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## Upper Cambrian fauna of the Holy Cross Mts

**ABSTRACT:** A description is given of the fauna from the Upper Cambrian deposits of the Holy Cross Mts. The fossils here described include 9 trilobite species — out of which seven are new, 3 brachiopod species (one new), one new gastropod species, also one new genus and species of the eocrinoid. With reference to the works of other authors and on the basis of his own paper (Orłowski 1968) the writer gives a stratigraphic division of the Upper Cambrian from the Holy Cross Mts., based on his material, and compared with the Upper Cambrian of Great Britain and Scandinavia.

### INTRODUCTION

Within the Holy Cross Mts. the Upper Cambrian is encountered only in the Lysogóry anticline (fig. 1; cf. also Samsonowicz 1956). It is developed as detrital rocks of considerable thickness, initially assigned to the Silurian, until a cranidium of *Olenus* sp. was found there by Gürich (1896). Additional fossils were found there by Samsonowicz (1916, 1934) and Czarnocki (1919, 1927). In the latter work Czarnocki subdivided the Upper Cambrian of the Holy Cross Mts. into lithological-stratigraphic horizons. Two of the horizons yielded a rich fauna of trilobites and brachiopods, including many new species (Czarnocki 1927; vide also Orłowski 1967, 1968). The fauna discovered by Czarnocki has never been described or published and his fossil collections have been destroyed. It took many years of field research to re-discover the localities where that author had collected specimens; one of the localities said to contain fossils of the older Upper Cambrian horizon has not, so far, been found (Orłowski 1968).

In his latest paper the writer (Orłowski 1968) has worked out the lithology, stratigraphy and tectonics of the Upper Cambrian deposits outcropping to the surface. The descriptions of fossils given in the present paper provide the paleontological documentation for stratigraphic (cf. chart 1) and tectonic inferences contained in the work mentioned above

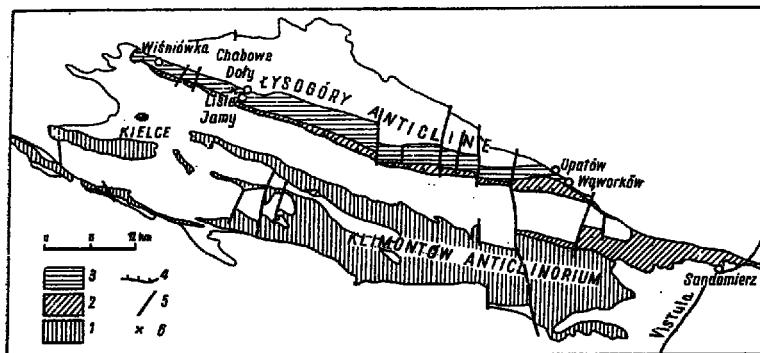


Fig. 1

The Cambrian of the Holy Cross Mts. (based on maps by Czarnocki and by Samsonowicz, somewhat simplified)

1 Lower Cambrian, 2 Middle Cambrian, 3 Upper Cambrian, 4 overthrust, 5 major faults, 6 Klonówka hill

(Orłowski 1968). A description of the fauna and stratigraphy of the uppermost Upper Cambrian deposits from boreholes on the northern slope of the Łysogóry anticline has been made by Tomczykowa (1967).

All the specimens described here are the property of the Warsaw University. They are a part of the collections of the Chair of Historical Geology of the Faculty of Geology of that University and bear the Nos. 1—1166.

#### STRATIGRAPHY

The upper part of the Middle Cambrian (Marcinkowice Beds, Orłowski 1967, 1968) is unfossiliferous. It is developed as clay or silty shales with thin intercalations of compact sandstones. The thickness of that part of the Cambrian is c. 200 m.

The Marcinkowice Beds are overlaid in sedimentary continuity by the Upper Cambrian. Minor tectonic unconformities, due to the variable resistivity of the rock complexes to tectonic agents, are observable at the boundary of the Middle and Upper Cambrian.

The lower part of the Upper Cambrian consists of the Święty Krzyż Beds (sensu Orłowski 1967, 1968), about 350 m thick. They are represented by thick-bedded, extremely hard quartz sandstones, intercalated by clay or silty shales. They contain numerous sedimentary structures suggesting very shallow-water environment (Dzulewski & Żak 1960; Radwański & Roniewicz 1960, 1962). The trilobite fauna discovered there contains *Olenus rarus* sp. n.<sup>1</sup>, *Protopeltura olenusorum* sp. n., *Protopeltura*

sp.; moreover, brachiopods represented by *Orusia* cf. *lenticularis* (Wahlenberg), *Acrotreta multa* sp. n., *Obolus* sp., and the eocrinoid *Cambrocrinus regularis* sp. n. There are also many problematical forms.

The Święty Krzyż Beds are overlain by the Klonówka Beds (Orłowski 1967, 1968), about 200 m thick, developed chiefly as clay shales with rare thin intercalations of sandstones. The amount of silty shales and the number of sandstone intercalations increase upwards. The outcrops in the lower part of the Klonówka Beds are rather poor, badly preserved fragments of the trilobite *Beltella* sp. being the only fossil they yield. The upper part of the Klonówka Beds contains the well known outcrop of Chabowe Doły. The fauna which occurs there in two layers — hereafter referred to as Chabowe Doły (mill) and Chabowe Doły (ravine), is abundant and diversified. It is represented by the trilobites: *Sphaerophthalmus alatus* (Boeck), *Peltura scarabeoides scarabeoides* (Wahlenberg), *Peltura? protopeltorum* sp. n., *Aagnostus (Homagnostus) pseudobesus* sp. n., *Beltella irae* sp. n., *Acerocare? klonowkae* sp. n., *Parabolina bella* sp. n., the gastropod *Latouchella aperta* sp. n. and the brachiopod *Acrotreta multa* sp. n. Two subhorizons (Orłowski 1968, chart 1) may be distinguished in this horizon.

On the Klonówka Beds rest the Łysogóry Beds (Tomczykowa 1967), developed as clay shales and clays with thin intercalations of quartz sandstones. They contain an interesting trilobite fauna described by Tomczykowa (1967). Some of the species there are considered by that author as index fossils on which is based her division of the Łysogóry Beds into a number of subhorizons. The thickness of the Łysogóry Beds has been estimated at c. 150 m (Orłowski 1968). They occur only in boreholes and do not outcrop on the surface.

As compared with that of the other countries the Upper Cambrian of the Holy Cross Mts. resembles closest the Upper Cambrian of Wales as to lithology, sedimentology and stratigraphy. In Wales, however, there is no uppermost Cambrian fauna, such as occurs in Poland, in spite of the existence in Wales of sedimentary continuity with the Tremadocian. Notwithstanding these differences, similarities in the facial development and the mode and type of occurrence of Upper Cambrian fossils in the two areas are remarkable (vide Stubblefield 1956, Orłowski 1968).

As compared with Scandinavia, the Upper Cambrian of the Holy Cross Mts. differs in the type of facial development and of its sedimentary basin; the faunal similarities are, however, obvious, although certain index fossils have a slightly greater vertical range (vide chart 1; Henning-smoen 1957; Czarnocki 1919, 1927; Orłowski 1968).

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<sup>1</sup> All the species here described as new, have previously been mentioned by the present writer in a report to the Polish Academy of Sciences on the results of his investigations. This report was published in the Academy's 1967 Bulletin (see References: Orłowski 1967).

Chart 1

Stratigraphical range of the Upper Cambrian fossils described in the paper

Horizons		Species	<i>Olenus rarus</i>	<i>Protopenetura olenusorum</i>	<i>Protopenetura</i> sp.	<i>Sphaerophthalmus alatus</i>	<i>Peltura scarabeoides scarabeoides</i>	<i>Peltura ? protopenetorum</i>	<i>Agnostus (H.) pseudobesus</i>	<i>Beltella irae</i>	<i>Beltella</i> sp.	<i>Acerocare ? klonowkae</i>	<i>Parabolina bella</i>	<i>Latouchella aperta</i>	<i>Orusia cf. lenticularis</i>	<i>Acrotreta multa</i>	<i>Obolus</i> sp.	<i>Cambrocrinurus regularis</i>
VI Acerocare																		
V Peltura	Vc <i>Peltura scarabeoides</i>																	
	Vb <i>Peltura minor</i>																	
	Va <i>Protopenetura praecursor</i>																	
IV Leptoplastus																		
III <i>Parabolina spinulosa</i>																		
II <i>Olenus</i> <i>Agnostus obesus</i>																		
I <i>Agnostus pisiformis</i> <i>Olenus alpha</i>																		

PRESERVATION OF FOSSILS

The writer's collection of Upper Cambrian fossils contains over 1,100 specimens, out of which more than 700 have been specifically identified. About 800 specimens are referable to the trilobites, c. 120 to brachiopods, c. 60 specimens have been assigned to gastropods and 70 to eocrinoids; the remainder are problematical. In the profiles the occurrence of the fauna is very uneven, often it is of the nest-like type. Most specimens,

i.e. nearly 900, come from Chabowe Doły (vide fig. 1), c. 200 from Wąworków, 10 from Lisie Jamy and only 4 from Wiśniówka.

*Trilobites.* The greatest number of specimens occur as isolated cranidia, librigenae, pygidia, pleurae or hypostomata. Only very few specimens represent thoraces with pygidia, or cranidia and cephalons with thoraces. The more complete specimens have been collected from Wąworków and Wiśniówka, none from Chabowe Doły. All the available specimens are preserved as external or internal casts and moulds. The preservation of the specimens from Chabowe Doły is more satisfactory than of those from Wąworków, although in both localities trilobites are encountered in fine grained, rather soft sandstone. Fossils encountered in the hard varieties of sandstone are less well preserved because, like the surrounding rock, they bear signs of diagenesis.

Since detached fragments of the exoskeleton represent the greater part of the writer's collection the fitting together of the fragments is of primary importance. The fitting together of librigenae into the corresponding cranidia did not present any serious difficulty, but the assignment of pygidia proved troublesome. Those of *Sphaerophthalmus alatus* (Boeck) and *Agnostus* (*H.*) *pseudobesus* sp. n. are so characteristic that the writer was able to refer them without hesitation to the corresponding cranidia; the remaining pygidia are, however described separately and only their most likely generic or specific assignment is tentatively suggested.

In describing the trilobites the writer has used the terminology of Harrington (1959) and Henningsmoen (1957). Comparative remarks and data on geographical distribution of these animals are based on monographs cited in the References.

*Brachiopods.* They are preserved as external or internal casts and moulds. *Acrotreta multa* sp. n., the most common form there, is remarkably well preserved in spite of its small dimensions. The hard sandstones in Chabowe Doły (ravine) have yielded the best preserved specimens. On the whole specimens from Wąworków are not so well preserved as those from Chabowe Doły.

*Gastropods.* They are preserved as external and internal casts and moulds. Damaged anterior parts of the shells are rather numerous, most likely owing to the shells being dragged by sea currents on the floor of the basin.

*Eocrinoids.* Single plates are those most frequently encountered. They are preserved as external or internal casts. Calyces or their fragments, preserved as above, are fairly common. Calyces preserved with the stems are very rare but stems alone fairly frequent. The upper parts of the calyx together with the bases of the arms have been observed in a very few specimens only.

## DESCRIPTION OF FOSSIL REMAINS

## Problematicum A

(pl. I, fig. 9)

*Description.* — Specimens oval in shape, c. 50 mm in diameter. Central area c. 5 mm in diameter, rimmed by a moderately deep, distinct groove, with numerous radial grooves irregularly distributed and increasing in number toward the periphery by implantation and bifurcation.

*Discussion.* — The above specimens, whose organic origin seems doubtless, come closest to the medusae. Their more detailed description and more accurate identification are hardly possible because of the scarcity of material. They bear some resemblance to the genus *Velumbrella* Stasińska, described from the Lower Cambrian of the Holy Cross Mts. (Stasińska 1960). They resemble *Velumbrella* in size and shape but differ from it in greater number of the radial canals and in the absence of velum. Our specimens also resemble genus *Ediacaria* Sprigg, described from the Lower Cambrian of South Australia (Harrington & Moore 1956).

*Horizon and locality.* — Problematicum A has been found in the Mała Wiśniówka quarry, in the *Olenus rarus* horizon.

## Problematicum B

(pl. I, fig. 10)

*Description.* — Specimens ovate, from 15—25 mm in diameter, slightly convex, consisting of 4—5 convex lobes separated by radial canals, with bead-like thickenings.

*Discussion.* — The above specimens resemble the medusae, and come closest to the genus *Brooksella* Walcott abounding in the Upper Precambrian, the Cambrian and the Ordovician of North America and Europe (Harrington & Moore 1956).

*Horizon and locality.* — Problematicum B was found in the Mała Wiśniówka quarry, the *Olenus rarus* horizon, associated with Problematicum A.

## GASTROPODA

Family *Coreospiridae* Knight, 1947Genus *Latouchella* Cobbold, 1921*Latouchella aperta* sp. n.

(pl. I, figs. 1—6)

*Holotypus*: specimen No. 750, pl. I, fig. 1a—1b.*Stratum typicum*: Upper Cambrian, *Sphaerophthalmus alatus* horizon, *Peltura?* protopeltorum subhorizon.*Locus typicus*: Chabowe Doły (mill), the Holy Cross Mts.*Derivatio nominis*: after the Latin word *aperta* = denuded, with reference to the preservation of all specimens as casts and moulds.

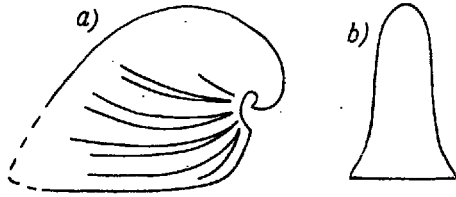
*Diagnosis.* — Shell mono-convolute, cap-like, flattened; apex posteriorly curved; surface of shell ornamented by faint rugae.

*Material.* — More than 70 specimens preserved as external casts and moulds.

*Description.* — Shell restored on casts, mono-convolute, cap-like, flattened (fig. 2). In highest point of cross section elongated, in the plane of symmetry sub-parallel to triangular, slightly widened at the aperture, rounded at apex. Apex situated farther to the back, beyond the border of aperture, strongly bent down. Aperture narrow and long; posterior

Fig. 2

Outline of shell of *Latouchella aperta* sp. n.; a side view, b vertical section through the highest part;  $\times 2$



part of the apertural border upraised. Surface of shell delicately marked by longitudinal rugae stretching postero-anteriorly as the shell coils, and gradually fading out towards the apex. Length of largest specimen c. 10 mm, height 7.5 mm.

*Discussion.* — The genus *Latouchella* was established by Cobbold (1921) on material collected from the Lower Cambrian of Great Britain. Two species: *L. costata* and *L? striata* were described by that author. From *L. costata* the new species *L. aperta* sp. n. differs in much greater dimensions, smoother shell and the upraised posterior apertural border. From *L? striata* it differs furthermore in different shape of the aperture and being situated further back and in a more strongly curved apex. From the Middle Cambrian Westergård (1936) described the new genus *Oelandia* which proved to be a synonym of *Latouchella* (cf. Knight, Batten & Yochelson 1960). In shape and size of shell the new species resembles *Latouchella pauciplicata* (Westergård) but differs from it in less distinct rugae and in different posterior part of the aperture.

## BRACHIOPODA

Family Finkelnburgiidae Schuchert & Cooper, 1931

Genus *Orusia* Walcott, 1905

*Orusia* cf. *lenticularis* (Wahlenberg, 1821)

(pl. I, fig. 8; pl. II, figs. 14—17)

1912. *Orusia lenticularis* — Walcott, pl. 98, figs. 1, 1a—p, 2, 2a—k, 3, 3a—b, 6, 6a—c.

*Material.* — 10 specimens preserved as external and internal casts.

*Remarks.* — In shape and size our specimens fully correspond to

the diagnostic features of this species (Walcott 1912). The only difference lies in less distinct ornamentation, this is, however, due to the state of preservation. The largest specimen is 4 mm long and 4.5 mm broad. In a description of this species Walcott (1912) stresses its strong specific variability in shell ornamentation, shape of shell and, in a measure, in the inner structure. The variability in the shape of shell and its ornamentation is also observable in the Polish material.

*Horizon and locality.* — *Orusia lenticularis* has a wide distribution in the Atlantic province. It is common in (Norway, Sweden, and Denmark (island of Bornholm) in the *Parabolina spinulosa* horizon, often associated with the trilobites *Parabolina spinulosa* and *Protopeltura aciculata*. It occurs in the same horizon in Canada. In Great Britain it is known from the Upper Lingula Flags. In Poland *Orusia cf. lenticularis* is encountered in the eastern part of the Holy Cross Mts., in the *Olenus rarus* horizon at Wąworków where it is associated with the trilobites *Olenus rarus* n. sp., *Protopeltura olenusorum* sp. n. and *Protopeltura* sp.

Family *Obolidae* King, 1846

Genus *Obolus* Eichwald, 1870

*Obolus* sp.

(pl. I, fig. 7)

*Material.* — 9 specimens preserved as external and internal casts.

*Description.* — Shells slightly convex, ovate, wider than long. The largest specimen is 1.1 mm long and 1.4 mm wide. Ornamentation unknown.

*Horizon and locality.* — *Obolus* sp. is known from Wąworków where it occurs in association with *Orusia cf. lenticularis* (Wahlenberg), *Olenus rarus* sp. n., *Protopeltura olenusorum* sp. n. and *Protopeltura* sp.

Family *Acrotretidae* Schuchert, 1893

Genus *Acrotreta* Kutorga, 1848

*Acrotreta multa* sp. n.

(pl. II, figs. 1—13)

*Holotypus:* specimen No. 934, pl. II, fig. 1.

*Stratum typicum:* Upper Cambrian, *Olenus rarus* and *Sphaerophthalmus alatus* horizons.

*Locus typicus:* Chabowe Doły, the Holy Cross Mts.

*Derivatio nominis:* after the Latin word *multa* = numerous.

*Diagnosis.* — Pedicle valve conical with long median septum; brachial valve slightly convex also with dorsal median septum.

*Material.* — 42 brachial valves and 70 pedicle valves, preserved as external or internal casts and moulds.

*Description.* — Pedicle valve high, ovate, conical, with fine growth lines on surface. Posterior margin straight. Apex far back. On the inter-



nal casts of pedicle valve a narrow straight furrow, representing the median septum, runs from apex to posterior margin. Brachial valve ovate, slightly convex. On the internal casts of brachial valve a long narrow furrow, representing the dorsal median septum, runs along the whole length of the valve. The mean length of brachial valve is 2 mm, the width 2.5 mm; in the largest specimens these measurements are 3 and 4 mm respectively. The mean height of a pedicle valve is 2 mm, the width 2.5 mm; the height of the largest specimen is 3 mm, the width 3.5 mm.

*Discussion.* — *Acrotreta multa* sp. n. is characterised by a distinctly developed median septum both on the brachial valve and the pedicle valve. It slightly resembles *A. kutorgai* Walcott but only in the brachial valve, the pedicle valve is different. From *A. sagittalis* (Salter) it differs in a longer median septum and much higher pedicle valve.

## EOCRINOIDEA

### Genus *Cambrocrinus* gen. n.

*Type species: Cambrocrinus regularis* sp. n.

*Diagnosis of genus.* — Calyx elongated, cylinder-like, at top rounded, consisting of five rows of large chiefly hexagonal plates. Stem shorter than calyx.

*Discussion.* — The assemblage of the above features permits the recognition of *Cambrocrinus* gen. n. as a separate new genus of the class Eocrinoidea, because it differs very distinctly from other genera referred to this class (vide Yakovlev 1956, Prokop 1962, Ubaghs 1963, Robinson 1965).

The Eocrinoidea contain groups of forms whose features are intermediate between those of Cystoidea and Crinoidea. The exact position of that class within the Echinodermata has not as yet been determined, (Regnéll 1945, 1960a, b; Ubaghs 1963), hence the number of genera referred to it by the particular authors varies considerably. The most complete list of the genera of the Eocrinoidea is given by Ubaghs (1963).

### *Cambrocrinus regularis* sp. n.

(pl. III, figs. 1—13)

*Holotypus:* specimen No. 970, pl. III, fig. 5a—5b.

*Stratum typicum:* Upper Cambrian, the Olenus rarus horizon.

*Locus typicus:* Wąworków, the Holy Cross Mts.

*Derivatio nominis:* after the latin word „regularis” with reference to the regular structure of the calyx.

*Material.* — 4 calyces with stems, 44 calyces, 13 stems and many isolated plates.

*Diagnosis.* — Calyx elongated, narrowing towards the base, after attaining about 1/4 of its length shows no important changes in the dia-

meter. Calyx c. three times as long as wide, consisting of 5 rows of chiefly hexagonal plates; basal plates three- or four-sided. Plates ornamented by radiate ribs. Stem slightly narrower at the base than at the top about half as long as the calyx, ornamented by thin transversal ledges.

*Description.* — Calyx elongated, regular (fig. 3), narrow at base, expanding upwards and attaining the maximum width at about 1/4 of its length, where from the width more or less constant. Calyx consisting of five vertical rows of hexagonal plates, larger at the base of the calyx, smaller towards the top. Plates massive, non-porous, mostly hexagonal, slightly convex; with 6 more or less radiate ribs. Occasionally there are 5, 7 or 8 ribs and the plates are correspondingly polygonal. This is a modification of the structural pattern of a hexagonal plate. Three-sided and four-sided plates occur at the base of the calyx. The stem does not seem to be divided into segments; it is somewhat wider at the top than at the base; about half as long as the calyx, ornamented by delicate ring-like paired ledges carrying tiny, irregularly spaced nodes placed always between one pair of the ledges. The nodes are arranged in coils and occur only in the upper part

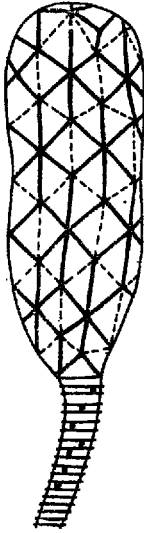


Fig. 3

Restored *Cambrocrinus regularis* gen. n., sp. n.; outer view. Broken lines delimit the particular plates, continuous lines the ornamentation on plates;  $\times 5$

of the stem. Arms unknown, their bases preserved in only 2 specimens. Canals observable in the interior of the arms.

### TRILOBITA

Family *Agnostidae* M'Coy, 1849

Genus *Agnostus* Brongniart, 1822

*Agnostus* (*Homagnostus*) *pseudobesus* sp. n.

(pl. IV, figs. 1—5)

*Holotypus*: specimen No. 201, pl. IV, fig. 1.

*Stratum typicum*: Upper Cambrian, *Sphaerophthalmus alatus* horizon, Peltura? protopetorum subhorizon.

*Locus typicus*: Chabowe Doly (mill), the Holy Cross Mts.

*Derivatio nominis*: after its likeness to *Agnostus obesus*.

*Diagnosis.* — Cephalon anteriorly rounded, glabella elongated, bilobed. Pygidium ovate, border bearing two small spines. Axis broad and long, divided into three rings.

*Material.* — 6 cephalons and 5 pygidia.

*Description.* — Cephalon anteriorly rounded, somewhat wider than long; narrow border is separated by a distinct border furrow (fig. 4a). Glabella elongated, anteriorly rounded, bilobed; anterior lobe smaller than the posterior one. Basal lobes small, triangular in shape. Axial furrows distinct, deep, united in front of the glabella and running straight to the border furrow. Genae smooth, slightly narrower than glabella. Pygidium convex, rounded, rimmed by a narrow but distinct border, carrying two small sharp spines (fig. 4b). Axis very broad and long, nearly reaching to the border, divided into 3 rings; the anterior consists of two triangular lobes situated at the anterior corners of the axis. The median ring is hexagonal, the

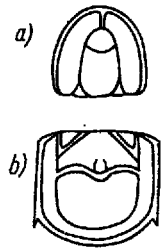


Fig. 4

Drawing of *Aagnostus (Homagnostus) pseudobesus* sp. n.; a cephalon, b pygidium;  $\times 5$

sides of its posterior part bent forward, the central part bent backwards and passing into a rather small mesial tubercle. Posterior ring long and broad, posteriorly rounded. Axial furrows distinct. Side lobes very narrow, particularly posteriorly.

Thorax unknown.

*Discussion.* — The above species *Aagnostus (Homagnostus) pseudobesus* sp. n. comes closest to *A. (H.) obesus obesus* Belt which is an index fossil for the Olenus Beds of Scandinavia and Great Britain. Our new species is characterised by a less ovate, more elongated cephalon, longer glabella and broader axis on the pygidium. From *A. (H.) obesus laevis* Westergård it differs, furthermore, in the presence of a preglabellar longitudinal furrow. The new species also resembles *A. (H.) rudius* Salter, but differs in the presence on the cephalon of a preglabellar longitudinal furrow and in a much longer posterior ring on the axis of the pygidium. From *A. dux* Callaway it differs in a longer glabella, the presence of a longitudinal preglabellar furrow and in a longer and wider axis of the pygidium. From *A. sidenbladhi* Linnarsson the new species differs in a different glabella, in the presence of a longitudinal preglabellar furrow, also in a longer and wider axis of the pygidium.

Family *Olenidae* Burmeister, 1843  
 Subfamily *Oleninae* Burmeister, 1843  
 Genus *Olenus* Dalman, 1827  
*Olenus rarus* sp. n.  
 (pl. IV, figs. 6—19)

*Holotypus*: specimen No. 1, pl. IV, fig. 6.

*Stratum typicum*: Upper Cambrian, *Olenus rarus* horizon.

*Locus typicus*: Wąworków, the Holy Cross Mts.

*Derivatio nominis*: after the Latin word *rarus* = rare.

*Diagnosis*. — Cephalon anteriorly rounded, cranidium nearly as long as broad; glabella tapering forward, anteriorly truncate. Palpebral lobes of moderate size, eye ridges directed to anterior corners of glabella. Librigenae bearing long librigenal spines.

*Material*. — 35 cranidia, 2 hypostomata, 7 librigenae.

Dimensions (in mm):

	1	5	3	7	6
Length of cranidium	5.5	5.0	9.0	5.5	15.2
Width of cranidium	5.8	4.9	8.0	4.0	14.1
Length of glabella	3.6	3.2	6.5	3.5	10.4
Width of glabella	2.3	2.3	4.3	2.0	7.1
(across palpebral lobes)					

*Description*. — Cranidium subtrapezoidal, slightly longer than wide, or as long as wide, somewhat convex (fig. 5). Glabella occupies c. two thirds of length, tapering forwards, truncate anteriorly, occipital ring distinct, occipital furrow simple, straight. Glabella with 3 pairs of lateral glabellar furrows, oblique backwards, convex; the first pair is the longest, the third one short. Axial furrows straight, distinct, united with the preglabellar furrows in front of glabella. Preglabellar field distinct, long (sag., exsag.), convex, straight; anterior border furrow distinct, straight. Fixigenae narrower than glabella, flat; palpebral lobes moderately large, situated in line with the second pair of lateral glabellar fur-

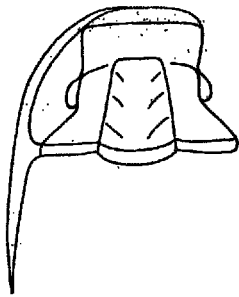


Fig. 5

Restored cephalon of *Olenus rarus* sp. n.  $\times 3$

rows; palpebral furrow distinct. Eye ridges short, stretching from the palpebral lobes towards the anterior corners of glabella, separated from the glabella by axial furrows. Anterior section of facial suture obliquely cuts the anterior border, as a rule it is parallel-sided or slightly divergent; posterior section of facial suture slightly sinuous, divergent.

Librigenae with distinct lateral border, posteriorly passing into a long genal spine which is half as long as the librigena. Hypostoma with well marked anterior wings and convex median body.

Pygidia, tentatively assigned by the writer to this species, are triangular in shape, without spines, with narrow border; the axis nearly reaching to the border. Interpleural furrows present on the axis and on lateral lobes.

Thorax unknown.

*Discussion.* — The species *Olenus rarus* sp. n., described above, is characterised i. a. by the shape of glabella and the eye ridges; these are short and slightly obliquely directed towards the anterior corners of the glabella. The new species differs from the Scandinavian species (vide Westergård 1922, Henningsmoen 1957) in different shape of glabella, longer (sag.) anterior border, narrower fixigena and shorter eye ridge. It comes closest to the species *O. scanicus* Westergård from which it differs in more tapering glabella, smooth preglabellar field, longer (sag.) anterior border, narrower fixigena and different eye ridges. The new species resembles *O. alpha* Henningsmoen in the ratio of proportions of the glabella to the fixigenae but differs in having a more tapering glabella, longer palpebral lobes and longer (sag.) preglabellar field.

Genus *Parabolina* Salter, 1849

*Parabolina bella* sp. n.

(pl. VI, figs. 16—21)

*Holotypus*: specimen No. 651, pl. VI, fig. 18.

*Stratum typicum*: Upper Cambrian, Sphaerophthalmus alatus horizon.

*Locus typicus*: Chabowe Doly, the Holy Cross Mts.

*Derivatio nominis*: after the Italian word „bella”.

*Diagnosis.* — Cranidium subtrapezoidal, anteriorly rounded, glabella slightly tapering anteriorly, convex, with two pairs of long lateral glabellar furrows. Anterior border long (sag.), strongly convex. Palpebral lobes placed at midlength of cranidium, just opposite the lateral glabellar furrows. Eye ridges short, indistinct.

*Material.* — 14 cranidia.

Dimensions (in mm):

	651	641	648	640
Length of cranidium	4.1	4.0	4.0	11.3
Width of cranidium (across palpebral lobes)	4.1	4.3	4.0	10.0
Length of glabella	3.3	3.1	3.0	8.5
Width of glabella (across palpebral lobes)	2.2	2.3	2.2	6.0

*Description.* — Cranidium subtrapezoidal, anteriorly rounded, strongly convex (fig. 6). Glabella elongated, somewhat tapering anteriorly, with anterior corners rounded, convex, occupying from 3/4 to 4/5 of the

length of cranidium. Occipital ring short (sag.), occipital furrow composite. Glabella with two pairs of lateral glabellar furrows. These are long and narrow but distinct, convex. The first pair longer, reaching to the middle of glabella and united or almost united across the glabella; the second pair close together but not connected. Axial furrows distinct, united in front of the glabella. Preglabellar field long (sag.), anterior border long (sag.), curved and strongly convex, nearly as long as the preglabellar field. Anterior border furrow distinct, curved.

Fixigena narrow in the interocular part (tr.), less than one half as wide as the glabella; broader in the postocular part so that its width there

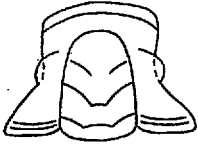


Fig. 6

Drawing of cranidium *Parabolina bella* sp. n.  $\times 4$

exceeds one half the width of the occipital ring. Palpebral lobe big, placed at midlength of cranidium, opposite the first and second pair of lateral glabellar furrows. Eye ridges faintly marked, running obliquely from the palpebral lobe to anterior corners of glabella.

Anterior section of facial suture long, slightly divergent, stretches from the palpebral lobe to the anterior border and cuts it arching gently; posterior section of facial suture divergent, gently outcurving to the posterior margin.

Thorax and pygidium unknown.

*Discussion.* — Our new species differs from *Parabolina lobata lobata* (Brögger) in less prominent and differently directed eye ridges, different lateral glabellar furrows and in much narrower postocular part of fixigena. From *P. acanthura* (Angelin) it differs in more parallel-sided glabella, fewer and different lateral glabellar furrows and longer (sag.) anterior border. From *P. spinulosa* (Wahlenberg) it differs in the number and shape of lateral glabellar furrows, absence of mesial tubercle on the occipital ring, longer anterior border and in different postocular part of fixigena. The new species also differs from *P. mobergi* Westergård in shape of glabella, different lateral glabellar furrows, absence of spine on the occipital ring, different anterior border and much narrower postocular part of fixigena.

*Beltella irae* sp. n.  
(pl. V, figs. 1—15)

*Holotypus:* specimen No. 500, pl. V, fig. 5.

*Stratum typicum:* Upper Cambrian, Sphaerophthalmus alatus horizon.

*Locus typicus:* Chabowé Doły (mill), the Holy Cross Mts.

*Derivatio nominis:* after the Polish name Ira.

*Diagnosis.* — Cephalon anteriorly semicircular, cranidium subtrapezoidal; glabella elongated, parallel-sided to sub-conical, anteriorly rounded, occupying c. 4/5 of the length of cranidium. Two pairs of lateral glabellar furrows, the first one longer; occipital furrow composite. Preglabellar field of equal length with anterior border, the latter well developed and triangular in shape. Fixigenae as wide as glabella or narrower. Eyes rather small, situated a little further to the front from middle of cranidium. Librigenae with distinct lateral border passing into long genal spine.

*Material.* — 96 cranidia and 21 librigenae.

Dimensions (in mm):

	500	501	504	503	505
Length of cranidium	7.6	5.0	5.2	9.6	6.3
Width of cranidium (across palpebral lobes)	8.2	5.4	6.0	10.8	6.4
Width of cranidium (along posterior margin)	10.4	7.8	8.0	15.6	9.0
Length of glabella	6.2	3.7	4.0	7.7	5.0
Width of glabella	4.3	2.8	2.9	5.6	3.5

*Description.* — Cephalon anteriorly semicircular, anterior border distinct (fig. 7). Cranidium subtrapezoidal, wider than long, convex. Glabella occupying c. 4/5 of the length of cranidium; in shape it varies from elongated, parallel-sided in young specimens to subconical in adults, anteriorly rounded, convex. Occipital ring rounded posteriorly, occipital furrow composite, narrow, prominent. Glabella with two pairs of lateral glabellar furrows, the first pair much longer, convex and oblique backwards, the anterior pair short, less distinct. Axial furrows distinct, parallel or slightly convergent, united in front of glabella. Preglabellar

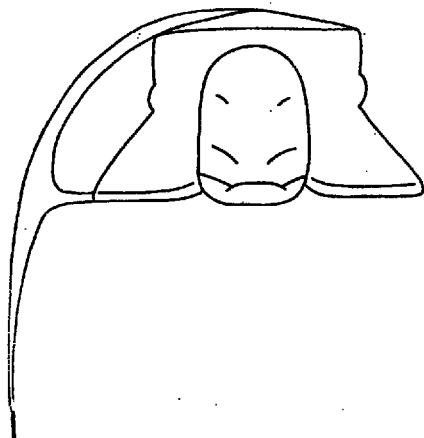


Fig. 7

Restored cephalon of *Beltella irae*  
sp. n. × 4

field, distinct, flat; anterior border of equal length (sag.) with preglabellar field, separated by distinct anterior border furrow. Anterior border convex, distinct, triangular, Fixigenae smooth, the interocular width about half that of glabella, the postocular width increases and approaches that of the occipital ring. Eyes small, somewhat to the front from the middle of cranidium (sag.) in the line of second pair of lateral glabellar furrows; eye ridges unknown.

Librigenae of equal width with the fixigenae; lateral border distinct, occupies c. 1/4 of the genal width of librigena across the eye line, passing backwards into a long genal spine tapering backwards. Genal spine is situated in exsagittal line of dorsal exoskeleton or slightly incurved. Anterior section of facial suture divergent, running from middle (tr.) of the anterior margin of anterior border, obliquely cutting the anterior border and then directed to the eye; posterior section of facial suture divergent, convex, directed from the eye to the posterior border, just before reaching the border it incurves abruptly and forms a flip on the librigena.

Thorax and pygidium unknown.

*Discussion.* — *Beltella irae* sp. n. differs from *B. depressa* (Salter) in the absence of eye ridges, in lateral glabellar furrows, different occipital furrow and in shape of librigena, also in much longer genal spine and its position to the exsagittal line of the dorsal exoskeleton. From *B. verisimilis* (Salter) it differs in form of librigena, most particularly in much longer genal spine and different occipital furrow.

Subfamily **Leptoplastinae** Angelin, 1854

Genus *Sphaerophthalmus* Angelin, 1854

*Sphaerophthalmus alatus* (Boeck, 1838)

(pl. VI, figs. 1—15)

1957. *Sphaerophthalmus alatus* (Boeck) — Henningsmoen, pp. 212—215, pl. 22, figs. 18—26.

*Material.* — 118 cranidia, 2 librigenae, 5 pygidia.

*Description.* — Cephalon anteriorly semicircular, cranidium wider than long, convex (fig. 8). Glabella from almost parallel-sided and slightly narrower in young specimens to faintly tapering and wider in adults. Occipital ring distinct, carrying a rather small and sharp occipital spine. Occipital furrow straight, deeper at the sides and shallower in the axis of glabella. One pair of distinct lateral glabellar furrows united across the glabella, somewhat shallower in the axis. Glabella long, reaching to the anterior border furrow.

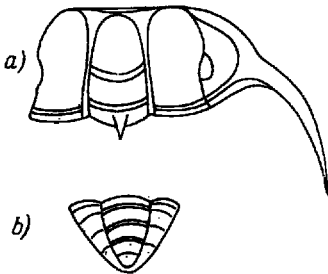


Fig. 8

Restored *Sphaerophthalmus alatus* (Boeck); a cephalon, b pygidium;  $\times 5$

Axial furrows straight, very deep and distinct, united with the anterior border furrow in front of glabella. Anterior border narrow, upturned, slightly concave in vertical projection, convex in the horizontal projec-



tion. Fixigenae strongly convex, narrower than glabella in the eye line, as wide as the occipital ring in the postocular part. Palpebral furrows rather wide, upcurved, opposite the lateral glabellar furrows. Facial suture sub-parallel to axis of cranidium. Anterior section of facial suture longer, convergent, convex, posterior section of facial suture shorter and oblique backwards.

Librigena as wide as fixigena; posterior lateral margin straight, short; anterior lateral margin longer curved. Eye ovate, strongly convex. Lateral border wide, flat. A strongly outcurved, wide-based genal spine situated in eye line. Pygidium large, triangular, wider than long. Axis wide, reaching nearly to the posterior margin and carrying 4 axial rings. Lateral lobes convex with distinct interpleural furrows.

Thorax unknown.

*Remarks.* — Henningsmoen (1957) has demonstrated that the lectotype of Boeck's species differs strongly from *S. alatus* in the sense of many Scandinavian authors. The differences lie in the position of eyes, the shape of eye ridges and of librigena. *S. major* of many Scandinavian authors, i.e. of Westergård (1922) should be assigned to *S. alatus*. Thus it is not certain that the true *S. alatus* occurs in Great Britain.

Our material corresponds to the material from Scandinavia, except that it is impossible to trace the eye ridges not preserved in the Polish material. It is interesting to note the variable shape of glabella.

*Horizon and locality.* — In Norway *S. alatus* (Boeck) occurs in horizon 5b, associated with *Peltura minor* (Brögger), *Protopeltura planicauda* Brögger, *Ctenopyge affinis* Westergård, *C. tumida* Westergård, *P. acutidens* Brögger. It is also found in the same horizon in the island of Bornholm and in Sweden. In England (if present) it is known from the Upper Lingula Flags (Dolgelly). In Poland *S. alatus* (Boeck) has been reported by Czarnocki (1927) from Chabowe Doly. The writer's specimens probably come from the same locality. *S. alatus* (Boeck) is associated with *Aagnostus* (*Homagnostus*) *pseudobesus* sp. n., *Peltura?* *protopeltorum* sp. n., *Beltella irae* sp. n., *Parabolina bella* sp. n., *Acerocare?* *klonowkae* sp. n., *Peltura scarabeoides scarabeoides* (Wahlenberg).

#### Subfamily Pelturinae Hawle & Corda, 1847

Genus *Peltura* Milne-Edwards, 1840

*Peltura?* *protopeltorum* sp. n.

(pl. VII, figs. 1—11)

*Holotypus:* specimen No. 220, pl. VII, fig. 1.

*Stratum typicum:* Upper Cambrian, Sphaerophthalmus alatus horizon, lower subhorizon *Peltura?* *protopeltorum*.

*Locus typicus:* Chabowe Doly (mill), the Holy Cross Mts.

*Derivatio nominis:* *protopeltorum* on the resemblance with the genus *Protopeltura*.

**Diagnosis.** — Cephalon wider than long, elliptical (tr.), cranidium subtrapezoidal, glabella strongly convex, elongated, anteriorly rounded. Eye small, far forward but at some distance from glabella. Librigenae wide, without genal spine, lateral border wide, tapering to the front.

**Material.** — 95 cranidia and 20 librigenae.

Dimensions (in mm):

	220	221	239	242
Length of cranidium	10.5	8.3	7.0	10.0
Width of cranidium (across palpebral lobes)	12.0	9.4	7.6	11.6
Length of glabella	9.5	7.4	6.0	9.0
Width of glabella	6.8	4.8	3.9	6.0

**Description.** — Cephalon elliptical (tr.), convex (fig. 9). Cranidium subtrapezoidal, wider than long. Glabella elongated, anteriorly rounded, convex, wide, length/width ratio 3 : 2. Occipital ring long (sag.), occipital furrow composite, prominent. On glabella two pairs of faintly impressed lateral glabellar furrows, slightly convex, directed backwards. Glabella

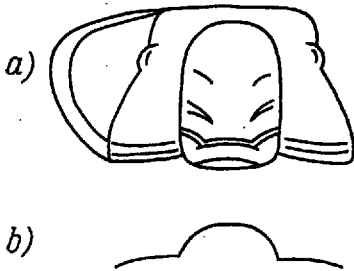


Fig. 9

Restored cephalon of *Peltura? protopeltorum* sp. n.; a cephalon, general view, b cross section through cranidium in line with the first pair of lateral glabellar furrows;  $\times 2$

occupies about 9/10 of the length of cranidium. Axial furrows straight, distinct. Fixigenae smooth, across palpebral lobes about half as wide as in the posterior margin. Palpebral lobes small, very far forwards, but at some distance from glabella. Eye ridges faint, short and directed to the front part of glabella. Preglabellar field very short (sag.), smooth, flat. Librigena ovate, twice as wide across the palpebral lobes as the fixigena. Lateral border wide, strongly tapering anteriorly. Lateral border furrow shallow and wide. Anterior section of facial suture convergent, posterior section of facial suture longer, divergent, convex.

Thorax and pygidium unknown.

**Discussion.** — *Peltura? protopeltorum* sp. n. is intermediate between the genera *Peltura* Milne-Edwards and *Protopeltura* Brögger. It resembles *Peltura* chiefly in librigena and facial suture, it approaches *Protopeltura* in the palpebral lobes being rather distant from the glabella and in a wider fixigena. These intermediate features reasonably suggest that the new species should be either included in an existing genus or that a new genus should be erected to accommodate it. The erection of a new genus is, however, impeded by the lack of completely preserved

specimens which would reliably show the structural differences in the thorax and pygidium. Hence, it is believed that the establishment of a new genus should be put off until more complete palaeontological material has been collected. The features observable in our material suggest its assignment to the genus *Peltura*; the uncertainties cited above are indicated by an interrogation mark after the generic name. The new species comes closest to *Peltura costata* (Brögger), but differs from it in the presence of lateral glabellar furrows, wider fixigenae and wider librigenae; from *P. transiens* (Brögger) and *P. paradoxa* (Moberg & Möller) it differs in having a wider librigena and in the absence of the genal spine. From *P. scarabeoides scarabeoides* (Wahlenberg) it differs in having a narrower glabella, broader fixigenae and in the presence of a preglabellar field; from *P. minor* (Brögger) and *P. acutidens* Brögger it differs in broader fixigenae and the presence of a preglabellar field, while the librigenae are very similar.

Genus *Protopeltura* Brögger, 1882

*Protopeltura olenusorum* sp. n.

(pl. VII, figs. 12—15; pl. VIII, figs. 1—3)

*Holotypus*: specimen No. 40, pl. VII, fig. 12b.

*Stratum typicum*: Upper Cambrian, *Olenus rarus* horizon.

*Locus typicus*: Wielka Wiśniówka quarry, the Holy Cross Mts.

*Derivatio nominis*: *olenusorum* — because of its occurrence in the same horizon with the trilobite *Olenus rarus*.

*Diagnosis*. — Cranidium wider than long, glabella wide, anteriorly rounded, preglabellar field short (sag.), palpebral lobes small, eye ridges prominent, librigena ending in genal spine. Thorax at least with 12 segments.

*Material*. — 3 nearly complete specimens (without pygidia), 16 cranidia.

Dimensions (in mm).

	40	55	54	52
Length of cranidium	6.0	3.8	4.2	2.2
Width of cranidium (across palpebral lobes)	3.2	3.5	5.0	2.0
Length of glabella	5.3	3.2	3.5	1.8
Width of glabella	4.3	2.3	2.5	1.2

*Description*. — Cranidium wider than long; glabella long and wide, anteriorly rounded, convex (fig. 10). Axial furrows parallel. Occipital ring prominent, short (sag.), with a rather small mesial tubercle, occipital furrow straight, distinct. Glabella with two pairs of faintly impressed lateral glabellar furrows. Preglabellar field short, occupying about 1/6 of the length of cranidium, flattened and separated from glabella by

a preglabellar furrow. Anterior border distinct, narrow (sag.), narrower on the sides. Fixigenae bent down from glabella, narrower than glabella. Palpebral lobes rather small, far forward, in line with the anterior part of glabella; eye ridges prominent, straight, directed to front of glabella

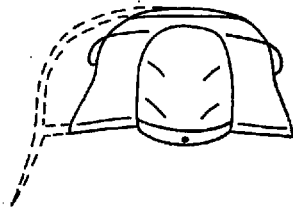


Fig. 10

Drawing of cranidium of *Protopeltura olenusorum* sp. n.; broken line shows the shape of librigena;  $\times 3$

and united with it. Facial suture pelturoid, anterior section of facial suture short, convergent, convex, posterior section of facial suture longer, divergent, convex. Librigenae bearing genal spines.

Thorax with at least 12 thoracic segments, their total number unknown. Axial ring wider than the pleural regions. Pleurae flat, pleural furrows straight, distinct.

Pygidium unknown.

*Discussion.* — *Protopeltura olenusorum* sp. n., described above, comes closest to *P. aciculata pusilla* Westergård encountered in horizon 3 of the Upper Cambrian of Scandinavia. The chief resemblance is in the structure of cranidium, but the new species differs in having slightly larger palpebral lobes, longer genal spine on the librigena and different structure of the pleurae. From *P. praecursor* Westergård the new species differs in having a wider fixigena in the preocular part, a longer (sag.) preglabellar field, longer eye ridges, different shape of occipital furrow and different pleurae. From *P. broeggeri* (Holtedahli) it differs mainly in having a wider glabella, different occipital furrow and narrower posterior part of fixigena. From *P. holtedahli* Henningsmoen it differs in shape of occipital furrow, different fixigena, longer eye ridges and somewhat larger palpebral lobes. From *P. kasakhtanica* Ivshin it differs in wider glabella, shorter (sag.) occipital ring, different occipital furrow and librigenae.

*Protopeltura* sp.  
(pl. VIII, fig. 4, 5)

*Material.* — 3 cranidia.

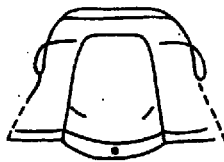
*Description.* — Cranidium wider than long, subtrapezoidal; glabella tapering forward, anteriorly truncated, occupying about 4/5 of the length of cranidium (fig. 11). Occipital ring short (sag.), bent backwards, with a rather small mesial tubercle; occipital furrow straight, distinct. Number of lateral glabellar furrows on glabella unknown; only the first pair is

visible. Axial furrows distinct, convergent anteriorly and united with the preglabellar furrow. Preglabellar field short (sag.), with distinct and straight anterior border, anterior border furrow distinct.

Fixigenae in the interocular part about one half as wide as glabella, in the postocular part the width of fixigenae unknown. Palpebral lobes

Fig. 11

Drawing of cranium of *Protopeltura* sp.; broken line marks parts poorly discernible on the specimens;  $\times 3$



rather small, eye ridges prominent, directed to anterior corners of glabella. Anterior section of facial suture short, convergent, posterior section of facial suture unknown.

Thorax and pygidium unknown.

*Discussion.* — The identification of the above fossils is impeded by the lack of facial suture; the majority of features suggest their assignment to *Protopeltura*. From *P. olenusorum* sp. n. it differs in different shape of glabella and different anterior border.

*Horizon and locality.* — The above remains of *Protopeltura* sp. were found at Wąworków in association with *Protopeltura olenusorum* sp. n. and *Olenus rarus* sp. n.

#### Genus *Acerocare* Angelin, 1854

Genus *Acerocare* Angelin was erected on the type species *Acerocare ecorne* Angelin. Recently Henningsmoen (1957) includes into this genus only 2 species, viz. *Acerocare ecorne* Angelin and *A. tullbergi* Moberg & Möller which are the index fossils of the uppermost horizon (6) of the Upper Cambrian of Norway and Sweden. Genus *Acerocare* Angelin shows close resemblance to the genera *Acerocarina* Poulsen and *Peltura* Milne-Edwards, but it is not certain from which of the two above genera it evolved. The Polish material consists exclusively of isolated cranidia and of one librigena which are intermediate between the genera *Acerocare* and *Acerocarina*. They resemble genus *Acerocare* in the anterior part of cranium, also in the size and position of the eyes, but differ in the lack of lateral glabellar furrows, in a tapering glabella and different outline of the postocular part of fixigena. The collected librigenae have a wider lateral border and a rather small sharp genal spine. The Polish specimens resemble genus *Acerocarina* in outline of glabella, lack of glabellar furrows on the glabella and in outline of the posterior part of fixigena. It differs in longer (sag.) preglabellar field, in the eyes being situated further back and in the direction of the anterior section of facial suture. The librigena differs in having a wider lateral border and the presence of a genal spine.

Perhaps, in the future, when more complete palaeontological material has been collected it will be possible to establish a new genus approaching those two just mentioned. The specimens described below resemble more closely the genus *Acerocare* Angelin to which they are, therefore, tentatively assigned by the writer.

*Acerocare? klonowkae* sp. n.  
(pl. VIII, figs. 6—11)

*Holotypus*: specimen No. 620, pl. VIII, fig. 6.

*Stratum typicum*: Upper Cambrian, Sphaerophthalmus alatus horizon, upper subhorizon Peltura scarabeoides scarabeoides.

*Locus typicus*: Chabowe Doly (ravine), the Holy Cross Mts.

*Derivatio nominis*: after the Klonówka hill where the specimens have been found.

*Diagnosis*. — Cranidium subtrapezoidal, slightly convex. Glabella tapering forwards, anteriorly truncate, corners rounded, flat, occupying about 4/5 of the length of cranidium. Preglabellar field smooth, slightly bending down to the front. Fixigena narrow in preocular part, much wider in postocular part. Eye small, situated forwards from the middle of cranidium. Librigena flat, with wide lateral border carrying a short sharp genal spine.

*Material*. — 15 cranidia and 1 librigena.

Dimensions (in mm):

	620	621	231	622
Length of cranidium	5.0	5.5	4.0	3.4
Width of cranidium (across palpebral lobes)	3.9	4.6	3.4	2.6
Width of cranidium (along posterior margin)	7.0	7.6	5.0	5.1
Length of glabella	4.0	4.3	3.0	2.7
Width of glabella (across palpebral lobes)	2.2	2.6	2.0	2.0
Width of occipital ring	3.0	3.3	2.6	2.2

*Description*. — Cranidium subtrapezoidal, slightly convex (fig. 12). Glabella tapering forward, anteriorly truncate, with rounded corners, flat, occupying c. 4/5 of the length of cranidium, faintly marked on crani-

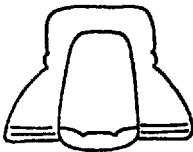


Fig. 12

Drawing of cranidium of *Acerocare? klonowkae* sp. n.  $\times 3$

dium, particularly so the anterior part of glabella. Occipital ring short (sag.), occipital furrow composite, deepest in the axis of glabella, faintly impressed on the sides. Lateral glabellar furrows absent, axial furrows distinct, narrower to the front of glabella and united with the preglabellar furrow. Preglabellar field long (sag.), smooth, bending down forwards; anterior margin straight. Fixigenae smooth, bending down outwards. Interocular part of fixigenae less than one half as wide as glabella, the postocular part more than one half as wide as the occipital ring. Palpebral lobe small, situated forward from the middle (sag.) of cranidium, close to glabella. Anterior section of facial suture reaching

to the anterior margin, first parallel, near the margin convergent, convex. Posterior section of facial suture pelturoid, outcurved, at the posterior margin strongly incurved.

Librigena, tentatively assigned to this species, ovate, the interocular part twice as wide as the fixigena, lateral border flattened, wide, lateral border furrow distinct. Lateral border carrying a short sharp genal spine directed outwards.

Thorax and pygidium unknown.

*Discussion.* — *Acerocare? klonowkae* sp. n. differs from *A. ecorne* Angelin in shape of glabella and lack of lateral glabellar furrows, also in having a longer preglabellar field and narrower postocular part of fixigena as well as differently directed facial suture. There are also some structural differences in librigena. From *A. tullbergi* Moberg & Möller it differs in the features cited above, furthermore in the lack of eye ridges and in lack of the anterior border in the preglabellar field.

*Peltura scarabeoides scarabeoides* (Wahlenberg, 1821)  
(pl. VIII, figs. 16—19)

1922. *Peltura scarabeoides* (Wahlenberg); Westergård, pl. XV, figs. 12, 13, 18.  
1957. *Peltura scarabeoides scarabeoides* (Wahlenberg); Henningsmoen, pl. 26, fig. 1, 2.

*Material.* — 15 pygidia.

*Description.* — Pygidium ovate, posterior margin straight, wider than long (fig. 13). Axial part convex, consisting of 3 axial rings, tapering backwards. Axial furrows distinct, wide. Pleural regions narrower than the axial part; each region with two distinct interpleural furrows. Pygi-

Fig. 13

Drawing of pygidium of *Peltura scarabeoides scarabeoides*  
(Wahlenberg) × 3



dium carries 3 pairs of short sharp marginal spines. The distance between the last pair is slightly more than the width of the anterior axial ring on the axial part.

*Remarks.* — The Polish material agrees excellently with the Scandinavian fossils presented in tables of the Scandinavian authors as well as with specimens collected by the writer from the vicinity of Slemmestad near Oslo. *Peltura scarabeoides scarabeoides* remains (including cranidia and pygidia) are richly represented in these collections.

*Horizon and locality.* — *Peltura scarabeoides scarabeoides* is often found in the lower part of horizon 5c, in the Upper Cambrian of Norway (Henningsmoen 1957), for which *Peltura scarabeoides* is the index fossil.

It occurs in the same horizon in Sweden, Denmark (Bornholm), Great Britain, Canada. In Poland this form has been reported by Czarnocki (1927) from Chabowe Doły; the writer's specimens have also been collected at Chabowe Doły (ravine).

*?Peltura* sp.  
(pl. VIII, figs. 20—24)

*Material.* — 22 pygidia.

*Description.* — Pygidium ovate, much wider than long, axial part occupying 1/2 of the width, convex, not reaching to the posterior margin, narrowing backwards, posteriorly rounded (fig. 14). Axial part divided into 4 axial rings. Axial furrows distinct, convergent. Pleural regions



Fig. 14

Drawing of pygidium of *?Peltura* sp. × 3

wide, with two interpleural furrows on each lobe, carrying two pairs of short sharp marginal spines. The distance between the posterior pair is twice the length of the pygidium.

*Discussion.* — The structure of pygidium suggests the assignment of our specimens to the genus *Peltura*. Our pygidia approach those in *P. acutidens* Brögger from which they differ in fewer pairs of marginal spines and in smaller length of the spines. Most likely they belong to *Peltura? protopeltorum* sp. n. because they are the most numerous group among all the pygidia and because they are associated with cranidia of this species.

*Horizon and locality.* — *?Peltura* sp. is encountered in the Sphaerophthalmus alatus horizon at Chabowe Doły.

*?Beltella* sp.  
(pl. VIII, figs. 14 and 15)

*Material.* — 5 pygidia.

*Description.* — Pygidium semicircular, axial part convex, narrowing backwards, reaching nearly to the posterior border; the width of the anterior part is 1/3 that of the full width of pygidium (fig. 15). Three prominent axial rings, the 4th, anterior ring very short (sag.). Two interpleural furrows on each pleural region. The border flat, broad, most distinct in the posterior part of pygidium. Border furrow faintly impressed; border carrying two pairs of short marginal spines.

*Discussion.* — The presence of marginal spines suggests the assignment of the pygidia to either the genus *Peltura* or the genus *Parabolina*;



the presence of the border seems much more characteristic and speaks in favour of the assignment to the genus *Beltella*. Our pygidia belong most likely to *Beltella irae* sp. n.

Fig. 15

Drawing of pygidium of ?*Beltella* sp.  $\times 3$



*Horizon and locality.* — ?*Beltella* sp. occurs in the Upper Cambrian at Chabowe Doly, in the *Sphaerophthalmus alatus* horizon.

?*Parabolina* sp.

(pl. VIII, figs. 12 and 13)

*Material.* — 5 pygidia.

*Description.* — Pygidium ovate, more than twice as wide as long; axial part convex, strongly narrowing backwards, posteriorly rounded; its width  $1/3$  the width of the pygidium (fig. 16), divided into 4 axial rings; the anterior ring poorly developed. Pleural regions convex in the

Fig. 16

Drawing of pygidium of ?*Parabolina* sp.  $\times 3$



middle (tr.), bent down on the sides and passing into a flat border of even width. Three pairs of interpleural furrows, the last pair faintly impressed. The margin carrying three pairs of sharp marginal spines directed backwards.

*Discussion.* — The above pygidia show a close resemblance to a number of species from the genus *Parabolina*. Thus they resemble *P. longicornis* Westergård from which they differ in smaller width of pygidium and fewer axial rings on the axial part. From *P. acanthura* (Angelin) they differ only in having a wider border and shorter marginal spines. From *P. mobergi* Westergård our pygidia differ in a wider border and fewer axial rings on the axial part of pygidium. Our pygidia belong most likely to *Parabolina bella* sp. n.

*Horizon and locality.* — ?*Parabolina* sp. occurs in the *Sphaerophthalmus alatus* horizon of the Upper Cambrian at Chabowe Doly (mill).

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S. ORŁOWSKI

## FAUNA GÓRNEGO KAMBRU GÓR ŚWIĘTOKRZYSKICH

(Streszczenie)

W Górach Świętokrzyskich górny kambry występuje jedynie na obszarze antykliny lysogórskiej (fig. 1). Najstarsze skały odsłaniające się w obrębie antykliny zaliczane są do górnej części kambru środkowego. Zarówno kambry środkowy jak i górny wykształcone są w postaci skał detrytycznych, przeważnie łupków ilastych i mułowcowych, mułowców oraz różnego rodzaju piaskowców. Poszczególne typy skał występują w różnej proporcji do siebie w profilu stratygraficznym. Najwyższe poziomy górnego kambru nie odsłaniają się na powierzchni.

Górny kambry Gór Świętokrzyskich badali G. Gürich (1896), J. Czarnocki (1919, 1927) i J. Samsonowicz (1934), ale opisy skamieniałości nigdy nie były publikowane, a same kolekcje w większości uległy zniszczeniu.

W czasie prac terenowych autor zebrał kolekcję skamieniałości liczącą przeszło 1100 okazów. Pochodzą one (vide fig. 1) częściowo z miejsc wzmiankowanych w pracach dawnych badaczy (Chabowe Doły — Czarnocki 1927), a także z miejsc, gdzie fauna była znana, ale w mniejszych ilościach (Wąworków — Samsonowicz 1934), lub też ze stanowisk nowych (Wiśniówka). W jednym odsłonięciu, znanym z bogatej fauny (Lisie Jamy — Czarnocki 1927), autor znalazł tylko pojedyncze skamieniałości.

Praca niniejsza zawiera pierwsze w Polsce opisy i ilustracje fauny górnego kambru (fig. 2—16 oraz pl. I—VIII).

Fauna górnego kambru Gór Świętokrzyskich występuje zwykle gniazdowo w drobnoziarnistych piaskowcach, a zachowana jest w postaci odcisków i ośródek. Panczerze trylobitów są zwykle rozczłonowane; w kolekcji przeważają kranidia, wolne policzki, segmenty tułowia i pygidia. Jedynie kilka okazów jest zachowanych w postaci większych fragmentów panczerza. Rozczłonowanie panczerzy jest powodem trudności we właściwym oznaczeniu gatunkowym poszczególnych fragmentów. W przypadkach, gdy przyporządkowanie poszczególnym gatunkom niektórych części panczerza było utrudnione, autor zdecydował się na oddzielne opisanie pygidium i oznaczenie ich jedynie do szczebla rodzajowego.

Najliczniejszą i najważniejszą dla celów stratygraficznych grupą skamieniałości w górnym kambrze Gór Świętokrzyskich są trylobity; w pracy opisano 9 gatunków, w tym 7 nowych. W dolnej części górnego kambru (Wąworków, Wiśniówka) występują: *Olenus rarus* sp. n. i *Protopeltura olenusorum* sp. n., zaś w części

górnjej (Chabowe Doły): *Sphaerophthalmus alatus* (Boeck), *Peltura scarabeoides scarabeoides* (Wahlenberg), *Peltura? protopeltorum* sp. n., *Aagnostus* (*Homagnostus*) *pseudobesus* sp. n., *Beltella irae* sp. n., *Acerocare? klonowkae* sp. n., *Parabolina bella* sp. n.

Brachiopody reprezentowane są przez *Orusia cf. lenticularis* (Wahlenberg) oraz bardzo licznie występującą w całym profilu *Acrotreta multa* sp. n. Zwraca uwagę obecność dużych, ale źle zachowanych okazów *Obolus* sp.

Slimaki reprezentowane są przez gatunek nowy *Latouchella aperta* sp. n.

Bardzo interesującą skamieniałością jest eokrynoid *Cambrocrinus regularis* gen. n., sp. n.; występuje on w dużych ilościach w dolnej części górnego kambru (Wąworków).

Opisana w niniejszej pracy fauna stanowi dokumentację paleontologiczną dla rozważań stratygraficznych dotyczących górnego kambru Gór Świętokrzyskich, omówionych w innej pracy autora (Orłowski 1968).

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Warszawa, w marcu 1967 r.

## DESCRIPTION OF PLATES I—VIII

## PL. I

*Latouchella aperta* sp. n.

- |                                                                                                                              |     |
|------------------------------------------------------------------------------------------------------------------------------|-----|
| 1 — Shell, 1a — internal cast, 1b — external cast, 1c — latex internal cast; specimen No. 750, holotype, Chabowe Doły (mill) | × 2 |
| 2 — Part of whorl with ornamentation; specimen No. 754, Chabowe Doły (mill)                                                  | × 2 |
| 3 — Cross section of shell; specimen No. 757, Chabowe Doły (mill)                                                            | × 5 |
| 4 — Cross section of shell; specimen No. 756, Chabowe Doły (mill)                                                            | × 5 |
| 5 — Internal cast of shell; specimen No. 807, Chabowe Doły (mill)                                                            | × 3 |
| 6 — Internal cast of shell; specimen No. 804, Chabowe Doły (mill)                                                            | × 3 |

*Obolus* sp.

- |                                                                |     |
|----------------------------------------------------------------|-----|
| 7 — Internal cast of pedicle valve; specimen No. 840, Wąworków | × 3 |
|----------------------------------------------------------------|-----|

*Orusia cf. lenticularis* (Wahlenberg)

- |                                                                                       |     |
|---------------------------------------------------------------------------------------|-----|
| 8 — Pedicle valve, 8a — external cast, 8b — internal cast; specimen No. 837, Wąworków | × 3 |
|---------------------------------------------------------------------------------------|-----|

## Problematicum A

- 9 — Cast on the topside of layer; specimen No. 1100, Mała Wiśniówka nat. size

## Problematicum B

- 10 — Three casts on topside of layer; specimen No. 1101, Mała Wiśniówka nat. size

## PL. II

*Acrotreta multa* sp. n.

- 1 — Brachial valve, internal cast; specimen No. 934, holotype, Chabowe Doły (ravine) × 10
- 2 — Brachial valve, internal cast; specimen No. 919, Chabowe Doły (ravine) × 6
- 3 — Brachial valve, internal cast; specimen No. 916, Chabowe Doły (ravine) × 5
- 4 — Brachial valve, internal cast; specimen No. 918, Chabowe Doły (ravine) × 5
- 5 — Brachial valve, internal cast; specimen No. 856, Chabowe Doły (mill) × 5
- 6 — Pedicle valve, internal cast, top view; specimen No. 862, Chabowe Doły (mill) × 6
- 7 — Pedicle valve, internal cast, top view; specimen No. 921, Chabowe Doły (ravine) × 10
- 8 — Three brachial valves, internal cast; specimen No. 853, Chabowe Doły (mill) × 5
- 9 — Pedicle valve, internal cast, front view; specimen No. 876, Chabowe Doły (mill) × 8
- 10 — Pedicle valve, internal cast, top view; specimen No. 928, Chabowe Doły (ravine) × 5
- 11 — Pedicle valve, internal cast, top view; specimen No. 888, Chabowe Doły (mill) × 5
- 12 — Pedicle valve, internal cast, front view; specimen No. 854, Chabowe Doły (mill) × 5
- 13 — Pedicle valve, 13a — internal cast, 13b — external cast; specimen No. 1165, Wąworków × 5

*Orustia cf. lenticularis* (Wahlenberg)

- 14 — Pedicle valve, internal cast; specimen No. 834, Wąworków × 3
- 15 — Brachial valve, internal cast; specimen No. 831, Wąworków × 3
- 16 — Pedicle valve, 16a — external cast, 16b — internal cast; specimen No. 835, Wąworków × 3
- 17 — Pedicle valve, 17a — external cast, 17b — internal cast; specimen No. 836, Wąworków × 3

## PL. III

*Cambrocrinus regularis* gen. n., sp. n.

- |                                                                                                                                                 |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1 — Isolated plate, external cast; specimen No. 1106, Wąworków                                                                                  | × 3 |
| 2 — Isolated plate, external cast; specimen No. 1105, Wąworków                                                                                  | × 3 |
| 3 — Isolated plate, external cast; specimen No. 982, Wąworków                                                                                   | × 2 |
| 4 — Stem; specimen No. 971, Wąworków                                                                                                            | × 3 |
| 5 — Lower part of calyx with stem, nearby <i>Acrotreta multa</i> ; 5a — internal cast, 5b — external cast; specimen No. 970, holotype, Wąworków | × 3 |
| 6 — Lower part of calyx with stem, 6a — external cast, 6b — internal cast; specimen No. 1111, Wąworków                                          | × 3 |
| 7 — Stem, external cast; specimen No. 976, Wąworków                                                                                             | × 2 |
| 8 — Calyx, external cast; specimen No. 1120, Wąworków                                                                                           | × 2 |
| 9 — Calyx, in the foreground part of mould, in the back external cast; specimen No. 1103, Wąworków                                              | × 3 |
| 10 — Stem, external cast; specimen No. 978, Wąworków                                                                                            | × 3 |
| 11 — Calyx and bases of arms in upper part, 11a — external cast, 11b — internal cast; specimen No. 1110, Wąworków                               | × 2 |
| 12 — Calyx and, close by, an isolated plate; specimen No. 972, Wąworków                                                                         | × 3 |
| 13 — Calyx, internal cast; specimen No. 974, Wąworków                                                                                           | × 2 |

## PL. IV

*Agnostus (Homagnostus) pseudobesus* sp. n.

- |                                                                                                          |     |
|----------------------------------------------------------------------------------------------------------|-----|
| 1 — Cephalon; specimen No. 201, hylotype, Chabowe Doły (mill)                                            | × 6 |
| 2 — Cephalon, 2a — internal cast, 2b — external cast; specimen No. 203, Chabowe Doły (mill)              | × 5 |
| 3 — Cephalon; specimen No. 202, Chabowe Doły (mill)                                                      | × 6 |
| 4 — Pygidium; specimen No. 204, Chabowe Doły (mill)                                                      | × 5 |
| 5 — Pygidium, nearby cranidium of <i>Sphaerophthalmus alatus</i> ; specimen No. 205, Chabowe Doły (mill) | × 3 |

*Olenus rarus* sp. n.

- |                                                   |     |
|---------------------------------------------------|-----|
| 6 — Cranidium; specimen No. 1, holotype, Wąworków | × 2 |
| 7 — Cranidium; specimen No. 122, Wąworków         | × 3 |
| 8 — Cranidium; specimen No. 108, Wąworków         | × 3 |

9 — Incomplete cranidium; specimen No. 10, Wąworków	× 5
10 — Incomplete cranidium; specimen No. 4, Wąworków	× 2
11 — Cranidium; specimen No. 5, Wąworków	nat. size
12 — Cranidium, external cast; specimen No. 8, Wielka Wiśniówka	× 2
13 — Cranidium, external cast; specimen No. 6, Wąworków	× 1,5
14 — Fragment of large cranidium; specimen No. 106, Wąworków	nat. size
15 — Fragment of large cranidium; specimen No. 107, Wąworków	× 2
16 — Hypostoma; specimen No. 104, Wąworków	× 3
17 — Cranidium, 17a — internal cast, 17b — external cast; specimen No. 3, Wąworków	× 2
18 — Cranidium; specimen No. 103, Wąworków	× 3
19 — Librigena; specimen No. 123, Wąworków	× 1.5

## PL. V

*Beltella trae* sp. n.

1 — Cranidium; specimen No. 506, Chabowe Doły (mill)	× 3
2 — Cranidium; specimen No. 503, Chabowe Doły (mill)	× 2
3 — Cranidium; specimen No. 504, Chabowe Doły (mill)	× 3
4 — Cranidium; specimen No. 357b, Chabowe Doły (mill)	× 1.5
5 — Cranidium, nearby another cranidium of the same species, also a cranidium of <i>Sphaerophthalmus alatus</i> ; specimen No. 500, holotype, Chabowe Doły (mill)	× 3
6 — Cranidium; specimen No. 507, Chabowe Doły (mill)	× 3
7 — Cranidium; specimen No. 509, Chabowe Doły (mill)	× 4
8 — Cranidium; specimen No. 510, Chabowe Doły (mill)	× 3
9 — Cranidium; specimen No. 505, Chabowe Doły (mill)	× 2.5
10 — Cranidium; specimen No. 515, Chabowe Doły (mill)	× 3
11 — Cranidium; specimen No. 513, Chabowe Doły (mill)	× 2
12 — Librigena, nearby cast of cranidium of <i>Sphaerophthalmus alatus</i> ; specimen No. 502, Chabowe Doły (mill)	× 2
13 — Cranidium; specimen No. 605, Chabowe Doły (mill)	× 3
14 — Cranidium, nearby two cranidia of <i>Peltura? protopeltorum</i> and two specimens of <i>Acrotreta multa</i> ; specimen No. 527, Chabowe Doły (mill)	× 3
15 — Cranidium, and, close by, pleura, probably of the same species; specimen No. 501, Chabowe Doły (mill)	× 3



## PL. VI

*Sphaerophthalmus alatus* (Boeck)

- |                                                                                                                                                                                                            |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1 — Cranidium; specimen No. 470, Chabowe Doly (ravine); 1a — × 5, 1b — × 3.                                                                                                                                |     |
| 2 — Cranidium, nearby <i>Acrotreta multa</i> ; specimen No. 470b, Chabowe Doly (mill)                                                                                                                      | × 3 |
| 3 — Cranidium; specimen No. 366, Chabowe Doly (mill)                                                                                                                                                       | × 3 |
| 4 — Cranidium, nearby <i>Acrotreta multa</i> ; specimen No. 468, Chabowe Doly (mill)                                                                                                                       | × 3 |
| 5 — Cranidium; specimen No. 381, Chabowe Doly (mill)                                                                                                                                                       | × 3 |
| 6 — Cast of cranidium; specimen No. 474, Chabowe Doly (ravine)                                                                                                                                             | × 3 |
| 7 — Librigena; specimen No. 475, Chabowe Doly (ravine)                                                                                                                                                     | × 5 |
| 8 — Cranidium; specimen No. 468, Chabowe Doly (mill)                                                                                                                                                       | × 6 |
| 9 — Cranidium; specimen No. 378, Chabowe Doly (mill)                                                                                                                                                       | × 3 |
| 10 — Cranidium; specimen No. 467, Chabowe Doly (mill)                                                                                                                                                      | × 3 |
| 11 — Librigena; specimen No. 480, Chabowe Doly (ravine)                                                                                                                                                    | × 2 |
| 12 — Two cranidia; specimen No. 358, Chabowe Doly (mill)                                                                                                                                                   | × 2 |
| 13 — Pygidium; specimen No. 499a, Chabowe Doly (ravine)                                                                                                                                                    | × 6 |
| 14 — Pygidium; specimen No. 497, Chabowe Doly (ravine)                                                                                                                                                     | × 3 |
| 15 — Two cranidia; nearby three cranidia of <i>Peltura? protopeltorum</i> and segment of thorax probably of the same species, also numerous <i>Acrotreta multa</i> ; specimen No. 252, Chabowe Doly (mill) | × 2 |

*Parabolina bella* sp. n.

- |                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------|-----|
| 16 — Cranidium; specimen No. 648, Chabowe Doly (ravine)                                                   | × 3 |
| 17 — Cranidium of young specimen; specimen No. 647, Chabowe Doly (ravine)                                 | × 5 |
| 18 — Cranidium; specimen No. 651, holotype, Chabowe Doly (mill)                                           | × 3 |
| 19 — Cranidium; specimen No. 641, Chabowe Doly (ravine)                                                   | × 4 |
| 20 — Cranidium, nearby cranidium of <i>Peltura? protopeltorum</i> ; specimen No. 652, Chabowe Doly (mill) | × 2 |
| 21 — Cranidium; specimen No. 640, Chabowe Doly (ravine)                                                   | × 2 |

## PL. VII

*Peltura? protopeltorum* sp. n.

- |                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 — Cranidium; 1a, 1b — top view, 1c — side view, 1d — front view; specimen No. 220, holotype, Chabowe Doly (mill), 1a — × 2.5; 1b, 1c, 1d — × 2. |
|---------------------------------------------------------------------------------------------------------------------------------------------------|

- 2 — Cranidium; specimen No. 246, Chabowe Doły (mill) × 3  
 3 — Cranidium; 3a — top view, 3b — side view, 3c — front view; specimen No. 242, Chabowe Doły (mill) × 2  
 4 — Cranidium; specimen No. 221, Chabowe Doły (mill) × 2.5  
 5 — Cranidium; specimen No. 241, Chabowe Doły (mill) × 2  
 6 — External cast of librigena; specimen No. 229, Chabowe Doły (mill) × 2  
 7 — External cast of librigena; specimen No. 233, Chabowe Doły (mill) × 3  
 8 — Two cranidia; specimen No. 243, Chabowe Doły (mill) × 2  
 9 — External cast of librigena; specimen No. 227, Chabowe Doły (mill) × 3  
 10 — Two cranidia, higher up cranidium of *Beltella irae*; specimen No. 256, Chabowe Doły (mill) × 2  
 11 — Cranidium, nearby librigena; specimen No. 245, Chabowe Doły (mill) × 2

*Protopeltura olenusorum* sp. n.

- 12 — Cephalon and part of thorax, 12a — latex cast, 12b — external cast; specimen No. 40, holotype. Wielka Wiśniówka × 2  
 13 — External cast of cranidium and of a part of thorax; specimen No. 51, Wąworków × 3  
 14 — Cranidium; specimen No. 54, Wąworków × 3  
 15 — Cranidium; specimen No. 41, Wąworków × 3

## PL. VIII

*Protopeltura olenusorum* sp. n.

- 1 — Cranidium with part of thorax of a young specimen; specimen No. 52, Wąworków × 5  
 2 — Cranidium; specimen No. 53, Wąworków × 5  
 3 — Cranidium; specimen No. 47, Wąworków × 3

*Protopeltura* sp.

- 4 — Cranidium; specimen No. 70, Wąworków × 2  
 5 — Cranidium, 5a — internal cast, 5b — external cast; specimen No. 71, Wąworków × 1.5

*Acerocare? klonowkae* sp. n.

- 6 — Cranidium; specimen No. 620, holotype, Chabowe Doły (ravine) × 4  
 7 — Cranidium; specimen No. 621, Chabowe Doły (ravine) × 3

- 8 — Cranidium; specimen No. 231, Chabowe Doły (mill) × 3  
 9 — Cranidium; specimen No. 623, Chabowe Doły (ravine) × 3  
 10 — Cranidium; specimen No. 622, Chabowe Doły (ravine) × 3  
 11 — Librigena, probably of the same species; specimen No. 630, Chabowe Doły (ravine) × 2

*?Parabolina sp.*

- 12 — Pygidium, latex cast; specimen No. 253, Chabowe Doły (mill) × 2  
 13 — Pygidium, cast; specimen No. 359b, Chabowe Doły (mill) × 2

*?Beltella sp.*

- 14 — Pygidium, cast; specimen No. 704, Chabowe Doły (mill) × 4  
 15 — Pygidium, cast; specimen No. 700, Chabowe Doły (mill) × 3

*Peltura scarabeoides scarabeoides* (Wahlenberg)

- 16 — Pygidium; specimen No. 663, Chabowe Doły (ravine) × 3  
 17 — Pygidium; specimen No. 655, Chabowe Doły (ravine) × 3  
 18 — Pygidium; specimen No. 661, Chabowe Doły (ravine) × 3  
 19 — Pygidium; specimen No. 656, Chabowe Doły — Wąwóz (ravine) × 6

*?Peltura sp.*

- 20 — Pygidium; specimen No. 672, Chabowe Doły (mill) × 3  
 21 — Pygidium; specimen No. 675, Chabowe Doły (mill) × 3  
 22 — Pygidium; specimen No. 703, Chabowe Doły (mill) × 3  
 23 — Pygidium; specimen No. 670, Chabowe Doły (mill) × 3  
 24 — Pygidium; specimen No. 685, Chabowe Doły (mill) × 6

*Fotografie wykonała B. Drozd*  
*Photographs by B. Drozd*

