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STANISŁAW ORŁOWSKI

Lower Cambrian biostratigraphy in the Holy Cross Mts, based on the trilobite family Olenellidae

ABSTRACT: The present paper contains a revision of trilobites of the family Olenellidae from the Lower Cambrian of the Holy Cross Mts, based on an abundant material collected by the writer and by the late Professor J. Samsonowicz. The material from borings in East Poland has also been used for comparative purposes. The following species and subspecies of the Olenellidae are described: *Schmidtiellus panowi* (Samsonowicz, 1959), *Holmia kjerulfi marginata* subsp. n., *H. glabra* sp. n., *H. orienta* sp. n., and *Kjerulfia orcina* sp. n. The biostratigraphic division of the Lower Cambrian in the Holy Cross Mts has been presented and compared with those in East Poland and other areas in East Europe and Scandinavia on the basis of the range of the trilobites examined.

INTRODUCTION

The Lower Cambrian, documented by *Holmia kjerulfi*, was discovered in the Holy Cross Mts by Samsonowicz (1918). A year later, Czarnocki (1919) considerably extended its area of occurrence in the western part of the region, also yielding *Holmia kjerulfi*. Unfortunately, neither paleontological descriptions, nor illustrations of the Lower Cambrian trilobites were given by the two investigators. The species *Holmia kjerulfi* was repeatedly mentioned in their subsequent papers, in which they emphasized its considerable importance to the stratigraphy of the Lower Cambrian in the Holy Cross Mts and, mostly on the basis

of trilobites, divided the Lower Cambrian into several zones. Czarnocki (1926) even went so far that he recognized new species within the Olenellidae, but, unfortunately, he confined himself to giving them new specific names only (*nomina nuda*). During the last war, his collections were destroyed and their remains which survived the fire at the Museum of Geological Survey, now devoid of records, cannot be referred to the localities in which the trilobites occur.

Thus, accumulating new collections of the Lower Cambrian trilobites had to be started after World War II practically from the scratch. The late Professor J. Samsonowicz, who collected a considerable amount of specimens and published a paper containing paleontological descriptions and protographs of the Olenellidae from the Holy Cross Mts (Samsonowicz 1959), primarily contributed to the founding of a new collection. Further specimens were collected by Dr. M. Piwocki, Dr. K. Ordyńska and M. Hoffmann, M. Sc., as they prepared their graduate papers. The collection of the Lower Cambrian trilobites has also been increased by the present writer's own finds.

Now, a collection of about 100 specimens of the Olenellidae, housed at the Institute of Geology of the Warsaw University, is at the writer's disposal. All of them occur in fine-grained, hard sandstones, in which the preparation of trilobites poses considerable problems. Usually, the dorsal exoskeletons are divided into cephala and thoracic segments but frequently they are crushed and form smaller fragments. There also occur extraocular cheeks, hypostomata, as well as pleurae and pygidia, while greater parts of thoraxes are less frequent. Some specimens are varyingly deformed by tectonic factors. On the other hand, an excellent state of preservation, expressed in a visible ornamentation of particular parts of dorsal exoskeletons and in finding larval forms, may also be observed frequently.

The elaboration of this material has recently become possible, since the knowledge of the Olenellidae was considerably extended in the last two decades. This new period in the studies on the Olenellidae was started by Hupé (1952) who described many species of the genera *Fallotaspis* and *Neltneria*, as well as other Olenellidae from Marocco. Repina (1961) described a new genus, *Fallotaspidella*, from the Lower Cambrian of Siberia. The presence of *Fallotaspis* and *Daguinaspis* was found by Nelson & Hupé (1964) in the Lower Cambrian of California. Tchernysheva (*in* Kiryanov & Tchernysheva 1967) described a new genus, *Wolynaspis*, from the Western Ukraine. The species *Holmia kjerulfi* and *Kjerulfia selandica* were described by Poulsen (1969) from the Lower Cambrian of Denmark. Within the range of new genera, *Parafallotaspis*, *Bradyfallotaspis* and *Holmiella* new species were described by Fritz (1972) from the Lower Cambrian of Northwestern Canada. Bergström (1973b) conducted a revision of the Olenellidae from the Balto-Scandinavian area, erecting in addition new species within the genera *Holmia* and *Schmidtiellus*.

The terminology applied to particular parts of the Olenellidae dorsal exoskeleton is more involved than that in other groups of trilobites. The terminology taken from the *Treatise on Invertebrate Paleontology* (Part O) and from Bergström (1973a) is used by the present writer, who — to avoid any mistakes — states the dimensions precisely (*tr., sag., exsag.*) as suggested by the *Treatise*.

Among the Lower Cambrian trilobites from the Holy Cross Mts, relatively frequent are enrolled specimens, but all of them belong to the non-olenellid genera *Strenuella, Strenuaeva* or *Ellipsocephalus*. The specimens of the Olenellidae in the writer's possession include those indicating the possibility of the enrolling also in this family; *e.g.*, in *Holmia kjerulfi marginata* subsp. n. (Pl. 2, Fig. 5) part of thorax with eight thoracic segments is strongly convex, but all of the thoracic segments are connected with each other.

All the specimens described in the present paper are housed at the Institute of Geology of the Warsaw University, except for Nos. *1-II-94* and *1211-II-48*, which are the property of the Museum of the Geological Survey of Poland.

Acknowledgements. The writer's most sincere thanks are extended to Dr. J. Bergström from the Institute of Historical Geology and Paleontology of the University of Lund, Sweden for discussing many problems, examining the collection of trilobites and making available the manuscript of his yet unpublished paper (Bergström 1973b).

The writer also feels indebted to the management of the Geological Institute (Geological Survey of Poland) for making available the collection of Lower Cambrian trilobites and for lending the specimens.

THE LOWER CAMBRIAN STRATIGRAPHY OF SCANDINAVIA AND CENTRAL EUROPE BASED ON TRILOBITES

Along the south-western and western border of the Fenno-Sarmatian Platform, considerable areas are taken by the Cambrian deposits, which are, therefore, of a considerable importance to stratigraphy, although their exposures take of course much smaller areas. In the Oslo Graben, Norway, in Southern Sweden, Estonia, Eastern Poland and Western Ukraine, the Lower Cambrian displays a development typical of epicontinental seas, whose waters invaded the peneplained margins of an extensive, pre-Cambrian platform. The epicontinental deposits are marked by a relatively small thickness of the Lower Cambrian, their horizontal occurrence, stratigraphic gaps and a comparatively rare occurrence of trilobites.

The margins of the platform was flooded by the Lower Cambrian epicontinental seas, which came from geosynclinal basins directly adjoining the platform. In these geosynclines, the marine deposits, already known from the Upper Ryphaean, usually turn into the marine deposits of the Cambrian. Now, the geosynclinal Cambrian deposits may be best recognized in the Holy Cross Mts which determines the key

Table 1
Stratigraphy of the Lower Cambrian in Scandinavia and Middle Europe

Series	Zone	Norway	Denmark	Sweden	Poland		USSR	
					Holy Cross Mts	East Poland	Estonia	West Ukraine
LOWER CAMBRIAN	Protolenus	Strenuella	———	Strenuella	Germarogyge and Protolenus	Germarogyge and Ellipsocephalus	———	———
	Holmia	Kjerulfia and Holmia	Kjerulfia and Holmia	Schmidtiellus and Holmia	Schmidtiellus, Kjerulfia and Holmia	Holmia	Schmidtiellus	Schmidtiellus and Wolynaspis
	sub-Holmia	no trilobites	no trilobites	no trilobites	no trilobites	no trilobites	no trilobites	no trilobites

position of the Cambrian of these area in a stratigraphic correlation with the epicontinental areas of the margin of platform. The Lower Cambrian of the Holy Cross Mts may easily be correlated with that of Scandinavia (Table 1) and it is considerably more extensively documented paleontologically not only by trilobites, but also by brachiopods, hyolithids, gastropods and jellyfish. Trace fossils are also numerous. The thickness of the Lower Cambrian is also considerably larger in this region. reaching at least 800 m. A strong folding, typical of geosynclinal areas and a considerable extent of being covered with the Tertiary and Quaternary deposits (*cf.* Fig. 1) are, on the other hand, poor characters of the Holy Cross Cambrian.

In Scandinavia (Kiaer 1916, Henningsmoen 1956), the Lower Cambrian is divided into three zones, the lowermost not containing trilobites, but only the fossils belonging to other orders. The middle, Holmia Zone is represented by an index trilobite, while the uppermost, Protolenus Zone is in this area exceptionally thin and trilobites it contains are represented by an endemic species, *Strenuella linnarssoni*. A more complete paleontological documentation of the Holmia Zone has recently been supplied by Bergström (1973b), who described from Scania the genus *Schmidtiellus* and new species within the genus *Holmia*.

In the Holy Cross Mountains, the Lower Cambrian is also divided into the three zones (Table 1) named above, but its paleontological documentation is richer (Orłowski 1968). The Sub-Holmia Zone is here at least 200 m thick, displays a sedimentary continuity with the uppermost marine pre-Cambrian, does not contain trilobites. but abounds in other fossils (Żakowa & Jagielska 1970).

The Holmia Zone, about 400 m thick, contains such Olenellidae as: *Schmidtiellus panowi* (Samsonowicz), *Holmia kjerulfi marginata* subsp. n.,

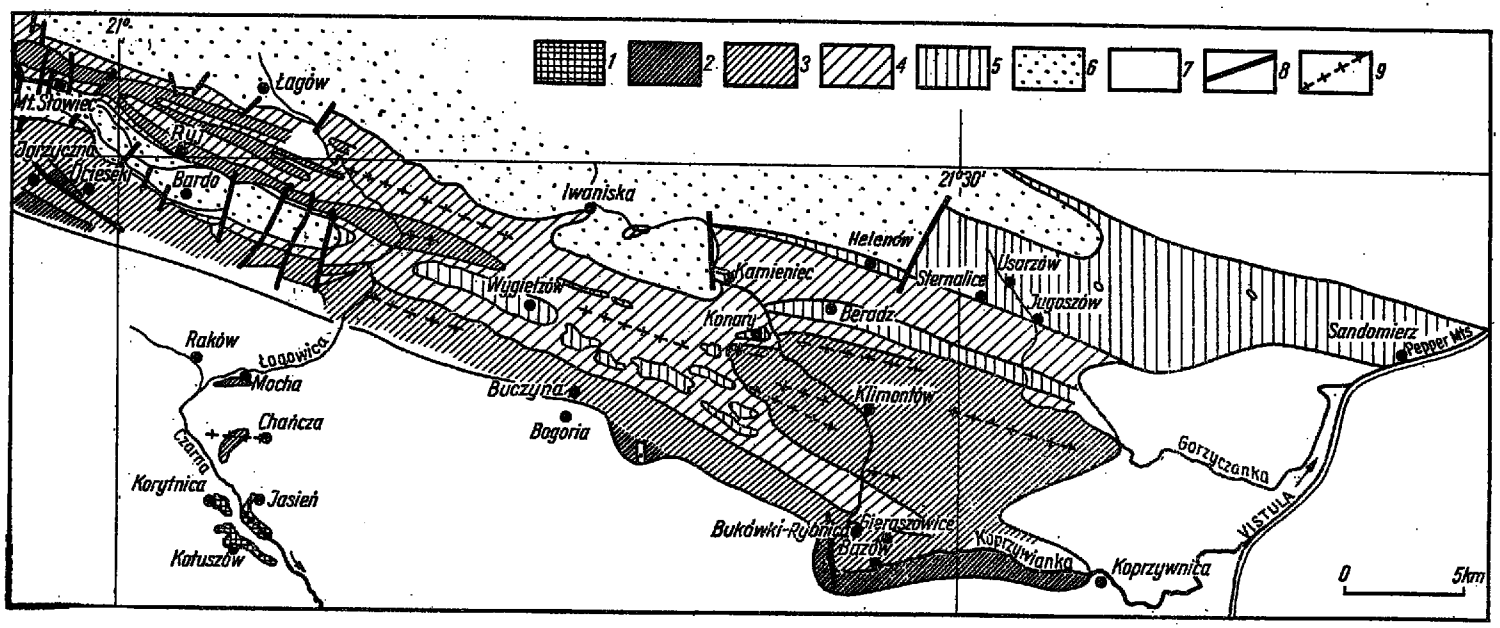


Fig. 1

Geological map of the Klimontów anticlinorium (according to Samsonowicz 1962; completed by the author in 1971, and in this paper) *1* Precambrian, *2* Lower Cambrian, sub-Holmia Zone, *3* Lower Cambrian, Holmia Zone, *4* Lower Cambrian, Protolenus Zone, *5* Middle Cambrian, *6* post-Cambrian Paleozoic deposits, *7* marine Miocene (Tortonian), *8* faults, *9* anticlinal axes

H. orienta sp. n., *H. glabra* sp. n. and *Kjerulfia orcina* sp. n. of which *H. kjerulfi marginata* and *K. orcina* are the most frequent fossils. These two species, most important to stratigraphy, very rarely occur together at Ociesęki and Igrzyczna sequence, which are the best exposures of the Lower Cambrian in the Holy Cross Mts. In other localities, their separate occurrence is a rule. In the future, the two species will perhaps provide a basis for determining two biostratigraphic zones or subzones to replace the present Holmia Zone. The occurrence in this zone of the genus *Schmidtiellus*, along with the genera *Holmia* and *Kjerulfia*, explains the stratigraphic correlations between the Lower Cambrian of the Holy Cross Mts, of Estonia and of the Ukraine.

Apart of the Holy Cross geosyncline, the Lower Cambrian was also recognized in East Poland, where it was reached by many borings. Several trilobites, including the Olenellidae, indicative of the Holmia Zone (Lendzion 1972, Orłowski 1973), were found in the deposits pierced there.

Lower Cambrian deposits, sedimentologically and paleogeographically similar to that of East Poland, were also pierced in the Western Ukraine (Kiryanov & Tchernysheva 1967). Its middle part was documented by *Wolynaspis unica* Tchernysheva, and the occurrence of the genus *Schmidtiellus* was also found.

The Protolenus Zone in the Holy Cross Mts, reaching about 200 m in thickness, contains many fossils, including the trilobites of which the genera *Protolenus*, *Strettonia* and *Germaropyge* (*cf.* Orłowski 1968) are most important stratigraphically. In East Poland, *Ellipsocephalus*, *Kingaspis* (*cf.* Lendzion 1972) and *Germaropyge* (*cf.* Orłowski 1973) are index fossils of this zone.

The trilobites of the Protolenus Zone display the greatest relationship to corresponding trilobites in Great Britain (*cf.* Cowie, Rushton & Stubblefield 1972), whereas in Scandinavia the fauna typical of this zone is replaced by *Strenuella linnarssoni*. In Estonia and the Ukraine, no trilobites were found in this zone. In the present writer's opinion, the lack of trilobites in this area is caused by a gradual regression of the sea. The marine basin became more and more shallow, its coastal line changed and the connection with an open, geosynclinal sea deteriorated.

TRACE FOSSILS

The Cambrian deposits of the Holy Cross Mts are also marked by many, well-preserved traces of the trilobite life activity. They may be observed throughout the Cambrian profile (Orłowski, Radwański & Roniewicz 1970), but particularly frequent they are in the Upper Cambrian (Orłowski, Radwański & Roniewicz 1970, 1971).

Relatively numerous trace fossils were found in the Lower Cambrian together with the Olenellidae, more frequent being the *Cruziana* and less so the *Rusophycus*. It is important to answer the question whether the trace fossils found may actually be attributed to the Olenellidae or were formed with the participation of the representatives of the genera *Strenuella, Strenuaeva* or *Ellipsocephalus*, found in this region considerably more frequently than the Olenellidae. The fact that adult specimens of the last-named family are considerably larger than those of the Ellipsocephalidae helps solve this problem. Thus, only large trace fossils, in formation of which the role of the Ellipsocephalidae may with a complete certainty be excluded, are regarded as those in whose formation the Olenellidae took part.

The most numerous group of trace fossils is represented by *Cruziana rusoformis* Orł., Radw. & Ron., accurately recognized (Orłowski, Radwański & Roniewicz 1970) from the Holmia Zone of Rybnica and Malkowice and equally frequent at Ociesęki and Igrzyczna. One of the specimens (Pl. 6, Fig. 1) is preserved with its anterior part, corresponding to a phase in which a trilobite started from the bottom. Clearly outlined traces of endopodites arranged at a larger angle to the median furrow than in the posterior part are visible in the anterior part. The posterior part is marked by more delicate traces of endopodites, arranged at a smaller angle. It is likely that the traces visible in the anterior part were formed with the participation of anterior appendages, which were more robust and perhaps more strongly operated when the animal furrowed the deposit. Usually, these strongly outlined traces of appendages were modified and by external parts of endopodites and by the posterior pairs of endopodites which were smaller and, consequently left traces nearer the median furrow. It is likely that the posterior endopodites make somewhat different movements than the anterior ones. When a trilobite started from the bottom, the movements of endopodites were probably more vigorous and the traces of the anterior endopodites were not deformed by the posterior ones.

Another specimen of *Cruziana*, shown in Pl. 5, Fig. 6, reaches as much as 10 cm in width and its traces of endopodites are arranged at a large angle to the median furrow. Its very large dimensions seem to be indicative that this *Cruziana* was formed with a participation of a new species, that is, *Kjerulfia orcina* sp. n., which is marked by a considerable size.

SYSTEMATIC DESCRIPTION

Family **Olenellidae** Vogdes, 1873
Genus *SCHMIDTIELLUS* Moberg, 1906
Schmidtiellus panowi (Samsonowicz, 1959)
(Pl. 1, Figs 5*a*—*b*, 6)

1959. *Holmia panowi* nova species; Samsonowicz, pp. 449—450, Pl. 2, Fig. 12*a*—*b*.
1973a. *Schmidtiellus panowi* (Samsonowicz); Bergström, pp. 13, 17, 19.

Lectotype: a partly preserved cephalon with some thoracic segments, presented by Samsonowicz (1959, Pl. 2, Fig. 12*a*—*b*; collection of the Museum of the Geological Survey, No. I-II-94).

Material. — A specimen preserved as a cephalon with thoracic segments, three partly preserved cephala and some fragments of thoracic segments.

Diagnosis. — A *Schmidtiellus* species with the palpebral lobe reaching the level of the occipital furrow, median node or spine, situated on *L0* and *L1*; thorax with the second thoracic segment longer (*sag.*) than others (= macropleura).

Description. — Glabella with occipital lobe (*L0*) and the first glabellar lobe (*L1*) longer than *L2* or *L3* and separated by a furrow from the palpebral area. Frontal lobe (*La*) convex, rounded anteriorly, slightly narrower (*tr.*) than the posterior part of glabella. Occipital lobe wider (*tr.*) than the first glabellar lobe. The third lobe (*L3*) short (*sag.*) and curving posteriorly in its outer course. Occipital furrow (*S0*) short (*tr.*); *S1* longer; *S2* and *S3* almost joining across glabella. Median node or spine strongly damaged but large (especially its basic part) and situated on the occipital lobe and the first glabellar lobe. Palpebral lobe bilobate, wide (*tr.*) and reaching the level of the occipital furrow; palpebral area very narrow (*tr.*).

Thorax partly preserved, eight thoracic segments visible (exact number of thoracic segments unknown). Pleural region slightly narrower (*tr.*) or almost as broad as the axial one. Pleurae with pleural furrows directed outward-backward, pleural spines short and sharp, directed strongly posteriorly. The second thoracic segment longer (*sag.*) than others, that is, the macropleura. The third and other thoracic segments much shorter (*sag.*) than the two first ones. A large spine on axis marks the boundary between prothorax and opisthothorax.

Pygidium unknown.

Discussion. — The characteristics of the genus *Schmidtiellus* Moberg, 1906, were discussed by Bergström (1973b), who also gave its diagnosis and pointed out the difficulties of a complete recognotion of this genus, caused by a very scarce, and partly lost, paleontological material. He also assigned to this genus four species, including that under study.

Schmidtiellus panowi differs from *Schmidtiellus mickwitzi torelli* (Moberg, 1899) *sensu* Bergström (1973b) in its smaller palpebral area, shorter (*sag.*) palpebral lobes, peculiar longitudinal furrows bounded by narrow crests on each side of glabella on *L1*, narrower axial region of thorax and macropleurid second thoracic segment.

From *Schmidtiellus reetae* Bergström, 1973, the new species differs in an exceptionally small palpebral area and differently situated median spine.

Genus *HOLMIA* Matthew, 1890
Holmia kjerulfi marginata subsp. n.
(Pl. 1, Figs 1—4 and Pl. 2, Figs 1—6)

1916. *Holmia kjerulfi* Linnarsson; Kiaer, pp. 58—70, Pls 6—8, Pl. 14, Fig. 3 [with references to older contributions].
1918. *Holmia Kjerulfi* Linnarss.; Samsonowicz, pp. 702—705.

PLATE 1

Holmia kjerulfi marginata subsp. n.

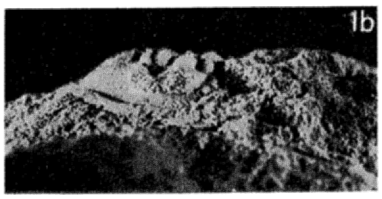
1a, b — Cephalon (holotype): *a* top view, *b* lateral view; Igrzyczna (specimen No. 55).
2a, b — Cephalon: *a* external mould, *b* latex; Igrzyczna (34).
3a, b — Cephalon: *a* external mould, *b* latex; Igrzyczna (52).
4 — Partly preserved cephalon; Igrzyczna (49).

Schmidtiellus panowi (Samsonowicz, 1959)

5a, b — Cephalon with a part of thorax (lectotype): *a* top view, *b* lateral view; Ryj hill near Bardo (Museum of the Geological Survey, No. *1-II-94*).
6 — Spine between the prothorax and opistothorax; Gieraszowice (*Gr 24*).

All photos × 2; taken by B. Drozd, M. Sc.


1a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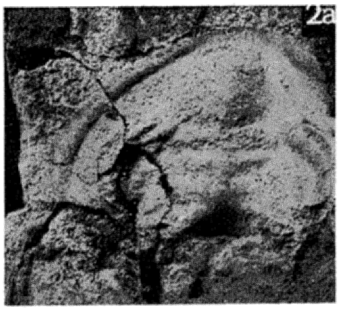
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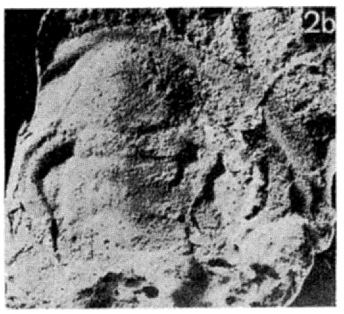
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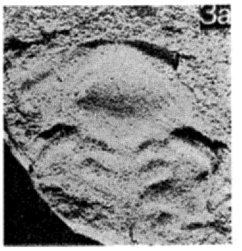
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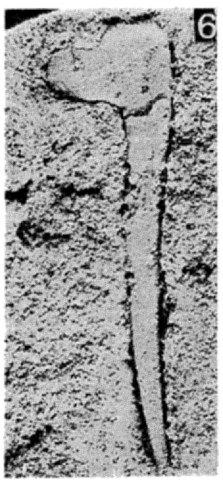
4


5b


5a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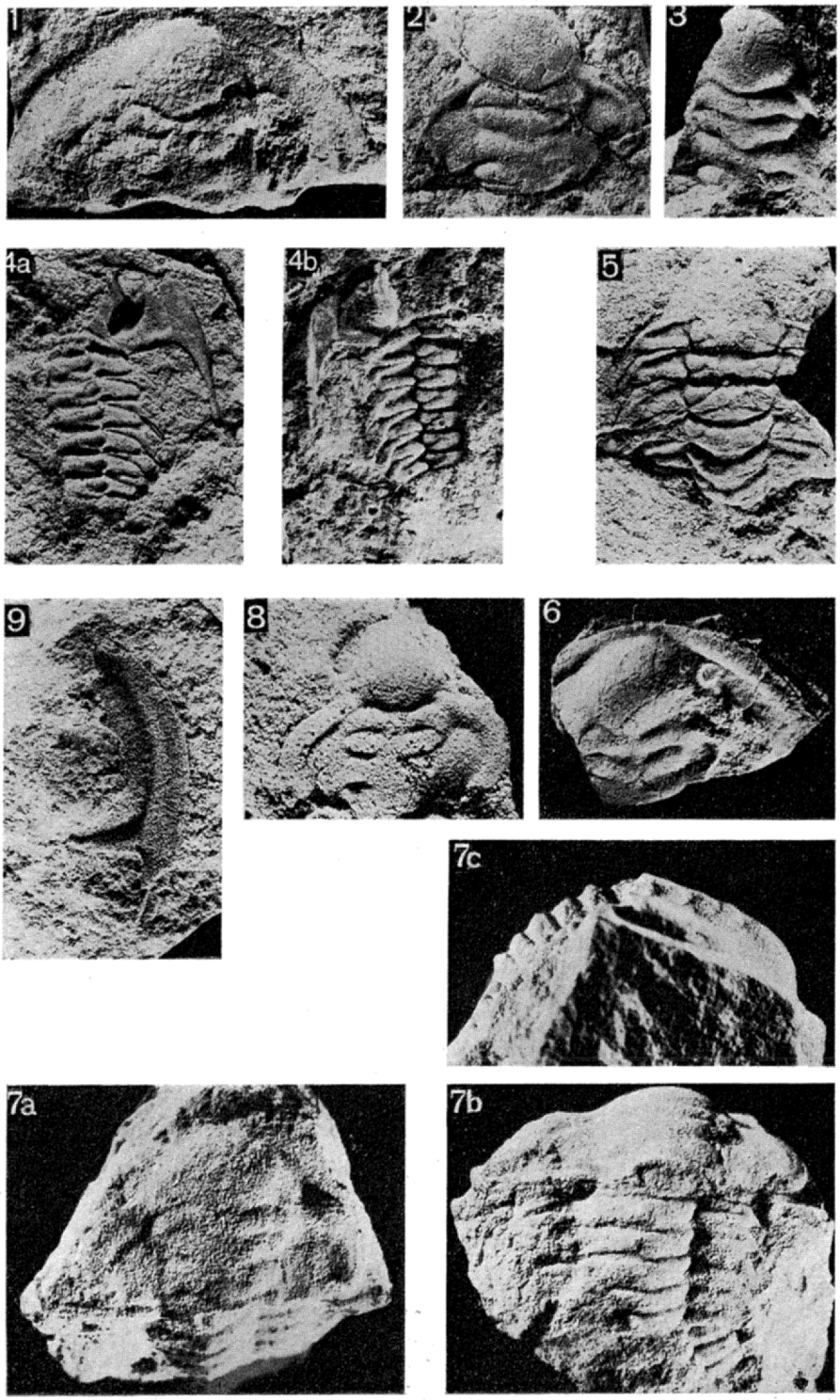
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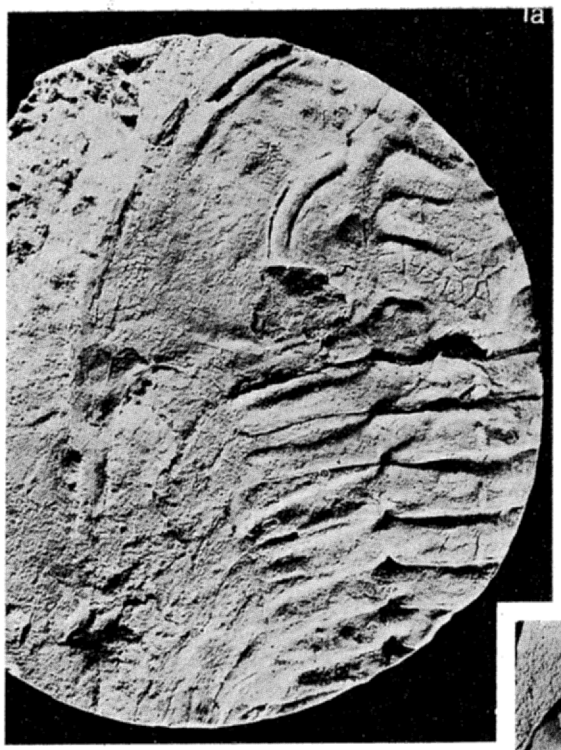
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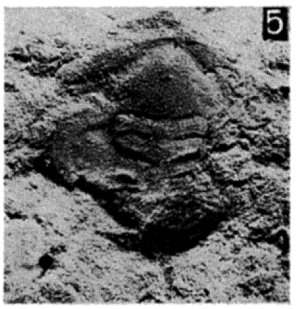
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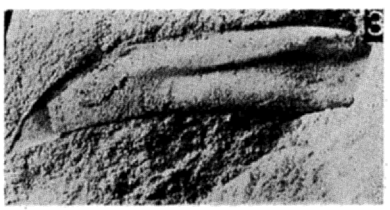
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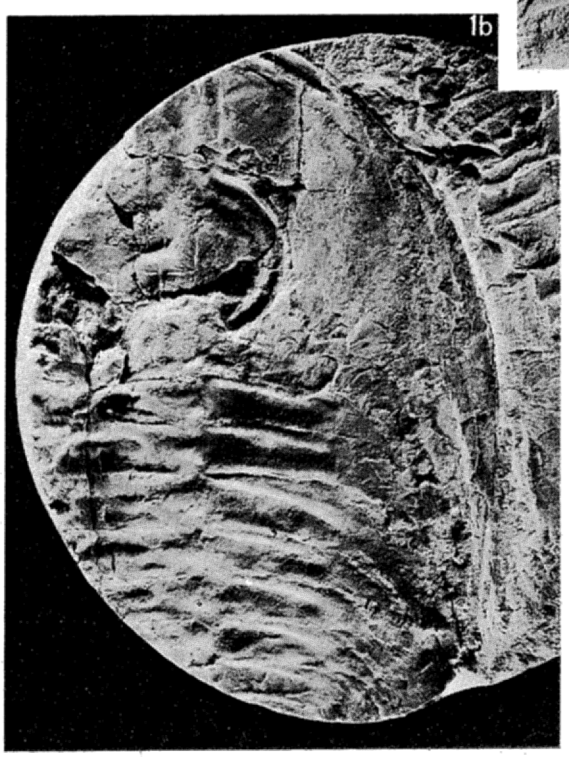
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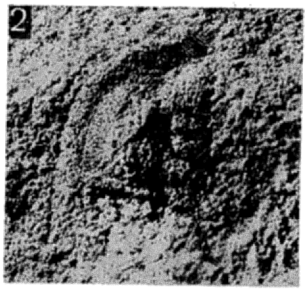
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6

Description. — Cephalon semioval with a convex glabella reaching close to anterior margin. Posterior margin nearly straight; a small metagenal spine situated below the palpebral lobe.

Glabella clavate, through *L0* and *L1* paralell sided, gradually extending anteriorly, the widest across the frontal lobe. Frontal lobe voulted and anteriorly rounded. Glabellar lobes very similar to those of *H. kjerulfi* except for *L3* which is much wider (*tr.*). Glabellar furrows *S0* and *S1* very similar to those of *H. kjerulfi*, while *S2* and *S3* are much longer (*tr.*) and connected across the glabella. Occipital node invisible but likely to exist, because of nodes are occurring on all thoracic segments. Palpebral lobe wide (*tr.*), flat, strongly curved and reaching the level of occipital furrow. Palpebral area wider (*tr.*) than in *H. kjerulfi*. Cephalic border wide (*tr.*) convex and tapering toward glabella, before which very short, poorly developed or absent at all. It is strongly convex opposite palpebral lobe and continuing in genal spine, running rather parallel to the axis.

Eight thoracic segments preserved. Thorax narrower (*tr.*) than cephalon. Axial part convex, with axial nodes in the posterior part of each ring. Dorsal furrows straight. Pleural part narrower (*tr.*) than axial, slightly convex. Pleurae longer (*tr.*) than those of *H. kjerulfi* and with a long (*tr.*), wide (*exsag.*) pleural furrow, running from dorsal furrow. Pleural furrow tapering, disappears before pleural spine. Pleural spines short, sharp, pointing outward-backward.

Pygidium unknown.

Discussion. — *Holmia glabra* sp. n. conspicuously differs from *Holmia kjerulfi* (Linnarsson, 1871) in the shape of glabella, longer (*exsag.*) palpebral lobes not divided by a furrow, straighter posterior margin, convex cephalic border, considerably wider thoracic segment (*tr.*) having longer pleural part and longer pleural furrow but shorter pleural spine.

The new species differs from *Holmia sulcata* Bergström, 1973, in a more voulted glabella, wider anteriorly and in a wider (*tr.*) palpebral lobe. From *Holmia mobergi* Bergström, 1973, it differs in the shape and convexity of glabella, longer (*tr.*) glabellar furrows and not bilobate palpebral lobe.

The new species differs from *Holmia grandis* Kiaer, 1916, in the shape of glabella, particularly its frontal lobe, in a longer (*exsag.*) palpebral lobe, narrower (*tr.*) extraocular cheek, straighter posterior margin, convex cephalic border and genal spine more parallel to the axis.

Holmia glabra sp. n. differs from *H. orienta* sp. n. in a more convex cephalon, broader (*tr.*) glabella, more curved and massive palpebral lobes, narrower (*tr.*)

PLATE 4

Kjerulfia orcina sp. n.

1a, b — Cephalon (holotype): *a* top view, *b* lateral view; Ociesęki (specimen No. *180*).
2 — Half of cephalon of a young individual; Ociesęki (*195*).
3 — Frontal lobe of glabella; Ociesęki (*198*).
4 — Half of cephalon; Igrzyczna (*94*).
5 — Part of cephalon; Ociesęki (*150*).
6 — Part of cephalon; Ociesęki (*168*).
7 — Extraocular cheek; Ociesęki (*186*).
8 — Extraocular cheek; Ociesęki (*183*).

All photos × 2, except No. 2 (× 5); taken by B. Drozd, M. Sc., except No. 4 taken by A. Jankowski

extraocular cheek and a different posterior margin. Its thorax differs from that of *H. orienta* in the lack of macropleura, a more convex axial part, axial nodes instead of axial spines, different pleural spines and narrower pleural region.

Holmia orienta sp. n.
(Pl. 3, Figs 1—3)

1972. *Holmia grandis;* Lendzion, pp. 136—137, Pl. 6, Figs 1—4; Pl. 7, Fig. 1 and Pl. 8, Fig. 2.

Holotype: the specimen No. *1211-II-48* (Museum of the Geological Survey of Poland), presented in Pl. 3, Fig. 1*a—b*.

Type horizon: Lower Cambrian, Holmia Zone.

Type locality: Łochów boring, East Poland.

Derivation of the name: Latin *orienta* — after the holotype found in East Poland.

Material. — A partly preserved cephalon and a thorax, two fragments of cephala, a fragment of thorax and a free pleura.

Diagnosis. — A very large cephalon with a broad (*tr.*), extraocular cheek, narrow palpebral area, composite posterior margin and a thorax with macropleura.

Description. — Cephalon semicircular, about twice as wide as long, slightly convex. Cephalic border broad, slightly convex or flat, turning posteriorly into long genal spines. Posterior margin nearly straight from glabella to metagenal node, from which strongly voulted anteriorly and steeply curved posteriorly toward the genal spine. Metagenal node small, situated far from glabella and outside of palpebral lobe. Genal spine solid, evenly arched, parallel to the axis, tapering and reaching the level of the fifth thoracic segment. Glabella nearly flat and almost parallel-sided, similar to that of *Holmia kjerulfi*. Occipital (*L0*) and next lobe (*L1*) long (*sag.*); *L2* and *L3* shorter; *L3* wider (*tr.*) than others, curved anteriorly and triangular. Furrows *S2* and *S3* longer (*tr.*) than others. A small occipital node seems to exist. Palpebral lobe curved, wide (*tr.*), reaching the level of occipital furrow, split in two by palpebral furrow. Palpebral area narrow (*tr.*) extraocular cheek about twice as wide as it.

Seven thoracic segments are known. Thorax narrower than cephalon, rather flat, with evenly convex axial part. The third thoracic segment is a macropleura. Axial rings with small axial spines, dorsal furrows shallow. Pleurae flat, the first of them reaching to the distance of metagenal node and from this point on increasing to form a large, solid pleural spine. Pleural furrow wide (*exsag.*), long (*tr.*), running obliquely from the dorsal furrow toward the spine.

Dorsal exoskeleton ornamented by small meshes; cephalic border and genal spines covered by fine intertwining lines.

Pygidium unknown.

Discussion. — Lendzion (1972) described a part of a large cephalon and thorax from the Łochów boring, East Poland, as *Holmia grandis* Kiaer, 1916. After

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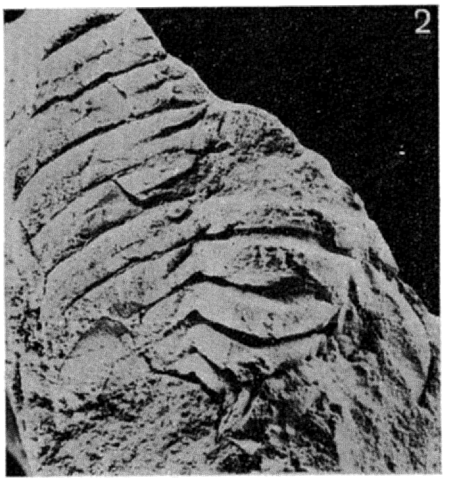
PLATE 5

Kjerulfia orcina sp. n.

1 — Anterior part of thorax; Ociesęki (specimen No. *204*).
2 — Posterior part of thorax; Ociesęki (*129*).
3 — Thoracic segment; Buczyna (*4*).
4 — Hypostoma; Ociesęki (*189*).
5 — Extraocular cheek; Ociesęki (*132*).
6 — Trilobite trackway, *Cruziana*, attributable to this species; Ociesęki (*266*).

All photos × 2, except No. 6 (nat. size); taken by B. Drozd, M. Sc.


1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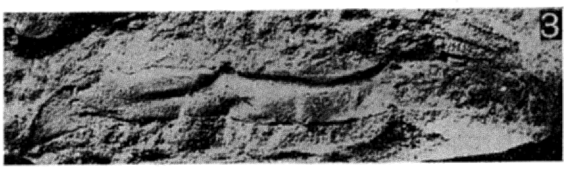
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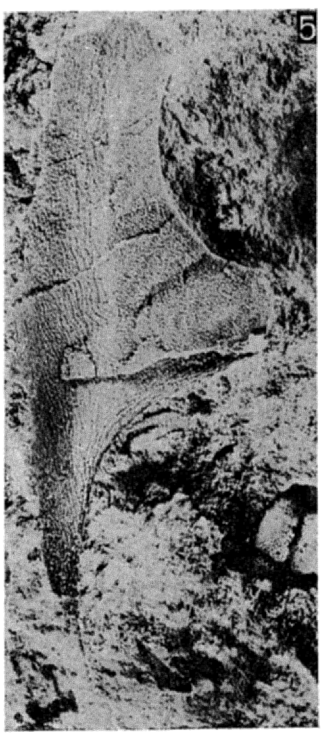
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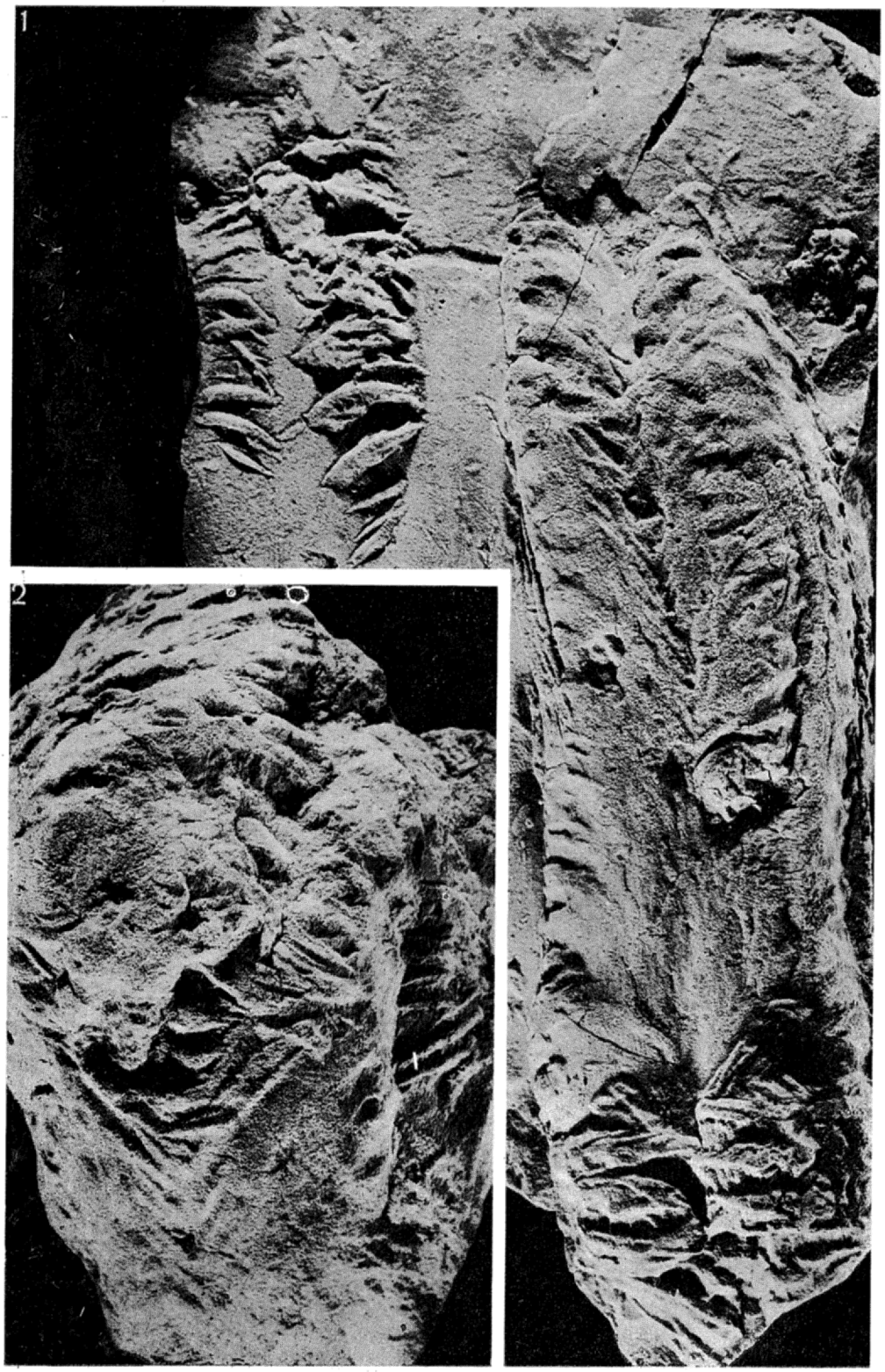
6


1
2

examining this specimens the writer believes that it cannot belong to this species since it strongly differs from Kiaer's holotype; the material differs from *H. grandis* in a non-split glabellar lobe, in a metagenal node situated far from glabella, in a posterior margin being straight only between glabella and metagenal node and strongly curved anteriorly behind it and in the third thoracic segment being the macropleura. According to Kiaer's (1916) description, in *Holmia grandis*, the posterior margin and metagenal spine are similar to those of *Holmia kjerulfi* (Linnarsson, 1871).

The new species strongly differs from *H. kjerulfi* (Linnarsson, 1871), in a broader (*tr.*) extraocular cheek, longer genal spine, composite posterior margin, the lack of metagenal spine, a metagenal node situated far outside of glabella and *L3* different in shape. Great differences also occur in thorax; the new species has the macropleura, whereas pleurae and pleural spines are different.

The new species differs from *Holmia glabra* sp. n. in much wider (*tr.*) and less convex cephalon, more elongate glabella, different *L3*, divided palpebral lobe and a composite posterior margin. It has different pleurae, plaural spines and pleural furrows. Each of axial rings bears a short axial spine and not an axial node as in *Holmia glabra*.

The new species is slightly similar to *Holmia sulcata* Bergström, 1973, in the shape of glabella and palpebral lobe, as well as in a similar convexity of cephalon. However, it strongly differs in a wider cephalic border, wider cephalon, wider extraocular cheek, composite posterior margin and different pleurae.

The species differs from *Holmia mobergi* Bergström, 1973, in a less convex cephalon, different posterior margin, different position of metagenal node, different *L3*, and a stronger curvature of the palpebral lobe.

Genus *KJERULFIA* Kiaer, 1916

Kjerulfia orcina sp. n.

(Pl. 3, Figs 4—5; Pl. 4, Figs 1—8 and Pl. 5, Figs 1—5)

1959. *Kjerulfia* sp.; Samsonowicz, p. 450, Pl. 3, Fig. 1.

Holotype: a cephalon from Ociesęki (specimen No. 180), presented in Pl. 4, Fig. 1*a*—*b*.
Type horizon: Lower Cambrian, Holmia Zone.
Type locality: Ociesęki, Holy Cross Mts.
Derivation of the name: after the Latin word — *orcina* — descendent from the world.

Material. — Four nearly complete and 23 partly preserved cephala, two partly preserved thoraxes and many other fragments of the dorsal exoskeleton.

Diagnosis. — *Kjerulfia* species with a clavate glabella, large palpebral lobe and a narrow (*tr.*) extraocular cheek with a broad (*tr.*) cephalic border. Thorax with large (*tr.*) pleurae and long, falcate pleural spines. Axial spines on the posterior thoracic segments.

Description. — Cephalon subsemicircular, about 1.5 times as wide as long, moderately convex. Posterior margin nearly straight.

PLATE 6

Cruziana rusoformis Orłowski, Radwański & Roniewicz, 1970
1 — Ociesęki (14), 2 — Igrzyczna (1)

Both photos of natural size; taken by B. Drozd, M. Sc.

Glabella clavate, almost reaching the anterior margin. Frontal lobe convex, triangular, rounded anteriorly. Next lobe (*L3*) short (*sag.*) curved and slightly wider (*tr.*) than others; *L2* longer (*sag.*) but narrower (*tr.*) than *L3*; *L1* is the longest, but the narrowest lobe. Occipital lobe, with a very small occipital node, situated close to the posterior margin. There are faint furrows running from the postero-lateral corners to the middle of the occipital lobe making up bifurcations on the sides of lobe. Glabellar furrows gently curved anteriorly, *S2* and *S3* better marked and longer (*tr.*), but not connected across glabella. Some specimens display short furrows on the frontal lobe. Palpebral lobe strongly curved outside, broad (*tr.*), flat, nearly reaching the posterior margin furrow below the level of occipital forrows. Posterior margin extends straight from glabella; toward genal spine it curves slightly backward. In well-preserved specimens the metagenal angle is situated below the palpebral lobe.

Cephalic border very wide (*tr.*) and moderately arched tapering toward glabella. In the front of glabella it almost disappears at all. Posteriorly, it turns into a wide (*tr.*) but short and sharp genal spine. The outer surface of cheek and spines gently ornamented by irregular, reticulated lines. A doublure varying in width, is visible on the inner side of cheek.

Hypostoma elongate, convex; its anterior border straight, turning into anterior wings. The posterior part narrower, with a rounded margin and without spines. Maculae occurring in the posterior part of hypostoma. Ornamentation consists in irregular gentle lines.

A total number of thoracic segments unknown. The collection includes two, partly preserved thoraxes, many detached thoracic segments, their parts and pleurae. The two partly preserved thoraxes consist of eight segments; the first specimen represents the anterior and the second the posterior part of the thorax.

Thorax wide (*tr.*), tapering toward pygidium. Axial part convex, each axial ring with two lateral furrows running outward backward, the furrows less distinct on posterior axial rings. Dorsal furrows distinct, straight, converging posteriorly. Each of axial rings bears an axial spine. They are very short on the anterior and longer on the posterior axial ring, the longest spines occurring on the third and second thoracic segments from the pygidium.

Pleurae long (*tr.*), curved posteriorly, with long falcate spines. The curvature gradually increases in the posterior pleura, pleural part tapering toward pygidium. Pleural furrows begin in the anterior part of pleurae close to the dorsal furrow and run toward pleural spines. Thoracic segments ornamented by irregular meshes. Pleurae have a wide (*tr.*) doublure reaching pleural furrows.

Pygidium unknown.

The specimens strongly very in size. The most completely preserved cephala are 20 to 25 mm long and 30 to 35 mm wide. The anterior part of thorax, with eight thoracic segments, is about 40 mm long and 50 mm wide. Fragments of the largest cephala, extraocular cheeks and thoracic segments enable the supposition that a total length of an adult specimen reaches 15 to 20 cm.

Discussion. — *Kjerulfia orcina* sp. n. is very easily distinguishable from two species of genus *Kjerulfia* separated thus far[1]. From *Kjerulfia lata* Kiaer, 1916, a genotype of *Kjerulfia*, the new species differs in a shorter (*sag.*) and more rounded frontal lobe of glabella, smaller and differently shaped occipital node

[1] Except for those discussed by Samsonowicz (1959, pp. 450—451, Pl. 3, Figs 11—13), no new paleontological materials are available concerning the species *Kjerulfia? lagowiensis* Czarnocki. Likewise, Czarnocki's collections, now housed at the Museum of the Geological Survey, do not include any materials which might serve as a basis for reconstructing this species. Thus, it should be recognized as a *nomen nudum*.

situated near the posterior margin of occipital lobe, longer (*exsag.*) palpebral lobes, narrower (*tr.*) extraocular cheek and a longer genal spine. The thoracic segments are similar to those of *Kjerulfia lata*, especially so in their axial spines longer on the posterior axial rings, but they differ in lateral furrows on axial rings and in shorter pleural furrows. The new species distinctly differs from *Kjerulfia selandica* Poulsen, 1969, in a narrower extraocular cheek, much broader (*tr.*) cephalic border and glabellar furrows not connected with each other across the glabella.

Institute of Geology
of the Warsaw University
02-089 Warszawa, Al. Żwirki i Wigury 93
Warsaw, August 1973

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S. ORŁOWSKI

BIOSTRATYGRAFIA DOLNEGO KAMBRU GÓR ŚWIĘTOKRZYSKICH W OPARCIU O TRYLOBITY Z RODZINY OLENELLIDAE

(Streszczenie)

Przedmiotem pracy jest analiza dolnokambryjskich trylobitów z rodziny Olenellidae z Gór Świętokrzyskich, znanych od dawna (Samsonowicz 1918; Czarnocki 1919, 1926), ale opracowanych paleontologicznie tylko w niewielkim zakresie (Samsonowicz 1959). W oparciu o zebrane w szeregu stanowiskach nowe materiały (Ociesęki, Igrzyczna, Malkowice, Bukówki-Rybnica — *por.* fig. 1), kolekcję J. Samsonowicza (1959) oraz porównawcze okazy uzyskane z wierceń we wschodniej Polsce, autor przeprowadził rewizję wszystkich Olenellidae z dolnego kambru Gór Świętokrzyskich, gdzie rodzina ta jest reprezentowana (*por.* pl. 1—5) przez następujące gatunki bądź podgatunki: *Schmidtiellus panowi* (Samsonowicz, 1959), *Holmia kjerulfi marginata* subsp. n., *H. glabra* sp. n., *H. orienta* sp. n. oraz *Kjerulfia orcina* sp. n. Spośród współwystępujących z wymienionymi trylobitami śladów, formy opisane jako *Cruziana rusoformis* Orłowski, Radwański & Roniewicz, 1970, należy wiązać ogólnie z aktywnością życiową tychże Olenellidae (*por.* pl. 6, fig. 1, 2). Niektóre natomiast ślady *Cruziana* odznaczające się bardzo dużymi rozmiarami (*por.* pl. 5, fig. 6) uznać należy za związane z działalnością życiową trylobitów należących do nowego gatunku *Kjerulfia orcina*.

Na podstawie analizy fauny trylobitowej przedstawiono próbę pełniejszego podziału biostratygraficznego dolnego kambru Gór Świętokrzyskich oraz wschodniej Polski. Na drodze porównań biostratygraficznych podano także podział dolnego kambru dla innych obszarów Europy Wschodniej i Skandynawii (tab. 1).

Instytut Geologii Podstawowej
Uniwersytetu Warszawskiego
02-089 Warszawa, Al. Żwirki i Wigury 93
Warszawa, w sierpniu 1973 r.