BOUČEK & PŘIBYL, 1960), is unusual for these genera, *Bollandia* being found not higher than the Upper Viséan, and *Cummingella* being almost entirely Viséan and rarely found in Lower Namurian. The same is true for the *Griffithides* species, but in the Dobsina region, *Griffithides dobsinensis* ILLES, 1902 (= *Cyrtoproetus dobsinensis* in BOUČEK & PŘIBYL, 1960) is suggested to be of Westphalian age.

Hungary, Austria, Yugoslavia

The only late Palaeozoic trilobites in Hungary were described from the Bük Mountains (SCHRÉTER, 1948) and they represent the Upper Carboniferous *Paladin* species nad Lower Permian *Pseudophillipsia* GAMMELLARO, 1892. From the Austrian Carnic Alps *Pseudophillipsia* and *Ditomopyge* NEWELL, 1931 were reported from the Uralian deposits (GAURI, 1965). In Yugoslavia, so far only the genus *Brachymetopus* MCCOY, 1847, was found in the Orenburgian of the Karawanken (GAURI & RAMOVŠ, 1964).

Spain and Portugal

The Carboniferous proetid trilobites on the Iberian Peninsula were described by RICHTER and RICHTER (1939) from the Viséan of Menorca and Catalonia, and by HAHN and HAHN (1968*b*) from the Upper Viséan of South Portugal. They are represented by *Drevermannia* RICHTER, 1909, and *Kulmiella* HAHN & HAHN, 1968.

Poland

Carboniferous trilobites in Poland are known from four main provinces: the Holy Cross Mountains (Góry Świętokrzyskie), Cracow region, Upper Silesia, Lower Silesia. In these areas they are found in deposits ranging from the uppermost Tournaisian to Namurian and developed in the goniatite (shale) or coral-brachiopod (limestone) facies.

Holy Cross Mountains. — In this region Carboniferous deposits are developed in a goniatite facies (Tournaisian-Viséan) and in a coral-brachiopod facies (Viséan). The former has yielded almost exclusively cyrtosymbolinid trilobites, previously described by the present author (OSMÓLSKA, 1962). The only non-cyrtosymbolinid genus found here is *Liobolina* RICHTER & RICHTER, 1951, which according to the new systematics proposed by HAHN and HAHN (1967) represents the subfamily Cummingellinae HAHN & HAHN, 1967.

The deposits developed in the coral-brachiopod facies are very limited both in space and in time and are represented by several outcrops in the locality Gałęzice. In these deposits the cyrtosymbolinid trilobites are rare, represented only by one species *Cyrtoproetus cracoensis* REED, 1899 (OSMÓLSKA, 1968*a*). The exceptionally rare, small otarionid trilobite *Coignouina acanthina* (COIGNOU, 1890) was also found in Gałęzice (OSMÓLSKA, 1967). Both forms are common to Great Britain and Poland. *Brachymetopus* MCCOY is represented in Gałęzice by two species occurring also in Great Britain and USSR. These species, however, are repre-

sented in Gałęzice by the new subspecies — *B. ouralicus sanctacrucensis* OSMÓLSKA, 1968 and *B. moelleri parvus* OSMÓLSKA, 1968.

However, the majority of trilobites in the Gałęzice beds represents non-cyrtosymbolinid proetid trilobites: *Cummingella jonesi tuberculigenata* n. subsp., *Griffithides claviger halinae* n. subsp., *Eocyphinium spinosum polonicum* n. subsp., the first form mentioned distinctly dominating numerically.

The presence in these beds of species known from the Viséan of Great Britain and USSR suggests their Viséan age. According to Dr. J. FEDOROWSKI and Dr. H. ŻAKOWA (personal communications), the corals and brachiopods allow one to determine the age more precisely as D_2.

Cracow region. — In this region two localities yielded Carboniferous trilobites, which were investigated by the present author. One of the localities includes several outcrops of light grey limestone in the Racławka river valley, between the villages Dębnik and Paczółtowice. Trilobites from here were described by JAROSZ (1909, 1913) and this material is revised in the present paper. Cyrtosymbolinae HUPÉ, 1953 are represented in these deposits by 3 species: *Liobole raclavicensis* (JAROSZ, 1909), *Weania zarecznyi* (JAROSZ, 1913), *Phillibole cracoviensis* (JAROSZ, 1913). Additionally, *Cummingella jaroszi jaroszi* n. sp., n. subsp. (Cummingellinae HAHN & HAHN, 1967), *Phillipsia gemmulifera* PORTLOCK, 1843 (Phillipsiinae OEHLERT, 1886), *Linguaphillipsia paczoltowicensis* (JAROSZ, 1913) (Dechenellinae PŘIBYL, 1946) and *Brachymetopus maccoyi maccoyi* (PORTLOCK, 1843) (Brachymetopidae PRANTL & PŘIBYL, 1950) are present. *Cummingella jaroszi jaroszi* predominates numerically in this assemblage. It is very unique in that it comprises genera very rare in the Middle and West European Lower Carboniferous such as *Linguaphillipsia* STUBBLEFIELD, 1948 and *Weania* CAMPBELL, 1963, together with *Phillipsia* PORTLOCK, 1843, *Cummingella* REED, 1942, *Liobole* RICHTER & RICHTER, 1949, *Phillibole* RICHTER & RICHTER, 1937, which are very common elements of the European Carboniferous trilobite faunas. In addition, *Liobole* and *Phillibole* are much more frequently found in goniatite facies than in coral-brachiopod facies.

The age of the deposits in question was determined by JAROSZ (1909, 1913) as Viséan on the base of brachiopods ("*Spirifer tornacensis*" and "*Productus giganteus*"). However, the presence in the trilobite assemblage from the Cracow region of such forms as *Brachymetopus maccoyi maccoyi* and *Phillipsia gemmulifera* seems to indicate rather Tournaisian age for at least the deposits containing the trilobites. The same opinion was expressed by Dr. J. FEDOROWSKI (personal communication) who determined the corals from these beds. The rest of the trilobite fauna, represented by new species or subspecies, is of small stratigraphic value. They represent genera which are found both in Tournaisian and Viséan, i.e. *Linguaphillipsia*, *Phillibole*, *Weania* and *Cummingella*.

Trilobites from the other locality in the Cracow region come from the black shales of Orlej. Here Cyrtosymbolinae are absent, and the most commonly found is the genus *Paladin* WELLER, 1936 (Ditomopyginae HUPÉ, 1953). This genus is represented by two species: one mucronate, determined here as *P. mucronatus mucronatus* (MCCOY, 1844) and one non-mucronate — *P. czarnieckii* n. sp. The occurrence in the same beds of the mucronate and non-mucronate forms, reported so far as exceptional, poses the question, whether they are manifestation of sexual dimorphism. So far, insufficient evidence is available to solve the problem. In the same beds were found, additionally to the *Paladin* representatives, *Cummingella jonesi orleiensis* n. subsp. and *Eocyphinium parvum* n. sp. However, both latter forms are not numerous. The representatives of *Cummingella* in the shale facies are rare though not exceptional, the majority

of its species coming from the limestone facies. The age of these beds is difficult of precise determination. Judging from the presence of *Paladin mucronatus mucronatus*, it is more reasonable to accept a Namurian age, however it should be also emphasized that other subspecies of *Cummingella jonesi* (PORTLOCK, 1843) are known from the Viséan,

Upper Silesia. — In the present paper only one specimen from Upper Silesia is described, i.e. *Kulmiella caroli* n. sp. The trilobites from this region were described by SCHWARZBACH (1936), but the present whereabouts of this collection is unknown, quite probably it was lost during the war. SCHWARZBACH (1936) described *Paladin mucronatus* MCCOY, 1844, *Paladin eichwaldi latilimbatus* (SCHWARZBACH, 1936) (= "*Phillipsia latilimbata*" SCHWARZBACH, 1936), and *Eocyphinium margaritiferum* (ROEMER, 1870) (= "*Phillipsia margaritifera*" ROEMER, 1870). These trilobites are of Lower Namurian age and the presence of the genus *Eocyphinium* here is very unusual, as it is rarely reported higher than the Viséan.

The genera included in the Upper Silesian trilobite fauna resemble those from Orlej in Cracow region. An important difference is the fact that in Orlej the non-mucronate and mucronate species of *Paladin*, as well as the *Eocyphinium* species, are found together in one bed, while in Upper Silesia the mucronate *Paladin* species follows the non-mucronate *Paladin* and *Eocyphinium*.

Lower Silesia. — This region is of some interest from the point of view of the composition of the trilobite fauna. The Lower Carboniferous deposits are developed in a shale facies and limestones are extremely limited. Cyrtosymbolinae HUPÉ, 1953 which are usually associated with goniatites, are here most numerous (OSMÓLSKA, 1968*a*). But some non-cyrtosymbolinid genera, which are commonly found in the coral-brachiopod facies, are also present here. They are: *Phillipsia (?) gemmulifera* (PHILLIPS, 1836), *Linguaphillipsia silesiaca* (SCUPIN, 1900), *Cummingella jonesi* (PORTLOCK, 1843), *Griffithides claviger* SCUPIN, 1900, *Bollandia claviceps* (BURMEISTER, 1846) and *Reediella frechi* (SCUPIN, 1900).

The age of the deposits which yielded the trilobites is, according to ŻAKOWA (1958), Upper Viséan (Goα, Goβ). In conclusion, it can be added here that, while the cyrtosymbolinid trilobites in the Lower Carboniferous are associated with the goniatite facies and the non-cyrtosymbolinid trilobites with the coral-brachiopod facies, there are exceptions to this rule, and the Lower Silesian trilobite assemblage constitutes one of them.

U. S. S. R.

In the USSR large assemblages of Carboniferous trilobites are known from four main provinces: Moscow Basin, Donets Basin, the Urals (including Novaya Zemla, Vaigatch to the North and Mugodzhary onto the South), Central Asia (Kazakhstan, Kirghiz including the Altai to the East and Kuznetsk Basin to the North-East).

The trilobites which were at the present author's disposal came from the collection described previously by WEBER (1932, 1933, 1937), MAKSIMOVA (1960) and BALASCHOVA (1956). They were collected both from the European and Asiatic parts of the USSR and range stratigraphically from the uppermost Devonian to the Permian. This material is of exceptional interest not only because it comes from so vast a territory, but above all, because it was often collected from continuous profiles of the marine Carboniferous (e.g. in the Donets Basin). It allows one to state that, as in the rest of Europe, the most long-lived genus among Carboniferous trilobites is *Paladin* WELLER, 1936, ranging from Lower to Upper Carboniferous (Upper Viséan — Gzhelian).

So far, such a range was reported only from the USA, where the latest known representative — *P. pyriformus* CHAMBERLAIN, 1969, occurs in the Atokan (thus only to about the Lower Moscovian according to the European subdivision). Unquestionable *Paladin* species are so far reported only from the European part of the USSR, and are not found east of the Urals. The same is true for *Phillipsia* PORTLOCK, 1843, which, according to present knowledge, is an exclusively European form.

Piltonia GOLDRING, 1955 and *Eocyphinium* REED, 1942 are, in the USSR, represented only in the Tournaisian and Viséan of the Urals and in Central Asia, as well as *Pudoproetus* HESSLER, 1963. *Linguaphillipsia* STUBBLEFIELD, 1948, is known in the USSR from the Viséan of the Moscow Basin, as well as from the Urals and Central Asia.

Weberiphillipsia n. gen., known so far as an exclusively Tournaisian genus, is widespread in Asia, being found in Kazakhstan, in Altai and the Kuznetsk Basin. *Cummingella* REED, 1942, which in the USSR ranges from the Tournaisian to the Namurian, is found both in the European and Asiatic parts. The same is true for the Viséan and Namurian genus *Griffithides* PORTLOCK, 1843. *Cyphinioides* REED, 1942, and *Particeps* REED, 1943 are found in the Viséan and Namurian (the former also in the Moscovian) of the USSR and these genera are so far exclusively European, and are not reported east of the Urals.

CARBONIFEROUS TRILOBITES IN U. S. A.

Carboniferous trilobites in North America have been described since the middle of the 19th century, when they were assigned mostly to the European genera: *Phillipsia* PORTLOCK, 1843 and *Griffithides* PORTLOCK, 1843. Subsequently WELLER (1935, 1936, 1944) and HESSLER (1963, 1965) showed that the Carboniferous trilobites in USA are much more differentiated.

The present author has not seen the material from the USA, however she had an opportunity to examine the specimens of "*Phillipsia sampsoni*" VODGES, 1888, from the Chouteau Limestone, locality Lupus, Missouri, and *Paladin* cf. *osagensis* CISNE, 1967 from the Keokuk Division, locality Green, Indiana. These specimens are housed in the British Museum (Nat. Hist.) under the numbers: In 18470—73, In 19063, and In 19742 respectively.

Both the examination of the BM specimens as well as the photographs in HESSLER's paper (1963, Pl. 61, Figs 13, 15-17, 19—23, 27, 28; Pl. 62, Figs 1, 18) leads the present author to the conclusion that *Phillipsia sampsoni* VODGES, 1888, which was designated by HESSLER as the type species of his new genus *Breviphillipsia*, represents in fact a species of *Eocyphinium* REED, 1942. HESSLER (1963) assigned also to *Breviphillipsia* "*Proetus swallowi*" SHUMARD, 1855, which even in his own opinion "does not conform in some respects to the general pattern of the genus". This species, having a rounded, downwardly directed anterior border, a glabella narrowest at S_2 and widening both forwards (where it is rounded at front) and backwards, having an occipital ring much wider (*tr.*) than the glabella across its base, a pygidium with a marked border and flat ribs divided into two equal bands, differs so distinctly from other genera, that it certainly represents a new genus, which seems to be close to Cummingellinae HAHN & HAHN, 1967. The suggestion is put forwards here that for "*Proetus swallowi*" SHUMARD, 1855 a new genus should be erected.

As may be concluded from WELLER's (1936), HESSLER's (1963) and CHAMBERLAIN's (1969) papers, "*Proetus missourensis*" SHUMARD has been described twice by SHUMARD: in 1855 and in 1858. However, according to WELLER (1936) and HESSLER (1963), the forms described successively by SHUMARD were not conspecific, one being even distant from *Proetus*. In 1865,

MEEK and WORTHEN described "*Phillipsia (?Griffithides) sangamonensis*", which was different from "*Proetus missourensis*" sensu SHUMARD, 1855, but conspecific with "*Proetus missourensis*" sensu SHUMARD, 1858. WELLER (1936), erecting a new genus *Ameura*, designated "*Phillipsia (?Griffithides) sangamonensis*" MEEK & WORTHEN, 1865 as a type species for this genus. He put "*Proetus missourensis*" SHUMARD, 1858 in the synonymy of this species. Thus, according to the rules of ICZN, WELLER was right in using the name "*sangamonensis*" instead of "*missourensis*", which was already preoccupied.

Later, HESSLER (1963) designated "*Proetus missourensis*" SHUMARD, 1855 as a type species for his new subgenus *Proetus (Pudoproetus)*, which is also in agreement with the ICZN.

However, CHAMBERLAIN (1969) discussing the genus *Ameura* returned to the name "*Proetus missourensis*" SHUMARD, 1858 (= *Ameura missourensis* (SHUMARD, 1858)) instead of using "*Phillipsia (?Griffithides) sangamonensis*" MEEK & WORTHEN, 1865 (= *Ameura sangamonensis* (MEEK & WORTHEN, 1865)) arguing that the first mentioned specific name has priority, in which he is mistaken. As a result, a misleading situation has arisen, which is contrary to the provisions of Art. 49 of the ICZN.

The revision of the Eurasian species of the genus *Phillipsia* PORTLOCK, 1843 leads the present author to the conclusion that the North American species assigned to *Phillipsia* are not congeneric with Eurasian ones. "*Phillipsia tuberculata*" MEEK & WORTHEN, 1870, recently revised by HESSLER (1963) as well as his new species "*Ph. eurybathrea*" HESSLER, 1963 and "*Ph. brevicornus*" HESSLER, 1963 should be assigned to *Piltonia* GOLDRING, 1955, as they show: 1) "the subcranial furrow", 2) the upturned anterior cephalic border, 3) the short and high eyes, 4) the coarse spinous or tubercular ornamentation.

The specimens from the USA, considered so far to be representatives of the genus *Griffithides*: "*G. meramecensis*" (SHUMARD, 1855), *G. buffo* (MEEK & WORTHEN, 1870), "*G. pustulosus*" SNIDER, 1915 — are not, in the present author's opinion, congeneric with the European forms. The "griffithid" characters are not so distinctly pronounced on their cephala: the glabella and basal lobes are less distinctly detached from each other, the glabella being shorter. The pygidia of these species are very unlike those of the European representatives of *Griffithides*. They lack the concave border around the pygidium, while the true *Griffithides* species have, as a rule, a distinctly separated, more or less concave border. The structure of the pygidium in e.g. "*Griffithides pustulosus*" resembles that found in the representatives of the European genus *Particeps* REED, 1943, these latter being also devoid of the distinct detachment of the basal lobes. The American forms mentioned are also younger than the European ones, occurring in the Meramecian. Thus they are about the age of the *Particeps* species. It is concluded that the American species discussed above should probably be assigned to a new genus, within the subfamily Griffithidinae HUPÉ, 1953. They most probably derived from *Griffithides*.

The literature on the North American trilobites allows one to state that there are some genera common to the Eurasian continent. *Pudoproetus* HESSLER, 1963 should be mentioned in the first place, a genus from the Devonian/Carboniferous boundary, which is so far unknown west of the Urals, but is present in Asia. *Piltonia* GOLDRING and *Eocyphinium* REED, are both present in the USA as well as in Europe and Asia. However, while *Piltonia* precedes in Eurasia the genus *Eocyphinium*, on the contrary, in the USA the latter appears in the late Kinderhookian, while *Piltonia* is known first from the Osagean deposits. The genus *Griffithidella* HESSLER, 1965, described from the USA, occurs also in Asia (cf. OSMÓLSKA, 1970), having about the same stratigraphic position. The genus *Paladin* WELLER, 1936, is, outside the USA, reported only from Europe.

The elements common to Australia are fewer and are listed on p. 25.

CARBONIFEROUS TRILOBITES IN AUSTRALIA

Australian Carboniferous trilobites were described mainly by ETHERIDGE (1892) and MITCHELL (1918). However, none of the trilobites described by these authors could be considered in the present revision, as they are very badly illustrated, and the original material or its duplicates were not available to the present author. Most recently CAMPBELL (1963) described 5 trilobite species from the Tournaisian of New South Wales, among others *Weania goldringi* CAMPBELL, 1963, *Conophillipsia* sp., *Griffithides*? *convexicaudatus* MITCHELL, 1918 and *Phillipsia*? *grandis* ETHERIDGE, 1892. According to the present author, "*Gr.*? *convexicaudatus*" (CAMPBELL, 1963, Pl. 8, Figs 5—10) as well as "*Conophillipsia* sp." (*ibid.*, Pl. 8, Figs 1—4) should be assigned to *Richterella* HESSLER, 1965, and are close to *R. snakedenensis* HESSLER, 1965. The species just mentioned comes from the late Kinderhookian, while *Richterella convexicaudata* (MITCHELL, 1918) is from the Upper Tournaisian; thus they are almost contemporary.

MITCHELL (1918, Pl. 46, Figs 1—5; Pl. 48, Figs 8, 9) described a new species "*Phillipsia collinsi*" from the Lower Viséan beds. The lack of clarity in the illustrations of this species has caused much misunderstanding. The pygidium assigned to this species (very characteristic, with distinctly pronounced ribs on the border) is extremely similar to the pygidium of *Weberiphillipsia kirgisica* (WEBER, 1932). On the other hand, the isolated cranidia assigned by MITCHELL to "*Phillipsia collinsi*", are different from these of the genus *Weberiphillipsia* n. gen. According to STUBBLEFIELD (1948), these cranidia most probably belong to the genus *Linguaphillipsia* STUBBLEFIELD, 1948. The only entire specimen illustrated by MITCHELL (1918) is unfortunately too poorly preserved to reveal the association.

It seems that the Lower Carboniferous trilobite fauna of Australia has some elements in common with Asia. *Conophillipsia* ROBERTS, 1963, *Weania* CAMPBELL, 1963, *Linguaphillipsia* STUBBLEFIELD, 1948 and *Weberiphillipsia* n. gen. may be quoted in this respect. The only common genus to Australia and North America so far is *Richterella* HESSLER, 1965.

Two Australian genera are known to be present in Europe (cf. OSMÓLSKA, 1970). They are: *Weania* CAMPBELL, 1963, and *Linguaphillipsia* STUBBLEFIELD, 1948. The Australian "*Phillipsia*" species deviate so strongly from the European *Phillipsia* PORTLOCK, 1843, that they should be assigned to another genus.

TABLE 1

GEOGRAPHIC AND STRATIGRAPHIC RANGE OF NON-CYRTOSYMBOLINID TRILOBITE SPECIES

Species	Geographic range	Stratigraphic range
Pudoproetus HESSLER, 1963		
P. fernglensis (S. WELLER, 1909)	N. America, 19 *	U. Kinderhookian — L. Osagean
P. missouriensis (SHUMARD, 1885)	N. America, 19	U. Devonian — L. Kinderhookian
P. auriculatus (HALL, 1862)	N. America, 19	U. Kinderhookian — L. Osagean
P. michiganensis (HESSLER, 1963)	N. America, 19	L. Osagean
P. chappelensis HESSLER, 1963	N. America, 19	U. Kinderhookian
P. pila (WEBER, 1937)	Asia, 11	U. Devonian-Tournaisian
P. sargaensis (WEBER, 1937)	Europe, 9	U. Devonian — L. Tournaisian
P. ussuilensis (NALIVKIN, 1933)	Asia, Europe, 12, 9	U. Tournaisian
P. eminens (WEBER, 1937)	Asia, 11	Tournaisian
Conophillipsia ROBERTS, 1963		
C. brevicaudata ROBERTS, 1963	Australia	U. Tournaisian
C. woodwardi (ETHERIDGE, 1892)	Australia	U. Tournaisian
C. labrosa (WEBER, 1937)	Asia, 11	U. Devonian — L. Tournaisian
C. kazakensis (WEBER, 1937)	Asia, 11	U. Devonian — L. Tournaisian
C. antonovi (WEBER, 1937)	Asia, 11	U. Tournaisian
C. meisteri (WEBER, 1937)	Asia, 11	Tournaisian
C. cervicontinens (WEBER, 1937)	Asia, 11	Tournaisian
Bitumulina n. gen.		
B. bitumulata (WEBER, 1932)	Asia, 10	L. Tournaisian
B. sosvensis (WEBER, 1937)	Europe, 9	Tournaisian
Weberiphillipsia n. gen.		
W. kirgisica (WEBER, 1932)	Asia, 11	U. Tournaisian
W. kuzneciana (WEBER, 1937)	Asia, 13	U. Tournaisian
W. inostranzevi (TOLMATSHOV, 1924)	Asia, 12	U. Tournaisian
W. collinsi (MITCHELL, 1918)	Australia	L. Viséan
Piltonia GOLDRING, 1955		
P. salteri GOLDRING, 1955	Europe, 1	U. Tournaisian
P. fryi GOLDRING, 1958	Europe, 1, 2	L. Tournaisian
P. krasensis CHLUPAČ, 1961	Europe, 4	U. Tournaisian
P. tuberculata (MEEK & WORTHEN, 1870)	N. America, 19	L. — M. Osagean
P. eurybathrea (HESSLER, 1963)	N. America, 19	U. Kinderhookian
P. brevicornus (HESSLER, 1963)	N. America, 19	M. Osagean
P. vilvensis (WEBER, 1937)	Europe, 9	U. Tournaisian
P. kassini (WEBER, 1937)	Asia, 11	L. Tournaisian
P. altaica (WEBER, 1937)	Asia, 12	U. Tournaisian
P. buchtarmensis (MAKSIMOVA, 1960)	Asia, 12	M. Tournaisian
P. mugodjarica (BALASCHOVA, 1956)	Asia, 10	L. Tournaisian
P. konincki (WEBER, 1937)	Europe, Asia, 9, 12	M. — U. Tournaisian
P. kuehnei HAHN, 1963	Europe, 2	U. Tournaisian
Moschoglossis GOLDRING, 1958		
M. decorata GOLDRING, 1958	Europe, 1	M. Tournaisian
M. rarissima CHLUPAČ, 1961	Europe, 4	U. Tournaisian
Liobolina RICHTER & RICHTER, 1951		
L. nebulosa RICHTER & RICHTER, 1951	Europe, 3	L. Tournaisian
L. submonstrans RICHTER & RICHTER, 1951	Europe, 3	L. Tournaisian
L. praevia OSMÓLSKA, 1962	Europe, 5	L. Tournaisian
L. apodemata OSMÓLSKA, 1962	Europe, 5	U. Tournaisian — L. Viséan
L. wurmi GANDL, 1968	Europe, 3	M. Tournaisian

TABLE 1 (*continued*)

Species	Geographic range	Stratigraphic range
Richterella HESSLER, 1965		
R. snakedensis HESSLER, 1965	N. America, 19	U. Kinderhookian
R. hindsvillensis HESSLER, 1965	N. America, 19	L. Chesterian
?*R. mauvaisensis* HESSLER, 1965	N. America, 19	?U. Osagean — ?L. Meramecian
R. loganensis (HALL & WHITFIELD, 1887)	N. America, 19	Osagean
R. convexicaudata (MITCHELL, 1918)	Australia	U. Tournaisian — L. Viséan
Phillipsia PORTLOCK, 1843		
P. kellyi PORTLOCK, 1843	Europe, 1	Tournaisian
P. ornata ornata PORTLOCK, 1843	Europe, 1	Tournaisian
P. ornata kumakensis n. subsp.	Europe, 9	Tournaisian
P. ornata belgica n. subsp.	Europe, 2	Tournaisian
P. moelleri n. sp.	Europe, 9	Tournaisian
P. glabra WEBER, 1937	Europe, 9	Tournaisian
P. gemmulifera PORTLOCK, 1843	Europe, 1, 5	?Tournaisian, ?Viséan
P. truncatula (PHILLIPS, 1836)	Europe, 1	?L. — M. Viséan
P. magnoculata n. sp.	Europe, 9	Tournaisian
Bollandia REED, 1943		
B. globiceps (PHILLIPS, 1836)	Europe, 1	?U. Tournaisian, ?L. Viséan
B. claviceps (BURMEISTER, 1846)	Europe, 5, 9, 7	U. Tournaisian — U. Viséan
B. obsoleta (PHILLIPS, 1836)	Europe, 1	?L. Viséan
B. karatauensis (WEBER, 1937)	Asia, 11	U. Tournaisian
B. sonkulensis n. sp.	Asia, 14	Tournaisian
B. kirgisiana n. sp.	Asia, 14	Tournaisian
Reediella n. gen.		
R. reedi n. sp.	Europe, 1	?L. Viséan
R. frechi (SCUPIN, 1900)	Europe, 5	U. Viséan
R. mitchelli (WEBER, 1937)	Asia, 11	L. Tournaisian
R. stubblefieldi n. sp.	Europe, 1	L. Viséan
R. granifera n. sp.	Europe, 1	?Viséan
?*R. karagandensis* (WEBER, 1937)	Asia, 11	L. Tournaisian
Linguaphillipsia STUBBLEFIELD, 1948		
L. terapaiensis STUBBLEFIELD, 1948	Asia, 15	Viséan
L. longicornuta (LEYH, 1897)	Europe, 3	L. Tournaisian
L. silesiaca (SCUPIN, 1900)	Europe, 3, 5	U. Viséan
L. paczoltovicensis (JAROSZ, 1913)	Europe, 5	U. Tournaisian
L. nongpoensis (PATTE, 1922)	Asia, 16	Viséan
L. tulensis (IVANOV in WEBER, 1937)	Europe, 7	Viséan
L. grandis (ETHERIDGE, 1892)	Australia	U. Tournaisian
L. divergens CVANCARA, 1958	Australia	?U. Tournaisian, ?L. Viséan
?*L. scabra* (WOODWARD, 1883)	Europe, 1	Tournaisian
?*L. „collinsi"* (MITCHELL, 1918)	Australia	U. Tournaisian
?*L. hildae* (GEYSHELINCK, 1938)	Timor	M. Permian
Cummingella REED, 1942		
C. jonesi jonesi (PORTLOCK, 1843)	Europe, 1	L. — M. Viséan
C. jonesi laticaudata (WOODWARD, 1883)	Europe 1	?Viséan
C. jonesi orleiensis n. subsp.	Europe, 5	?L. Namurian — L. Viséan
C. brevicauda (GOLDRING, 1958)	Europe, 2	L. Tournaisian
C. carringtonensis carringtonensis (ETHERIDGE in WOODWARD, 1883)	Europe, 1	U. Viséan
C. carringtonensis tuberculigenata n. subsp.	Europe, 5	U. Viséan
C. shartymensis shartymensis (WEBER, 1937)	Europe, 9	L. Namurian

TABLE 1 (*continued*)

Species	Geographic range	Stratigraphic range
C. shartymensis weberi n. subsp.	Europe, 9	Namurian
C. jaroszi jaroszi n. sp., n. subsp.	Europe, 5	U. Tournaisian
C. jaroszi insulae n. subsp.	Europe, 1	M. Viséan
C. gapeevi (WEBER, 1933)	Europe, 8, 9	U. Viséan — L. Namurian
C. polonica (WEBER, 1937)	Europe, 1, 9	L. Viséan
C. costabisulca GOLDRING, 1958	Europe, 1	Tournaisian
C. dalmani (EMMRICH, 1839)	Europe, 3	?U. Tournaisian, ?L. Viséan
C. augae HAHN & HAHN, 1968	Europe, 3	?U. Tournaisian, ?L. Viséan
?C. minuta (MAKSIMOVA, 1960)	Asia, 12	M. Tournaisian
Griffithides PORTLOCK, 1843		
G. longiceps PORTLOCK, 1843	Europe, 1	M. Viséan
G. longispinus PORTLOCK, 1843	Europe, 1	Viséan
G. platyceps PORTLOCK, 1843	Europe, 1	Viséan
G. acanthiceps WOODWARD, 1883	Europe, 1	M. Viséan
G. brevispinus WOODWARD, 1883	Europe, 1	U. Viséan
G. claviger claviger SCUPIN, 1900	Europe, 5	U. Viséan
G. claviger uralicus WEBER, 1937	Europe, 9	L. Namurian
G. claviger halinae n. subsp.	Europe, 5	U. Viséan
G. moriceps WOODWARD, 1883	Europe, 1	?U. Viséan
G. kasykurti WEBER, 1932	Asia, 11	Viséan
G. rotundipleuratus WEBER, 1937	Europe, 9	U. Viséan
G. obsoletus WEBER, 1937	Europe, 9	U. Viséan
Kulmiella HAHN & HAHN, 1968		
K. westfalica (NEBE, 1911)	Europe, 3	U. Viséan
K. leei (WOODWARD, 1883)	Europe, 1	U. Viséan
K. sudetica (PATTEISKY, 1930)	Europe, 4	U. Viséan — L. Namurian
K. caroli n. sp.	Europe, 5	U. Viséan
Eocyphinium REED, 1942		
E. clitheroense REED, 1942	Europe, 1	L. Viséan
E. seminiferum (PHILLIPS, 1836)	Europe, 1	Viséan
E. spinosum spinosum (WEBER, 1937)	Europe, 9	Viséan
E. spinosum polonicum n. subsp.	Europe, 5	U. Viséan
E. margaritiferum (ROEMER, 1870)	Europe, 4, 5	L. Namurian
E. parvum n. sp.	Europe, 5	?L. Namurian
E. brevis n. sp.	Europe, 1	?U. Viséan, ?L. Namurian
E. sampsoni (VODGES, 1888)	N. America, 19	U. Kinderhookian
Cyphinioides REED, 1942		
C. ashfellensis REED, 1942	Europe, 1	?L. Viséan
C. micheevi (WEBER, 1937)	Europe, Asia, 9, 11	U. Viséan — L. Namurian
C. alapaicus (WEBER, 1937)	Europe, 9	L. Namurian
?C. limbatus n. sp.	Europe, 8	Moscovian
Particeps REED, 1943		
P. scoticus scoticus REED, 1943	Europe, 1	?U. Viséan — L. Namurian
P. scoticus minimus n. subsp.	Europe, 1	L. Namurian
P. kiritchenkoi (WEBER, 1937)	Europe, 8, 9	L. Namurian
P. productus (WEBER, 1937)	Europe, 9	L. Namurian
P. kargini (WEBER, 1933)	Europe, 8	L. Namurian
Paladin WELLER, 1936		
P. morrowensis (MATHER, 1915)	N. America, 19	M. — U. Morrowan
P. longispinus (STRONG, 1872)	N. America, 19	M. Meramecian
P. granulatus (WHETHERBY, 1881)	N. America, 19	Chesterian

TABLE 1 (*continued*)

Species	Geographic range	Stratigraphic range
P. wilsoni (WALTER, 1927)	N. America, 19	U. Meramecian
P. bairdensis (WHEELER, 1935)	N. America, 19	U. Meramecian — L. Chesterian
P. chesterensis (WELLER, 1936)	N. America, 19	Chesterian
P. rarus WHITTINGTON, 1954	N. America, 19	L. Chesterian
P. helmsensis WHITTINGTON, 1954	N. America, 19	L. Chesterian
P. osagensis CISNE, 1967	N. America, 19	U. Osagean
P. rosei CISNE, 1967	N. America, 19	U. Meramecian — L. Chesterian
P. pyriformus CHAMBERLAIN, 1969	N. America, 19	Atokan
P. retrolatus CHAMBERLAIN, 1969	N. America, 19	L. Morrowan
P. girtyi n. nom.	N. America, 19	
P. belli n. sp.	N. America, 18	Viséan
P. eichwaldi eichwaldi (FISCHER v. WALDHEIM, 1825)	Europe, 9	U. Viséan
P. eichwaldi shunnerensis (KING, 1914)	Europe, 1	L. Namurian
P. eichwaldi latilimbatus (SCHWARZBACH, 1936)	Europe, 5	L. Namurian
P. eichwaldi parilis (REED, 1942)	Europe, 1	L. Namurian
P. mucronatus mucronatus MCCOY, 1844	Europe, 1, 4, 5	?U. Viséan — L. Namurian
P. mucronatus russicus n. subsp.	Europe, 7, 8	L. Namurian
P. mucronatus rotundatus n. subsp.	Europe, 1	L. Namurian
P. mucronatus latispinatus n. subsp.	Europe, 1	?L. Namurian
P. glaber (WOODWARD, 1883)	Europe, 1	U. Viséan
P. barkei (WOODWARD, 1902)	Europe, 1	U. Viséan
P. mladeki (SMETANA, 1916)	Europe, 4, 5	L. Namurian
P. jurezanensis (WEBER, 1937)	Europe, 9	?Ghzelian
P. lutugini (WEBER, 1933)	Europe, 8	Moscovian
P. cervilatus (WEBER, 1933)	Europe, 8	Moscovian
P. maillieuxi (DEMANET, 1938)	Europe, 2	U. Viséan
P. cuspidatus (REED, 1943)	Europe, 1	U. Viséan
P. pitzi HAHN & HAHN, 1968	Europe, 3	L. Namurian
P. trigonopyge OSMÓLSKA, 1968	Europe, 6	?Ghzelian
P. czarnieckii n. sp.	Europe, 5	?L. Namurian
P. angustipygus n. sp.	Europe, 1	U. Viséan
P. eakringensis n. sp.	Europe, 1	U. Viséan
P. bakewellensis n. sp.	Europe, 1	U. Viséan
P. griffithidoides n. sp.	Europe, 1	U. Viséan
P. lowickensis n. sp.	Europe, 1	L. Namurian
P. subbakewellensis n. sp.	Europe, 8	Moscovian
?P. ailinensis n. sp.	Europe, 9	Upper Carboniferous
„Breviphillipsia" HESSLER, 1963		
B. semiteretis HESSLER, 1963	N. America, 19	U. Kinderhookian
B. swallowi (SHUMARD, 1855)	N. America, 19	U. Kinderhookian
B. trophis HESSLER, 1963	N. America, 19	U. Kinderhookian
Exochops WELLER, 1936		
E. portlocki WELLER, 1936	N. America, 19	U. Osagean
Thaiaspis KOBAYASHI, 1961		
T. sethaputi KOBAYASHI, 1961	Asia, 17	?M., ?U. Carboniferous
Thigriffithides HESSLER, 1965		
T. roundyi (GIRTY, 1926)	N. America, 19	U. Kinderhookian

* 1 — British Isles; 2 — Belgium; 3 — Germany; 4 — ČSR; 5 — Poland; 6 — Spitsbergen; 7 — Moscow Basin; 8 — Donets Basin; 9 — The Urals; 10 — The Mugodzhars; 11 — Kazakhstan; 12 — Altai; 13 — Kuznetsk Basin; 14 — Kirgiz; 15 — Malaya; 16 — Laos; 17 — Thailand; 18 — Canada; 19 — USA

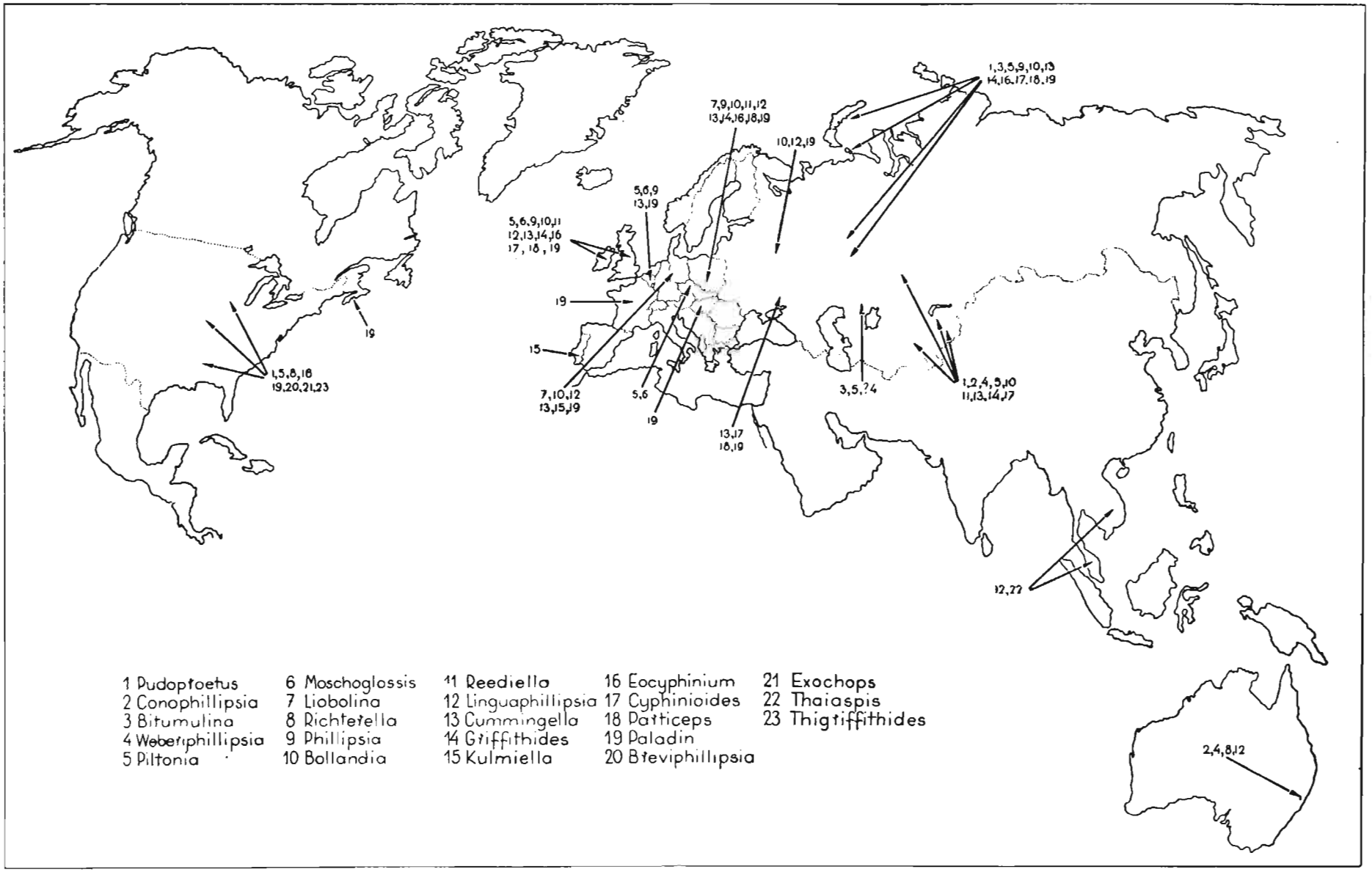
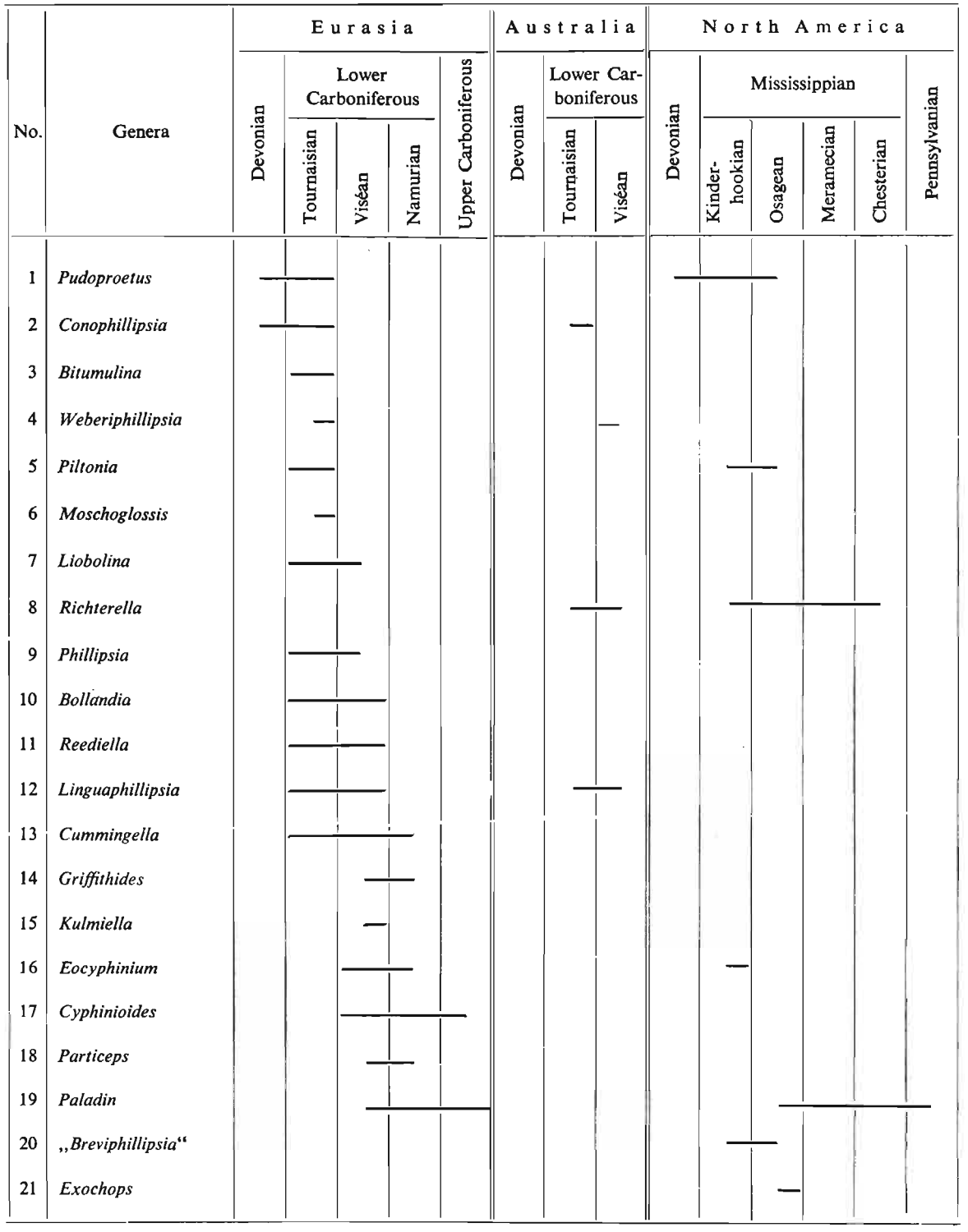


Fig. 3
Geographic distribution of trilobite genera in Tournaisian-Namurian time

TABLE 2

STRATIGRAPHIC RANGE OF NON-CYRTOSYMBOLINID TRILOBITE GENERA DURING THE TOURNAISIAN — NAMURIAN AND MISSISSIPPIAN TIME



SYSTEMATIC PART

Subfamily PROETINAE SALTER, 1864

Genus **BOLLANDIA** REED, 1943

Type species: Asaphus globiceps PHILLIPS, 1836.

Species assigned: Bollandia globiceps (PHILLIPS, 1836), *B. obsoleta* (PHILLIPS, 1836), *B. claviceps* (BURMEISTER, 1846), *B. sonculensis* n. sp., *B. kirgisiana* n. sp., *B. karatauensis* (WEBER, 1937), *?B. rozlozsniki* (RAKUSZ, 1932).

Stratigraphic and geographic range: Tournaisian-Viséan of Eire, Great Britain, Germany, Poland, USSR (Moscow Basin, Central Asia).

Diagnosis. — Cephalon strongly arched transversely, anterior border vertical, covered by glabella, the latter short, inflated, parallel-sided, only S_1 present, basal lobes long, occupying a half or a little less of total glabellar length, eyes usually short, palpebral lobes comparatively broad (*tr.*); hypostoma strongly swollen, subtriangular; pygidium very strongly vaulted transversely and longitudinally, usually no distinct border, and segmentation of pleural lobes obsoleting; 10—12 axial rings, 7—8 ribs; exoskeleton usually smooth or covered by wrinkles.

Remarks. — *Bollandia* REED, 1943 was by its author assigned within *Permoproetus* TOUMANSKAYA, 1935 as the subgenus of the latter. However, though there exists some superficial resemblances especially in the pygidia of both forms, the exclusively Lower Carboniferous *Bollandia* can be by no means joined together with the Middle Permian *Permoproetus* (the cephalon of which is poorly known).

HAHN and HAHN (1967) assigned *Bollandia* to *Griffithides* PORTLOCK, 1843 as the subgenus of the latter. In the present author's opinion, these two forms should be treated as the independent genera, and moreover belong to different subfamilies, *Bollandia* being in this paper placed in Proetinae SALTER, 1864. For such a systematic position of this genus speaks the presence in the Lower Tournaisian deposits of Central Asia of the *Bollandia* representatives: *Bollandia* sp. *1* and *?Bollandia* sp. *2*. This forms are intermediate between the Devonian *Proetus* STEININGER, 1831, or *Pudoproetus* HESSLER, 1963 (from the passage beds between the Uppermost Devonian and Lowest Carboniferous) and typical *Bollandia*, which is exclusively Tournaisian and Viséan.

In the present author's opinion it is difficult to find a common character between *Griffithides* PORTLOCK and *Bollandia*. Both genera are highly specialized but in different directions. *Bollandia* tends to achieve the most globular (while enrolled) shape, *Griffithides*, with long genal spine and flattened pygidial margin, distinctly deviates from this pattern. In the tendency to achieve

the globular form during enrollment *Bollandia* recalls *Cummingella* REED, 1942. However, these two genera from the very beginning of their history are well separated and developed parallelly, thus their common origin is not very probable.

Bollandia globiceps (PHILLIPS, 1836)

(Pl. I, Figs 3-6, 11; Text-fig. 4*A, E, F, I, L, N*)

1836. *Asaphus globiceps* PHILL.; J. PHILLIPS, Illustrations..., p. 240, Pl. 22, Figs 16-20.
?1836. *Asaphus granuliferus* PHILL.; J. PHILLIPS, *Ibid.*, p. 240, Pl. 22, Fig. 7.
1843. *Griffithides globiceps* PHILL.; J. E. PORTLOCK, Report..., p. 311, Pl. 11, Fig. 9.
1883. *Griffithides globiceps* PHILL.; H. WOODWARD, A Monograph..., p. 29, Pl. 6, Figs 1-4.
1943. *Permoproetus (Bollandia) globiceps* PHILL.; F. R. C. REED, Genera of British..., p. 63.
non 1932. *Griffithides globiceps* PHILL (?); V. N. WEBER, Trilobity..., p. 48, Pl. 3, Fig. 32.
non 1937. *Griffithides globiceps* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 66, Pl. 7, Figs 27-31; Pl. 11, Fig. 8; Text-fig. 58.

Lectotype: Cephalon Ox No. E 1391 figured by PHILLIPS (1836, Pl. 22, Figs 16, 17); here refigured on Pl. I, Fig. 6.
Type locality: Bolland, Yorkshire. Great Britain.
Type horizon: ?Lower Viséan (C_2).

Diagnosis. — Cephalon very strongly vaulted transversely with weakly convex sloping down lateral border; glabella short, broad, frontally overhanging somewhat vertical anterior border; only S_1 furrow developed, glabella in front of it equally long, or only somewhat longer than posteriorly to S_1; basal lobe long (*exsag.*); eye very short, its anterior tip placed opposite to S_1, posterior one slightly anterior to mid-length of the basal lobe; pygidium broadly rounded, with wide axis of 10 rings, ribs very faintly pronounced, 7 in number, pleural furrows slightly more distinct than interpleural ones; exoskeleton smooth to extremely finely granulated.

Material. — Three cephala, 2 pygidia from the type locality, 1 cephalon and 1 pygidium from Kildare, Eire.

Dimensions (in mm):

	Ox E 1391	SMC E 3423
Length of cephalon . . .	13.2	—
Width of cephalon	?20.0	—
Length of glabella	11.0	—
Width of glabella	8.7	—
Length of pygidium . . .	—	11.0
Width of pygidium	—	20.0
Length of axis	—	10.0
Width of axis	—	6.5

Description. — Cephalon comparatively short, strongly vaulted transversely and longitudinally, anterior border under glabella, vertical, glabella parallel-sided, nearly half of its length occupied by basal lobes, basal furrow not reaching occipital furrow, S_2 and S_3 only exceptionally present (Pl. I, Fig. 11), short; palpebral lobe broad (*tr.*), short (*exsag.*) reaching forwards from half the length (*exsag.*) of basal lobe to S_1; fixigena very narrow; eye short (*exsag.*), high, placed on comparatively broad platform; librigena strongly inclined downwards, broad, with weakly convex, down sloping lateral border. In longitudinal view anterior border steep, somewhat concave in its lower part (rostrum?); glabella very high and vertically raising frontally, arched in its main part; occipital ring lower than glabella, comparatively weakly convex. In transverse section, glabella very highly arched, palpebral lobes lower than glabella,

visual lobes high and convex, librigenae steeply sloping towards faintly convex lateral border, which is inclined in the same plane as librigenae. Exoskeleton smooth or very delicately granulated.

Remarks. — In the collection of the Oxford Museum, where a part of PHILLIPS' type material is housed, in addition to the lectotype of *Bollandia globiceps* (PHILLIPS, 1836) and to the entire, badly damaged specimen (Ox E 1393) illustrated by PHILLIPS (1836, Pl. 22, Figs 19, 20) there is a pygidium stored, which was illustrated by PHILLIPS (*l. c.*, Pl. 22, Fig. 7) as "*Asaphus granuliferus*". This specimen, coming from Florence Court (Eire) has the same shape as the paratype pygidia from Bolland; it differs only in the number of the axial rings which is eleven, while ten only in the paratype pygidia. The pygidia from Bolland are mostly exfoliated or with surface of the exoskeleton worn out, while that from the Florence Court has exoskeleton preserved, and it shows a very delicate granulation. Similarly granulated is a preserved part of the exoskeleton on one of the cephala of *B. globiceps*. Thus is probable that "*Asaphus granuliferus*" is conspecific with "*Asaphus globiceps*".

Stratigraphic and geographic range. — ?Upper Tournaisian — ?Lower Viséan of British Isles.

Bollandia claviceps (BURMEISTER, 1846)

(Pl. I, Figs 7-9)

1843. *Archegonus aequalis* MEYER; H. BURMEISTER, Die Organization..., p. 121, Pl. 5, Fig. 3.
1846. *Archegonus claviceps* BURMEISTER; H. BURMEISTER, The organization..., p. 102, Pl. 5, Fig. 3.
1900. *Griffithides Damesi* nov. nom.; H. SCUPIN, Die Trilobiten..., p. 10, Pl. 1, Fig. 7.
1900. *Griffithides depressus* nov. spec.; H. SCUPIN, *Ibid.*, p. 13, Pl. 1, Fig. 5.
1937. *Griffithides globiceps* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 66, Pl. 7, Figs 29, 31.

Diagnosis. — Cephalon broad, vaulted transversely, with very broad and short glabella; basal lobes distinctly cut off, occupying slightly less than a third of the glabellar width; eyes large, reaching from occipital furrows forwards to a point somewhat in front of S_1; pygidium uniformly vaulted transversely with indistinctly marked border; pygidial axis very faintly narrowing backwards with 12 rings; 7—8 poorly pronounced flat ribs; the segmentation of pygidium very obscure. Glabella ornamented by concentrical striae which become less distinct backwards.

Material. — One entire specimen, damaged, 2 fragments of thorax with joined pygidia from the Upper Viséan shales of Jugów (Hausdorf), Lower Silesia, several pygidia from the Upper Tournaisian and Viséan of the Moscow Basin.

Dimensions (in mm):

	IG 442.II.196a	IG 442.II.196b
Length of entire specimen . . .	18.2	—
Length of cephalon	6.0	—
Width of cephalon	?15.0	—
Length of glabella	5.3	—
Width of glabella	5.3	—
Length of pygidium	6.2	7.1
Width of pygidium	?12.0	?13.2
Length of axis	5.6	6.1
Width of axis	3.5	3.5

Remarks. — The specimens from the Moscow Basin (pygidia) in their shape, vaultness, obscure segmentation, character of border and the number of axial rings are identical with those from the Lower Silesia. The only difference noticed is the shape of the axis which is conical in the Soviet specimens and U-shaped in the Silesian.

Nothing is known to the present author about the type specimen of this species, which was described by BURMEISTER (1846) from Altwasser (Wałbrzych Miasto) in Lower Silesia. The specimens described by SCUPIN (1900) and coming from the near vicinity of Wałbrzych (Hausdorf — Jugów) have been lost. The forms here discussed were collected from the same locality as these of SCUPIN. Fossils collecting, led by Dr. ŻAKOWA in Wałbrzych Miasto (ŻAKOWA, 1957) did yield no specimen of *B. claviceps*.

Stratigraphic and geographic range. — Upper Tournaisian — Viséan of USSR (the Moscow Basin); Upper Viséan of Poland (Lower Silesia).

Bollandia karatauensis (WEBER, 1937)

(Pl. II, Fig. 11)

1937. *Phillipsia karatauensis* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 48, Pl. 5, Figs 23, 33; Text-fig. 40.

Holotype: Pygidium, TML, No. 1135/5107; figured by WEBER (1937, Pl. 5, Fig. 33); here refigured on Pl. II, Fig. 11.
Type locality: Ak-tash-sai river, Karatau Range, Kazakhstan, USSR.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium strongly vaulted transversely and longitudinally with somewhat convex border; axis of 11 convex rings, 7 very convex ribs divided into two almost equally wide (*exsag.*) bands; ornamentation fine, granular.

Remarks. — *Bollandia karatauensis* (WEBER, 1937) is known only from pygidia. It has most convex ribs of all the species within this genus. This indicates the close relations between *Bollandia* and two other proetine genera — *Pudoproteus* HESSLER, 1963 and *Reediella* n. gen.

In the general characters such as: strong vaultness, proportions of broad, faintly narrowing axis, rounded marginal part of pygidium — *B. karatauensis* is a typical representative of the genus *Bollandia* REED, 1943.

Stratigraphic and geographic range. — Type horizon and type locality.

Bollandia obsoleta (PHILLIPS, 1836)

(Pl. I, Fig. 12; Text-fig. 4*G*)

1836. *Asaphus obsoletus* n. sp.; J. PHILLIPS, Illustrations..., p. 239, Pl. 22, Figs 3, 4.
1883. *Griffithides obsoletus* PHILL.; H. WOODWARD, A Monograph..., p. 36, Pl. 6, Fig. 12.

Lectotype: Pygidium, GSM, No. GSb 2108; figured by PHILLIPS (1936, Pl. 22, Fig. 4).
Type locality: Kildare, Eire, no precise data.
Type horizon: ?Upper Tournaisian — ?Lower Viséan.

Diagnosis. — Cephalon with distinct, comparatively convex lateral border; pygidium with long axis of 10—11 rings, axis broader than pleural lobe; ring-furrows undulating; pygidial border distinctly delimited, comparatively convex; ornamentation in form of very fine wrinkles.

Remarks. — In the British Museum collection a fragment of pygidium (BM 59700) is housed coming from Settle, Yorkshire, which have a very well preserved ornamentation,

exposing moreover all the characters of *Bollandia obsoleta* (PHILLIPS). It allows to state that pygidium is similarly ornamented as the glabella. WOODWARD (1883) included into the synonymy of "*Griffithides obsoletus*" PHILLIPS also the pygidium determined by PHILLIPS (1836) as "*Asaphus granuliferus*". The latter, however, being finely granulated cannot be regarded as a synonym of *B. obsoleta*, and may belong to *B. globiceps* (p. 35).

Stratigraphic and geographic range. — ?Upper Tournaisian — ?Lower Viséan of British Isles.

Bollandia sonkulensis n. sp.

(Pl. I, Fig. 10)

1937. *Griffithides globiceps* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 66, Pl. 7, Fig. 27.

Holotype: Cephalon, ML No. 1644/5107; figured by WEBER (1937, Pl. 7. Fig. 27); here refigured on Pl. I, Fig. 10.
Type locality: Kakyr-kurgan, Son-kul lake region, Kirgiz, USSR.
Type horizon: Tournaisian.
Derivation of the name: sonkulensis — after Son-kul lake, where the type specimen was found.

Diagnosis. — Cephalon with posterior genal angles elongated backwards, anterior border inclined backwards, under glabella, lateral border convex; glabella comparatively narrow, palpebral lobe triangular, eye long, anteriorly reaching far from S_1, posteriorly almost to occipital furrow.

Remarks. — The specimen chosen here as the holotype of *Bollandia sonkulensis* n. sp. was assigned by WEBER (1937) to "*Griffithides globiceps*". It differs from the latter in its much longer eyes, strongly elongated posteriorly genal angles and comparatively more slender glabella. It is similar to the Viséan *B. claviceps* (BURMEISTER, 1846), which also has long eyes and similar character of the genal angles. The glabella of *B. claviceps* is, however, much shorter and broader than that of *B. sonkulensis* n. sp. In the same locality a separate librigena and pygidium were found (TML No. 1648/5107, 1649/5107). The latter is, however, too badly damaged for stating something more than that it represents a *Bollandia* species.

Stratigraphic and geographic range. — Type locality and type horizon.

Bollandia kirgisiana n. sp.

1932. *Griffithides damesi* SCUPIN; V. N. WEBER, Trilobity..., p. 48, Pl. 3, Fig. 51.
1937. *Griffithides globiceps* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 66, Pl. 7, Fig. 28, Text-fig. 58.

Holotype: Cranidium, TML No. 1642/5107; figured by WEBER (1937, Pl. 7, Fig. 28).
Type locality: Kazakhstan, USSR, no precise data.
Type horizon: Tournaisian.
Derivation of the name: kirgisiana — found on Kirgiz Steppe.

Diagnosis. — Glabella subquadrate, distinctly arched in longitudinal section, fixigena comparatively broad, about a fifth of the glabellar width.

Remarks. — This cranidium in its subquadrate shape is somewhat resemblant of the cranidium of *Bollandia claviceps* (BURMEISTER, 1846), but differs from this species in having broader fixigenae (*tr.*), narrower basal lobes (*tr.*) and the glabella more strongly arched longitudinally.

Stratigraphic and geographic range. — Tournaisian of USSR (Kazakhstan and Kirgiz, Talass Range).

Bollandia sp. **1**

(Pl. I, Fig. 2)

1937. *Griffithides globiceps* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 66, Pl. 7, Fig. 30.

Remarks. — The pygidium TML No. 1647/5107 from the Tournaisian of the Talass Range, Kirghiz, was assigned by WEBER (1937) to *B. globiceps*, but it differs very strongly not only from the representatives of this species but also from other *Bollandia* species, exposing the characters, which place it very close to the probable ancestor of *Bollandia*. The pygidium in question is comparatively flat and has very distinctly delimited border what differs it from *Bollandia* species and resembles the pygidia of *Proetus* STEININGER, 1831. The axis of the pygidium in question has, however, 10 rings, which is common in *Bollandia* and not found in *Proetus*, where there are 6—9 rings.

From the same locality, where the pygidium in question was found, comes a cranidium typical of *Bollandia* assigned here to a new species *B. kirgisiana* (p. 37). It is very probable that the pygidium here discussed belongs to this species.

?Bollandia sp. **2**

(Pl. II, Figs 5, 7)

Material. — One cranidium (TML No. 588/5107) from the Lower Tournaisian of Semiz-Bughu, Karaganda region, Kazakhstan, USSR.

Description. — Glabella elongate but broad and strongly arched longitudinally; anterior border narrow, weakly convex, in front of glabella; three pairs of glabellar furrows faint, but visible, S_1 in the middle of the glabella, not reaching occipital furrow; occipital ring broad, somewhat narrowing laterally; palpebral lobe comparatively broad (*tr.*), semicircular, short (*exsag.*), opposite mid-length of glabella; facial suture close and parallel to dorsal furrow.

Remarks. — This cranidium is found on the same piece of rock as the short *Proetus*-like pygidium described by WEBER (1937, p. 30, Pl. 2, Fig. 43) as "*Cyrtosymbole librovitchi* var. *euryaxis*". The relative position of both specimens suggests that they may belong to the same, enrolled individual. However, the thoracic part (if this supposition is true) is broken off. The geographic and stratigraphic range of the pygidium is given by WEBER on p. 30 as "the Urals gusikhinskaya series". In the explanation to Pl. 2, Fig. 43 (WEBER, 1937) the locality "Kirgiz Steppe, outcrop 128*b*, MEDOV'S collection" is given for the type specimen. The beds exposed in MEDOV'S outcrop 128*b* are supposed to be of the Lower Tournaisian age. Taking into account the character of both the cranidium and pygidium in question (which is distinctly Tournaisian) the latter stage and locality in Kazakhstan is more probable.

The cranidium *?Bollandia* sp. *2* strongly reminds the cranidia of other *Bollandia* species, especially in the position and size of the palpebral lobe, course of the posterior branch of the facial suture, shape and arching of the glabella, as well as in the position of S_1 furrow. However, the anterior border is here placed in front of glabella (instead of being covered by it, as it is common in *Bollandia*) and S_2 and S_3 are still visible.

These characters place the discussed specimen between *Bollandia* REED, 1943 and e.g. *Pudoproetus* HESSLER, 1963 or *Proetus* STEININGER, 1831, which are morphologically more primitive than *Bollandia*. The pygidium of "*Cyrtosymbole librovitchi* var. *euryaxis*" mentioned above (Pl. II, Fig. 2) have also much more in common with e.g. *Pudoproetus pila* (WEBER, 1937) than with any cyrtosymbolinid species.

?Bollandia sp. 3

(Pl. II, Fig. 10; Text-fig. 4*K*)

Material. — Two pygidia from the ?Viséan of Forest of Wyre, Oreton, Worcestershire, Great Britain (BM No. 59552).

Description. — Pygidium short, strongly arched transversely, with narrow, concave border; axis very broad frontally and strongly tapering backwards, axis with 11 (?10) very flat, narrow (*sag.*) rings; ring furrows extremely weakly marked; pleural lobe narrower (*tr.*) than the axis, with 6 flat ribs, distinctly separated from each other; interpleural furrows very obscure, visible only on the marginal part of pleural lobe, where they cut the ribs somewhat obliquely backwards.

Remarks. — The pygidium described above cannot be assigned to any known species. Also its generic assignment is very doubtful, though it seems to be closest to *Bollandia* in its very indistinct segmentation. Within the latter genus was never found the concave pygidial border which is characteristic of the here considered pygidium. The shape of axis, very rapidly tapering backwards, is also different than that of *Bollandia* species, where it is only gently narrowing, and often U-shaped.

Most probably the pygidium belongs to a representative of other, new genus, of the subfamily Proetinae, but a larger material would be desired for erecting a new genus.

Genus **REEDIELLA** n. gen.

Type species: Reediella reedi n. sp.

Derivation of the name: Reediella — in honour of the late F. R. C. REED, eminent British palaeontologist.

Species assigned: Reediella reedi n. sp., *R. stubblefieldi* n. sp., *R. frechi* (SCUPIN, 1900), *R. mitchelli* (WEBER, 1937), *R. ?karagandensis* (WEBER, 1937).

Stratigraphic and geographic range: Lower Tournaisian of Central Asia; Lower Viséan of Great Britain; Upper Viséan of Poland.

Diagnosis. — Cephalon strongly convex longitudinally and transversely, cephalic border upturned, very close or coalesced frontally with glabella, the latter short to very short, parallel-sided; eye short but high, with vertically placed visual lobe, covered by very broad (*tr.*), flat palpebral lobe; pygidium short, vaulted, with axis of 10—12 rings; 7—9 convex ribs on pleural lobes; border distinct, convex; coarse, granular ornamentation.

Remarks. — The here erected new genus in its parallel-sided and short glabella, as well as the comparatively short pygidium is a typical representative of the subfamily Proetinae and is most closely related to the contemporary genus *Bollandia* REED, 1942. The main differences between the two genera can be listed as follows: glabella somewhat longer in *Reediella* than in *Bollandia*, cephalic border upturned in the former genus, while sloping vertically downwards in the latter, pygidium with delimited border and strongly pronounced anterior bands of the ribs in *Reediella*, while smooth with indistinct ribs and without pronounced border in *Bollandia*.

It should be noted here, however, that sometimes in *Reediella* species (e.g. in *R. reedi*) the border is so completely coalesced with the glabella frontally, that at first glance it looks as if sloping downwards, similarly to that in *Bollandia* species. Moreover, in some *Bollandia* species the pygidium has a very faintly outlined border (e.g. *B. kirgisiana* n. sp.) and somewhat convex anterior bands of ribs. These features may indicate that one of the mentioned genera

gave rise to the other, but which is the ancestral form cannot be decided as both are contemporary.

Some resemblance exists between the cephala of the *Reediella* representatives and these of *Eocyphinium* species. This resemblance is superficial and limited to the same character of the cephalic border and the short eyes with vertical visual lobes. However, the eyes of the *Eocyphinium* representatives are much smaller in comparison to the length of the glabella, the latter being also distinctly longer than in the species of *Reediella*, and the palpebral lobes are depressed medially, while flat in *Reediella*. Pygidia of the discussed genera diverge very distinctly and do not allow for any comparisons.

Both *Reediella* and *Bollandia* find their close relative in *Pudoproetus*, which however is more primitive, and closer to *Proetus*.

Reediella reedi n. sp.

(Pl. II, Fig. 1; Text-fig. 4*D*)

Holotype: Cephalon, BM. No. I 5809; Pl. II, Fig. 1.
Type locality: Derbyshire area, Great Britain; no precise data.
Type horizon: Lower Carboniferous (?Lower Viséan); no precise horizon.
Derivation of the name: reedi — as for the genus.

Diagnosis. — Cephalon subtriangular, strongly convex transversely; glabella parallel-sided, short, with deeply incised 3 pairs of lateral furrows; cephalic border upturned, deeply furrowed with sharp edge; coarse granulation.

Material. — A holotype specimen, from light grey limestone of unknown locality in Derbyshire, Great Britain.

Dimensions (in mm):

	BM I 5809
Length of cephalon . . .	11.0
Width of cephalon	16.0
Length of glabella	8.5
Width of glabella	7.0

Description. — Cephalon subtriangular but rounded frontally, surrounded by vertically upturned, close to glabella, border, the edge of which is sharp; glabella with parallel-sided and deeply incided 3 pairs of lateral furrows, S_1 the deepest, not reaching the occipital furrow, S_2 and S_3 short; the part of glabella in front of S_3 short; basal lobe narrower (*tr.*) than a third of glabellar width; occipital ring broad (*sag.*), occipital furrow deepened at extremities; palpebral lobe very short (*exsag.*) and broad (*tr.*), semicircular in shape; fixigena extremely narrow (*tr.*); anterior and posterior branches of facial suture parallel to axial furrow; eye strongly crescentic with high, vertical visual lobe; librigena broad (*tr.*), steeply sloping; lateral border separated from librigena by concave, broad depression; outer surface of the border vertical with deep longitudinal furrows; between the eye and the posterior genal angle a geniculation marked. In longitudinal section, occipital ring higher than glabella, which is comparatively short and horizontal, sloping vertically at the front, touching the upturned anterior border, the latter being slightly inclined backwards, under the glabella. In transverse section, glabella flat, axial furrows deep, palpebral lobes flat and faintly rising outwards, eye lobes vertical to the plane of glabella, placed on narrow, horizontal platform, librigena

very steeply sloping down towards the upturned lateral border. Ornamentation in form of coarse tubercles covering glabella and librigenae, but palpebral lobes only finely granulated; in border furrow exoskeleton smooth. Other parts of exoskeleton unknown.

Remarks. — The specimen above described is so characteristic and so different from all known Carboniferous trilobites that it seemed worth to be chosen for a type species of a new genus, in spite of the fact that it is represented by a single specimen and comes from the unknown locality and horizon. The presence in the Lower Viséan deposits of Yorkshire of another representative of the same genus, represented by the cephalon and pygidium (*Reediella stubblefieldi* n. sp.) seems to be a sufficient evidence that also *R. reedi* n. sp. represents a Carboniferous trilobite.

Stratigraphic and geographic range. — Type horizon and type locality.

Reediella frechi (SCUPIN, 1900)

(Pl. II, Fig. 13; Text-fig. 4, *O*)

1900. *Griffithides frechi* nov. spec.; H. SCUPIN, Die Trilobiten..., p. 12, Pl. 1, Fig. 6.

Neotype: Pygidium, IG No. 442.II. 3; Pl. II, Fig. 13.
Type locality: Jugów (Hausdorf), Lower Silesia, Poland.
Type horizon: Upper Viséan (Goα).

Diagnosis. — Pygidium subsemicircular, no border furrow, but border pronounced by means of ending or ribs; axis broad with 10 rings, 7 ribs with anterior bands raising backwards, fine granulation.

Material. — Three pygidia from the shales of the type horizon and locality.
Dimensions (in mm):

	IG 442.II.3
Length of pygidium . . .	7.2
Width of pygidium	11.0
Length of axis	5.0
Width of axis	3.5

Description. — Pygidium semicircular, axis short, broad, tapering backwards, 10 axial rings, ring-furrows distinct, sinuous, 6—7 ribs on pleural lobes, their anterior bands raising backwards; pleural furrows deep, interpleural furrows weak; border differentiated only by the ending of pleural and interpleural furrows. In longitudinal and transverse sections pygidium slightly arched, but it may be possibly secondarily flattened. Pygidial doublure broad, faintly convex ventrally. Exoskeleton thick, covered by fine granular ornamentation.

Remarks. — The original material described by SCUPIN (1900) has been lost during the war. Thus, the necessity arises for designation of the neotype. The specimen chosen here as the neotype comes from the same locality and horizon as SCUPIN's material, and is in agreement with his original description, so fullfilling the demands of ICZN. Unfortunately, no cephala have been found this time, thus the diagnosis given here refers only to the pygidia. As can be judged from SCUPIN's description and illustrations, "*Griffithides frechi*" is a typical representatives of *Reediella*, both in characters of the pygidium and those of the cephalon. Recently, in the same locality, but in somewhat younger beds, *Bollandia claviceps* (BURMEISTER, 1846)

has been found, but both forms are distinctly different, the pygidia of the latter species being smooth, with the boundaries between the ribs and rings barely visible.

Reediella frechi is closest to *R. mitchelli* (WEBER, 1937), described from the Lower Tournaisian of Central Asia, in its absence of the border furrow on the pygidium. This latter species has a longer axis of 13 rings as well as 8 ribs instead of the 10 rings and 7 ribs in *R. frechi.*

Reediella mitchelli (WEBER, 1937)

(Pl. II, Fig. 12)

1937. *Phillipsia mitchelli* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 49, Pl. 5, Fig. 35.
non 1937. *Phillipsia mitchelli* n. sp.; V. N. WEBER, *Ibid.*, Pl. 5, Fig. 36.

Holotype: Pygidium TML No. 1137/5107 figured by WEBER (1937, Pl. 5, Fig. 35); here refigured on Pl. II, Fig. 12.
Type locality: Vicinity of Ak-tcheku, Kok-tal valley, Central Asia, USSR.
Type horizon: Lower Tournaisian.

Diagnosis. — Pygidium with indistinctly delimited border, axis high of 13 narrow rings, 8 ribs, their anterior bands very high, posterior ones reduced and merged with interpleural furrows.

Remarks. — WEBER (1937, Pl. 5, Fig. 36) assigned to this species, in addition to the type specimen, an entire exoskeleton, which, however, does not belong here and should be placed in the genus *Weania* CAMPBELL, 1963.

This species is closest to *R. frechi* (SCUPIN, 1900) and the comparisons are made above.

Stratigraphic and geographic range. — Type horizon and type locality.

Reediella karagandensis (WEBER, 1937)

(Pl. I, Fig. 1; Pl. II, Fig. 2)

1937. *Phillipsia karagandensis* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 50, Pl. 5, Figs 50, 51.
1937. *Phillipsia karagandensis* var. *longa* n. var.; V. N. WEBER, *Ibid.*, p. 50, Pl. 5, Fig. 47.

Lectotype: Pygidium, TML No. 1202/5107, figured by WEBER (1937, Pl. 5, Fig. 51); here refigured on Pl. II, Fig. 2.
Type locality: Vicinity of Nurinsk, Karaganda region, Kazakhstan, USSR.
Type horizon: Lower Tournaisian.

Diagnosis. — Pygidial border marked, axis of 10 rings; 6 ribs; posterior bands of ribs pronounced only on the first rib, further backwards they merge with pleural furrows.

Remarks. — The incompletness of the cranidium of "*Phillipsia karagandensis*" (WEBER, 1937, Pl. 5, Fig. 50) does not allow one to judge, which are the cephalic features of this species, as it could represent any non-cyrtosymbolinid species.

The pygidium, however, cannot be assigned to *Phillipsia* PORTLOCK, 1843 because of its shortness, convex border, and the structure of the ribs, where the anterior bands are very strongly raised above the posterior ones. All these characters are typical for *Reediella* n. gen.

The differences between *Reediella karagandensis* and the closest species of this genus — *R. stubblefieldi* n. sp. concern the shorter axis and the smaller number of ribs, which in the considered species is six, while eight in *R. stubblefieldi.*

Another specimen of this species from the Central Asian collection was assigned by WEBER (1937) to a separate subspecies "*Ph. karagandensis* var. *longa*", but the differences be-

tween the two are due to the state of preservation — the type specimen being deformed in the sagittal direction.

Stratigraphic and geographic range. — Lower Tournaisian of USSR (Karaganda region, the Karatau Range, Kazakhstan).

Reediella stubblefieldi n. sp.

(Pl. II, Figs 3, 6; Text-fig. 4*C*, *I*)

Holotype: Cephalon, GSM No. Rh 1447; Pl. II, Fig. 3.
Type locality: Haw Crag, 1 ml. E of Bell Rusk Station, Yorkshire, Great Britain.
Type horizon: Lower Viséan (C_2 or S_1, S_2).
Derivation of the name: stubblefieldi — in honour of Sir JAMES STUBBLEFIELD (Geol. Survey and Museum, London).

Diagnosis. — Cephalon broadly rounded anteriorly, border only slightly upturned; rostral plate bent longitudinally, its upper (anterior) part vertical, while the lower (posterior) ventrally situated; glabella very short and broad, with shallow glabellar furrows, the basal one not reaching occipital furrow; pygidium broad and short, surrounded by a convex, distinctly delimited border; ornamentation in form of sparse, medium-sized granulation.

Material. — One holotype cephalon, 5 cranidia, 6 pygidia, 1 librigena from the grey limestone of the type horizon and locality.

Dimensions (in mm):

	GSM Rh 1447	GSM Rh 1452
Length of cephalon . . .	10.8	—
Width of cephalon	14.5	—
Length of glabella	8.5	—
Width of glabella	7.0	—
Length of pygidium . . .	—	8.0
Width of pygidium	—	11.5
Length of axis	—	7.0
Width of axis	—	5.0

Description. — Cephalon broadly rounded frontally, very strongly vaulted longitudinally; glabella with weakly incised furrows overhangs somewhat upturned anterior border; basal lobe occupies slightly more than a third of the basal glabellar width; occipital ring separated from glabella by comparatively shallow occipital furrow; palpebral lobe very broad (*tr.*), semicircular and flat; fixigena very narrow, facial suture anteriorly and posteriorly parallel to axial furrow; visual lobe high and vertically placed; librigena very steeply sloping towards the slightly raised lateral border. Thorax and hypostoma unknown. Pygidium semicircular, surrounded by narrow but convex border, very distinctly delimited from the pleural lobes; axis weakly tapering backwards, with 10 narrow, convex rings, ring-furrows comparatively narrow, somewhat undulating; ribs with convex, rounded in cross-section (*exsag.*) anterior bands, while posterior ones merged with interpleural furrows; ends of anterior bands very distinctly separated from the border. Ornamentation of the cephalon comparatively sparse but coarse (the surface of pygidium worn out).

Remarks. — The species here established is very close to *Reediella reedi* n. sp. in the general character of the glabella, eyes and the course of the facial sutures. However, the differences between the two species are very well marked; the glabella in *R. stubblefieldi* n. sp. is somewhat

shorter in the relation to its length, lateral furrows shallower, basal lobes broader (*tr.*), lateral and anterior cephalic border much less upturned, and the whole cephalon is frontally broadly rounded, while that of *R. reedi* n. sp. is distinctly subtriangular in the outline. The pygidia cannot be compared because that of *R. reedi* is so far unknown.

Stratigraphic and geographic range. — Type horizon and type locality.

Reediella granifera n. sp.

(Pl. II, Figs 4, 9)

Holotype: Pygidium, BM No. I 5805; Pl. II, Fig. 9.
Type locality: Derbyshire, Great Britain; no precise data.
Type horizon: ?Lower Viséan.
Derivation of the name: granifera — Lat. *granifer* = bearing the grain; because of granular ornamentation.

Diagnosis. — Pygidium broadly rounded, with narrow, convex border; axis with 11 rings, ring-furrows broad, 8 ribs with anterior bands raising backwards; dense, grain-like ornamentation.

Material. — Four pygidia from the light grey limestone of Bolland, Yorkshire, 2 pygidia from the unknown locality in Derbyshire.

Dimensions (in mm):

	BM I 5805	BM I 5806
Length of pygidium . . .	14.0	10.0
Width of pygidium	13.4	14.6
Length of axis	8.0	9.2
Width of axis	5.8	5.3

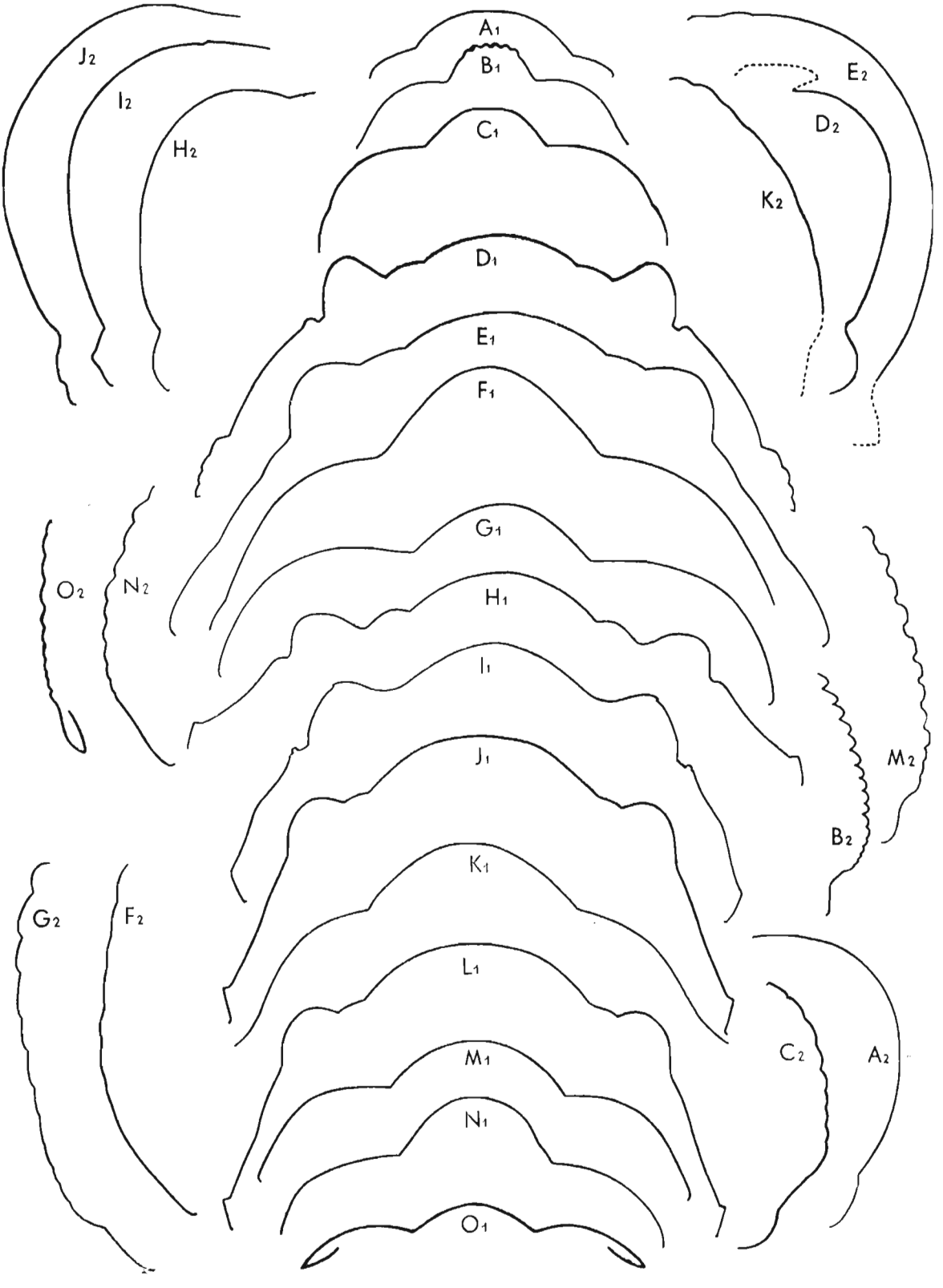
Description. — Pygidium surrounded by a narrow convex border which is distinguished by ending of ribs; axis slender with 11 convex narrow rings, ring-furrows broad (especially anterior ones) and undulating; 8—9 ribs, their anterior bands raising backwards, they narrow somewhat at their distal ends; posterior bands depressed but also slightly convex; ornamentation granular, on rings and anterior bands of ribs coarser, with grains of different sizes, those covering the border smaller and, more or less, equal in size, ring-furrows and often also posterior bands of ribs smooth.

Remarks. — The cephalon, which could be attributed to the described pygidia is so far unknown. Judging from the character of the ornamentation one can presume that the above

Fig. 4

A *Bollandia globiceps* (PHILLIPS), cranidium (BM It 2272), Bolland, Gt. Britain, ?Viséan; B *Linguaphillipsia tulensis* (Ivanov in WEBER), pygidium (BM In 37452), Tula, Moscow Basin, Viséan; C *Reediella stubblefieldi* n. gen., n. sp., pygidium (GSM Rh 1452), Haw Crag, Gr. Britain, Viséan; D *R. reedi* n. sp., holotype, cephalon (BM I 5809), Derbyshire, Gt. Britain, ?Viséan; E *Bollandia globiceps* (PHILLIPS), cephalon (SMC E 3422), Kildare, Eire, ?Tournaisian; F *B. globiceps* PHILLIPS), pygidium (SMC E 3423), Kildare, Eire, ?Tournaisian; G *B. obsoleta* (PHILLIPS), pygidium (BM 59700), Settle, Gt. Britain, ?Viséan; H *Reediella* sp. cephalon (BM I 15473), Black Rock, Eire, ?Tournaisian; I *R. stubblefieldi* n. sp., holotype, cephalon (GSM Rh 1447), Haw Crag, Gt. Britain, Viséan; J *Bollandia globiceps* (PHILLIPS), lectotype, cephalon (Ox E 1391), ?Bolland, Gt. Britain, ?Viséan; K ?*Bollandia* sp. 3, pygidium (BM 59552a), Forest of Wyre, Gt. Britain, ?Tournaisian; L *B. globiceps* (PHILLIPS), cephalon (BM It 2272), Bolland, Gt. Britain, ?Viséan; M *Reediella granifera* n. sp., holotype, pygidium (BM I 5805), Derbyshire, Gt. Britain, ?Viséan; N *Bollandia globiceps* (PHILLIPS, pygidium (Ox E 1344), Bolland, Gt. Britain, ?Viséan; O *Reediella frechi* (SCUPIN), neotype, pygidium (IG 442.II.3), Jugów, Poland, Viséan. Not to the scale.

Transverse sections marked with *1*, longitudinal — with *2*


A1
B1
C1
D1
E1
F1
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I1
J1
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J2
I2
H2
E2
D2
K2
O2
N2
M2
B2
G2
F2
C2
A2

Fig. 4

pygidia represent the same species as the cephalon described here as *Reediella reedi* n. sp. However, the exact locality of the latter is unknown and only the vague information that it comes from the Derbyshire area is given. The here described pygidia (BM I 5806) were also labelled as coming from Derbyshire, without any precise locality given. This evidence is not sufficient for assigning the discussed pygidia together with the cephalon mentioned, and therefore a new specific name is introduced for the pygidia. *R. granifera* n. sp. is close both to *R. mitchelli* (WEBER, 1937) and to *R. frechi* (SCUPIN, 1900), showing the same mode of development of the ribs with a backward raising of the anterior bands. The number of rings in *R. granifera* (11) lies between that of *R. frechi* (10) and *R. mitchelli* (13).

Stratigraphic and geographic range. — Type horizon and type locality.

Subfamily DECHENELLINAE PŘIBYL, 1946

Genus **BITUMULINA** n. gen.

Type species: Phillipsia bitumulata WEBER, 1932.
Derivation of the name: Bitumulina — based on the name of the type species „*bitumulata*".
Species assigned: Bitumulina bitumulata (WEBER, 1932), *B. sosvensis* (WEBER, 1937).
Stratigraphic and geographic range: Tournaisian of the Mugodzhars, the Urals, Kazakhstan, ?Viséan of Great Britain.

Diagnosis. — Cephalon broadly rounded, border in front of glabella, the latter constricted in mid-length, basal furrows (S_1) connected by preoccipital furrow, broad palpebral lobes (*tr.*); pygidium faintly vaulted transversely, long, broadly rounded posteriorly, pygidial border distinct, axis gently tapering backwards with 15—17 rings, 10—12 ribs very distinctly separated.

Remarks. — *Bitumulina* n. gen. differs from all early Carboniferous trilobites in the presence of a distinct preoccipital furrow which separates median preoccipital lobe. This structure is common among the Permian and Upper Carboniferous trilobites, while it is exceptional in Tournaisian trilobites and not to be found in any of the Upper Devonian trilobites. Both in the structure of its cephalon and of its pygidium, *Bitumulina* is very close to the representatives of the subfamily Dechenellinae PŘIBYL, 1946, e.g. to the Middle Devonian *Schizoproetus* RICHTER, 1912. Only the lack of the lateral occipital lobes in *Bitumulina* could speak against its assignment within Dechenellinae. But, some of the genera, which are assigned to Dechenellinae, are also devoid of the occipital lobes (e.g. *Monodechenella* STUMM, 1953), while some of those assigned to the other subfamilies (e.g. *Cyrtoproetus* REED, 1943 and *Liobole* RICHTER & RICHTER, 1949 within Cyrtosymbolinae) have the occipital lobes distinctly developed. Thus, the present author is of the opinion that *Bitumulina* is closer to Dechenellinae than to any other subfamily within Proetidae SALTER, 1864, and consequently it is so assigned here.

Bitumulina bitumulata (WEBER, 1932)

(Pl. III, Figs 8, 17)

1932. *Phillipsia bitumulata* sp. nov.; V. N. WEBER, Trilobity..., p. 45, Pl. 4, Figs 1-15.
1937. *Phillipsia bitumulata* WEBER; V. N. WEBER, Kamennougolnye trilobity..., p. 58, Pl. 6, Figs 33-35.

Holotype: Cranidium, TML No. 528/349, figured by WEBER (1932, Pl. 4, Fig. 1).
Type locality: Karak-bulak river region, the Mugodzhars, USSR.
Type horizon: Lower Tournaisian.

Diagnosis. — Cephalon with short spines, cephalic border broad, flat; glabella constricted at S_3, broadly rounded frontally, narrower anteriorly than across the base; preoccipital furrow sharp, delimiting median preoccipital lobe; palpebral lobe very broad (*tr.*) opposite the posterior half of glabella; anterior branches of facial suture somewhat divergent; hypostoma elongate, parallel-sided; thorax unknown; pygidium longer than semicircle, broadly rounded posteriorly with well defined somewhat convex border; axis long, reaching the border, with 15—16 flat rings; 11 flat ribs divided into two equally broad (*exsag.*) bands; ornamentation of glabella consisting of large, flattened tubercles, symmetrically arranged along the midline; pygidium finely granulated.

Remarks. — "*Phillipsia bitumulata*" described by WEBER (1932) from the early Carboniferous deposits of the Mugodzhars differs very strongly in the character of its cephalon and pygidium from all known Carboniferous and Upper Devonian proetids.

The most striking difference is the presence of the preoccipital furrow, which is in *Bitumulina bitumulata* thin and distinct; the ornamentation of the cephalon, which is covered by large, flattened and symmetrically arranged tubercles, was so far not reported in any other proetid trilobite. The typical dechenellinid pygidium with equally divided rib bands and very distinctly distinguished border is also different from those found in the Upper Devonian and Lower Carboniferous trilobites.

Stratigraphic and geographic range. — Type locality and type horizon.

Bitumulina sosvensis (WEBER, 1937)

(Pl. III, Fig. 16)

1937. *Griffithides (?) sosvensis* sp. nov.; V. N. WEBER, Kamennougolnye trilobity..., p. 77, Pl. 9, Fig. 7.

Holotype: TML No. 1880/5107; figured by WEBER (1937, Pl. 9, Fig. 7); here refigured on Pl. III, Fig. 19.
Type locality: Left bank of the Sosva river, up to the mouth of Mania river, the Urals, USSR.
Type horizon: Tournaisian.

Diagnosis. — Pygidium weakly arched transversely with convex border, axis with 17 rings, 12 ribs on pleural lobes, axis in transverse section trapezoidal; 2 longitudinal rows of spine-like tubercles along the medial part of axis.

Remarks. — The shape of this pygidium is identical to that in *Bitumulina bitumulata* (WEBER, 1932), however, the border in the latter is somewhat more convex, and the axis comprises only 16 rings, and the pleural lobes — 12 ribs. *Bitumulina sosvensis* differs from *B. bitumulata* in the presence of conspicuous tubercles, a pair on each ring, which are arranged in two longitudinal rows along the axis. Both, the morphological features, and the low stratigraphic position (Tournaisian) speak for the assignment of this species to the genus *Bitumulina*. From the representatives of *Griffithides* PORTLOCK, 1843, the pygidium of *B. sosvensis* differs in the lack of a concave border, which is here convex, as well as in a more slender axis and in the flatter ribs, which are moreover indistinctly divided into bands.

Stratigraphic and geographic range. — Type horizon and type locality.

?Bitumulina sp.

(Pl. III, Fig. 20)

Material. — One, slightly damaged pygidium (BM No. In 22889) from the Upper Viséan (D_2) of Castleton, Derbyshire, Great Britain.

Dimensions (in mm):

	BM In 22889
Length of pygidium	11.5
Width of pygidium	19.7
Length of axis	10.0
Width of axis	5.0

Description. — Pygidium long, broadly rounded posteriorly, comparatively convex transversely, border distinctly delimited, flat, axis long, uniformly narrowing backwards with apodemal markings aligned on its both sides; 15 narrow rings, ring-furrows deep, semiannulus present; 10 (?11) flat ribs separated by deep pleural furrows, anterior bands of ribs somewhat wider (*exsag.*) than posterior ones. In longitudinal section, axis gently arching backwards, border faintly convex. In transverse section, axis comparatively high, axial lobes strongly vaulted, border flat. Ornamentation granular, along each axial ring (*tr.*) a row of tubercles, every second one being somewhat larger, and in form of short, blunt spine directed backwards. In spite of this regularity, they are not arranged in distinct longitudinal rows along the axis; along the interpleural furrows a row of tubercles arranged; border very finely granulated.

Remarks. — The specimen described above, in its general shape, presence of the border, the shape of the axis and the number of axial rings is similar to *Bitumulina bitumulata* (WEBER, 1932). It differs from the latter species in having a flatter border, and unequally divided rib bands. In these features, as well as in the character of the ornamentation, it is close to *Linguaphillipsia tulensis* (IVANOV, in WEBER, 1937), however *L. tulensis* has an elongate pygidium, narrow posteriorly, and more (18) rings on the axis.

As the pygidium here described exposes the features intermediating between *Linguaphillipsia* STUBBLEFIELD, 1948 and *Bitumulina* n. gen. it is only tentatively assigned to the latter genus. The *Bitumulina* features prevail, but the high stratigraphic position (Upper Viséan) is unusual for this genus. This pygidium is slightly similar to some *Paladin* WELLER, 1936, species (e.g. *P. eakringensis* n. sp.), in the unequal division of the ribs, length of axis and the number of its rings. It differs from *Paladin* species in the character of the ornamentation of the axial rings, which are always provided with a row of spine-like, regular tubercles, while the latter are of varying sizes in *?Bitumulina* sp.

Stratigraphic and geographic range. — Upper Viséan of Castleton, Derbyshire, Great Britain.

Genus LINGUAPHILLIPSIA STUBBLEFIELD, 1948

Type species: Linguaphillipsia terapaiensis STUBBLEFIELD, 1948.

Species assigned: Linguaphillipsia terapaiensis STUBBLEFIELD, 1948, *L. grandis* (ETHERIDGE, 1892), *L. longicornuta* (LEYH, 1897), *L. silesiaca* (SCUPIN, 1900), *L. nongpoensis* (PATTE, 1922), *L. paczoltovicensis* (JAROSZ, 1913), *L. tulensis* (IVANOV, in WEBER, 1937), *L. divergens* CVANCARA, 1958, *?L. scabra* (WOODWARD, 1883), *?L. collinsi* (MITCHELL, 1918), *?L. hildae* (GEYSHELINCK, 1938).

Stratigraphic and geographic range: Tournaisian-Viséan of Great Britain, Germany, Tournaisian of Australia, Viséan of Poland, USSR (Moscow Basin), Malaya, Laos, ?Middle Permian of Timor.

Diagnosis. — Anterior border usually flat, in front of glabella, the latter long, constricted at S_3, broadly rounded frontally, widest across the base, 3 pairs of glabellar furrows deeply incised, palpebral lobes large, usually concave or rising outwards, anterior branches of facial suture very close and parallel (or weakly divergent) to axial furrows, eyes very large, long genal spines; thorax of 9 segments; hypostoma unknown; pygidium somewhat elongate to long with smooth, distinctly delimited border, axis V-shaped with 15 to 20 rings; 10—12 ribs divided into two, usually subequal bands.

Remarks. — STUBBLEFIELD (1948), while establishing the genus *Linguaphillipsia*, assigned to it several species, in which the present author for its most part accepts. But, after re-examination of the Carboniferous trilobites from the USSR territory she stated that the cranidia of "*Phillipsia laticaudata* var. *kuzneciana*?" WEBER, 1937, which were assigned by STUBBLEFIELD to the genus *Linguaphillipsia*, should be excluded. They are assigned here together with the pygidia determined by WEBER (1937) as "*Phillipsia laticaudata* var. *kuzneciana*" to *Weberiphillipsia* n. gen. established in the present paper.

The present author has not seen the Australian Carboniferous trilobites, thus she cannot express her own opinion as to whether "*Phillipsia collinsi*" MITCHELL, 1918 (MITCHELL, 1918, Pl. 47, Fig. 8) is a true representatives of *Linguaphillipsia* so she has followed STUBBLEFIELD in this respect [1].

In STUBBLEFIELD'S opinion, the specimens described by MANSUY (1913) as "*Phillipsia* cf. *propinqua*" MANSUY are probably not congeneric with *Linguaphillipsia*, though related. However, judging from the illustration given by HOFFET (1931, Pl. 35, Figs 2—11), who described the Carboniferous trilobites from the same locality and horizon as did MANSUY (1913) and PATTE (1922), this form should be assigned within *Linguaphillipsia*. It shows a great resemblance to *L. silesiaca* (SCUPIN, 1900). It should be added here that the name given to this form by HOFFET (1931) "*Phillipsia truncatula* var. *mansuyi*" is a younger synonym of *L. nongpoensis* (PATTE, 1922) *(= Ph. propinqua* var. *nongpoensis)*.

The material coming from the type locality of *L. terapaiensis* contains also two types of pygidia. One of them (the shorter) was determined by STUBBLEFIELD (1948) as ?*L. terapaiensis*, while the other (the longer) as "*Phillipsia*" sp. After the re-examination of the Eurasian species of *Linguaphillipsia* it seems that it is more probable that "*Phillipsia*" sp. corresponds to the cranidia of *L. terapaiensis*.

The pygidium, very much resembling that of the species of *Linguaphillipsia*, is present in the Tournaisian "*Phillipsia scabra*" WOODWARD, 1884 from Great Britain. However, the shape of the glabella is not very much like that of any *Linguaphillipsia* species and resembles more that of *Phillipsia* species. A very striking character of "*Ph. scabra*" is the lateral border of the cephalon which is steeply bent upwards. This feature is not to be found in *Phillipsia*, but seems to be present in *L. nongpoensis*.

STUBBLEFIELD (1948) suggested a relationship between *Linguaphillipsia* and "*Phillipsia bitumulata*" WEBER, 1932 which is here regarded as the type species of the new genus *Bitumulina*. The present author fully accepts this view. In her opinion, in addition to the close resemblance between the cephala of the representatives of the two genera (i.e. *B. bitumulata* and *L. tulensis* [IVANOV in WEBER, 1937]), the structure of the pygidia with a well defined border, long axis and subequal division of the ribs, is strikingly similar (p. 47). In the present

[1] A more detailed discussion of MITCHELL'S species was carried on in STUBBLEFIELD'S paper (1948). The isolated pygidia illustrated by MITCHELL (1918, Pl. 47, Figs 3-5) present the genus *Weberiphillipsia*.

author's opinion, both genera in question are closer to Dechenellinae than to Phillipsiinae and she assigns them, accordingly, within Dechenellinae.

HAHN and HAHN (1967) assigned "*Phillipsia hildae*" GHEYSELINCK, 1938 to *Linguaphillipsia*. This, however, seems to be only tentative, as this species strongly deviates in the shape of its glabella, more diverging anterior branches of facial sutures, as well as in the structure of the pygidium, from the typical representatives of *Linguaphillipsia*. It comes also from much younger deposits (Middle Permian) than all the other species of this genus (Tournaisian-Viséan).

Linguaphillipsia paczoltovicensis (JAROSZ, 1913)

(Pl. III, Figs 6, 10, 12, 19; Text-fig. 7*A*, *G*)

1909. *Griffithides obsoletus* PHILL.; J. JAROSZ, Fauna..., I, p. 7, Pl. 10, Fig. 3.
1909. *Griffithides* aff. *globiceps* PHILL.; J. JAROSZ, *Ibid.*, p. 11, Pl. 10, Fig. 4.
?1909. *Phillipsia eichwaldi* FISCH.; J. JAROSZ, *Ibid.*, p. 5, Pl. 10, Fig. 5.
1913. *Phillipsia colei* MCCOY; J. JAROSZ; Fauna wapienia..., II, p. 166, Pl. 20, Fig. 13.
1913. *Phillipsia eichwaldi* FISCH.; J. JAROSZ, *Ibid.*, p. 168, Pl. 20, Fig. 17.
1913. *Phillipsia* sp.; J. JAROSZ, *Ibid.*, p. 174, Pl. 20, Fig. 20.
1913. *Griffithides acanthiceps* v. *paczoltovicensis* n. var.; J. JAROSZ, *Ibid.*, p. 175, Pl. 20, Fig. 21.

Holotype: Pygidium, ZNG Kr. No. AI-18/3, figured by JAROSZ (1913, Pl. 20, Fig. 21); here refigured on Pl. III, Fig. 19.
Type locality: Paczółtowice, Cracow region, Poland.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium triangular with gently rounded apex; border broad, flat, distinctly delimited; axis with 14—15 rings; ring furrows somewhat undulated; 9—10 ribs divided into two equally broad (*exsag.*) bands; interpleural furrows deepened and broadened towards the border; cranidium with vertically raised anterior border, separated from the glabella by extremely deeply situated comparatively broad border furrow; glabella frontally strongly swollen, overhanging border furrow; occipital ring much broader (*tr.*) than the base of glabella; ornamentation granular, very faint on pygidium, coarser on glabella, where it occurs only along the medial line.

Material. — Five cranidia, 11 pygidia from the type locality and horizon.
Dimensions (in mm):

	ZNG Kr. AI-18/				
	3	4	5	6	7
Length of cranidium	—	—	8.0	7.1	6.2
Length of glabella	—	—	5.2	5.0	4.8
Width of glabella	—	—	4.0	3.2	3.0
Length of pygidium	7.2	5.0	—	—	—
Width of pygidium	(?)9.8	6.8	—	—	—
Length of axis	6.5	4.2	—	—	—
Width of axis	3.8	2.5	—	—	—

Description. — Frontal outline of cranidium highly arched, anterior border rised vertically with its marginal part flat and nearly horizontal; between glabella and anterior border a deep slit corresponding to border furrow; glabella long, constricted at the level of S_3 from here forwards parallel-sided, while it rapidly broadens backwards; frontal lobe of glabella strongly swollen and partly overhanging border furrow; glabellar furrows deep, S_1 extremely short,

S_3 directed obliquely backwards, very deep, somewhat shallower before reaching occipital ring; basal lobe small, but prominent, overhanging occipital furrow; the latter deep and broad; occipital ring wider (*tr.*) than the base of glabella at basal lobes, its extremities sloping low; palpebral lobe broad (*tr.*) and long (*exsag.*), reaching from almost occipital furrow to S_3; central area of palpebral lobe depressed; anterior branch of facial suture long, close and nearly parallel to axial furrow, falling nearly perpendicularly down towards the posterior border. In longitudinal section, outer part of anterior border flat and nearly horizontally placed, the inner part vertically sloping down; between anterior border and glabella a deep, narrow slit; preglabellar furrow overhung by glabella, the latter in its upper part only gently arched, occipital furrow deep, occipital ring higher than glabella. In transverse section, glabella narrow and strongly vaulted, axial furrows deep, palpebral lobes steeply rising and only distally horizontal. Librigenae, hypostoma and thorax unknown. Pygidium long, subtriangular, with rounded apex; border weakly convex, very distinctly delimited, axis reaching to the border, slender, V-shaped, with 14-15 convex and narrow rings, ring furrows undulated about the width of rings; 9 convex ribs divided into two equally broad bands; interpleural furrows thin, becoming somewhat deeper and broader (*exsag.*) near the border, pleural furrows deep, broad (*exsag.*). In longitudinal section, axis straight, gently sloping backwards, axial rings separated by wide furrows, postaxial region steep. In transverse section, axis highly vaulted, rounded at the top, pleural lobes in their proximal half horizontal, then abruptly bent down and steeply sloping, border less steep than pleural lobes. Pygidial doublure comparatively broad, flat, raising inwards. Ornamentation granular. Along medial part of glabella densely arranged small tubercles, sides of glabella devoid of any ornamentation; basal lobes coarsely granulated; central part of occipital ring and margins of palpebral lobes covered by finer granulation, occipital node present. Pygidium densely and finely granulated, granules covering the sides of axis smaller, than those in its central part.

Growth changes. — Some changes were observed on the mature pygidia during the growth process. The smallest pygidium found (ZNG Kr. AI-18/8) is comparatively broader and not so triangular as the larger ones; it is also more vaulted in both directions and has a very convex border. Successively, the shape becomes more triangular (ZNG. Kr. AI-18/4), convexity decreases, border flattens significantly. The holotype pygidium (ZNG. Kr. AI-18/3), which is among the largest in the collection, has already comparatively flat pleural lobes and a very weakly convex border, while its shape, being still subtriangular, is distinctly elongate. As seems to be the rule, the ornamentation tends to become less distinct with growth.

Remarks. — The species was described by JAROSZ (1909, 1913) under several names. However, developing of the specimens from the matrix allowed the present author to state that all these specimens should be assigned to the same species, and the differences between them are connected with the growth stages. The pygidia are very typical for *Linguaphillipsia*, so it was not difficult to assign them. The same is only partly true for the cranidia, which have a glabella shape found, so far, only in this genus, but similar development of the preglabellar portion of the cranidium was not observed in any other representative of this genus. The very characteristic for *L. paczoltovicensis* (JAROSZ, 1903) steep anterior border is found in other genera, as e.g. *Piltonia*, *Eocyphinium* and *Weania*, the latter having also somewhat similar though not so long glabella. It should be added that 2 pygidia of *Weania zarecznyi* (JAROSZ, 1913) were found in the same material. But, their small dimensions decided the present author to reject them as the possible counterparts of the cranidia mentioned. The sizes of the cranidia in question, corresponding more to the sizes of the pygidia of *L. paczoltovicensis*, combined with

the linguaphillipsid shape of the glabella and the character of the deep basal furrows, made the supposition as to their representing the same species, very probable.

In the shape of pygidium, *L. paczoltovicensis* is closest to *L. silesiaca* (SCUPIN, 1900), which has longer axis and narrower border, than the above described species. As can be judged from the SCUPIN's illustration (1900, Pl. 1, Figs 1, 2) the strong resemblance exists between the glabellae of the two species, which in both cases are strongly swollen frontally, and have distinctly overgrown basal lobes. In his description, SCUPIN did not mention the position of the anterior border, it seems, however, flat, and glabella is partly covering it. The same similarity in the shape of glabella joins *L. paczoltovicensis* with the Laos species *L. nongpoensis* (PATTE, 1922), but there also the anterior border is not raised. Pygidium of *L. nongpoensis* is similarly triangular as that in *L. paczoltovicensis* (Pl. III, Fig. 12).

Linguaphillipsia tulensis (IVANOV in WEBER, 1937)

(Pl. III, Figs 7, 9, 11, 14, 18; Tex-fig. 4*B*)

1937. *Phillipsia tulensis* IVANOV; V. N. WEBER, Kamennougolnye trilobity..., priloženie: Podmoskovnye trilobity; A. IVANOV & V. WEBER, p. 106, 11, Figs 20-24.

Holotype: Pygidium, TML No. 2305/5107, figured by WEBER (1937, Pl. 11, Fig. 24); here refigured on Pl. III, Fig. 11.

Type locality: Tula, Moscow Basin, USSR.

Type horizon: Middle Viséan.

Diagnosis. — Cephalon broadly rounded with long genal spine; cephalic border convex, very distinctly delimited; basal furrow bifurcated abaxially; eye very long; pygidium long, narrow, subtriangular in shape, with very distinct, faintly convex border; axis long, slightly narrowing backwards, high in transverse section; 18 convex axial rings, semiannulus present; 12—13 convex ribs, unequally divided by thin interpleural furrows, anterior band twice as broad as the posterior, ornamentation granular, dense on cephalon; on pygidium a row of large tubercles along (*tr.*) each ring and small ones along the interpleural furrows.

Remarks. — *Linguaphillipsia tulensis* (IVANOV in WEBER, 1937) in the shape of its pygidium is very close to *L. silesiaca* (SCUPIN, 1900), being of a similar shape and length. It is, however, more distinctly triangular than the pygidium of *L. silesiaca*, having also more gently tapering axis, which is shorter, being composed of 18 rings instead of 20 in *L. silesiaca*.

Glabella of the here discussed species is somewhat less elongate than in other *Linguaphillipsia* species, and it has not so distinctly marked difference between the widths of its anterior and posterior part as it is the case with *L. silesiaca* and *L. paczoltovicensis* (JAROSZ, 1913). *L. tulensis* differs from *L. paczoltovicensis* also in having pygidium in a shape of the narrow triangle, while the pygidium of *L. paczoltovicensis* is broader frontally, strongly tapering backwards, axis in this species is also shorter than in *L. tulensis*, having only 15 rings. *L. tulensis* exposes some similarities with *Bitumulina bitumulata* (WEBER, 1932), in the shape of the glabella and the broad anterior border, which is placed in the same position in front of the glabella; even the short branch-furrow, absent in other species of *Linguaphillipsia* STUBBLEFIELD, can be interpreted as the rudiment of the preoccipital furrow connecting S_1 in *B. bitumulata*. However the pygidia of both compared species are quite different, this of *L. tulensis* being typical for *Linguaphillipsia*.

Stratigraphic and geographic range. — Type horizon and type locality.

Linguaphillipsia silesiaca (SCUPIN, 1900)

(Pl. III, Fig. 13)

1900. *Phillipsia silesiaca* nov. spec.; H. SCUPIN, Die Trilobiten..., p. 8, Pl. 1, Figs 1-3.

Neotype: Pygidium, IG 442.II.150; Pl. III, Fig. 13.
Type locality: Sokolec, Lower Silesia, Poland.
Type horizon: Upper Viséan.

Diagnosis. — Pygidium long and narrow, with narrow, flat border, axis long, tapering backwards with 19 rings and 12 ribs, cephalon comparatively narrow with genal spines, glabella partly covers anterior border, it is constricted at S_3, in front of it being longer and much more slender than posteriorly; glabellar furrows deeply incised; occipital ring broader (*tr.*) than the base of glabella.

Material. — Four pygidia from the Upper Viséan of Sokolec, Central Sudetes, Poland. Dimensions (in mm):

	IG 442.II.150
Length of pygidium . . .	8.0
Width of pygidium	10.0
Length of axis	7.1
Width of axis	3.2

Remarks. — The original SCUPIN's collection has been lost during the war. ŻAKOWA (1958) while collecting fossils in the Viséan deposits of Sokolec, Lower Silesia, found several internal moulds of pygidia, which represent *Linguaphillipsia*, one of them being here chosen for a neotype. The locality Sokolec is situated in the near vicinity of SCUPIN's collecting place (Jugów). It seems reasonable to choose for a neotype one of the only available specimens, though imperfect, as it is in comparison with SCUPIN's originals.

The species was lately questionably mentioned, but not illustrated by WEYER (1965) and WEYER & KNÜPFER (1967) from the Upper Viséan of Lausitz and the Island of Rugia, as well as by SCHWARZBACH (1949) and KOREJWO (1958, 1960) from the Upper Viséan of the Bug region, Poland.

Ph. silesiaca is similar to *L. longicornuta* (LEYH, 1897), but differs from the latter species in having shorter genal spines and eyes.

Stratigraphic and geographic range. — Upper Viséan of Lower Silesia, Bug region, Poland; Rugia and ?Lausitz, Germany.

Subfamily CUMMINGELLINAE HAHN & HAHN 1967

Genus **CUMMINGELLA** REED, 1942, emend. STUBBLEFIELD, 1952

Type species: Phillipsia jonesi PORTLOCK, 1843.

Species and subspecies assigned: Cummingella jonesi jonesi (PORTLOCK, 1843), *C. jonesi laticaudata* (WOODWARD, 1884), *C. jonesi orleiensis* n. subsp., *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD, 1884), *C. carringtonensis tuberculigenata* n. subsp., *C. jaroszi jaroszi* n. sp., n. subsp., *C. jaroszi insulae* n. subsp., *C. gapeevi* (WEBER, 1933), *C. shartymensis shartymensis* (WEBER, 1937), *C. shartymensis weberi* n. subsp., *C. polonica* (WEBER, 1937), *C. brevicauda* (GOLDRING, 1958), ?*C. minuta* (MAKSIMOVA, 1960), *C. costabisulca* GOLDRING, 1958, *C. dalmani* (EMMRICH, 1839), *C. auge* HAHN & HAHN, 1968.

Stratigraphic and geographic range: Upper Tournaisian-Namurian of Eire, North Ireland, Great Britain, Belgium, Germany, Poland, USSR (Donets Basin, the Urals, Novaya Zemla, Tien Shan, Altai).

Diagnosis. — Cephalon compact; anterior border covered by glabella, the latter constricted in its mid-length, expanded frontally; 3—4 pairs of lateral glabellar furrows usually visible; fixigena extremely narrow; palpebral lobe narrow, long; posterior and anterior branches of facial sutures close and parallel to axial furrow; eye large to very large; genal angle rounded to spine-bearing; rostrum suboval; hypostoma with convex median body, well defined border and a pair of short spines on posterior edge; 9 thoracic segments, pleurae without spines; pygidium subsemicircular, border usually marked; axis stout with 11 to 14 rings; 7—9 ribs divided into two subequal bands; at least the first interpleural furrow invading pygidial border; pseudomegalaspid type of enrollment.

Remarks. — In contrast to the most trilobite genera, the pygidium here is very important for diagnostic purposes. In its short, subsemicircular shape, the subequally divided ribs and the stout, but rather long axis, it differs from the pygidia of all the other Carboniferous trilobites. The species within *Cummingella* have, as a rule, a very finely ornamented cephalon (often smooth), while the pygidia within the same species are more coarsely granulated. The only exceptions, known to the present author, are *C. jaroszi jaroszi* and *C. brevicauda*. The shape of the glabella, usually an important diagnostic character, is in *Cummingella* comparatively constant, and thus of limited value. For the specific and subspecific determination other characters are more useful, and are listed as follows: 1) the compactness of the cephalon, i.e. its transverse vaultness; 2) the character of the lateral border, which can be well or poorly delimited; 3) the genal angles — rounded, pointed or even with spine; 4) the ornamentation; 5) the compactness of the pygidium; 6) the degree of the delimitation of the pygidial border; 7) the deepness of the glabellar furrows; 8) the presence or the absence of the prolongations of the ribs onto the pygidial border.

The stratigraphically oldest species of *Cummingella* — Tournaisian, *C. brevicauda* (GOLDRING), is already very advanced morphologically, having all the features characteristic for this genus, well pronounced. On the other hand, *C. gapeevi* (WEBER), the species with the anterior border in front of the glabella, the latter being narrower across the front than at the base and devoid of the distinct constriction, thus morphologically primitive, is known from the Namurian. The partial ontogenetic development studied in two subspecies of the genus in question — *C. jaroszi jaroszi* n. sp., n. subsp. and *C. carringtonensis tuberculigenata* n. subsp. allowed the present author to state that in young forms the anterior border is visible in front of the glabella (in dorsal view), the latter being nearly cylindrical, slender, weakly constricted and distinctly furrowed. Very young pygidia have a distinctly marked larval notch, those somewhat older being very distinctly furrowed, with a well delimited, flattened border. Both the young cranidia and pygidia of the investigated subspecies were granulated even when the adult forms were strikingly smooth, as in the case of *C. jaroszi jaroszi*.

GOLDRING (1958) and HAHN & HAHN (1967) indicated the genus *Moschoglossis* GOLDRING, 1958 as a possible forerunner of *Cummingella*. This view is also accepted by the present author, as in the material of the *Cummingella* she had at her disposal some rare forms, which are typical for this genus showing, however, some primitive characters present in *Moschoglossis*. E.g. *Cummingella* sp. *2* displays a glabella narrowest frontally, anterior border covered only partly by glabella and the anterior branches of the facial sutures more divergent than is typical for *Cummingella*. Another example which can be quoted here is *C. carringtonensis* cf. *tuberculigenata*, a young cranidium, which, having a typical cummingellid glabella, also exposes anterior branches of the facial sutures more divergent than usual.

Cummingella jonesi (PORTLOCK, 1843), emend. STUBBLEFIELD, 1952

Subspecies assigned: C. jonesi jonesi (PORTLOCK, 1843), *C. jonesi laticaudata* (WOODWARD, 1884), *C. jonesi orleiensis* n. subsp.

Stratigraphic and geographic range: Ireland, Great Britain, Poland, ?Lower-Upper Viséan.

Remarks. — Little can be added here to the remarks of STUBBLEFIELD (1946, 1952) who first clarified the status of *Phillipsia jonesi* PORTLOCK, 1843. The present author, while revising the old material of the Carboniferous trilobites was able to find some new subspecies within the species. The common feature which speaks for the assignment of "*Ph. laticaudata*" WOODWARD, 1884 and *C. jonesi orleiensis* n. subsp. within the species under discussion is the very characteristic structure of their pygidia with the anterior bands of all the ribs passing onto the border. This character is the best pronounced in *C. jonesi laticaudata* which seems to be the oldest of these three subspecies.

Cummingella jonesi jonesi (PORTLOCK, 1843), emend. STUBBLEFIELD, 1952

(Pl. V, Figs 3, 4; Text-fig. 5*A, G, P, S*)

?1836. *Asaphus ranlceps* PHILL.; J. PHILLIPS, Illustrations..., p. 240, Pl. 22, Figs 14, 15.
1843. *Phillipsia jonesi* n. sp.; J. E. PORTLOCK, Report..., p. 308, Pl. 11, Figs 3a-d.
1843. *Phillipsia jonesi* var. *seminifera*? (PHILLIPS); J. E. PORTLOCK, *Ibid.*, p. 308, Pl. 11, Fig. 5*a, b*.
1865. *Phillipsia Derbiensis* (MARTIN); J. W. SALTER & H. WOODWARD, Chart of fossil Crustacea..., p. 16, Fig. 111.
1883—1884. *Phillipsia Derbensis* (MARTIN); H. WOODWARD, A Monograph..., p. 12, Pl. 1, Figs 2, 5.
?1883—1884. *Phillipsia Derbiensis* (MARTIN); H. WOODWARD, *Ibid.*, p. 12, Pl. 1, Figs 1, 4.
1946. *Cummingella jonesi* (PORTLOCK); C. J. STUBBLEFIELD, The genotype..., p. 186.
1952. *Cummingella jonesi* (PORTLOCK); C. J. STUBBLEFIELD, Proposed use..., p. 150, Pl. 1, Figs 1, 2.
?1968. *Cummingella jonesi* ssp. *H.* cf. *shartymensis* (WEBER); J. GANDL, Die Trilobiten..., p. 93, Pl. 9, Figs 1-3.
1968. *Cummingella jonesi jonesi* (PORTLOCK); G. HAHN & R. HAHN, Cummingella..., p. 445, Pl. 1, Figs 1-5, Text-fig. 1.

Lectotype: Entire specimen, GSM No. 63031, figured by PORTLOCK (1843, Pl. 11, Fig. 3*a*) and STUBBLEFIELD (1952, Pl. 1, Figs 1*a-c*); here refigured on Pl. VI, Fig. 3.

Type locality: Clonfeacle, Tyrone, Eire.

Type horizon: (?Middle) Viséan.

Diagnosis. — Cephalon vaulted transversely with weakly convex lateral border and rounded genal angles, anterior border vertical, coalesced with glabella and covered by it; glabella contracted at mid-length, as broad across the frontal lobe as between palpebral lobes; 4 pairs of glabellar furrows very shallow, S_1 not reaching occipital furrow, S_3 far from axial furrow; basal lobe flat, eye does not stand out from general plane of librigena; pygidium strongly vaulted transversely, axis with 13 convex rings, 9 very convex ribs, pleural furrows deep, reaching the border, interpleural furrows weak, passing onto border, anterior bands of ribs much broader than posterior ones, passing onto border, cephalon finely punctured, pygidium granulated.

Dimensions (in mm):

	BM 59839
Length of cephalon . . .	9.0
Length of glabella	7.7
Width of cephalon	11.0
I Width of glabella . . .	6.0
II Width of glabella . . .	6.0

Material. — In the collection of the British Museum (Nat. Hist.) there are several specimens which can be assigned to this species.: No. 59839 is accompanied by a label with the locality "?Derbyshire" given, however, judging from the colour and the texture of the limestone matrix, it seems to be more probable that it comes from the type locality; BM Nos.: 13127 pygidium from the Stainton Quarry, Furness, Lancashire, 45014 from Bolland, Yorkshire (figd. PHILLIPS and WOODWARD), It 474 cephalon from Malham Knoll, Yorkshire; GSM Nos.: 63031 (lectotype), 63037, from the pink Carboniferous limestone of Clonfeacle, Co. Tyrone, Eire.

Description. — Cephalon broadly rounded anteriorly, anterior border vertically situated, covered by glabella, lateral border weakly convex, lateral and anterior border furrow usually faint, genal angles rounded; glabella elongate, constricted between S_3, expanded frontally, across frontal lobe as broad as between palpebral lobes; 4 pairs of shallow lateral furrows, S_1 curved backwards, not reaching occipital furrow, S_2 and S_3 thin, connected with axial furrow, S_4 horizontal, far from axial furrow; basal lobe flat; occipital furrow deep, occipital ring weakly convex, without, or with a very low occipital node; palpebral lobe long (*exsag.*), narrow (*tr.*) and weakly curved, anterior and posterior branches of facial suture parallel to axial furrow, posterior branch is short; librigena narrow, with broad, weakly delimited lateral border; eye long, semilunate, its posterior tip nearly at occipital furrow, anterior one reaching close to S_4. In longitudinal section, occipital ring low and faintly convex, glabella in posterior half horizontal, then sloping gently downwards covering, but not overhanging the flat, vertical anterior border. In transverse section, cephalon uniformly arched, glabella flat, palpebral lobes flat, sloping outwards, eyes not standing out from the general arch of cephalon, librigenae steeply sloping, lateral border weakly convex, continuing the slope of librigena. Hypostoma unknown. Thorax of 9 segments, thoracic axis about as broad (*tr.*) as a pleural lobe and somewhat higher; pleural lobe horizontal along half its width (*tr.*), then abruptly bent downwards; pleurae with rounded tips, their anterior bands narrower than posterior ones. Pygidium slightly elongate with weakly marked border, axis broad, gently tapering backwards, reaching border; 13 very convex axial rings, ring-furrows deep, shallowed at axial furrows, oblique apodemae marked near the posterior edge of all rings excluding first and the three last ones; 9—10 very convex ribs, their anterior bands passing onto the border and are much broader *(exsag.)* than posterior ones; pleural furrows deep, broad, reaching border, interpleural furrows extremely faint. In longitudinal section, axis arched, postaxial region oblique, flat. In transverse section, axis strongly vaulted, highly elevated above pleurae, which are gently bent down from nearly half their width (*tr.*). Ornamentation of cephalon in the form of fine, moderately dense punctures; pygidium bears punctures as well as distinct granules arranged in one row along posterior edge of each ring, and anterior band of rib; granulation usually is obsolete on first pygidial segments but becomes more and more distinct towards the back.

Stratigraphic and geographic range. — Viséan of Eire and Great Britain.

Cummingella jonesi laticaudata (WOODWARD, 1883-1884)

(Pl. V, Figs 5, 6, 8, 9; Text-fig. 5*V*, *X*)

1883-1884. *Phillipsia laticaudata* sp. nov.; H. WOODWARD, A Monograph..., p. 42, Pl. 7, Fig. 4.

Lectotype: Pygidium, BM No. I 875b, figured by WOODWARD (1883-1884, Pl. 7, Fig. 4); here refigured on Pl. VI, Fig. 9.

Type locality: Bolland, Yorkshire, Great Britain.

Type horizon: (?Middle) Viséan.

Diagnosis. — All pygidial ribs (9—10) distinctly marked on pygidial border, axis of 12 rings; glabellar furrows S_1—S_3 deeply incised, S_1 reaching occipital furrow; librigena with pointed genal angle; border furrow distinct along the whole cephalon; exoskeleton sparsely granulated.

Material. — Eleven cranidia, 2 fragments of librigenae, 1 hypostoma, 4 pygidia — all from the black limestone D_1?, S_1? of Bolland, Yorkshire; several cranidia, pygidia and librigena from the dark grey limestone (Upper Viséan — P_2) of Ashford, Derbyshire; pygidia and librigenae from the unknown locality (BM Nos. 38415, 25510); probably also cranidia from the Fourlows Limestone of Redesdale, Cumberland; Great Britain.

Dimensions (in mm):

	BM				
	4506a	45008	I 875a	I 875b	45020
Length of cranidium . . .	8.0	5.0	6.0	—	6.0
Length of glabella	7.0	4.2	4.9	—	4.8
I Width of glabella . . .	6.0	3.0	3.8	—	—
II Width of glabella . . .	5.5	3.2	4.0	—	4.0
Length of pygidium . . .	—	—	—	6.8	—
Width of pygidium	—	—	—	9.0	—
Length of axis	—	—	—	5.2	—
Width of axis	—	—	—	3.5	—

Description. — Glabella nearly cylindrical, slightly contracted between S_3, broadly rounded frontally, reaching but not covering the anterior border; the latter faintly convex, vertically placed; 4 pairs of lateral glabellar furrows incised, S_1 deep, strongly curved reaching occipital furrow, S_4 in the form of a shallow pit far from axial furrow; L_1 swollen, its hind edge overhanging occipital furrow, which is very deep; occipital ring convex, faintly narrowed at axial furrows; palpebral lobe somewhat curved, narrow (*tr.*), anterior and posterior branches of facial suture parallel to axial furrow; librigena with convex lateral border and a distinct border furrow; eye long, large, genal angle pointed. In longitudinal section, occipital ring convex with node, occipital furrow deeply incised, posterior edge of glabella cut vertically, profile of glabella vaulted, glabella not covering the somewhat convex anterior border. In transverse section glabella arched, axial furrows deep, palpebral lobes flat, narrow. Hypostoma (probably belonging to the species) slender, convex transversely and gently arched longitudinally; median body weakly separated from posterior lobe, maculae faint, posterior margin slightly notched. Thorax unknown. Pygidium slightly parabolic with a distinct border; axis nearly as broad as pleural lobe, slightly tapering backwards and reaching the border posteriorly; 12 convex axial rings, ring furrows very deep, at the sides of axis rings flattened and ring-furrows shallowed; 8 convex ribs, interpleural furrows indistinct, pleural furrows deep, broad; all anterior bands of ribs passing onto the border, posterior ones ending just at the border. In longitudinal section, axis gently vaulted, postaxial region steeply sloping, axial rings with scale-like arrangement. In transverse section, axis low, pleural lobes strongly arched, their abaxial parts horizontal; pygidial doublure broad and flat laterally, becomes narrow and convex mesially. Ornamentation: cephalon covered with small, low and very sparse tubercles and extremely faint punctures; pygidium granulated, prominent tubercles arranged in a row along posterior edge of each axial ring and along interpleural furrows, border covered with smaller, dispersed granules.

Remarks. — Preparation of the material described by WOODWARD (1883-1884) as *Phillipsia laticaudata* allowed the present author to state that it displays a cranidium typical for

Cummingella, and is close to *Cummingella jonesi jonesi* (PORTLOCK, 1843) in the structure of its pygidium with well pronounced anterior bands of ribs on the border. There exist some differences between the two forms which seem to be of subspecifical value (cf. table on p. 59).

Stratigraphic and geographic range. — ?Middle-Upper Viséan of Great Britain.

Cummingella jonesi orleiensis n. subsp.

(Pl. V, Figs 1, 2; Text-figs 5*E*, *F* & 7*P*)

Holotype: Entire specimen, ZNG Kr. Cz. 1; Pl. V, Fig. 2.
Type horizon: ?Lower Namurian.
Type locality: Orlej, Piekło Hill, Cracow region, Poland.
Derivation of the name: orleiensis — after the type locality.

Diagnosis. — Cephalon without genal spines; lateral border convex; glabella elongate, with deeply incised furrows; pygidium with very convex ribs passing onto the border.

Material. — Two entire specimens, 2 cephala, 1 librigena, 5 isolated pygidia, all from the black shales of type locality and horizon.

Dimensions (in mm):

	ZNG Kr. Cz. 1	ZNG Kr. Cz. 2
Length of entire specimen	13.8	—
Length of cephalon	5.1	—
Width of cephalon	7.3	—
Length of glabella	4.3	—
Width of glabella	3.2	—
Length of pygidium	5.0	4.0
Width of pygidium	6.2	5.5
Length of axis	3.6	2.8
Width of axis	2.4	1.8

Remarks. — The here erected new subspecies has a pygidium typical for this species with ribs distinctly marked on the border. In its characters it intermediates between *Cummingella jonesi jonesi* (PORTLOCK) and *C. jonesi laticaudata* (WOODWARD). Its cephalon is devoid of genal spines as is that of *C. jonesi jonesi*, having, however, a lateral border well separated from the librigenae and a comparatively slender glabella, with incised lateral furrows like those found in *C. jonesi laticaudata*. The glabella seems to be, however, less distinctly constricted than in both compared subspecies. Two other species of *Cummingella* REED from the territory of Poland, *C. carringtonensis tuberculigenata* n. subsp. and *C. jaroszi jaroszi* n. subsp., differ from *C. jonesi orleiensis*: the first — in having genal spines, not so distinct glabellar furrows and a pygidium with only the two first ribs passing onto the border, the second — in its more compact shape of the cephalon, absence of glabellar furrows, very indistinctly separated lateral border and much more convex pygidium with very weakly marked ribs. Moreover, the here regarded new subspecies is the youngest of the three mentioned forms being found in the Lower Namurian deposits, while *C. jaroszi jaroszi* comes from uppermost Tournaisian and *C. carringtonensis tuberculigenata* from Upper Viséan. *C. jonesi orleiensis* has been found in association with the *Paladin* species.

Stratigraphic and geographic range. — Type horizon and type locality.

Comparison of subspecies within *Cummingella jonesi* (PORTLOCK)

Subspecies	*C. jonesi jonesi*	*C. jonesi laticaudata*	*C. jonesi orleiensis*
Cephalic border	faintly convex, anteriorly covered by glabella	convex, partly in front of glabella	anteriorly convex, covered by glabella
Glabellar furrows	weak	deep	deep
Basal lobes	flat	swollen	weakly swollen
Genal angles	rounded	pointed	rounded
Shape of pygidium	elongate, vaulted transversely	broadly rounded, comparatively flat	broadly rounded, vaulted transversely
Ornamentation	cephalon punctured, pygidium granulated	cephalon and pygidium granulated, cephalon additionally with punctures	pygidium and cephalon granulated

Cummingella brevicauda (GOLDRING, 1958)

(Pl. VI, Figs 1-5; Text-fig. 5*K, L*)

1842—1844. *Phillipsia Derbiensis* MARTIN; L. G. KONINCK, Description..., p. 601, Pl. 53, Fig. 2.
1958. *Moschoglossis decorata brevicauda* n. subsp.; R. GOLDRING, Lower Tournaisian..., p. 238, Pl. 43, Figs 8-11.
?1964. *Cummingella jonesi* cf. *belgica* (WEBER); G. HAHN, Trilobiten..., p. 462, Pl. 43, Figs 5-8.
?1968. *Paladin (Kaskia) arduennensis* n. sp.; G. HAHN & R. HAHN, Cummingella..., p. 453, Pl. 1, Figs 10-12.
non 1937. *Phillipsia derbyensis* var. *belgica* n. nom.; V. N. WEBER, Kamennougolnye trilobity..., pp. 52, 55, Pl. 5, Fig. 49; Pl. 6, Figs 16, 17.

Holotype: Pygidium, IRB No. 13.829.1, figured by GOLDRING (1958, Pl. 43, Fig. 8).
Type locality: Feluy 41, Belgium.
Type horizon: Lower Tournaisian (Tn2b).

Diagnosis. — Pygidium with smooth, broad border, axis of 12—13 rings, 9 ribs not passing onto the border; cephalon broad without genal spines, but with somewhat pointed genal angles: anterior border convex, in vertical position, visible a little in front of glabella; axial furrow angularly bent at basal furrow S_1; surface of exoskeleton punctured, with weak scale-like tubercles; subocular groove densely furrowed in vertical direction and punctured.

Material. — Numerous specimens, including entire ones, from the yellow-grey marly limestone of the Upper Tournaisian (Tn 3b) age, Clypot Quarry, Neufvilles, Soignies, Belgium.

Dimensions (in mm):

	IRB 18.741			
	46	34	71	88
Length of entire specimen	25.3	—	—	—
Length of cephalon	8.0	6.0	11.9	—
Width of cephalon	—	—	19.0	—
Length of glabella	6.6	4.8	8.5	—
Width of glabella	4.7	3.2	7.0	—
Length of pygidium	8.7	—	—	9.0
Width of pygidium	11.7	—	—	10.7
Length of axis	7.7	—	—	7.3
Width of axis	4.8	—	—	4.3

Description. — Cephalon wide, with pointed genal angles; lateral border furrow shallow, lateral border weakly convex, marked with 5—6 longitudinal lines; anterior border convex, placed vertically, but in top view somewhat visible in front of glabella; glabella distinctly constricted, broadest between the palpebral lobes; axial furrow faint, with shallow fossula; near the place where the axial furrow meets S_1 it bends sharply, forming an angle; 3 pairs of glabellar furrows marked, only S_1 incised, not reaching occipital furrow; occipital furrow deep and broad; occipital ring sloping low at extremities; anterior and posterior branches of facial suture running closely and almost parallelly to axial furrow, palpebral lobe distinctly curved, but narrow (*tr.*); a very faint furrow visible along the edge of palpebral lobe; eye large, reaching from the occipital furrow to S_3; subocular groove very broad, its slope adjoining the visual lobe, marked with very thin furrows and punctures (Pl. VII, Fig. 3*c*). In longitudinal section, occipital ring flat, broad, occipital furrow deeply incised, glabella sloping gently forwards, from about mid-length, anterior border vertical, weakly convex. In transverse section, glabella flat, forming together with palpebral lobes an uniform arch; eyes convex, almost vertically situated, subocular groove very clearly marked, librigenae steeply sloping, lateral border weakly differentiated. Hypostoma with moderately convex median body, lateral border narrow and convex, while posterior border flat, comparatively narrow, maculae weakly developed. Thorax of 9 segments, each one with a well developed semiannulus and distal ends cut straight off. Pygidium broadly rounded, rimmed by a smooth, band-like border; axis as broad as pleural lobe with 12—13 rings; ring furrows deep across the top of axis, shallowed on its slopes; apodemal depressions clearly discernible; 9 ribs, but only 7 of them distinctly pronounced, none of them passing onto the border; pleural furrows deep, interpleural furrows in the form of thin lines. In longitudinal section, axis forming a gentle arch, postaxial field steep. In transverse section, axis forming a high arch, pleural lobes gently vaulted. Ornamentation: The surface of the cephalon rough, consisting of very fine, low tubercles, somewhat scale-like in form, as well as very fine punctures. Pygidium covered by the same kind of ornamentation, which is, however, more weakly pronounced.

Remarks. — The specimens from Belgium described by DE KONINCK (1842—1844) as „*Phillipsia derbyensis*" have been lost, but the shape of the cephalon as well as of the pygidium speak for their assignment to *Cummingella*. They resemble very much the specimens here described, coming from Neufvilles. GOLDRING (1958) described the pygidia and a hypostoma from Feluy, Belgium, which he assigned to *Moschoglossis* GOLDRING, 1958 as the new subspecifical form of the type species of this genus — *M. decorata brevicauda* GOLDRING, 1958. The cranidium of this subspecies was imperfectly known, but it exposed the type of ornamentation found also in the nominate subspecies *M. decorata decorata* GOLDRING, 1958. The pygidia from Feluy are conspecific with those found in Neufvilles, which are associated with the cephala of the typical *Cummingella*. Thus, there is little doubt but that they should be assigned to the latter genus.

HAHN (1964*b*) described from Modave, Belgium, some *Cummingella* material, which he determined as *C. jonesi* cf. *belgica* (WEBER, 1937). The pygidia of these forms do not differ from *Cummingella brevicauda* (GOLDRING, 1958). Some difference (mainly the smaller eyes) can be observed on the cephala of the Modave specimens. However, they are very unsatisfactorily preserved, the one illustrated by HAHN (1964, Pl. 43, Fig. 5) being crushed. In 1968, HAHN and HAHN (1968*c*) erected a new species *Paladin (Kaskia) ardennuensis* HAHN & HAHN, 1968, and they included into the synonymy of the latter the above mentioned specimens from Modave. The holotype of this species, coming from Tournai, Belgium, differs distinctly from *C. brevi-*

cauda, however the paratype pygidium (HAHN & HAHN, 1968*c*, Pl. 1, Fig. 10) is very much resembling the pygidium from Modave and this from Feluy assigned to *C. brevicauda*. It is also extremely similar to the specimens of *C. brevicauda* here described from the Soignies region. The librigenae described by HAHN & HAHN (1968*c*) from Modave are also identical with those of *C. brevicauda*, though nothing is known whether they expose the peculiar ornamentation of the subocular groove, which is found in *C. brevicauda*. In the view of these facts, the present author includes tentatively the librigenae and pygidia of "*Paladin (Kaskia) ardennuensis*" HAHN & HAHN, 1968 into the synonymy of *Cummingella brevicauda* GOLDRING, 1968.

The status of "*Cummingella jonesi belgica*" (the name, which was intended to cover the *Cummingella* species from Belgium) seems to be very unclear (p. 73). In the present author's opinion, it should be abandoned, as the type material (WEBER, 1937) represents presumably a species of *Eocyphinium*, but is so poorly preserved that nothing definite can be stated. This is the reason that the name "*brevicauda*" established by GOLDRING (1958) is here chosen for the species discussed.

Stratigraphic and geographic range. — Tournaisian (Tn1b-Tn3b) of Belgium and France.

Cummingella carringtonensis (ETHERIDGE in WOODWARD, 1883-1884)

Subspecies assigned: *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD, 1884), *C. carringtonensis tuberculigenata* n. subsp.

Stratigraphic and geographic range: Great Britain, Poland. Middle — Upper Viséan (D_1-D_2).

Remarks. — The species was assigned originally by its author to the genus *Griffithides* PORTLOCK, 1843 and was based on the pygidia only. However, the pygidia under consideration are typical for *Cummingella*, those of the *Griffithides* species being surrounded by a concave border, and having narrower, much more convex ribs. Moreover, in addition to the pygidia of *C. carringtonensis* thecephala were found, which leave no doubt but that this species is a representative of *Cummingella*.

C. carringtonensis differs from other representatives of the genus mainly in the characters of the pygidium which has a very distinctly delimited flat border and coarse granulation.

Cummingella carringtonensis carringtonensis (ETHERIDGE in WOODWARD, 1883-1884)

(Pl. VII, Figs 1-4, 7-11, 13; Text-fig. 5*C, J, M, R, U*)

1883—1884. *Griffithides ?Carringtonensis* ETHERIDGE MS; H. WOODWARD, A monograph..., p. 41, Pl. 9, Fig. 6a, b.
1942. *Cummingella balladoolensis* REED; R. F. C. REED, Some new..., p. 649, Pl. 10, Figs 1-3.

Lectotype: Pygidium GSM No. 103111, figured by WOODWARD (1884, Pl. 9, Fig. 6a); here refigured on Pl. VII, Fig. 8.

Type locality: Longnor, Derbyshire, Great Britain.

Type horizon: Viséan (D_1?).

Diagnosis. — Pygidium with flat border, very convex ribs not passing onto border; cephalon with genal spines, distinct lateral border furrow and convex lateral border; glabellar furrows weak.

Material. — Two pygidia from the Viséan (D_1?) of Falls Brew, Caldbeck, Cumberland, 1 entire specimen, 3 cephala, 4 cranidia, 16 pygidia from the light grey Viséan (D_1) limestone of Narrowdale, Staffordshire, 1 pygidium from Longnor, Derbyshire, 1 cephalon from White-

well, Bolland, Yorkshire, numerous cranidia and pygidia from Settle, Yorkshire, 2 pygidia from Wetten, Derbyshire, several cranidia and pygidia from Cracoe, Yorkshire, Great Britain.

Dimensions (in mm):

	BM						
	27930	27936	27906	27935	27904	36797	36810
Length of cephalon . . .	11.0	9.3	15.7	6.6	—	—	—
Width of cephalon	14.2	12.0	20.0	—	—	—	—
Length of glabella	9.0	8.0	13.5	5.2	—	—	—
I Width of glabella . . .	7.7	5.8	11.0	4.2	—	—	—
II Width of glabella . . .	7.2	6.0	9.6	4.2	—	—	—
Length of pygidium . . .	—	—	—	—	12.0	8.0	4.8
Width of pygidium. . . .	—	—	—	—	17.0	11.0	6.7
Length of axis	—	—	—	—	10.0	6.5	3.6
Width of axis	—	—	—	—	6.0	5.0	2.5

Description. — Cephalon compact, lateral border furrow distinct, anterior border furrow extremely faint, anterior border flat, covered by glabella, lateral border convex; glabella cylindrical, slightly contracted between S_3, its anterior width usually almost equal to posterior width, 4 pairs of glabellar furrows very faintly marked, usually as darker lines on exoskeleton; S_1 reaching occipital furrow, S_4 in the form of a rounded spot, far from axial furrow; basal lobe unswollen but posteriorly overhanging occipital furrow; occipital ring flat, somewhat narrowing distally; palpebral lobe narrow, anterior branch of facial suture close and parallel to axial furrow, when cutting occipital segment is very characteristically curved; librigena steeply sloping, eye large reaching nearly from occipital furrow to S_4; genal spine strong, comparatively short. In longitudinal section, occipital ring flat, glabella slightly higher and also flat, in front very gently sloping and covering flat, somewhat obliquely downwards and backwards directed anterior border. In transverse section, glabella low, flat, palpebral lobes horizontal, librigenae sloping steeply, eyes do not stand out beyond the general arch of cephalon. Hypostoma unknown. Thoracic pleurae with rounded tips, strongly bent down from about a third of their width (*tr.*). Pygidium broad, parabolic, surrounded by a broad flattened border, axis reaching the border, with 12—13 rings; axial rings very convex, scale-like arranged mesially, becoming flat at axial furrows; ring-furrows deep, shallowed distally, preannulus usually present; 8—9 very convex ribs, only the first one passing onto border; pleural furrows deep and broad, interpleural furrows fine but distinct, anterior bands of ribs broader than posterior ones. Pygidial doublure as broad as the border, convex, behind axis directed nearly vertically towards the dorsal side of exoskeleton. In longitudinal section, axis slightly arched, its end distinctly differentiated from the flat, gently sloping border. In transverse section, axis highly vaulted, pleural lobes bent down at about 45°; pygidium much flatter transversely than the thorax. Ornamentation on cephalon indistinct, it seems to consist of sparse, low granules, pygidium with prominent tubercles along axial rings and along each band of rib, border finely granulated.

Growth changes. — The smallest cranidium found (length 6.6 mm) has all the characters typical for the species. However, frontal lobe of the glabella is slightly more convex transversely. The largest cephalon (length 15.7 mm) shows striking differences: the glabella in this specimen narrows forwards, instead of being constricted and as broad frontally as posteriorly, but a very slight constriction can be still detected. The eyes of this specimen are slightly shorter, their anterior tips reaching to S_3; the glabellar furrows on the mould are incised (this can be found

in the smaller cephala but is usually lacking on those of average size); the genal angles do not protrude into the spines, being only pointed; the basal lobes do not overhang the occipital furrow. This specimen has, in common with other cephala of *Cummingella carringtonensis* found in the same beds and locality (Narrowdale), a similarly convex lateral border, the same shape of cephalon and, what is very characteristic for this species, the axial furrows bent outwards where they cut the occipital segment.

The variation range within the species concerns the pygidia, which may have more or less flattened border. In some specimens one can observe that the anterior bands of ribs are extremely weakly pronounced also on the border.

Remarks. — *Cummingella carringtonensis carringtonensis* (ETHERIDGE in WOODWARD, 1883—1884) bears some resemblances to *C. jonesi jonesi* (PORTLOCK, 1843), such as the poorly marked lateral glabellar furrows and unswollen basal lobes, which, however, in both subspecies overhang the occipital furrow. The cephalon of *C. jonesi jonesi* differs from this in *C. carringtonensis carringtonensis* in being more compact, the eyes more flat in transverse section, glabella more distinctly constricted and more strongly arched longitudinally. The genal angles in *C. carringtonensis carringtonensis* are protruded into spines, while they are rounded in *C. jonesi jonesi.*

Stratigraphic and geographic range. — Viséan of Great Britain.

Cummingella carringtonensis tuberculigenata n. subsp.

(Pl. IV, Figs 7, 9, 11; Pl. IX, Figs 1, 5, 6, 10, 12, 15, 16, 20; Text-fig. 7*F, L*)

Holotype: Cephalon, Z. Pal. Tr. II.139; Pl. IV, Fig. 11.
Type locality: Todowa Grząba, Gałęzice, Holy Cross Mountains, Poland.
Type horizon: Viséan (D_2).
Derivation of the name: tuberculigenata — librigena bearing tubercular ornamentation.

Diagnosis. — Cephalon with short, thin spines and very sharp lateral border furrow; frontal lobe of glabella broadly rounded: glabella covered by punctures and very small, sparse scale-like tubercles, librigena sparsely granulated; pygidium with comparatively slender axis, distinctly granulated.

Material. — Five cephala, 13 cranidia, 4 librigenae, 1 thorax associated with the pygidium, 25 pygidia from the Viséan limestone (D_2) of Todowa Grząba, Besówka Hill, Ostrówka Hill in Gałęzice, Holy Cross Mountains, Poland.

Dimensions (in mm):

	Z. Pal. Tr. II.							
	139	252	117	233	24	44	31	136
Length of cephalon . . .	9.0	4.0	4.6	5.0	—	—	—	—
Width of cephalon	10.5	—	—	—	—	—	—	—
Length of glabella	7.4	3.2	3.8	4.0	—	—	—	—
I Width of glabella . . .	5.4	2.0	2.4	2.7	—	—	—	—
II Width of glabella . . .	5.6	2.0	2.2	2.7	—	—	—	—
Length of pygidium . . .	—	—	—	—	1.2	2.5	4.0	5.2
Width of pygidium. . . .	—	—	—	—	1.6	3.8	5.0	6.3
Length of axis	—	—	—	—	0.8	2.0	3.4	4.5
Width of axis	—	—	—	—	0.3	1.4	2.0	2.5

Description. — Cephalon broadly rounded frontally, very compact, with thin, short genal spines; glabella squat, constricted between the anterior tips of eyes; axial furrow delimiting glabella from occipital ring to S_3 distinctly curved, frontal lobe of glabella broadly rounded, covering anterior border, but not overhanging it; glabella frontally as wide as posteriorly; four pairs of glabellar furrows marked, S_1 the deepest, reaching occipital furrow, S_4 occasionally visible as a dark spot far from axial furrow; basal lobe elongate, occupying a quarter of the basal glabellar width (*tr.*), its posterior part inflated, overhanging occipital furrow; the latter deep; occipital ring broad (*sag.*), strongly lowering towards the axial furrows, fixigena very narrow; width of palpebral lobe equals a nineth that of the glabella; librigena with a very large eye; lateral border convex, sharply delimited. In longitudinal section, glabella gently lowers forwards, not overhanging anterior border, which is directed obliquely downwards; doublure broad with terrace lines; rostral plate transversely elongated, connective sutures arched giving an oval shape to the rostral plate. In transverse section, glabella almost flat, librigenae steeply sloping. Thorax of nine segments. Pygidium with well defined border, axis comparatively slender, gently narrowing, reaching the border posteriorly; 12—13 convex axial rings; pleural lobe almost as broad (*tr.*) as the axis; 9—10 convex ribs, pleural furrows deep ending on meeting the border, interpleural furrows faint, shallow, the first 3—4 of them passing onto the border; anterior rib-bands broader (*exsag.*) than the posterior; no border furrow. In longitudinal section, pygidium sloping backwards. In transverse section axis arched, high, pleural lobes gently vaulted. Ornamentation: Glabella smooth with faint punctures, and very low scale-like tubercles near the posterior edge; librigenae covered by low tubercles; granulation on thoracic segments dense but fine; tuberculation on pygidium coarser, with the exception of the border, which is covered with dense but fine granules.

Growth changes. — The smallest cranidium known (length 0.4 mm; Pl. IX, Fig. 5) has finger-shaped glabella, almost devoid of any constriction; 3 pairs of glabellar furrows are deeply incised; glabella reaches the horizontally placed, convex border; the width of palpebral lobe (*tr.*) equals about a fifth of that of the glabella; ornamentation in the form of small, sparse tubercles, developed on the posterior part of glabella. On the larger cranidium (length 5.0 mm; Pl. IX, Fig. 10) the constriction of the glabella is somewhat more distinct, lateral glabellar furrows shallow, width (*tr.*) of the palpebral lobe about a sixth that of the glabella, anterior border verticaly placed and covered by glabella; ornamentation of glabella less distinct. Width to length ratio of glabella in younger forms 0.6, in the adult 0.7. The smallest pygidium known (length 1.2 mm; Pl. IX, Fig. 1) is a transitory one and has a broad, flat border with a larval notch, very slender axis consists of 8 rings and posteriorly elevates highly above the flat border, 7 segments visible on pleural lobe, their posterior bands are more strongly pronounced and pass onto the border. There is a prominent tubercle situated on each segment, the successive tubercles forming a line marking the slope of the pleural lobe. This line of more strongly developed tubercles is marked even on a much bigger pygidium (length 2.5 mm; Pl. IX, Fig. 6) which exposes already the features typical for adult forms (ornamentation, general proportions), but still has a flat, horizontal border, though devoid of a larval notch. In the further growth stages, the pygidial border becomes gradualy more obliquely situated and not so flat, and the row of more prominent tubercles obsoletes among the increasing number of other ornamental tubercles.

The individual variability is not very great in this species and concerns mainly the pygidia. The axis can be more or less slender, and the pygidial border, which is usually faintly convex, in some pygidia is flat and situated more obliquely downwards (Pl. IX, Fig. 20).

Remarks. — The new subspecies here described has a typical, for this species, structure of pygidium with a very well defined border without ribs marked on it and comparatively coarse granulation. The cephalic border is very well defined similarly to this in the nominate subspecies. In contrast to *Cummingella carringtonensis carringtonensis* (ETHERIDGE in WOODWARD, 1883-1884) which has long genal spines, these are very short in *C. carringtonenis tuberculigenata*. The Polish form differs also from the nominate subspecies in having a more robust glabella and somewhat longer eyes which reach forwards to a point placed somewhat in front of S_3. In the British subspecies they attain at most S_3. Little can be said about the difference in the ornamentation of the glabella of both compared forms, the surface of the exoskeleton not being preserved on the glabellae of all the investigated specimens of *C. carringtonensis carringtonensis*. However, librigenae in *C. carringtonensis carringtonensis* are smooth while these of *C. carringtonensis tuberculigenata* n. subsp. are sparsely granulated.

Stratigraphic and geographic range. — Type locality and type horizon.

Cummingella carringtonensis cf. **tuberculigenata** n. subsp.

(Pl. IX, Fig. 9)

Material. — One young cranidium (Z. Pal. Tr. II. 123b), from the Viséan (D_2) limestone of Besówka Hill, Gałęzice, Holy Cross Mountains, Poland.

Dimensions (in mm):

	Z. Pal. Tr. II. 123b
Length of cranidium . . .	4.2
Length of glabella	3.5
Width of glabella	2.7

Remarks. — In the same bed where *Cummingella carringtonensis tuberculigenata* n. subsp. occurs, a cranidium was found which represents a young *Cummingella*. It is similar to the young cranidium of *C. carringtonensis tuberculigenata*, but differs in having the more arched frontal outline of the cranidium, an upturned anterior border and the anterior branches of the facial sutures divergent, instead of being parallel as in typical *Cummingella* species. Also its palpebral lobe is somewhat larger, γ and ε being farther from the axial furrow.

Cummingella shartymensis (WEBER, 1937)

Subspecies assigned: C. shartymensis shartymensis (WEBER, 1937), *C. shartymensis weberi* n. subsp.
Stratigraphic and geographic range: Namurian of the Urals, USSR.

Remarks. — HAHN and HAHN (1968*c*) assigned "*Phillipsia derbyensis* var. *shartymensis*" WEBER, 1937 to *Cummingella kargini* (WEBER, 1933), as its subspecies. The present author while revising the both forms in question stated that "*Phillipsia kargini*" WEBER, 1933 does not represent *Cummingella* REED, 1942. It is here assigned to *Particeps* REED, 1943. On the other hand, "*Phillipsia derbyensis* var. *shartymensis*" is a typical *Cummingella*, thus the two species in question cannot be joined. The present author agrees with HAHN and HAHN (1968c), who pointed out the similarity existing between *Cummingella auge* HAHN & HAHN, 1968 and *C. shartymensis*.

Cummingella shartymensis shartymensis (WEBER, 1937)

(Pl. VII, Figs 5, 6)

1937. *Phillipsia derbyensis* var. *shartymensis* n. nom.; V. N. WEBER, Kamennougolnye trilobity..., p. 53, Pl. 6, Figs 1, 2, 4.
?1937. *Phillipsia derbyensis* var. *polonica* (?) n. nom.; V. N. WEBER, *Ibid.*, p. 56, Pl. 6, Fig. 19.

Holotype: Pygidium TML No. 1401/5107, figured by WEBER (1937, Pl. 6, Fig. 2); here refigured on Pl. VII, Fig. 6.
Type locality: Shartymka river, the South Urals, USSR.
Type horizon: Namurian.

Diagnosis. — Pygidium broad, comparatively short, weakly arched; indistinctly delimited, very broad pygidial border; axis broader than pleural lobe, flat; 10—11 axial rings; 7 flat ribs, pleural and interpleural furrows very shallow; pygidium finely granulated; cephalon narrow, transversely vaulted; genal angle pointed, anterior border vertical, coalesced with glabella; glabellar furrows weak; eye large.

Remarks. — The cephalon of *Cummingella shartymensis shartymensis* (WEBER, 1937) shows some resemblance to the Lower Viséan subspecies *C. jaroszi jaroszi* n. sp. from Poland. It is also well vaulted transversely, narrow, and has very slightly pointed genal angles, as well as large eyes, which do not stand out from the plane of librigena. However, both species have quite different pygidia, this of *C. shartymensis* being very flat and short, while that of *C. jaroszi* is strongly vaulted. The only common characters of these pygidia are: the broad axis and the broad, flat and faintly differentiated border. The segmentation of pygidium, though in both species weakly marked, nevertheless is better pronounced in *C. shartymensis shartymensis*.

A very similar pygidium to that of *C. shartymensis shartymensis* is the one described in the present paper as *Cummingella jaroszi ?insulae* n. subsp. from Great Britain. This pygidium is also more vaulted than the pygidium from Shartymka. The pygidium illustrated by WEBER (1937, Pl. 6, Fig. 3), though included to *C. shartymensis* in the note under the title ("Pl. 6, Figs 1-4") cannot be assigned to this species. Besides, in the explanations to his Pl. 6 (p. 154) WEBER (1937) named it "*Phillipsia derbyensis* var. *kiritchenkoi*", while again, on Pl. 6, under the photographs, this form is named "*Ph. derbyensis* var. *shartymensis*". The specimen in question was not found by the present author in WEBER's collection. The pygidium tentatively assigned by WEBER (1937, Pl. 6, Fig. 5) to the considered species does not belong to *Cummingella*. CHLUPAČ (1966) placed *Cummingella shartymensis shartymensis* (WEBER, 1937) in the genus *Moschoglossis* GOLDRING, 1958. In the present author's opinion, as well as in the opinion of HAHN and HAHN (1968*c*), there is no reason for assignment of this form to the Tournaisian *Moschoglossis*, the latter being characterized by somewhat narrowing forwards glabella and the presence of an anterior border in front of the latter, what is not the case with *C. shartymensis shartymensis* (WEBER).

Stratigraphic and geographic range. — Namurian of USSR (the South Urals).

Cummingella shartymensis weberi n. subsp.

(Pl. VI, Figs 7, 10)

Phillipsia derbyensis; V. N. WEBER, Trilobity Alapaievskogo regiona (unpublished).

Holotype: Cephalon TML No. 30/4173; Pl. VI, Fig. 7.
Type locality: Outcrop 280a, Alapaievsk region, the Urals, USSR.
Type horizon: Namurian.
Derivation of the name: weberi — in honour of the late V. N. WEBER, author of the monograph on Soviet Carboniferous trilobites.

Diagnosis. — Cephalon narrow, broadly rounded anteriorly; anterior border covered and coalesced with glabella; glabella broader anteriorly than between palpebral lobes; eye comparatively small, with posterior tip at some distance from occipital furrow, its length (*exsag.*) equals one third of that of glabella; pygidium short, broad and flat, surrounded by poorly delimited, broad and weakly convex border; axis as broad as pleural lobe, bluntly ended, with 12 flat rings; 5—6 comparatively convex, broad ribs; cephalon scarcely and finely pitted, pygidium scarcely granulated.

Material. — One damaged cephalon, 3 pygidia from the grey limestone of the Alapaievsk region (outcrops 280, 280a).

Dimensions (in mm):

	TML 30/4173	TML 49/4173
Length of cephalon	9.0	—
Length of glabella	7.2	—
I Width of glabella	6.0	—
II Width of glabella	6.5	—
Length of pygidium	—	10.1
Width of pygidium	—	?14.0
Length of axis	—	8.2
Width of axis	—	6.0

Remarks. — The material of the new, above established species comes from MICHEEV's collection and was prepared by the late V. N. WEBER to publication. However, it was never published because of the death of this author.

The present author had only the specimens at her disposal, and has not seen the manuscript. WEBER's determination on the labels accompanying the specimens was "*Phillipsia derbyensis*" thus he has in mind a representative of *Cummingella* REED, 1942.

This subspecies, in its very weakly constricted glabella, strong, transverse compactness of the cephalon, weakly marked glabellar furrows as well as the length of eyes is very close to *C. shartymensis shartymensis* (WEBER, 1937). The resemblances occur also in pygidia of both forms, as they are broad, comparatively flat and short with the axis broader than pleural lobe. The differences between the nominate subspecies and *C. shartymensis weberi* n. subsp. concern: the glabella which is broader, pygidial axis which has one ring more, and pygidial ornamentation with a single row of conspicuous tubercles along a pleural lobe, in *Cummingella shartymensis weberi* n. subsp.

Stratigraphic and geographic range. — Type horizon and type locality.

Cummingella jaroszi n. sp.

Subspecies assigned: C. jaroszi jaroszi n. subsp., *C. jaroszi insulae* n. subsp.

Derivation of the name: jaroszi — in honour of the late Polish palaeontologist JAN JAROSZ, who first described the Carboniferous trilobites in Poland.

Stratigraphic and geographic range: Poland, Great Britain; Upper Tournaisian — Middle Viséan.

Remarks. — The main difference between *C. jaroszi* and other species of *Cummingella* REED, 1942 concerns the pygidium, which is very convex transversely and does not have the interpleural furrows marked on the border, the latter being very indistinctly pronounced.

Cummingella jaroszi jaroszi n. subsp.

(Pl. VIII, Figs 1-9; Text-figs 5*E*, *T* & 7*E*, *H*)

1913. *Phillipsia Derbiensis* MARTIN; J. JAROSZ, Fauna..., p. 162, Pl. 20, Figs 1-11.
non 1937. *Phillipsia derbyensis* var. *polonica* n. nom; V. N. WEBER, Kamennougolnye trilobity..., p. 56, Pl. 6, Figs 18, 19?
non 1937. *Phillipsia derbyensis* var. *belgica* n. nom.; V. N. WEBER, *Ibid.*, p. 55, Pl. 5, Fig. 49; Pl. 6, Figs 16, 17; Text-fig. 48.
non 1968. *Cummingella jonesi jonesi* (PORTLOCK); G. HAHN & R. HAHN, Cummingella..., p. 445.

Holotype: Cephalon ZNG Kr. No. AI-18/30, figured by JAROSZ (1913, Pl. 20, Fig. 2); here refigured on Pl. VIII, Fig. 5.
Type locality: Racławka river valley, Cracow region, Poland.
Type horizon: Upper Tournaisian.

Diagnosis. — Cephalon narrow, compact transversely without genal spines; glabella with indistinct glabellar furrows, constricted twice: opposite the posterior and anterior tips of eyes; pygidium with obscure segmentation, strongly vaulted transversely and longitudinally; ornamentation in form of punctures.

Material. — Numerous counterparts of the carapace, 2 thoraces with connected pygidia from the light-grey Upper Tournaisian limestone of Racławka river valley, Cracow region, Poland.

Dimensions (in mm):

	ZNG Kr. AI-18/							
	30	31	32	33	34	35	36	37
Length of cephalon . . .	8.3	6.2	5.0	6.5	—	—	—	—
Width of cephalon	?13.0	?10.0	—	—	—	—	—	—
Length of glabella	6.2	5.0	3.9	5.2	—	—	—	—
Width of glabella	5.0	3.9	3.0	4.0	—	—	—	—
Length of pygidium . . .	—	—	—	—	2.2	3.8	5.7	7.2
Width of pygidium	—	—	—	—	3.2	?6.0	7.8	9.4
Length of axis	—	—	—	—	1.9	3.0	4.9	6.1
Width of axis	—	—	—	—	1.0	1.9	3.1	3.9

Description. — Cephalon compact, narrow, broadly rounded frontally, without genal spines; glabella long, covering anterior border, with two constrictions marked: one at posterior tips of eyes, second — just in front of the anterior tips of eyes; glabella across the frontal lobe as broad as between the middle points of palpebral lobes; glabellar furrows marked only as dark lines, S_1 not reaching occipital furrow, S_4 occasionally visible as a dark spot far from axial furrow; basal lobe undifferentiated, occupying less than a third of the basal glabellar width; occipital ring flat, equally broad (*sag.*); palpebral lobe narrow, curved; eye large reaching back from S_4 to half a length (*exsag.*) of basal lobe; librigena with very weakly pointed angle, lateral border furrow shallow, border weakly convex. In longitudinal section, occipital ring flat, glabella flat, only frontally steeply sloping to vertical anterior border, the latter coalesced with glabella. In transverse section, glabella weakly convex, axial furrows shallow, palpebral lobes flat, visual lobes as well as librigenae sloping nearly vertically. Hypostoma unknown. Thorax of 9 segments; ends of pleurae rounded, articulating facets large. Pygidium broadly rounded, without a distinctly delimited border; axis broader than pleural lobe, faintly narrowing, with pointed tip; 12 flat rings; ring-furrows thin; 7 flat ribs, the last three of them very indistinctly pronounced; pleural furrows shallow, interpleural furrows extremely indistinct, dividing ribs into two equal bands; pleural and interpleural furrows not invading flat border, which is dif-

ferentiated only by ends of ribs; pygidial doublure slightly convex, reaching ventrally the axis. In longitudinal section, axis sloping backwards, postaxial region obliquely inclined. In transverse section, axis arched; the distal two-thirds of pleural lobes steeply sloping down. Ornamentation on the whole surface of exoskeleton in form of dense and fine punctures.

Individual variations. — Variability of this subspecies concerns: the number of the lateral glabellar furrows visible, which may be from 2 to 4; the swelling of the middle part of the glabella, just at the occipital furrow, which is present on two specimens (Pl. VIII, Fig. 5); the genal angle, which can be from rounded to pointed, the latter character being, however, connected with the growth stage, because the small cephala have it pointed, while the larger—rounded. The variability of pygidia is still more limited and concerns the axis, which sometimes is slightly narrower, and the postaxial region, which, usually sloping obliquelly down, is in several cases almost vertical.

Growth changes. — The smallest cranidium found (length 3.3 mm; Pl. VIII, Fig. 3) has a convex cylindrical glabella faintly constricted between the S_3; lateral glabellar furrows fine but incised; the extremities of occipital ring strongly lowered; the axial furrows deep; the glabella not covering a convex anterior border; the palpebral lobes narrow, but more steeply raising than on bigger cranidia; the surface of exoskeleton densely granulated.

The smallest pygidium known (length 2.2 mm; Pl. VIII, Fig. 7) has a semicircular shape, comparatively slender axis with 11 rings on it and a pointed tip; the pleural lobes are vaulted, with 7 convex ribs, each divided by a distinct interpleural furrow, pleural furrows deep, broad, the first one reaching nearly the margin of pygidium; the border differentiated by stronger vaulting of the pleural lobes as well as by the ending of the pleural furrows; the axis is highly vaulted transversely. In the next known growth stage of pygidium (length 4.0 mm; Pl. VIII, Fig. 8), the axis is still slender and has 11 rings, but the border is a continuation of the slope of the pleural lobes, and is here differentiated only by the ending of pleural furrows; transversely, the axis is much lower, than in the preceding pygidium; the pygidia representing the older growth stages, than these mentioned above, have already the characters typical for the adult ones (Pl. VIII, Fig. 9), the furrowing being, perhaps, more distinct than in the adult (Pl. VIII, Fig. 6). A librigena, smaller than the others was found, which though typical for *Cummingella jaroszi jaroszi* n. sp., n. subsp. has its genal angle distinctly ended by a short, pointed spine.

Remarks. — The same material of *Cummingella* as redescribed above, was previously investigated by JAROSZ (1913) and determined as *Phillipsia Derbiensis* MARTIN (= *Cummingella jonesi* PORTLOCK, 1843). The illustration given by JAROSZ (1913, Pl. 20, Figs 1-11) are inaccurate, as can be seen by comparing them with the photographs of the same specimens in the present paper (Pl. VIII, Figs 4-7). After publishing his paper, JAROSZ collected more material which was examined by the present author and enabled her to make some corrections. In JAROSZ' opinion, the specimens from the Racławka valley are conspecific with those described by WOODWARD (1883—1884). However, there exist very important differences between *C. jonesi jonesi* (PORTLOCK) (as this is the right determination of WOODWARD'S specimens) and the forms described by JAROSZ. They are: shape of glabella, which in Polish specimens is constricted twice, while in *C. jonesi jonesi* has an hour-glass shape, quite different character of pygidium with very obscure segmentation in *C. jaroszi jaroszi* n. sp., n. subsp. and with ribs passing onto the border in *C. jonesi jonesi.*

In the collected material of *Cummingella* from the Racławka valley, JAROSZ (1913) had distinguished two forms of the glabellae (A and B) and four forms of pygidia (a-d). However, the investigation of a larger material left no doubt that the differences between the particular

JAROSZ' „forms" are due to the growth stage or a state of the preservation, and all *Cummingella* specimens from Racławka valley represent one subspecies. Following JAROSZ, WEBER (1937) gave the new names to these "forms" — "*polonica*" and "*belgica*" — and assigned to them some material from the USSR and Belgium.

Stratigraphic and geographic range. — Upper Tournaisian of Cracow region, Poland.

Cummingella jaroszi insulae n. subsp.

(Pl. VIII, Fig. 11; Text-fig. 5 *O*)

Holotype: Cephalon, BM No. I 2605a; Pl. VIII, Fig. 11.
Type locality: Wetton, North Staffordshire, Great Britain.
Type horizon: Viséan (D_1).
Derivation of the name: insulae — found on the island (British Isles).

Diagnosis. — Cephalon compact; cephalic border weakly convex. In transverse section eyes do not stand out from the uniform arch of cephalon; glabella short and broad; glabellar furrows obsolete; occipital furrow shallow.

Material. — One (holotype) cephalon from the Viséan (D_1) of Wetton, N. Staffordshire, 1 cephalon from Wetten, Derbyshire (BM I 1048a), 1 cranidium from Bolland or Settle (BM I 3929), 1 cephalon from an unknown locality (BM, no number). All in light grey limestone.

Dimensions (in mm):

	BM I 2605a	BM I 1048a
Length of cephalon . . .	7.8	6.0
Width of cephalon	8.5	?6.6
Length of glabella	6.5	4.8
I Width of glabella . . .	5.1	4.0
II Width of glabella . . .	5.3	4.3

Description. — Cephalon very compact; lateral border faintly convex but distinctly delimited; glabella broad, slightly broader at front than between palpebral lobes; lateral furrows obsolete, basal lobe not developed; occipital furrow shallow; occipital ring flat, broad (*sag.*); palpebral lobe narrow (*tr.*); librigena steeply sloping without genal spine; eye longitudinally weakly convex, comparatively long, reaching to S_3. In longitudinal section, occipital ring flat, glabella strongly bent down in the front, reaching but not overhanging weakly convex border, which is situated nearly vertically. In transverse section, cephalon uniformly and strongly arched; eyes do not stand out beyond the arch of cephalon. Surface of exoskeleton smooth. Hypostoma, thorax and pygidium unknown.

Remarks. — The here described subspecies differs from *Cummingella jaroszi jaroszi* n. sp., n. subsp. in having a broader and shorter glabella, and eyes less convex longitudinally so that they do not stand out beyond the arch of the cephalon. Eyes so closely attached to the glabella as in *C. jaroszi insulae* n. subsp. are found in *C. jonesi jonesi* (PORTLOCK), but in the latter subspecies they are longer than in *C. jaroszi insulae*, reaching to S_4. The glabella in the subspecies above described is also shorter and its frontal lobe more convex transversely than in *C. jonesi jonesi*.

Both subspecies of *C. jaroszi*, the nominate subspecies as well as *C. jaroszi insulae* have in common their glabellae broadest across the frontal lobe, what is never found in any other *Cummingella* species.

Cummingella ?jaroszi insulae n. subsp.

(Pl. VIII. Fig. 14; Text-fig. 5*N*)

Material. — One pygidium (BM No. I 2605b) from the light grey limestone of Wetton, N. Staffordshire, Great Britain.

Dimensions (in mm):

	BM I 2605b
Length of pygidium . . .	7.2
Width of pygidium	9.0
Length of axis	6.0
Width of axis	4.0

Description. — Pygidium parabolic, strongly vaulted transversely as well as longitudinally; border flat, broad, distinctly delimited by border furrow; axis broad, reaching border furrow with 11 flat rings; ring-furrows thin, undulated; 7 flat ribs not passing onto border; pleural furrows distinct, interpleural furrows weak, first one passing onto border. Exoskeleton poorly preserved but with traces of granulation.

Remarks. — The pygidium above described comes from the same bed as the cephalon of *Cummingella jaroszi insulae* n. subsp. It is also strongly vaulted like the cephalon of the subspecies mentioned, and in its vaultness shows some resemblances to the pygidium of *C. jaroszi jaroszi* from the Cracow region, Poland. The latter has not such a strongly differentiated border, and has a slightly narrower axis, as well as weaker pleural and interpleural furrows, the ring-furrows being not so strongly undulated as in the form described above.

Together with the pygidium here described and the cephalon of *C. jaroszi insulae* n. subsp., there was found another pygidium, however distinctly different. Being similarly strongly vaulted, it has a shorter axis with 9 rings (thus less than in any other known *Cummingella* species). It lacks a border and the pleural furrows are extremely faint.

Therefore, there exists some doubt, as to which of the two pygidia — if any — could be assigned with *C. jaroszi insulae*. In the present author's opinion, the pygidium last mentioned shows in its short axis and weakness of furrows more resemblance to *Bollandia* REED, 1942 than to *Cummingella* REED, 1942, thus more probably the pygidium above described could be suggested as a counterpart of *C. jaroszi insulae*.

Cummingella gapeevi (WEBER, 1933)

(Pl. V, Figs 7*a*, *b*)

1933. *Phillipsia derbyensis* var. *gapeevi* n. nov.; V. N. WEBER, Trilobity..., p. 18, Pl. 1, Figs 1, 2.
1937. *Phillipsia derbyensis* var. *gapeevi* WEB.; V. N. WEBER, Kamennougolnye trilobity..., p. 56, Pl. 6, Figs 20, 22.

Neotype: Entire specimen, TML No. 6/3139, illustrated by WEBER (1933, Pl. 1, Fig. 2); refigured here on Pl. V, Figs 7*a*, 7*b*.

Type locality: Beshevo, on the right side of the Kalmiusa river, Donets Basin, USSR.

Type horizon: Lower Namurian.

Diagnosis. — Cephalon narrow, surrounded by a narrow, convex border; anterior border horizontally situated, in front of glabella; the latter broadest at the base, with deeply cut off basal lobes, S_2 and S_3 weakly marked, short; eye comparatively small; pygidium subsemicircular, vaulted transversely and longitudinally with broad, convex border; axis comparatively narrow, high, with 13 convex rings and 9 convex ribs.

Remarks. — The original specimen (TML No. 50/3139) indicated by WEBER (1937, Pl. 6, Fig. 20) is lost, thus the neotype is here established, chosen from the specimens of the same locality as WEBER'S holotype, and illustrated by this author (1933, Pl. 1, Fig. 2).

This species was also found in the older, Viséan beds of the Urals (WEBER, 1937, p. 56, Figs 21, 22).

Cummingella gapeevi presents a morphologically conservative structure of cephalon, which is strongly in contrast to its late stratigraphic range. The anterior border is here distinctly delimited from the glabella and situated in front of it, instead of being vertical and usually coalescent with the glabella, as in the majority of the representatives of *Cummingella*. Also, usually, the glabella in *Cummingella* is as broad, or nearly so, frontally as it is at the base. In *C. gapeevi*, it is narrower frontally. A basically similar structure of cephalon is found in the ontogenetically young individuals of *Cummingella* (see pp. 64, 69).

A similarly developed anterior border occurs in the here described singular and fragmentary cephalon of *Cummingella* sp. *2* from Eire (see p. 74).

Stratigraphic and geographic range. — Upper Viséan-Lower Namurian of USSR (the South Urals, Donets Basin).

Cummingella polonica (WEBER, 1937)

(Pl. VIII, Figs 10, 12; Text-fig. 5*H*)

1937. *Phillipsia derbyensis* var. *polonica* n. nom.; V. N. WEBER, Kamennougolnye trilobity..., p. 56, Pl. 6, Fig. 18.
1937. *Phillipsia derbyensis* var. *belgica* n. nom.; V. N. WEBER, *Ibid.*, p. 55, Pl. 6, Fig. 17.
?1937. *Phillipsia derbyensis* var. *belgica* n. nom.; V. N. WEBER, *Ibid.*, p. 55, Pl. 6, Fig. 16.
1937. *Phillipsia derbyensis* MART. var.?; V. N. WEBER, *Ibid.*, p. 55, Pl. 6, Fig. 15.

Holotype: Pygidium, TML No. 1478/5107, figured by WEBER (1937, Pl. 6, Fig. 18); here refigured on Pl. X, Fig. 10.
Type locality: Right side of Usuila river, the South Urals, USSR.
Type horizon: Lower Viséan.

Diagnosis. — Pygidium broad, short, somewhat vaulted transversely, with broad, slightly convex border; axis comparatively high and narrow, with 12 (?) rings; 8 convex ribs reaching border, divided into equally broad bands; cephalon with anterior border vertical, coalesced with glabella; basal lobes overhanging posteriorly occipital furrow.

Remarks. — Though WEBER (1937) has included into the synonymy of "*Phillipsia derbyensis* var. *polonica*" a part of Polish material described by JAROSZ (1913, Pl. 20, Figs 1-11) the latter has nothing in common with the specimens from the South Urals and is described in the present paper under the name *Cummingella jaroszi jaroszi* n. subsp. From the locality of the Sukhaia river, WEBER (1937) has described pygidia and cranidia of *Cummingella* REED, 1942. The pygidia, which he assigned to "*Ph. derbyensis* var. *belgica*" WEBER, 1937, are conspecific with these from the Usuila river considered here as *C. polonica* (WEBER, 1937). The cranidia were described by WEBER (1937) under the name "*Ph. derbyensis* MART. var.?". As no other representative of *Cummingella* was present in the locality of the Sukhaia river, it seems to be reasonable to regard them as belonging to the same species *C. polonica* (WEBER, 1937). These cranidia differ from many *Cummingella* species in having basal lobes strongly overhanging the occipital furrow. This character is also distinct in the *C. carringtonensis* (ETHERIDGE in WOODWARD, 1883).

The only difference between the holotype and the specimen (pygidium) from the Sukhaia river (WEBER, 1937, Pl. 6, Fig. 17) is the greater width and depth of the first two pairs of the pleural and interpleural furrows in the holotype pygidium. The latter is also about three times

larger than the other, thus the difference can easily be explained by the individual age. Additionally, some of pygidia of *C. polonica* from the Sukhaia river are distinctly granulated, while others lack any ornamentation, similarly as does the holotype pygidium from the Usuila river. This is, however, caused by the different state of preservation.

WEBER (1937), while describing *C. polonica*, tentatively assigned to it the pygidium (TML 1479/5107) from the locality of the Musagodka river, the South Urals. This pygidium most probably represents *C. shartymensis* (WEBER, 1937), but this latter species is known to be Lower Namurian, while *C. polonica* is of Viséan age.

The pygidia of *Cummingella polonica* differ from other *Cummingella* species in having a distinctly delimited, somewhat convex border and convex ribs, which do not pass onto the border. In this respect, they are most close to the pygidia of *C. carringtonensis* where also a border is delimited, but much flatter. Several pygidia, nearly identical with these from the Sukhaia river, differing only slightly in their finer ornamentation, were found in the Viséan deposits of Narrowdale, Staffordshire, Great Britain (BM: In 36811, I 27942) and Derbyshire (BM I 4070), thus the species has a very large geographic range.

Stratigraphic and geographic range. — Lower Viséan-?Lower Namurian of USSR (the Urals), Upper Viséan of Great Britain.

?Cummingella belgica (WEBER, 1937)

(Pl. VIII, Fig. 13)

1937. *Phillipsia derbyensis* var. *belgica* n. nom.; V. N. WEBER, Kamennougolnye trilobity..., p. 52, Pl. 5, Fig. 49.

Remarks. — WEBER (1937) in his description of "*Phillipsia derbyensis* var. *belgica*" WEBER 1937 did not indicate a holotype. Moreover, he described (1937, p. 52, foot note Pl. 5, Fig. 49) separately the two internal moulds of nearly entire specimens coming from DE KONINCK's collection, which are now stored in the Tshernyshev's Museum, Leningrad. In this description he put DE KONINCK's "*Phillipsia Derbiensis*" (DE KONINCK, 1842—1844, Pl. 53, Fig. 2) in the synonymy with a question mark. Several pages further, WEBER (1937, p. 55) gave the description of "*Ph. derbyensis* var. *belgica*", based on the Viséan material of pygidia from the Sukhaia river (these pygidia are in the present paper assigned to *Cummingella polonica* (WEBER, 1937)). Here, in the synonymy WEBER (1937) placed DE KONINCK's specimen (DE KONINCK, 1842—44, Pl. 53, Fig. 2), and included into his description also the Belgian specimens (WEBER, 1937, Pl. 5, Fig. 49), from the TML collection, whose assignment together with DE KONINCK's original he had previously (p. 52) considered as questionable.

According to the present author, the unclearness of the status of "*Ph. derbyensis* var. *belgica*" calls for abandoning this name. Further complications are caused by two facts: 1) the Belgian specimens which are stored in Leningrad are not conspecific with those coming from the Urals; 2) they most probably should be assigned to another genus (may be *Piltonia* GOLDRING, 1955 or *Eocyphinium* REED, 1942). Unfortunately, the originals of DE KONINCK's paper (1842—44) are lost. However, the present author had at her disposal new material of Carboniferous trilobites (Tournaisian) from Neufvilles (Carrière du Clypot), Belgium, which is housed in the Royal Museum of Natural History in Brussels. In this material occur the specimens of *Cummingella* REED, 1942, which are conspecific with DE KONINCK's "*Phillipsia Derbiensis*" (they are in the present paper described as *Cummingella brevicauda* (GOLDRING, 1958). The Belgian specimen illustrated by WEBER (1937, Pl. 5, Fig. 49) is, by no means, conspecific with those latter.

?Cummingella sp. 1

(Pl. VI, Fig. 9; Text-fig. 5*D*)

Material. — One cephalon from the unknown locality, Great Britain (BM No. 59700).

Description. — Cephalon broadly rounded frontally, very compact; glabella squat, somewhat constricted, as broad as long; glabellar furrows very weakly pronounced, basal lobe completely flat; in front of S_3 glabella very short; palpebral lobe and fixigena very narrow; eye long, large; genal angle rounded. In longitudinal section, anterior border covered completely by glabella and inclined backwards, glabella from about its mid-length sloping rapidly forwards, being in dorsal view extremely short. In transverse section, cephalon very strongly arched, glabella flat, eyes do not stand out from the arch of cephalon, librigenae sloping nearly perpendicularly downwards. Ornamentation of glabella in form of weakly raised, anastomosing lines.

Remarks. — The specimen described above has long, flatly situated eyes, very narrow and long palpebral lobes, narrow fixigenae and constricted glabella as all the representatives of *Cummingella*. But, it differs from all known species within the latter genus in comparatively short, rapidly sloping forwards glabella, unusually strong transverse and longitudinal vaulting of cephalon and at last in a character of ornamentation. These differences makes it close to *Bollandia* REED, 1948, where however the glabella is not so flat, basal lobes are comparatively well developed and palpebral lobes are short but broader.

Cummingella sp. 2

(Pl. VI, Fig. 6; Text-fig. 5*B*)

Material. — One damaged cephalon from the light grey limestone (C_1-C_2) of Blackrock, Corck, Eire.

Dimensions (in mm):

	BM 58864a
Length of cephalon . . .	8.0
Length of glabella	7.0
I Width of glabella . . .	5.3
II Width of glabella . . .	4.9

Description. — Cephalon broadly rounded frontally; lateral border distinctly delimited, convex, anterior border in front of glabella, the latter contracted between S_3, narrower across frontal lobe than between palpebral lobes; 4 pairs of shallow glabellar furrows, S_1 not reaching occipital furrow, S_4 in the form of a dark spot, far from axial furrow; basal lobe unswollen; occipital furrow shallow, deepened at extremities, occipital ring comparatively flat, band-like; antenuary pit marked in the front part of axial furrow; palpebral lobe elongate, narrow, anterior branch of facial suture slightly diverging from axial furrow; eye moderately long, reaching from about half of L_1 to S_3. In longitudinal section, occipital ring weakly convex, glabella gently sloping forwards from S_1, reaching, but not covering anterior border. In transverse section, glabella very flat, palpebral lobes faintly convex, eyes not standing out from the low arch of cephalon. Exoskeleton punctured. Hypostoma, thorax and pygidium unknown.

Remarks. — The cephalon above described has all the main diagnostic characters of *Cummingella*: contraction of glabella, narrow, long palpebral lobes and large eyes. In some respects it reminds one, however, of the representatives of *Phillipsia*, having the glabella narrower across the frontal lobe than between the palpebral lobes, a somewhat divergent anterior branch of facial suture and an anterior border placed partly in front of the glabella. Such a position of anterior border is found in some representatives of *Cummingella*, however, comparatively rarely. It is known in *C. brevicauda* (GOLDRING, 1958) and *C. gapeevi* (WEBER, 1933), but these species differ in all other characters from the cephalon here described. It should be emphasized that such a position of the anterior border is found in the known young forms of some other species of *Cummingella* (p. 64) but it disappears during the ontogenetic development.

Some similarity exists between the here described cephalon and the cephala of *Moschoglossis* GOLDRING, 1958. However, in the only representative of this latter genus, where the cephalon is known, the glabella is more slender, and it covers less of the anterior border. Also the anterior branches of facial sutures are more divergent in the *Moschoglossis*.

Genus **WEBERIPHILLIPSIA** n. gen.

Type species: Phillipsia kirgisica WEBER, 1932.

Synonyms:
1918. *Phillipsia*; J. MITCHELL. The Carboniferous..., p. 444.
1937. *Phillipsia*; V. N. WEBER, Kamennougolnye trilobity..., pp. 46, 51.

Species assigned: W. kirgisica (WEBER, 1932), *W. kuzneciana* (WEBER, 1937), *W. inostranzewi* (TOLMACHOV, 1924), *W. collinsi* (MITCHELL, 1918).

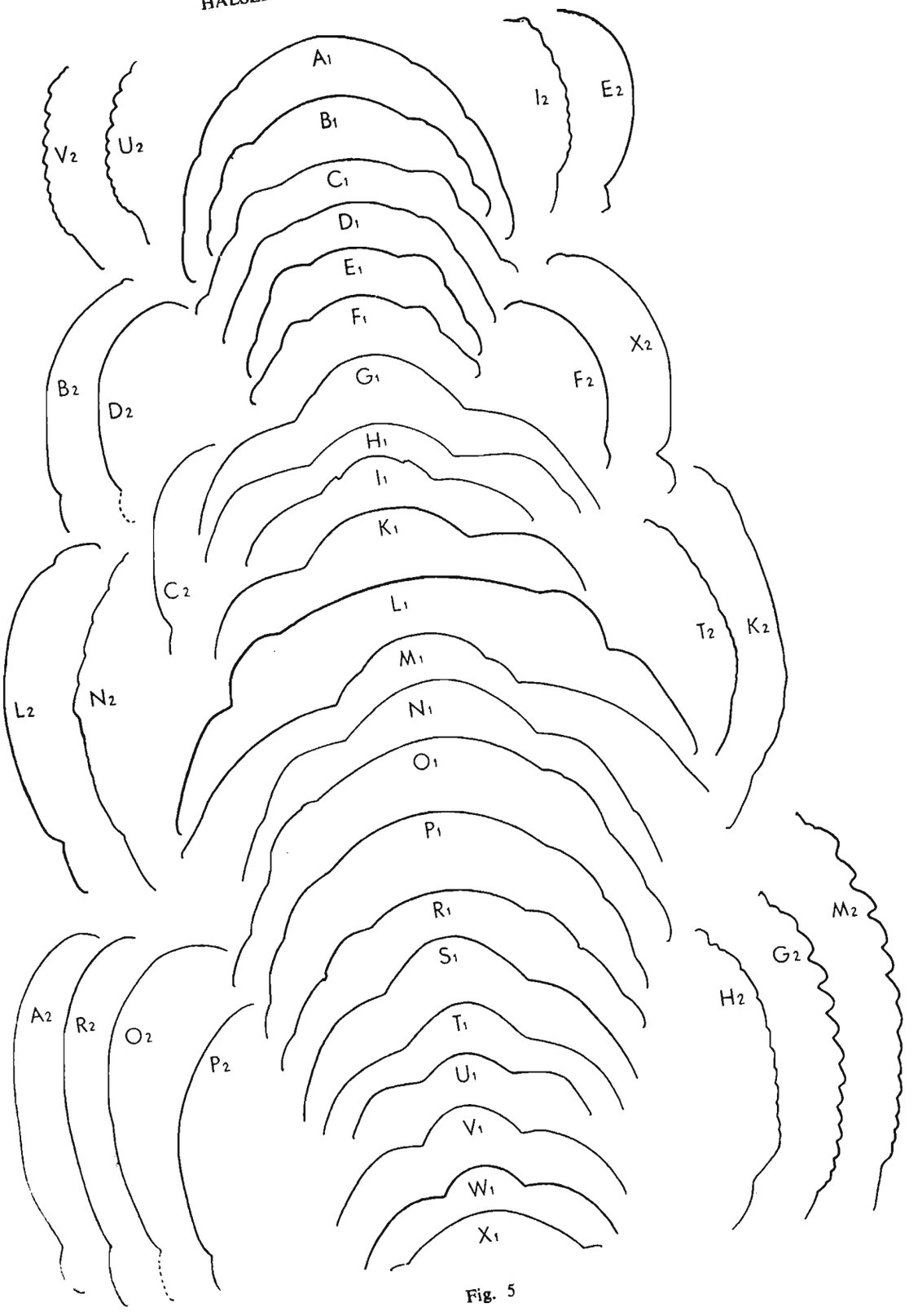
Stratigraphic and geographic range: Tournaisian of Asia and Australia.

Derivation of the name: Weberiphillipsia — in honour of the late, distinguished Russian palaeontologist VLADIMIR N. WEBER.

Diagnosis. — Cephalon broadly rounded frontally with long genal spines; anterior border in front of glabella, horizontally placed; no preglabellar field; glabella distinctly constricted, somewhat narrower frontally than between eyes; eye long; pygidium comparatively short and broad with distinctly separated border, pygidial axis very slender, with 12—16 rings; anterior bands of ribs broader than posterior ones and invading the border.

Remarks. — *Weberiphillipsia* n. gen. is similar to the genus *Phillipsia* PORTLOCK, 1843 in the shape of its cephalon provided with comparatively long genal spines as well as in the presence of the anterior border in front of the glabella. However, comparatively short pygidium and a distinctly constricted glabella differ *Weberiphillipsia* very strongly from all the representatives of the subfamily Phillipsiinae OEHLERT, 1886. In the structure of pygidium *Weberiphillipsia* strongly resembles the representatives of Cyrtosymbolinae HUPÉ, 1953, while the cephalon, devoid of the preglabellar field with its shortened and distinctly constricted glabella is distant from the Cyrtosymbolinae and is very much like that of the representatives of *Cummingella* REED, 1942. It should be emphasized here that e.g. *Cummingella jonesi* (PORTLOCK, 1843) displays a pygidium with ribs invading the border, similarly as it is the case in *Weberiphillipsia* species.

Nevertheless, the two compared genera are distinctly separated, though very close, and the differences between them are listed below.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P2

Fig. 5

Cummingella REED, 1942	*Weberiphillipsia* n. gen.
Cephalic border covered anteriorly by glabella.	Cephalic border well in front of glabella.
Glabella constricted, usually as broad anteriorly as between the eyes.	Glabella constricted, narrower frontally than between the eyes.
Pygidium vaulted transversely.	Pygidium flat.
Pygidial axis broad.	Pygidial axis narrow.

Weberiphillipsia kirgisica (WEBER, 1932)

(Pl. IV, Figs 3, 4, 8, 10)

1932. *Phillipsia kirgisica* n. spec.; V. N. WEBER, Trilobity..., p. 44, Pl. 3, Figs 38-50.
1937. *Phillipsia kirgisica* WEBER; V. N. WEBER, Kamennougolnye trilobity..., p. 51, Pl. 5, Figs 42-46.
1937. *Phillipsia kirgisica* var.?; V. N. WEBER, *Ibid.*, p. 51, Pl. 5, Fig. 48.

Holotype: Pygidium, TML No. 821/349, figured by WEBER (1932, Pl. 3, Fig. 50); here refigured on Pl. IV, Fig. 3.
Type locality: Outcrop 17 (WEBER's collection), Malyi Karatau range, USSR.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium with broad, flat border; border furrow distinct; ribs passing onto border, where marked in form of the elongate elevations; posterior bands of ribs very narrow; glabella with very deep S_1; anterior border convex in front of glabella.

Remarks. — In WEBER's collection (1932, 1937) occur the specimens from many localities in Central Asia, which have always very well marked specifical characters in form of the elevations of the ribs on the border. However, these prolongations of ribs are more distinctly marked in the specimens from sandy or argillaceous limestones than in those coming from the pure limestone.

Fig. 5

A *Cummingella jonesi jonesi* (PORTLOCK), holotype specimen, cephalon (GSM 63037), Clonfeacle, Eire, Viséan; B *Cummingella* sp. *2*, cephalon (BM 58864a), Black Rock, Eire, Upper Tournaisian or Lower Viséan; C *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD), cephalon (HMG A 3704), Balladoole, Isle of Man, Viséan; D ?*Cummingella* sp. *1*, cephalon (BM 59700), unknown locality; E *C. jaroszi jaroszi* n. sp., n. subsp., cephalon (ZNG Kr. O. 31), Racławka, Poland, Tournaisian; F *C. jonesi orleiensis* n. subsp., holotype specimen, cephalon (ZNG Kr. Cz. 1), Orlej, Poland, ?Namurian; G *C. jonesi jonesi* (PORTLOCK), pygidium (BM I 3127), Furness, Gt. Britain, Viséan; H *C. polonica* (WEBER), pygidium (BM 27942), Narrowdale, Gt. Britain, Viséan; I *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD), lectotype, pygidium (GSM 103111), Longnor, Gt. Britain, Viséan; K *C. brevicauda* (GOLDRING), pygidium (IRB 18.741.88), Neufvilles, Belgium, Tournaisian; L *C. brevicauda* (Goldring), cephalon (IRB 18.741.71), Neufvilles, Belgium, Tournaisian; M *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD), pygidium (BM I 5798), Falls Brew, Gt. Britain, Viséan; N *C. ?jaroszi insulae* n. sp., n. subsp., pygidium (BM I 2605b), Wetton, Gt. Britain, Viséan; O *C. jaroszi insulae* n. sp., n. subsp., holotype, cephalon (BM I 2605a), Wetton, Gt. Britain, Viséan; P *C. jonesi jonesi* (PORTLOCK), cephalon (BM 59839), ?Clonfeacle, Eire, ?Viséan; R *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD), cephalon (BM I7507), Bolland, Gt. Britain, Viséan, S *C. jonesi jonesi* (PORTLOCK), lectotype specimen, pygidium (GSM 63037), Clonfeacle, Eire, Viséan; T *Cummingella jaroszi jaroszi* n. sp., n. subsp., pygidium (ZNG Kr. O. 37), Racławka, Poland, Tournaisian; U *C. carringtonensis carringtonensis* (ETHERIDGE in WOODWARD), pygidium (BM 36805), Narrowdale, Gt. Britain, Viséan; V *C. jonesi laticaudata* (WOODWARD), lectotype, pygidium (BM 875b), Bolland, Gt. Britain, Viséan, W *C. jonesi orleiensis* n. subsp., holotype specimen, pygidium (ZNG Kr. Cz. 1), Orlej, Poland, ?Namurian; X *C. jonesi laticaudata* (WOODWARD), cranidium (BM 45036), Bolland, Gt. Britain, Viséan. Not to the scale.
Transverse sections marked with , *1* longitudinal — with *2*

In this species is observed a comparatively large variability in the number of the axial rings, which is 12 to 16.

The pygidium described by WEBER as "*Phillipsia kirgisica* var.?" (WEBER, 1937, Pl. 5, Fig. 48) should be assigned together with the other representatives of the species. The regularity in the axial ornamentation, which was the cause for its separation, seems to be unimportant, moreover, it is found in some other specimens.

Stratigraphic and geographic range. — Upper Tournaisian of USSR (Central Asia).

Weberiphillipsia kuzneciana (WEBER, 1937)

(Pl. IV, Figs 1, 2, 5, 6)

1937. *Phillipsia laticaudata* var. *kuzneciana* n. var.; V. N. WEBER, Kamennougolnye trilobity..., p. 46, Pl. 5, Figs 21-23.
?1937. *Phillipsia laticaudata* var. *amarginata* n. var.; V. N. WEBER, *Ibid.*, p. 46, Pl. 5, Figs 27, 28.
?1937. *Phillipsia laticaudata* var. *kuzneciana*? *(amarginata?)*; V. N. WEBER, *Ibid.*, p. 46, Pl. 5, Figs 24, 25.

Holotype: Pygidium, TML No. 1014/5107, figured by WEBER (1937, Pl. 5, Fig. 21); here refigured on Pl. IV, Fig. 1.
Type locality: Left side of Tomi river, mouth of Mozjukha river, Kuznetsk Basin, USSR.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium with slender axis of 12 rings; 9 ribs, very finely marked on border; glabella comparatively short, with narrow, flat anterior border.

Remarks. — WEBER (1937) assigned this form to the "*Phillipsia laticaudata*" WOODWARD, 1883 as its subspecies. "*Phillipsia laticaudata*" is here regarded as a subspecies of *Cummingella jonesi* (PORTLOCK, 1843).

In fact, the pygidium of *Weberiphillipsia kuzneciana* (WEBER, 1937) is similar to that of *Cummingella jonesi laticaudata* (as well as to that of *C. jonesi jonesi*), it has however much more slender axis, having also more distinctly separated border. Nevertheless, the cranidium of *W. kuzneciana*, with flat border in front of glabella, as well as the difference in pygidium, decided that "*Ph. laticaudata* var. *kuzneciana*" should be assigned to *Weberiphillipsia*.

In WEBER's paper (1937), there are distinguished 3 varietates within "*Phillipsia laticaudata*": "*kuzneciana*", "*amarginata*", "*convexa*", based on pygidia. The latter, maybe, represents the genus *Cummingella* REED, 1942, thus is not considered here. The two other forms are certainly conspecific, as the differences between them are not significant. Perhaps, they may represent two subspecies of *Weberiphillipsia kuzneciana*, but as specimens in question are of different size, it is difficult to decide, which character is due to the stage of the individual development, and which may have a subspecific value. With both groups of pygidia, cranidia were found which should be assigned to one species. Thus, for the time being, the present author assigns the whole material above mentioned to *Weberiphillipsia kuzneciana* (WEBER, 1937).

Stratigraphic and geographic range. — Upper Tournaisian-Lower Viséan of USSR (the Kuznetsk Basin).

Subfamily PHILLIPSIINAE OEHLERT, 1884

Genus **PHILLIPSIA** PORTLOCK, 1843

Type species: Phillipsia kellyi PORTLOCK, 1843.

Synonym: 1836. *Asaphus*; J. PHILLIPS, Geology..., p. 240.

Species assigned: Phillipsia kellyi PORTLOCK, 1843, *Ph. gemmulifera* (PHILLIPS, 1836), *Ph. truncatula* (PHILLIPS, 1836), *Ph. ornata ornata* PORTLOCK, 1843, *Ph. ornata belgica* n. subsp., *Ph. ornata kumakensis* n. subsp., *Ph. glabra* WEBER, 1937, *Ph. moelleri* n. sp., *Ph. magnoculata* n. sp.

Stratigraphic and geographic range: Tournaisian — ?Lower Viséan of Europe (Eire, Great Britain, Belgium, Poland, USSR — the Urals).

Diagnosis. — Cephalon with moderately long or long, flat genal spines; anterior border in front of glabella; preglabellar field usually absent; glabella very weakly constricted, always narrower frontally than across the base; 3—4 pairs of glabellar furrows present; occipital ring broad (*exsag.*) at extremities; palpebral lobes short (*exsag.*,) curved; anterior branch of facial suture long, divergent; hypostoma long, triangular, with a very convex median body; thorax of 9 segments; pygidium vaulted transversely, long, to very long, without border but with concave of somewhat flattened, narrow marginal rim, axis long, slender, less than a third of total pygidial width, weakly narrowing backwards; 17—22 well pronounced, narrow rings; 13—18 convex ribs, directed obliquelly backwards and reaching nearly to the edge of pygidium, composed nearly exclusively of anterior bands, posterior ones forming only the posterior slopes of ribs; cephalic and pygidial doublure comparatively narrow and flat; ornamentation granular, always present on pygidium; tubercles on axis very regularly arranged into longitudinal rows (4—8), on ribs tubercles arranged along interpleural furrows; cephala from smooth to coarsely granulated; hypostoma covered with very faintly raised longitudinal, papillar-like ridges.

Characters of specific and subspecific value: structure of anterior border and preglabellar region; length of genal spines; height of eyes; proportions of pygidium, degree of its transverse vaulting; structure of marginal rim; ornamentation.

Remarks. — Until WELLER (1936) and STUBBLEFIELD (1952) elucidated the status of *Phillipsia* PORTLOCK, 1843, the majority of the European and North American trilobites was assigned to this genus. It was thought to be a very broad unit. However, the revision of *Phillipsia*, undertaken here by the present author, allows her to state that, in fact, *Phillipsia* forms a comparatively small and weakly variable group of species, with very well distinguishable generic characters. It is limited geographically to the territory of Europe and is almost exclusively Tournaisian, only some rare representatives being questionably reported from the Lower Viséan deposits.

Though *Phillipsia* is a typical representative of the superfamily Proetacea SALTER, 1846, its ancestors cannot be, at present, indicated without any doubt. The very peculiar, long and practically border-less pygidium, distinguishes this genus from any known Devonian proetid group. A similar pygidium is found within Dechenellinae PŘIBYL, 1946, however, the structure of the cephalon is different in this subfamily, and it seems improbable that it could have given rise to *Phillipsia*. Taking into account the structure of cephalon, it seems to be more reasonable to look for the ancestors within the Cyrtosymbolinae HUPÉ, 1953, namely in the *Phillibole* RICHTER & RICHTER, 1937. In the present author's opinion, *Phillipsia* cannot be regarded as a central, ancestral form, from which all the remaining late Palaeozoic genera evolved, but represents rather a specialized unit. Taking into account the structure of the cephala, three groups of species can be differentiated within *Phillipsia* PORTLOCK, 1843. They are:

1) group of *Phillipsia kellyi* PORTLOCK, 1843, with *Ph. gemmulifera* (PHILLIPS, 1836) and *Ph. glabra* WEBER, 1937 — glabella in these species has comparatively weakly developed glabellar furrows, is convex frontally and partly covers broad border furrow, the anterior border being practically reduced to a very narrow, sharp edge of cephalon; cephalic ornamentation is here scarce and fine;
2) group of *Phillipsia ornata* PORTLOCK, 1843 with *Ph. truncatula* (PHILLIPS, 1836) — glabella with well incised furrows, flat frontally, preglabellar region flat, without border furrow, anterior border weakly convex, edge of cephalon rounded, ornamentation dense, fine;
3) group of *Phillipsia moelleri* n. sp. with *Ph. magnoculata* n. sp. — glabella convex frontally, with deep furrows, anterior border comparatively broad, placed nearly vertically, separated from glabella by a kind of concave preglabellar field, edge of cephalon being highly rised.

The group of *Ph. moelleri*, with usually well pronounced ornamentation seems to be close to *Piltonia* GOLDRING, 1955 and *Eocyphinium* REED, 1942, where all essential characters mentioned above can be detected, however much more strongly developed. The group of *Ph. ornata* seems to resemble somewhat *Paladin* WELLER, 1936 where also the same structures can be found, but in a somewhat changed form.

Phillipsia kellyi PORTLOCK, 1843

(Pl. X, Figs 7, 11*a, b*; Text-fig. 6*G, H*)

1843. *Phillipsia kellyi* PORTLOCK; J. E. PORTLOCK, Report..., p. 307, Pl. 11, Fig. 1.
1937. *Phillipsia truncatula* var. *pustulata* DE KON. (partim;) V. N. WEBER, Kamennougolnye trilobity..., Pl. 4, Figs 32, 33.

Holotype: Entire specimen, GSM No. 63045, figured by PORTLOCK (1843, Pl. 11, Fig. 1); here refigured on Pl. X, Fig. 11*a, b*.

Type locality: Ardpodien, Kildare, Eire.
Type horizon: Upper Tournaisian.

Diagnosis. — Cephalon with sharp edge and short genal spines; glabella gently tapering forwards, very slightly constricted; frontal lobe convex, covering border furrow; 3 pairs of glabellar furrows faintly marked, eyes weakly convex; pygidium long and narrow, surrounded by narrow, flat margin; axis with 17 rings; 13 ribs on pleural lobe; cephalon finely and scarcely granulated with some additional coarser granules on librigena; pygidium with conspicuous, regularly arranged tubercles.

Remarks. — WEBER (1937) in his description of "*Phillipsia truncatula* var. *pustulata* DE KONINCK non SCHLOTHEIM" included some groups of specimens from different localities, which in the present author's opinion, are not conspecific. Among others there are three pygidia from the North Urals and Novaya Zemla (TML Nos. 861/5107, 862/5107, 867/5107; WEBER, 1937, Pl. 4, Figs 32, 33) which in the present author's opinion should be assigned to *Ph. kellyi* PORTLOCK, 1843, because they have comparatively faint transverse vaultness, 17 rings on the axis, as well as a flat, narrow margin surrounding the pygidium. On the label accompanying the two of the pygidia mentioned, the locality Sosva river, the North Urals, is given. However, other specimens from this locality (WEBER, 1937, Pl. 4, Figs 27, 28, 35) are not conspecific with these pygidia and are here assigned to *Ph. moelleri* n. sp. They are, moreover, preserved in a different kind of matrix, than this in which *Ph. moelleri* n. sp. is found, which is a dark grey, coarsely crystalline limestone. The pygidia here assigned to *Ph. kellyi* are embedded in a yellowish and somewhat argillaceous limestone. So, if the above mentioned specimens come from the same locality, they most probably occurred in different beds.

Stratigraphic and geographic range. — Tournaisian of Eire (Kildare), Great Britain (Yorkshire, Lancashire), USSR (the North Urals, Novaya Zemla).

Phillipsia gemmulifera (PHILLIPS, 1836)

(Pl. X, Figs 5, 9, 12, 14; Text-fig. 6*C, K, N*)

1836. *Asaphus gemmuliferus* PHIL.; J. PHILLIPS, Geology..., p. 240, Pl. 22, Fig. 11.
1883—1884. *Phillipsia gemmulifera* PHILLIPS; H. WOODWARD, A Monograph..., p. 17, Pl. 3, Figs 4, 5, 8.
1909. *Phillipsia gemmulifera* PHILLIPS; J. JAROSZ, Fauna wapienia..., p. 2, Pl. 10, Fig. 2.
1913. *Phillipsia gemmulifera* PHILLIPS; J. JAROSZ, Fauna..., p. 165, Pl. 20, Fig. 16.

Holotype: Pygidium, BM No. 45012, figured by PHILLIPS (1836, Pl. 22, Fig. 11) and WOODWARD (1883—1884, Pl. 3, Fig. 5); here refigured on Pl. X, Fig. 14.
Type locality: Bolland, Yorkshire, Great Britain.
Type horizon: ?Upper Tournaisian, ?Lower Viséan.

Diagnosis. — Pygidium with convex ribs, divided by a row of tubercles into two nearly equal bands; tubercles arranged regularly both along the axis and the pleural lobes; anterior border somewhat upturned, anterior branches of facial sutures comparatively strongly divergent; fine granular ornamentation on cephalon.

Material. — Holotype pygidium from Bolland (no precise data), several pygidia from the ?Lower Viséan of Settle, Yorkshire, cephalon with disarticulated thorax and pygidium from Clitheroe, Lancashire, 7 pygidia, 2 fragmentary cranidia from the Upper Tournaisian of Racławka river valley, Poland.

Remarks. — *Phillipsia gemmulifera* (PHILLIPS, 1836) is close to *Ph. kellyi* PORTLOCK, 1843 but there exist some differences between these species. The most striking is the structure of the ribs, which in *Ph. gemmulifera* are uniformly rounded in cross section and divided by a row of tubercles into two almost equally wide (*exsag.*) bands, while in *Ph. kellyi* the posterior bands of the ribs are very steep and form the slopes of the anterior bands. Further differences are marked on the cephala, the anterior border in *Ph. gemmulifera* being somewhat more upturned and the anterior branches of the facial sutures more divergent than in *Ph. kellyi.*

Stratigraphic and geographic range. — Upper Tournaisian — ?Lower Viséan of Europe (Great Britain, Poland).

Phillipsia truncatula (PHILLIPS, 1836)

1836. *Asaphus truncatulus* sp. nov.; J. PHILLIPS; Geology..., p. 240, Pl. 22, Figs 12, 13.
non 1883—1884. *Phillipsia truncatula* PHIL.; H. WOODWARD, A Monograph..., p. 21, Pl. 3, Figs 9-14.
non 1900. *Phillipsia truncatula* PHILL.; H. SCUPIN, Die Trilobiten..., p. 7, Pl. 1, Fig. 4.
non 1937. *Phillipsia truncatula* var. *pustulata* DE KON.; V. N. WEBER, Kamennougolnye trilobity..., p. 40, Pl. 4, Figs 26-35.
non 1937. *Phillipsia truncatula* (?) var. *glabra* n. var.; V. N. WEBER, *Ibid.*, p. 41, Pl. 4, Fig. 23.
non 1937. *Phillipsia truncatula* var. *granilimbata* n. var.; V. N. WEBER, *Ibid.*, p. 42, Pl. 10, Fig. 34.

Lectotype: Pygidium, GSM No. GS b 2104, figured by PHILLIPS (1836, Pl. 22, Fig. 13).
Type locality: Near Dublin (no precise data), Eire.
Type horizon: ?Upper Tournaisian, ?Lower Viséan.

Diagnosis. — Pygidium with flat smooth border; edge of pygidium sharp; large, regular tubercles on pygidal surface; glabella almost touching convex, anterior border.

Remarks. — *Phillipsia truncatula* (PHILLIPS, 1836) is close to *Ph. ornata* PORTLOCK, 1843 in its long pygidium. The latter was considered to be a younger synonym of *Ph. truncatula*, but there are some differences between them and, according to the present author, both species are distinct from each other (p. 82).

HAHN (1964) described from Belgium a *Phillipsia* species which he assigned to *Ph. truncatula.* The cranidium of this form is similar to that of *Ph. truncatula*, however, the pygidium is shorter having only at most 17 rings. The ribs in the pygidium in question almost continue to the edge of the pygidium, which is not the case in *Ph. truncatula.*

Stratigraphic and geographic range. — ?Upper Tournaisian, ?Lower Viséan of Dublin region (?Malahide), Eire.

Phillipsia ornata PORTLOCK, 1843

Subspecies assigned: Phillipsia ornata ornata PORTLOCK, 1843, *Ph. ornata belgica* n. subsp., *Ph. ornata kumakensis* n. subsp.

Remarks. — *Phillipsia ornata* PORTLOCK, 1843 was for a long time believed to be conspecific with *Ph. truncatula* (PHILLIPS, 1836). However, as the examination of the type specimens of both species proved, they should be assigned to the separate species. They differ chiefly in their pygidia, this of *Ph. truncatula* being surrounded by a narrow, flat and smooth margin, the very edge of which is sharp. The ornamentation of this pygidium is pronounced in the form of tubercles which are arranged in regular, longitudinal rows, both on the axis and on the pleural lobes. On the pygidium of *Ph. ornata* this flat band around the pygidium is absent, and the tubercles, not so regularly arranged on the pleural lobes cover the pygidium right to the very edge. The glabella of *Ph. truncatula* seems to be more slender, reaching nearer the margin of the cephalon than in *Ph. ornata.*

The specimens of "*Ph. truncatula*" illustrated by WOODWARD (1883—1884, Pl. 3, Figs 9—12), DE KONINCK (1842—1844, Pl. 53, Fig. 5) and WEBER (1937, Pl. 4, Fig. 29) should be assigned to *Ph. ornata*, however to the different subspecies of this species.

Stratigraphic and geographic range. — Tournaisian of Eire (Wexford), Belgium, USSR (the Urals).

Phillipsia ornata ornata PORTLOCK, 1843

1843. *Phillipsia ornata*; J. E. PORTLOCK, Report..., p. 307, Pl. 11, Figs 2*a, b*, 4, 12.
1883—1884. *Phillipsia truncatula*; H. WOODWARD, A Monograph..., p. 21, Pl. 3, Figs 9-14.

Holotype: Cranidium, No. GSM 63038; figured by PORTLOCK (1843, Pl. 11, Fig. 2*a*).
Type locality: Hook Point, Wexford, Eire.
Type horizon: Tournaisian.

Diagnosis. — Cephalon with rounded edge; glabella flattened frontally, with distinct furrows; preglabellar field flat, anterior border weakly convex, eyes low; pygidium long with 19 axial rings and 16 ribs reaching close to the margin; no border; glabella densely ornamented with moderately large tubercles, librigena sparsely granulated, tubercles on pygidium regularly arranged along axis, but not so regular along the pleural lobes.

Stratigraphic and geographic range. — Tournaisian of Eire.

Phillipsia ornata kumakensis n. subsp.

(Pl. X, Fig. 10)

1937. *Phillipsia truncatula* var. *pustulata* (partim); V. N. WEBER, Kamennougolnye trilobity..., p. 40, Pl. 4, Fig. 29.

Holotype: Pygidium, TML No. 869/5107, figured by WEBER (1937, Pl. 4, Fig. 29); here refigured on Pl. X, Fig. 10.
Type locality: Right side of the Kumak river, near the mill, up to Novo Orsk, the South Urals, USSR.
Type horizon: Tournaisian.
Derivation of the name: kumakensis — after the type locality.

Diagnosis. — Subspecies of *Phillipsia ornata* with pygidium long, very strongly vaulted transversely; axis with about 21 rings, 17 ribs; postaxial region sloping nearly perpendicularly to the very narrow flat margin, which is present only along the posterior part of pygidium.

Material. — Besides the holotype specimen, which is embedded in yellowish limestone, one more pygidium TML No. 866/5107 in dark grey Lower Tournaisian limestone from the Tomi river.

Description. — Pygidium strongly elongate, narrowing backwards, axis as broad as pleural lobe, weakly delimited on tip; 21 rings; 17 ribs reaching nearly to the margin of pygidium; no border, but posterior part of pygidium somewhat flattened, forming a kind of narrow band; pleural furrows broad. In longitudinal section, axis gently arched, postaxial region nearly vertically sloping, towards very narrow, flat margin. In transverse section, axis arched, comparatively elevated, pleural lobes very strongly vaulted; abaxial, horizontal parts narrower (*tr.*) than adaxial ones, which slope very steeply.

Remarks. — Both known specimens of this subspecies expose a very unsatisfactorily preserved surface, so the ornamentation cannot be properly observed. It can only be stated, that along (*sag.*) the axis and along (*tr.*) the ribs tubercles were present.

In the significant length of its pygidium, *Phillipsia ornata kumakensis* n. subsp. is closest to *Ph. ornata belgica* n. subsp., the latter having only one segment more in the axis. The here described subspecies differs from *Ph. ornata belgica*, as well as from all the known species of *Phillipsia*, in having unusually strongly vaulted pleural lobes, so that the pygidium is very narrow and high. In the longitudinal section, the axis is more arched and its postaxial region more steep in *Ph. ornata kumakensis* n. subsp. than in *Ph. ornata belgica* n. subsp.

Stratigraphic and geographic range. — Tournaisian of USSR (the Urals).

Phillipsia ornata belgica n. subsp.

(Pl. XI, Figs 1-8, 10-13; Text-fig. 6,*O*)

1842—1844. *Phillipsia pustulata* (SCHLOTHEIM); L. DE KONINCK, Description..., p. 605, Pl. 53, Fig. 5.
?1964. *Phillipsia truncatula* (PHILLIPS); G. HAHN, Trilobites..., Teil 3, p. 460, Pl. 43, Figs 2-4.

Holotype: Entire specimen, IRB No. 18.741/100; Pl. XI, Fig. 7.
Type locality: Neufvilles, carrière du Clypot, Soignies 14, Belgium.
Type horizon: Upper Tournaisian.
Derivation of the name: belgica — coming from Belgium.

Diagnosis. — Cephalon with comparatively long genal spines and rounded edge; anterior border weakly convex, preglabellar region flat, glabella flat frontally with 4 pairs of furrows; basal lobe cut off; occipital ring with finely marked lateral occipital lobe; eye low, narrow (*tr.*); pygidium very long, subtriangular, vaulted transversely, axis with 22 rings, 18 ribs on pleural lobes; ornamentation of cephalon in the form of scale-like tubercles; on pygidium tubercles inclined backwards, regularly arranged along axis, irregularly — along pleural lobes.

Material. — About 50 specimens of different size, from the yellowish marly limestone of Neufvilles, Belgium.

Dimensions (in mm):

	IRB 18.741									
	100	113	121	130	116	111	117	123	102	131
Length of entire exoskeleton	38.5	—	—	—	—	—	—	—	—	—
Length of cephalon	12.5	3.4	5.9	9.2	—	—	—	—	—	—
Width of cephalon	19.0	—	—	—	—	—	—	—	—	—
Length of glabella	10.5	2.5	4.5	7.2	—	—	—	—	—	—
Width of glabella	7.5	1.6	3.3	6.0	—	—	—	—	—	—
Length of pygidium	15.1	—	—	—	2.9	3.2	4.5	5.2	16.0	18.0
Width of pygidium	15.0	—	—	—	3.6	4.1	5.2	6.0	17.0	18.0
Length of axis	13.5	—	—	—	2.4	3.0	4.0	4.9	14.7	16.0
Width of axis	6.0	—	—	—	1.1	1.2	1.7	2.1	6.3	6.6

Description. — Cephalon subparabolic, broadly rounded frontally, with comparatively long genal spines; anterior border weakly convex; preglabellar region flat; glabella flat with very flat frontal lobe; 4 pairs of glabellar furrows, S_4 being indistinct; basal lobe cut off; occipital ring very broad at extremities, with very finely marked lateral occipital lobes; palpebral lobe short (*exsag.*) curved; in axial furrow, by frontal lobe, a shallow, small depression; librigena with weakly delimited, broad border; eye comparatively low, surrounded by a somewhat convex, narrow band, with a shallow, broad subocular groove on the outside. In longitudinal section, occipital ring flat, glabella somewhat sloping forwards, flat, preglabellar field also flat, anterior border weakly convex, poorly delimited. In transverse section, cephalon weakly vaulted, glabella flat, somewhat higher than flat, horizontal palpebral lobes; eyes weakly convex with visual lobes at an angle of about 45° to the plane of glabella, postocular part of librigena slightly convex, gently sloping. Hypostoma with subglobular median body, and flat, long posterior wing, on which a pair of very short spines is present; ornamental lines thin and low. Thorax of 9 segments; thoracal axis broader than pleural lobe; pleurae bluntly cut. Pygidium very long, narrowing backwards, without flattened band surrounding it; axis somewhat narrower than pleural lobe, with 22 narrow, distinctly delimited rings; pleural lobe with 18 narrow ribs, obliquely directed backwards, reaching nearly to the very edge of pygidium; interpleural furrows visible only on first two ribs, so the boundaries between the rib-bands are marked only in ornamentation; pleural furrows comparatively deep and narrow. In longitudinal section, axis very weakly sloping backwards, postaxial field obliquely situated; no flattened margin. In transverse section, axis low, pleural lobes vaulted. Ornamentation of glabella in the form of tubercles which are inclined backwards and increasing in size posteriorly; on central field of librigena large but comparatively low tubercles, which do not incline backwards; along the posterior edge of thoracic segment a row of tubercles; on pygidial axis 4—6 longitudinal rows of conspicuous and backwardly inclined tubercles, situated along the posterior edges of rings; no regular, longitudinal rows of tubercles along pleural lobes; here tubercles are small, arranged along (*tr.*) ribs, near to their posterior margins.

Variability. — The only noticed individual variability in this subspecies concerns the pygidia, most of them being more distinctly vaulted transversely and devoid of marginal flattened band (Pl. XI, Fig. 13), while some are somewhat flatter having a marginal band, though narrow, distinctly flattened (Pl. XI, Fig. 11). This latter type of pygidia is found comparatively rarely.

Growth changes. — The smallest cranidium found (length 3.4 mm; Pl. XI, Fig. 1) has a very cyrtosymbolinid appearence, with finger-shaped glabella, which is convex, the distinctly pronounced, somewhat concave, preglabellar field and a comparatively convex anterior border. Different from the majority of cyrtosymbolinid young cranidia, the anterior outline of this cranidium is not pointed; also the extremities of the occipital ring are in *Phillipsia ornata belgica* n. subsp. broad and the weak lateral occipital lobes are already visible, which is not the case in the known adolescent cyrtosymbolinid cranidia. The anterior branches of the facial sutures are, in the here considered young cranidium of *Ph. ornata belgica*, more divergent than in the larger cranidia of this subspecies. During growth, the glabella in *Ph. ornata belgica* becomes flatter and comparatively broader, the concave preglabellar field disappears, and the glabella becomes closer to the anterior border, which is much less convex than before (Pl. XI, Figs 5, 10, 7).

The smallest pygidium found (length 2.9 mm; Pl. XI, Fig. 2) has no larval notch developed, but exposes a flat, comparatively broad border, with distinct prolongations of ribs on it. Axis of this pygidium has only 20 rings, while on the pleural lobes there are 16 ribs. During the

growth of the pygidium its proportions distinctly change; at first it is somewhat broader than long, but in adult pygidia the length equals the width. Also the marginal band becomes successively less flat, and narrows significantly, usually disappearing in adult pygidia (Pl. XI, Figs 3, 4, 6, 8, 13).

Remarks. — The specimen of "*Phillipsia pustulata*" described by DE KONINCK (1842—1844) is lost and its locality has not been precisely determined by this author ("Carboniferous limestone, Tournay"). At the present author's disposal was ROLLAND's collection of the Carboniferous trilobites from Neufvilles, Soignies, Belgium, which contains specimens of *Phillipsia* PORTLOCK, 1843. It seems almost certain that the form described here as *Phillipsia ornata belgica* n. subsp. is conspecific with the specimen described by DE KONINCK. The assignment of this specimen together with "*Asaphus pustulatus*" SCHLOTHEIM, 1823, given by DE KONINCK (1842-1844) is wrong (comp. WOODWARD, 1883-1884 and WEBER, 1937). The name "*pustulata*", according to art. 49 of ICZN cannot be retained for the considered subspecies of *Phillipsia*, as it was used in an erroneous specific identification. WEBER (1937) was the first to recognize the relationship of the Belgian form, here described, with that from Eire, which up to now has been widely known as "*Phillipsia truncatula*" (PHILLIPS, 1836) (= *Ph. ornata* PORTLOCK, 1843, partim). However, the specimens from the USSR, assigned by WEBER (1937) together with the Belgian form, are not conspecific with the latter, differing from it in many aspects. Within the genus *Phillipsia* PORTLOCK, 1843, *Ph. ornata belgica* n. subsp. has the longest pygidium with 22 rings on the axis. Among the other genera occurring in the early Carboniferous such long pygidia are found in some species of *Eocyphinium* REED, 1943. However, the structure of the cephalon in this genus is different from that in *Phillipsia.*

The cranidia of "*Ph. truncatula*" (PHILLIPS, 1836) described by HAHN (1964) from Modave, Belgium, are somewhat similar to the young cranidia of the here described subspecies. Nevertheless the pygidia from Modave are shorter and have only at most 17 rings. Therefore, though they come from beds of the same age, it is not sure whether they are conspecific with *Ph. ornata belgica* n. subsp.

Stratigraphic and geographic range. — Upper Tournaisian of Belgium.

Phillipsia glabra WEBER, 1937

(Pl. X, Fig. 2)

1937. *Phillipsia truncatula* (?) var. *glabra* n. var.; V. N. WEBER, Kamennougolnye trilobity..., p. 41, Pl. 4, Fig. 23.

Holotype: Cranidium; TML, No. 942/5107, figured by WEBER (1937, Pl. 4, Fig. 23); here refigured on Pl. X, Fig. 2.
Type locality: Right side of Ori river, the South Urals, USSR.
Type horizon: Tournaisian.

Remarks. — The species is represented by only one cranidium. From the point of view of the structure of the anterior region of the cephalon, with sharp edge, vertical border, it is closest to *Phillipsia moelleri* n. sp. It differs however from the latter, having a glabella placed much nearer the border, which almost touches it, in which it resembles *Ph. kellyi* PORTLOCK, 1843. Another striking difference may be noticed in ornamentation, this of *Ph. glabra* being in the form of fine punctures covering the glabella, while the very low and small tubercles are visible only on basal lobe. The ornamentation of the exoskeleton in *Ph. moelleri* is very coarse.

Stratigraphic and geographic range. — Type horizon and type locality.

Phillipsia moelleri n. sp.

(Pl. X, Figs 6, 8)

1867. *Phillipsia pustulata* SCHLOTH., V. v. MOELLER, Über die Trilobiten..., p. 38, Pl. 2, Fig. 4*a*, *b*.
1937. *Phillipsia truncatula* var. *pustulata* DE KON. (partim); V. N. WEBER, Kamennougolnye trilobity..., p. 40, Pl. 4, Figs 27, 28, 35.
?1937. *Phillipsia truncatula* var. *pustulata;* V. N. WEBER, *Ibid.*, p. 40, Pl. 4, Fig. 34.

Holotype: Cranidium, No. TML 854/5107, figured by WEBER (1937, Pl. 4, Fig. 28); here refigured on Pl. X, Fig. 6.
Type locality: Sosva river, mouth of the Manya river, the North Urals, USSR.
Type horizon: Tournaisian.
Derivation of the name: moelleri — after V. v. MOELLER, who first gave the description of the specimens here assigned.

Diagnosis. — Anterior border of cephalon vertically situated, preglabellar field very narrow (*sag.*), palpebral lobe very short (*exsag.*) and narrow (*tr.*), glabellar furrows very deep; pygidium long, narrow, with axis of 20 rings and pleural lobe of 15 ribs; ornamentation coarse.

Material. — Two cranidia, 1 fragment of librigena, 1 hypostoma, 5 pygidia from the dark grey fossiliferous limestone of the type locality and horizon.

Description. — Anterior margin of cranidium broadly rounded, sharp; anterior border vertically placed, somewhat upturned, which results in the narrow preglabellar field being steeply inclined; glabella slender, convex, rounded frontally, reaching close to anterior border; 3 pairs of very deeply incised glabellar furrows; basal lobe rounded, swollen; occipital furrow deep, occipital ring broad, convex; palpebral lobe comparatively narrow (*tr.*) and curved, but very short (*exsag.*), only somewhat longer than L_2 (*exsag.*); anterior branches of facial suture weakly divergent. Fragmentary librigena with strong genal spine. In longitudinal section, glabella convex at front, preglabellar field steeply raising forwards and close to glabella, anterior border vertically situated, separated from preglabellar field by the sharp edge of cephalon. In transverse section, glabella broadly arched, palpebral lobes somewhat raising outwards, not reaching the height of glabella. Hypostoma with very convex, subglobular median body, and flat, long posterior wing, the latter without spines; maculae swollen, ornamental line thin. Thorax unknown. Pygidium elongate, strongly narrowing backwards, surrounded by flattened, narrow marginal band; axis slender, somewhat narrower than pleural lobe; 20 convex rings, pleural lobe with 15 sharply pronounced ribs; posterior bands of ribs as a steep slope; pleural furrows very deep and broad, interpleural furrows not pronounced. In transverse section, axis highly arched, somewhat trapezoidal, pleural lobes vaulted. Ornamentation very coarse, tubercular; on glabella tubercles becoming larger and higher backwards; along (*tr.*) L_2 and L_3 tubercles largest and arranged in one row; fixigena and palpebral lobe smooth, central field of librigena coarsely granulated; tubercles on pygidium very high, blunt, these on pygidial axis inclined backwards and arranged into 4 regular longitudinal rows; no regular arrangement along pleural lobe.

Remarks. — The specimens here assigned to *Phillipsia moelleri* n. sp. were included by WEBER (1937), together with some other forms (pp. 80, 82, 87), to "*Ph. truncatula* var. *pustulata* DE KONINCK, not SCHLOTHEIM". In so doing WEBER had in mind "*Ph. truncatula*" sensu WOODWARD (1883-1884) the species which actually turns out to be partly a synonym of *Ph. ornata* PORTLOCK, 1843 (see p. 82). However, the above described specimens from the Sosva river differ very strongly from *Ph. ornata*, mainly in the structure of cephalon. They have a vertically

placed anterior border and steeply inclined preglabellar field, these latter being separated from each other by a sharp cephalic edge, while in *Ph. ornata* the preglabellar field is flat and horizontally placed, "prolonged" by a weakly convex anterior border, which simultaneously forms the rounded margin of the cephalon. Also the glabella of the latter species is much flatter and its ornamentation finer than in *Ph. moelleri.*

DE KONINCK's specimens of "*Phillipsia pustulata*" which WEBER included into the synonymy of "*Ph. truncatula* var. *pustulata*", have all those characters diagnostic for *Ph. ornata*, thus they are assigned to this species as its new subspecies *Ph. ornata belgica* (see p. 83) and they are not conspecific with WEBER's form. However, the characters of the pygidium of *Ph. moelleri* n. sp. are close to these found in the pygidia of *Ph. ornata.* They are: similarly elongate shape of pygidium and a long, though somewhat shorter (20 rings), axis in *Ph. moelleri.* The pygidia of both species differ in the lack of the flattened margin around the pygidium in *Ph. ornata.*

Among the specimens from the Sosva river, there occur two pygidia (TML No. 859/5107; WEBER, 1937, Pl. 4, Fig. 34) which distinctly differ from the remaining pygidia from the same locality in being smaller, broader (especially posteriorly), having a shorter axis of 18 rings and 14 ribs on pleural lobes. The ribs in these specimens seem to be less sharply pronounced, and ornamentation, though coarse, is somewhat finer than in other specimens. Whether these differences are due to the variability within the species or depend on the individual age of the animal' cannot be decided at present, the material of *Ph. moelleri* n. sp. being too scarce.

Stratigraphic and geographic range. — Type horizon and type locality.

Phillipsia magnoculata n. sp.

(Pl. X, Figs 1, 3, 13)

1937. *Phillipsia truncatula* var. *pustulata* DE KON. (partim); V. N. WEBER, Kamennougolnye trilobity..., p. 40, Pl. 4, Figs 26, 30, 31.

Holotype: Cephalon, No. TML 853/5107, figured by WEBER (1937, Pl. 4, Fig. 26); here refigured on Pl. X, Fig. 13.
Type locality: Outcrop 1*c* (PETRENKO's collection), the South Urals, USSR (no other informations).
Type horizon: Tournaisian.
Derivation of the name: magnoculata — Lat. *magnus* = *great, oculatus* — having eyes; because of its very high eyes.

Diagnosis. — Cephalon strongly vaulted, with somewhat concave preglabellar field and comparatively sharp edge; anterior border extremely narrow, poorly delimited; glabella convex, distinctly constricted; 3 pairs of deep glabellar furrows; palpebral lobe strongly raised, not covering eye; eye extremely high; pygidium somewhat longer than semicircle, broadly rounded posteriorly, surrounded by a flattened marginal part; axis with 16 rings; 13 ribs; dense granulation.

Material. — One cephalon, 3 pygidia from the light beige Tournaisian limestone of outcrop 1c (PETRENKO's collection) in the South Urals, USSR.

Description. — Outline of cephalon in the form of a narrow arch, edge of cephalon comparatively sharp, border poorly delimited, narrow; no border furrow; preglabellar field somewhat concave, its width (*sag.*) equals about half the length (*exsag.*) of basal lobe; glabella constricted between L_3, distinctly narrower frontally than at base; 3 pairs of glabellar furrows deeply incised, a trace of S_4 marked; basal lobe round, swollen; basal furrow reaching occipital furrow, which is deep, directed forwards at extremities; occipital ring broad (*sag.*); palpebral lobe in the form of a rounded triangle, short (*exsag.*), very broad (*tr.*); anterior branch of facial

suture long and strongly divergent; librigena with concave lateral part and probably long genal spine; eye extremely high, with nearly vertical visual surface, strongly convex longitudinally, not entirely covered by palpebral lobe; at its base, eye surrounded first by a narrow smooth band, then by a broad furrow. In longitudinal section, occipital ring convex, sloping to occipital furrow, glabella straight in posterior part, from half its length sloping at an angle 45° to the somewhat concave preglabellar field; edge of cephalon somewhat raised, anterior border weakly convex, narrow. In transverse section, glabella weakly arched, pleural lobes steeply raised, higher than glabella, eyes convex, nearly vertically situated, postocular platform sloping towards the somewhat concave marginal part. Hypostoma and thorax unknown. Pygidium comparatively short and wide, broadly rounded posteriorly, surrounded by a flattened narrow margin; axis slender, as broad as pleural lobe, with 16 moderately convex rings; 13 ribs rounded in cross-section, anterior bands of ribs broader than posterior ones, which at the end of the pygidium become still narrower and steeply sloping; pleural furrows reaching to the flattened margin, interpleural furrows indistinct, covered by tubercles. In longitudinal section, axis gently sloping backwards, poorly delimited at tip, postaxial region steeply sloping to the flattened, horizontal margin. In transverse section, axis and pleurae gently vaulted. Ornamentation very coarse, tubercular; glabella covered by tubercles which increase posteriorly, a row of largest tubercles along L_2 and L_3; central field of librigena granulated; very conspicuous tubercles arranged along outer margin of subocular groove; fixigenae, preglabellar field and marginal part of librigenae smooth; along pygidial axis 6 longitudinal rows of comparatively low, backwards inclined tubercles; along (*tr.*) each rib, a row of small, conspicuous, densely arranged tubercles covering interpleural furrow; some regularity in ornamentation of pleural lobe seen; marginal band smooth.

Growth changes. — Each of the three known pygidia of *Phillipsia magnoculata* n. sp. is of different size, the smallest (TML 865/5107, Pl. X, Fig. 1) is 4.1 mm long. It can be observed that during growth, the flat margin of the pygidium changes its position from horizontal to somewhat sloping. The axis of the smallest pygidium has already 16 rings, while the pleural lobe has only 12 ribs.

Remarks. — WEBER (1937) assigned the species described here as *Phillipsia magnoculata* n. sp. together with some other representatives of *Phillipsia* (pp. 80, 82, 86) to "*Ph. truncatula* var. *pustulata* DE KON.". Among these specimens only those, assigned here to *Ph. moelleri* n. sp. can be compared, as both have a similar structure of the anterior part of the cephalon and coarse ornamentation of the exoskeleton. However, when in *Ph. magnoculata* n. sp. the preglabellar field is only weakly concave and still comparatively broad, this of the cephalon of *Ph. moelleri* n. sp. is situated in a very deep depression, nearly reduced, and the anterior border vertically situated is very close to glabella. This structure in *Ph. moelleri* is caused by a significant rising of the anterior edge of cephalon. Additionally, the palpebral lobes in the representatives of the latter species are small and flatly placed, while in *Ph. magnoculata* they are comparatively large and steeply raised, in connection with the very high eyes.

From the point of view of the structure of the frontal part of the cephalon, the three Ural species: *Ph. magnoculata*, *Ph. moelleri* n. sp. and *Ph. glabra* (WEBER, 1937) form a continuous morphological sequence from the stadium with a comparatively broad and flat preglabellar field, to the stadium where the preglabellar field is nearly entirely reduced, the anterior border touching the glabella, and the anterior edge of cephalon highly rised. Whether this morphological line may constitute a phylogenetical sequence, cannot be stated without knowledge of the ontogenetic development of the species in question. The pygidia of *Ph. moelleri*

and *Ph. magnoculata* differ mainly in shape; this of the first species being long, narrow posteriorly, with an axis of 20 rings, while this of the second species is shorter, with an axis of 16 rings, and broadly rounded posteriorly. Moreover, the ribs in the pygidia of *Ph. moelleri* are sharp in cross-section, separated by broad pleural furrows, while these of pygidia of *Ph. magnoculata* are more rounded. The pygidia of *Ph. magnoculata* are closer to those two pygidia of *Ph. moelleri*, which somewhat deviate from the typical pattern of this species (WEBER, 1937, Pl. 4, Fig. 34) being broadly rounded posteriorly and having 18 rings on the axis. However, in these pygidia the ribs are developed as in the other specimens of *Ph. moelleri*. The comparatively short pygidia of *Ph. magnoculata* resemble that of *Ph. gemmulifera* (PHILLIPS, 1836), having only somewhat more vaulted pleural lobes, a less flattened margin and more densely arranged tubercles along (*tr.*) the ribs. These differences may have only a subspecifical value, however, without knowledge of the complete cephalon of *Ph. gemmulifera* (which is still unknown) this cannot be clarified, thus *Ph. magnoculata* is considered here as a separate species. The possibility that it constitutes only a subspecies of *Ph. gemmulifera* cannot be excluded.

?**Phillipsia** sp.

(Pl. X, Fig. 4)

Material. — One fragmentary cephalon (BM No. In 27931) with several thoracic segments, from the Middle Viséan Limestone (D_1) of Narrowdale, Staffordshire, Great Britain.

Dimensions (in mm):

	BM In 27931
Length of cephalon . . .	2.4
Width of cephalon	?3.2
Length of glabella	2.2
Width of glabella	1.2

Description. — Cephalon narrow, rounded frontally with moderately long genal spines; anterior border convex, well delimited; preglabellar field as wide (*sag.*) as the anterior border (*sag.*); glabella convex, finger-shaped, somewhat constricted at S_1; 2 pairs of glabellar furrows visible; occipital ring somewhat narrowed at extremities; palpebral lobe broad (*tr.*), weakly curved; visual lobe narrow, comparatively low.

Remarks. — The specimen described above represents a young cephalon most probably of a *Phillipsia* species. It resembles very much *Phillipsia kellyi* PORTLOCK, 1843 in the shape of its glabella and in the comparatively small eyes. The ontogenetic development within *Phillipsia* is so far only partly known in *Ph. ornata belgica* n. subsp. (p. 84) and the youngest found cranidium of this species (Pl. XI, Fig. 1) is very similar in the presence of the narrow (*sag.*) preglabellar field and course of the facial suture to that of ?*Phillipsia* sp. The only character which makes questionable the assignment of the considered cranidium to *Phillipsia* is the occipital ring which is narrowed at its extremities, while in the young cranidium of *Ph. ornata belgica* it is as wide as in the middle part. Tapering of the occipital ring is most often observed in the young cephala of cyrtosymbolinid trilobites, but here the frontal outline of the cephalon is always pointed, while it is broadly rounded in ?*Phillipsia* sp. and in *Ph. ornata belgica*.

Genus **PILTONIA** GOLDRING, 1955

Type species: Piltonia salteri GOLDRING, 1955.

Synonyms:

1870. *Phillipsia*; F. B. MEEK & A. H. WORTHEN, Description..., p. 52.
1877. *Proetus*; J. HALL & R. P. WHITFIELD; Palaeontology. *In* C. KING, Annual report... p. 262.
1904. *Phillipsia*; J. H. GIRTY, Note..., p. 49.
1937. *Phillipsia*; V. N. WEBER, Kamennougolnye trilobity..., pp. 42-44, 48, 58.
1956. *Phillipsia*; E. A. BALASCHOVA, Turneyskie trilobity..., p. 255.
1960. *Phillipsia*; Z. A. MAKSIMOVA, Devonskie i kamennougolnye..., pp. 55, 57.
1963. *Phillipsia*; R. R. HESSLER, Lower Mississippian..., p. 553.

Species assigned: Piltonia salteri GOLDRING, 1955, *P. tuberculata* (MEEK & WORTHEN, 1870), *P. altaica* (WEBER, 1937), *P. konincki* (WEBER, 1937), *P. kassini* (WEBER, 1937), *P. vilvensis* (WEBER, 1937), *P. mugodjarica* (BALASCHOVA, 1956), *P. fryi* GOLDRING, 1958, *P. buchtarmensis* (MAKSIMOVA, 1960), *P. krasensis* CHLUPAČ, 1961, *P. eurybathrea* (HESSLER, 1963), *P. brevicornus* (HESSLER, 1963), *P. kuehnei* HAHN, 1964, ?*P. coronata* (BALASCHOVA, 1956).

Stratigraphic and geographic range: Tournaisian of Great Britain, Belgium, Tchekoslovakia, USSR (the South Urals, Mugodzhary, Kazakhstan, Altai); Upper Kinderhookian-Lower Osagean of the USA.

Diagnosis. — See R. GOLDRING, 1958, p. 41.

Remarks. — The most primitive species within *Piltonia* GOLDRING, 1955 — *P. kassini* (WEBER, 1937) from the Lower Tournaisian of Central Asia clearly indicates the close relationship of this genus to the representatives of the subfamily Cyrtosymbolinae HUPÉ, 1953. The most striking character of this genus is the presence of the „subcranial furrow" along the cephalon. A similar furrow, however placed along the edge of the pygidium, is present in *Piltonia buchtarmensis* (MAKSIMOVA, 1960), but most probably also in some other representatives of this genus. According to GOLDRING's (1955) diagnosis the pygidium of *Piltonia* is characterized a.o. by distinct rib furrows and 12—13 rings. The examination of extensive material of the *Piltonia* species allows one to state that sometimes the number of rings is greater, reaching up to 14 in *Piltonia konincki* (WEBER, 1937), 15 in *Piltonia kuehnei* HAHN, 1964 and even 19 in the North American representative *Piltonia tuberculata* (MEEK & WORTHEN, 1870). As far as the presence of distinct rib furrows is concerned, it was noted by the present author that they are clearly visible only in some species: *P. kassini* (WEBER, 1937), *P. vilvensis* (WEBER, 1937), *P. salteri* GOLDRING, 1955, *P. fryi* GOLDRING, 1958. In other species e.g. *P. buchtarmensis* (MAKSIMOVA, 1960), *P. krasensis* CHLUPAČ, 1961 they are visible only on the two first ribs or not visible at all, the posterior bands of the ribs being suppressed e.g. in *P. kuehnei* and *P. tuberculata*.

Piltonia kassini (WEBER, 1937)

(Pl. III, Figs 1-3)

1937. *Phillipsia kassini* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 48, Pl. 9, Figs 42-47.

Holotype: Pygidium, TML No. 1089/5107, figured by WEBER (1937, Pl. 9. Fig. 45); here refigured on Pl. III, Fig. 1.
Type locality: Ak-tshek, Kazakhstan, USSR.
Type horizon: Lower Tournaisian.

Diagnosis. — Pygidium broad, comparatively flat, surrounded by a weakly convex, narrow border; pygidial axis slender, narrower than pleural lobe, with 11 rings; 10 very convex ribs, consisting of two bands; cephalon vaulted transversely, with short genal spines; cephalic border sharp, upturned, along its outer edge a comparatively deep furrow; narrow pregla-

bellar field present; glabella conical with 4 pairs of deep furrows, palpebral lobe concave in the middle; anterior branch of facial suture long and divergent; eye high, convex longitudinally; cephalon and pygidium coarsely granulated.

Remarks. — "*Phillipsia kassini*" WEBER, 1937 is a typical representative of *Piltonia* GOLDRING, 1958 displaying the following characters of this genus: 1) upturned border with deep furrow along it, 2) presence of a preglabellar field, 3) palpebral lobe concave in the middle, 4) ribs consisting of two bands, 5) coarse granulation.

In the characters of its cephalon, *Piltonia kassini* (WEBER, 1937) shows a distinct resemblance with some representatives of *Phillipsia* PORTLOCK, 1843 (e.g. *Ph. magnoculata* n. sp.). However, the short pygidium of *P. kassini* with convex border and differently developed ribs divided into two bands, allows one to distinguish it very easily from all representatives of *Phillipsia*.

Morphologically, *Piltonia kassini* constitutes a more primitive stage than *Phillipsia* (and than the other *Piltonia* species) and is closer to Cyrtosymbolinae HUPÉ, 1963 than any other representative of Phillipsiinae OEHLERT, 1884. The very low stratigraphic position of this species (Lower Tournaisian) makes it even possible that *P. kassini* represents the phylogenetically oldest stage of Phillipsiinae.

Piltonia kassini is close to *Piltonia salteri* GOLDRING, 1955, but the latter had much less conical glabella and narrower preglabellar field.

Stratigraphic and geographic range. — Lower Tournaisian of USSR (Kazakhstan).

Piltonia vilvensis (WEBER, 1937)

(Pl. II, Fig. 8)

1937. *Phillipsia* (?)*vilvensis* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 58, Pl. 6, Fig. 38.

Holotype: Pygidium (damaged), TML, No. 1528/5107, figured by WEBER (1937, Pl. 6, Fig. 38); here refigured on Pl. II, Fig. 8.

Type locality: Krivyi rog, Vilva river, western slope of the Urals, USSR.

Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium with vaulted pleural lobes, rounded posteriorly, without any border; axis narrower than pleural lobe; 10 ribs composed of two bands; anterior bands overgrowing posterior ones; ornamentation spinose.

Remarks. — The pygidium described by WEBER (1937) as "*Phillipsia (?)vilvensis*" is a typical representative of *Piltonia* GOLDRING, 1955, with its spinose ornamentation, strong vaulting of pleural lobes and two-banded ribs, the anterior band being higher, wider and ornamented.

Stratigraphic and geographic range. — Type horizon and type locality.

Piltonia konincki (WEBER, 1937)

(Pl. XII, Fig. 1; Pl. XIII, Fig. 10)

1937. *Phillipsia konincki* n. nom.; V. N. WEBER, Kamennougolnye trilobity..., p. 44, Pl. 5, Figs 11, 12; Text-fig. 35.
1937. *Phillipsia konincki* n. nom.?; V. N. WEBER, *Ibid.*, p. 44, Pl. 5, Figs 13, 14; Pl. 10, Fig. 37.

Holotype: Pygidium (negative), TML, No. 979/5107, figured by WEBER (1937, Pl. 5, Fig. 11); here refigured on Pl. XIII, Fig. 10.

Type locality: Outcrop No. 847 (NECHAROSHEV's collection); Altai, USSR.

Type horizon: Middle Tournaisian.

Diagnosis. — Pygidium broad, faintly convex, surrounded by a weakly delimited broad and convex marginal part; axis somewhat narrower than a pleural lobe, with 14 rings; 12 ribs well separated from each other, consisting of anterior bands, and reaching across the convex margin to the very edge of the pygidium.

Remarks. — WEBER (1937) described separately the pygidia from the Altai and the South Urals, assigning the latter only tentatively to "*Phillipsia konincki*". However, the differences quoted by WEBER concern only one pygidium from the Urals, the rest being identical, the differences observed are due to the preservation, in the decalcisized mudstone.

The pygidium of this species is very close to *Piltonia kuehnei* HAHN, 1964 from Belgium. The latter species differs in having a broader axis, which is wider than the pleural lobe, while in *P. konincki* it is narrower than the latter. Cranidium of *P. konincki* is very poorly preserved, but it allows one to observe that there is present a very weakly developed incipient preoccipital lobe, which is in the more distinct form found in the representatives of the Viséan-Namurian genus *Eocyphinium* REED, 1942.

Stratigraphic and geographic range. — Middle-Upper Tournaisian of the USSR (the South Urals, Altai).

Piltonia kuehnei HAHN, 1964

(Pl. XI, Fig. 9; Pl. XII, Fig. 11; Pl. XIII, Fig. 12)

1842—1844. *Phillipsia gemmulifera* PHIL.; L. DE KONINCK, Description..., p. 603, Pl. 53, Figs 3, 4*a-c*.
1964. *Piltonia kuehnei kuehnei* n. ssp.; G. HAHN, Morphologie..., p. 363, Pl. 33, Figs 7, 8; Text-fig. 5.
1964. *Piltonia kuehnei antoingensis* n. ssp.; G. HAHN, *Ibid.*, p. 367, Pl. 33, Figs 9-12; Text-figs 6, 7.

Material. — Numerous counterparts of exoskeleton from the Middle Tournaisian of Allain, Carrière de la Chapelle, Antoing, Belgium.

Remarks. — HAHN (1964*b*) described from Modave and Antoing the specimens of *Piltonia kuehnei* HAHN, 1964 which he assigned respectively to two subspecies of this species: *P. kuehnei kuehnei* HAHN, 1964 and *P. kuehnei antoingensis* HAHN, 1964. At the present author's disposal were the specimens coming from ROLLAND's collection (IRB I. G. 18.596) and these which she collected herself in Carrière de la Chapelle, Allain, Antoing 7. They allowed her to state that, in fact, the differences between *P. kuehnei* and *P. kuehnei antoingensis* are due to the state of preservation, and that the specimens coming from Antoing are identical with those from Modave. The main difference reported by HAHN (1964) is the position of the spines on the frontal lobe of the glabella; those in *P. kuehnei kuehnei* are directed very strongly backwards and merged with the exoskeleton, those in *P. kuehnei antoingensis* are not so directed backwards and do not touch the exoskeleton. However, the specimens from Modave were found with the exoskeletons, while those from Antoing represent internal moulds. Among the specimens from ROLLAND's collection in the Royal Institute of Natural Sciences in Brussells, both internal as external moulds are found. They allow one to state that the cores of the ornamental spines, covering the frontal lobe and merged with the exoskeleton, are always free and appear to be more vertically situated than the spines themselves. Another difference between the considered specimens quoted by HAHN (1964*b*) is the shape of pygidium, which is long in Modave specimens, while shorter in these from Antoing. But, comparing HAHN's illustration of "*P. kuehnei kuehnei*" (Pl. 33, Fig. 8) with that of "*P. kuehnei antoingensis*" (Pl. 33, Fig. 13), it seems probable that the difference is caused by the state of preservation.

P. kuehnei HAHN, 1964 is very close to *P. konincki* (WEBER, 1937) especially when the pygidia are compared. Both species also display the characters found in the species of *Eocyphinium* REED, 1942, i.e. very weakly marked, incipient preoccipital lobe and glabellae only very faintly narrowing forwards. In the *Eocyphinium* species the preoccipital lobe is much more distinct and the glabella is frontally at least as broad as across its base. Thus, it seems very probable that *P. konincki* and *P. kuehnei* are very close to the forms ancestral for *Eocyphinium*.

Stratigraphic and geographic range. — Middle-Upper Tournaisian of Belgium.

Piltonia altaica (WEBER, 1937)

(Pl. XII, Fig. 4; Pl. XIII, Fig. 2)

1937. *Phillipsia altaica* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 42, Pl. 5, Figs 1-3.
1937. *Phillipsia altaica* n. sp. (?) (cf. *Phill. truncatula* PHILL.); V. N. WEBER, *Ibid.*, p. 43, Pl. 5, Fig. 4.
1960. *Phillipsia altaica* WEBER; Z. A. MAKSIMOVA, Devonskie i kamennougolnye..., p. 55, Pl. 9, Figs 9-11.

Holotype: Pygidium, TML No. 958/5107, figured by WEBER (1937, Pl. 5, Fig. 1); here refigured on Pl. XIII, Fig. 2.
Type locality: Malaia Ulba river, basin of the Buchtarma river, Altai, USSR.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium short and broad, surrounded by a narrow, flattened border, axis faintly narrowing backwards with 13 rings, 10 very convex ribs, consisting only of anterior bands; glabella weakly narrowing forwards with 3 pairs of deep glabellar furrows, anterior border steeply upturned, close to glabella; incipient preoccipital lobe faintly marked.

Remarks. — "*Phillipsia altaica*" WEBER, 1937 is a representative of *Piltonia* GOLDRING, 1955 and shows the diagnostic characters of this genus: comparatively short pygidium, coarse spinose ornamentation, glabella somewhat tapering forwards, anterior branches of facial sutures strongly divergent and long, anterior border upturned and close to glabella but not fused with the latter.

MAKSIMOVA (1960) described several specimens of this species coming from the same region and horizon as the type material. It allows one to state that on the anterior border there is a "subcranial furrow" present.

Stratigraphic and geographic range. — Upper Tournaisian of USSR (Altai).

Piltonia buchtarmensis (MAKSIMOVA, 1960)

(Pl. III, Figs 4, 5, 15)

1937. *Phillipsia altaica* n. sp.?; V. N. WEBER, Kamennougolnye trilobity..., p. 43, Pl. 5, Figs 5, 6.
1937. *Phillipsia altaica* n. sp., n. var.; V. N. WEBER, *Ibid.*, p. 43, Pl. 5, Figs 7, 8.
1960. *Phillipsia buchtarmensis* n. sp.; Z. A. MAKSIMOVA, Devonskie i kamennougolnye..., p. 57, Pl. 9, Figs 6-8.

Holotype: Pygidium, TML No. 41/7592/4574, figured by MAKSIMOVA (1960, Pl. 9, Fig. 8); here refigured on Pl. III, Fig. 5.
Type locality: Buchtarma river, Altai, USSR.
Type horizon: Upper Tournaisian.

Diagnosis. — Pygidium elongate with very narrow flat border and marginal furrow along it; axis with 11 rings; 9 ribs; glabella strongly conical, very narrow preglabellar field; ornamentation of glabella in the form of thick tubercles (?spines).

Remarks. — The presence of a "subcranial furrow" along the cephalic border, as well as a conical glabella and very divergent anterior branches of the facial sutures make "*Phillipsia buchtarmensis*" MAKSIMOVA, 1960 a typical representative of *Piltonia* GOLDRING, 1955. The pygidium of this species displays unusual character. That is the presence of a marginal furrow along the border (Pl. III, Fig. 15). Such a furrow was not reported up to now in any *Piltonia* species. The species here considered is very similar to *Piltonia altaica* (WEBER, 1937) in the shape of its pygidium and the character of the ribs, which consist only of anterior bands, the posterior ones forming their slopes. The differences between these species concern the glabella, which is in *P. buchtarmensis* more conical and covered by thicker tubercles than in *P. altaica*.

Stratigraphic and geographic range. — Upper Tournaisian of USSR (Altai).

Piltonia mugodjarica (BALASCHOVA, 1956)

1956. *Phillipsia mugodjarica* sp. nov.; E. A. BALASCHOVA, Turnejskie trilobity..., p. 255, Pl. 1, Figs 1-4.

Remarks. — The specimens from Mugodzhary described by BALASCHOVA (1956) as "*Phillipsia mugodjarica*" should be assigned to *Piltonia* GOLDRING, 1955 as the cranidium displays characters typical for this genus, i.e. "subcranial furrow", conical glabella, steeply upturned anterior border and spinose ornamentation, which is also present on the pygidium of this species. *Piltonia mugodjarica* (BALASCHOVA, 1956) is similar to *P. buchtarmensis* (MAKSIMOVA, 1960). MAKSIMOVA, in her paper (1960, p. 59) listed all the differences between these two species. Here is only necessary to add, that in the species from Mugodzhary the preoccipital lobe is more distinctly pronounced. *P. mugodjarica* precedes in time *P. buchtarmensis* being found in the Lower Tournaisian deposits.

Stratigraphic and geographic range. — Lower Tournaisian of USSR (Mugodzhary).

?Piltonia coronata (BALASCHOVA, 1956)

1956. *Phillipsia coronata* sp. nov.; E. A. BALASCHOVA, Turnejskie trilobity..., p. 252, Pl. 1, Fig. 13.

Remarks. — The species described by BALASCHOVA (1956) most probably represents a species of *Piltonia* GOLDRING, 1955, but contrary to *Piltonia* species there is no distinctly pronounced "subcranial furrow" on the anterior border of the holotype cranidum of ?*P. coronata* (BALASCHOVA, 1956) and the glabella is nearly cylindrical, instead of conical.

Stratigraphic and geographic range. — Lower Tournaisian of USSR (Mugodzhary).

Genus **EOCYPHINIUM** REED, 1942

Type species: Eocyphinium clitheroense REED, 1942.

Synonyms:

1836. *Asaphus*; J. PHILLIPS, Geology..., p. 240.
1870. *Phillipsia*; F. ROEMER, Geologie..., p. 79.
1883—1884. *Griffithides*; H. WOODWARD, A Monograph..., p. 28.
1888. *Phillipsia*; A. W. VODGES, Description..., p. 247.
1888. *Phillipsia*; C. L. HERRICK, Geology..., p. 53.
1891. *Phaëthonides*; C. L. HERRICK, The Cuyahoga shale..., p. 37.

1936. *Phillipsia*; M. SCHWARZBACH, Die Trilobiten..., p. 453.
1937. *Griffithides*; V. N. WEBER, Kamennougolnye trilobity..., p. 71.
1938. *Phillipsia*; E. B. BRANSON; Stratigraphy..., p. 116.
1943. *Metaphillipsia*; F. R. C. REED, The genera..., p. 57.
1944. *Phillipsia*; H. SHIMER & R. SHROCK, Index fossils..., p. 651.
1960. *Phillipsia*; B. BOUČEK & A. PŘIBYL, Revised trilobite..., p. 25.
1963. *Breviphillipsia*; R. R. HESSLER, Lower Mississippian..., p. 556.

Species assigned: Eocyphinium clitheroense REED, 1942, *E. seminiferum* (PHILLIPS, 1836), *E. sampsoni* (VODGES, 1888), *E. margaritiferum* (ROEMER, 1870), *E. spinosum spinosum* (WEBER, 1937), *E. spinosum polonicum* n. subsp., *E. granilimbatum* (WEBER, 1937), *E. brevis* n. sp., *E. parvum* n. sp., *E. castletonensis* n. sp., ?*E. podtsheremensis* n. sp.

Stratigraphic and geographic range: Viséan — Namurian of Europe: Great Britain, Slovakia, Poland, USSR (the South Urals) and North America (USA).

Diagnosis. — Exoskeleton spinose, "subcranial furrow" present along the cephalon; short genal spines; anterior border vertical, upturned, attached to glabella which is constricted medially and at least as broad frontally as across the base; weakly pronounced preoccipital lobe present; anterior branch of facial suture parallel to axial furrow; pygidium long to very long; axis of 14—17 rings, ribs consisting only of anterior bands, the posterior ones forming their slopes.

Remarks. — In 1942 REED erected a new genus *Eocyphinium*, with *Eocyphinium clitheroense* REED, 1942 as the type species. In 1943, he etablished another new genus — *Metaphillipsia* — with "*Asaphus seminiferus*" PHILLIPS, 1836 as the type species. While re-examining

Diagnostic characters of *Piltonia* GOLDRING and *Eocyphinium* REED

Genera	*Piltonia* GOLDRING, 1955	*Eocyphinium* REED, 1942
Anterior border	upturned, close to glabella or separated from it by preglabellar field	upturned, attached to glabella
Subcranial furrow	present	present
Glabella	conical	constricted in the middle, frontally at least as wide as across the base
Preoccipital lobe	usually present	present
Anterior branches of facial sutures	strongly divergent	parallel to axial furrows
Palpebral lobes	short (*exsag.*), broad (*tr.*), depressed	short, broad, depressed
Eyes	short (*exsag.*), high	short, high
Pygidium	usually short	usually long
Pygidial ribs	mostly of two bands	posterior bands forming only the slopes of anterior ones
Ornamentation	spinose or granular	spinose

these two species, the present author stated that they should be assigned to the same genus, the differences between them being mostly due to the different states of preservation. The specimens of "*Asaphus seminiferus*" which were at REED's disposal are preserved in the "Rotten Stone" and are somewhat flattened, while *E. clitheroense* comes from a limestone matrix. As the name *Eocyphinium* REED, 1942 has priority, *Metaphillipsia* (REED, 1943) becomes its younger synonym. The pygidium described by REED (1942) as "*Eocyphinium*? *bivium*" REED, 1942 comes from a different locality (Linn Spout, Ayrshire) and there is no reason for assigning it to *Eocyphinium*, even tentatively, as the comparatively numerous pygidia of the *Eocyphinium* species known at present do not show any resemblance to the form mentioned. "*Eocyphinium*? *bivium*" more probably represents *Paladin eichwaldi parilis*. *Eocyphinium* REED, 1942 is very close to *Piltonia* GOLDRING, 1955, the latter being its ancestor. Though the differences between the two genera are clearly pronounced (see table above) there are some species which are intermediate between them, e.g. *Piltonia koninckí* (WEBER, 1937), *P. kuehnei* HAHN, 1964 and *Eocyphinium brevis* n. sp., which have both the characters of *Piltonia* as well as of *Eocyphinium* pronounced. While the species of *Piltonia* are characteristic for the Tournaisian deposits, the *Eocyphinium* species are reported from the Viséan (?Upper Tournaisian) to the Namurian. The range of both compared genera is very wide. *Piltonia* is spread from Central Asia across Europe and North America (USA), *Eocyphinium* being reported both from Europe to North America (USA). Such a wide geographic range during the Tournaisian-Namurian time is probably due to the mode of life of these genera. Judging from the character of the exoskeletons of the *Piltonia* and *Eocyphinium* species, which are covered by comparatively long spines, they might have led a planktonic life, being transported by the currents over great distances. Other spinose genera, e.g. *Brachymetopus* MCCOY, 1844, have a similarly wide geographic range being found during the Carboniferous-Permian times in Australia, Asia Europe and North America.

Eocyphinium clitheroense REED, 1942

(Pl. XIII, Figs 1, 5; Text-fig. 6*L*, *S*)

1942. *Eocyphinium clitheroense* gen. et sp. nov.; F. R. C. REED, Some new..., p. 656, Pl. 9, Fig. 1.

Holotype: Cephalon (internal mould), HMG No. A 3701, figured by REED (1942, Pl. 9, Fig. 1); here refigured on Pl. XIII, Fig. 5.

Type locality: Clitheroe, Lancashire, Great Britain.

Type horizon: ?Upper Tournaisian, ?Lower Viséan.

Diagnosis. — Cephalon strongly vaulted transversely, comparatively narrow; glabella comparatively slender, faintly broader frontally than across the base.

Material. — Holotype cephalon from Clitheroe, Lancashire, cranidium (BM No. 45037) from the black limestone of Bolland, Yorkshire, Great Britain.

Dimensions (in mm):

	BM 45037
Length of cranidium . . .	6.0
Length of glabella	5.0
Width of glabella	3.3

Remarks. — The cranidium from Bolland (GILBERTSON's collection) has a similarly slender glabella as the holotype specimen of *Eocyphinium clitheroense* REED, 1942. The difference observed concerns the anterior border which is slightly visible in front of the glabella in this specimen,

while it is covered by the glabella in the type specimen. However, this difference may be due to the individual age of the specimens, the holotype cephalon being twice as long as the cranidium mentioned. From the same locality (Bolland) and the same matrix comes a pygidium of *Eocyphinium* REED, 1942 which distinctly differs from the pygidia of all the known species within this genus. It is here described as *Eocyphinium ?clitheroense* REED, 1942.

Stratigraphic and geographic range. — ?Upper Tournaisian, ?Lower Viséan of Great Britain.

Eocyphinium ?clitheroense REED, 1942

(Pl. XIII, Fig. 3; Text-fig. 6*F*)

Material. — One pygidium (BM It 2261) from the black limestone of Bolland, Yorkshire, Great Britain.

Dimensions (in mm):

	BM It 2261
Length of pygidium . . .	8.8
Width of pygidium	10.5
Length of axis	7.2
Width of axis	4.5

Description. — Pygidium short, strongly vaulted transversely and longitudinally, without border; axis somewhat broader than pleural lobe, almost as wide posteriorly as it is frontally; 12 narrow axial rings separated by very deep ring furrows, on pleural lobe 8 very high ribs consisting only of anterior bands, ribs separated from each other by very deep spaces. Ornamentation in form of very conspicuous spines arranged in a single row along (*tr.*) each ring and rib.

Remarks. — The pygidium described above differs in its strong convexity from the pygidia of all the known *Eocyphinium* species, except *Eocyphinium brevis* n. sp., the latter has, however, a distinct flattened rim along the pygidium, which is completely lacking in the here discussed specimen. Also the ring furrows and the spaces between the ribs are not so deep in *E. brevis* as they are in *E. ?clitheroense* REED, 1942. The pygidium from Bolland is shorter than the majority of the pygidia within the *Eocyphinium* REED, 1942, and in this it resembles the pygidia of some *Piltonia* species, e.g. *P. krasensis* CHLUPAČ, 1961; the latter is not so vaulted and has a scarcer ornamentation. It seems probable that the pygidium in question may represent a pygidium of *E. clitheroense* REED, 1942, unknown up to now, allthemore that a cranidium of the latter species was found in the same locality and matrix. However, the differences above mentioned, which are observed between this pygidium and others known in the genus *Eocyphinium*, make its assignment to *E. ?clitheroense* REED, 1942 only tentative.

Eocyphinium seminiferum (PHILLIPS, 1836)

(Pl. XII, Figs 2, 15; Pl. XIII, Figs 4, 7; Text-fig. 6*B*, *R*)

1836. *Asaphus seminiferus* PHILL.; J. PHILLIPS, Geology..., p. 240, Pl. 22, Figs 8-10.

1883—1884. *Griffithides seminiferus* PHILLIPS; H. WOODWARD, A Monograph..., p. 28, Pl. 5, Figs 1-9.

1943. *Metaphillipsia seminifera* (PHILLIPS); F. R. C. REED, The genera..., p. 57.

non 1937. *Griffithides seminiferus* PHILL.; V. N. WEBER, Kamennougolnye trilobity..., p. 73, Pl. 8, Figs 27-29.

Lectotype: Pygidium GSM No. O 3770; figured by PHILLIPS (1836, Pl. 22, Fig. 10).
Type locality: Matlock, Derbyshire, Great Britain.
Type horizon: Viséan (Rotten Stone).

Diagnosis. — Pygidium elliptical, with 13 axial rings and slightly convex, broad marginal part; glabella broader frontally than across the base.

Material. — Six entire (damaged) specimens preserved as internal or external moulds from the "Rotten Stone", Matlock, Derbyshire, 1 damaged pygidium from the Viséan (D_2) limestone of Park Hill, Derbyshire, 1 cranidium and 2 pygidia from Stebden Knoll (B_2), Yorkshire, 1 damaged pygidium from the Viséan (D_2) of Axton, Flintshire, North Wales, Great Britain.

Dimensions (in mm):

	BM				GSM
	31868	45035	51208	45032	O 3424
Length of entire exoskeleton	—	37.0	—	—	—
Length of cephalon	—	13.5	13.0	—	2.7
Width of cephalon	—	—	—	—	—
Length of glabella	—	13.0	12.5	—	2.1
I Width of glabella	—	9.0	7.5	—	1.6
II Width of glabella	—	—	8.2	—	—
Length of pygidium	13.0	14.0	—	16.0	—
Width of pygidium	16.0	—	—	19.0	—
Length of axis	11.5	12.0	—	14.0	—
Width of axis	6.0	6.5	—	8.5	—

Description. — Cephalon subtriangular, surrounded by a sharp, steeply upturned border; outer slope of anterior border nearly vertical, forming a broad (*sag.*) semicircular plate with 3 deep furrows, which are parallel to its lower edge; anterior border narrows outwards, so that beyond facial suture it has only one furrow running along the lateral border; glabella swollen and expanded frontally, touching anterior border; 2—3 pairs of lateral glabellar furrows; S_2 and S_3 (when present) hardly visible through coarse ornamentation; S_1 usually deep and having a shallow offspring which merges with that from the opposite side, forming an extremely shallow depression (a kind of the preoccipital furrow) well visible on internal mould; basal lobe small, triangular, cut off but not detached from glabella; occipital furrow deep, directed backwards at extremities; occipital ring convex, strongly narrowed laterally; palpebral lobe small, strongly curved, steeply rising outwards; posterior and anterior branches of facial suture running very close and parallel to axial furrow; librigena broad, triangular, with short genal spine, lateral border sharp, steeply raised with a marginal furrow; no border furrow; eye short (*exsag.*) with visual lobe vertical to the plane of palpebral lobe. In longitudinal section, occipital ring convex, not higher than glabella, which is very gently bent downwards in the front; anterior border close to glabella, vertical and sharp. In transverse section, glabella gently convex, palpebral lobes steeply rising from axial furrows, then becoming horizontal, eyes steeply placed, librigenae gently sloping down towards the sharp, upturned lateral border. Hypostoma elongate, with well defined border, faintly convex median body and shallow median furrow; maculae present but weakly pronounced; median body deeply furrowed. Thorax composed of 9 segments; axis convex, nearly twice as broad (*tr.*) as pleural lobe; the latter bent downwards at half

of its width; thoracic rings convex and narrow (*sag.*), semiannulus broad (*sag.*), crescentic, separated from the articular half-ring by a deep furrow; pleurae slightly pointed, flattened along their sloping outer portion; abaxial parts divided by broad pleural furrows into flat anterior bands and equally broad (*exsag.*) but very convex posterior bands. Doublure of thoracic pleurae has its panderian openings in the form of elongate, short notches situated behind the elevated crests of the panderian protuberances. Pygidium elliptical, surrounded by a faintly convex, broad marginal part; no border furrow; axis about as broad as pleural lobe, with 13 convex rings; ring-furrows deep, first axial ring with a broad semiannulus; 11 ribs, reaching the very edge of the pygidium, only the two first ribs having developed their posterior bands, the latter being however suppressed against corresponding anterior bands; pleural furrows very deep and wide. In longitudinal section, axis gently bent down at the end, postaxial region sloping. In transverse section, axis highly elevated above vaulted pleural lobes. Pygidial doublure narrow, its inner margin reaching the end of the axis. Ornamentation consisting of coarse, spiny tubercles with granules of different size spaced among them; spines always directed backwards, forming, on anterior slope of frontal lobe, sagittally elongated protuberances; along the outer edge of the palpebral lobe the spines arranged in a single row, a tubercle present in the middle part of the central depression of the palpebral lobe; occipital ring covered by irregularly spaced spines and tubercles; along (*tr.*) axial rings of thoracic and pygidial segments an irregular row of spines; along (*tr.*) posterior bands of thoracic pleurae and anterior bands of pygidial ribs a single, irregular row of spines is arranged, reaching on ribs to the very edge of pygidium.

Variability within the species was observed on pygidia. The specimens have 14 or 15 rings and the somewhat convex marginal part of the pygidium is sometimes not pronounced at all, being instead very indistinctly concave. Such an indistinctly concave border is to be found on all pygidia coming from the limestone deposits, while these from „Rotten Stone" are invariably provided with a somewhat convex marginal part.

Growth changes. — In Stebden Knoll, Cracoe, Yorkshire, a young cranidium was found (GSM O 3424, length 2.7 mm; Pl. XII, Fig. 2) which occurs together with the adult pygidia of *E. seminiferum*. It shows a parallel-sided glabella (very much like that found in the *Phillipsia* species) which is covered by a coarse granulation (spinose?). The glabella has very deeply incised furrows, and reaches the steep anterior border. Anterior branches of the facial sutures are comparatively divergent.

Remarks. — *Eocyphinium seminiferum* (PHILLIPS, 1836) differs from all the known species of this genus in its comparatively short glabella which is broadest frontally. A similarly short glabella is found in *E. brevis* n. sp., however in this species it is as broad frontally as posteriorly, being moreover somewhat shorter than in *E. seminiferum*. The pygidia of both compared species are also quite different, this of *E. seminiferum* being longer and less convex. Very close to *E. seminiferum* seems to be *E. margaritiferum* (ROEMER, 1870) from the Lower Namurian of Upper Silesia and Slovakia, especially where their pygidia are concerned. The glabella of *E. margaritiferum* is, however, frontally somewhat narrower than in *E. seminiferum*. The specimens described by WEBER (1937, p. 73, Pl. 8, Figs 27—29) as "*Griffithides seminiferus* PHILL." are not conspecific with the English form. They cannot be assigned to *Eocyphinium* REED, 1942, as they lack such typical characters of *Eocyphinium* as: 1) the steeply upturned anterior border which is deeply furrowed and attached to the frontal lobe of the glabella (the anterior border of WEBER's specimens is narrow and horizontal without furrows), 2) marked preoccipital ring. Moreover, the pygidia of the specimens described by WEBER are surrounded by a distinct,

narrow and convex border, which in such shape is never found in any *Eocyphinium* species. The specimens mentioned are only convergent with *Eocyphinium* representatives in the spinose onrnamentation and the cylindrical shape of glabella. They seem to be closer to *Griffithides moriceps* WOODWARD, 1884 from Great Britain.

Stratigraphic and geographic range. — Middle-Upper Viséan of Great Britain.

Eocyphinium spinosum (WEBER, 1937)

Subspecies assigned: Eocyphinium spinosum spinosum (WEBER, 1937), *E. spinosum polonicum* n. subsp.
Stratigraphic and geographic range: Upper Viséan of USSR (the Urals) and Poland.

Remarks. — *Eocyphinium spinosum* (WEBER, 1937) is close to the type species of *Eocyphinium* — *E. clitheroense* REED, 1942 and maybe, both here distinguished subspecies of *E. spinosum* represent the subspecies of *E. clitheroense*. Whether this is the case, cannot be decided at present as in *E. clitheroense* the pygidium, which provides significant diagnostic characters, is unknown. A pygidium found together with the cranidium of *E. clitheroense* (p. 97) and only tentatively assigned to this species is shorter and without a flattened border, contrary to the pygidia of both subspecies within *E. spinosum*. Thus, for the time being, the present author decides to regard *E. spinosum* as a separate species.

Eocyphinium spinosum spinosum (WEBER, 1937)

(Pl. XII, Figs 10, 16)

1937 *Griffithides spinosus* n. sp.; V. N. WEBER, Kamennougolnye trilobity..., p. 71, Pl. 8, Figs 16-19.

Holotype: Pygidium, TML No. 1760/5107, figured by WEBER (1937, Pl. 8, Fig. 16); here refigured on Pl. XII, Fig. 10.

Type locality: Kaskynovo, left side of the Ahtamysh river, the Middle Urals, USSR.

Type horizon: Viséan.

Diagnosis. — Pygidium long, narrowing backwards, surrounded by a concave marginal part and narrow, somewhat convex border; axis with 16 rings; 14 ribs; glabella frontally very high in longitudinal and transverse section; preoccipital lobe very well pronounced.

Remarks. — To *Eocyphinium spinosum spinosum* (WEBER, 1937) can be assigned only the specimens described by WEBER from the South Urals and from the type locality. The pygidium recorded by this author from Alapaievsk region (outcrop 280) TML No. 1764, differs in having a very concave marginal part and represents some other species of *Eocyphinium* REED, 1942, or, what is more probable, the species of *Griffithides* PORTLOCK, 1843.

In the material from Kaskynovo described by WEBER (1937) a fragment of the anterior border with exposed doublure is preserved, which allows one to observe the very characteristic doublure of *E. spinosum spinosum*. The rostral plate is here concave (this concavity shallowing backwards), and is very indistinctly separated from the rest of the doublure, as if the rostral suture were not functional. In the places, where the exoskeleton is damaged, it is clearly visible that the anterior border is not coalesced with the glabella, but only attached to the latter very closely.

Stratigraphic and geographic range. — Type locality and type horizon.

Eocyphinium spinosum polonicum n. subsp.

(Pl. XII, Figs 3, 14; Pl. XIII, Fig. 8; Text-fig. 7*N*)

Holotype: Pygidium, Z. Pal. No. Tr. II.281; Pl. XII, Fig. 14.
Type locality: Ostrówka Hill, Gałęzice, Holy Cross Mountains, Poland.
Type horizon: Upper Viséan (D_2).
Derivation of the name: polonicum — found in Poland.

Diagnosis. — Pygidium long, weakly narrowing backwards, surrounded by a weakly concave marginal part; 13 ribs; glabella moderately long, frontally comparatively weakly elevated.

Material. — Two cranidia, 5 pygidia from the dark grey limestone of the type locality and horizon.

Dimensions (in mm):

	Z. Pal. Tr. II		
	280	281	34
Length of cranidium . . .	9.2	—	3.0
Length of glabella	7.3	—	2.3
Width of glabella	5.6	—	1.1
Length of pygidium . . .	—	10.5	—
Width of pygidium	—	12.7	—
Length of axis	—	9.5	—
Width of axis	—	4.5	—

Description. — Anterior border broad, deeply furrowed, vertically situated and attached to glabella; the latter moderately long, broad, with 3 pairs of lateral furrows; S_1 very deep, cutting off basal lobe; preoccipital lobe marked; palpebral lobe short (*exsag.*), very strongly curved, concave medially. In longitudinal and transverse section, glabella moderately high frontally. Librigena, hypostoma and thorax unknown. Pygidium long, faintly narrowing backwards, surrounded by a somewhat concave marginal part; axis long, slightly narrower than pleural lobe, weakly narrowing backwards; 15 axial rings; 12—13 high, widely separated ribs reaching to the edge of pygidium. In longitudinal section, axis gently sloping, postaxial region somewhat concave. In transverse section, axis low, pleural lobes comparatively strongly vaulted. Ornamentation spinose, typical for the genus.

Growth changes. — In the type locality and horizon a small cranidium of *E. spinosum polonicum* n. subsp. was found (Z. Pal. Tr. II. 34, length 3.0 mm, Pl. XII, Fig. 3). It shows a great resemblance to the cranidium of *Phillipsia* species. The *Eocyphinium* features on this cranidium are: comparatively coarse and dense ornamentation, deep glabellar furrows (especially S_1), steep anterior border, which is very close to the glabella, weakly divergent anterior branches of the facial sutures. The *Phillipsia* characters are as follows: glabella narrower frontally than across its base, anterior border, though close to the glabella, but still not attached to it, comparatively long (*exsag.*) and narrow (*tr.*) palpebral lobes. The age of the deposits, where this cranidium was found, is determined as the Upper Viséan (D_2), thus it is too young for any *Phillipsia* representative, the latter never being found above the Lower Viséan, the majority of its species being Tournaisian. The here regarded young cranidium is very similar to the young cranidium of *E. seminiferum* (PHILLIPS, 1836) found in Great Britain (Pl. XII, Fig. 2), it differs only from the latter in having less divergent anterior branches of the facial sutures and a somewhat narrower (*sag.*) occipital ring.

Remarks. — The above described *Eocyphinium spinosum polonicum* n. subsp. differs from the nominate subspecies in having a somewhat shorter and broader glabella, which is moreover not so highly elevated frontally. The basal lobes in the new subspecies are less swollen than in *E. spinosum spinosum*, where they are nearly detached from the glabella. Pygidia, of both subspecies compared, differ in the somewhat more triangular shape in the nominate subspecies, which has also a higher axis and a narrow, convex border-like structure outside the somewhat concave marginal part.

Stratigraphic and geographic range. — Type horizon and type locality.

Eocyphinium castletonensis n. sp.

(Pl. XII, Figs 6, 9; Pl. XIII, Figs 6, 9, 11; Text-fig. 6*A*, *E*, *I*, *J*, *P*)

Holotype: Pygidium, BM No. In 23029b.; Pl. XIII, Fig. 6.
Type locality: Castleton, Derbyshire, Great Britain.
Type horizon: Middle Viséan (D_1).
Derivation of the name: castletonensis — after the type locality.

Diagnosis. — Pygidium long with narrow, concave marginal part; axis with 16 rings; 12 ribs; pleural lobes posteriorly steeply sloping towards the flattened marginal part; glabella parallel-sided very, indistinctly constricted; anterior branches of facial sutures somewhat divergent.

Material. — Numerous cranidia, librigenae, hypostomata and pygidia attributed on the sedimentary surface of the light-greyish limestone (D_1) from the type locality (BM Nos. In 23028, In 23029), 2 pygidia (BM Nos. In 36807, In 26342) from the light grey limestone (D_1) of Narrowdale, Staffordshire, Great Britain.

Dimensions (in mm):

	BM In		
	23029b	23028	36807
Length of cranidium	—	6.8	—
Length of glabella	—	5.5	—
Width of glabella	—	4.0	—
Length of pygidium	13.0	—	12.0
Width of pygidium	14.5	—	15.0
Length of axis	11.2	—	10.0
Width of axis	6.0	—	5.2

Description. — Glabella almost parallel-sided, very indistinctly constricted, S_1 glabellar furrow the only marked; median preoccipital lobe weakly developed; anterior border deeply furrowed, steep and attached to the glabella, convex at frontal part of the fixigena; palpebral lobes short (*exsag.*), curved; anterior branch of facial suture diverging somewhat from axial furrow; librigena broad with short (*exsag.*) and high eye and short genal spine; hypostoma high in transverse section, elongate, narrow; median body indistinctly divided by median furrow; its surface very deeply furrowed. In transverse section, glabella very convex, especially frontally, palpebral lobes lower than the glabella, somewhat depressed. In longitudinal section, occipital ring as high as glabella, preoccipital lobe weakly distinguished, glabella frontally very steeply sloping towards anterior border, which is vertically upturned and attached to glabella. Pygidium elongate with concave marginal part; axis slender, long, with 16—17 rings; rings narrow, convex;

12—13 convex ribs passing onto concave marginal part and reaching to the very edge of pygidium; ribs consisting of anterior bands exclusively, except the first two of them, where very reduced posterior bands can be recognized. In longitudinal section, axis straight, postaxial region steeply sloping towards flat marginal part. In transverse section, axis gently arched, pleural lobes weakly vaulted, marginal part somewhat concave. Ornamentation typical for the genus, spinose. Spines of comparatively large basal diameters, densely arranged. They are spaced irregularly on the surface of the glabella and librigena; on pygidium one row of spines present along (*tr.*) each ring and rib. Their longitudinal arrangement not quite regular.

Remarks. — The glabella of *Eocyphinium castletonensis* n. sp. differs this species from other representatives of the genus in being almost parallel-sided, the usual constriction at the level of S_2 lacking here. In this respect, the glabella reminds of the young representatives of the genus. Pygidium in its proportions is similar to that of *E. spinosum* (WEBER, 1937), being elongate and having slender axis as well as the somewhat concave marginal rim. It differs in the structure of its postaxial region, which is more steeply sloping. In the described material of *E. castletonensis* there is a pygidium coming from an unknown locality in Derbyshire (BM In 36807, Pl. XII, Fig. 6) which though has the same proportions as the type specimen, is however subtriangular in the shape, instead of being broadly rounded posteriorly as the typical pygidia within this species. However the presence of the concave border as well as the fact that the ribs come to the very edge of the pygidium make it probable that this specimen should be placed within the range of variability of *E. castletonensis* n. sp.

Stratigraphic and geographic range. — Middle Viséan (D_1) of Great Britain.

Eocyphinium granilimbatum (WEBER, 1937)

1937. *Phillipsia truncatula* var. *granilimbata* n. var.; V. N. WEBER, Kamennougolnye trilobity..., p. 42, Pl. 10, Fig. 34

Holotype: Pygidium, TML No. 943/5107; figured by WEBER (1937, Pl. 10, Fig. 34).
Type locality: Outcrop 42-d (ROTAI's collection), Kuznetsk Basin, USSR.
Type horizon: Viséan.

Diagnosis. — Pygidium long, broadly rounded posteriorly, surrounded by a somewhat concave marginal part; axis slender with 19 rings; pleural lobes strongly vaulted, with 13 ribs; ornamentation spinose, regularly arranged along axis; along the ribs (*tr.*) reaching to the very edge of the pygidium.

Remarks. — "*Phillipsia truncatula* var. *granilimbata*" WEBER, 1937, in its spinose ornamentation, which extends along the ribs (*tr.*) to the very edge of the pygidium, deviates from the typical representatives of *Phillipsia* PORTLOCK, 1843. It seems to be, in these characters, very close to the species of *Eocyphinium* REED, 1943 but with a longer axis than the latter. Moreover, so regular ornamentation of the axis is rarely found in the representatives of *Eocyphinium*, being much more common in *Phillipsia*. The stratigraphic position (Viséan) of this form also speaks for its assignment within *Eocyphinium*.

Eocyphinium parvum n. sp.

(Pl. XII, Figs 5, 7, 8; Text-fig. 7*R*)

Holotype: Pygidium; ZNG Kr. No. Cz. 4; Pl. XII, Fig. 7.
Type locality: Piekło Hill, Orlej, Cracow region, Poland.
Type horizon: ?Lower Namurian.
Derivation of the name: Lat. *parvum* — small; because of the small dimensions of the specimens.

Diagnosis. — Pygidium short, broadly rounded with concave border; 13 axial rings; 10—11 ribs; ornamentation of pygidial axis irregular; glabella short, anterior border visible in front of glabella; occipital ring strongly narrowed at extremities.

Material. — One cranidium (partly an internal mould), 3 pygidia from the black shales of the type horizon and locality.

Dimensions (in mm):

	ZNG Kr. Cz.	
	3	4
Length of cranidium . . .	6.0	—
Length of glabella	5.0	—
Width of glabella	4.1	—
Length of pygidium . . .	—	4.0
Width of pygidium	—	5.0
Length of axis	—	3.2
Width of axis	—	1.8

Description. — Anterior border attached to glabella frontally, upturned, comparatively low, with 3 deep furrows; glabella cylindrical somewhat swollen frontally, with a weakly marked preoccipital lobe; basal furrow deep, S_2 marked; occipital lobe broad (*sag.*) narrowing laterally. In longitudinal section, occipital ring somewhat higher than glabella, the latter slightly arched with an indistinctly pronounced preoccipital lobe, anterior border attached to glabella. In transverse section, glabella swollen. Librigena, hypostoma and thorax unknown. Pygidium short, surrounded by a somewhat convex, broad marginal part; axis as broad as pleural lobe, with 13 rings; 10—11 ribs. In longitudinal section, axis gently sloping, postaxial region convex. In transverse section, axis rounded, pleural lobes distinctly vaulted. Ornamentation spinose, typical for the genus; spines along the axis irregularly arranged.

Remarks. — The here described new species is similar to *Eocyphinium spinosum polonicum* n. subsp. in the structure of its cranidium the glabella having the same proportions in both forms compared. Their pygidia, however, differ substantially, this of *E. parvum* n. sp. being short and broad, while that of *R. spinosum polonicum* is elongate. A pygidium close to this of *E. parvum* is present in *Eocyphinium brevis* n. sp. The latter has a similar concave marginal part and is comparatively short, like the pygidium of *E. parvum*. But, the pygidial axis of *E. parvum* is more slender. Cranidia in both compared species are, however, different, this of *E. parvum* having a longer glabella and the anterior border visible in front of it, while it is much less exposed in *E. brevis*.

Eocyphinium brevis n. sp.

(Pl. XII, Figs 12, 13; Text-fig. 6*D*, *M*)

1884. *Griffithides seminiferus* PHILLIPS; H. WOODWARD, A Monograph..., p. 28, Pl. 8, Fig. 14.

Holotype: Pygidium, SMC No. E 3673; Pl. XII, Fig. 13.
Type locality: Settle, Yorkshire, Great Britain.
Type horizon: Viséan.
Derivation of the name: Lat. *brevis* — short; because of the short pygidium.

Diagnosis. — Pygidium broad and short; pygidial border concave; axis with 13 rings, distinctly curved in longitudinal section, glabella short with a distinct preoccipital lobe.

Material. — Seven pygidia with exoskeleton preserved, 1 damaged cephalon, 3 cranidia, 1 librigena (internal moulds) and several fragments of cranidia and pygidia from the grey limestone of Settle, Yorkshire, Great Britain (SMC Nos. E 3671-80, E 3488-96).

Dimensions (in mm):

	SMC	
	E 3493	E 3673
Length of cephalon . . .	7.5	—
Length of glabella	6.0	—
Width of glabella	4.0	—
Length of pygidium . . .	—	9.5
Width of pygidium	—	12.2
Length of axis	—	8.3
Width of axis	—	4.2

Description. — Cephalon strongly vaulted, with upturned border, glabella parallel-sided, swollen frontally, short; basal lobe cut off, S_1 deep with a short offspring, which marks off a preoccipital lobe; S_2 short; occipital ring broad (*sag.*) narrowing laterally. In longitudinal section, the glabella slightly raised in front of the preoccipital lobe, anterior border close to glabella, upturned. In transverse section, glabella slightly convex, librigena strongly vaulted, lateral border strongly upturned, with a deep longitudinal furrow. Pygidium short and broad, axis broad, with 13 rings, slightly narrowing posteriorly, not reaching the border; ring-furrows deep and broad; a shallow furrow present along the side of the axis, parallel to axial furrow; 10 ribs separated by very deep and broad pleural furrows; posterior band of rib visible only on the first rib; first four ribs reaching to the margin of the pygidium, others reaching only to the border. In longitudinal section, axis strongly curved, posterior border slightly convex. In transverse section, axis broad and convex, pleurae strongly vaulted. Ornamentation very coarse; pygidium seems to be covered rather by large tubercles than spines, they are arranged in one row along (*tr.*) the rings and ribs, the concave part of the border being smooth, and only on very edge of the pygidium is there a row of indistinct tubercles, each in the continuation of a rib.

Remarks. — There was observed a certain irregularity on the holotype pygidium. The latter has, on its right side in front of the second rib, a thoracic pleura almost normally developed, which is, however, already fused with the rest of the pygidium along its edge. Between the latter point and the axial furrow, the interpleural furrow, on the right side of the pygidium in question, is very clear and deep, contrary to the left side, where it is indistinctly marked. Pygidium of *Eocyphinium brevis* n. sp. in its shortness reminds of this in *E. parvum* n. sp. (see p. 103). Also close to this in *E. brevis* is the pygidium described here as *E. ?clitheroense* REED, 1943 (p. 97). Both pygidia have in common a short, subsemicircular shape, comparatively broad axis and the very convex ribs. Nevertheless, there are the differences between them, e.g. pygidium of *E. brevis* is provided with a somewhat concave marginal rim, which lacks in the specimen compared (see p. 97). In its short pygidium *E. brevis* resembles some species of the Tournaisian genus *Piltonia* GOLDRING, 1955, e.g. *P. altaica* (WEBER, 1937). Pygidium of the latter species has a similarly developed marginal rim, which is flattened but it has a narrower axis and is less convex than the pygidium of *Eocyphinium brevis*. In addition, cephalon of *Piltonia altaica* is quite different, being typical for the *Piltonia*.

Stratigraphic and geographic range. — Type horizon and type locality.

?Eocyphinium podtsheremensis n. sp.

1937. *Phillipsia truncatula* PHILL. var. *multipustulata* SMYTH; V. N. WEBER, Kamennougolnye trilobity..., p. 42, Pl. 4, Fig. 36.

non 1930. *Phillipsia truncatula* var. *multipustulata* n. var.; L. B. SMYTH, The Carboniferous rocks..., p. 361, Pl. 18, Figs 6, 7.

Holotype: Pygidium, TML No. 954, 955/5107 (internal and external mould of the same specimen), figured by WEBER (1937, Pl. 4, Fig. 36).

Type locality: Podtsherem, the North Urals, USSR.

Type horizon: Tournaisian.

Derivation of the name: podtsheremensis — after the type locality.

Diagnosis. — Pygidium long, with slender axis of about 20 rings; ornamentation in form of wart-like spines.

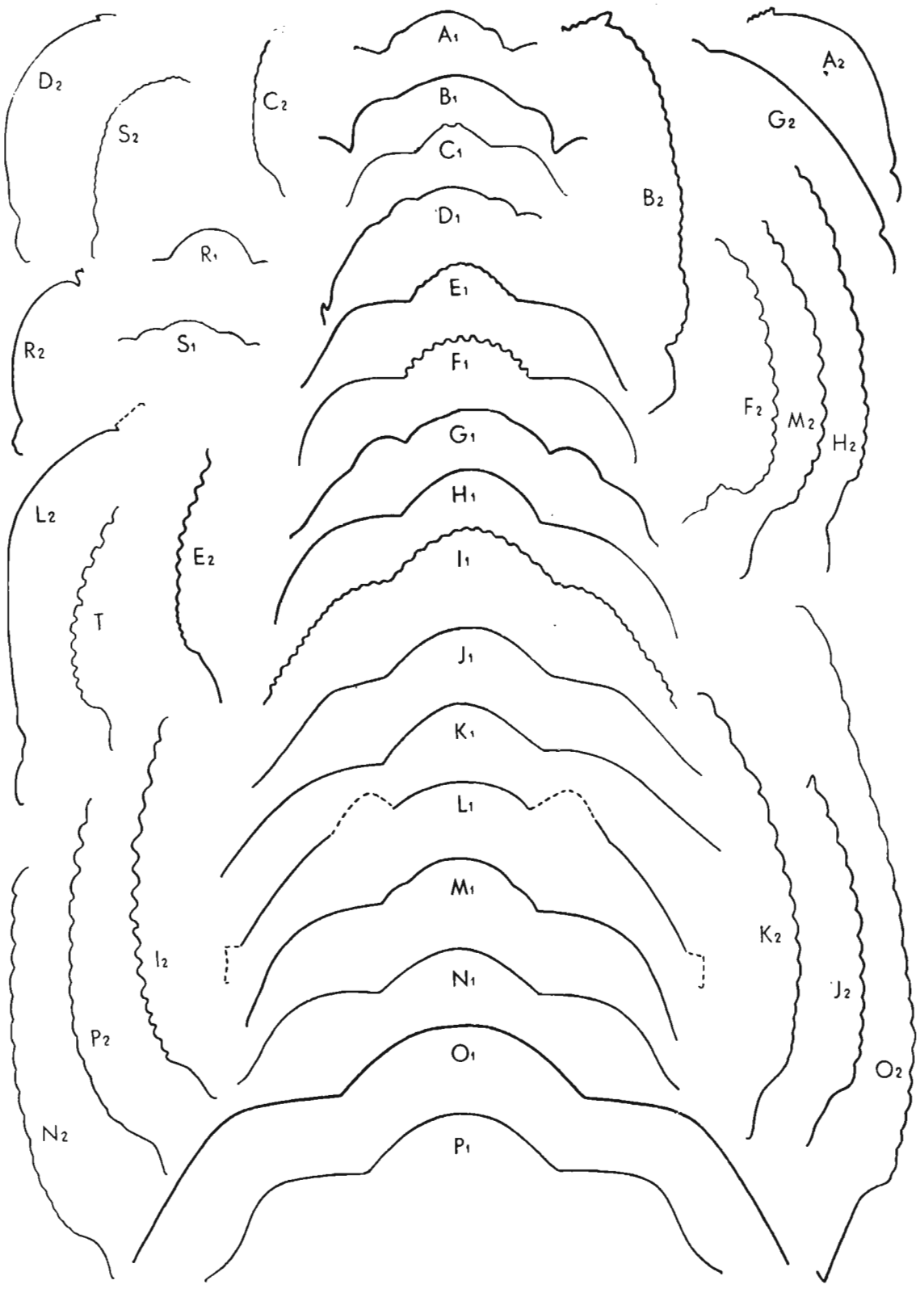
Remarks. — The ornamentation of the pygidium here reconsidered, being the only specimen known, is so striking that this specimen cannot be assigned to any known species. From the point of view of the length of its axis, as well as the fact that the pygidium was found in the Tournaisian deposits, it would be reasonable to assign it within *Phillipsia* PORTLOCK, 1843. On the other hand, no one form is known within this genus with such a prominent, verrucous ornamentation, but which is common within the *Eocyphinium* REED, 1943. The structure of the marginal part of pygidium in *?Eocyphinium podtsheremensis* n. sp. is also very unlike this in *Phillipsia* where the narrow, flattened band is developed, which is usually placed in more horizontal plane than the pleural lobes. In ?*E. podtsheremensis* the marginal part of pygidium is not distinguished from the pleural lobes and the verrucous ornamentation covers the pygidium to its very margin. Though the number of axial rings in *Eocyphinium* usually does not exceed 16—17, in some rare cases it is 19 (*E. granilimbatum* WEBER, 1937), in ?*E. podtsheremensis* n. sp., the number of axial rings is 20, what would be an exception within the *Eocyphinium*. This is why the assignment of the new subspecies to *Eocyphinium* is here tentative.

Stratigraphic and geographic range. — Type horizon and type locality.

Fig. 6

A *Eocyphinium castletonensis* n. sp., cranidium (BM In 23029a), Castleton, Gt. Britain, Viséan; B *E. seminiferum* (PHILLIPS), cranidium (BM 45035), Matlock, Gt. Britain, Viséan; C *Phillipsia gemmulifera* (PHILLIPS), pygidium (BM It 2267); Settle, Gt. Britain, ?Viséan; D *Eocyphinium brevis* n. sp., cephalon (SMC E 3493), Settle, Gt. Britain, ?Viséan; E *E. castletonensis* n. sp., pygidium (BM 4071c), Derbyshire, Gt. Britain, Viséan; F *E.? clitheroense* REED, pygidium (BM It 2261), Bolland, Gt. Britain, ?Viséan; G *Phillipsia kellyi* PORTLOCK, holotype specimen, cephalon (GSM 63045), Ardpodien, Eire, Tournaisian; H *Ph. kellyi* PORTLOCK, same specimen, pygidium; I *Eocyphinium castletonensis* n. sp., pygidium (BM 36807a), Narrowdale, Gt. Britain, Viséan; J *E. castletonensis* n. sp., pygidium (BM 36807), Narrowdale, Gt. Britain, Viséan; K *Phillipsia gemmulifera* (PHILLIPS), holotype, pygidium (BM 45012), Bolland, Gt. Britain, ?Viséan; L *Eocyphinium clitheroense* REED, holotype cephalon (HMG A 3701), Clitheroe, Gt. Britain, ?Tournaisian; M *E. brevis* n. sp., holotype, pygidium (SMC E 3673), Settle, Gt. Britain, ?Viséan; N *Phillipsia gemmulifera* (PHILLIPS), pygidium (BM It 2266), Settle, Gt. Britain, ?Viséan; O *Ph. ornata belgica* n. subsp., pygidium (IRB 18.741.331), Neufvilles, Belgium, Tournaisian; P *Eocyphinium castletonensis* n. sp., holotype pygidium (BM In 23029b), Castleton, Gt. Britain, Viséan; R *E. seminiferum* (PHILLIPS), cranidium (GSM O 3424), Cracoe, Gt. Britain, Viséan; S *E. clitheroense* REED, cranidium (BM 45037), Bolland, Gt. Britain, ?Viséan. Not to the scale.

Transverse sections marked with *1*, longitudinal — with *2*


A1
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I1
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Fig. 6

Subfamily GRIFFITHIDINAE HUPÉ, 1953

Genus **GRIFFITHIDES** PORTLOCK, 1843

Type species: Griffithides longiceps PORTLOCK, 1843.

Species assigned: Griffithides longiceps PORTLOCK, 1843, *G. longispinus* PORTLOCK, 1843, *G. platyceps* PORTLOCK, 1843, *G. acanthiceps* WOODWARD, 1883—1884, *G. brevispinus* WOODWARD, 1883—1884, *G. moriceps* WOODWARD, 1883—1884, *G. claviger claviger* SCUPIN, 1900, *G. claviger uralicus* WEBER, 1937, *G. claviger halinae* n. subsp., *G. kasykurti* WEBER, 1937, *G. rotundipleuratus* WEBER, 1937, *G. obsoletus* WEBER, 1937.

Stratigraphic and geographic range: Middle Viséan — Namurian of Europe and Central Asia.

Diagnosis. — Cephalon with genal spines, glabella elongate, gibbous anteriorly with basal lobe small and distinctly detached; pygidium broadly rounded posteriorly with concave or at least flattened and horizontally placed border; 13—15 pygidial rings; 9—10 ribs; rings and ribs distinctly delimited, convex; ornamentation granular, usually dense and coarse.

Remarks. — *Griffithides* PORTLOCK, 1843, is an almost entirely European genus, *G. kasykurti* WEBER, 1937 being its only representative known from Central Asia (Kazakhstan). The American forms assigned so far to this genus do not belong here (see p. 24). *Griffithides* is very clearly distinguishable from the other Carboniferous trilobites by its very peculiar structure of glabella which is pear-shaped with reduced and clearly detached basal lobes. Some species of *Griffithides* have developed preoccipital lobe, though it is exceptional and so far noticed by the present author only in a few individuals of *G. claviger claviger* SCUPIN, 1900 (Pl. IX, Fig. 14) and *G. acanthiceps* (Pl. IX, Fig. 24). The tendency of the basal lobes to detach, so strongly marked in *Griffithides*, among the Carboniferous Griffithidinae HUPÉ is only present in *Cyphinioides* REED, 1942 and *Exochops* WELLER, 1936. The presence of the median preoccipital lobe in some representatives of *Griffithides* as well as the generally similar structure of the glabella suggest that *Griffithides* may be a forerunner of *Cyphinioides*.

Griffithides claviger SCUPIN, 1900

Subspecies assigned: Griffithides claviger claviger SCUPIN, 1900, *G. claviger uralicus* WEBER, 1937, *G. claviger halinae* n. subsp.

Stratigraphic and geographic range: Upper Viséan — Lower Namurian of Poland and USSR (the Urals, ?Kazakhstan).

Griffithides claviger claviger SCUPIN, 1900

(Pl. IX, Fig. 14)

1900. *Griffithides claviger* nov. spec.; H. SCUPIN, Die Trilobiten..., p. 14, Pl. 1, Figs 6, 9.
non 1937. *Griffithides claviger* SCUPIN; V. N. WEBER, Kamennougolnye trilobity..., p. 69, Pl. 8, Figs 1-7.
non 1937. *Griffithides claviger* SCUP.?; V. N. WEBER, *Ibid.*, p. 70, Pl. 8, Fig. 8.

Lectotype: Entire specimen, figured by SCUPIN (1900, Pl. 1, Fig. 6). Recent deposition of the lectotype unknown.
Type locality: Jugów (Hausdorf), Central Sudetes, Poland.
Type horizon: Upper Viséan (Goα).

Diagnosis. — Glabella long and slender, basal lobe extremely small, its length (*exsag.*) equals about a seventh of that of glabella; pygidium long, narrowing backwards; 14 axial rings, 11 convex ribs.

Remarks. — The present author did not have at her disposal SCUPIN's types of *Griffithides claviger* SCUPIN, 1900. However, in the IG collection of Dr. H. ŻAKOWA (ŻAKOWA, 1958) from

the Central Sudetes, several poorly preserved pygidia are present as well as a fragmentary cephalon (internal mould) from the locality Sokolec, which without any doubt represent *Griffithides claviger claviger* SCUPIN, 1900. This specimen allows one to observe that a very weak preoccipital furrow is present on the glabella. The same is marked also on the cephalon of the lectotype specimen (SCUPIN, 1900, Pl. 1, Fig. 6a).

Griffithides claviger claviger is distinctly different from all other representatives of this genus, in having the basal lobes extremely reduced. The specimens from the Viséan of the Urals cannot be assigned to *G. claviger claviger* as they differ from the latter both in the structure of the cephalon with a short glabella, comparatively large basal lobes and very large eyes, as well in the shape of the pygidium, which is shorter and broadly rounded posteriorly, while it is narrowing backwards in *G. claviger claviger*. Similar small basal lobes, long glabella and small eyes are exposed in the cephalon from the Urals, determined by WEBER (1937, p. 71, Pl. 8, Figs 11-15) as *Griffithides* cf. *acanthiceps* WOODWARD. It differs from *G. claviger claviger* mainly in having a scarcer granulation on the glabella, and in the present author's opinion probably represents another subspecies of *G. claviger* SCUPIN, 1900.

Stratigraphic and geographic range. — Upper Viséan of Poland (Central Sudetes).

Griffithides claviger halinae n. subsp.

(Pl. IX, Figs 2-4, 8, 13, 17-19, 21, 22; Text-fig. 7*B, O*)

Holotype: Cranidium, Z. Pal. No. Tr. II/1; figured on Pl. IX, Fig. 17.
Type locality: Gałęzice, Holy Cross Mountains, Poland.
Type horizon: Upper Viséan (D_2).
Derivation of the name: halinae — in honour of Dr. HALINA ŻAKOWA.

Diagnosis. — Glabella moderately elongate, length (*exsag.*) of basal lobes equals about a fifth of that of glabella, cephalic border convex; pygidium broad; axis narrower than pleural lobe, weakly tapering backwards; 13 axial rings; 9—10 ribs.

Material. — Ten cranidia, 1 damaged cephalon, 4 librigenae, numerous pygidia from the Upper Viséan (D_2) limestone of Gałęzice (Ostrówka, Besówka and Stokówka Hills), Holy Cross Mountains, Poland.

Dimensions (in mm):

	Z. Pal Tr. II.							
	1	115	36	54	171	10	181	122
Length of cranidium	6.0	3.0	—	—	—	—	—	—
Length of glabella	5.0	2.1	—	—	—	—	—	—
Width of glabella	3.8	1.5	—	—	—	—	—	—
Length of pygidium	—	—	1.4	1.8	2.1	2.3	5.0	9.8
Width of pygidium	—	—	2.0	2.7	3.0	3.8	5.0	12.5
Length of axis	—	—	1.1	1.5	1.9	2.0	4.2	8.7
Width of axis	—	—	0.3	0.4	0.9	1.1	2.0	4.1

Description. — Glabella expanding forwards, covering, but not overhanging anterior border; basal lobes detached, rounded about one fifth the length of glabella; basal furrow (S_1) broad, joined with deep axial furrow; S_2, S_3 vestigial, marked only just at the axial furrow; occipital ring prominent and very broad (*long.*) mesially, narrowing outwards; deep fossula sit-

uated in broad axial furrow, just before γ; palpebral lobe situated in front of basal lobe; anterior branch of facial suture long, slightly divergent from axial furrow, posterior one short, parallel; librigena broad, vertically situated, eye large, crescentic, lateral border furrow broad, deep, lateral border upturned convex, with longitudinal ridges; genal spine as long as the rest of librigena. In longitudinal section, occipital ring with prominent node, nearly as high as glabella, the latter inflated, covering the vertical, somewhat oblique backwards anterior border. In transverse section glabella highly vaulted; palpebral lobes steeply raising outwards, their adaxial edges lower than glabella; visual lobe vertical, genal field steeply sloping down towards upturned lateral border. Thoracic segments with slightly pointed ends. Pygidium semielliptical, surrounded by concave border; axis slender, composed of 13 rings, the posterior ones divided transversely into two parts; rings prominent mesially, flattened on sides, on slopes of each ring a pair of muscle scars; articulating half ring with preannulus; ring furrows deep in middle part, on the sides of axis much shallower; on pleural lobe 9-10 convex ribs visible, the first five ribs divided by thin interpleural furrows; anterior bands of ribs broader (*long.*) than posterior ones; pleural furrows deep and broad. In longitudinal section, axis arched, rings delimited by deep and broad furrows, each ring raising backwards, so that the successive ones form a scale-like arrangement; axis abruptly cut off at the end; postaxial field concave with slightly upturned rim. In transverse section, axis narrow (*tr.*), highly elevated above the vaulted pleural lobes; border flat, horizontal. Pygidial doublure narrow, very convex. Ornamentation: glabella covered with densely arranged vesicle-like tubercles of different size, diminishing towards the frontal border; tubercles smaller on palpebral lobes and occipital ring; librigenae coarsely granulated, except the border which is smooth. On thorax and pygidium tubercles somewhat less prominent, arranged in a row along axial ring and in a row along each of the pleural bands. Those on posterior bands of pygidial ribs smaller, but in greater number than on anterior ones.

Variability of the species concerns: 1) the shape of basal lobes which can be rounded (Pl. IX, Fig. 17) or slightly drop-like (Pl. IX, Fig. 21) but never as long as in *Griffithides longiceps* PORTLOCK, 1843; 2) the lateral furrows S_2 and S_3, which usually are obsolete, in some cases are marked, though being very short; 3) the development of the preannulus, which can be delimited by a distinct intra-annular furrow, or marked only as indistinct lowering of the first pygidial ring, behind the articulating furrow; 4) the pygidial border, which in the majority of specimens is weakly concave, while in some, its concavity is deeper; 5) the ornamentation, which is more or less prominent.

Growth changes. — The smallest cranidium known (length 3.0 mm, Pl. IX, Fig. 4) is characterized by the presence of an upturned anterior border, in front of the glabella, separated from the latter by a narrow, concave space. The glabella in this small cranidium is slender, only slightly inflated and has distinctly detached, not ornamented, elongate basal lobes; the palpebral lobes of the small cranidium are comparatively broader (*tr.*) than in adult individuals. The smallest pygidia found (length 1.4 — 1.8 mm; Pl. IX, Figs 3, 8) have more arched transversely pleural lobes, surrounded by a flat, horizontal border with a larval notch posteriorly; axis with 11 rings, pleural lobes with at least 11 ribs, passing onto the border and marked also on the postaxial field. The larger pygidium (length 2.3 mm; Pl. IX, Fig. 2) is also strongly arched transversely, but the larval notch is absent, the border is somewhat concave, instead of being flat as before; the axis is here more arched longitudinally, with 13 rings; rings are arranged in a scale-like manner as in the adult pygidia; 9 ribs visible, none of them invading the border postaxially. A very indistinct preannulus is already present.

Remarks. — *Griffithides claviger halinae* n. subsp. is similar to the nominate subspecies in the elongate shape of the glabella and comparatively small basal lobes. Nevertheless, the glabella in the here described subspecies is somewhat shorter and the basal lobes somewhat larger than those in *G. claviger claviger* SCUPIN, 1900. The pygidium of *G. claviger halinae* is not so elongate as it is in the nominate subspecies. Though, both subspecies came from deposits of about the same age (Upper Viséan), the nominate subspecies occurs in the shale facies (Go α), while *G. claviger halinae* n. subsp. was found in the limestone facies (D_2). The here described subspecies differs from *Griffithides claviger uralicus* WEBER, 1937 in the pygidium, which in *G. claviger uralicus* has a subtriangular shape, 15 axial rings and 12 ribs, while this of *G. claviger halinae* is more broadly rounded posteriorly, has only 13 rings and 9—10 ribs, which are, moreover, very distinctly divided into two parts, contrary to those of *G. claviger uralicus*. The latter subspecies was found probably in the Lower Namurian.

Stratigraphic and geographic range. — Type horizon and type locality.

Griffithides ?rotundipleuratus WEBER, 1937

(Pl. IX, Figs 7, 11; Text-fig. 7*D*)

?1937. *Griffithides longiceps* PORTL. var. *rotundipleurata* n. var. (forma *parva*); V. N. WEBER, Kamennougolnye trilobity..., p. 69, Pl. 7, Figs 36, 37.

non 1937. *Griffithides longiceps* PORTL. var. *rotundipleuruta* n. var. (forma *magna*); V. N. WEBER, *Ibid.* p. 69, Pl. 7, Figs 39-41.

Material. — Five pygidia from the Upper Viséan Limestone (D_2) of Gałęzice (Besówka Hill), Holy Cross Mountains, Poland.

Dimensions (in mm):

	Z. Pal Tr. II	
	188	39
Length of pygidium . . .	3.0	4.5
Width of pygidium	4.8	6.1
Length of axis	2.7	3.8
Width of axis	1.2	2.5

Description. — Pygidium semielliptical, axis with 12 rings, broad, strongly tapering backwards, not reaching flat, horizontal border; a pair of muscle scars marked on sides of each ring; ring-furrows deep, shallowing at their extremities; articulating half-ring with indistinct preannulus; 8 ribs on pleural lobes; the first three divided by interpleural furrows. In longitudinal section, axis slightly arched, with rings arranged scale-like, postaxial field gently sloping towards the flat, horizontally placed border. In transverse section, axis arched, as broad as the strongly vaulted pleural lobes; border, frontally having same continuous slope as rest of pleural lobes, becomes more horizontal backwards. Pygidial doublure slightly convex. Ornamentation of pygidium consists of low tubercles, arranged in one row on each ring and indistinctly pronounced along (*tr.*) the mid-line of ribs.

Remarks. — The pygidia above described were found together with the pygidia of *Griffithides claviger halinae* n. subsp., but differs from the latter very distinctly in a broader and strongly tapering backwards axis as well as in being comparatively shorter. In the shape of the axis and convexity of the pleural lobes they resemble very closely *Griffithides rotundi-*

pleuratus WEBER, 1937, the pygidia of the latter species differ from the Polish ones in having a wider border, which is moreover concave, while it is flat in the here described form. For this reason, the assignment to *G. rotundipleuratus* is tentative. *Griffithides rotundipleuratus* was assigned by WEBER (1937) to *Griffithides longiceps* PORTLOCK, 1843 as its "varietas". However, in the present author's opinion, the pygidia mentioned described by WEBER and these described above, are different from the pygidium of *Griffithides longiceps* in being much more convex transversely, having more convex ribs, which do not invade the border so distinctly as is the case in *G. longiceps*. WOODWARD (1901) recognized within *Griffithides longiceps* a new "varietas" which he named "*angusta*" as it was stated to have a thoracic axis equal to a third of a total width of the thorax. In only this character was it suggested by WOODWARD (1901) to be different from *Griffithides longiceps*, figured by this author in 1883—1884 (Pl. 6, Fig. 7). At the present author's disposal was this last mentioned specimen of *Griffithides longiceps*, so she could state that though the thoracic axis in this specimen is indeed somewhat broader than in "var. *angusta*", the difference is so small that it does not seem to be of the subspecific value.

Genus **PARTICEPS** REED, 1943

Type species: Griffithides (Particeps) scoticus REED, 1943.

Synonyms:

1933. *Phillipsia*; V. N. WEBER, Trilobity..., pp. 19, 21.
1937. *Phillipsia*; V. N. WEBER, Kamennougolnye trilobity..., pp. 54, 56.
1943. *Griffithides (Particeps)*; F. R. C. REED. Carboniferous trilobites..., p. 177.

Species assigned: Particeps scoticus scoticus REED, 1943, *P. scoticus minimus* n. subsp., *P. kiritchenkoi* (WEBER, 1937), *P. productus* (WEBER, 1937), *P. kargini* (WEBER, 1933).

Stratigraphic and geographic range: Viséan-Namurian of Great Britain, USSR (Donets Basin, the Urals), Poland.

Diagnosis. — Cephalon narrow, broadly rounded frontally, with short genal spines; anterior border completely coalesced with glabella and covered by the latter; lateral border broad, convex and very poorly delimited from librigena; glabella broadest across frontal lobe, posteriorly nearly parallel-sided, with short, oblique basal furrows; eyes large, close to glabella; pygidium strongly vaulted transversely and longitudinally, without marked border, but with somewhat concave marginal part; axis broad, distinctly narrowing backwards, with 12—14

Fig. 7

A *Linguaphillipsia paczoltovicensis* (JAROSZ), cranidium (ZNG Kr. 0.6), Paczółtowice, Poland, Tournaisian; B *Griffithides claviger halinae* n. subsp., holotype cranidium (Z. Pal. Tr. II.1), Gałęzice, Poland, Viséan; C *Paladin czarnieckii* n. sp., holotype cranidium (ZNG Kr. Cz. 14), Orlej, Poland, ?Namurian; D *Griffithides ?rotundipleuratus* WEBER, pygidium (Z. Pal. Tr. II.39), Gałęzice, Poland, Viséan; E *Cummingella jaroszi jaroszi* n. sp., n. subsp., cephalon (ZNG Kr. 0.31), Racławka, Poland, Tournaisian; F *C. carringtonensis tuberculigenata* n. subsp., pygidium (Z. Pal. Tr. II.136), Gałęzice, Poland, Viséan; G *Linguaphillipsia paczoltovicensis* (JAROSZ), holotype pygidium (ZNG Kr. 0.3), Paczółtowice, Poland, Tournaisian; H *Cummingella jaroszi jaroszi* n. sp., n. subsp., pygidium (ZNG Kr. O. 37), Racławka, Poland, Tournaisian; *Paladin czarnieckii* n. sp., pygidium (ZNG Kr. Cz. 23), Orlej, Poland, ?Namurian; J *Griffithides moriceps* WOODWARD, lectotype cephalon (SMC E 3457), Settle, Gt. Britain, ?Viséan; K *G. acanthiceps* WOODWARD, lectotype cephalon (SMC E 3395), Settle, Gt. Britain, ?Viséan; L *Cummingella carringtonensis tuberculigenata* n. subsp., holotype cephalon (Z. Pal. Tre II.139), Gałęzice, Poland, Viséan; M *Griffithides acanthiceps* WOODWARD, cephalon (SMC E 3396), Settle, Gt. Britain, ?Viséan, N *Eocyphinium spinosum polonicum* n. subsp., pygidium (Z. Pal. Tr. II.267), Gałęzice, Poland, Viséan; O *Griffithides claviger halinae* n. subsp., pygidium (Z. Pal. Tr. II.122), Gałęzice, Poland, Viséan; P *Cummingella jonesi orleiensis* n. subsp., holotype specimen, cephalon (ZNG Kr. Cz. 1), Orlej, Poland, ?Namurian; R *Eocyphinium parvum* n. sp., paratype cranidium (ZNG Kr. Cz. 3), Orlej, Poland, ?Namurian. Not to the scale.

Transverse sections marked with *1*, longitudinal — with *2*

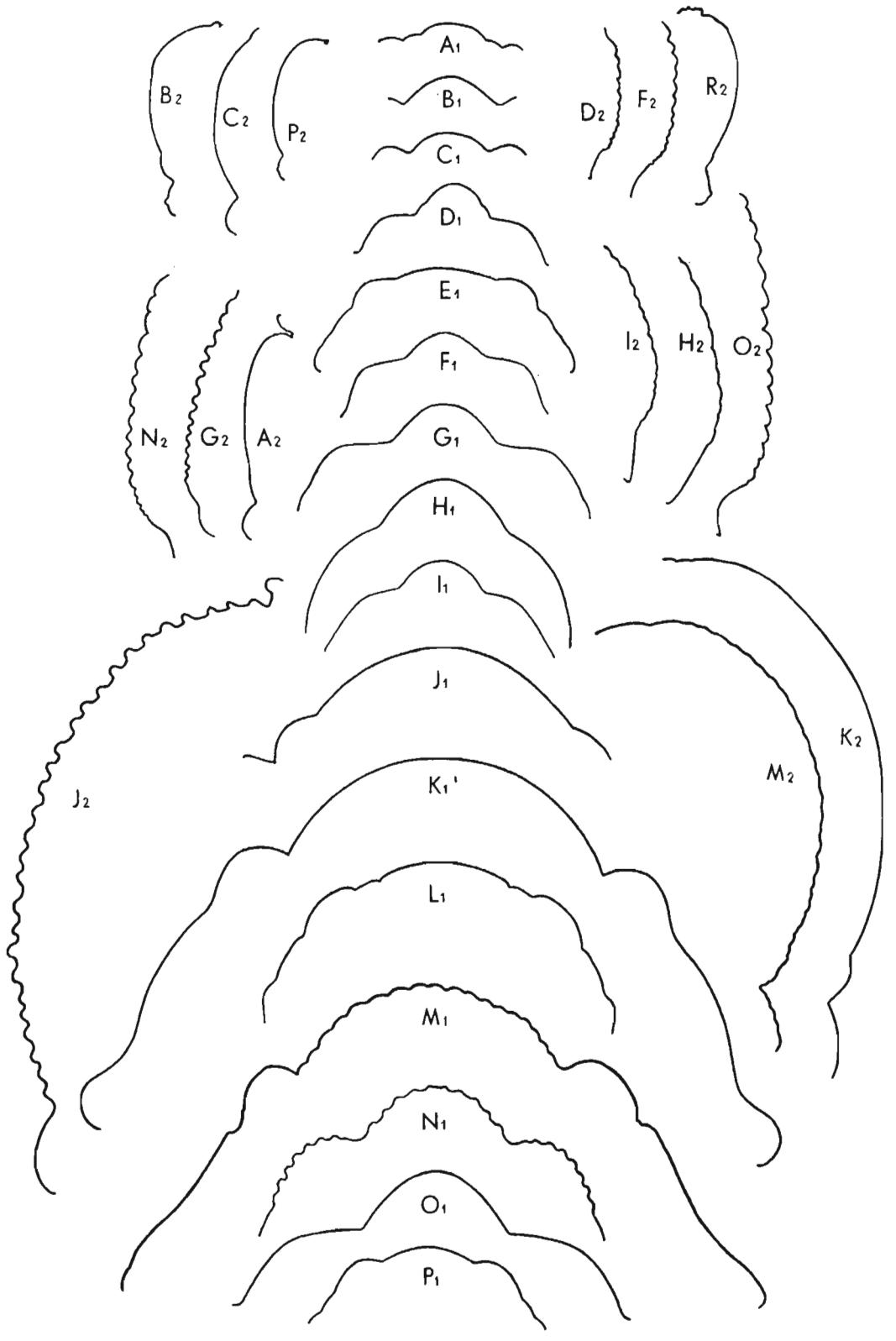
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Fig. 7

convex rings; 7—11 weakly convex to convex ribs prolonging nearly to the edge of pygidium; cephalon very smooth, scarcely and finely punctured; pygidium punctured or granulated.

Remarks. — REED (1943) while establishing this new taxon assigned *Particeps* within the genus *Griffithides* PORTLOCK, 1843 as the subgenus of the latter. However, the re-examination of the Eurasian species of *Griffithides* and *Particeps* REED, 1943 convinced the present author that *Particeps* in the structure of its cephalon strongly deviates from *Griffithides*. The most essential characters of the latter genus, i.e. strong swelling of the frontal lobe, complete separation of the basal lobes from the glabella and small, steep eyes, are lacking in *Particeps*. Moreover, contrary to *Griffithides*, *Particeps* exposes a tendency to shallowing of the basal furrows S_1, which results in the partial merging of the basal lobes with the rest of the glabella. On the other hand, the pygidium in the species of *Particeps* bears characters which indicate that this genus should be assigned with *Griffithides* within the same subfamily Griffithidinae HUPÉ, 1953. These characters are: the general shape of the pygidium which in both genera is broadly rounded posteriorly, as well as the distinct axial rings and pleural ribs (both latter features being however marked only in some species of *Particeps*, while in the other species, e.g. in *P. kargini*, the separation of rings and ribs is not so sharp). The pygidium of *Griffithides* is, in addition, characterized by the presence of a narrow, somewhat concave or flat border. In *Particeps* this character is very weakly pronounced and present only in *P. kargini* (WEBER, 1933) and *P. productus* (WEBER, 1937), while in the type species it is completely lacking. In *P. kiritchenkoi* (WEBER, 1937) an intermediate stadium is present; a kind of flat border is developed, but it still has the same, uninterrupted slope as the pleural lobes.

The cephalon of *Particeps* in the tendency of the boundaries of its glabella to fade, shallowing of furrows, usually the presence of the very large eyes and the punctured ornamentation strongly resembles the species of *Cummingella* REED, 1942, but the shape of the glabella is different as well as the shape of the basal lobes. Even in the structure of the pygidium some, very superficial similarities can be noticed, for instance its strong convexity, which is common to both genera. Those similarities may be explained rather by the similar mode of life, they probably led, than by any relationship between them. On the contrary, the relationship exists between *Particeps* and *Griffithides*.

Particeps scoticus REED, 1943

Subspecies assigned: Particeps scoticus scoticus REED, 1943, *P. scoticus minimus* n. subsp.
Stratigraphic and geographic range: Upper Viséan-Lower Namurian (P_2-E_2) of Great Britain and Poland.

Particeps scoticus scoticus REED, 1943

(Pl. XIV, Fig. 2; Pl. XV, Figs 5, 8-10, 13; Text-fig. 9*E, N, O, V, W, Z*)

1943. *Griffithides (Particeps) scoticus* subg. and sp. nov.; F. R. C. REED, Some Carboniferous..., p. 177, Pl. 2, Figs 1-5.

Lectotype: Entire, very strongly damaged specimen, RSM No. 1958.1.2673, figured by REED (1943, Pl. 2, Figs 1,2); here refigured on Pl. XV, Fig. 8.

Type locality: Invertiel, Kirkaldy, Fife, Great Britain.

Type horizon: Upper Viséan (P_2).

Diagnosis. — Frontal lobe of glabella much broader than its base; S_1 short and straight, reaching neither occipital nor axial furrow; palpebral lobe long (*sag.*) about the width of occipital ring (*sag.*); eye very large; lateral border poorly delimited from librigena; pygidium without

border; 14 axial rings, 11 ribs; anterior bands of ribs broader and higher than posterior ones, which form the slope of a rib; cephalon smooth, shining, punctured; pygidia covered by conspicuous tuberculation, tubercles being arranged in a single row along (*tr.*) the posterior edge of each axial ring and along the interpleural furrow.

Material. — One, nearly complete specimen (lectotype), 1 cranidium from Invertiel, 2 pygidia from Bogi, Fife, 1 pygidium from Bowertrapping, 1 cephalon, 1 cranidium, 1 librigena from Beith, Dalry, Ayrshire, 1 pygidium from Castleton, Derbyshire, 3 cranidia, 1 librigena from the unknown locality, Great Britain.

Remarks. — The majority of the specimens of this subspecies are known from P_2-E_2 zones of Scotland. In the British Museum collection a pygidium is stored, which according to the accompanying label comes from Castleton, Derbyshire. This would suggest the presence of high Viséan or low Namurian zones in this locality.

The cephala of *Particeps scoticus* which were at REED's disposal are very insufficiently preserved for any detailed observation. The additional material examined by the present author in the British Museum allowed her to state that *P. scoticus scoticus* REED, 1943 has such characters of cephalon which distinguish it from all the representatives of *Griffithides* PORTLOCK, 1843, where it was placed by REED (1943) (see p. 114).

Stratigraphic and geographic range. — Upper Viséan-Lower Namurian of Great Britain, Lower Namurian of Poland.

Particeps scoticus minimus n. subsp.

(Pl. XV, Figs 2, 14; Text-fig. 9*S*, *T*, *X*)

Holotype: Pygidium, GSM No. 102540; Pl. XV, Fig. 2.
Type locality: Old Quarry, near old Colliery Shaft, Christonbank, Northumberland, Great Britain.
Type horizon: Six Yard Lst., Lower Namurian (E).
Derivation of the name: Lat. *minimus* = the smallest; because of the small size.

Diagnosis. — Small size; frontal lobe of glabella about the same width as base of glabella; S_1 very shallow, reaching dorsal furrow; pygidium strongly arched transversely and longitudinally; 13 axial rings, 12 ribs.

Material. — Five cephala, 1 cranidium, 6 pygidia from the grey limestone of the type horizon and locality (GSM Nos. 102533—102541).

Dimensions (in mm):

	GSM		
	102541	102533	102540
Length of cephalon . . .	6.8	—	—
Width of cephalon	(10.0)	—	—
Length of glabella	5.2	—	—
I Width of glabella . . .	3.8	—	—
II Width of glabella . . .	4.1	—	—
Length of pygidium . . .	—	4.5	3.7
Width of pygidium	—	5.0	4.2
Length of axis	—	3.5	3.2
Width of axis	—	1.1	1.3

Description. — Cephalon narrow and compact, flatly rounded frontally; anterior border vertically placed, coalesced with glabella, which covers it nearly completely; glabella constricted between the anterior tips of eyes, from this point uniformly widening forwards, and very indistinctly widening backwards, so that it is nearly as wide across its base as at front; basal furrow S_1 very shallow, straight, reaching to dorsal furrow, but ended far in front of occipital furrow, S_2 and S_3 short and indistinct; occipital furrow very thin, moderately deep; occipital ring broad, with node, strongly sloping towards its extremities; palpebral lobe reaching from S_3 back nearly to occipital furrow, equal in width (*tr.*) to two thirds of that of occipital ring; librigena with short genal spines and lateral border comparatively well delimited; eye very large, rimmed with narrow subocular groove. In longitudinal section, occipital ring broad and flat, as high as glabella, the latter very gently sloping down towards the flat, vertically situated anterior border. In transverse section, glabella nearly flat, palpebral lobes horizontal, only somewhat lower than glabella, visual surface of eyes vertical, librigenae steeply sloping, lateral border very indistinctly delimited, continuing the slope of librigenae. Hypostoma and thorax unknown. Pygidium somewhat longer than semicircle, without border, but with slightly concave, very narrow band along the margin; axis as broad as pleural lobe, gently and uniformly narrowing backwards, with a line of appodemal markings on each side; 13 convex rings; 12 convex ribs reaching nearly to the margin and well visible to the very end of pygidium; they are composed of anterior bands, posterior ones forming the slope of rib. In longitudinal section, axis distinctly arched in its posterior part, postaxial region very steeply sloping. In transverse section, axis very high, pleural lobes very strongly vaulted. Ornamentation: cephalon smooth and somewhat shining, scarcely covered by fine punctures. On pygidium, a single row of conspicuous tubercles arranged along the posterior edge of each axial ring and of each anterior band or rib.

Remarks. — The new subspecies differ very slightly from *Particeps scoticus scoticus* REED, 1943, mainly in its smaller size, the glabella somewhat less expanded frontally and more strongly vaulted pygidium, which has also shorter axis, which counts 13 rings instead of 14 as it is the case in the nominate subspecies.

A question could be pushed forward, whether *P. scoticus minimus* n. subsp. does not represent an adolescent form of *P. scoticus scoticus*. It seems to be not very likely as in such a case the basal furrows would be very deeply incised and basal lobes well cut off as in all known young Proetidae. In the subspecies above described contrary is the case. Moreover, all the specimens found in the type locality are of about the same, small size, which also makes it more probable that they represent the adult developmental stage.

Stratigraphic and geographic range. — Type locality and type horizon.

Particeps kargini (WEBER, 1933)

(Pl. XV, Figs 3, 7)

1933. *Phillipsia derbyensis* var. *kargini* n. var.; V. N. WEBER, Trilobity..., p. 19, Pl. 1, Figs 4-9.
1937. *Phillipsia derbyensis* var. *kargini* WEBER; V. N. WEBER, Kamennougolnye trilobity..., p. 56, Pl. 6, Figs 23, 24.
1968. *Cummingella kargini kargini* (V. N. WEBER); G. HAHN & R. HAHN, Cummingella (Trilobita)..., p. 449.

Holotype: Entire specimen (strongly damaged), No. TML, 62/3139, figured by WEBER (1933, Pl. 1, Fig. 9; 1937, Pl. 6, Fig. 23); here refigured on Pl. XV, Fig. 7.

Type locality: Novoselovka, Donets Basin, USSR.

Type horizon: Lower Namurian.

Diagnosis. — Cephalon compact, with pointed genal angles; glabella somewhat broader frontally than across its base; weakly swollen basal lobes; glabellar furrows, except shallow S_1, absent; eye short, placed opposite the middle of glabella; pygidium subtriangular, weakly convex, with very narrow, flat border, axis with 13—14 rings, 8—9 ribs; ornamentation granular, scarce.

Remarks. — "*Phillipsia derbyensis* var. *kargini*" WEBER, 1933 cannot be assigned to the genus *Cummingella* REED, 1942 as most of the remaining representatives of "*Phillipsia derbiensis*" auctorum. It differs from all species of the Cummingellinae HAHN & HAHN, 1967 in having: 1) a glabella which is not distinctly constricted at one, definite point, as in the representative of Cummingellinae, being instead limited laterally by the axial furrows, which are concave inwards; 2) much smaller eyes, but relatively wider (*tr.*) palpebral lobes; 3) straight and oblique basal furrows not reaching the occipital ring, while those in the species of Cummingellinae are always arched and most often merged with the occipital furrow; 4) a more flat pygidium surrounded by a flat, very narrow border, the latter if present, being broad in Cummingellinae. Most of the characters mentioned are found in the genus *Particeps* REED, 1943, except that the eyes, in the representatives of this genus, are larger (though the tendency of the size of eyes to diminish is marked in this genus) and the glabella distinctly broadens forwards from a definite point at the level of S_3. However, the glabellae in the known young representatives of *Particeps* (*Particeps productus*; Pl. XV, Figs 1, 4) are not so strongly expanding frontally as in the adult specimens and the axial furrows are here not so sharply bent outwards frontally. It could be evidence that during the ontogenetic development the shape of glabella in the *Particeps* passed through the stadium represented in the glabella of *P. kargini*. The pygidium of the latter species is close to the pygidia of the species of *Particeps*, though some differences are here noted, e.g. the ribs are flatter than in the type species and a narrow band is present along the margin of the pygidium, which is lacking in *P. scoticus* REED, 1943. The pygidium of *P. kargini* somewhat resembles the pygidia reported in the genus *Phillibole* (Cyrtosymbolinae) in the tendency of the rib-furrows to disappear posteriorly. However, no similarity exists between the cephala of both forms.

Stratigraphic and geographic range. — Lower Namurian of USSR (the Donets Basin).

Particeps kiritchenkoi (WEBER, 1937)

(Pl. XIV, Fig. 5; Pl. XV, Fig. 11)

1933. *Phillipsia derbyensis* MART. var. *α* ; V. N. WEBER, Trilobity..., p. 21, Pl. 1, Fig. 12.
1937. *Phillipsia derbyensis* var. *kiritchenkoi* n. var.; V. N. WEBER, Kamennougolnye trilobity..., p. 54, Pl. 6, Figs 6, 7.

Holotype: Pygidium, No. TML 1429/5107, figured by WEBER (1937, Pl. 6, Fig. 7); here refigured on Pl. XIV, Fig. 5.
Type locality: Tashtchla river, the South Urals, USSR.
Type horizon: Upper Viséan.

Diagnosis. — Basal furrow of glabella deep, basal lobe occupying less than one third of basal glabellar width, palpebral lobe narrow; posterior tip of eye distant from occipital furrow; length of eye equal to one third the length of glabella; pygidium with 12 rings, margin faintly concave in posterior part, with weakly pronounced prolongations of ribs; along posterior edges of axial rings and of anterior bands of ribs, a row of low and small tubercles.

Remarks. — Material of this species described by WEBER (1933, 1937) included two fragmentary cephala and a number of pygidia from Donets Basin and Urals. The cephala differ

only very slightly from one another, this from the Donets Basin having a somewhat more swollen frontal lobe and a more deeply incised basal furrows. Whether those differences have a subspecific value cannot be here decided because of the scarcity of the material of the genus *Particeps*. Moreover, as the available material indicates, the cephala are surprisingly conservative in this genus, the more essential differences being observed on pygidia. The pygidium associated with the cephalon of *Particeps kiritchenkoi* (WEBER, 1957) from the Donets Basin and assigned by WEBER to this species (together with one other pygidium more — Pl. 1, Fig. 14), differs very significantly from the holotype, mainly in being flatter, having a shorter axis (11 rings), less narrowing backwards, and comparatively well delimited, somewhat convex border. Both these pygidia from the Donets Basin, most probably, belong to *Cummingella* REED, 1942. It should be here emphasized, however, that the holotype pygidium also has the *Particeps* characters very weakly marked. It differs from the pygidia of other *Particeps* species in having a less concave marginal part, and ribs very indistinctly pronounced near the margin, while in the type species — *P. scoticus* (REED, 1943) — they are convex and distinct nearly to the very edge of the pygidium. In general aspect, this pygidium also resembles somewhat the pygidium of *Cummingella*. All the remaining pygidia from WEBER'S collection assigned to "*Ph. derbyensis* var. *kiritchenkoi*" (Pl. 6, Figs 8, 9; Pl. 9, Fig. 4) or to "*Ph. derbyensis* cf. var. *kiritchenkoi*" (Pl. 6, Figs 10, 11) cannot be, in the present author's opinion, assigned to the genus *Particeps*, and, may be, represent the species of *Cummingella*.

Stratigraphic and geographic range. — Upper Viséan, ?Lower Namurian of USSR (the Donets Basin and the Urals).

Particeps productus (WEBER, 1937)

(Pl. XV, Figs 1, 4, 6, 12)

1937. *Phillipsia derbyensis* var. *producta*; V. N. WEBER, Kamennougolnye trilobity..., p. 56, Pl. 6, Figs 25-27.

Holotype: Cranidium No. TML 42/4173, figured by WEBER (1937, Pl. 6, Fig. 26); here refigured on Pl. XV, Fig. 6.
Type locality: Outcrop No. 280, Alapaievsk region, the Urals, USSR.
Type horizon: Namurian.

Diagnosis. — Basal furrow long, reaching close to occipital furrow, basal lobe occupying one third of basal glabellar width, palpebral lobe narrow, posterior tip of eye in some distance from occipital furrow, eye moderately large, surrounded by broad subocular groove; pygidium strongly vaulted; axis with 13 moderately convex rings, 9 convex ribs, pygidium and cephalon punctured.

Material. — Four cranidia, 3 librigenae, 1 hypostoma, 10 pygidia from light-grey Namurian limestone (outcrop 280 of MICHEEV'S collection) of the Alapaievsk region, the Central Urals.

Dimensions (in mm):

	TML 31/4173
Length of pygidium . . .	11.7
Width of pygidium	13.3
Length of axis	10.3
Width of axis	6.1

Description of pygidium. — Pygidium somewhat elongate, with margin in its posterior part slightly concave; axis as broad as pleural lobe, distinctly narrowing and bluntly ended; 13 moderately convex rings, ring-furrows distinct, narrow, undulated; on pleural lobe 9 convex

ribs, pleural furrows distinct, interpleural furrows extremely faint and visible only along (*tr.*) first two ribs, where they divide the rib into two unequal bands, the anterior one broader; ribs become flatter outwards and invade concave marginal part, not coming close to the edge of pygidium; exoskeleton smooth, punctured. Pygidial doublure convex, steeply placed, reaching to the tip of axis. In longitudinal section, axis gently arched, well delimited at the tip, postaxial region moderately concave. In transverse section, axis arched, pleural lobes strongly vaulted, horizontal along the proximal third of their width (*tr.*), then steeply sloping outwards.

Growth changes. — Two cranidia of *P. productus* (WEBER, 1937) from the type collection are smaller than the remaining ones. The smallest cranidium (TML 44/4173, length 4.8 mm; Pl. XV, Fig. 1) has typical for *Particeps* basal furrows — short, straight and deep, distant from occipital furrow, while in the adult, holotype cranidium they are longer and shallower. Basal lobes of this small cranidium are also narrower (*tr.*) than in the adult specimen. Other, somewhat larger cranidium (TML 45/4173, length 7.5 mm; Pl. XV, Fig. 4) represents, in the characters above mentioned, a transitional stage between the smallest and the adult cranidium.

On the small pygidia (which are, however, too poorly preserved for any more general observations) occurs a different ornamentation than that observed on the adult one. Exoskeleton is here somewhat rough, with a row of extremely low tubercles along the posterior edges of axial rings and interpleural furrows. The ornamentation of those smaller pygidia is typical for *Particeps*.

Remarks. — WEBER (1937) while establishing "*Phillipsia derbyensis* var. *producta*" did not know the pygidium of this form. However, in the same material from the Alapaievsk region, where the cranidia occur, there were found pygidia typical for the genus *Particeps*. The description of these pygidia is given above to complete WEBER's description (1937). The hypostoma described by WEBER (1937, Pl. 6, Fig. 25) is of an unusual character, being very high and narrow transversely (Pl. XV, Fig. 6), so that the medial line of hypostoma is pronounced in the form of a rounded ridge.

Particeps productus (WEBER, 1937) in the structure of its pygidium is closer to *P. scoticus* REED, 1943 than the Upper Viséan *P. kiritchenkoi* (WEBER, 1937). Their pygidia, in fact, differ only in the somewhat longer pygidial axis in *P. scoticus* (14 rings), better pronounced ribs, which in the latter species are convex along their whole length (*tr.*), and lastly, in the ornamentation, which is granular in the type species. In the structure of the cephala the considered species from the Urals is closer to *P. kiritchenkoi*, in having narrow palpebral lobes and shorter eyes situated some distance from the occipital furrow, while they are very near the latter, in the type species. The character which mainly distinguishes *P. productus* is the shape of the basal furrow, which is comparatively shallow, long, reaching close to the occipital furrow. In this character *P. productus* resembles the species of *Cummingella* REED.

Stratigraphic and geographic range. — Type locality and type horizon.

Genus **CYPHINIOIDES** REED, 1942

Type species: Cyphinioides ashfellensis REED, 1942.

Synonyms:

1933. *Griffithides*; V. N. WEBER, Trilobity..., p. 38.
1937. *Griffithides*; V. N. WEBER, Kamennougolnye trilobity..., pp. 74, 75.
1937. *Griffithides (Cyphinium)*; V. N. WEBER, *Ibid.*, p. 79.

Species assigned: Cyphinioides ashfellensis REED, 1942, *C. micheevi* (WEBER, 1937), *C. alapaicus* (WEBER, 1937), ?*C. limbatus* n. sp.

Stratigraphic and geographic range: Upper Viséan of Great Britain, Namurian, Upper Moscovian of USSR (the Urals, Donets Basin).

Diagnosis. — Cephalon with anterior border coalesced with glabella and partly, or entirely, covered by the latter; glabella expanded frontally with swollen, completely detached, drop-like basal lobes; medial preoccipital lobe always present, although weakly pronounced; pygidium surrounded by concave band; axial rings very prominent mesially, 12—15 in number; ribs with anterior bands much broader and higher than posterior ones, which form the slope of each rib.

Remarks. — This genus is extremely rare and only one species represented by one specimen was known. It now seems that two Namurian species "*Griffithides micheevi*" WEBER, 1937 and "*Griffithides (Cyphinium) alapaicus*" WEBER, 1937 from the Alapaievsk region (the Urals) of USSR show so strong a similarity in the structure of the glabella, shape of basal lobes and the presence of a medial preoccipital lobe, that they should be assigned within *Cyphinioides* REED, 1942. The same is true, in the present author's opinion, with the specimens from the Viséan of the Tashkent region determined by WEBER (1937, p. 80, Pl. 9, Figs 26—29) as "*Griffithides (Cyphinium)* cf. *alapaicus*".

The stratigraphically youngest representative, assigned here tentatively to *Cyphinioides* — ?*C. limbatus* n. sp. from the Upper Moscovian of the Donets Basin, is separated from the remaining species by a long stratigraphic gap — throughout Bashkirian and Lower Moscovian. However, taking into account the rarity of this genus as well as the fact that the Bashkirian of the Donets Basin, where the most complete succession of the Carboniferous is developed, yielded only very few trilobites, could explain such a long break in the stratigraphic range of *Cyphinioides*.

There exists a very strong resemblance between the genus *Cyphinioides* REED, 1942 and *Griffithides* PORTLOCK, 1843, which concerns not only the shape of the glabella and the distinct detachment and longitudinal elongation of the basal lobes, but also the presence of the median preoccipital lobe. This latter feature, so characteristic for *Cyphinioides*, is to be found also in some *Griffithides* species. E.g. in *Griffithides acanthiceps* WOODWARD 1883—1884, one of the specimens (SMC No. E 3396) coming from the type locality (WOODWARD, 1883—1884, Pl. 6, Fig. 2; here refigured on Pl. IX, Fig. 24), exposes a very distinctly developed medial preoccipital lobe, which is lacking in other cephala (e.g. SMC No. E 3395; WOODWARD, 1883—1884, Pl. 6, Fig. 10; here refigured on Pl. IX, Fig. 23). Moreover, in *Griffithides claviger claviger* SCUPIN, 1900, the specimens illustrated by SCUPIN (1900, Pl. 1, Fig. 6) and the present author (Pl. IX, Fig. 14) display a very faintly marked preoccipital furrow. A pygidium similar to these of the *Griffithides* representatives, is found in two species of *Cyphinioides* — *C. micheevi* (WEBER, 1937) and *C. alapaicus* (WEBER, 1937). The pygidia of these species are somewhat longer than in *Griffithides* and their borders are less concave. The pygidium of the type species — *C. ashfellensis* REED, 1942, though very poorly preserved, seems to be of a similar pattern as that of *Griffithides*. It somewhat deviates from the more complete pygidia of *C. alapaicus* and *C. micheevi* in having a much narrower axis, but is has the very sharply separated rings they have. On the base of the facts quoted above, it seems that *Cyphinioides* is closer to *Griffithides* than to any other genus of the Carboniferous trilobites, excluding perhaps *Particeps* REED, 1943.

Cyphinioides ashfellensis REED, 1942

(Pl. XVI, Fig. 5; Text-fig. 9*U*)

1942. *Cyphinioides ashfellensis* sp. nov.; F. R. C. REED, Some new Carboniferous..., p. 654, Pl. 8, Figs 1, 2.

Holotype: Entire, damaged specimen, HMG No. A 3700, figured by REED (1942, Pl. 8, Figs 1, 2); here refigured on Pl. XVI, Fig. 5.

Type locality: Kirkby Stephen, Yorkshire, Great Britain.

Type horizon: The Ashfell Limestone, ?Upper Viséan.

Diagnosis and description — see REED, 1942.

Remarks. — The type specimen of this species being the only specimen known, does not allow one to recognize in detail the structure of its pygidium. The latter seems to have rather a narrow axis and the character of ornamentation found in *Paladin* WELLER, 1936 and *Particeps* REED, 1943. The well preserved cephalon distinguishes this form not only from the representatives of the mentioned genera, but also from other Carboniferous proetids.

The general shape of the cephalon, which would appear to be comparatively broad, is difficult to determine, as the specimen in question shows clearly that the librigenae on both sides are moved out of their natural position.

As can easily be seen from the photograph of the holotype given in the present paper (Pl. XVI, Fig. 5), the medial preoccipital lobe in *C. ashfellensis* is not so distinctly developed as it would seem from the drawing in the Treatise on the Invertebrate Paleontology (1958, P. O., Fig. 308, 1a).

Stratigraphic and geographic range. — Type horizon and type locality.

Cyphinioides micheevi (WEBER, 1937)

(Pl. XVI, Figs 3, 4)

1937. *Griffithides micheevi* WEBER; V. N. WEBER, Kamennougolnye trilobity..., p. 74, Pl. 8, Fig. 30.

Holotype: Entire, damaged specimen, TML No. 1808/5107, figured by WEBER (1937, Pl. 8, Fig. 30); here refigured on Pl. XVI, Figs 3, 4.

Type locality: Outcrop No. 28 (MICHEEV's collection), Alapaievsk region, the Urals, USSR.

Type horizon: Lower Namurian.

Diagnosis. — Cephalon strongly vaulted transversely, narrow; anterior border coalesced with pyriform glabella; basal lobe small, but very strongly swollen, detached of glabella; weak median preoccipital lobe marked; eyes very short, with very convex visual surface; pygidium surrounded by weakly concave narrow band; about 15 very high, broadly separated rings, their medial sections laterally overhanging dorsal furrows; cephalic exoskeleton smooth, with scarce punctures.

Material. — Only the type specimen known.

Remarks. — "*Griffithides micheevi*" WEBER, 1937 is a species, which though having some features of *Griffithides*, differs from representatives of the latter in having a distinctly different longer pygidium with the axis laterally overhanging the dorsal furrows, and a lateral border only very weakly concave. The lateral border of the typical *Griffithides* species is much more concave and devoid of any prolongations of the ribs. The differences in the cephala of the both genera, though smaller, are also present. The anterior border in *Griffithides* species, which is also covered by the glabella, can always be easily distinguished from the latter, especially at

the sides of the frontal lobe of the glabella, where it is convex and dorsally placed. The lateral border is distinctly delimited from the librigenae; the visual lobes being similarly short and convex, stand no out from the slopes of the librigenae, while in *C. micheevi* they do not break the uniform arch of the latter. The detached basal lobes of *C. micheevi* are somewhat differently developed than in *Griffithides* species — being tuber-like and conspicuous, at their postero-internal angles, instead of being drop-like. This latter feature is very typical of *Cyphinioides*. The whole structure of the cephalon of the here considered species is so close to that of *Cyphinioides ashfellensis* REED, that it is most reasonable to assign "*Griffithides micheevi*" within the genus *Cyphinioides*. The only difference between the two compared cephala deals with the size of the eyes, which are very large in the type species and very small in *C. micheevi*. On the other hand, it seems possible that in this genus (as in some others, e.g. *Particeps* REED) the size of the eyes changed from species to species, the evidence for this being the size of the eyes in the next species assigned here to *Cyphinioides* — *C. alapaicus* (WEBER, 1937) — where the eyes are intermediating in size between *C. ashfellensis* and *C. micheevi*.

Some similarities exist between the pygidium of *C. micheevi* and those of the *Particeps* species, especially those from the USSR territory, i.e. *P. productus* (WEBER, 1937) and *P. kargini* (WEBER, 1937). They refer to the similarly developed ribs with high anterior bands, prolongations of which invade the somewhat concave border. However, as far as the known *Particeps* species allows one to judge, the median preoccipital lobe and the detached basal lobes were never observed in the latter genus.

Stratigraphic and geographic range. — Type horizon and type locality.

Cyphinioides alapaicus (WEBER, 1937)

(Pl. XVI, Figs 6, 7)

1937. *Griffithides (Cyphinium) alapaicus* sp. nov.; V. N. WEBER, Kamennougolnye trilobity..., p. 79, Pl. 9, Figs 23-25.

Lectotype: Cephalon (damaged), TML No. 1963/5107, figured by WEBER (1937, Pl. 9, Fig. 23); here refigured on Pl. XVI, Fig. 7.

Type locality: Outcrop 280 (MICHEEV's collection), Alapaievsk region, the Urals, USSR.

Type horizon: Lower Namurian.

Diagnosis. — Cephalon with broad, concave latero-marginal part and narrow lateral border; eye surrounded by subocular groove, preoccipital furrow broad, shallow, but distinct; preoccipital lobe weakly delimited from small tuber-like basal lobes; occipital ring comparatively narrow; pygidium without border, but surrounded with slightly concave marginal part; axis with narrow, well separated rings, their top-parts flattened and somewhat outstanding laterally; ribs very narrow, convex, reaching to the very edge of pygidium; ornamentation punctured; very large dimensions.

Remarks. — From the same locality and horizon where the above diagnosed species was found, occurs also *Cyphinioides micheevi* (WEBER, 1937), which has a nearly identical, but much smaller pygidium. The similarities in the pygidia of both compared species concern the structure of narrow ribs, which reach to the very edge, and the somewhat concave marginal part. The top-part of the pygidial axis is in *C. alapaicus* partly destroyed, but still the longitudinal furrow along the each side of the axis is visible, though it is shallower than in *C. micheevi*. The top-sections of the two first, preserved rings have a distinctly marked tendency to lateral extension. However, their extremities do not overhang the axial furrows so strongly as is the case in

C. micheevi. If a cephalon of similarly very large size as the pygidium had not been found, the latter would most probably be assigned to *C. micheevi* as its gerontic stage. However, the cephalon of this species shows considerably significant differences with *C. micheevi*. It is broader, has a narrow but distinct lateral border, separated from the librigena by a very broad concave part, the preoccipital furrow is well developed; in *C. micheevi* the librigena is steeply sloping, what makes the cephalon very compact; the lateral border is broad, convex, but very poorly delimited from the librigena; preoccipital lobe is very indistinct, of incipient character. Nevertheless similarities are here also observed. They concern the strongly frontally expanded glabella, very well pronounced, small, tuber-like basal lobes, anterior border covered by glabella (in *C. alapaicus* not so completely as in *C. micheevi*, what is probably due to the state of preservation of the here regarded cephalon), similar relative size of the eyes, punctured ornamentation. Taking into account all the similarities and differences mentioned above, the present author is of the opinion that "*Griffithides (Cyphinium) alapaicus*" should be assigned to *Cyphinioides* REED, 1942. This species has nothing in common with *Ditomopyge (= Cyphinium)* besides the presence of the preoccipital lobe. Moreover, its comparatively early stratigraphic position also seems to exclude the possibility of its assignment within the latter genus.

Stratigraphic and geographic range. — Lower Namurian of the Urals, ?Viséan of Central Asia.

?Cyphinioides limbatus n. sp.

(Pl. XVI, Figs 1, 2)

1933. *Griffithides transilis* var. α; V. N. WEBER, Trilobity..., p. 38, Pl. 2, Figs 24, 25.
?1933. *Griffithides transilis* var. α; V. N. WEBER, *Ibid.*, Pl. 2, Fig. 27.
1933. *Griffithides transilis* var. β; V. N. WEBER, *Ibid.*, p. 39, Pl. 2, Figs 28-33, 37.
1937. *Griffithides transilis* var. α; V. N. WEBER, Kamennougolnye trilobity..., p. 75, Pl. 8, Fig. 39.
1937. *Griffithides transilis* var. β; V. N. WEBER, *Ibid.*, p. 75, Pl. 8, Figs 40, 41, 48.

Holotype: Cephalon (damaged), TML No. 228/3139, figured by WEBER (1933, Pl. 2, Fig. 24); here refigured on Pl. XVI, Fig. 1.

Type locality: Dolgaia ravine, Donets Basin, USSR.

Type horizon: M_8, lower part of Upper Carboniferous.

Derivation of the name: Lat. *limbatus* — bordered; because of the presence of the border around cephalon.

Diagnosis. — Lateral border very well pronounced; preoccipital lobe faintly developed; basal lobe very small, basal furrow not reaching occipital furrow; pygidium moderately long, with weakly pronounced, slightly convex border; axis broader than pleural lobe, convex and rounded in cross section; exoskeleton punctured.

Remarks. — The specimens assigned by WEBER (1933, 1937) to "*Griffithides transilis* var. α". (excluding the pygidium illustrated on Pl. 2, Fig. 26) and "*Griff. transilis* var. β" are conspecific. The pygidium mentioned above represents in fact *Ditomopyge transilis* (WEBER, 1933), the differences with the holotype of the latter species being caused by the state of preservation. The differences between "var. α" and "var. β" are limited only to "the lack of the transverse constriction of the glabella at back" (in var. β, WEBER, 1933, p. 79). However, an extremely faint preoccipital lobe can be detected on the specimens TML No. 309/3139 (WEBER, 1933, Pl. 2, Fig. 28) and TML No. 318/3139 (WEBER, 1933, Pl. 2, Fig. 31). In all the other features the mentioned specimens differ insignificantly, and these differences may be caused by the state of preservation and the individual variability. In the structure of the cephalon the established above new species is very close to *Cyphinioides ashfellensis* REED, 1942, in spite of their

spaced stratigraphic occurrence. Especially similar is the structure of the cranidium of both species, with very weakly pronounced, incipient preoccipital lobe, small, but distinctly swollen basal lobes, very lowly sloping extremities of the occipital ring, the anterior border covered by glabella and separated from the latter by a very thin line only, as well as the comparatively narrow *(tr.)* palpebral lobes.

The pygidium of the type species of *Cyphinioides* REED, 1942 — *C. ashfellensis* — is very poorly preserved, and so the generic characters cannot be determined. The pygidium of the here established new species (if it belongs here!) has a very strong resemblance to the pygidium of the *Particeps* REED, 1942 in its comparatively strong transverse vaulting, broad and comparatively short (15—16 rings) axis, which is rounded in transverse section. This resemblance is not at all surprising, because the two genera *Particeps* and *Cyphinioides*, judging from the cephala of their representatives, are closely related. The mentioned above complex of features of *?Cyphinioides limbatus* n. sp. put it aside from *Griffithides* PORTLOCK, 1843, *Paladin* WELLER, 1936 and *Ditomopyge* NEWELL, 1931 and decided about its assignment rather within the *Cyphinioides* REED, 1942. The differences between this species and the other representatives of the genus concern the well developed lateral cephalic border, which usually is coalesced with the librigenae, rising outwards palpebral lobes, usually flat and the presence of the convex pygidial border (though comparatively poorly developed), which is generally lacking in other representatives of the *Cyphinioides*. This latter features make the assignment of the here established new species within *Cyphinioides* tentative. So does its comparatively high stratigraphic position, the rest of the representatives of *Cyphinioides* being reported from the Viséan and Namurian.

Stratigraphic and geographic range. — Moscovian of the USSR (the Donets Basin).

Genus **KULMIELLA** HAHN & HAHN, 1968

Kulmiella caroli n. sp.

(Pl. XIV, Fig. 6)

Holotype: Entire specimen (librigenae lacking), IG Sosnowiec, No. 459/72; Pl. XIV, Fig. 6.
Type locality: Gołonóg, Poland.
Type horizon: Lower part of Malinowice Beds, Upper Viséan (Goα-Goβ).
Derivation of the name: caroli — in honour of Dr. KAROL BOJKOWSKI (Geological Institute in Sosnowiec, Upper Silesia, Poland), who gave the holotype specimen at the present author's disposal.

Diagnosis. — Glabella broader frontally than across basal part, fixigena comparatively narrow frontally, β on the same line as δ; palpebral lobe comparatively wide (*tr.*) about the width of occipital ring (*sag.*); 13 pygidial rings, 10 ribs, fine granular ornamentation on occipital ring and axial rings.

Material. — So far only a holotype specimen known.
Dimensions (in mm):

	IG 459/72
Length of entire specimen . . .	22.0
Length of cephalon	7.7
Length of glabella	5.8
Width of glabella	4.2
Length of pygidium	8.0
Width of pygidium	11.0
Length of axis	6.8
Width of axis	3.0

Description. — Glabella somewhat inflated frontally, reaching to slightly upturned border and separated from the latter by a moderately deep furrow; frontal lobe of glabella somewhat wider than the base; basal furrow straight, oblique, not reaching occipital furrow; basal lobe tear-shaped: S_2 and S_3 indistinctly pronounced; fossula present, palpebral lobe well developed, about the width of the occipital ring (*sag.*); posterior branch of facial suture parallel to axial furrow, anterior branch slightly diverging from axial furrow; β situated not further outwards than δ; librigena unknown. In longitudinal section, glabella raising forwards, then sloping towards the upturned anterior border. Hypostoma unknown. Nine thoracic segments, ends of pleurae cut parallelly to the axis, their posterior angles pointed; axis narrower than pleural lobe. Pygidium subtriangular, with weakly narrowing, slender axis which reaches to the border; 13 wide and moderately convex rings, 10 ribs, their posterior bands forming the slopes of the anterior ones; pygidial doublure flat, narrow. In longitudinal and transverse section pygidium comparatively flat. Only fragments of exoskeleton preserved, which allow one to state that the occipital ring and axial rings were finely and densely granulated.

Remarks. — The here described new species differs from all other representatives of *Kulmiella* HAHN & HAHN, 1968 in having comparatively broad (*tr.*) palpebral lobes and β placed on the same line as δ, while in e.g. *Kulmiella westphalica* (NEBE, 1911) and *K. leei* (WOODWARD, 1883—1884) it is situated to the outside of δ. Though in the holotype specimen of *K. caroli* n. sp. the pygidial border is damaged and only the doublure is preserved, it seems that it was distinctly delimited from the pleural lobes, and is similar to the pygidium of *K. westphalica*. It resembles this species in the presence of a very narrow pygidial axis and the same structure of ribs. Judging from the general, weak convexity of the exoskeleton of *K. caroli*, the eyes might be (librigenae are lacking) comparatively flat and facing dorsally, though probably larger than in other species of this genus. *K. caroli* seems to be close to *K. sudetica* (PATTEISKY, 1930), which has comparatively large eyes. The cranidium of the latter species is, however, poorly preserved and does not allow for any comparisons. The pygidia of both these species are different; this of *K. caroli* being flatter transversely and having a narrower axis.

Stratigraphic and geographic range. — Type horizon and type locality.

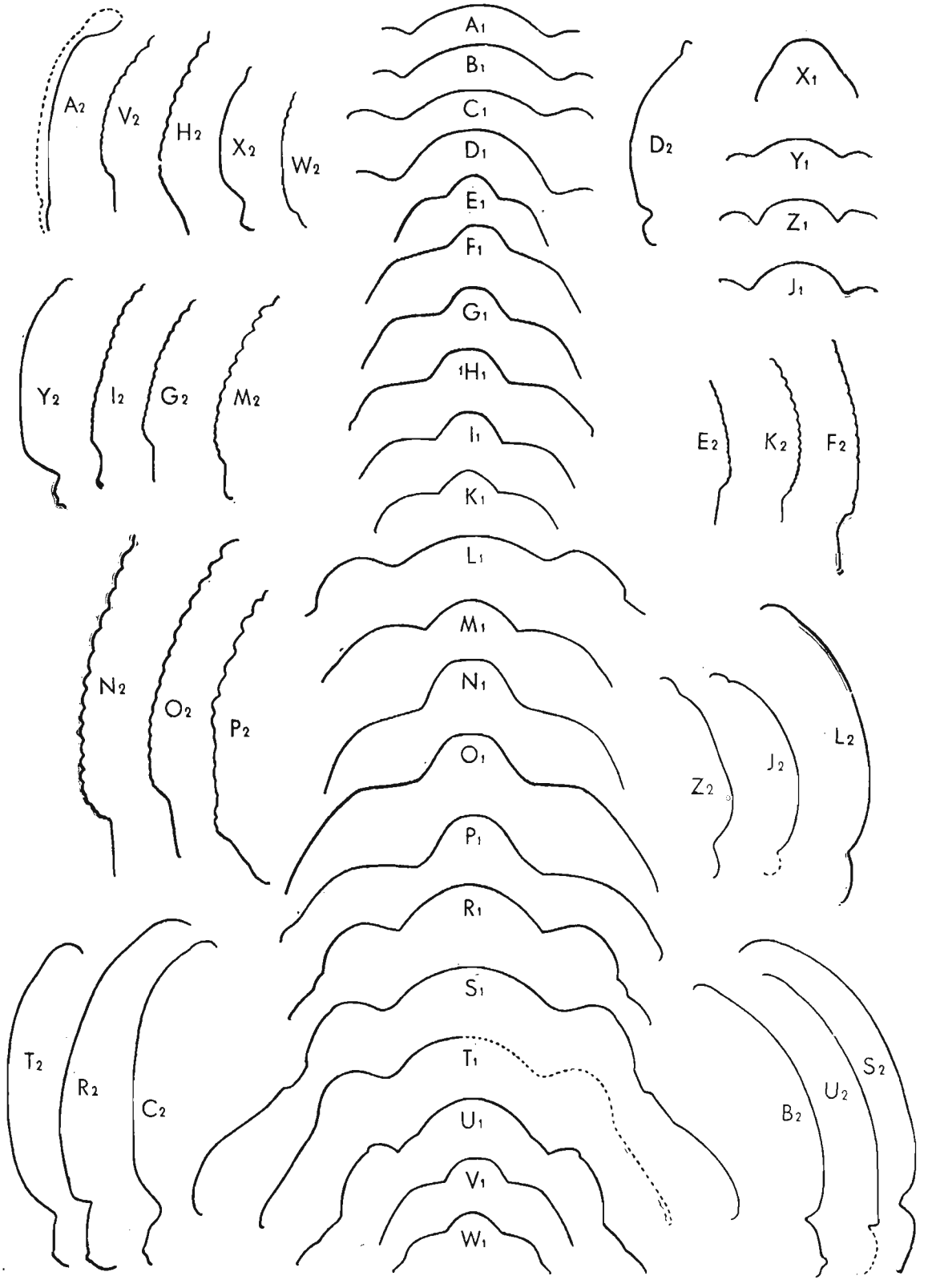
Subfamily DITOMOPYGINAE HUPÉ, 1953

Genus **PALADIN** WELLER, 1936

Type species: Griffithides morrowensis MATHER, 1915.

Synonyms:

1825. *Asaphus*; G. FISCHER v. WALDHEIM; Geognostico-zoologicae..., p. 54.
1844. *Phillipsia*; F. MCCOY, Synopsis..., p. 161.
1855. *Griffithides*; F. MCCOY, Systematic description..., p. 182.
1860. *Griffithides*; E. EICHWALD, Lethaea Rossica, p. 1435.
1867. *Phillipsia*; V. v. MOELLER, Ueber die Trilobiten..., p. 121.
1883—1884. *Phillipsia*; H. WOODWARD, Monograph..., pp. 22-23.
1883—1884. *Griffithides*; H. WOODWARD, *Ibid.*, pp. 38, 40.
1902. *Griffithides*; H. WOODWARD, Culm trilobites..., p. 484.
1914. *Griffithides*; W. B. R. KING, A new trilobite..., p. 392.
1915. *Griffithides*; K. F. MATHER, The fauna..., p. 244.
1933. *Griffithides*; V. N. WEBER, Trilobity..., p. 33.


A2
V2
H2
X2
W2
A1
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C1
D1
E1
F1
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E2
K2
F2
N2
O2
P2
Z2
J2
L2
T2
R2
C2
B2
U2
S2

Fig. 8

1936. *Kaskia*; J. M. WELLER; Carboniferous trilobite..., p. 708.
1936. *Phillipsia*; M. SCHWARZBACH, Die Trilobiten..., p. 432.
1937. *Phillipsia (Griffithides?)*; V. N. WEBER, Kamennougolnye trilobity..., p. 63.
1938. *Griffithides*; F. DEMANET, La faune..., p. 156.
1942. *Weberides*; F. R. C. REED, Some new..., p. 660.
1943. *Weberides*; F. R. C. REED, Carboniferous trilobites..., p. 179.
1950. *Weberides*; A. PŘIBYL, On the Carboniferous..., p. 10.
1954. *Paladin (Paladin)*; H. B. WHITTINGTON, Two silicified..., p. 6.
1954. *Paladin (Kaskia)*; H. B. WHITTINGTON, *Ibid.*, p. 12.
1968. *Paladin (Paladin)*; G. HAHN & R. HAHN, Trilobiten..., p. 599.
1968. *Paladin (Kaskia)*; G. HAHN & R. HAHN, *Ibid.*, p. 607.

Species assigned: Paladin morrowensis (MATHER, 1915), *P. eichwaldi eichwaldi* (FISCHER v. WALDHEIM, 1825), *P. eichwaldi shunnerensis* (KING, 1914), *P. eichwaldi parilis* (REED, 1942), *P. mucronatus mucronatus* (MCCOY, 1844), *P. mucronatus russicus* n. subsp., *P. mucronatus latispinatus* n. subsp., *P. mucronatus rotundatus* n. subsp., *P. longispinus* (STRONG, 1872), *P. granulatus* (WHETHERBY, 1881), *P. glaber* (WOODWARD, 1884), *P. barkei*, 1902, *P. mladeki* (SMETANA, 1916), *P. wilsoni* (WALTER, 1927), *P, lutugini* (WEBER, 1933), *P. cervilatus* (WEBER, 1933), *P. bairdensis* (WHEELER, 1935), *P. chesterensis* (WELLER, 1936), *P. jurezanensis* (WEBER, 1937), *P. mailleuxi* (DEMANET, 1938), *P. cuspidatus* (REED, 1943), *P. rarus* WHITTINGTON, 1954, *P. helmsensis* WHITTINGTON, 1954, *P. osagensis* CISNE, 1967, *P. rosei* CISNE, 1967, *P. pitzi* HAHN & HAHN, 1968, *P. trigonopyge* OSMÓLSKA, 1968, *P. pyriformus* CHAMBERLAIN, 1969, *P. retrolatus* CHAMBERLAIN, 1969, *P. eakringensis* n. sp., *P. bakewellensis* n. sp., *P. angustipygus* n. sp., *P. griffithidoides* n. sp., *P. lowickensis* n. sp., *P. czarnieckii* n. sp., *P. subbakewellensis* n. sp., *?P. ailinensis* n. sp., *P. belli* n. sp., *P. girtyi* n. nom.

Stratigraphic and geographic range: Upper Viséan — Gzhelian of Eire, Great Britain, Belgium, Germany, ČSR, Poland, Hungary, USSR (the Urals, Donets Basin, Moscow Basin), Spitsbergen; Lower Mississippian-Lower Pennsylvanian of North America (USA, Canada).

Diagnosis. — Cephalon with long genal spines; anterior cephalic border ranges in position from anterior to glabella to placed vertically and covered by glabella; glabella expanded frontally; basal lobe always cut off; incipient medial preoccipital lobe sometimes present; palpebral lobe broad to very broad (*tr.*); eye large to very large with steep visual lobe, centrally to posteriorly located; thorax of 9 segments; pygidium rounded to strongly elongated with delimited border; axis with 13—20 rings; 9—11 moderately convex ribs, divided into two unequal bands, the anterior ones broader; pleural and interpleural furrows not passing onto border;

Fig. 8

A, B *Paladin mucronatus mucronatus* (MCCOY), cranidia (GSM 102526, 102527), Craster-Dunstan, Gt. Britain, Namurian; C *P. eichwaldi shunnerensis* (KING), cranidium (BM 55004), Shunner Fell, Gt. Britain, Namurian; D *P. cuspidatus* (REED), cranidium (RSM 1958.1.2719), St. Monans, Gt. Britain, Viséan; E *P. eichwaldi parilis* (REED), pygidium (RSM 1911.62. 8392), Bowertrapping, Gt. Britain, Namurian; F *P. eichwaldi parilis* (REED), holotype pygidium (HMG A3708), Linn. Spout, Gt. Britain, Namurian; G *P. eichwaldi parilis* (REED), pygidium (RSM 1911.62.8389), Bowertrapping, Gt. Britain, Namurian; H *P. bakewellensis* n. sp., holotype pygidium (GSM 33701), Bakewell, Gt. Britain, Viséan; I *P. mucronatus* subsp., pygidium (SMC E 3624), Lowick, Gt. Britain, Viséan; J *P. angustipygus* n. sp., cranidium (GSM Bi 1255), Cleveland Hills, Gt. Britain, Namurian; K *P. mucronatus* subsp., pygidium (SMC E 3618), Lowick, Gt. Britain; L *P. mucronatus mucronatus* (MCCOY) cephalon (RSM 1906.140.2), Wilkiestone, Gt. Britain, Namurian; M *P. eakringensis* n. sp., holotype pygidium (GSM Zh 4338), Eakring, Gt. Britain, Viséan; N *P. cuspidatus* (REED), pygidium (RSM 1958.1.2685), St. Monans, Gt. Britain, Viséan; O *P. eichwaldi parilis* (REED), pygidium (RSM 1911.62.8385), Bowertrapping, Gt. Britain, Namurian; P *?Paladin* sp., pygidium (GSM 103104), unknown locality; R *P. griffithidoides* n. sp., holotype specimen, cephalon (GSM X 2453), Bands Gill, Gt. Britain, Viséan; S *P. cuspidatus* (REED), cephalon CMG 01.53. pm/2), High Blantyre, Gt. Britain, Viséan; T *P. ?cuspidatus* (REED), cephalon (CMG 01.53. pm/14), Gt. Britain, Viséan; U *P. cuspidatus* (REED), lectotype cephalon (RSM 1958.1.2683), St. Monans, Gt. Britain, Viséan; V *P. eichwaldi parilis* (REED), pygidium (RSM 1911.62.8390), Bowertrapping, Gt. Britain, Namurian; W *P. eichwaldi parilis* (REED), pygidum (BM It 2260), Beith, Gt. Britain, Namurian; X *P. eichwaldi parilis* (REED), cranidium (RSM 1911.62.8393), Bowertrapping, Gt. Britain, Namurian; Y *P. eichwaldi shunnerensis* (KING), cranidium (SMC E 10499), Shunner Fell, Gt. Britain, Namurian; Z *P. eichwaldi parilis* (REED), cranidium (RSM 1911.62.8387), Bowertrapping, Gt. Britain, Namurian. Not to the scale. Transverse section marked with *1*, longitudinal — with *2*

ornamentation of cephalon granular, dense, weak to coarse; axial rings with a row of posteriorly elongated tubercles along the hind edge of each ring.

Remarks. — The genus *Paladin* WELLER, 1936 is, among the Carboniferous Proetidae, the most wide spread, both geographically and stratigraphically. The status of the genus *Weberides* REED, 1942 was already discussed by WHITTINGTON (1954) and other authors, and the present author agrees that it is the younger synonym of *Paladin*. WELLER (1936) established, among others, the genus *Kaskia*, which according to WHITTINGTON (1954) should be regarded as the subgenus of the *Paladin*, being very close to the latter, the intermediate form between them having been found ("*Paladin (Kaskia) rarus*" WHITTINGTON, 1954). Later on, CISNE (1967), while describing two American species of *Paladin* — *P. rosei* and *P. osagensis* — discussed the relationship between *Paladin* and *Kaskia* and stated that the latter genus is the synonym of the former. This opinion of CISNE is in contradiction to the view expressed by HAHN & HAHN (1968), that two units — *Paladin (Paladin)* and *Paladin (Kaskia)* — should be recognized within *Paladin*.

After examining a number of the European representatives of *Paladin*, the present author fully accepts CISNE's opinion that the two forms in question should not be separated either as different genera or subgenera. Some of the species here described or revised show a combination of "*Paladin*" features and "*Kaskia*" features (see table below).

Species	„*Paladin*" features	„*Kaskia*" features
Paladin griffithidoides	eyes large, posterior, pygidium elongate	anterior border covered by glabella, glabella parallel-sided, S_2-S_3 lacking, fixigena narrow anteriorly
P. cuspidatus	anterior border in front of glabella, S_2, S_3 present, fixigena broad anteriorly, pygidium elongate	glabella parallel-sided
P. mucronatus russicus	anterior border in front of glabella, S_2, S_3 present but very weak, fixigena broad anteriorly	glabella parallel-sided
P. mucronatus mucronatus	anterior border partly covered by glabella, S_2, S_3 weak to absent, fixigena comparatively narrow anteriorly; glabella expanded frontally, eyes large, posterior	
P. mucronatus rotundatus	glabella expanded frontally, eyes large, posterior	anterior border covered by glabella, S_2, S_3 lacking, fixigena narrow anteriorly

As the table indicates, the characters, which according to WELLER (1936, 1959) are important for the separation of the two genera (or subgenera, according to HAHN & HAHN, 1968), may change even within one species, as it is the case with *Paladin mucronatus*. To the species above quoted, one can add *P. pitzi* HAHN & HAHN, 1968, and *P. rarus* WHITTINGTON, 1954, where their authors themselves emphasized the simultaneous presence of features characterizing either *Paladin* or "*Kaskia*". To this group belong also *P. longispinus* (STRONG, 1872), *P. rosei*

CISNE, 1967, and *P. osagensis* CISNE, 1967 (CISNE, 1967). Both in Europe as in North America, the Paladin species with "*Kaskia*" features as well as those "purely" *Paladin* species are found parallelly in the Upper Viséan and Lower Namurian of Europe and in the Mississippian of USA, thus they are not even separated stratigraphically.

In spite of all that was stated above about the features of the cephalon of *Paladin*, it is rather conservative during the whole of its stratigraphic range. The cephalon of the supposed Gzhelian species — *P. trigonopyge* OSMÓLSKA, 1968 (OSMÓLSKA, 1968) does not differ much from that of the Viséan representatives of the genus. On the cephalon, most of the diagnostic characters are connected with the position of the anterior border and the structure of the posterior part of the glabella, which is here very often strongly modified. E.g. in *P. eichwaldi parilis* (REED, 1942) the exoskeleton is in this place thickened (Text-fig. 1 *A*, *B*), while in *P. cuspidatus* (REED, 1942), *P. mailleuxi* (DEMANET, 1938), *P. trigonopyge* OSMÓLSKA, 1968 and *P. belli* n. sp. the incipient medial preoccipital lobe is developed. This last mentioned structure, even though very weakly pronounced on the outer surface of the exoskeleton, is quite clearly visible on the internal mould, or on the inner surface of the dorsal exoskeleton, here in the form of the deep pit (Pl. XXI, Figs 5, 7). This character, though not present in all the representatives of *Paladin*, is quite wide spread, being found also in *P. osagensis* (CISNE, 1967, Text-fig. 1 *C*) and *P. rosei* (CISNE, 1967, Text-fig. 1 *J*). This incipient medial preoccipital lobe is, in the *Paladin* species, better developed and more distinctly visible on the young cephala than on adult (Pl. XXI, Figs 2, 3).

All, so far known *Paladin* species can be, generally speaking, divided into three groups on the base of the shape of their pygidia:

I — group, including nearly all the species known from the territory of USA and the rare European species — *P. eakringensis* n. sp., *P. bakewellensis* n. sp., *P. pitzi* HAHN & HAHN, 1968, with pygidium wide, subsemicircular and broadly rounded posteriorly;

II — group, including only 2 European species — *P. mucronatus* (MCCOY) and *?P. ailinensis* n. sp., with mucronate pygidium;

III — group, which covers all the rest of the European species, as well as 3 North American forms *P. pyriformus* CHAMBERLAIN, 1969, *P. retrolatus* CHAMBERLAIN, 1969, *P. belli* n. sp., characterized by an elongate, narrow pygidium, which is sometimes bluntly pointed posteriorly (e.g. *P. cuspidatus* (REED, 1943)) or subtriangular (e.g. *P. trigonopyge* OSMÓLSKA, 1968).

The North American (USA) representatives of *Paladin* retained the wide, comparatively short pygidia during the whole of their history until the Lower Pennsylvanian. In Europe, the short pygidia are rather exceptional and are known from the Upper Viséan and the lowermost Namurian. Those short pygidia seem to be more primitive than the long ones and correspond to a certain degree with the pygidia of the *Griffithides* species, which preceded *Paladin* stratigraphically. However, it does not seem to be possible that any of the so far known *Griffithides* species could have been the ancestor of *Paladin*, the former species having highly specialized cephalon, with completely detached basal lobes and swollen antero-medial portion of the glabella. The structure of the glabella in *Paladin*, though showing the same trend in its modification, has never reached such an advanced stage. On the other hand, as the investigation of the young forms of some *Paladin* species (*P. mucronatus mucronatus* (MCCOY) (Pl. XIX, Fig. 6), *P. czarnieckii* n. sp. (Pl. XVII, Figs 3, 5), *P. eichwaldi parilis* (REED) (Pl. XVIII, Fig. 1)) has shown, the griffithid pattern of the cranidium and of the pygidium appears during the ontogenetic development, at least in some species. The other possibility is that *Paladin* could have derived from the early Carboniferous representatives of Dechenellinae PŘIBYL, 1946, i.e. from the genus *Bitumulina* n. gen. or *Linguaphillipsia* STUBBLEFIELD, 1948, which have the very similar shape

of pygidium with a distinct border, as well as the long glabella with a marked tendency to develop a medial preoccipital lobe. In the present author's opinion, this possibility seems to be more probable. Lately, GANDL (1968) described a new species "*Paladin franconicus*" from the uppermost Tournaisian of the Frankenwald, the form with distinctly long pygidium. However, it is more probable that the material of this form represents the genus *Linguaphillipsia*, which is present in the same deposits. Also, the early stratigraphic position of the species in question, speaks against its assignment within *Paladin*.

Paladin eichwaldi (FISCHER v. WALDHEIM, 1825)

Subspecies assigned: P. eichwaldi eichwaldi (FISCHER v. WALDHEIM, 1825), *P. eichwaldi shunnerensis* (KING, 1914), *P. eichwaldi parilis* (REED, 1942), *P. eichwaldi latilimbatus* (SCHWARZBACH, 1936).

Stratigraphic and geographic range: Upper Viséan—Lower Namurian of Great Britain, Poland, USSR (Donets Basin, Timan, the Urals).

Remarks. — The present author has not seen the Silesian material of "*Phillipsia mladeki*" SMETANA, 1916, and "*Weberides mladeki cuneiformis*" (SCHWARZBACH, 1936, in PŘIBYL, 1950), which species, as PŘIBYL has proved (1950) should be assigned within the genus *Paladin*. However, in the present author's opinion it cannot be excluded that they represent the subspecifical forms of *P. eichwaldi*, having the long pygidium typical for this species. The pygidium described as "*Paladin eichwaldi*" by SCHRÉTER (1948, Figs 1, 3) from the Lower Stephanian of Hungary and illustrated by PŘIBYL (1950, Pl. 10, Figs 1, 2) cannot be assigned within *Paladin eichwaldi*, being broad, nearly semicircular and having a short (15 rings) axis. This stratigraphically high form represents most probably a new species of *Paladin*.

Paladin eichwaldi eichwaldi (FISCHER v. WALDHEIM, 1825)

(Pl. XVII, Figs 8, 13, 15, 17)

1825. *Asaphus Eichwaldi*; G. FISCHER v. WALDHEIM, *in E.* EICHWALD, Geognostico-zoologicae..., p. 54, Pl. 4, Fig. 5.
1933. *Phillipsia* cf. *eichwaldi* (FISCH.); V. N. WEBER, Trilobity..., p. 21, Pl. 1, Figs. 28-32.
1937. *Phillipsia (Griffithides?) eichwaldi* (FISCH.); V. N. WEBER, Kamennougolnye trilobity..., p. 63, Pl. 7, Figs 15-17.

Neotype: Pygidium (external mould); TML No. 1551/5107, figured by WEBER (1937, Pl. 7, Fig. 15); here refigured on Pl. XVII, Fig. 17.

Type locality: Vol River, the North Urals, USSR.

Type horizon: Viséan.

Diagnosis. — Pygidium weakly vaulted longitudinally and transversely, somewhat broader than long, posteriorly comparatively broadly rounded; pygidial border broad and flat; axis narrower than pleural lobe, with 17—18 axial rings; 10 ribs, weakly convex, rounded in cross-section; pleural furrows distinct, interpleural furrows very faint, posterior bands or ribs narrower than anterior ones; cephalon broadly rounded frontally; anterior border convex, visible in front of glabella, but situated partly vertically, it is faintly delimited from the latter; glabella long, broader frontally than across the base; basal lobe weakly differentiated, flat, triangular, lower than a high medial lobe; palpebral lobe moderately wide, ornamentation granular.

Remarks. — The type specimen of "*Asaphus eichwaldi*" FISCHER VON WALDHEIM, 1825 has been lost, and its original illustration is far from sufficient. Moreover, it is not clear from

which locality the specimen illustrated by FISCHER came (cf. WEBER, 1937). In this situation, the present author chose for a neotype one of the specimens from WEBER's collection, which comes from one of the localities mentioned by the author of the species — Vol river. Unfortunately, this specimen represents only an external mould. It is, however, very well preserved, so that all the details can be easily observed on the latex cast. The short description, given by FISCHER (1825), is in agreement with the characters observable on the neotype, it differs only in the number of the rings. This, however, can be explained by the difficulties in counting the last pygidial rings (the number given by earlier authors is often smaller). Lastly, so far there has not been found in the Viséan deposits of USSR other species of *Paladin*, which could correspond to the illustration and description given by FISCHER. Though, the reasons above given for choosing a neotype, are far from being satisfactory, the present author does not see any other possibility of making clear the status of "*Asaphus eichwaldi*", the specific name being already very widely accepted. The present author had the possibility of comparing the type material of "*Griffithides shunnerensis*" KING, 1914 with that of *Paladin eichwaldi* from the USSR. These two forms were suggested by WEBER (1937) as being conspecific. However, between them there exist some differences. They are here regarded as those of the subspecific value and they concern the number of the ribs (9 in British specimens, 10 in Soviet ones) as well as the width of the lateral cephalic broder, which on the only known from USSR cephalon of this subspecies is broader and flatter.

Paladin eichwaldi shunnerensis (KING, 1914)

(Pl. XIV, Fig. 3; Pl. XVII, Figs 7, 10, 14; Text-figs 8*C*, *Y* & 9*K*)

1914. *Griffithides shunnerensis* sp. nov.; W. B. R. KING, A new trilobite..., p. 392, Pl. 32, Figs 1-7.
1943. *Weberides shunnerensis* (KING); F. R. C. REED, Some Carboniferous..., p. 183.
?1962. *Weberides* cf. *Weberides shunnerensis* (KING); P. J. YATES, The palaeontology..., p. 407, Pl. 62, Figs 1, 2.

Lectotype: Entire, damaged specimen, SMC No. E 10500, figured by KING (1914, Pl. 32, Figs 2, 6); here refigured on Pl. XVII, Fig. 10.

Type locality: Great Shunner Fell, Yorkshire, Great Britain.

Type horizon: Lower Namurian (E_2).

Diagnosis. — Anterior border partly covered by glabella, basal lobes comparatively flat, pygidium with 17 axial rings and 9 ribs.

Remarks. — *P. eichwaldi shunnerensis* (KING, 1914) is very close to *P. eichwaldi parilis* (REED, 1942), both subspecies having in common the peculiar structure of the hind part of the glabella, which is elevated medially and the exoskeleton is thickened here, so that on the internal mould both the basal lobes and the space between them are situated in the broad depression, while in front of the latter the mould of the glabella is very highly elevated. This character is to be found also in other representatives of *Paladin eichwaldi*, which is why "*Griffithides shunnerensis*" is assigned within this species. There are some differences which allow one to distinguish it from others as a subspecies of *P. eichwaldi*. They are: lack of distinct glabellar furrows S_2 and S_3, broader frontal part of fixigena, comparatively flatter pygidium, which has developed a very characteristic flattened area around the posterior tip of axis, which also affects the postaxial part of the pygidial border. Dr. E. N. K. CLARKSON (Grant Institute of Geology, Edinburgh) found in the type locality a very small (0.5 mm) pygidium, which exposes the deep larval notch. This specimen is figured here on Pl. XVII, Fig. 7.

Stratigraphic and geographic range. — Lower Namurian of Great Britain.

Paladin eichwaldi parilis (REED, 1942)

(Pl. XIV, Fig. 4; Pl. XVIII, Figs 1-11, 14; Text-figs 8*E-G, O, V-X, Z* & 9*K*)

1942. *Weberides parilis* sp. nov.; F. R. C. REED, Some new Carboniferous..., p. 664, Pl. 10, Fig. 5.
1942. *Weberides dalriensis* sp. nov.; F. R. C. REED, *Ibid.*, p. 666, Pl. 10, Fig. 4.
?1942. *Eocyphinium ?bivium* sp. nov., F. R. C. REED, *Ibid.*, p. 659, Pl. 9, Fig. 2.
1943. *Weberides parilis* REED; F. R. C. REED, Some Carboniferous..., p. 179, Pl. 3, Figs 4-8.

Holotype: Pygidium, HMG, No. A 3708, figured by REED (1942, Pl. 10, Fig. 5); here refigured on Pl. XVIII, Fig. 9.
Type locality: Linn Spout, Dalry, Ayrshire, Great Britain.
Type horizon: Lower Namurian (E_2).

Diagnosis. — Pygidium narrow, axis being frontally one third of total pygidial width; 18 axial rings; 10 ribs; anterior border horizontally placed, in front of glabella; medial portion of glabella very high posteriorly, separated from the occipital ring by a depression formed by means of merging basal furrows and occipital furrow.

Material. — Numerous counter-parts and several enrolled specimens from the Lower Namurian limestones (E_1, E_2) of Scotland (Gair, Beith, Bowertrapping), several pygidia from Wales (Halkyn Mountain).

Dimensions (in mm):

	RSM. 1911.62							HMG A 36	
	8393	8387	8395	8391	8390	8388	8385	2	6
Length of cephalon . . .	3.7	6.5	8.7	—	—	—	—	7.5	7.0
Width of cephalon	—	—	—	—	—	—	—	9.2	—
Length of glabella	3.0	5.0	6.5	—	—	—	—	6.0	—
Width of glabella	2.0	3.5	4.8	—	—	—	—	4.0	—
Length of pygidium . . .	—	—	—	4.0	5.0	7.7	9.3	—	—
Width of pygidium	—	—	—	4.5	5.7	8.0	10.0	—	—
Length of axis	—	—	—	3.8	4.4	6.2	8.0	—	—
Width of axis	—	—	—	—	—	2.9	4.0	—	—

Description. — To REED's observations, which are sufficient, one can add that the cranidium has a very peculiar structure in the posterior part of the glabella. Basal furrows merge together and with the occipital furrow form a comparatively broad depression between the occipital ring and posterior edge of the medial portion of the glabella, which is highly elevated. On the internal mould (Pl. XVIII, Fig. 10) it can be noticed that this depression includes also the area of the basal lobes, that means that in this place the exoskeleton is very thick, as the basal lobes on the surface of the exoskeleton are low, but normally developed (Text-fig. 1*A*, *B*).

Individual variability. — The very rich material of the here considered subspecies allowed the present author to observe that a comparatively high degree of variability takes place within *P. eichwaldi parilis* (REED). It is especially clearly pronounced on the pygidia. Some of them (Pl. XVIII, Fig. 14) are faintly pointed posteriorly with a comparatively narrower postaxially pygidial border, while others (Pl. XVIII, Figs 9, 11) are rounded posteriorly and their border is somewhat broader here.

Growth changes. — The smallest cranidium known (length 3.7 mm, Pl. XVIII, Fig. 1) has a distinctly convex anterior border, which is much flatter in adult individuals. Basal lobes are small, moderately convex, and the basal furrows, though they merge together with the occipital furrow, do not form such a distinct depression as is the case in adult cranidia. As far

as it could be observed, the young pygidia (the length of the smallest one being 4.0 mm, Pl. XVIII, Fig. 2) all belong to the posteriorly rounded type.

Remarks. — "*Weberides parilis*" REED, 1942 is here assigned as a subspecies within *Paladin eichwaldi* (FISCHER v. WALDHEIM), because it exposes the characters found in this species: 1) shape of pygidium, which is long and has a distinct and comparatively broad border, 2) shape of glabella, with highly elevated postero-medial portion and basal lobes preserved on the internal mould in the form of a shallow depression, 3) comparatively flat anterior border situated almost horizontally and in front of the glabella. *P. eichwaldi parilis* differs from the nominate subspecies in having the basal lobes somewhat larger (*tr.*), pygidium transversely more vaulted and more strongly elongated, pygidial axis less narrowed posteriorly. From *P. eichwaldi shunnerensis* (KING) it differs in having more convex postero-medial part of glabella, broader (*tr.*) and shifted further backwards palpebral lobes, and narrower pygidium.

Paladin mucronatus (McCOY, 1844)

Subspecies assigned: Paladin mucronatus mucronatus (McCOY, 1844), *P. mucronatus russicus* n. subsp., *P. mucronatus rotundatus* n. subsp., *P. mucronatus latispinatus* n. subsp.

Stratigraphic and geographic range: Upper Viséan—Lower Namurian of Eire, Great Britain, Germany, ČSR, Poland, USSR.

Remarks. — The terminal spine occurring on the pygidium of the representatives of *Paladin mucronatus* (McCOY) is such a striking character that, very often, the other features, also diagnostically important, have been overlooked. However, within the group of the Carboniferous trilobites, so far assigned to "*Phillipsia eichwaldi mucronata*" McCOY, several subspecies can be established. The diagnostically important subspecifical characters seem to be: 1) the cross-section of the pygidial ribs and their number, 2) the thickness of the pygidial spine, 3) the shape of the pygidium. The last mentioned feature can, however, be changed as a result of the preservation, and as the specimens of *Paladin mucronatus* mostly occur in shales, it cannot be the only character taken into account when determining the subspecies. The number of the pygidial rings seems to vary within one subspecies, while that of the ribs is more constant. Less changeable are the cephala in the subspecies of *P. mucronatus*. Here, the only noticed character, in which the subspecies of *P. mucronatus* differ among each other, is the proportion between the width (*tr.*) of the basal lobe and that of the postero-medial portion of the glabella. The Upper Carboniferous species from the USSR with the mucronate pygidium, which was previously assigned by WEBER (1937) to "*Phillipsia eichwaldi* var. *mucronata*", is here separated from *Paladin mucronatus* and described as ?*P. ailinensis* n. sp. The North American species described by GIRTY (1910) as "*Griffithides mucronatus*", which appeared to represent a *Paladin* species, should have its specific name rejected and replaced, for avoiding the homonymy with *Paladin mucronatus* (McCOY, 1844). A new specific name *Paladin girtyi* n. nom. is here proposed as replacing "*Griffithides mucronatus* GIRTY, 1910".

Paladin mucronatus mucronatus (McCOY, 1844)

(Pl. XIX, Figs 1-8, 10-12, 14; Text-figs 8*A, B, L* & 9*I*)

1844. *Phillipsia mucronata* sp. nov.; F. McCOY, Synopsis..., p. 161, Pl. 4, Fig. 5.
1883—1884. *Phillipsia Eichwaldi* var. *mucronata* McCOY; H. WOODWARD, A Monograph..., p. 23, Pl. 4, Figs 1, 3, 12.
1936. *Phillipsia mucronata* McCOY; M. SCHWARZBACH, Die Trilobiten..., p. 432, Pl. 27, Fig. 1.

1936. *Phillipsia mucronata* var. *subcarinata* n. var.; M. SCHWARZBACH, *Ibid.*, p. 434, Pl. 27, Fig. 2.
1936. *Phillipsia mucronata* var. *vasta* n. var.; M. SCHWARZBACH, *Ibid.*, p. 434, Pl. 27, Fig. 3.
1937. *Griffithides mucronatus* McCOY; S. WEIGNER, Fauna piaskowców..., p. 52, Pl. 3, Fig. 14.
1937. *Griffithides acuminatus* ROEMER; S. WEIGNER, *Ibid.*, p. 54, Pl. 3, Figs 13, 15, 16.
1942. *Weberides mucronatus* (McCOY) var. nov. *traquairi*; F. R. C. REED, Some new..., p. 660, Pl. 11, Figs 1-4.
1942. *Weberides mucronatus* (McCOY) var. nov. *lata*; F. R. C. REED, *Ibid.*, p. 663, Pl. 11, Fig. 5.
1943. *Weberides mucronatus* var. *lata* REED; F. R. C. REED, Some Carboniferous..., p. 183, Pl. 11, Figs 6, 7.
1950. *Weberides mucronatus* (McCOY); A. PŘIBYL, On the Carboniferous..., p. 11, Pl. 1, Fig. 8; Pl. 2, Figs 4-6.
1961. *Paladin mucronatus* McCOY; K. BOJKOWSKI; Nowe stanowisko..., p. 424, Pl. 1, Figs 1-3.

Holotype: Pygidium, figured by McCOY (1844, Pl. 4, Fig. 5); present deposition unknown.
Type locality: Eire, no precise data.
Type horizon: ?Lower Namurian.

Diagnosis. — Cephalon with long genal spines, anterior border in front of glabella, continuing its slope; glabella somewhat swollen, strongly widening forwards, with basal lobes small and nearly detached from the rest of glabella; no trace of preoccipital lobe; palpebral lobes broad (*tr.*) but δ situated not farther out than β; pygidium slender with short terminal spine; width of pygidium larger than its length (without spine), pygidial border distinct; 15 pygidial rings, 9 convex ribs; pleural furrows deep; ornamentation granular, moderately pronounced, covering glabella and pygidium.

Material. — Two cranidia, 1 cephalon, 1 pygidium, with exoskeleton partly preserved (GSM Nos. 102526, 102527, 102524, 102523) from the 8-yd Limestone of an old quarry in Craster-Dunstan, Northumberland, 1 pygidium (HMG No. A 7141) from the Index Limestone in Wallacetown near Dailly, 1 entire, damaged specimen, 1 cranidium, 1 pygidium, 1 cephalon+pygidium (RSM Nos. 1906.140.1, 1906.140.3, 1906.140.4, 1906.140.5) from the black limestone of Wilkieston, Fife, Great Britain, numerous young and adult cranidia and pygidia from the black, ?Lower Namurian shales of Orlej, Cracow region, Poland.

Dimensions (in mm):

	RSM. 1906.140			GSM		ZNG Kr. Cz.							
	1	3	4	102527	102523	6	7	8	9	10	11	12	13
Length of entire specimen (without mucro)	30.5	—	—	—	—	—	—	—	—	—	—	—	—
Length of cephalon	12.0	—	9.0	9.7	—	5.2	6.5	—	—	—	—	—	—
Width of cephalon	?19.0	—	—	—	—	—	—	—	—	—	—	—	—
Length of glabella	9.0	—	6.5	7.0	—	4.0	5.1	—	—	—	—	—	—
Width of glabella	?6.3	—	5.0	6.0	—	2.9	4.0	—	—	—	—	—	—
Length of pygidium with mucro	?12.0	10.5	—	—	10.8	—	—	3.0	3.3	3.9	4.0	4.9	8.9
Width of pygidium	12.5	10.7	—	—	10.8	—	—	2.8	4.0	4.1	5.0	4.8	8.8
Length of axis	8.8	7.0	—	—	7.0	—	—	2.0	2.4	3.0	3.2	3.3	6.2
Width of axis	4.0	4.0	—	—	4.5	—	—	0.7	1.0	1.1	1.2	1.2	3.0

Growth changes. — In the collection of the Polish representative of *Paladin mucronatus mucronatus* (McCOY, 1844) there are several small cranidia which show some differences from the larger ones (length 5.2 mm; Pl. XIX, Fig. 6). Their glabella is a little less broadened frontally, fixigena near β being somewhat wider (*tr.*) than in larger cranidia. The medial portion of glabella at the occipital furrow is also proportionally broader in small cranidia.

Very interesting material of the young pygidia is provided from Orlej. A succession of young pygidia was found which show the process of development of the terminal pygidial spine (Pl. XIX, Figs 1-4, 11; lengths from 3.3 to 4.9 mm. The smallest pygidia are distinctly elongate in their most posterior part and the broad, flat border of the "*eichwaldi*" - type is present. The pygidium then becomes distinctly pointed at the end, but the true spine is still lacking (Pl. XIX, Fig. 4). In the successive stage, the pygidium is provided with a distinct but very short spine (Pl. XIX, Fig. 11) which becomes proportionally twice as long in the adult forms. The absence of a spine makes the very young pygidia of *P. mucronatus mucronatus* difficult to recognize from the young pygidia of *P. czarnieckii* n. sp. present in the same beds.

Remarks. — *Paladin mucronatus mucronatus* (McCoy, 1844) has been described very often, but a close examination of the specimens coming from different localities allowed the present author to state that the "mucronate" forms sometimes differ distinctly. The nominate subspecies differs from the other subspecies in having the most rounded form of pygidium (that of the Polish representatives figured on Pl. XIX, Fig. 7 being somewhat compressed laterally) and the most slender spine. As to the differences in the cephala, there is unfortunately only two other subspecies known — *P. mucronatus russicus* n. subsp. and *P. mucronatus rotundatus* n. subsp. — in which the cephalon is preserved (see discussion p. 133). In only two cases known to the present author was the "mucronate" form of *Paladin* found in the same beds as the "non-mucronate" one. So the possibility exists that the two forms represent opposite sexes. The probem cannot be finely solved at the moment, as in the case of *Paladin lowickensis* n. sp. and *P. mucronatus* subsp., both being found together in the same beds, no cephalon was found. In Orlej, the only entire specimen found is that of *P. czarnieckii* n. sp. (non-mucronate form) and it is comparatively badly preserved. However, it allowed the present author to state that the differences between "mucronate" and "non-mucronate" forms concern also the cephala, so she inclines to the view, that the two discussed forms represent separate species. It should be noted that the specimens from Orlej differ slightly from those from Great Britain in having a somewhat shorter glabella and slightly more divergent anterior branches of the facial sutures. However, this does not seem a sufficient base for separating them as the different subspecies. The differences between e.g. *P. mucronatus mucronatus* and *P. mucronatus russicus* n. subsp. are much wider.

Stratigraphic and geographic range. — Lower Namurian (?uppermost Viséan) of Eire, Great Britain, Poland, ČSR.

Paladin mucronatus russicus n. subsp.

(Pl. XIV, Figs 1, 7; Pl. XVIII, Fig. 13; Pl. XIX, Figs 9, 13)

1860. *Griffithides eichwaldi*; E. Eichwald, Lethea Rossica, p. 1435, Pl. 54, Fig. 10.
1933. *Phillipsia eichwaldi* var. *mucronata* McCoy; V. N. Weber, Trilobity..., p. 24, Pl. 1, Fig. 16.
1937. *Phillipsia (Griff.?) eichwaldi* var. (?) *mucronata* McCoy; V. N. Weber, Kamennougolnye trilobity..., p. 64, Pl. 7. Figs 18-23.
non 1937. *Phillipsia (Griff.?) eichwaldi*, var. (?) *mucronata* McCoy; V. N. Weber, *Ibid.*, Pl. 7, Fig. 24.

Holotype: Pygidium, TML No. 1606/5107, figured by Weber (1937, Pl. 7, Fig. 18); here refigured on Pl. XIX, Fig. 13.
Type locality: Rovnoe, Borovitch region, USSR.
Type horizon: Lower Namurian.
Derivation of the name: russicus — found in Russia.

Diagnosis. — Pygidium subtriangular; axis with 16—17 rings, 10 ribs which are sharp and high in cross-section and separated by broad, deep furrows; terminal spine moderately slender, short; cephalon with very long (as long as cranidium) genal spines reaching to half the length of pygidium; medial part of glabella highly raised posteriorly and narrower than a basal lobe (*tr.*), basal furrows and occipital furrow merging together.

Individual variability. — The comparatively abundant material from the type locality allows one to distinguish two groups among the pygidia of *P. mucronatus russicus*; some pygidia are broad, subtriangular (Pl. XVIII, Fig. 13), while the others are elongate, comparatively narrower. The cranidia also display some differences in the proportions of the glabella; some of them (Pl. XIV, Fig. 7) being comparatively short, other (Pl. XIX, Fig. 9) much more slender.

Growth changes. — In the material from Rovnoe there occur one pygidium and one cranidium much smaller than the others. The pygidium (length 3 mm; Pl. XIV, Fig. 1) has its axis of 17 rings, strongly bent down at the tip, and the posterior region is steeply falling towards the horizontal and comparatively broad border; these characters are common to all the young pygidia of proetids. The spine in this pygidium is somewhat shorter. The smallest cranidium is 4 mm long. It is strongly damaged, but still allows one to observe that its anterior border is flatter, wider, more horizontally situated, and its glabella is shorter, but at the same time much more arched longitudinally than in the older forms.

Remarks. — *Paladin mucronatus russicus* n. subsp. differs from the nominate subspecies in having in cross-section very high and sharp ribs, separated by much broader and deeper furrows. The terminal spine seems to be somewhat stronger on the pygidium of *P. mucronatus russicus*. Differences can be also observed in the cephala: that of *P. mucronatus mucronatus* McCoy (Pl. XIX, Fig. 14) having the medial part of the glabella flat posteriorly and broader than a basal lobe (*tr.*). However, the cranidium of *P. mucronatus mucronatus* from Northumberland (Great Britain) (Pl. XIX, Fig. 10) does not show the character mentioned, being very similar to that of *P. mucronatus russicus* n. subsp., though the pygidia associated with the cranidium from Northumberland (Pl. XIX, Fig. 12) is typical for *P. mucronatus mucronatus* and differs distinctly from those of *P. mucronatus russicus*. The state of preservation of the material from Rovnoe (USSR) allows one to state that the terminal spine was hollowed, which is also true for the other representatives of the species.

Stratigraphic and geographic range. — Lower Namurian of USSR (Moscow Basin, Donets Basin).

Paladin mucronatus rotundatus n. subsp.

(Pl. XX, Figs 1, 9)

Holotype: Cephalon with part of thorax, BM No. In 56282; Pl. XX, Fig. 1.
Type locality: Ireshope Burn, Durham, Great Britain.
Type horizon: Four Fathom Lst., Lower Namurian.
Derivation of the name: rotundatus — Lat. *rotundus* = round; because of the rounded outer edges of cephalon and pygidium.

Diagnosis. — Anterior border placed vertically, hidden under glabella, outer margin of cephalon rounded; basal lobe extremely small, the remaining part of glabella swollen without any furrow; pygidium with poorly delimited border, outer edge rounded, terminal spine short, thin.

Material. — Several poorly preserved cephala, librigena and pygidia from the Lower Namurian black shales of Ireshope Burn, Durham, Great Britain.

Dimensions (in mm):

	BM In 56283	BM In 56294
Length of cephalon . . .	8.1	—
Width of cephalon	12.0	—
Length of glabella	6.1	—
Width of glabella	5.4	—
Length of pygidium . . .	—	9.3
Width of pygidium	—	9.4
Length of axis	—	6.6
Width of axis	—	2.5

Description. — Cephalon broadly rounded frontally; outer margin of cephalon rounded in cross-section; anterior border convex, hidden under glabella, situated vertically; occipital ring very broad (*sag.*), convex; occipital furrow deep, sharp; glabella swollen with pear-shaped central part and extremely small basal lobe being about a fifth of the basal glabellar width; no glabellar furrows except the basal ones; width (*tr.*) of palpebral lobe less than that (*sag.*) of occipital ring; lateral border very convex and distinctly delimited by lateral border furrow; genal spine thin, rounded in cross-section, about the length of the librigena. Hypostoma unknown. Thorax poorly preserved. Pygidium with poorly delimited border and short, thin terminal spine; axis with 16 rings; 8—9 ribs.

Remarks. — The here described new subspecies has a pygidium of the same proportions as that of *Paladin mucronatus mucronatus* (McCoy, 1844). The only difference is in its outer margin which is rounded in cross-section, which also applies to the margin of the cephalon. The cephalon of the new subspecies differs, moreover, from all other subspecies of *P. mucronatus* (McCoy) in having the anterior border completely covered by the glabella, while it is always visible in the remaining representatives of the species. The second difference is the size of the basal lobes, which are here extremelly small, being much larger in other subspecies of this species. Taking into account the shape of the pygidium, as well as this of the glabella, and the width (*tr.*) of palpebral lobes, *P. mucronatus rotundatus* seems to be the most closely related to the nominate subspecies.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin mucronatus latispinatus n. subsp.

(Pl. XVIII, Fig. 12; Text-fig. 9*L*)

Holotype: Pygidium, SMC No E3610; Pl. XVIII, Fig. 12.

Type locality: Settle, Yorkshire, Great Britain.

Type horizon: ?Upper Viséan.

Derivation of the name: latispinatus — Lat. *latus* = broad, *spinus* = spine; because of the presence of a broad spine on the pygidium.

Diagnosis. — Pygidium long, with broad, flat spine; 16 rings, 9 ribs.

Material. — One internal mould of pygidium from the black limestone of Settle, Yorkshire, Great Britain.

Dimensions (in mm):

	SMC E 3610
Length of pygidium (with spine)	11.2
Width of pygidium	11.2
Length of axis	8.0
Width of axis	4.0

Description. — Pygidium elongated, tapering gradually backwards, so that the medial spine is placed in the prolongation of the posterior part of pygidium; border broad, probably flat; axis narrow, reaching to the border, 16 rings; 9 ribs. In longitudinal and transverse section, pygidium low. The preserved portions of exoskeleton show that it was comparatively thick.

Remarks. — The pygidium described bears some resemblance to the pygidium described from Leslie, Fife, by REED (1943) as "*Weberides mucronatus* var. *traquairi*" and illustrated by this author on Pl. 11, Fig. 4 (HMG No. A 3712). The latter specimen is supposed to represent a young pygidium of this form being the smallest found. Two other pygidia, assigned by REED to his new "varietas", are bigger and both were found in another locality (Garple Burn, Muirkirk, Ayrshire). They differ very distinctly from the here described species, having the medial spine on their pygidia developed in a form typical for *Paladin mucronatus mucronatus* (MCCOY, 1844), i.e. thinner and more distinctly delimited from the posterior part of the pygidium, while in *P. mucronatus latispinatus* it is difficult to determine a boundary between the pygidium and the spine, the latter being the continuation of the former. A somewhat similar form to that mentioned in *P. mucronatus latispinatus* is observed in the spine of the smallest pygidium from Leslie, mentioned above. However, it is not so slender as in *P. mucronatus latispinatus*.

Two pygidia described in the present paper as *Paladin mucronatus* subsp. and coming from the Lower Namurian of Lowick, Northumberland, have a somewhat similar pygidial mucro (broad at its base) to this of *P. mucronatus latispinatus*. They differ, however, being more vaulted transversely as well as having a developed septum, which is lacking in the here described subspecies.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin mucronatus subsp.

(Pl. XX, Figs 2, 12; Text-fig. 8*I*, *K*)

Material. — Two internal moulds of pygidia from the dark grey limestones of Lowick, Northumberland, Great Britain.

Dimensions (in mm):

	SMC	
	E 3621	E 3624
Length of pygidium (without spine)	9.0	6.5
Width of pygidium	10.5	7.0
Length of axis	8.5	6.0
Width of axis	4.5	2.2

Remarks. — Both pygidia found have their terminal spines partly broken off, but they seemed to represent the same type of mucro as that found in the here described new species *Paladin latispinatus* n. sp. from Settle, Yorkshire. It is broad at the base, and its internal mould

is flat so that the mucro forms, in fact, a continuation of the pygidium. In *Paladin mucronatus mucronatus* (McCoy) (p. 133) the mucro is more distinctly differentiated from the outline of the pygidium. The smaller of the two pygidia has a very similar elongate shape to that of *P. lowickensis* n. sp., as well as a similar strong transverse vaulting. The only difference is the presence of a mucro and of 17 rings, instead of 16 in *P. lowickensis*. The second pygidium differs more strongly from *P. lowickensis*, being in addition to the above shorter and flatter transversely. However, both pygidia in question have a developed septum. The similarities mentioned as well as the fact that the pygidia were found together with those of *P. lowickensis* n. sp. could be the evidence that they represent the sexual form of the latter species. In the collection of the Geological Survey Museum is housed a mucronate pygidium from Ancroftstaed near Lowick, Northumberland (No. 102543) which somewhat resembles the pygidia of *P. mucronatus* subsp. Also in the Sedgwick Museum collection there are two pygidia (Nos. E 12757, E 12758) with mucros of *P. mucronatus* subsp. type.

Paladin glaber (Woodward, 1882)

(Pl. XIV, Fig. 8)

1883—84. *Griffithides glaber* Woodward; H. Woodward, A Monograph..., p. 40, Pl. 9, Fig. 4.

Lectotype: Entire specimen, GSM No. 562; figured by Woodward (1883—84, Pl. 9, Fig. 4*a*).
Type locality: Castle Mumbles, Glamorganshire, Great Britain.
Type horizon: Upper Viséan (D_3).

Diagnosis. — Glabella flat, with flat anterior border; pygidium elongated, broadly rounded posteriorly, with very broad, flat pygidial border; 15 axial rings, 8 ribs; ornamentation very weakly pronounced.

Material. — One entire, somewhat damaged specimen (lectotype), 1 damaged thorax with pygidium from the type locality, 1 pygidium (GSM No. 103113) from Ashford, Derbyshire, Great Britain.

Dimensions (in mm):

	GSM 103113
Length of pygidium . . .	10.8
Width of pygidium	11.0
Length of axis	8.5
Width of axis	4.0

Remarks. — Woodward's species "*Griffithides glaber*", which has the typical pygidium of *Paladin* Weller, 1936, should be assigned to this genus. The strongly damaged cephalon does not allow for any detailed comparison with other species of this genus. However, the very characteristic for *Paladin* ornamentation of axial rings is present in *P. glaber*. Pygidial axis in this species is shorter than in some other representatives of the genus, but the most striking difference is the presence of a broad and flat, poorly delimited pygidial border. *P. glaber* is most similar to *P. eichwaldi parilis* (Reed, 1942) in the shape of its pygidium which is nearly as long as broad and in the character of the pleural ribs, which are well separated by the pleural furrows and with interpleural furrows distinctly visible.

Stratigraphic and geographic range. — Uppermost Viséan of Great Britain.

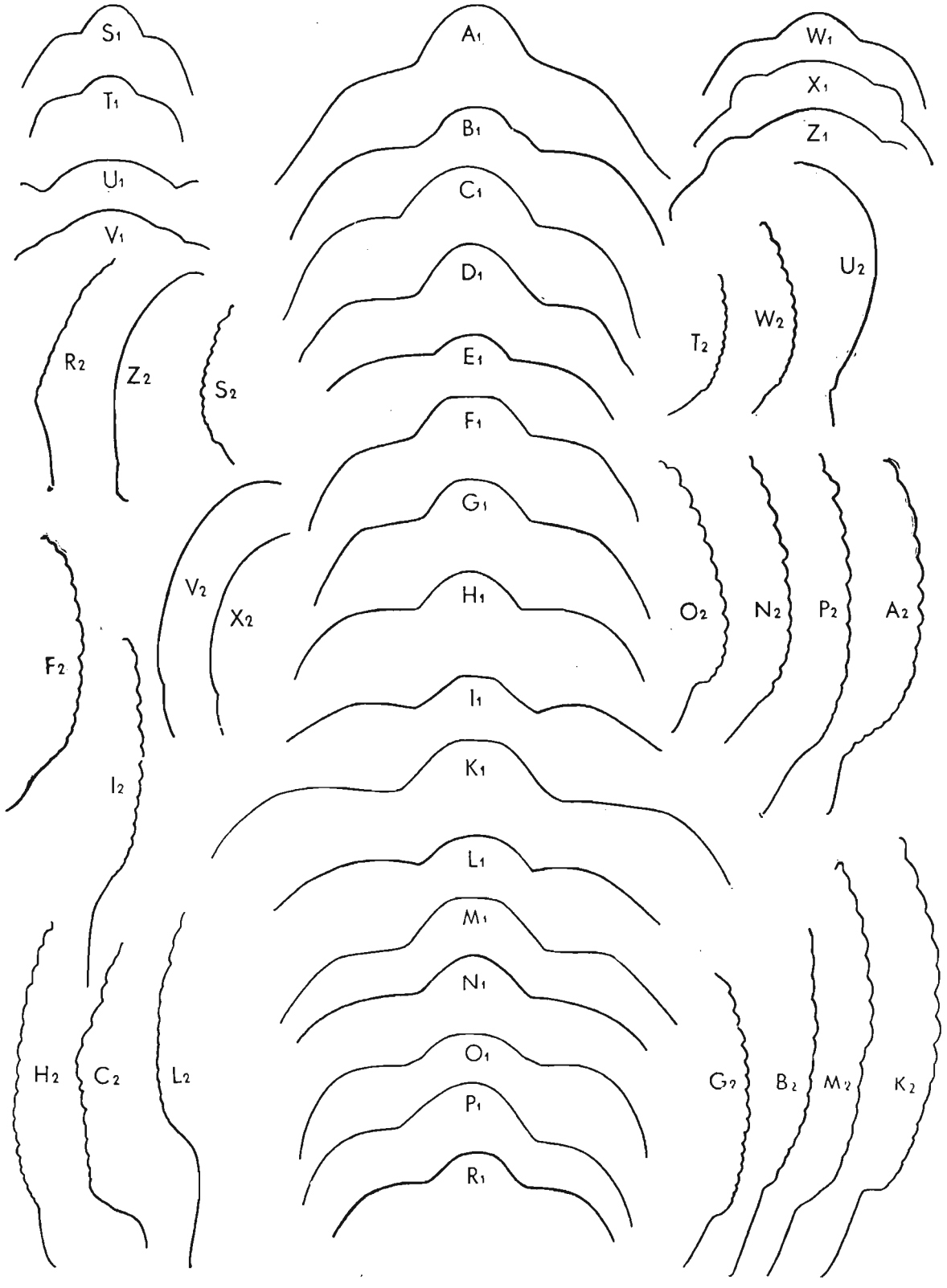
S1
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Fig. 9

Paladin barkei (WOODWARD, 1902)

(Pl. XXI, Fig. 9)

1902. *Griffithides barkei* WOOD.; H. WOODWARD, Culm trilobites..., p. 484, Pl. 20, Figs 14, 15.

Holotype: Entire specimen. BM I 7312, figured by WOODWARD (1902, Pl. 20, Fig. 14); here refigured on Pl. XXI, Fig. 9.

Type locality: Bishopston, Glamorganshire, Great Britain.

Type horizon: Upper Viséan.

Diagnosis. — Anterior border visible in front of glabella; glabella long; basal lobe occupying a third of basal glabellar width (*tr.*); pygidium moderately elongate, with very broad border; 14—15 axial rings; 9 ribs.

Remarks. — This species is a typical representative of the genus *Paladin* WELLER, exposing some resemblance in the structure of its cephalon with *Paladin eichwaldi eichwaldi* (FISCHER V. WALDHEIM, 1825). The pygidium of *P. barkei* (WOODWARD, 1902) is also similar to that of the species mentioned, being gently rounded posteriorly. However, the pygidium of *P. barkei* is shorter (with only 15 rings instead of 17—18 in *P. eichwaldi eichwaldi*) and its border is much broader. The posterior part of the glabella of *P. barkei* does not show the peculiar elevation, which was noticed in *P. eichwaldi eichwaldi*. A very close resemblance exists between *P. barkei* and the here described new species *P. czarnieckii* from Poland (comp. p. 147). On the thoracic and pygidial rings of *P. barkei* a typical for *Paladin* ornamentation consisting of rows of elongated tubercles is developed. The shape of pygidium as well as its comparatively poorly delimited border are similar to those in *P. glaber* (WOODWARD, 1883—1884), which was reported also from the Upper Viséan of Glamorganshire. The structure of the cephalon, which has more convex glabella in *P. barkei*, differs these two species.

Stratigraphic and geographic range. — Type horizon and type locality.

Fig. 9

A *Paladin cuspidatus* (REED), pygidium (CMG O1.53. pm/2), High Blantyre, Gt. Britain, Viséan; B *P. glaber* (WOODWARD,) pygidium (GSM 103113), Ashford, Gt. Britain, Viséan; C *P. griffithidoides* n. sp., holotype specimen, pygidium (GSM X 2453), Bands Gill, Gt. Britain, Viséan; D *P. cuspidatus* (REED), pygidium (RSM 1938.1.2684), St. Monans, Gt. Britain, Viséan; E *Particeps scoticus scoticus* REED, pygidium (RSM 1958.1.2675), Bogie, Gt. Britain, Viséan; F *Paladin bakewellensis* n. sp., pygidium (GSM 33698), Bakewell, Gt. Britain, Viséan; G *P. eichwaldi parilis* (REED), pygidium (RSM 1911.62.8388), Bowertrapping, Gt. Britain, Namurian; H *P. belli* n. sp., holotype pygidium (BM I 18446), Kennetcook, Canada, Viséan; I *P. mucronatus mucronatus* (MCCOY), pygidium (GSM 102523), Craster-Dunstan, Gt. Britain, Namurian; K *P. eichwaldi shunnerensis* (KING), pygidium (BM 55007a), Shunner Fell, Gt. Britain, Namurian; L *P. mucronatus latispinatus* n. subsp., holotype pygidium (SMC E 3610), Settle, Gt. Britain, ?Viséan; M *P. lowickensis* n. sp., holotype pygidium (SMC E 3626), Lowick, Gt. Britain, Namurian; N *Particeps scoticus scoticus* REED, pygidium (RSM 1958.1.2674), Bogie, Gt. Britain, Viséan; O *P. scoticus scoticus* REED, pygidium (BM I 7508), Farhouse, Gt. Britain, Viséan; P *Paladin angustipygus* n. sp., holotype pygidium (GSM Bi 1259), Cleveland Hills, Gt. Britain, Viséan; R *P. ?bakewellensis* n. sp., pygidium (GSM 33705), Bakewell, Gt. Britain, Viséan; S *Particeps scoticus minimus* n. subsp., holotype pygidium (GSM 102540), Christonbank, Gt. Britain, Namurian; T *P. scoticus minimus* n. subsp., pygidium (GSM 102533), Christonbank, Gt. Britain, Namurian; U *Cyphinioides ashfellensis* REED, holotype specimen, cephalon (HMG A 3700), Kirkby Stephen, Gt. Britain, ?Viséan; V *Particeps scoticus scoticus* REED, cranidium (RSM 1958.1.2676), Invertiel, Gt. Britain, Viséan; W *P. scoticus scoticus* REED, pygidium (RSM 1911.62.8386), Bowertrapping, Gt. Britain, Namurian; X *P. scoticus minimus* n. subsp., cephalon (GSM 102541), Christonbank, Gt. Britain, Namurian; Z *P. scoticus scoticus* REED, cephalon (BM I 867), Beith, Gt. Britain, Namurian. Not to the scale.

Transverse section marked with *1*, longitudinal — with *2*

Paladin cuspidatus (REED, 1943)

(Pl. XXI, Figs 1, 2, 4, 6; Text-figs 8 *D*, *N*, *S*, ? *T*, *U* & 9 *A*, *D*)

1883—84. *Phillipsia eichwaldi* FISCH.; H. WOODWARD, A Monograph..., p. 22, Pl. 4, Fig. 2.
1943. *Weberides parilis* var. *cuspidata* REED; F. R. C. REED, On some new..., p. 181, Pl. 3, Figs 1-3.

Lectotype: Cephalon, RSM No. 1958.1.2683, figured by REED (1943, Pl. 3, Fig. 1); here refigured on Pl. XXI, Fig. 6.
Type locality: E of St. Monans, Fife, Great Britain.
Type horizon: Upper Viséan (P_2); Zone 19.

Diagnosis. — Anterior border visible in front of glabella, basal lobes very distinctly cut off, tear-shaped, initial preoccipital lobe developed; pygidium very narrow, long, ending in a sharp arch posteriorly, axis high with 16 rings, pleural lobes vaulted above narrow border; 9 convex ribs.

Growth changes. — In the collection of this species coming from the type locality, two young cranidia were found. One of them (RSM No. 1958.1.2719, length 5 mm; Pl. XXI, Fig. 2) shows, that the glabella is proportionally broader (*tr.*) anteriorly than it is in the adult cephalon; anterior border is placed more horizontally; basal lobe occupies a third of the basal glabellar width, in the adult cephalon only a quarter of that. The most striking character of the young glabella is the presence of a distinct preoccipital lobe, which becomes less clearly visible in the adult form.

Remarks. — REED (1943) while erecting „*Weberides parilis* var. *cuspidata*" treated it as the subspecies of *Paladin parilis* (REED, 1943). However, the latter form is distinctly different from the here considered one, and in the present author's opinion they should be separated. The most significant difference is seen in the structure of the posterior part of the glabella in both forms, this of *P. cuspidatus* with an initial preoccipital lobe and a very highly elevated posterior edge of glabella, that of *P. eichwaldi parilis* with basal glabellar furrows, merged with the occipital furrow so that the posterior part of the glabella is separated from the occipital ring by means of a depression. The pygidia of both compared forms are also different, this of *P. cuspidatus* differing in its narrowness and sharply arched outline from all so far known representatives of the genus *Paladin*.

P. cuspidatus in its structure of cephalon seems to be the most closely related to *P. maillieuxi* (DEMANET, 1938) from the Upper Viséan of Belgium. Both species expose a preoccipital lobe and very distinctly cut off basal lobes. These latter are, however, in *P. cuspidatus* narrower (*tr.*) and tear-shaped, while those of *P. maillieuxi* are rather triangular. The anterior border of the Belgian species is broader (*sag.*), more flatly placed, the cephalon is wider and the genal spines longer. Moreover, the latter species has a broader pygidium, not so pointed posteriorly.

Stratigraphic and geographic range. — Upper Viséan of Great Britain.

Paladin maillieuxi (DEMANET, 1938)

(Pl. XXI, Figs 3, 5, 8, 10)

1938. *Griffithides maillieuxi* DEMANET; F. DEMANET, La faune..., p. 156, Pl. 13, Figs 12-16.

Lectotype: Entire specimen designed by DEMANET (1938, Pl. 13, Fig. 12).
Type locality: Bioul 5, Assis de Chokier, Belgium.
Type horizon: Upper Viséan (V3c).

Diagnosis. — Cephalon with very long genal spine, anterior border very broad and flat; faint preoccipital lobe developed; pygidium elongate with well delimited border; 15 rings, 10 ribs, interpleural furrows visible.

Remarks. — The feature, which differs *Paladin maillieuxi* (DEMANET, 1938) from all the so far known *Paladin* species, is its very broad, flat and horizontal anterior border. An anterior border of a similar character (but never so broad) is found only in some representatives of *P. eichwaldi* (FISCHER v. WALDHEIM), i.e. *P. czarnieckii* n. sp. and in the type species of the genus — *P. morrowensis* (MATHER, 1915). However, the pygidium of the latter species is short, while that of *P. maillieuxi* resembles very much those found in the representatives of *P. eichwaldi*. The young specimen of *P. maillieuxi* (Pl. XXI, Fig. 3) shows that the anterior border was somewhat concave during the early stages of the development. Such a concave preglabellar region is present, but in the adult individual, in *Paladin lutugini* (WEBER, 1933). On the other hand, the structure of the posterior portion of the glabella in the latter species is completely different, with a narrow, concave area separating the medial lobe of the glabella from the occipital ring. In *P. maillieuxi* a weak preoccipital lobe is present in this place. A somewhat similar cranidium to that of the species here discussed has the British form — *Paladin cuspidatus* (REED, 1943). The latter has, however, a more strongly developed preoccipital lobe, as well as a glabella less expanded frontally.

Paladin lutugini (WEBER, 1933)

(Pl. XXII, Figs 3, 5, 6, 11)

1933. *Griffithides lutugini* n. sp.; V. N. WEBER, Trilobity..., p. 33, Pl. 2, Figs 2-7.
1933. *Griffithides lutugini* var. *robusta* n. sp., n. v.; V. N. WEBER, *Ibid.*, p. 34, Pl. 2, Fig. 11.
?1933. *Griffithides lutugini* var. *multisegmentata* n. sp., n. v.; V. N. WEBER, *Ibid.*, p. 35, Pl. 2, Fig. 9.
1933. *Griffithides lutugini* var. *longicauda* n. sp. et var.; V. N. WEBER, *Ibid.*, p. 35, Pl. 2, Fig. 8.
1937. *Griffithides lutugini* WEB.; V. N. WEBER, Kamennougolnye trilobity..., p. 74, Pl. 8, Figs 32-34.

Neotype: Cranidium, TML No. 139/3139, figured by WEBER (1933, Pl. 2, Fig. 2); here refigured on Pl. XXII, Fig. 5.

Type locality: Izbarino, Donets Basin, USSR.

Type horizon: Moscovian (L_6).

Diagnosis. — Cranidium broadly rounded frontally, anterior border vertical, separated from glabella by a comparatively narrow (*sag.*), somewhat concave preglabellar region; middle lobe of glabella high posteriorly, basal lobe triangular, small, swollen but lower than postero-medial part of glabella; palpebral lobe very highly elevated; pygidium broadly rounded posteriorly, gradually widening forwards; axis with 18 rings; 10 ribs, very convex, rounded in cross-section; glabella coarsely granulated.

Remarks. — The holotype specimen of "*Griffithides lutugini*" WEBER, 1933 — pygidium — is lost. Unfortunately, there is no other pygidium in WEBER's collection with the author's original assignment to this species. The other, preserved pygidia were assigned by WEBER to "*G. lutugini* var. *multisegmentata*" WEBER, 1933 and "*G. lutugini* var. *longicauda*" WEBER, 1933. In the present author's opinion, these latter specimens should be included within the range of the individual variability and are conspecific with the lost holotype of "*Griffithides*" *lutugini*. They come from other localities than the holotype of the latter species. Taking into account the facts above mentioned, the present author decided to choose for a neotype the topotype cranidium illustrated by WEBER (1933, Pl. 2, Fig. 2). The cephalon assigned by WEBER (1933)

to "*G. lutugini* var. *robusta*" is somewhat compressed in sagittal direction which caused stronger longitudinal "vaulting". In fact, the glabella of "robusta" form does not differ from that of the neotype cranidium (which, as a matter of fact, is also very strongly vaulted longitudinally, due to similar deformation). The other topotype cranidia do not display such strong vaulting. The species discussed above is by the present author assigned within *Paladin* WELLER, 1936, because it exposes the characters typical for this genus: 1) shape of glabella, with elevated postero-medial part of glabella; 2) distinctly separated basal lobes; 3) palpebral lobes strongly moved backwards and broad and, lastly, 4) the elongate pygidium with a very slender, long axis and flat border. The ornamentation of glabella in *Paladin lutugini* is somewhat coarser than in the Lower Carboniferous representatives of the genus, but on pygidial rings the characteristic for *Paladin* spine-like tubercles are developed. The structure of the preglabellar region differs somewhat from that in the Lower Carboniferous species of *Paladin*, where it is less distinctly delimited from the anterior border and glabella; it is in *P. lutugini* even morphologically more primitive, and somewhat resembles that in *Phillipsia* s. str. or in Cyrtosymbolinae. The similarly developed preglabellar region is present in the uppermost Carboniferous representative of the same genus — *Paladin trigonopyge* OSMÓLSKA, 1968. A very characteristic feature of *Paladin lutugini* is the outline of its pygidium — differing it from all the other Carboniferous trilobites except *P. cervilatus* (WEBER, 1933) — which gradually widens forwards with a comparatively straight posterior margin, what gives it a somewhat trapezoidal shape, instead of the usual parabolic one.

Stratigraphic and geographic range. — Moscovian of USSR (the Donets Basin).

Paladin cervilatus (WEBER, 1933)

(Pl. XXII, Figs 12, 14)

1933. *Griffithides cervilatus* n. sp.; V. N. WEBER, Trilobity..., p. 36, Pl. 2, Figs 12-16.
?1933. *Griffithides planus* n. sp., V. N. WEBER, *Ibid.*, p. 37, Pl. 2, Figs 34, 35.
1937. *Griffithides cervilatus* WEB.; V. N. WEBER, Kamennougolnye trilobity..., p. 75, Pl. 8, Figs 35, 37; Pl. 11, Figs 25-26, 28.

Holotype: Pygidium, TML No. 204/3139, figured by WEBER (1933, Pl. 2, Fig. 15); here refigured on Pl. XXII, Fig. 14.
Type locality: Varvaropole, Donets Basin, USSR.
Type horizon: Moscovian (M_5, M_6).

Diagnosis. — Pygidium narrow posteriorly and gradually widening forwards; border very broad and flat, pleural lobe flat; axis very narrow, almost half as broad as pleural lobe, with 17 rings; 10 convex ribs; segmentation of pygidium faintly pronounced; cranidium with short glabella, flat preglabellar region, border not striated and not delimited from preglabellar region; exoskeleton smooth, with very faintly marked punctures.

Remarks. — The most striking character of this species is the lack of ornamentation, which in almost all the species of *Paladin* WELLER, 1936 is very distinct. The broad, triangular shape of the pygidium of *P. cervilatus* (WEBER, 1933) resembles that of *P. mucronatus* (MCCOY, 1844), but in this species the terminal spine is developed and the segmentation is very sharp, while in *P. cervilatus* it is very weakly pronounced. From all known *Paladin* species as well as from many other Carboniferous trilobites, *P. cervilatus* differs in the lack of striation of the anterior border as well as of the pygidial border. In spite of all these differences, which set *P. cervilatus* apart from the other representatives of *Paladin*, it still has the distinctly marked diagnostic characters of this genus as: shape of the glabella, broad, elevated palpebral lobes and com-

paratively long pygidium. In all these characters mentioned it is closest to *P. lutugini* (WEBER, 1933).

Stratigraphic and geographic range. — Moscovian of USSR (the Donets Basin).

Paladin eakringensis n. sp.

(Pl. XX, Fig. 6; Text-fig. 8*M*)

Holotype: Pygidium, GSM, No. Zh 4338; Pl. XX, Fig. 6.
Type locality: Eakring, Nottingham, Great Britain.
Type horizon: Upper Viséan (P).
Derivation of the name: eakringensis — after the type locality.

Diagnosis. — Pygidium short and broad; axis with 13 rings; pygidial border narrow and convex, well defined.

Material. — One pygidium, 1 anterior part of cranidium probably belonging to the species, from the dark grey limestone, the bore-hole No. 80, Eakring.

Dimensions (in mm):

	GSM Zh 4338
Length of pygidium . . .	6.0
Width of pygidium	8.0
Length of axis	5.1
Width of axis	2.7

Description. — Pygidium broad, slightly subtriangular, with well defined border; axis broad and flat anteriorly, becomes higher and narrow posteriorly; 13 axial rings: ring furrows deep mesially, shallower on sides; 8 fairly convex ribs, pleural furrows deep, interpleural furrows visible along all the ribs, none of them invading the border; short postaxial ridge present. In longitudinal section, axis horizontal, postaxial region slightly sloping. In transverse section, axis somewhat angular, fairly elevated above pleural lobes, which are gently arched. Ornamentation typical for *Paladin* with a row of elongated tubercles along each ring-edge. Preserved part of cranidium from the same piece of rock and probably belonging to this species is characterized by its flat anterior border protruding in front of glabella; anterior outline of cranidium highly arched; ornamentation of glabella very dense, granular.

Remarks. — The here described new species has the shortest pygidium known in any Eurasian *Paladin* species. But similar short and broad pygidia are reported in many North American representatives of the genus. Among the European forms a similar, short pygidium is found in *Paladin barkei* (WOODWARD, 1902); there it is, however, narrower, with 14 rings and a wider border. The pygidium of *Paladin maillieuxi* (DEMANET, 1938) which has also a short (14—15 rings) axis, is however more distinctly triangular, being narrower posteriorly. The latter species have a similar, highly arched anterior outline of cranidium and a broad, flat anterior border, somewhat similar as in the fragmentary cranidium found together with the type specimen of *P. eakringensis* n. sp. It seem, than *P. eakringensis*, together perhaps with the two other above mentioned species — *P. barkei* and *P. maillieuxi*, form the group of the European most primitive species of *Paladin* WELLER, 1936 and are the closest to the North American representatives of this genus.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin bakewellensis n. sp.

(Pl. XXII, Figs 7, 8; Text-figs 8*H* & 9*F*)

Holotype: Pygidium, GSM No. 33701; Pl. XXII, Fig. 8.
Type locality: Bakewell, Derbyshire, Great Britain.
Type horizon: Upper Viséan.
Derivation of the name: bakewellensis — after the type locality.

Diagnosis. — Pygidium rounded posteriorly, with convex, narrow border; axis with 14—15 rings.

Material. — Seven pygidia (GSM Nos. 33699—33704) from the black limestone of Bakewell, Derbyshire, 1 pygidium with damaged cephalon attributed from the black limestone of Ashford, Derbyshire (GSM No. 33698).

Dimensions (in mm):

	GSM			
	33699a	33701	33703	33698
Length of pygidium . . .	4.2	6.0	9.0	—
Width of pygidium	5.0	7.0	10.8	—
Length of axis	3.7	5.7	8.0	—
Width of axis	1.3	2.3	3.5	—
Length of cephalon . . .	—	—	—	8.0
Width of cephalon	—	—	—	13.0
Length of glabella	—	—	—	6.2
Width of glabella	—	—	—	5.0

Description. — Pygidium rounded posteriorly, surrounded by a narrow convex border; axis indistinctly delimited at the end, nearly touches border; 14—15 convex axial rings, separated by ring-furrows which are deep mesially but shallow at sides of axis; 8—10 ribs, very convex and separated by well defined, deep pleural furrows; interpleural furrows visible on almost all ribs, the first two passing onto border; anterior band of rib broader than posterior one. In longitudinal section, axis straight, bent down only at the very tip, gradually passing onto border, which in its postaxial part is not separated from pygidium. In transverse section, axis flattened at top and on sides, subquadrate; pleural lobes, along their abaxial part, flat, sloping outwards. Ornamentation of pygidium consists of typical for the genus, elongate tubercles, arranged in one row along the posterior edge of rings, and a row of small rounded tubercles along (*tr.*) the each interpleural furrow. Cephalon attributed to the pygidium of *P. bakewellensis* n. sp. and probably belonging to the species, has a strongly damaged glabella. Shape of cephalon subtriangular, with slightly rounded anterior part; border convex, comparatively narrow, slightly broader at the anterior end of librigena, becoming narrower posteriorly; basal lobe of glabella tear-shaped, delimited by very deep basal furrow; occipital ring broad mesially (*sag.*), strongly narrowed at extremities; palpebral lobe curved, moderately wide (*tr.*); eye large, situated obliquely and surrounded by a narrow, smooth band along its base; genal spine present. Small granules covering central field of librigena. The slightly damaged hypostoma, found together with a pygidium of the species, has a swollen hind wing and rather flat margin.

Growth changes. — The smallest pygidium found (GSM No. 33699a) differs from the others in being more elongate and having somewhat pointed posterior part; the border, being as

narrow as in the larger pygidia, does not continue, however, the slope of pleural lobe, being situated slightly more horizontally.

Remarks. — The pygidium of the species described above is very different from the other pygidia of *Paladin* species so far known, being comparatively short and having very distinctly delimited, convex border. It most resembles "*Cyphinium kumpani*" WEBER, 1933 and "*C. productum*" WEBER, 1933. However, the damage of the glabella in *Paladin bakewellensis* n. sp. does not allow one to state if the preoccipital lobe was present here. The shape of cephalon, as well as the size of eyes and ornamentation of axial rings are typical for *Paladin* WELLER, 1936.

Stratigraphic and geographic range. — Upper Viséan of Great Britain.

Paladin ?bakewellensis n. sp.

(Pl. XIV, Fig. 10; Pl. XX, Fig. 8; Text-fig. 9*R*)

Material. — Two pygidia from the black Upper Viséan limestone of Bakewell, Derbyshire, Great Britain (GSM No. 33705a, b), 1 pygidium from ?Castleton, Derbyshire (BM No. I 871b).

Dimensions (in mm):

	33705a
Length of pygidium . . .	6.8
Width of pygidium	7.8
Length of axis	5.5
Width of axis	2.4

Remarks. — Both pygidia being found close to one another, on the same piece of rock, show the same shape as the pygidia of *Paladin bakewellensis* n. sp. They have, however, twice as broad and a poorly delimited border and somewhat flatter pleural lobes. They resemble pygidium of *Particeps scoticus* REED, 1943, but the latter is shorter and much strongly vaulted transversely and longitudinally, bearing no trace of border.

In the collection of the British Museum a pygidium (BM I 871b) was found, which is very close to *P. bakewellensis*. It exposes some abnormality in the development of 7th and 8th ribs, which merge together in a half of their length (*tr.*), leaving aside, near the border a small swelling, which evidently represents the remaining of the 7th rib.

Paladin czarnieckii n. sp.

(Pl. XVII, Figs 1-6, 9, 11, 12, 16; Text-fig. 7*C, J*)

Holotype: Cranidium, ZNG Kr. Cz. 14; Pl. XVII, Fig. 12.
Type locality: Orlej, Cracow region, Poland.
Type horizon: ?Lower Namurian.
Derivation of the name: czarnieckii — in honour of Dr. ST. CZARNIECKI (Institute of Geological Sciences, Polish Academy of Sciences, Cracow), who gave this material at the present writer's disposal.

Diagnosis. — Cephalon with moderately long spines, anterior border convex, nearly horizontally situated, central portion of glabella uniformly narrowing towards the occipital furrow, basal lobe small, detached, palpebral lobe very wide (*tr.*) with δ situated well outwards beyond β; pygidium elongated, subtriangular, with broad but indistinctly delimited border; 14-15 rings, 7-8 ribs.

Material. — Twenty four cranidia, 1 enrolled, entire specimen, 17 pygidia, from the black Upper Viséan shales of the type locality.

Dimensions (in mm):

	ZNG Kr. Cz.									
	14	15	16	17	18	19	20	21	22	23
Length of cephalon . . .	6.5	5.0	3.8	4.2	5.2	6.3	—	—	—	—
Width of cephalon	—	9.2	—	—	—	—	—	—	—	—
Length of glabella	4.9	3.9	2.9	3.2	3.8	4.2	—	—	—	—
Width of glabella	3.7	3.2	1.8	2.0	3.0	3.5	—	—	—	—
Length of pygidium . . .	—	—	—	—	—	—	2.2	3.1	4.0	6.5
Width of pygidium	—	—	—	—	—	—	2.7	3.8	5.0	8.0
Length of axis	—	—	—	—	—	—	1.8	2.7	3.0	5.2
Width of axis	—	—	—	—	—	—	0.5	0.7	1.1	2.2

Description. — Cephalon subtriangular, with strong, not very long genal spines, border broad, convex, in front of glabella well visible, situated nearly horizontally, occipital ring very broad (*sag.*), narrowed laterally, medial portion of glabella uniformly narrowing backwards, basal furrow very obliquely directed, reaching occipital furrow; basal lobe small but distinctly detached, no other lateral glabellar furrows, palpebral lobe moved backwards, very broad (*tr.*), horizontal, with δ far outwards beyond the projection of β, anterior branch of facial suture running parallelly to axial furrow so that anterior part of glabella is bordered by equally broad rim. In longitudinal section, occipital ring broad and very convex, occipital furrow deep, glabella in its most posterior part sloping towards the occipital furrow, otherwise horizontal and only at front gently bent towards the convex, somewhat sloping downwards anterior border. In transverse section, glabella very convex, axial furrows very well incised, palpebral lobes highly elevated, broad (*tr.*), horizontally situated. Librigena with broad lateral border, distinct border furrow, genal spine strong, sharply pointed, somewhat shorter than the length of librigena; visual lobe steeply placed, large, the portion of librigena between the lateral furrow and visual lobe narrow, steeply sloping outwards. Hypostoma and complete thorax unknown. Pygidium subtriangular, surrounded by broad and indistinctly delimited border; axis narrower than pleural lobe, with 14-15 rings; 7-8 flat ribs, with thin pleural furrows and extremely indistinct interpleural furrows. In longitudinal section, axis gently arched, postaxial region flat. In transverse section, axis narrow, rounded, pleural lobes weakly vaulted. Ornamentation: glabella and occipital ring densely granulated, pygidium with granulation much weaker developed.

Growth changes. — The smallest cranidium found (length 3.8 mm; Pl. XVII, Fig. 4) exposes a convex and broad anterior border, placed in front of the glabella, in entirely horizontal position. The glabella is very convex and has a griffithid appearance. In longitudinal section it is very distinctly arched. Basal lobes are very small and comparatively flat. No glabellar furrows, except the basal one, present. Fixigenae are comparatively twice as broad as in the adult cranidia and the anterior branches of the facial suture are more divergent. The palpebral lobes are proportionally about the same width as in the larger specimens, thus δ is not moved so far beyond the projections of β.

In the next development stages of the cranidia found (Pl. XVII, Figs 6, 3, 5) the longitudinal arching of the glabella decreases, the glabella broadens frontally and, as a result, the anterior portions of the fixigenae become narrower, while the anterior branches of the facial

sutures, without changing their direction, become close and parallel to the axial furrows. The basal lobes during the growth process become somewhat larger.

The smallest pygidium found (length 2.2 mm; Pl. XVII, Fig. 1) exposes a very shallow larval notch, and its appearance is very typical for all known young pygidia of Proetidae, i.e. the border is broad, flat, horizontal in position and distinctly delimited from the pleural lobes, which are elevated above the border and very strongly vaulted. The axis is very slender and convex having 14 rings visible, with a place for more. The ribs, 9 in number, are very convex and to some extent invade the border. The first pygidial segment is distinctly separated from the rest of the pygidium, as is the case in all the transitory pygidia.

The pygidium next in size to the latter (length 3.1 mm; Pl. XVII, Fig. 2) probably represents the successive instar, as in the material from Orlej several pygidia of the same size were found. It is still a transitory pygidium with an axis of 14 rings, having the first segment somewhat separated from the rest of the pygidium. A larval notch, though shallower than in the above mentioned pygidium, is present. In this instar, the border is still very broad and placed lower than the rest of the pygidium, but during the succeeding instars it loses this position becoming incorporated into the uniform arch of pleural lobes.

Remarks. — The here described new species of *Paladin* WELLER, 1936, has a pygidium elongate, but gently rounded posteriorly and comparatively flat ribs, similar to those found in *P. eichwaldi*. Its most striking character, differing it from this latter species, is the absence of lateral glabellar furrows and a shorter pygidium of 14—15 rings. *P. czarnieckii* most closely resembles *P. barkei* (WOODWARD, 1902). However, the holotype specimen of the latter is rather poorly preserved, and it cannot be decided which differences are caused by the state of preservation and which are of specific value. The possibility, that *P. czarnieckii* will, in the future, be proved a younger synonym of *P. barkei*, cannot be excluded. The pygidial border in the latter species seems to be more distinctly delimited than is the case in *P. czarnieckii*.

The partial ontogeny of *P. czarnieckii* described above is of some interest. It is very surprising to find, that the young cranidia of *P. czarnieckii* have a very distinct griffithid appearance, instead of being, as could be expected, of a more generalized proetid-cyrtosymbolid type. The adult representatives of *Paladin* mostly display glabellae of a more phillipsid than griffithid type. Also the comparatively long pygidium is quite unlike that in *Griffithides* and, again, more closely corresponds to *Linguaphillipsia* or *Phillipsia*.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin griffithidoides n. sp.

(Pl. XX, Figs 10, 11; Text-figs 8*R* & 9*C*)

Holotype: Entire enrolled specimen, GSM No. X 2453; Pl. XX, Figs 10, 11.
Type locality: Bands Gill, South-west of Hawes, Yorkshire, Great Britain.
Type horizon: Upper Viséan (P_2).
Derivation of the name: griffithidoides — similar to *Griffithides*.

Diagnosis. — Cephalon laterally compressed, strongly arched longitudinally; anterior border covered by glabella; posterior edge of glabella high and vertically cut; pygidium highly arched transversely, with flat border in the continuation of the slope of pleural lobe.

Material. — Only holotype specimen known.

Dimensions (in mm):

	GSM X 2453
Length of cephalon	10.0
Width of cephalon	12.2
Length of glabella	8.2
Width of glabella	5.0 5.8
Length of pygidium	9.0
Width of pygidium	10.0
Length of axis	8.0
Width of axis	4.5

Description. — Cephalon parabolic, compressed laterally; glabella uniformly expanding forwards, covering, but not overhanging, flat vertical anterior border, which is fused with glabella; anterior border furrow faint but marked; medial lobe of glabella posteriorly highly elevated, its edge sloping vertically towards broad occipital furrow; basal furrow deep, but somewhat shallowed before reaching occipital furrow, basal lobe triangular, occupying less than one third of total glabellar width (*tr.*); S_2 and S_3 absent; occipital furrow directed strongly backwards, towards its extremities; occipital ring very broad and high mesially, narrows laterally; palpebral lobe moderately broad, moved backwards; anterior and posterior branches of facial suture running parallelly and very close to axial furrow; eye highly elevated and occupying nearly whole surface of triangular librigena; lateral border very broad and flat; genal spine broken off but obviously long and strong. In longitudinal section, occipital ring high and sloping down towards deep occipital furrow; posterior edge of glabella vertically raised, profile of glabella sloping gradually towards anterior border, which is broad, convex and vertically placed under glabella. In transverse section, glabella highly arched, eyes convex and very steeply situated, librigena sloping downwards. Hypostoma unknown. Rostral plate broad (*sag.*), semi-oval. Nine thoracic segments. Thoracic axis very highly arched and elevated above pleural lobes, occupying slightly more than one third the total width. Thoracic rings convex, each with comparatively broad (*sag.*), semiannulus and articulating half-ring; pleural lobe horizontal along its proximal part, bent down distally; pleural furrows deep, anterior pleural band narrower than posterior one. Pygidium nearly as long as broad, surrounded by distinct flat border, continuing the slope of pleural lobe; no border furrow, axis with about 15 narrow, convex rings; ring-furrows deep and broad mesially, faint at extremities; 10 faintly convex ribs; pleural furrows deep, interpleural furrows very faint; both reaching, but not passing onto border, except first one. Pygidial doublure convex. In longitudinal section, axis very slightly inclined backwards. In transverse section, axis high, pleural lobes vaulted, as a whole pygidium compact. Ornamentation: occipital ring covered by backwards inclined tubercles, basal lobes smooth, glabella posteriorly covered by somewhat smaller but also backwards inclined granules, which become gradually lower and smaller towards the front of glabella, until they disappear near the anterior border, where glabella is covered only by fine punctures. Granulation on librigenae very fine. On thoracic rings, as well as on the pygidial rings, a row of spine-like tubercles arranged along the posterior edge of each ring; those on pygidial rings being larger and closer arranged; sides of pygidial axis deprived of granulation, pleural lobes, except the border which is smooth, covered by dense, fine granulation, slightly larger tubercles occurring along interpleural furrows.

Remarks. — The new species of *Paladin* described above, reaches a very advanced morphological degree in the compactness of its exoskeleton. It differs very distinctly from the other

species of *Paladin* WELLER, 1936 both in this character and in its anterior border, which does not protrude in front of the glabella but, on the contrary, is covered by the latter. However, this species is still a typical representative of *Paladin* having all the important, generic characters pronounced. These are: the shape and position of basal lobes, which are strongly separated from glabella but not detached from it; elevated posteriorly medial lobe of glabella, big, steeply placed eyes, presence of a distinct, though flat border, and a very characteristic ornamentation of pygidium consisting of the small, elongated, spine-like tubercles arranged into a row along the posterior edge of each pygidial ring.

A superficial similarity exists between *Paladin griffithidoides* n. sp. and the representatives of the genus *Griffithides* PORTLOCK, 1843, which is the uniformly expanding forwards, swollen, medial lobe of glabella, the latter being moreover also deprived of glabellar furrows, and the anterior border covered by glabella. But, as is noticed also in the evolution of other Carboniferous genera, i.e. *Cummingella*, *Eocyphinium*, *Bollandia*, all these characters are correlated with each other, and occur always as a result of sagittal and transversal expansion of the frontal lobe of glabella independently of the phylogenetic relations.

Some characters of *P. griffithidoides*, as e.g. lack of lateral glabellar furrows S_2 and S_3, shape of basal lobes, ornamentation, are also found in the North American representative of *Paladin* — *P. chesterensis* (WELLER & WELLER), but the latter species has shorter and not so sloping forwards glabella, as well as somewhat shorter pygidium. The posterior part of glabella is also not so highly elevated in the North American form as it is in *P. griffithidoides*.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin lowickensis n. sp.

(Pl. XX, Figs 4, 5, 7; Text-fig. 9*M*)

Holotype: Pygidium No. SMC E3626; Pl. XX, Fig. 7.
Type locality: Lowick, Northumberland, Great Britain.
Type horizon: Lower Namurian (E_1).
Derivation of the name: lowickensis — after the type locality.

Diagnosis. — Pygidium slightly broader than long, pointed posteriorly, 16 rings, 11 ribs.

Material. — Ten pygidia (SMC Nos. E 3618, E 3625, E 3617, E 3622, E 3620, E 3619, E 3629, E 3628, E 3627) from the dark grey limestone of Lowick, Northumberland, Great Britain.

Dimensions (in mm):

	SMC	
	E 3626	E 3618
Length of pygidium . . .	12.2	6.0
Width of pygidium	12.6	6.2
Length of axis	10.2	5.0
Width of axis	5.0	2.8

Description. — Pygidium elongated, subtriangular, slightly pointed posteriorly; axis narrower than one third of the total width of pygidium, with 16 convex rings; 11 flat ribs; ring furrows deep, thinner at sides of the axis; pleural furrows distinct, the first three passing onto the border; interpleural furrows visible on all the ribs except last two; anterior bands of ribs twice as broad as the posterior; border flat, equally broad along the whole pygidium, situated horizontally in relation to the slopes of pleural lobes; in the prolongation of the axis a septum occurs. In longitudinal section, axis gently arched, reaching the border, which slopes downwards.

In transverse section, axis elevated above pleural lobes, which are, at half their width, bent down at nearly right angles. Ornamentation typical for *Paladin*, consisting of the elongated tubercles situated along the posterior edge of each ring. Pleural lobes finely granulated.

Remarks. — All the pygidia in the collection of the Sedgwick Museum, except the type specimen, are preserved as internal moulds. However, the remainings of the exoskeleton allow one to observe that the latter is very thick. The pygidia of *P. lowickensis* resemble somewhat the pygidia of *P. cuspidatus* (REED, 1943), the latter however are narrower. Some resemblance can also be noticed between *P. lowickensis* and the pygidia of *P. eichwaldi parilis* (REED, 1942), but these from Lowick have more convex rings and a border placed in a different plane to that of the pleural lobes, which is not the case in *P. eichwaldi parilis*.

Stratigraphic and geographic range. — Type horizon and type locality.

Paladin angustipygus n. sp.

(Pl. XXII, Figs 1, 2, 10, 13; Text-fig. 8*J*)

Holotype: Pygidium GSM No Bi 1259; Pl. XXII, Fig. 10.
Type locality: Cleveland Hills, Carlton, Yorkshire, Great Britain.
Type horizon: Upper Viséan (P_2).
Derivation of the name: angustipygus — Lat. *angustus* = narrow; because of a narrow pygidium.

Diagnosis. — Pygidium long and very narrow, with pleural lobes and postaxial region abruptly sloping downwards.

Material. — Three pygidia and 1 damaged cranidium, probably belonging to the species, from the dark grey P_2 limestone of the type locality, 1 cranidium from the Upper Viséan of Okrzeja, Lublin region, Poland.

Dimensions (in mm):

	GSM Bi 1259
Length of pygidium . . .	9.5
Width of pygidium	9.5
Length of axis	8.0
Width of axis	4.0

Remarks. — The pygidium is similar to that found in *Paladin griffithidoides* n. sp., it is, however, more abruptly narrowing backwards, so that the posterior outline of the pygidium is a little more pointed. The pleural furrows in *P. angustipygus* are not so deep and the ornamentation is finer than in *P. griffithidoides*.

The cranidium found in the same bed and locality and probably belonging to the same species is strongly arched longitudinally, very much like that of *P. griffithidoides*. It differs very distinctly from the latter in having a quite different anterior border, which is convex and protruding in front of the glabella, while in the compared species it is fused with the glabella and situated vertically. The glabella on the cranidium in question is not compressed laterally, which is the case in *P. griffithidoides*, moreover it has lateral furrows S_2 and S_3 visible on its sides.

In the Upper Viséan deposits of Poland (Lublin region) a cranidium was found (Pl. XXII, Figs 1, 13) which in its convex border in front of glabella, the shape and width (*tr.*) of palpebral lobes closely resembles the fragmentary cranidium of *P. angustipygus* n. sp. found in the type locality. The only difference, which could be stated on such a scarce material, is a somewhat denser ornamentation of the Polish specimen.

Stratigraphic and geographic range. — Upper Viséan of Great Britain and Poland.

Paladin belli n. sp.

(Pl. XXI, Fig. 7; Text-fig. 9*H*)

1929. *Phillipsia eichwaldi* FISCH.; W. A. BELL, Horton-Windsor District..., p. 186, Pl. 35, Figs 3-6.

Holotype: Pygidium, BM No. In 18446a; Pl. XXI, Fig. 7.
Type locality: Kennetcook, Hants Co., Nova Scotia, Canada.
Type horizon: Upper Windsor Formation, Upper Viséan.
Derivation of the name: belli — after W. A. BELL, who first described the specimens of the here established new species.

Diagnosis. — Pygidium very narrow and long, pygidial border weakly convex, broadest at rear, axis as broad as pleural lobe, with 18 rings, 9 well defined ribs; glabella partly covering anterior border, as broad frontally as posteriorly, incipient medial preoccipital lobe present, basal lobe narrow (*tr.*); S_2 and S_3 weakly marked; palpebral lobe posteriorly situated, somewhat broader (*tr.*) than basal lobe.

Material. — Several pygidia, 1 negative of the cranidium from the type locality.
Dimensions (in mm):

	BM	
	In 18446a	In 18446b
Length of cranidium . . .	—	9.0
Length of glabella . . .	—	7.2
Width of glabella	—	4.2
Length of pygidium . . .	11.0	—
Width of pygidium . . .	10.0	—
Length of axis	9.0	—
Width of axis.	3.5	—

Remarks. — The species was reported by BELL (1929) under the name of "*Phillipsia eichwaldi*" from a different locality in Nova Scotia, Canada. It was later mentioned by WEBER (1937, p. 63), who included it into the synonymy of his "*Phillipsia (Griffithides?) eichwaldi.* The present author, having at her disposal the specimens collected by POOLE and housed in the British Museum (Nat. Hist.), noticed that the pygidia from Nova Scotia differ from all those known in *Paladin eichwaldi* FISCHER, 1825 by its narrowness, being however most close to *P. eichwaldi parilis* (REED, 1942). A pygidium very similar in shape is reported in *P. cuspidatus* (REED, 1943) this, however, differs from *P. belli* n. sp. in being more pointed posteriorly as well as having more prominent rings and more convex ribs. The presence of the incipient preoccipital lobe has been reported in both compared species.

Stratigraphic and geographic range. — Upper Viséan of Nova Scotia, Canada.

Paladin subbakewellensis n. sp.

(Pl. XXII, Figs 4, 9)

1933. *Griffithides transilis* var. γ; V. N. WEBER, Trilobity..., p. 41, Pl. 2, Figs 38-41.
1937. *Griffithides transilis* var. γ; V. N. WEBER, Kamennougolnye trilobity..., p. 75, Pl. 8, Figs 43, 44.

Holotype: Cranidium, TML No. 325/3139, figured by WEBER (1933, Pl. 2, Fig. 39); here refigured on Pl. XXII, Fig. 4.

Type locality: Semenovskaia, right side of the Bulavina ravine, village Olkhovatka, Donets Basin, USSR.
Type horizon: Moscovian (M_6).
Derivation of the name: subbakewellensis — pygidium similar to that of *Paladin bakewellensis* n. sp.

Diagnosis. — Cranidium narrowly rounded frontally, anterior border narrow, convex in front of glabella, no preglabellar region; basal lobe weakly developed and short (*tr.*), occupying a fifth of basal glabellar width; pygidium elongate, narrow posteriorly, vaulted transversely; border well delimited, narrow and convex; axis narrower than pleural lobe, with 18 rings; 10 very convex, narrow ribs.

Remarks. — "*Griffithides transilis* var. γ" cannot be assigned to *Ditomopyge transilis* (WEBER, 1933) because it differs very significantly from the latter in having a narrowly rounded frontal outline of the cranidium, a convex anterior border as well as very weakly pronounced basal lobes. These latter in *D. transilis* are also flat, but still occupy about a third of the basal glabellar width, while in the above erected new species they are much more reduced. The most striking differences are, however, visible in the pygidia, this of *Paladin subbakewellensis* n. sp. being long, well vaulted transversely and narrow, while that of *D. transilis* is comparatively flat and broad.

This shape of pygidium is very common in the *Paladin* species, and for this reason "*Griffithides transilis* var. γ" is assigned to the latter genus and a new species — *Paladin subbakewellensis* n. sp. — is established for it.

This species shows a close resemblance to the British form *Paladin bakewellensis* n. sp. (p. 146), in having a similar pygidium, though with a longer axis of 18 rings, surrounded by a similarly narrow and convex border. Also the cranidium of *P. subbakewellensis* shows some common characters with *P. bakewellensis*. It has a similarly outlined anterior margin, which is narrowly rounded, as well as a narrow convex border in front of the glabella. From the British species, as well as from most other representatives of *Paladin* WELLER, 1936, *P. subbakewellensis* differs in having extremely small and narrow (*tr.*) basal lobes. Such small basal lobes are also found in *P. trigonopyge* OSMÓLSKA, 1968 from the supposed uppermost Carboniferous of Spitsbergen. This latter species, which has also a similar shape of glabella, differs from the Donets species in having a kind of preglabellar region in front of the glabella and a distinctly triangular pygidium, with very flat ribs. However, it seems that the both mentioned species are very close to each other and represent the latest (youngest) known European species of *Paladin*.

Stratigraphic and geographic range. — Moscovian of USSR (the Donets Basin).

?Paladin ailinensis n. sp.

(Pl. XIV, Fig. 9)

1937. *Phillipsia (Griff.?) etchwaldi* var. (?) *mucronata*; V. N. WEBER, Kamennougolnye trilobity..., p. 64, Pl. 7, Fig. 24.

Holotype: Pygidium, TML No. 1610/5107, figured by WEBER (1937, Pl. 7, Fig. 24); here refigured on Pl. XIV, Fig. 9.
Type locality: Ailino, on Ai river, the South Urals, USSR.
Type horizon: Upper Carboniferous; no precise data.
Derivation of the name: ailinensis — after the type locality.

Diagnosis. — Pygidium subtriangular with short, terminal spine; axis slender with 21 narrow rings; 12 ribs, narrow, rounded in cross-section, divided into two equal bands.

Remarks. — This pygidium (the only specimen known) was assigned by WEBER (1937) to *Paladin mucronatus* MCCOY. However, this Upper Carboniferous form can be regarded by no means as conspecific with *P. mucronatus*. Moreover, it is doubtfull whether it represents the genus *Paladin*. The only common characters with *P. mucronatus* are the presence of the terminal spine and the subtriangular shape of the pygidium. Striking differences are observed in the number of rings, which is 21 instead of at most 18 in *P. mucronatus*. Even more unusual, never found in any species of *Paladin*, is structure of the ribs in ?*P. ailinensis*, where both bands are equally broad and high, the interpleural furrows, though thin, being very distinct and the whole rib very narrow. Besides, the pygidium of ?*P. ailinensis* n. sp. is nearly devoid of any ornamentation, only extremely fine and scarce granules being observed along the boundaries of the former segments, in contrast to most of the *Paladin* species which have very well developed elongate tubercles along the posterior boundary of each axial ring.

Stratigraphic and geographic range. — Type horizon and type locality.

?**Paladin** sp.

(Pl. XX, Fig. 3; Text-fig. 8*P*)

Material. — One pygidium, GSM No. 103104, from an unknown locality, Great Britain.

Description. — Pygidium broadly rounded, with narrow border delimited by means of rib-endings; axis narrow, with 14 rings, does not reach the border but is prolonged by elevated, narrow postaxial region; rings very convex mesially, separated by very deep, broad ring-furrows; along both sides of axis longitudinal line distinctly marked, from which the ring-furrows become shallower and are directed backwards; on pleural lobes 12 very convex ribs, their posterior bands vertically placed, narrower than the anterior ones. In longitudinal section, axis arched with distinctly defined end and elevated postaxial region, which merges into a convex narrow border. In transverse section, axis very highly vaulted, pleural lobes gently arched. Ornamentation: a row of very distinct, elongated tubercles arranged along the posterior edge of each pygidial ring; a row of similar tubercles along the crest of each pleural rib.

Remarks. — The pygidium described above is in some respects similar to the pygidia of the *Paladin* species, i.e. it has the same characters of ornamentation. The shape of the pygidium and the structure of the pygidial border in this species are similar to that found in the pygidia of *Paladin bakewellensis* n. sp. From the latter species, the pygidium in question differs in the structure of the ribs, which have their posterior bands very steep and narrow, the anterior bands covering them almost completely. Such a structure of the ribs is not to be found in any of the *Paladin* species so far known. On the other hand, the same structure of ribs is found in the genus *Particeps* REED, 1943. However, in the so far known species of this genus such a distinct, convex pygidial border as that in ?*Paladin* sp. is never present.

Subfamily CRASSIPROETINAE n. subfam.

Genera assigned: Crassiproetus STUMM, 1953, *Conophillipsia* ROBERTS, 1963.

Stratigraphic and geographic range: Middle Devonian of the USA, uppermost Devonian — Lower Carboniferous (Tournaisian) of Asia, Tournaisian of Australia.

Diagnosis. — Cephalon strongly vaulted transversely and longitudinally; glabella parallel-sided to conical, with distinct basal lobes; pygidium vaulted with long axis consisting of 13 to 16 rings.

Subfamily THAIASPINAE n. subfam.

Genera assigned: Thaiaspis KOBAYASHI, 1961, *Thigriffithides* HESSLER, 1965.

Stratigraphic and geographic range: Lower Carboniferous (Late Kinderhookian) of USA, Middle (?Upper) Carboniferous of Thailand.

Diagnosis. — Cephalon with glabella widening forwards, basal lobes very indistinctly differentiated or not pronounced at all; pygidium comparatively short, surrounded by flattened border.

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PLATES

PLATE I

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Reediella karagandensis (WEBER) 42

(see also Pl. II, Fig. 2)

Fig. 1. Pygidium (TML 1203/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 47) as *Phillipsia karagandensis*. var. *longa* n. sp. et var. Karatau range, Kazakhstan, Lower Tournaisian; × 6.5.

Bollandia sp. *1* 38

Fig. 2. Damaged pygidium (TML 1647/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 30) as *Griffithides globiceps* PHILL., Talass range, Kirgiz, Tournaisian; × 4.

Bollandia globiceps (PHILLIPS) 34

Fig. 3. Exfoliated pygidium (SMC E 3423). Co. Kildare, Eire, ?Upper Tournaisian; × 3.

Fig. 4. Pygidium (Ox E 1344) — specimen figured by PHILLIPS (1836, Pl. 22, Fig. 7) as *Asaphus granuliferus* spec. nov. ?Bolland, Great Britain, ?Lower Viséan; × 3.5.

Fig. 5. Cephalon (SMC E 3422), Co. Kildare, Eire, ?Upper Tournaisian; × 2.5.

Fig. 6. Lectotype cephalon, partly exfoliated (Ox E 1391) — specimen figured by PHILLIPS (1836, Pl. 22, Figs 16, 17) as *Asaphus globiceps* spec. nov. ?Bolland, Great Britain, ?Lower Viséan; × 2.4.

Fig. 11. Fragmentary cephalon (BM It 2272). Bolland, Great Britain, ?Lower Viséan; × 4.

Bollandia claviceps (BURMEISTER) 35

Fig. 7. Damaged specimen (IG 442.II. 149); × 2.7.

Fig. 8. Two damaged entire specimen (IG 442.II.149a); × 2.8.

Jugów, Poland, Upper Viséan.

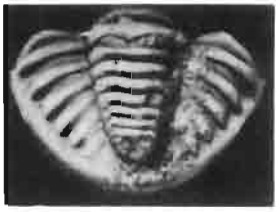
Fig. 9. Pygidium (TML 1641/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 31) as *Griffithides globiceps* PHILL. Tsherepet, Moscow Basin, Upper Tournaisian; × 3.2.

Bollandia sonkulensis n. sp. 37

Fig. 10. Holotype cephalon, partly exfoliated (TML 1644/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 27) as *Griffithides globiceps* PHILL. Kakyr-kurgan, Kirgiz, Tournaisian; × 3.7.

Bollandia obsoleta (PHILLIPS) 36

Fig. 12. Fragmentary pygidium (BM 59700). Settle, Great Britain, ?Lower Viséan; × 3.



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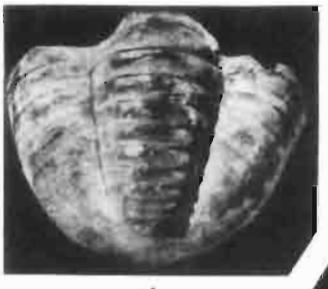

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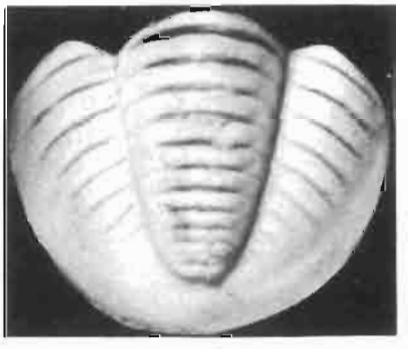

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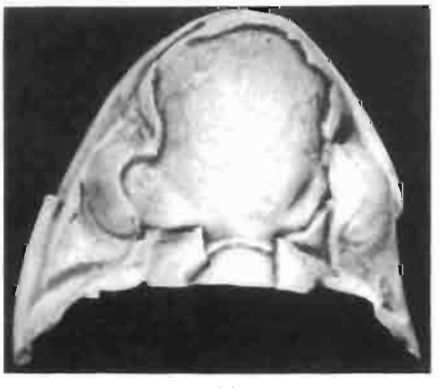

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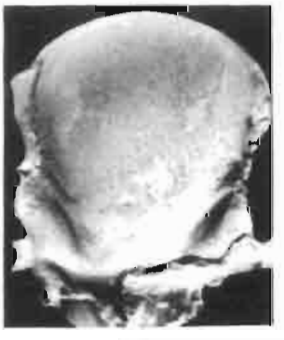

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PLATE II

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Reediella reedi n. gen., n. sp. 40

Fig. 1. Holotype cephalon (BM I 5809). Derbyshire area, ?Lower Viséan; × 2.3.

Reediella karagandensis (WEBER) 42

(see also Pl. I, Fig. 1)

Fig. 2. Lectotype pygidium (TML 1202/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 51) as *Phillipsia karagandensis* n. sp. Nurinsk area, Kazakhstan, Lower Tournaisian; × 5.6.

Reediella stubblefieldi n. gen., n. sp. 43

Fig. 3. Holotype cephalon (GSM Rh 1447); × 3.
Fig. 6. Paratype pygidium (GSM Rh 1452); × 4.

Haw Crag, Great Britain, Lower Viséan.

?*Bollandia* sp. *2* 38

Fig. 5. Exfoliated pygidium (TML 588/5107) — specimen figured by WEBER (1937, Pl. 2, Fig. 43) as *Cyrtosymbole librovitchi* var. *euryaxis* n. sp. et var.; × 3.
Fig. 7. Cranidium probably belonging to the same specimen as the pygidium above (TML 588/5107); × 6.

Semiz-bughu, Kazakhstan, Lower Tournaisian.

Reediella granifera n. gen., n. sp. 44

Fig. 4. Paratype pygidium (BM I 5806): × 3.
Fig. 9. Holotype pygidium (BM I 5805); × 2.

Derbyshire area, ?Lower Viséan.

Piltonia vilvensis (WEBER) 91

Fig. 8. Holotype pygidium (TML 1528/5107) — specimen figured by WEBER (1937, Pl. 6, Fig. 38) as *Phillipsia* (?) *vilvensis* n. sp. Krivoi Rog, the Urals, Upper Tournaisian; × 3.2.

?*Bollandia* sp. *3* 39

Fig. 10. Damaged pygidium (BM 59552a). Forest of Wyre, Great Britain, ?Tournaisian; × 3.4.

Bollandia karatauensis (WEBER) 36

Fig. 11. Holotype pygidium (TML 1135/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 33) as *Phillipsia karatauensis* n. sp. Ak-tash-sai river, Kazakhstan, Upper Tournaisian; × 3.

Reediella mitchelli (WEBER) 42

Fig. 12. Holotype pygidium (TML 1137/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 35) as *Phillipsia mitchelli* n. sp. Ak-tshek, Kazakhstan, Lower Tournaisian; × 4.2.

Reediella frechi (SCUPIN) 41

Fig. 13. Neotype pygidium (IG 442.II.3). Jugów, Poland, Upper Viséan; × 5.3.

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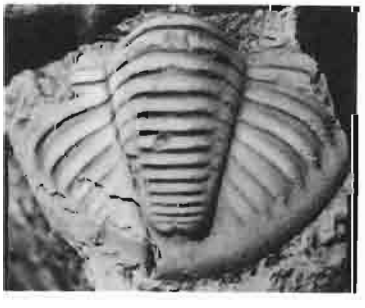

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PLATE III

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Piltonia kassini (WEBER) 90

Fig. 1. Holotype pygidium (TML 1089/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 45) as *Phillipsia kassini* n. sp.; × 4.

Fig. 2. Paratype cranidium (TML 1085/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 42) as *Ph. kassini* n. sp.; × 4.

Fig. 3. Paratype librigena (TML 1086/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 43) as *Ph. kassini* n. sp.; × 4.

Ak-tshek, Kazakhstan, Lower Tournaisian.

Piltonia buchtarmensis (MAKSIMOVA) 93

Fig. 4. Cranidium (TML 974/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 6) as *Phillipsia altaica* n. sp.? Buchtarma river, Altai, Upper Tournaisian; × 3.

Fig. 5. Holotype pygidium (TML 41/4574) — specimen figured by MAKSIMOVA (1960, Pl. 9, Fig. 8) as *Ph. buchtarmensis* n. sp. Ulba Perevalotshnaya, Altai, Upper Tournaisian; × 2.3.

Fig. 15. Damaged pygidium (TML 975/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 7) as *Ph. altaica* n. sp., n. var. Buchtarma river, Altai, Upper Tournaisian; × 5.

Linguaphillipsia paczoltovicensis (JAROSZ) 50

Fig. 6. Paratype cranidium (ZNG Kr.AI-18/7) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 13) as *Phillipsia colei* McCOY; × 5.

Fig. 10. Paratype cranidium (ZNG Kr. AI-18/6); × 4.6.

Fig. 12. Paratype pygidium (ZNG Kr. AI-18/4) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 20) as *Phillipsia* sp.; × 5.

Fig. 19. Holotype pygidium (ZNG Kr. AI-18/3) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 21) as *Griffithides acanthiceps* var. *paczoltovicensis* n. var.; × 5.2.

Paczółtowice, Poland, Upper Tournaisian.

Linguaphillipsia tulensis (IVANOV in WEBER) 52

Fig. 7. Paratype cranidium (TML 2300/5107); × 4.3.

Fig. 9. Paratype cranidium (TML 2301/5107) — specimen figured by WEBER (1937, Pl. 11, Fig. 20) as *Phillipsia tulensis* IVANOV n. sp.; × 4.3.

Fig. 11. Holotype pygidium (TML 2305/5107) — specimen figured by WEBER (1937, Pl. 11, Fig. 24) as *Ph. tulensis* IVANOV n. sp.; × 4.

Fig. 14. Paratype, fragmentary cranidium and librigena (TML 2303/5107) — specimen figured by WEBER (1937, Pl. 11, Fig. 22) as *Ph. tulensis* IVANOV n. sp.; × 4.3.

Fig. 18. Pygidium (BM In 37452); × 3.

Tula, Moscow Basin, Middle Viséan.

Bitumulina bitumulata (WEBER) 46

Fig. 8. Paratype cranidium (TML 521/349) — specimen figured by WEBER (1932, Pl. 4, Fig. 4) as *Ph. bitumulata* n. sp.; × 5.

Fig. 17. Paratype pygidium (TML 515/349) — specimen figured by WEBER (1932, Pl. 4, Fig. 15; 1937, Pl. 6, Fig. 35) as *Ph. bitumulata* n. sp.; × 3.4.

Kara-bulak region, Mugodzhars, Lower Tournaisian.

Linguaphillipsia silesiaca (SCUPIN) 53

Fig. 13. Neotype pygidium (IG 442.II.150). Sokolec, Poland, Upper Viséan; × 3.7.

Bitumulina sosvensis (WEBER) 47

Fig. 16. Holotype pygidium (TML 1880/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 7) as *Griffithides* (?) *sosvensis* n. sp. Sosva river, the Urals, Upper Tournaisian; × 2.2.

?*Bitumulina* sp. 48

Fig. 20. Damaged pygidium (BM In 22889). Castleton, Great Britain, Upper Viséan; × 3.4.

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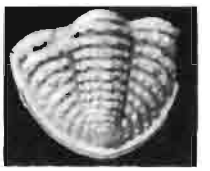

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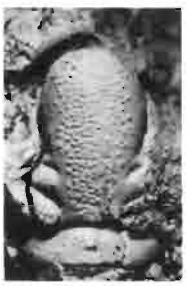

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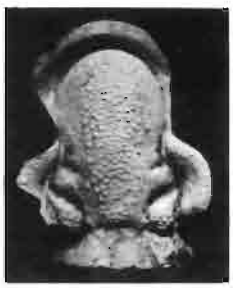

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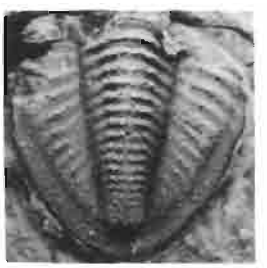

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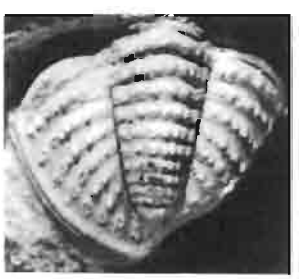

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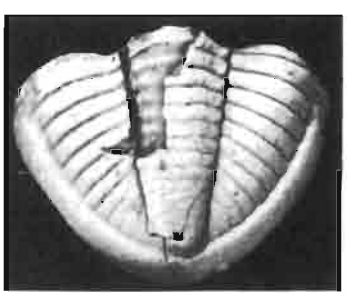

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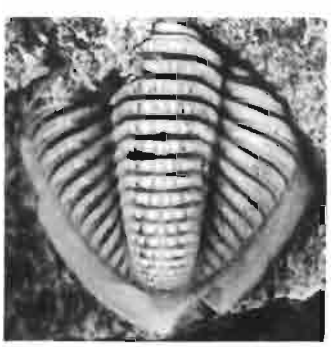

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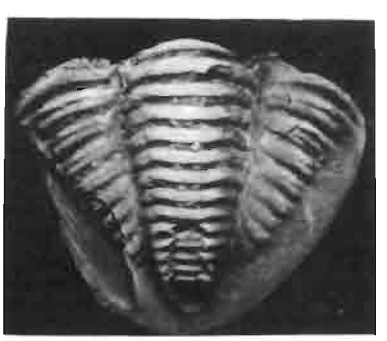

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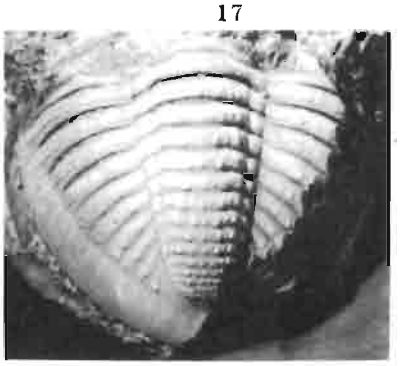

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PLATE IV

Page

Weberiphillipsia kuzneciana (WEBER) 78

Fig. 1. Holotype pygidium (TML 1014/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 21) as *Phillipsia laticaudata* var. *kuzneciana* n. var.; × 5.

Fig. 2. Cranidium (TML 1046/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 24) as *Ph. laticaudata* var. *kuzneciana*? *(amarginata?)* n. var.; × 5.

Fig. 5. Pygidium (TML 1016/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 23) as *Ph. laticaudata* var. *kuzneciana* n. var.; × 6.

Tomi river, Kuznetsk Basin, Upper Tournaisian.

Fig. 6. Cranidium (TML 1048/5107), Kuznetsk Basin, Tournaisian; × 5.4.

Weberiphillipsia kirgisica (WEBER) 77

Fig. 3. Holotype pygidium (TML 821/349) — specimen figured by WEBER (1932, Pl. 3, Fig. 50) as *Ph. kirgisica* n. sp. Malyi Karatau range, Kazakhstan, Upper Tournaisian; × 5.

Fig. 4. Entire specimen (TML 1208/5107) — figured by WEBER (1937, Pl. 5, Fig. 46) as *Ph. kirgisica* WEB. Altai, Upper Tournaisian; × 2.7.

Fig. 8. Paratype, entire specimen (TML 985/349) — figured by WEBER (1932, Pl. 3, Fig. 39) as *Ph. kirgisica* n. sp. Karatau range, Kazakhstan, Upper Tournaisian; × 3.2.

Fig. 10. Two damaged cephala (TML 1204/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 42) as *Ph. kirgisica* WEB. Karatau range, Kazakhstan, Upper Tournaisian; × 2.8.

Cummingella jonesi orleiensis n. subsp. 58

(see also Pl. V, Figs 1, 2)

Fig. 7. Exfoliated pygidium (IG 442.II.55). Wałbrzych Miasto, Poland, Upper Viséan; × 6.

Cummingella carringtonensis tuberculigenata n. subsp. 63

(see also Pl. IX, Figs 1, 5, 6, 10, 12, 15, 16, 20)

Fig. 9. Paratype pygidium (Z. Pal. Tr II.92); × 5.

Fig. 11. Holotype cephalon (Z. Pal. Tr II. 139): *a* lateral view, *b* dorsal view; × 4.6.

Gałęzice, Poland, Upper Viséan.

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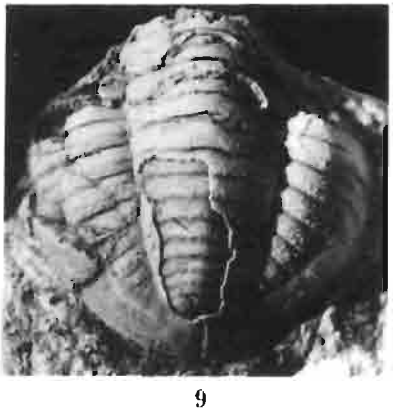

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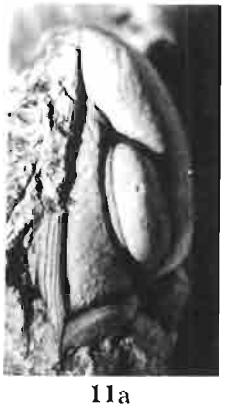

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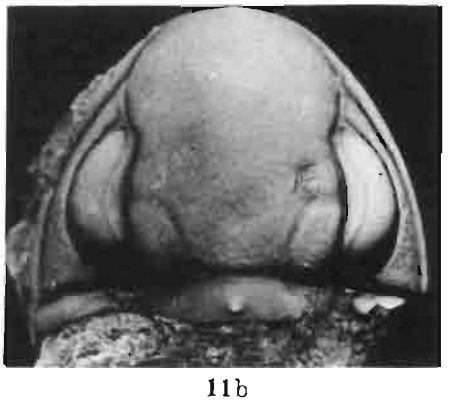

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PLATE V

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Cummingella jonesi orleiensis n. subsp. 58

(see also Pl. IV, Fig. 7)

Fig. 1. Pygidium (ZNG Kr. Cz. 2); × 3.
Fig. 2. Holotype specimen (ZNG Kr. Cz. 1); × 3.

Orlej, Poland, ?Lower Namurian.

Cummingella jonesi jonesi (PORTLOCK) 55

Fig. 3. Holotype specimen with pygidium exposed (GSM 63037) — figured by PORTLOCK (1843, Pl. 11, Fig. 3) as *Phillipsia jonesi* n. sp. Clonfeacle, Eire, ?Middle Viséan; × 2.3.
Fig. 4. Cephalon (BM 59839). ?Clonfeacle, Eire, ?Middle Viséan; × 3.3.

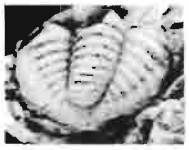
Cummingella jonesi laticaudata (WOODWARD) 56

Fig. 5. Paralectotype cranidium (BM 45020a); × 6.
Fig. 6. Paralectotype cranidium (BM 45036); × 5.5.
Fig. 8. Damaged paralectotype cranidium and pygidium (*a*) with abnormally developed 6th rib on left pleural lobe (BM I 875a); × 8.3.
Fig. 9. Lectotype pygidium (*b*) (BM I 875b) and cranidium (*c*) associated (BM I 875c) — figured by WOODWARD (1883-1884, Pl. 7, Fig. 4) as *Phillipsia laticaudata* sp. nov.; × 6.2.

Bolland, Great Britain, ?Middle Viséan.

Cummingella gapeevi (WEBER) 71

Fig. 7. Entire enrolled neotype specimen (TML 6/3139) — figured by WEBER (1933, Pl. 1, Fig. 2) as *Phillipsia derbyensis* var. *gapeevi* n. nom.: *a* cephalon, *b* pygidium; Beshevo, Donets Basin, Lower Namurian; × 6.5.



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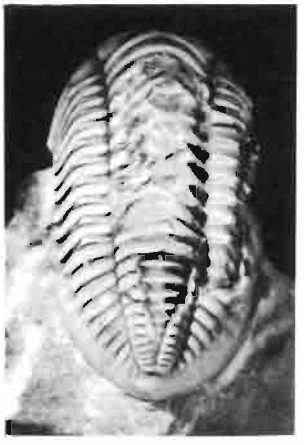

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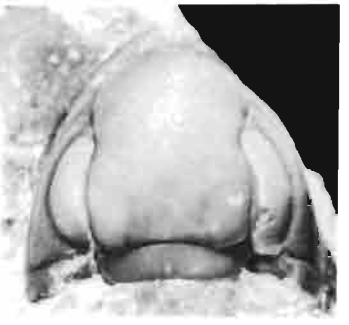

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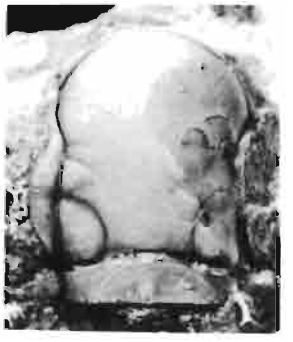

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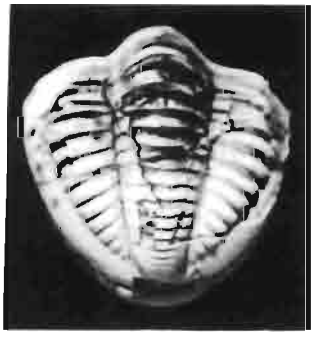

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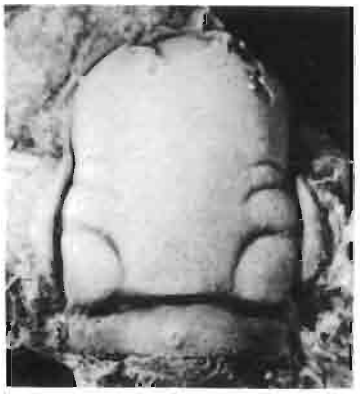

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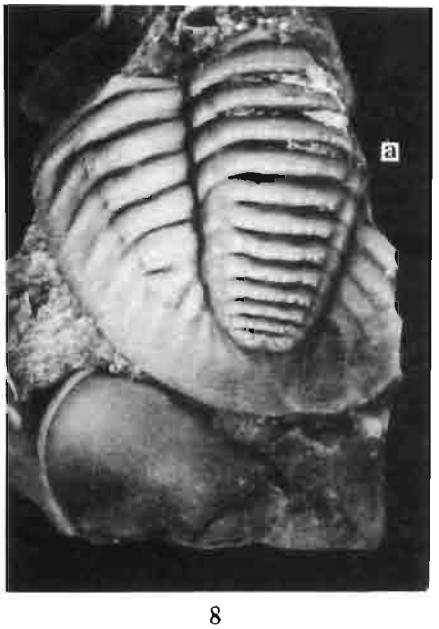

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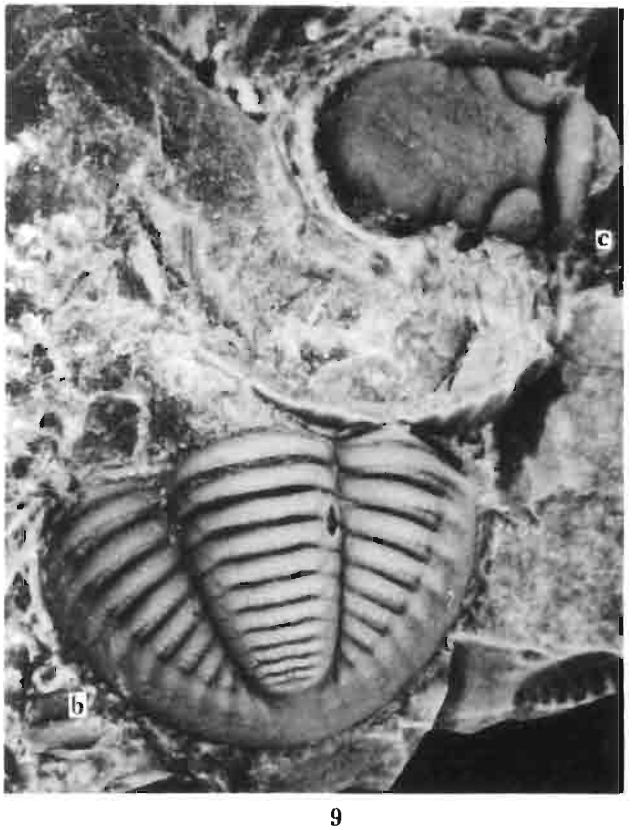

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H. OSMÓLSKA: REVISION OF NON-CYRTOSYMBOLINID TRILOBITES

PLATE VI

Page

Cummingella brevicauda (GOLDRING) 59

Fig. 1. Hypostoma (IRB 18.741.72); × 3.
Fig. 2. Small cranidium (IRB 18.741.34); × 3.
Fig. 3. Cephalon (IRB 18.741.71): *a* lateral view, *b* dorsal view, × 4; *c* enlarged section of subocular groove showing furrows and punctures, × 10.
Fig. 4. Entire, damaged specimen (IRB 18.741.46); × 3.
Fig. 5. Pygidium (IRB 18.741.88); × 3.

Neufvilles, Belgium, Upper Tournaisian.

Cummingella sp. *2* 74

Fig. 6. Damaged cephalon (BM 58864a). Blackrock, Eire, Upper Tournaisian or Lower Viséan; × 5.6.

Cummingella shartymensis weberi n. subsp. 66

Fig. 7. Damaged holotype cephalon (TML 30/4173); × 4.
Fig. 10. Fragmentary paratype pygidium (TML 49/4173); × 4.

Alapaievsk region, the Urals, Namurian.

Cummingella ?jonesi (PORTLOCK) 55

Fig. 8. Cephalon (BM 45014) — specimen figured by PHILLIPS (1836, Pl. 22, Figs 14, 15) as *Asaphus raniceps* PHILL. Bolland, Great Britain, Viséan; × 6.3.

?Cummingella sp. *1* 74

Fig. 9. Cephalon (BM 59700). Unknown locality, Great Britain; × 5.3.

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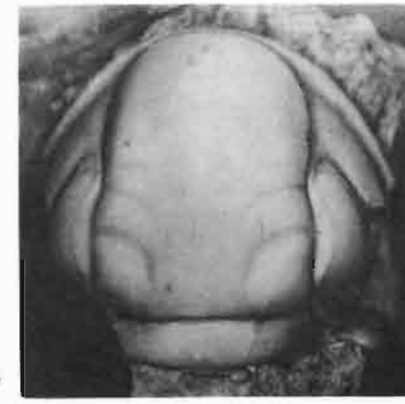

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PLATE VII

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Cummingella carringtonensis carringtonensis (ETHERIDGE in WOODWARD) . . 61

Fig. 1. Partly exfoliated cephalon (BM I 7507). Bolland, Great Britain, Viséan; × 2.

Fig. 2. Exfoliated cephalon (HMG A 3704) — specimen figured by REED (1942, Pl. 10, Figs 1, 2) as *Cummingella balladoolensis* n. sp. Balladoole, Isle of Man, Viséan; × 5.2.

Fig. 3. Partly exfoliated cephalon (BM 27930). Narrowdale, Great Britain, Middle Viséan; ×2.6.

Fig. 4. Exfoliated pygidium (HMG A 3706) — specimen figured by REED (1942, Pl. 10, Fig. 3) as *C. balladoolensis* n. sp. Balladoole, Isle of Man, Viséan; × 6.4.

Fig. 7. Exfoliated, gerontic cephalon (BM 27906). Narrowdale, Great Britain, Upper Viséan; × 2.6.

Fig. 8. Lectotype pygidium, partly exfoliated (GSM 103111) — specimen figured by WOODWARD (1883-1884, Pl. 9, Fig. 6a) as *Griffithides? carringtonensis* ETHERIDGE MS. Longnor, Great Britain, Viséan; × 5.

Fig. 9. Young pygidium (BM 36805); Narrowdale, Great Britain, Middle Viséan; × 6.

Fig. 10. Young pygidium (BM 36810). Narrowdale, Great Britain, Middle Viséan; × 6.

Fig. 11. Large pygidium (BM I 5798). Falls Brew, Great Britain, Viséan; × 3.5.

Fig. 13. Young pygidium with thoracic segment attached (BM I 36797). Narrowdale, Great Britain, Upper Viséan; × 3.5.

Cummingella shartymensis shartymensis (WEBER) 66

Fig. 5. Paratype cephalon (TIM 1400/5107) — specimen figured by WEBER (1937, Pl. 6, Fig. 1) as *Phillipsia derbyensis* var. *shartymensis* n. nom; × 2.4.

Fig. 6. Holotype pygidium (TIM 1401/5107) — specimen figured by WEBER (1937, Pl. 6, Fig. 2) as *Ph. derbyensis* var. *shartymensis* n. nom.; × 2.6.

Shartymka river, the Urals, Namurian.

?*Cummingella minuta* (MAKSIMOVA) 53

Fig. 12. Holotype pygidium (TML 1554/5107) — specimen figured by MAKSIMOVA (1960, Pl. 9, Fig. 3) as *Phillipsia* (?) *minuta* n. sp. Narin river, Kazakhstan, Tournaisian; × 5.2.

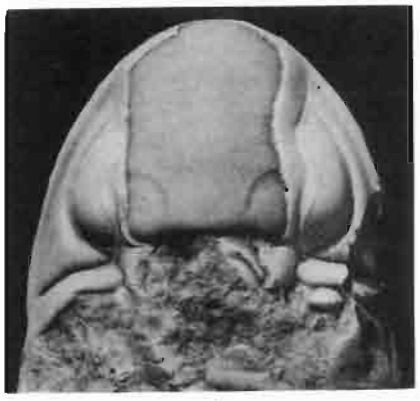

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PLATE VIII

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Cummingella jaroszi jaroszi n. sp., n. subsp. 68

Fig. 1. Damaged paratype cranidium (ZNG Kr. AI-18/33); × 4.8.
Fig. 2. Damaged paratype cranidium (ZNG Kr. AI-18/32); × 5.
Fig. 3. Young paratype cranidium (ZNG Kr. AI-18/266); × 5.
Fig. 4. Fragmentary paratype cephalon (ZNG Kr. AI-18/31) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 4) as *Phillipsia derbiensis* MARTIN: *a* dorsal view, *b* lateral view; × 5.
Fig. 5. Holotype cephalon (ZNG Kr. AI-18/30) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 2) as *Ph. derbiensis* MARTIN; × 5.3.
Fig. 6. Paratype pygidium (ZNG Kr. AI-18/37); × 5.3.
Fig. 7. Young paratype pygidium (ZNG Kr. AI-18/34) — specimen figured by JAROSZ (1913, Pl. 20, Fig. 11) as *Ph. derbiensis* MARTIN; × 7.3.
Fig. 8. Young paratype pygidium (ZNG Kr. AI-18/35); × 5.3.
Fig. 9. Paratype pygidium (ZNG Kr. AI-18/36); × 4.

Racławka river valley, Poland, Upper Tournaisian.

Cummingella polonica (WEBER) 72

Fig. 10. Holotype pygidium (TML 1478/5107) — specimen figured by WEBER (1937, Pl. 6, Fig. 18) as *Phillipsia derbyensis* var. *polonica* n. nom. Usuila river, the Urals, Lower Viséan; × 3.2.
Fig. 12. Pygidium (BM I 27942). Narrowdale, Great Britain, Middle Viséan; × 6.

Cummingella jaroszi insulae n. sp., n. subsp. 70

Fig. 11. Holotype cephalon (BM I 2605a). Wetton, Great Britain, Middle Viséan; × 5.4.

?*Cummingella belgica* (WEBER) 73

Fig. 13. Entire, exfoliated specimen (TML 1398/5107). Unknown locality, Belgium; × 3.

Cummingella ?jaroszi insulae n. sp., n. subsp. 71

Fig. 14. Pygidium (BM I 2605b). Wetton, Great Britain, Middle Viséan; × 6.4.

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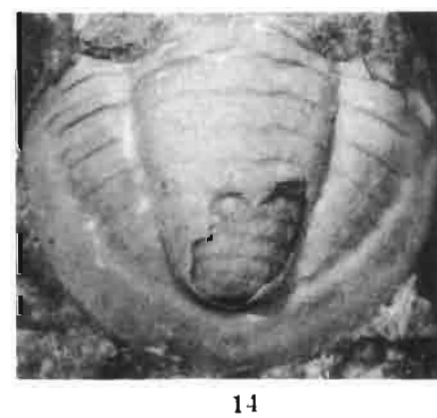

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H. OSMÓLSKA: REVISION OF NON-CYRTOSYMBOLINID TRILOBITES

PLATE IX

Page

Cummingella carringtonensis tuberculigenata n. subsp. 63

(see also Pl. IV, Figs 9, 11)

Fig. 1. Meraspis paratype pygidium (Z. Pal. Tr. II.24); × 7.5.
Fig. 5. Young paratype cranidium (Z. Pal. Tr.II.252) × 4.5.
Fig. 6. Young paratype pygidium with thoracic segments attached (Z. Pal. Tr. II.44); × 8.4.
Fig. 10. Young paratype cranidium (Z. Pal. Tr. II.117); × 4.6.
Fig. 12. Paratype librigena (Z. Pal. Tr. II.244); × 5.
Fig. 15. Paratype cranidium (Z. Pal. Tr. II.233); × 5.
Fig. 16. Young paratype pygidium with a thoracic segment attached (Z. Pal. Tr. II.31); × 6.
Fig. 20. Paratype pygidium (Z. Pal. Tr. II.136); × 5.4.

Gałęzice, Poland, Upper Viséan.

Griffithides claviger halinae n. subsp. 109

Fig. 2. Young paratype pygidium (Z. Pal. Tr. II.10); × 5.6.
Fig. 3. Meraspis paratype pygidium (Z. Pal. Tr. II.36); × 11.4.
Fig. 4. Young paratype cephalon (Z. Pal. Tr. II.115); × 6.
Fig. 8. Young paratype pygidium (Z. Pal. Tr. II.54); × 12.8.
Fig. 13. Paratype librigena (Z. Pal. Tr. II.129); × 4.3.
Fig. 17. Holotype cranidium (Z. Pal. Tr. II.1); × 5.
Fig. 18. Young paratype pygidium (Z. Pal. Tr. II.171); × 10.4.
Fig. 19. Paratype pygidium (Z. Pal. Tr. II.181); × 5.
Fig. 21. Fragmentary paratype cranidium (Z. Pal. Tr. II.38); × 5.
Fig. 22. Paratype pygidium (Z. Pal. Tr. II.122); × 3.8.

Gałęzice, Poland, Upper Viséan.

Griffithides ?rotundipleuratus WEBER 111

Fig. 7. Pygidium (Z. Pal. Tr. II.39); × 4.
Fig. 11. Pygidium (Z. Pal. Tr. II.188); × 6.

Gałęzice, Poland, Upper Viséan.

Cummingella carringtonensis cf. *tuberculigenata* n. subsp.. 65

Fig. 9. Cranidium (Z. Pal. Tr. II.123b). Gałęzice, Poland, Upper Viséan; × 5.5.

Griffithides claviger claviger (SCUPIN) 108

Fig. 14. Fragmentary exfoliated cephalon (IG 442.II.58). Sokolec, Poland, Upper Viséan; × 2.

Griffithides acanthiceps WOODWARD 120

Fig. 23. Paralectotype cephalon (SMC E 3396); × 2.5.
Fig. 24. Lectotype cephalon (SMC E 3395), showing an incipient median preoccipital lobe; × 2.4.

Settle, Great Britain, Viséan.


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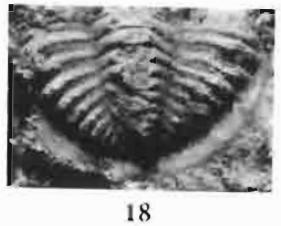
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PLATE X

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Phillipsia magnoculata n. sp. 87

Fig. 1. Paratype pygidium (TML 865/5107); × 4.
Fig. 3. Paratype pygidium (TML 858/5107) — specimen figured by Weber (1937, Pl. 4, Fig. 31) as *Phillipsia truncatula* var. *pustulata* DE KON.; × 1.3.
Fig. 13. Holotype cephalon (TML 853/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 26) as *Ph. truncatula* var. *pustulata* DE KON.; × 2.7.

The South Urals, Tournaisian.

Phillipsia glabra (WEBER) 85

Fig. 2. Holotype cephalon (TML 942/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 23) as *Ph. truncatula* (?) var. *glabra* n. var. Ori river, the Urals, Tournaisian; × 4.

Phillipsia sp. 89

Fig. 4. Fragmentary cephalon with thoracic segments attached (BM In 27931). Narrowdale, Great Britain, Viséan; × 10.4.

Phillipsia gemmulifera (PHILLIPS) 80

Fig. 5. Pygidium (ZNG Kr. AI-18/39). Racławka river valley, Poland, Upper Tournaisian; × 2.7.
Fig. 9. Fragmentary cranidium (ZNG Kr. AI-18/38). Racławka river valley, Poland, Upper Tournaisian; × 5.7.
Fig. 12. Distorted entire specimen (BM 59320) — eye figured by WOODWARD (1883-1884, Pl. 3, Fig. 8) as *Ph. gemmulifera* PHIL. Clitheroe, Great Britain, ?Upper Tournaisian, ?Lower Viséan; × 3.
Fig. 14. Holotype pygidium (BM 45012) — specimen figured by PHILLIPS (1836, Pl. 22, Fig. 11) as *Asaphus gemmuliferus* n. sp. Bolland, Great Britain, ?Upper Tournaisian, ?Lower Viséan; × 3.5.

Phillipsia moelleri n. sp. 86

Fig. 6. Holotype cranidium (TML 854/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 28) as *Ph. truncatula* var. *pustulata* DE KON.; × 1.8.
Fig. 8. Paratype pygidium (TML 864/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 35) as *Ph. truncatula* var. *pustulata* DE KON.; × 2.3.

Sosva river, the Urals, Tournaisian.

Phillipsia kellyi PORTLOCK 80

Fig. 7. Pygidium (TML 862/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 33) as *Ph. truncatula* var. *pustulata* DE KON. ?Sosva river, the Urals, ?Tournaisian; × 2.4.
Fig. 11. Holotype specimen (GSM 63045) — figured by PORTLOCK (1843, Pl. 11, Fig. 1): *a* pygidium exposed, *b* cephalon exposed. Ardpodien, Eire, Upper Tournaisian; × 2.4.

Phillipsia ornata kumakensis n. subsp. 82

Fig. 10. Holotype pygidium (TML 869/5107) — specimen figured by WEBER (1937, Pl. 4, Fig. 29) as *Ph. truncatula* var. *pustulata* DE KON. Kumak river, the Urals, Tournaisian; × 2.4.

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PLATE XI

Page

Phillipsia ornata belgica n. subsp. 83

Fig. 1. Young paratype cranidium (IRB 18.741.113); × 3.
Fig. 2. Young paratype pygidium (IRB 18.741.116); × 3.
Fig. 3. Young paratype pygidium (IRB 18.741.111); × 3.
Fig. 4. Young paratype pygidium (IRB 18.741.117); × 3.
Fig. 5. Paratype cranidium (IRB 18.741.121); × 3.
Fig. 6. Paratype pygidium (IRB 18.741.123); × 3.
Fig. 7. Holotype specimen (IRB 18.741.100); × 3.
Fig. 8. Paratype pygidium (IRB 18.741.105); × 3.
Fig. 10. Paratype cranidium (IRB 18.741.130); × 3.
Fig. 11. Paratype pygidium with flattened marginal band (IRB 18.741.102); × 3.
Fig. 12. Paratype hypostoma (IRB 18.741.128); × 3.
Fig. 13. Paratype pygidium (IRB 18.741.131); × 3.

Neufvilles, Belgium, Upper Tournaisian.

Piltonia kuehnei HAHN 92

(see also Pl. XII, Fig. 11; Pl. XIII, Fig. 12)

Fig. 9. Damaged, partly exfoliated entire specimen (BM I 7324). Tournai, Belgium, Tournaisian; × 1.5.

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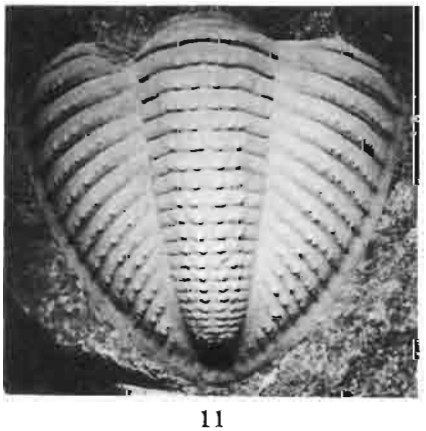

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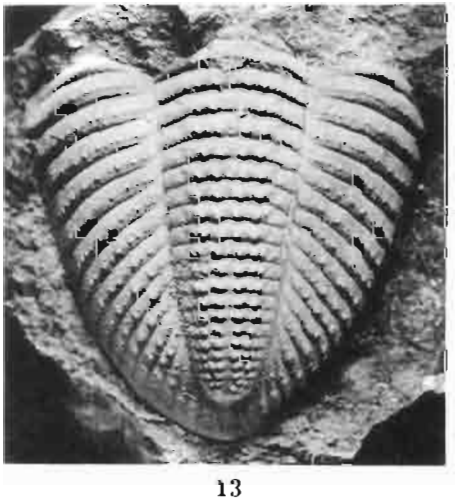

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PLATE XII

Page

Piltonia konincki (WEBER) 91
(see also Pl. XIII, Fig. 10)

Fig. 1. Internal mould of cranidium (TML 990/5107) — specimen figured by Weber (1937, Pl. 5. Fig. 14) as *Phillipsia konincki* n. nom.? Ori river, the Urals, Tournaisian; × 3.

Eocyphinium seminiferum (PHILLIPS) 97
(see also Pl. XIII, Figs 4, 7)

Fig. 2. Young cranidium (GSM O 3424). Cracoe, Great Britain, Upper Viséan; × 7.
Fig. 15. Latex cast of entire specimen (BM I 3194), Matlock, Great Britain, Viséan; × 3.

Eocyphinium spinosum polonicum n. subsp. 101
(see also Pl. XIII, Fig. 8)

Fig. 3. Young cranidium (Z. Pal. Tr. II.34); × 6.
Fig. 14. Holotype pygidium (Z. Pal. Tr. II.281); × 3.6.
Galęzice, Poland, Upper Viséan.

Piltonia altaica (WEBER) 93
(see also Pl. XIII, Fig. 2)

Fig. 4. Damaged cranidium (TML 972/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 4) as *Phillipsia altaica* n. sp. (?) Altai, Upper Tournaisian; × 4.

Eocyphinium parvum n. sp. 103

Fig. 5. Paratype cranidium (ZNG Kr. Cz. 3); × 4.
Fig. 7. Holotype pygidium (ZNG Kr. Cz. 4); × 4.
Fig. 8. Paratype pygidium (ZNG Kr. Cz. 5); × 4.
Orlej, Poland, ?Lower Namurian.

Eocyphinium castletonensis n. sp. 102
(see also Pl. XIII, Figs 6, 9, 11)

Fig. 6. Pygidium (BM In 36807). Narrowdale, Great Britain, Middle Viséan; × 3.
Fig. 9. Hypostoma and cranidium (BM In 23029). Castleton, Great Britain, Upper Viséan; × 4.5.

Eocyphinium spinosum spinosum (WEBER) 100

Fig. 10. Latex cast of holotype pygidium (TML 1760/5107) — specimen figured by WEBER (1937, Pl. 8, Fig. 16) as *Griffithides spinosus* n. sp.; × 4.
Fig. 16. Latex cast of paratype cranidium (TML 1762/5107) — specimen figured by WEBER (1937, Pl. 8, Fig. 18) as *G. spinosus* n. sp.; × 3.6.
Kaskynovo, the Urals, Viséan.

Piltonia kuehnei HAHN 92
(see also Pl. XI, Fig. 9; Pl. XIII, Fig. 12)

Fig. 11. Pygidium (IRB IG 18.596.33). Allain, Belgium, Middle Tournaisian; × 3.

Eocyphinium brevis n. sp. 104

Fig. 12. Paratype cranidium (SMC E 3493); × 5.
Fig. 13. Holotype pygidium (SMC E 3673); × 4.
Settle, Great Britain, Viséan.

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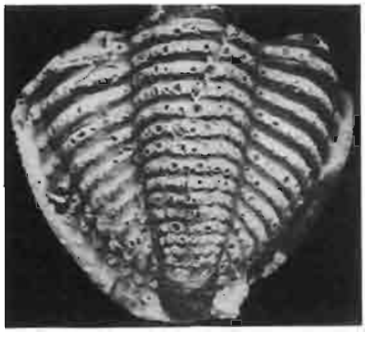

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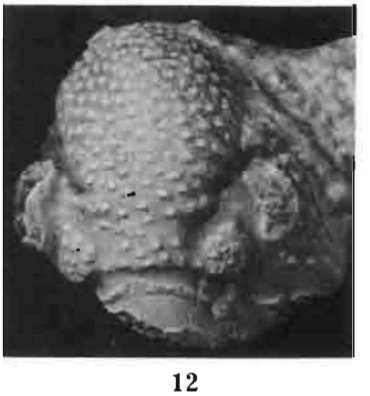

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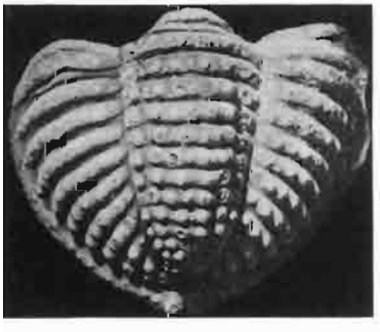

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PLATE XIII

Page

Eocyphinium clitheroense REED 96

Fig. 1. Exfoliated cranidium (BM 45037). Bolland, Great Britain, ?Upper Tournaisian, ?Lower Viséan; × 6.
Fig. 5. Holotype cephalon, exfoliated (HMG A 3701) — specimen figured by REED (1942, Pl. 9, Fig. 1). Clitheroe, Great Britain, ?Upper Tournaisian, ?Lower Viséan; × 4.

Piltonia altaica (WEBER) 93

(see also Pl. XII, Fig. 4)

Fig. 2. Holotype pygidium (TML 958/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 1) as *Phillipsia altaica* n. sp. Malaia Ulba river, Altai, Upper Tournaisian; × 3.

Eocyphinium ?clitheroense REED 97

Fig. 3. Pygidium (BM It 2261). Bolland, Great Britain, ?Upper Tournaisian, ?Lower Viséan; × 3.4.

Eocyphinium seminiferum (PHILLIPS) 97

(see also Pl. XII, Figs 2, 15)

Fig. 4. Latex cast of fragmentary pygidium (BM 51208); × 3.
Fig. 7. Latex cast of entire specimen librigenae lacking (BM 45035); × 3.

Matlock, Great Britain, Viséan.

Eocyphinium castletonensis n. sp. 102

(see also Pl. XII, Figs 6, 9)

Fig. 6. Holotype pygidium (BM In 23029b). Castleton, Great Britain, Middle Viséan; × 3.
Fig. 9. Pygidium (BM 4071c). Derbyshire, Great Britain; × 4.6.
Fig. 11. Cranidium (BM In 23029a). Castleton, Great Britain, Middle Viséan; × 4.

Eocyphinium spinosum polonicum n. subsp. 101

(see also Pl. XII, Figs 3, 14)

Fig. 8. Paratype cranidium (Z. Pal. Tr. II.280). Gałęzice, Poland, Upper Viséan; × 4.6.

Piltonia konincki (WEBER) 91

(see also Pl. XII, Fig. 1)

Fig. 10. Latex cast of holotype pygidium (TML 979/5107) — specimen figured by WEBER (1937, Pl. 5, Fig. 11) as *Phillipsia konincki* n. sp. Altai, Middle Tournaisian; × 5.3.

Piltonia kuehnei HAHN 92

(see also Pl. XI, Fig. 9; Pl. XII, Fig. 11)

Fig. 12. Internal mould of cranidium associated with external mould of pygidium (Z. Pal. Tr. II.1/8). Allain, Belgium, Middle Tournaisian; × 3.

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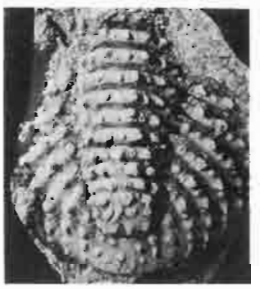

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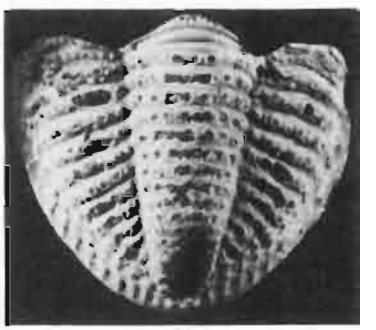

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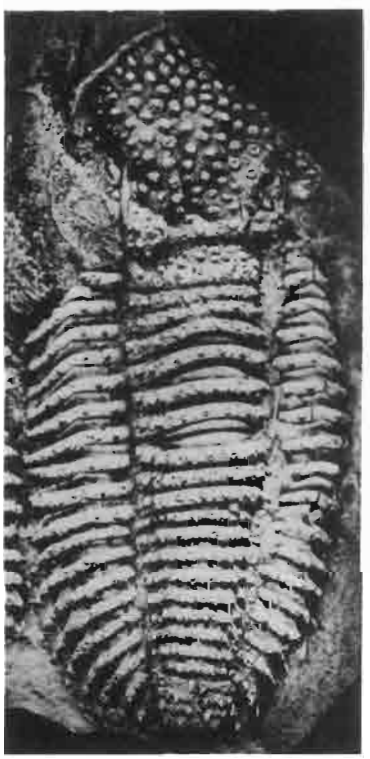

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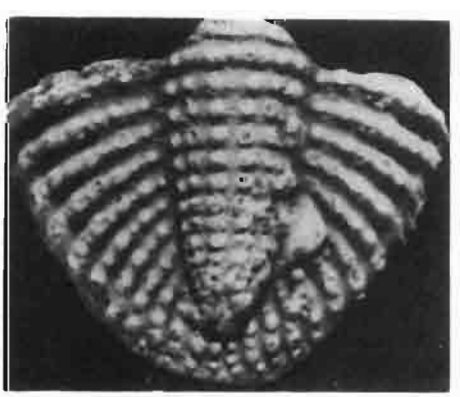

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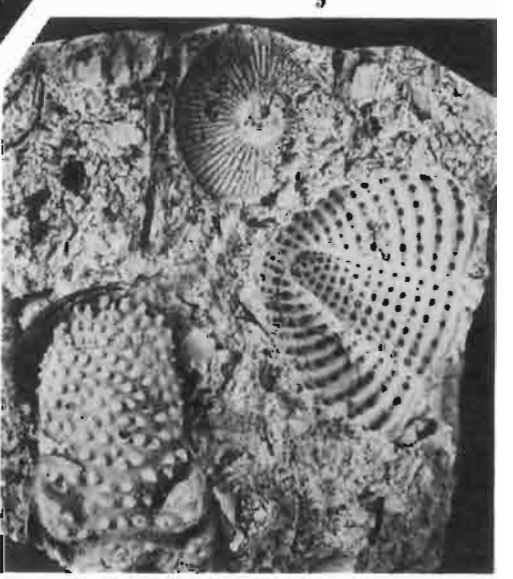

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PLATE XIV

Page

Paladin mucronatus russicus n. subsp. 135

(see also Pl. XVIII, Fig. 13; Pl. XIX, Figs 9, 13)

Fig. 1. Young paratype pygidium (TML 1906/5107); × 7.

Fig. 7. Paratype cranidium (TML 1601/5107) — specimen figured by Weber (1937, Pl. 7, Fig. 20) as *Phillipsia eichwaldi* var. *mucronata* McCoy; × 4.8.

Rovnoe, Moscow Basin, Lower Namurian.

Particeps scoticus scoticus Reed 114

(see also Pl. XV, Figs 5, 8-10, 13)

Fig. 2. Fragmentary paralectotype pygidium (RSM 1958.1.2674) — specimen figured by Reed (1943, Pl. 2, Fig. 3) as *Griffithides (Particeps) scoticus* subgen. and sp. nov. Bogie, Great Britain, Upper Viséan; × 4.4.

Paladin eichwaldi shunnerensis (King) 131

(see also Pl. XVII, Figs 7, 10, 14)

Fig. 3. Paralectotype cranidium (SMC E 10499) — specimen figured by King (1914, Pl. 32, Fig. 5) as *Griffithides shunnerensis* sp. nov. Great Shunner Fell Well, Great Britain, Lower Namurian; × 6.

Paladin eichwaldi parilis (Reed) 132

(see also Pl. XVIII, Figs 1-11, 14)

Fig. 4. Pygidium (BM I 866). Halkyn Montain, Great Britain, Lower Namurian; × 3.

Particeps kiritchenkoi (Weber) 117

(see also Pl. XV, Fig. 11)

Fig. 5. Holotype pygidium (TML 1429/5107) — specimen figured by Weber (1937, Pl. 6, Fig. 7) as *Phillipsia derbyensis* var. *kiritchenkoi* n. var. Tashtshla river, the Urals, Upper Viséan; × 5.7.

Kulmiella caroli n. sp. 124

Fig. 6. Entire holotype specimen, lacking librigenae (IG Sosnowiec 459/72); × 3.

Paladin glaber (Woodward) 139

Fig. 8. Pygidium (GSM 103113). Ashford, Great Britain, Upper Viséan; × 4.

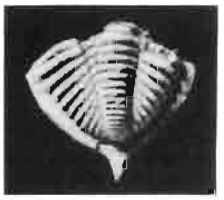
?Paladin ailinensis n. sp. 154

Fig. 9. Holotype pygidium (TML 1610/5107) — specimen figured by Weber (1937, Pl. 7, Fig. 24) as *Phillipsia (Griff.?) eichwaldi* var. (?) *mucronata*. Ailino, the Urals, Upper Carboniferous; × 5.3.

Paladin ?bakewellensis n. sp. 147

(see also Pl. XX, Fig. 8)

Fig. 10. Pygidium (GSM 33705a). Bakewell, Great Britain, Upper Viséan; × 6.4.



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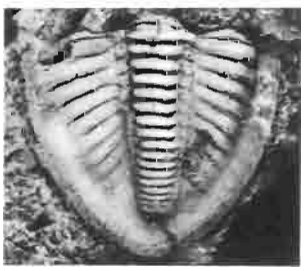

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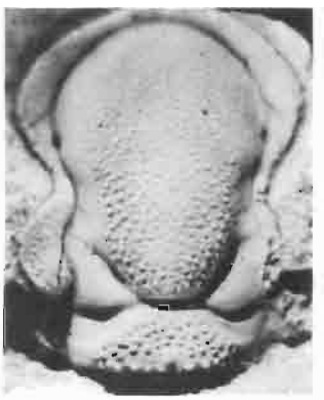

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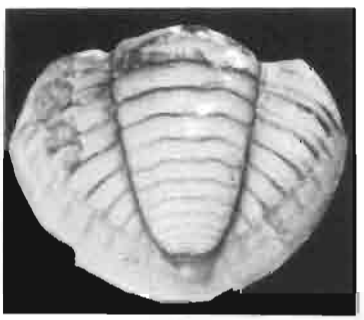

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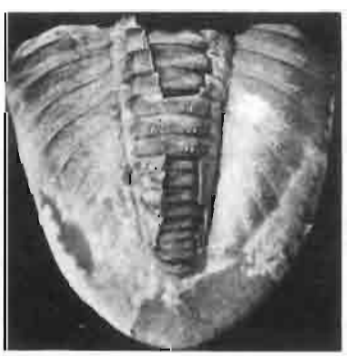

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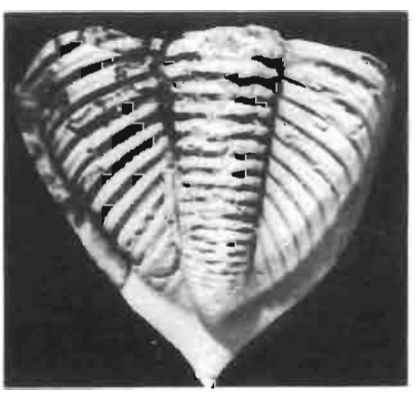

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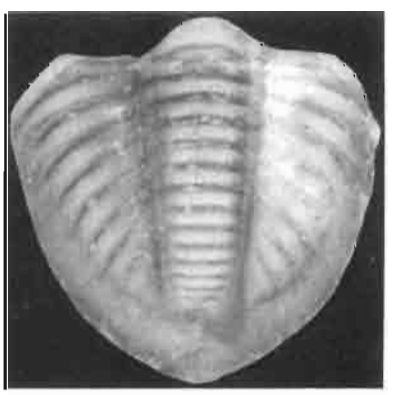

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PLATE XV

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Particeps productus (WEBER) 118

Fig. 1. Young paratype cranidium (TML 44/4173); × 3.
Fig. 4. Young paratype cranidium (TML 45/4173); × 3.
Fig. 6. Librigena, hypostoma and holotype cranidium (TML 42/4137) — specimens figured by WEBER (1937, Pl. 6, Figs 25-27) as *Phillipsia derbyensis* var. *producta* n. var.; × 2.4.
Fig. 12. Pygidium (TML 31/4173); × 3.

Alapaievsk region, the Urals, Namurian.

Particeps scoticus minimus n. subsp. 115

Fig. 2. Holotype pygidium (GSM 102540); × 4.6.
Fig. 14. Paratype cephalon (GSM 102541); × 5.6.

Christonbank, Great Britain, Lower Namurian.

Particeps kargini (WEBER) 116

Fig. 3. Damaged paratype cephalon (TML 58/3139) — specimen figured by WEBER (1933, Pl. 1, Fig .6) as *Phillipsia derbyensis* var. *kargini* n. var.; × 4.
Fig. 4. Holotype specimen (TML 62/3139) — specimen figured by WEBER (1933, Pl. 1, Fig. 9) as *Ph. derbyensis* var. *kargini* n. var.; × 5.6.

Novoselovka, Donets Basin, Lower Namurian.

Particeps scoticus scoticus REED 114

(see also Pl. XIV, Fig. 2)

Fig. 5. Damaged pygidium (BM I 7508). Farhouse, Great Britain, Upper Viséan; × 3.
Fig. 8. Strongly damaged entire lectotype specimen (RSM 1958.1.2673) — figured by REED (1943, Pl. 2, Figs 1, 2) as *Griffithides (Particeps) scoticus* subgen. and sp. nov.; × 4.
Fig. 9. Paralectotype cranidium (RSM 1958.1.2676) — specimen figured by REED (1943, Pl. 2, Fig. 5) as *G. (Particeps) scoticus* subgen. and sp. nov.; × 4.

Invertiel, Great Britain, Upper Viséan.

Fig. 10. Damaged cephalon (BM I 867). Beith, Great Britain, Lower Namurian; × 4.6.
Fig. 13. Pygidium (RSM 1911.62.8386). Bowertrapping, Great Britain, Lower Namurian; × 6.

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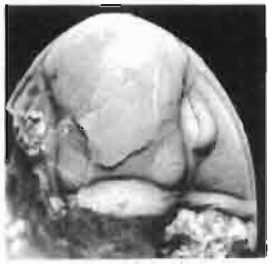

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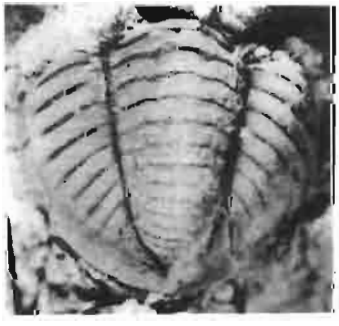

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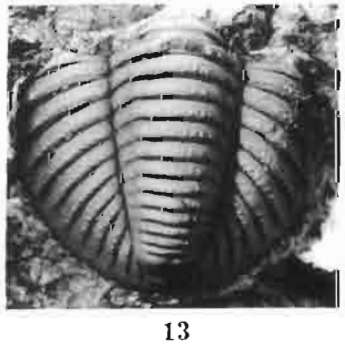

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PLATE XVI

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?Cyphinioides limbatus n. sp. 123

Fig. 1. Holotype cephalon (TML 288/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 24) as *Griffithides transilis* var. α . Dolgaia ravine, Donets Basin, lower part of Upper Carboniferous; × 3.7.

Fig. 2. Pygidium (TML 314/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 33). Luganskoe, Donets Basin, Moscovian; × 6.5.

Cyphinioides micheevi (WEBER) 121

Fig. 3. Enrolled holotype specimen with cephalon exposed (TML 1808/5107), figured by WEBER (1937, Pl. 8, Fig. 30) as *Griffithides micheevi* n. sp.; × 3.

Fig. 4. Same specimen, pygidium exposed; × 3.

Alapaievsk region, the Urals, Namurian.

Cyphinioides ashfellensis REED. 121

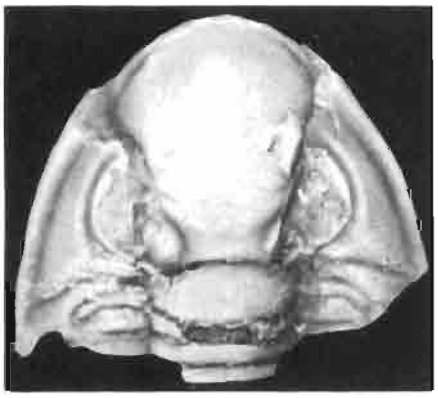
Fig. 5. Enrolled holotype specimen, cephalon exposed (HMG A 3700) — figured by REED (1942, Pl. 8, Figs 1, 2). Kirkby Stephen, Great Britain, ?Upper Viséan; × 5.6.

Cyphinioides alapaicus (WEBER) 122

Fig. 6. Paralectotype pygidium (TML 1964/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 24) as *Griffithides (Cyphinium) alapaicus* n. sp.; × 2.5.

Fig. 7. Lectotype cephalon (TML 1963/5107) — specimen figured by WEBER (1937, Pl. 9, Fig. 23) as *G. (Cyphinium) alapaicus* n. sp.; × 2.2.

Alapaievsk region, the Urals, Lower Namurian.



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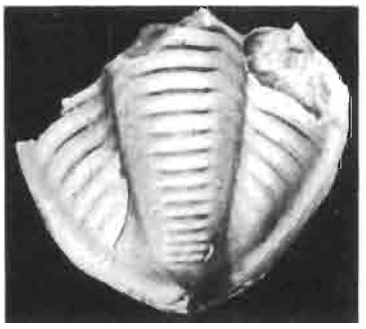

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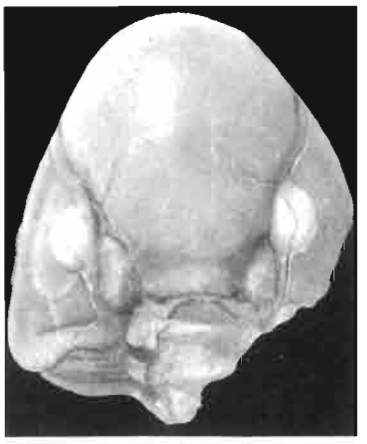

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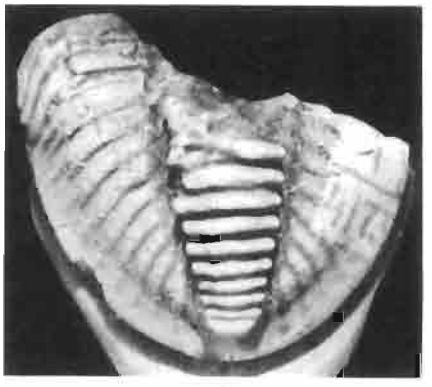

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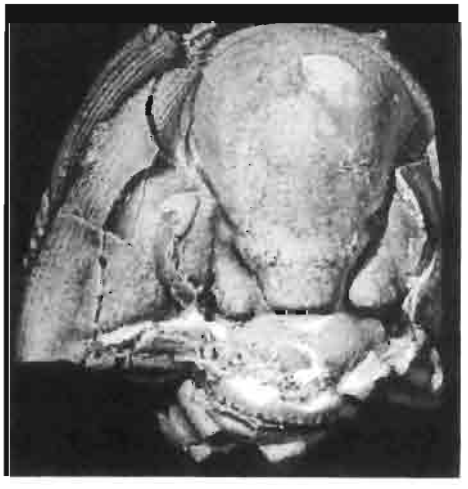

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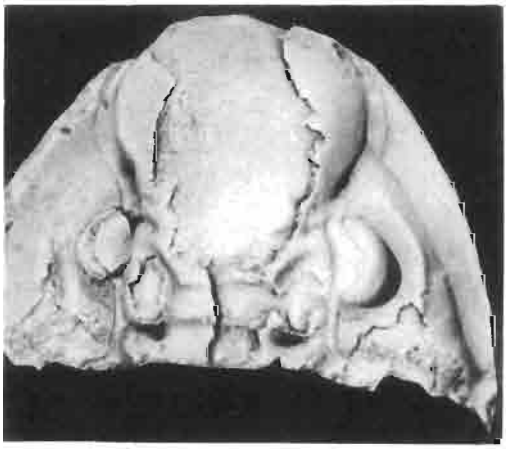

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PLATE XVII

Page

Paladin czarnieckii n. sp. 147

Fig. 1. Paratype meraspis pygidium (ZNG Kr. Cz. 20); × 6.
Fig. 2. Paratype meraspis pygidium (ZNG Kr. Cz. 21); × 6.4.
Fig. 3. Paratype cranidium (ZNG Kr. Cz. 18); × 5.7.
Fig. 4. Young paratype cranidium (ZNG Kr. Cz. 16); × 6.
Fig. 5. Young paratype cranidium (ZNG Kr. Cz. 19); × 3.8.
Fig. 6. Paratype cranidium (ZNG Kr. Cz. 17); × 5.5.
Fig. 9. Young paratype pygidium (ZNG Kr. Cz. 22); × 7.2.
Fig. 11. Enrolled paratype specimen (ZNG Kr. Cz. 15); × 9.
Fig. 12. Holotype cranidium (ZNG Kr. Cz. 14); × 6.
Fig. 16. Paratype pygidium (ZNG Kr. Cz. 23); × 6.3.

Orlej, Poland, ?Lower Namurian.

Paladin eichwaldi shunnerensis (KING) 131

(see also Pl. XIV, Fig. 3)

Fig. 7. Early meraspis pygidium with deep larval notch (RSM); × 4. Photograph obtained by courtesy of Dr. E. N. K. CLARKSON (Grant Institute of Geology, Edinburgh).
Fig. 10. Entire lectotype specimen, damaged (SMC E 10500) — figured by KING (1914, Pl. 32, Figs 2, 6) as *Griffithides shunnerensis* n. sp.; × 4.
Fig. 14. Pygidium (BM 55007a); × 5.

Great Shunner Fell Well, Great Britain, Lower Namurian.

Paladin eichwaldi eichwaldi (FISCHER VON WALDHEIM) 130

Fig. 8. Pygidium (TML 1559/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 17) as *Phillipsia* (*Griffithides*?) *eichwaldi* FISCH.; × 3.
Fig. 13. Fragmentary cephalon, partly exfoliated (TML 88/3139) — specimen figured by WEBER (1933, Pl. 1, Fig. 29) as *Ph.* cf. *eichwaldi* FISCH.; × 4.
Fig. 15. Cranidium (TML 89/3139) — specimen figured by WEBER (1933, Pl. 1, Fig. 28) as *Ph.* cf. *eichwaldi* FISCH.; × 5.8.

Zapaltiube, Donets Basin, Viséan.

Fig. 17. Neotype pygidium, latex cast (TML 1551/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 15) as *Ph.* (*Griffithides*?) *eichwaldi* FISCH. Vol river, the Urals, Viséan; × 5.6.


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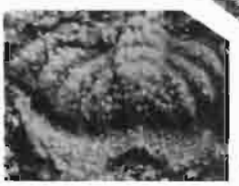
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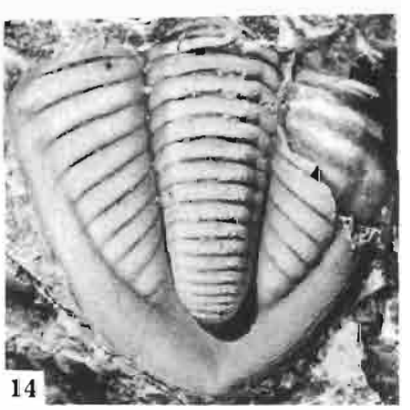
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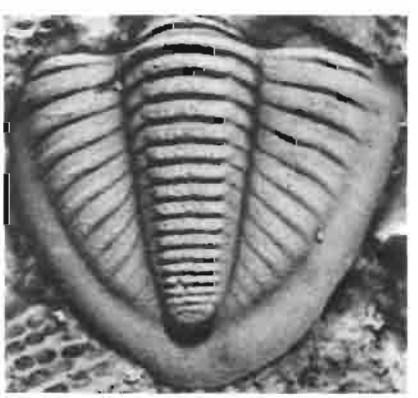
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PLATE XVIII

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Paladin eichwaldi parilis (REED) 132

(see also Pl. XIV, Fig. 4)

Fig. 1. Young cranidium (RSM 1911.62.8393); × 4.3.
Fig. 2. Young pygidium (RSM 1911.62.8391); × 7.
Fig. 3. Hypostoma (RSM 1911.62.8394); × 7.3.
Fig. 4. Cranidium (RSM 1911.62.8387); × 6.

Bowertrapping, Great Britain, Lower Namurian.

Fig. 5. Pygidium with abnormally developed ribs (3d to 5th) on right pleural lobe (BM It 2260). Beith, Great Britain, Lower Namurian; × 3.
Fig. 6. Pygidium (RSM 1911.62.8390). Bowertrapping, Great Britain, Lower Namurian; × 7.
Fig. 7. Damaged cephalon (RSM 1911.62.8395). Bowertrapping, Great Britain, Lower Namurian. × 3.7.
Fig. 8. Lateral view of enrolled specimen (HMG A 36/6). Gair, Great Britain, Lower Namurian; × 8.5.
Fig. 9. Holotype pygidium (HMG A 3708) — specimen figured by REED (1942, Pl. 10, Fig. 5) as *Weberides parilis* sp. nov. Linn Spout, Great Britain, Lower Namurian; × 6.3.
Fig. 10. Fragmentary exfoliated cephalon (HMG A 36/2). Gair, Great Britain, Lower Namurian; × 6.
Fig. 11. Pygidium rounded posteriorly (RSM 1911.62.8388), Bowertrapping, Great Britain, Lower Namurian; × 6.2.
Fig. 14. Pygidium pointed posteriorly (RSM 1911.62. 8385). Bowertrapping, Great Britain, Lower Namurian; × 5.6.

Paladin mucronatus latispinatus n. subsp. 137

Fig. 12. Holotype pygidium (SMC E 3610). Settle, Great Britain, ?Upper Viséan; × 4.5.

Paladin mucronatus russicus n. subsp. 135

(see also Pl. XIV, Figs 1, 7; Pl. XIX, Figs 9,13)

Fig. 13. Paratype pygidium (TML 1607/5107) — specimen figured by WEBER (1937, Pl. 7, Fig. 19) as *Phillipsia* (*Griff.*?) *eichwaldi* var. (?) *mucronata* MCCOY. Rovnoe, Moscow Basin, Lower Namurian; × 5.

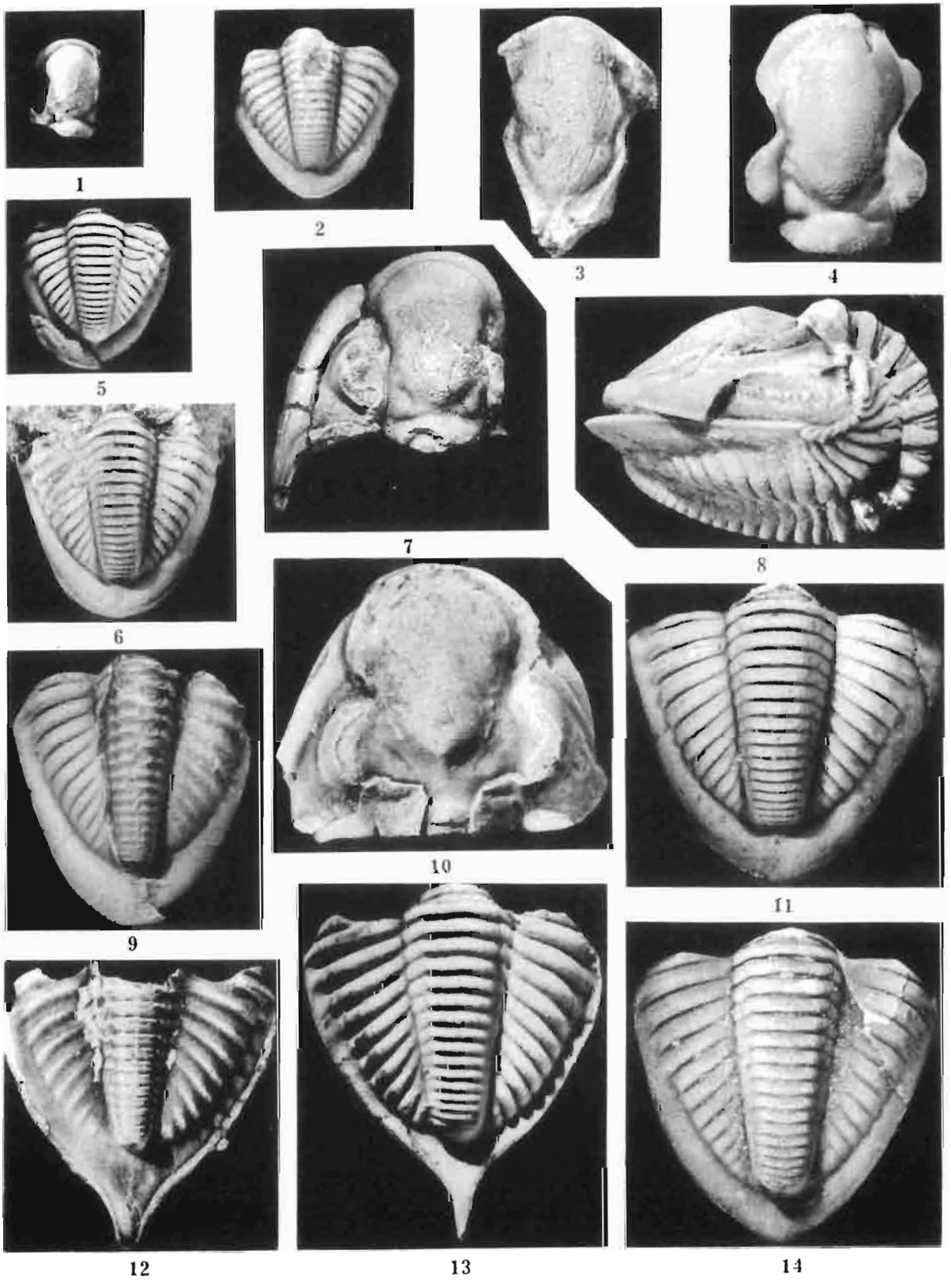

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PLATE XIX

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Paladin mucronatus mucronatus (McCoy) 133

Fig. 1. Young pygidium (ZNG Kr. Cz. 8); × 6.
Fig. 2. Young pygidium (ZNG Kr. Cz. 9); × 6.6.
Fig. 3. Young pygidium (ZNG Kr. Cz. 10); × 6.
Fig. 4. Young pygidium with incipient mucro (ZNG Kr. Cz. 11); × 7.
Fig. 5. Cranidium (ZNG Kr. Cz. 7); × 5.4.
Fig. 6. Cranidium (ZNG Kr. Cz. 6); × 6.
Fig. 7. Pygidium (ZNG Kr. Cz. 13); × 4.5.
Fig. 11. Young pygidium with incipient mucro (ZNG Kr. Cz. 12); × 6.

Orlej, Poland, ?Lower Namurian

Fig. 8. Cephalon (RSM 1906.140.2) — specimen figured by Woodward (1883-1884, Pl. 4, Fig. 3) as *Phillipsia eichwaldi* var. *mucronata* McCoy. Wilkiestone, Great Britain, Lower Namurian; × 2.3.
Fig. 10. Cranidium (GSM 102527). Craster-Dunstan, Great Britain, Lower Namurian; × 4.
Fig. 12. Pygidium (GSM 102523). Craster-Dunstan, Great Britain, Lower Namurian; × 4.
Fig. 14. Damaged entire specimen (RSM 1906.140.1) — figured by Woodward (1883-1884, Pl. 4, Fig. 1) as *Ph. eichwaldi* var. *mucronata* McCoy. Wilkiestone, Great Britain, Lower Namurian; × 7.4.

Paladin mucronatus russicus n. subsp. 135

(see also Pl. XIV, Figs 1, 7; Pl. XVIII, Fig. 13)

Fig. 9. Paratype cephalon (TML 1599/5107) — specimen figured by Weber (1937, Pl. 7, Fig. 23) as *Phillipsia* (*Griff.*?) *eichwaldi* var. (?) *mucronata* McCoy; × 2.3.
Fig. 13. Holotype pygidium (TML 1606/5107) — specimen figured by Weber (1937, Pl. 7, Fig. 18) as *Ph.* (*Griff.*?) *eichwaldi* var. (?) *mucronata* McCoy; × 4.

Rovnoe, Moscow Basin, Lower Namurian

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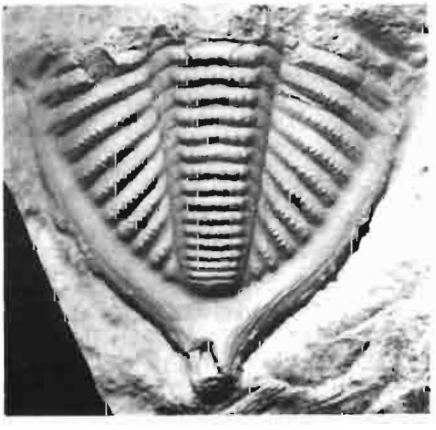

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PLATE XX

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Paladin mucronatus rotundatus n. subsp. 136

Fig. 1. Holotype cephalon with thoracic segments attached (BM In 56282); × 3.
Fig. 9. Entire, badly damaged specimen (BM In 56294); × 3.
Ireshope Burn, Great Britain, Lower Namurian.

Paladin mucronatus subsp. 138

Fig. 2. Partly exfoliated pygidium (SMC E 3624); × 4.6.
Fig. 12. Internal mould of pygidium (SMC E 3621); × 5.
Lowick, Great Britain, Lower Namurian.

?*Paladin* sp.. 155

Fig. 3. Pygidium (GSM 103104). Locality unknown; × 4.

Paladin lowickensis n. sp.. 151

Fig. 4. Exfoliated paratype pygidium (SMC E 3620); × 4.
Fig. 5. Exfoliated paratype pygidium (SMC E 3618); × 6.5.
Fig. 7. Holotype pygidium (SMC E 3626); × 3.6.
Lowick, Great Britain, Lower Namurian.

Paladin eakringensis n. sp. 145

Fig. 6. Holotype pygidium (GSM Zh 4338). Eakring, Great Britain, Upper Viséan; × 6.3.

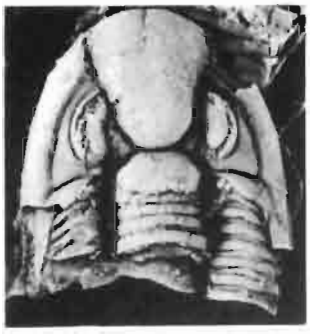
Paladin ?bakewellensis n. sp. 147

(see also Pl. XIV, Fig. 10)

Fig. 8. Pygidium with abnormally developed 7th and 8th ribs on pleural lobe (BM I 871 b). ?Castleton, Great Britain, Upper Viséan; × 5.

Paladin griffithidoides n. sp. 149

Fig. 10. Enrolled holotype specimen, pygidium exposed (GSM X 2453); × 4.
Fig. 11. Same specimen, cephalon exposed; × 4.
Bands Gill, Great Britain, Upper Viséan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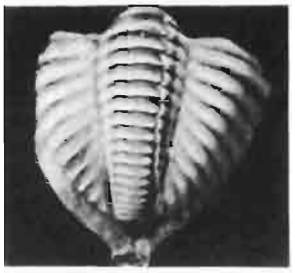
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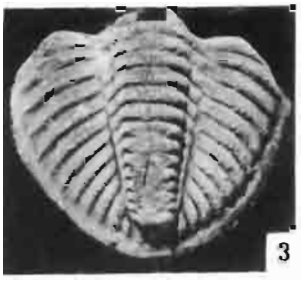
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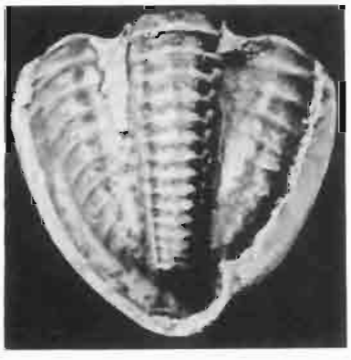
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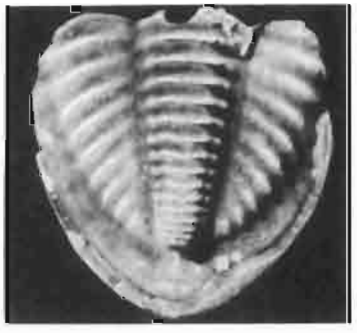
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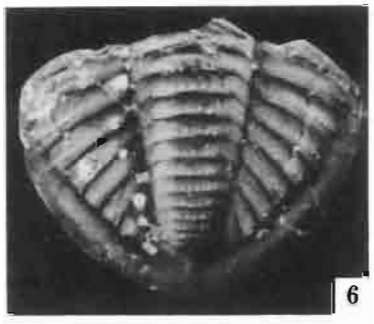
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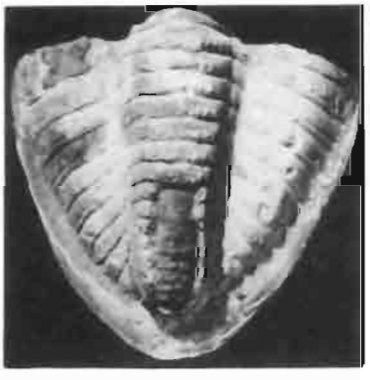
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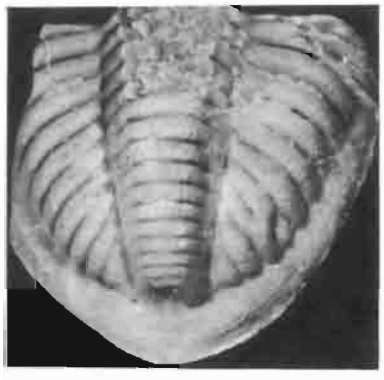
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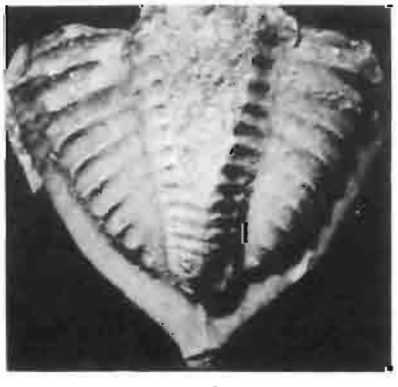
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H. OSMÓLSKA: REVISION OF NON-CYRTOSYMBOLINID TRILOBITES

PLATE XXI

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Paladin cuspidatus (REED) 142

Fig. 1. Paralectotype pygidium (RSM 1958.1.2685) — specimen (developed) figured by REED (1943, Pl. 3, Fig. 3); × 3.4.
Fig. 2. Young paralectotype cranidium (RSM 1958.1.2719); × 5.6.
Fig. 6. Lectotype cephalon (RSM 1958.1.2683) — specimen figured by REED (1943, Pl. 3, Fig. 1); × 3.4.
St. Monans, Great Britain, Upper Viséan.

Fig. 4. Entire damaged specimen (CMG Ol. 53. pm/2) — figured by WOODWARD (1883-1884, Pl. 4, Fig. 2) as *Phillipsia eichwaldi* FISCHER. High Blantyre, Great Britain, Upper Viséan; × 2.6.

Paladin maillieuxi (DEMANET) 142

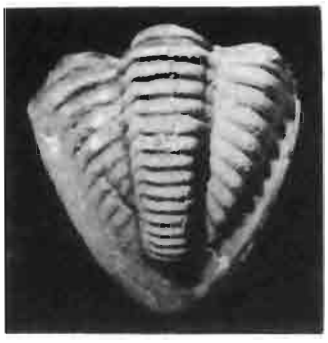
Fig. 3. Entire young paratype specimen, latex cast (IRB IG. 10004.145); × 6.
Fig. 5. Two pygidia and an external mould of cranidium, latex cast (IRB IG. 10003.146); × 3.
Fig. 8. Distorted entire specimen, latex cast (IRB IG. 1003.147); × 3.
Fig. 10. Entire specimen, latex cast (IRB IG. 100003.148); × 3.
Bioul, Belgium, Uppér Viséan.

Paladin belli n. sp. 153

Fig. 7. Holotype pygidium (*a*) with an external mould of cranidium associated (BM In 18446). Kennetcook, Canada, Upper Viséan; × 3.

Paladin barkei (WOODWARD) 141

Fig. 9. Holotype specimen, latex cast (BM I 7312) — figured by WOODWARD (1902, Pl. 20, Fig. 14) as *Griffithides barkei* n. sp. Bishopston, Great Britain, Upper Viséan; × 3.



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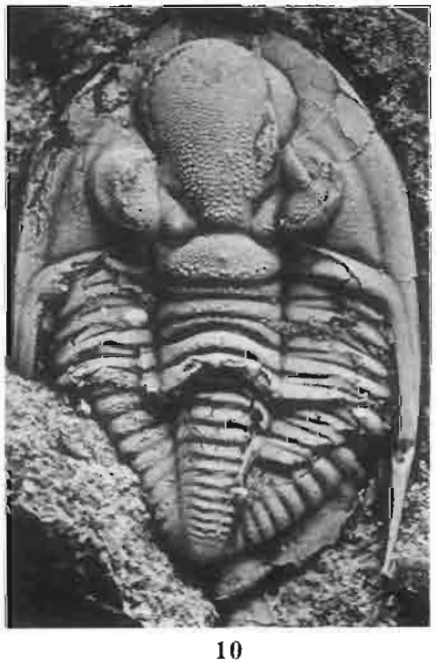

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H. OSMÓLSKA: REVISION OF NON-CYRTOSYMBOLINID TRILOBITES

PLATE XXII

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Paladin angustipygus n. sp. 152

Fig. 1. Cranidium, latex cast (ZNG W); × 3.
Fig. 13. Same specimen, internal mould; × 4.
Okrzeja, Poland, Upper Viséan.

Fig. 2. Fragmentary paratype cranidium (GSM Bi 1255); × 7.
Fig. 10. Holotype pygidium (GSM Bi 1259); × 3.6.
Cleveland Hills, Great Britain, Upper Viséan.

Paladin lutugini (WEBER) 143

Fig. 3. Cranidium, latex cast (TML 522/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 6) as *Griffithides lutugini* n. sp.; × 4.
Fig. 5. Neotype cranidium (TML 139/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 2) as *G. lutugini* n. sp.; × 3.
Izvarino, Donets Basin, Moscovian.

Fig. 6. Damaged pygidium (TML 200/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 8) as *G. lutugini* var. *longicauda* n. sp. et var. Popovka, Donets Basin, Moscovian; × 2.2.
Fig. 11. Pygidium (TML 197/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 9) as *G. lutugini* var. *multisegmentata*. Mechetnaia Ravine, Moscovian; × 4.7.

Paladin subbakewellensis n. sp. 153

Fig. 4. Holotype cranidium (TML 325/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 39) as *Griffithides transilis* var. γ; × 6.
Fig. 9. Pygidium (TML 327/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 41) as *G. transilis* var. γ; × 4.5.
Semenovskaia, Donets Basin, Moscovian.

Paladin bakewellensis n. sp. 146

Fig. 7. Paratype cephalon with damaged glabella and pygidium associated (GSM 33698); × 4.
Fig. 8. Holotype pygidium (GSM 33701); × 6.6.
Bakewell, Great Britain, Upper Viséan.

Paladin cervilatus (WEBER) 144

Fig. 12. Exfoliated paratype cranidium (TML 202/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 13) as *Griffithides cervilatus* n. sp.; × 6.
Fig. 14. Holotype pygidium (TML 204/3139) — specimen figured by WEBER (1933, Pl. 2, Fig. 15) as *G. cervilatus* n. sp.; × 5.
Varvaropole, Donets Basin, Moscovian.

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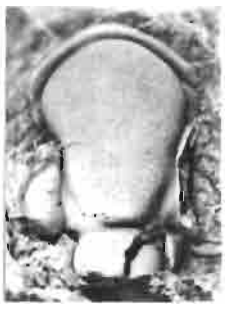

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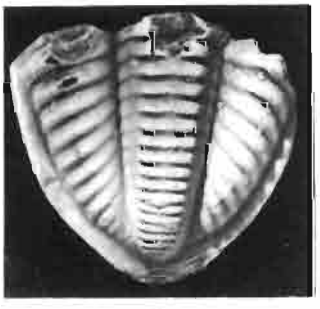

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