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THE TRILOBITE SUBFAMILY HOMALONOTINAE FROM THE UPPER SILURIAN AND LOWER DEVONIAN OF POLAND

Abstract. — Twelve species of trilobites, including six new ones (*Dipleura praecox* sp. n., *Trimerus lobatus* sp. n., *T. novus* sp. n., *Digonus bostoviensis* sp. n., *D. elegans* sp. n., and *Parahomalonotus angusticostatus* sp. n.), assigned to five genera of the subfamily Homalonotinae from the Upper Ludlovian, Upper Gedinnian and Lower Siegenian of Poland are described below. Taxonomic criteria of this subfamily are discussed, along with its outline phylogeny.

INTRODUCTION

Relatively frequently found, the specimens of Homalonotinae are, in general, poorly preserved and, therefore, they are among the groups of trilobites that have so far been rather insufficiently studied. Since their occurrence is limited to the Llandovery through Middle Devonian, they may serve as a good index fossil. Their paleogeographical and correlative importance in the Upper Silurian and Lower Devonian was discussed separately (Tomczykowa, 1974).

The materials, on which the present paper is based, were collected by the writer in 1956—1958 in the Holy Cross Mts. Most of them, however, come from the boreholes managed by the Geological Institute, that is, from Gołdap, Bostów, Ciepielów, Białopole, Krowie Bagno, Łopiennik, Strzelce IG-2 and Zakrzew IG-3, as well as from the drillings of the Oil Research Survey (Małochwiej and Rozkopaczew boreholes) (Text-fig. 1).

The writer's remarks on the species described thus far are based on the observation of the casts of holotypes and other specimens from classic collections. German species were examined by the writer on the basis of the casts of the following specimens:

Digonus rhenanus (Koch 1883, Pl. 3, Figs 2, 4, 5);
Digonus ornatus disornatus Richter & Richter 1932, p. 361, Fig. 2;
Digonus ornatus perlornatus Richter & Richter 1932, p. 361, Fig. 1;
Digonus rudersdorfensis Richter & Richter 1932, p. 364, Figs 3—5;
Digonus ? roemeri (De Koninck 1876), Richter & Richter 1954, Pl. 1, Figs 8—10;

Digonus ? sp. Richter & Richter 1954, Pl. 1, Fig. 13;
Trimerus ? *crassicauda* (Sandberger 1856), Koch 1883, Pl. 5, Fig. 2;
Dipleura laevicauda (Quenstedt 1852), Koch 1883, Pl. 8, Figs 2, 2a;
Dipleura plana (Sandberger 1856), Koch 1883, Pl. 7, Fig. 3;
Dipleura simplex Richter 1923, Fig. 37;
Parahomalonotus multicostatus (Koch 1883, Pl. 7, Fig. 5);
Parahomalonotus obtusus (Sandberger, 1856), Koch 1883, Pl. 6, Fig. 1;
Burmeisterella armata westrami (Dohm, 1910).

Except for the Gedinian species *Digonus* ? *roemeri*, the rest of them come from the Upper Siegenian or Emsian and they are, therefore, younger stratigraphically than the Polish species.

Single Gedinnian and Siegenian species of the Homalonotinae from the Lower Devonian of France, described by Rouault (1851, 1855), Barrois (1886) and Tromelin & Lebesconte (1876) have not so far been revised. Some holotypes got lost and there was not a possibility of making casts of *Trimerus* ? *lehiri* (Barrois, 1886) and of a holotype of *Homalonotus roemeri* De Koninck, 1876, which comes from the Gedinnian of the Ardennes. The writer has succeeded only to examine the casts of the following French species:

Digonus vialai (Gosselet 1912, Pl. 1, Figs 1, 2, 12);
Digonus ? *collini* (Renaud 1942, Pl. 11, Fig. 9);
Digonus ? *armoricanus* Pillet 1961, Pl. 14, Fig. 2;
Trimerus acuminatus (Tromelin & Lebesconte 1876), Renaud 1942, Pl. 11, Fig. 11;
Parahomalonotus forbesi (Rouault 1855, p. 1042, Text-fig.) and the holotype of a synonymic species, *P. miloni* (Renaud, 1942, Pl. 14, Fig. 1), of a much better state of preservation. As shown by the writer's observations, *P. forbesi* (= *P. miloni*) also occurs in Poland (Table I).

Differences between the genera *Trimerus* and *Dipleura* could be shown by the writer on the basis of her observations of the casts of holotypes from American collections (New York State Museum, abbr. NYSM), that is, of the type species of the Silurian *Trimerus delphinocephalus* Green (1832, p. 82, Fig. 1) and the Middle Devonian *Dipleura dekayi* Green (1832, p. 79, Fig. 9). In addition, the writer examined casts of English *Trimerus delphinocephalus* Green (Salter 1865, Pl. 11, Fig. 1), *T. johannis* (Salter, 1865, Pl. 13, Figs 1, 3, 7) and *T. cylindricus* (Salter, 1865, Pl. 11, Fig. 12), as well as a cast of the holotype of *Homalonotus knighti* König (1825, Pl. 7, Fig. 85) refigured by Salter (1865, Pl. 12, Fig. 6) and other specimens of this species (Salter, 1865, Pl. 12, Figs 3, 4, 9 and Pl. 13, Fig. 8).

New materials from the Upper Silurian and Lower Devonian, along with a revision of the most important, well-known species, allowed the writer to reclassify species of the subfamily Homalonotinae (Table III). The trilobites described in the present paper are housed at the Geological Institute's Museum (abbr. IG).

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THE HOMALONOTINAE OF POLAND

In Poland, the Homalonotinae have so far been recorded in the Upper Emsian deposits of the Holy Cross Mts (Czarnocki, 1936; Pajchlowa, 1957, 1970), from which *Digonus gigas* (Roemer) is cited. Three species from the Upper Ludlovian (Table I) of the Holy Cross Mts and north-eastern Poland, described in the present paper, were previously mentioned by the present writer (Tomczykowa, 1971), but some of them were erroneously identified.

Upper Silurian. — One species only, that is, *Homalonotus knighti* König was found in the Silurian of the Holy Cross Mts. It occurs in marly-detrital limestones and marly claystones of the Łężyce-Bełcz section and, in addition, east of Opatów (a specimen found at Lipniczek by Samsonowicz, IG.8/II/350, Pl. I, Fig. 4), as well as at Rzepin, where it occurs in a stratotype section of the Rzepin Beds (IG.1321.II.6; Pl. I, Fig. 6). This species, represented by single and, sometimes, even fragmentary specimens, occurs with other trilobites (Tomczykowa, 1962, 1971) in the top part of the Lower Rzepin Beds (Tomczyk, 1970) in the Holy Cross Mts (Table I).

About 30 specimens of three species of the subfamily Homalonotinae were found by the writer in 3 m-thick sediments composed of marly claystones and marls of the Upper Siedlce Beds (Table I) occurring in the Gołdap borehole (Text-fig. 1) in the eastern part of the Peri-Baltic area.

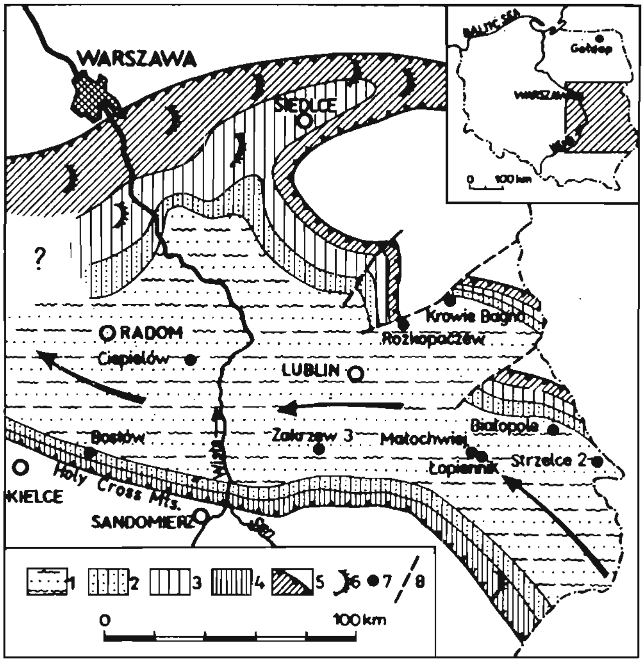

Fig. 1. Geological map of East-central Poland, without deposits younger than Siegenian (According to Tomczyk, 1974). *1* Ciepielovian; *2*. Bostovian; *3* Upper Podlasian; *4* Podlasian (Upper Rzepin Beds); *5* Lower Podlasian (up to erosion boundary); *6* claystones with graptolites; *7* situation of the boreholes; *8* dislocations.

They are: *Trimerus lobatus* sp.n., *Dipleura praecox* sp.n., and few specimens of *Homalonotus knighti* König. The occurrence of the last-named species is of a considerable importance to a detailed stratigraphy and correlation of the Siedlce Series, where it was found, along with graptolite *Monograptus formosus* Bouček. This confirms Tomczyk's view (1962, 1970) that the Upper Siedlce Beds with *Monograptus formosus*, correspond to the Whitcliffian Stage (Holland, Lawson & Walmsley, 1963). A biostratigraphical zone, determined by the range of *Homalonotus knighti* König in the top part of the Upper Siedlce Series in Poland (Table I) may be correlated with the Upper Ludlovian of Wales (Cocks *et al.*, 1971), as well as with Moydart and Stonehouse Formations in Nova Scotia (McLearn, 1924).

Dipleura praecox sp.n. and the British species *Dip.*? *ludensis* (Salter) are similarly situated stratigraphically, which also corresponds to the Upper Ludlovian (Table I).

Table I

OCCURRENCE OF THE HOMALONOTINAE IN POLAND

	Stages		Regional stratigraphy		Homalonotinae in Poland
Lower Devonian	EMSIAN	Upper	Zagórze	Upper	*Digonus gigas*[1]
				Lower	
		Lower	Barcza		
	SIEGENIAN	Upper	Ciepielovian	Upper	*Parahomalonotus angusticostatus* *Digonus elegans* *Trimerus novus* *Parahomalonotus forbesi*
		Lower		Lower	
	GEDINNIAN	Upper	Bostovian	Upper	*Digonus vialai* *Digonus bostoviensis*
		Lower		Lower	
Upper Silurian	PODLASIAN		Upper Rzepin (= Podlasie)		
	LUDLOVIAN	Upper	Lower Rzepin (= Upper Siedlce)	Siedlce Series	*Homalonotus knighti* *Trimerus lobatus*, *Dipleura praecox*
			Wydryszów		
		Lower	Wilków Shales		

The Homalonotinae have not thus far been found in the deposits of the Podlasie Stage (Table I) of the Uppermost Silurian of Poland.

Lower Devonian. — The continuity of sedimentation between the Silurian and Devonian in the northern part of the Holy Cross Mts has been known for a long time and recently discussed several times (e.g., Tomczyk, Pajchlowa & Tomczykowa, 1974).

The Lowermost Devonian deposits of the neritic facies, marked by abundant fauna, are developed as mudstones and marly claystones with intercalations of detrital limestones. They occur in the northern part of the Holy Cross Mts (Łysogóry region), as well as north and north-east of them in the Lublin-Radom depression (Tomczykowa & Tomczyk, 1970). Found in the Lowermost Devonian sections, the Homalonotinae appear, in the Upper Bostovian (Table I), in the following boreholes: Bostów, Krowie Bagno, Białopole, Małochwiej and Łopiennik (Text-fig. 1). The writer collected in these localities about twenty specimens, of which she descri-

[1] Stratigraphy of the Emsian according to Łobanowski (1971) and occurrence of *D. gigas* according to Czarnocki (1936).

bed two species, *Digonus bostoviensis* sp.n. and *D. vialai* (Gosselet), determining the biostratigraphical zone in the Upper Gedinnian (Table I). The Homalonotinae have not thus far been recorded in the Lower Gedinian of Poland and the stratigraphy of the Lower Bostovian (Tomczykowa, 1974) was based mostly on the Acastavinae, [2] which predominate there.

The Homalonotinae are considerably more abundant in the Siegenian. About 50 specimens of this subfamily were collected by the writer in the boreholes (Text-fig. 1): Ciepielów, Zakrzew IG-3, Rozkopaczew, Białopole, Małochwiej, Łopiennik and Strzelce IG-2, where they occur in the Lower Ciepielovian deposits. Four species, including three new ones, were described by her. The occurrence of *Parahomalonotus forbesi* (Rouault), *P. angusticostatus* sp.n., *Digonus elegans* sp.n. and *Trimerus novus* sp.n. makes the first biostratigraphical record of the Lower Siegenian deposits of Poland, which also contain abundant Acastavinae and Asteropyginae not described so far. Such species of the Homalonotinae as *Digonus vialai* (Gosselet) and *Parahomalonotus forbesi* (Rouault) are indicative of close palaeogeographical relationship (Tomczykowa, 1974) between Poland and France occurring within limits of the Rhenish facies.

A considerable development of the Homalonotinae falls in upper members of the Siegenian and in the Emsian (Table II), from which very numerous species are known in other parts of Europe. In the area of Poland, a sedimentation of the Old Red type starts, however, to predominate above the Ciepielovian. In the Emsian (Table I), together with a renewed transgression of the sea (Pajchlowa, 1959), the rare specimens of *Digonus gigas* (Roemer) reached the area of the Holy Cross Mts.

THE RECORD OF THE HOMALONOTINAE SPECIES KNOWN SO FAR

The genus *Homalonotus* is represented by only three species (Table III) related with the top part of the Ludlow Series. *H. knighti* König, 1825 was first described from the Shropshire area in Wales (Murchison, 1837; Salter, 1865) and, later, from Whitcliffian Stage (Holland, Lawson & Walmsley, 1963). A similar stratigraphical situation is displayed by this species in Poland, in the Artois area in France (Barrois, Pruvost & Dubois, 1920) and in the Appalachian Province of North America, where *H. dawsoni* Hall also occurs (McLearn, 1924). The third species, *H. rhinotropis* Angelin, occurring in the Öved-Ramsåsa Beds of Skannia (Mo-

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[2] The *Acastella elsana* and *A. tiro* zones, widely distributed in the Rhenish facies, were found in six boreholes, in which, in addition to many specimens of Acastellids, also *Podolites* ex gr. *rugulosus* (Alth) occurs.

Table II

GEOGRAPHICAL DISTRIBUTION OF HOMALONOTINAE

System	Series	Europe and Turkey			Africa	South America	North America	Australia and Asia
		Belgium (B) France (F) Germany (D) Great Britain (GB) Spain (S)	Poland	Bohemia- -Sudetes (S) Gothland, Podolia (P) Scannia (G) Rumania (R) Turkey- -Bithynia (T)	Algeria (A) Ghana (G) Morocco (Mor) Mauretania (Mau) South Africa (Cap)	Argentina (A) Bolivia (Bol) Brazil (Br) Paraguay (P) Uruguay (U)	North Appalachian Province	New Zealand (Z) Tasmania (T) Victoria (V) Mongolia (M)
Devonian	(Middle)	*Dip. lanvoiensis* (F)		*Dip. fornix* (R, T)		*Dip. dekayi* (U) *Dip. dekayi boliviensis* (Bol)	*Dip. dekayi*	
Devonian (Lower)	Emsian	*Dip. laevicauda* (B, D, F) *P. gervillei* (F, S) *P. multicostatus* (B, D) *P. obtusus* (D, F) *P. mutabilis* (D) *Dip. plana* (B, D) *Dip. simplex* (D) *Bl. bifurcata* (GB) *Bl. elongata* (GB) *D. gigas* (B. D, S) *B.? pradoana* (F, S) *Bl. armata armata* (B, D, F) *Bl. armata westrami* (D) *D.?maillieuxi* (B) *D. harpyius* (D) *D. ornatus disornatus* (B, D) *D. ornatus ornatus* (B, D) *D. ornatus perlornatus* (D) *D.? collini* (B) *D.? mosanus* (B)	*D. gigas*	*P. gervillei* (R, T) *D. gigas* (S)	*P. gervillei* (Mor) *Dip. clarkei* (Cap) *Dip. simplex* (A) *B. herscheli* (Cap, A) *B. hippocampus* (Cap) *D.? goniopygaeus* (Cap) *B.? pradoana* (A) *Bl. armata armata* (Cap, A) *Bl. champernownei* (Cap)	*Dip.clarkei* (Bol, U) *D.? oiara* (Br) *B. herschelii* (Bol, U) *D.? derbyi* (Br) *D. spatulirostrus* (U)	*D. major* *D. laticaudatus*	*D. expansus* (Z) *B. huttoni* (Z)
	Siegenian	*T.? crassicauda* (B,D) *T.? intermedius* (B, D, F) *D.* rudersdorfensis (D) *D. rhenanus* (B, D, F) *D.? armoricanus* (F) *T. acuminatus* (F) *P. forbesi* (F)	*P. angusticostatus* *D. elegans* *T. novus* *P. forbesi*		*T. accraensis* (G) *D.? zemmourensis* (Mau, A)	*T. noticus* (Bol, Br, U)		*T. lilydalensis* (V) *T. kinglakensis* (V) *T. zeehanensis* (T)
	Gedinnian	*D. vialai* (B, F) *T.? lehiri* (F) *D.? roemeri* (B, D, F, S)	*D. vialai* *D. bostoviensis*	*D.? roemeri* (P)	*D. vialai* (Mor) *D.? roemeri* (Mor)	*T. cf. noticus* (Bol) *T. linares* (Bol)	*T.?vanuxemi*	*T. vomer* (V)
Silurian	Postludlow Podlasian							
	Ludlow	*H. knighti* (GB, F) *Dip.? ludensis* (GB)	*H. knighti* *Dip. praecox* *T. lobatus*	*H. rhinotropis* (G)	*Trimerus* sp.A (Mor)		*H. knighti* *H. dawsoni*	*T. harrisoni* (V)
	Wenlock	*T. johannis* (GB) *T. delphinocephalus* (GB) *T. cylindricus* (GB)				*T. kayseri* (A)	*T. delphinocephalus*	*T. mongolicus* (M)
	Llandovery					*Trimerus* sp.A (P)		

Abbreviations of generi names as on Table III berg & Grønwall, 1909) and Burgsvik Beds of Gothland (Lindström, 1885), is also related with Ludlow Series.

The genus *Trimerus*, whose earliest species *Trimerus* sp. A comes from the Lower Llandovery of eastern Paraguay (Wolfart, 1961), is most numerously represented in the Middle Silurian (Tabl. II). The type species, *T. delphinocephalus* Green, comes from the Lockport Limestone in North America (Hall, 1852) and from the Woolhope Limestone in Great Britain (Salter, 1865), where it is accompanied by another two species, *Trimerus cylindricus* Salter and *T. johannis* Salter. Single species of the genus *Trimerus* have also been known from the Middle Silurian of Mongolia (Tchernycheva, 1937), Argentina (Thomas, 1905), Morocco (G. Alberti, 1970) and Australia (McCoy, 1876).

Only few species of this genus are recorded in the Lower Devonian (Table II). *T.* ? *lehiri* (Barrois, 1886) from the Gedinnian of Brittany and *T. acuminatus* (Tromelin & Lebesconte, 1876) from the Lower Siegenian have been assigned by the present writer to the genus *Trimerus* (Table III). It is likely, however, that this genus also includes such species as *T* ? *crassicauda* (Sandberger, 1856) and *T* ? *intermedius* (Viëtor, 1919) occurring in the Lower Devonian of Rhineland and the Ardennes. *Trimerus accraensis* (Saul), described from the Lower Devonian of Ghana and the very closely related *T. noticus* (Clarke) from South America have also been included by the writer in this genus (Table III). In addition (Table II), two species of *Trimerus* have been described from Southern Australia and one from Tasmania (Gill, 1949). The upper limit of the stratigraphical range of occurrence of the *Trimerus* species probably doesn't exceed the Siegenian.

The genus *Dipleura* is represented in the Silurian by two species, *Dip. praecox* sp.n. and *Dip.* ? *ludensis* (Salter, 1865), the latter known only as a single specimen of cranidium. The remaining species of *Dipleura* such as: *Dip. laevicauda* (Quenstedt), *Dip. plana* (Sandberger), *Dip. simplex* (Richter & Richter), *Dip. fornix* Haas and *Dip. clarkei* (Kozłowski) occur as late as the Emsian (Table II), while the species *Dip. dekayi* Green, *Dip. dekayi boliviensis* Wolfart and *Dip. lanvoiensis* Morzadec pass, as sole representatives of the Homalonotinae, to the Middle Devonian. The Lower Devonian species of *Dipleura* are marked by a wide geographical distribution (Table II). They are most abundant in Rhineland (Sandberger, 1856; Koch, 1883), in the Ardennes (Asselberghs, 1946) and in Brittany (Renaud, 1942; Morzadec, 1969), while single species are known from Bithynia (Haas, 1968), Algeria (Legrand, 1967), South Africa (Reed, 1925), Bolivia (Kozłowski, 1923; Wolfart, 1968) and Uruguay (Mendez-Alzola, 1938). The type species, *Dip. dekayi* Green, comes from the Hamilton Group of North America (Hall & Clarke, 1888).

The genus *Digonus* appears in the Gedinnian and includes the greatest number of species of Homalonotinae (Table III). Their maximum occurrence falls in the Upper Siegenian and Emsian. *Digonus ? roemeri* (De Koninck, 1876), the earliest species known thus far, was assigned by Richter & Richter (1954) to the *Acastella tiro* Zone. Originally described from the Mondrepuis shales in the Ardennes, it also was later mentioned erroneously from the Siegenian (Koch, 1883) and in Poland erroneously cited from the Rzepin Beds (Czarnocki, 1936). In Podolia, it was described (Balashova, 1968) from the Borshchow Beds. The holotype of *D. ? roemeri* (De Koninck) disappears and the neotype has never been selected. The writer did not find this species in the Lower Gedinnian of Poland. On the other hand, two other species of the genus *Digonus*, *D. bostoviensis* sp.n. and *D. vialai* (Gosselet, 1912), occur in the Upper Gedinnian (Table I). *D. vialai* (Gosselet, 1912) was first described from the Mericourt shales of Artois and its presence in a similar stratigraphic position was cited from Morocco (Holland, 1967).

Digonus ? armoricanus (Pillet) occurs in the *Dalmanella monnieri* Zone in the Lower Siegenian of Brittany (Pillet, 1961*b*). In that stage, *Digonus* sp. and *D. elegans* sp.n. occur in the Lower Ciepielovian of Poland (Table I). Six species of the genus *Digonus* (Tables II and III) occur in younger deposits, that is, in the Upper Siegenian and maybe even as early as the Emsian (Koch, 1883; Richter & Richter, 1932). *Digonus gigas* (Roemer) is common in the Emsian and makes up a characteristic biostratigraphical and correlative zone, since it occurs in Spain, Rhineland, the Ardennes, the Holy Cross Mts and the Sudetes. Single species of the genus *Digonus*, occurring in the extra-European Emsian, were recorded in Algeria, South Africa, South and North America and New Zealand.

The genus *Parahomalonotus* is known beginning with the Lower Siegenian. *P. forbesi* (Rouault, 1855), occurring in the Lower Siegenian of Normandy and in Poland is the oldest stratigraphically of all species of this genus. In addition, *P. angusticostatus* sp.n. was described by the present writer from the uppermost Lower Ciepielovian. The remaining four species occur in the Emsian of Rhineland (Koch, 1880, 1883). *P. obtusus* (Sandberger) was also described from Brittany (Pillet, 1972) and *P. multicostatus* (Koch) also from the Ardennes (Asselberghs, 1946). The type species, *P. gervillei* (De Verneuil), makes up a characteristic biostratigrapical horizon of the Upper Emsian and was described from Brittany, Normandy and Spain (Pillet, 1972), from Bithynia, Turkey (Haas, 1968) and cited from Rumania (Iordan, 1969) and Morocco (Holland, 1967).

Species of the genera *Burmeisteria* and *Burmeisterella* start to appear with the Emsian, reaching their largest dimensions in the subfamily Homalonotinae. *Burmeisterella elongata* (Salter) and *Bl. bifurcata* Reed come from the Lower Devonian of England, while *Bl. armata* (Burmeister) occurs in Rhineland and the Ardennes and also is cited from Algeria and South Africa, where they are, however, predominated over by the repre-

Table III

REVISED SYSTEMATICS OF THE HOMALONOTINAE

HOMALONOTUS König, 1825

H. knighti König, 1825
H. dawsoni Hall, 1860
H. rhinotropis Angelin, 1852

DIGONUS Gürich, 1909

D. gigas (Roemer, 1843)
D. ? armoricanus Pillet, 1961
D. bostoviensis sp. n.
D. ? collini (Renaud, 1942)
D. ? derbyi (Clarke, 1895)
D. elegans sp. n.
D. expansus (Hector, 1876)
D. ? goniopygaeus (Woodward, 1882)
D. harpyius Richter & Richter, 1932
D. laticaudatus (Williams & Breger, 1916)
D. ? maillieuxi (Asselberghs, 1923)
D. major (Whitfield, 1885)
D. ? mosanus (Maillieux, 1932)
D. ? oiara (Hartt & Rathbun, 1876)
D. ornatus disornatus Richter & Richter, 1932
D. ornatus ornatus (Koch, 1883)
D. ornatus perlornatus Richter & Richter, 1932
D. rhenanus (Koch, 1883)
D. ? roemeri (De Koninck, 1876)
D. rudersdorfensis Richter & Richter, 1932
D. spatulirostrus (Mendez-Alzola, 1938)
D. vialai (Gosselet, 1912)
D. zemmourensis Pillet, 1961

BURMEISTERIA Salter, 1865

B. herscheli (Murchison, 1839)
B. hippocampus (Schwarz, 1906)
B. huttoni Allan, 1935
B. ? pradoana (De Verneuil, 1850)
B. querna (Lake, 1904)

BURMEISTERELLA Reed, 1918

Bl. elongata (Salter, 1865)
Bl. armata armata (Burmeister, 1843)
Bl. armata westrami (Dohm, 1910)
Bl. bifurcata Reed, 1918
Bl. champernownei (Woodward, 1881)

? doubtful genus

TRIMERUS Green, 1832

T. delphinocephalus Green, 1832
T. accraensis (Saul, 1967)
T. acuminatus (Tromelin & Lebesconte, 1876)
T. ? crassicauda (Sandberger, 1856)
T. cylindricus (Salter, 1865)
T. harrisoni (McCoy, 1876)
T. ? intermedius (Viëtor, 1919)
T. johannis (Salter, 1865)
T. kayseri (Thomas, 1905)
T. kinglakensis Gill, 1949
T. ? lehiri (Barrois, 1886)
T. lilydalensis Gill, 1949
T. linares (Salter, 1861)
T. lobatus sp. n.
T. mongolicus Tchernycheva, 1937
T. noticus (Clarke, 1913)
T. novus sp. n.
T. ? vanuxemi (Hall, 1859)
T. vomer (Chapman, 1912)
T. zeehanensis Gill, 1949
Trimerus sp. A Wolfart, 1961
Trimerus sp. A Alberti, 1970

DIPLEURA Green, 1832

Dip. dekayi Green, 1832
Dip. clarkei (Kozłowski, 1923)
Dip. dekayi boliviensis Wolfart, 1968
Dip. fornix Haas, 1968
Dip. laevicauda (Quenstedt, 1852)
Dip. lanvoiensis Morzadec, 1969
Dip. ? ludensis (Salter, 1865)
Dip. plana (Sandberger, 1856)
Dip. praecox sp. n.
Dip. simplex (Richter & Richter, 1923)

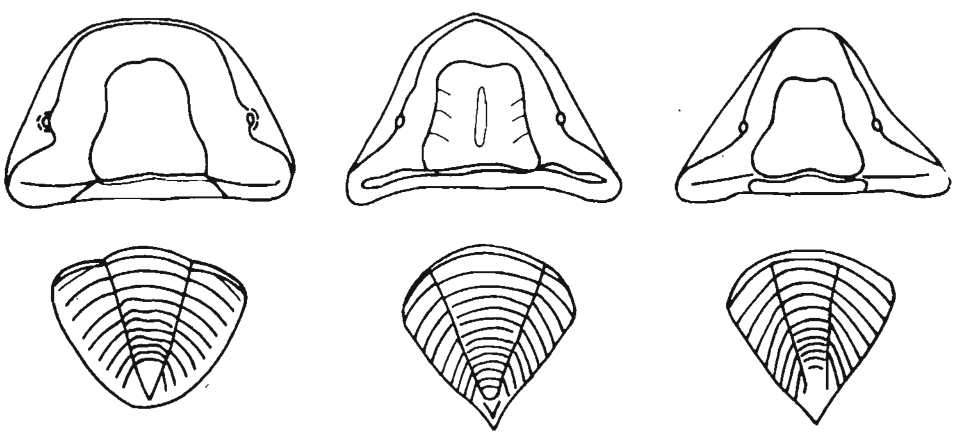
PARAHOMALONOTUS Reed, 1918

P. gervillei (De Verneuil, 1850)
P. angusticostatus sp. n.
P. forbesi (Rouault, 1855)
P. multicostatus (Koch, 1883)
P. mutabilis (Koch, 1880)
P. obtusus (Sandberger, 1856)

sentatives of *Burmeisteria*, in particular its type species, *Burmeisteria hersheli* (Murchison), which also occurs in Bolivia (Swartz, 1925; Wolfart, 1968) and Uruguay (Mendez-Alzola, 1938). A species of *Burmeisteria* was also described from New Zealand (Allan, 1935).

PHYLOGENY AND CLASSIFICATION OF THE HOMOLONOTINAE

In the light of new materials, the interpretation of evolutionary trends in the Homalonotinae and the classification of this subfamily, submitted by Sdzuy (1957, 1959), require completion. Trilobites of the subfamily Homalonotinae are probably derived from the Ordovician Eohomalonotinae Hupé, 1953, which was already suggested by Reed (1918). *Trimerus*, derived according to Sdzuy (1957) from the Ordovician *Eohomalonotus*, is the oldest stratigraphically of all genera of the Homalonotinae. The present writer is, however, of a different opinion and believes that *Trimerus* is related with species of the genus *Brongniartellā*, to which attention has already been called by Reed (1918, p. 323) and which is corroborated by studies on such species as *Trimerus* sp. A Wolfart from the Lower Llandovery of Paraguay and *Brongniartella benderi* Wolfart from the Lower Llandovery of Jordania (Wolfart, 1968). *Trimerus delphinocephalus* Green, occurring in the Wenlock, displays a similarity to the Upper Ordovician species *Brongniartella bisulcata* Salter, which, however, is more similar to *Trimerus johannis* Salter in the trace of its rostral suture (Text-fig. 2*a* and 2*c*). On the other hand, in *Trimerus delphinocephalus*, whose pregla-

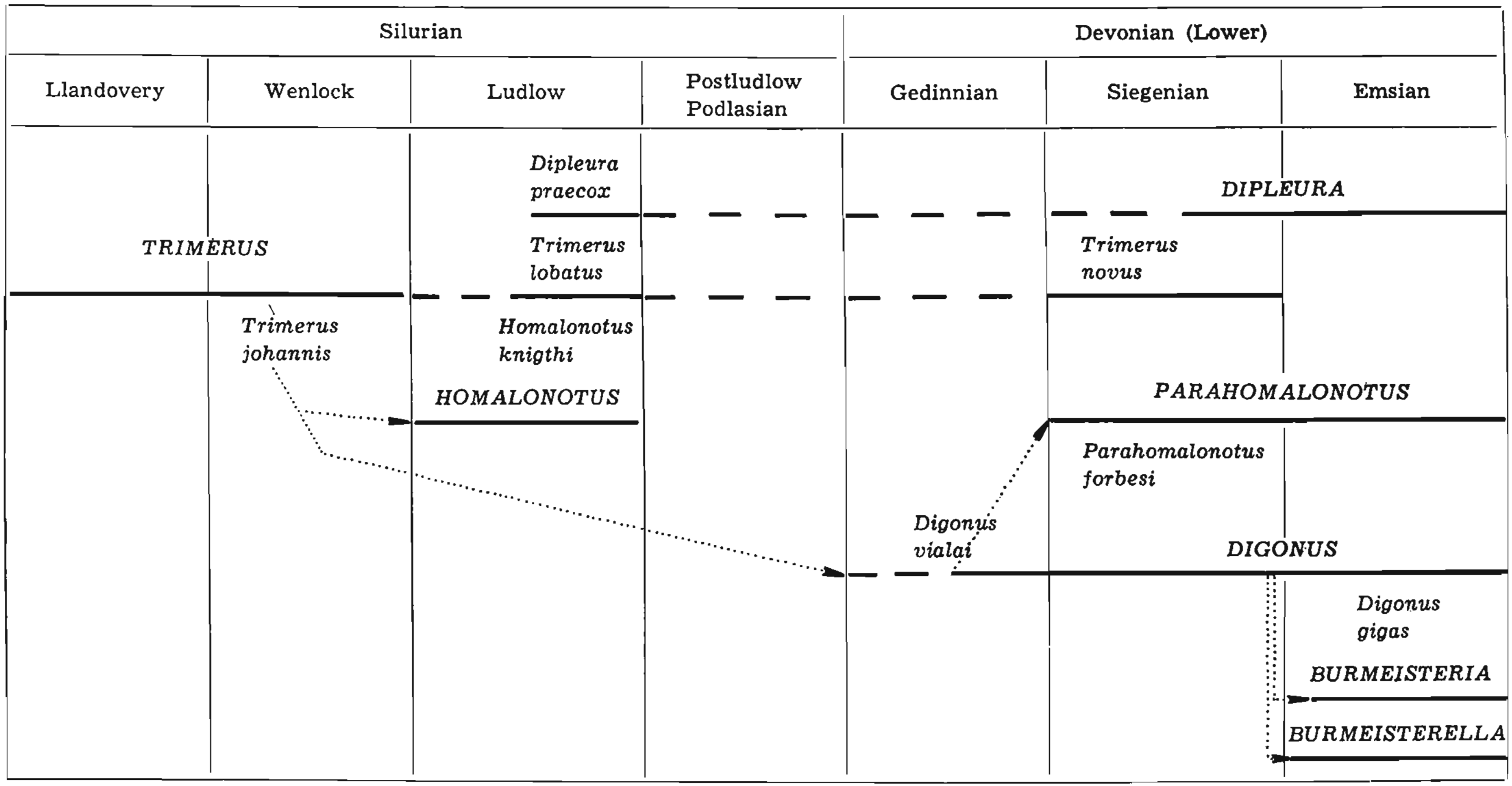


a b c

Fig. 2. A comparison between the *Brongniartella* and *Trimerus* representatives. *a* *Brongniartella bisulcata* (Salter, 1865; Pl. 10, Figs 3, 9); *b* *Trimerus delphinocephalus* Green, 1832 (Salter, 1865; Pl. 11, Fig. 1); *c* *Trimerus johannis* (Salter, 1865; Pl. 13, Figs 1, 7).

Table IV

PHYLOGENY OF THE HOMALONOTINAE



bellar field (Text-fig. 2*b*) is equally wide (sag.) as in the two species discussed above, the anterior sections of facial suture join each other axially and, consequently, the frontal area becomes triangular. *Dipleura* is considered by Sdzuy (1959) as a subgenus of the genus *Trimerus*, with *T. mongolicus* Tchernycheva, 1937 as transitional between the two genera. On the basis of an analysis of type species, *Trimerus delphinocephalus* Green and *Dipleura dekayi* Green, as well as of other species of the two genera, the present writer believes that the differences in trilobation and segmentation of pygidium and in the shape and lobation of glabella entitle her to consider them as quite different genera (Table IV). On the other hand, the descent of *Dipleura* from *Trimerus* is confirmed by two new species, closely related with each other, that is, *Trimerus lobatus* sp.n. and *Dipleura praecox* sp.n., which may thus be treated as transitional links between *Trimerus* and *Dipleura*. The remaining species of these genera have strongly expressed generic characters, which is particularly distinct in Lower Devonian species.

Sdzuy (1957) suggests that the genus *Homalonotus* descends from *Trimerus* and considers *Homalonotus johannis* Salter, assigned by the present writer to the genus *Trimerus*, as a transitional species between the two genera. However, this species seems to be transitional rather between the genera *Trimerus* and *Digonus*, as indicated by a wide preglabellar field anteriorly truncate (Text-fig. 2*c*) as in all species of *Digonus*. The triangular and cylindrical pygidium of *Trimerus johannis* (Salter, 1865) assigns this species decidedly to *Trimerus*, while its deep axial furrows, emphasizing trilobation, make this species similar to the representatives of *Digonus* rather than of *Trimerus*, whose pygidial axial furrows are shallow. On the other hand, the deep pygidial pleural furrows in *Trimerus johannis* resemble those in the genera *Digonus* and *Homalonotus* rather than in *Trimerus* in which they are considerably shallower (Table V).

A small number of species of *Homalonotus* makes difficult comparing this genus with others, including *Digonus* and *Parahomalonotus*. In regard to the two last-named genera, it is the writer's supposition, based on the materials available, that *Parahomalonotus* descends from *Digonus*, which is indicated by the characters of such closely related species as *Digonus vialai* (Gosselet, 1912) and *Parahomalonotus forbesi* (Rouault, 1855), discussed elsewhere (pp. 33, 36).

The genera *Burmeisteria* Salter, 1865, and *Burmeisterella* Reed, 1918 have so far been unsufficiently studied from the viewpoint of taxonomy and phylogeny. The separate character of the genera *Burmeisteria* and *Digonus* seems not to arouse reservations. Considering *Digonus* as a subgenus of *Burmeisteria*, as it has been done so far, resulted from the presence of a rostral process in some of their representatives. *D. gigas* (Roe-

Table V

GENERIC DIFFERENCES IN THE HOMALONOTINAE

Characters	*HOMALONOTUS* König, 1825	*DIGONUS* Gürich, 1909	*TRIMERUS* Green, 1832	*DIPLEURA* Green, 1832	*PARAHOMALONOTUS* Reed, 1918	*BURMEISTERIA* Salter, 1865	*BURMEISTERELLA* Reed, 1918
	H. knighti König, 1825	*D. gigas* (Roemer, 1843)	*T. delphinocephalus* Green, 1832	*D. dekayi* Green, 1832	*P. gervillei* (Verneuil, 1850)	*B. herscheli* (Murchison, 1839)	*Bl. elongata* (Salter, 1865)
Cephalon Shape	trapezoidal	subtriangular	triangular	subtriangular	semicircular	substriangular	subtriangular
Preglabellar field	obsolete or very narrow	well developed	well developed	well developed	more or less developed	rather narrow with median point	narrow with median point
Glabella Shape	trapezoidal	trapezoidal or rectangular	subconical	almost rectangular	slightly urceolate, large	urceolate	subtrapezoidal
Lobation	obsolete	obsolete	occasionally lobed	obsolete, visible only in young	indistinct	distinct	occasionally lobed
Thorax Trilobation	almost obsolete	distinct	faint	very faint	almost obsolete	faint	distinct
Pygidium Shape	triangular	triangular, elongate	triangular, cylindrical	triangular, subconical	semicircular, or semioval	triangular, strongly convex	parabolic
Axial furrows	almost obsolete	deep	very shallow	obsolete	faint	faint	distinct
Trilobation	almost obsolete	distinct	faint	very indistinct	indistinct	fairly distinct	distinct
Pleural furrows	distinct	deep	shallow	faint	distinct	deep	deep
Segmentation	distinct	distinct	distinct	very faints	distinct	fairly distinct	distinct
Ornamentation	fine granulated	granulated tuberculated or noded	smooth, or fine granulated	smooth, or granulated	granulated	tuberculated, noded and spinose	tuberculated, and spinose

mer, 1843), a type species of the genus *Digonus,* reaches considerable dimensions (Koch, 1883, Pl. IV, Figs 1 and 6) and has a relatively narrow (sag.) preglabellar field and a coarse tuberculation of exoskeleton, which make it similar to the representatives of the genus *Burmeisteria.* However, earlier species of *Digonus* such as *D. rhenanus* (Koch) and *D. ornatus* (Koch), with the latter's subspecies *D. ornatus ornatus* (Koch), *D. ornatus disornatus* Richter & Richter, and *D. ornatus perlornatus* Richter & Richter, as well as *D. rudersdorfensis* Richter & Richter are completely different than the representatives of *Burmeisteria* or *Burmeisterella.* They differ from these genera in having the following characters: an anteriorly truncate, wide (sag.) preglabellar field, obsolete glabellar lobation and elongate, triangular pygidium, having deep axial and pleural furrows. Now in turn, a glabellar lobation, never observed in species of the genus *Digonus* (Table V), occurs in *Burmeisteria herscheli* (Murchison) and *B. armata westrami* (Dohm). In addition, in all species of *Burmeisteria* and *Burmeisterella* the granulate or tuberculate exoskeleton displays more or less regularly arranged spines, whereas species of *Digonus,* although with granulate or tuberculate exoskeletons, are never spinose (Table V; Text-fig. 3).

Examining the phylogenetic development of the Homalonotinae, Reed (1918, p. 327) found that "the Devonian subgenera fall into two main groups, one of which, comprising *Burmeisteria* and *Digonus,* suggests a connexion with the Silurian subgenera, but on the other hand *Parahomalonotus* suggests reversion to the earlier types." Since, on the basis of the species of *Digonus* discussed above, the transition is observed from the genus *Digonus* to the genera *Burmeisteria* and *Burmeisterella,* the present writer agrees with Reed's opinion. On the other hand, *Parahomalonotus,* which, according to the present writer (Table IV), descends from *Digonus* through the mediation of such species as *Digonus vialai* (Gosselet) and *Parahomalonotus forbesi* (Rouault), is also related to a certain extent to *Homalonotus* (Table V), which is indicated by a very slight trilobation of pygidium in the representatives of both *Homalonotus* and *Parahomalonotus,* as well as by a pygidium which is wide anteriorly in all representatives of *Parahomalonotus* and in *Homalonotus rhinotropis* Angelin *sensu* Moberg & Grønwall (1909, Pl. V, Fig. 3).

The third group, very important, occurring for the longest time (Llandovery-Middle Devonian) and represented by species of the genera *Trimerus* and *Dipleura,* evidently related phylogenetically with each other, is, however, not mentioned by Reed (1918).

Summing up the phylogenetic development of the Homalonotinae, the writer supposes that all Lower Devonian Homalonotinae have their eyes mounted more posteriorly than the representatives of this subfamily which occur in the Silurian.

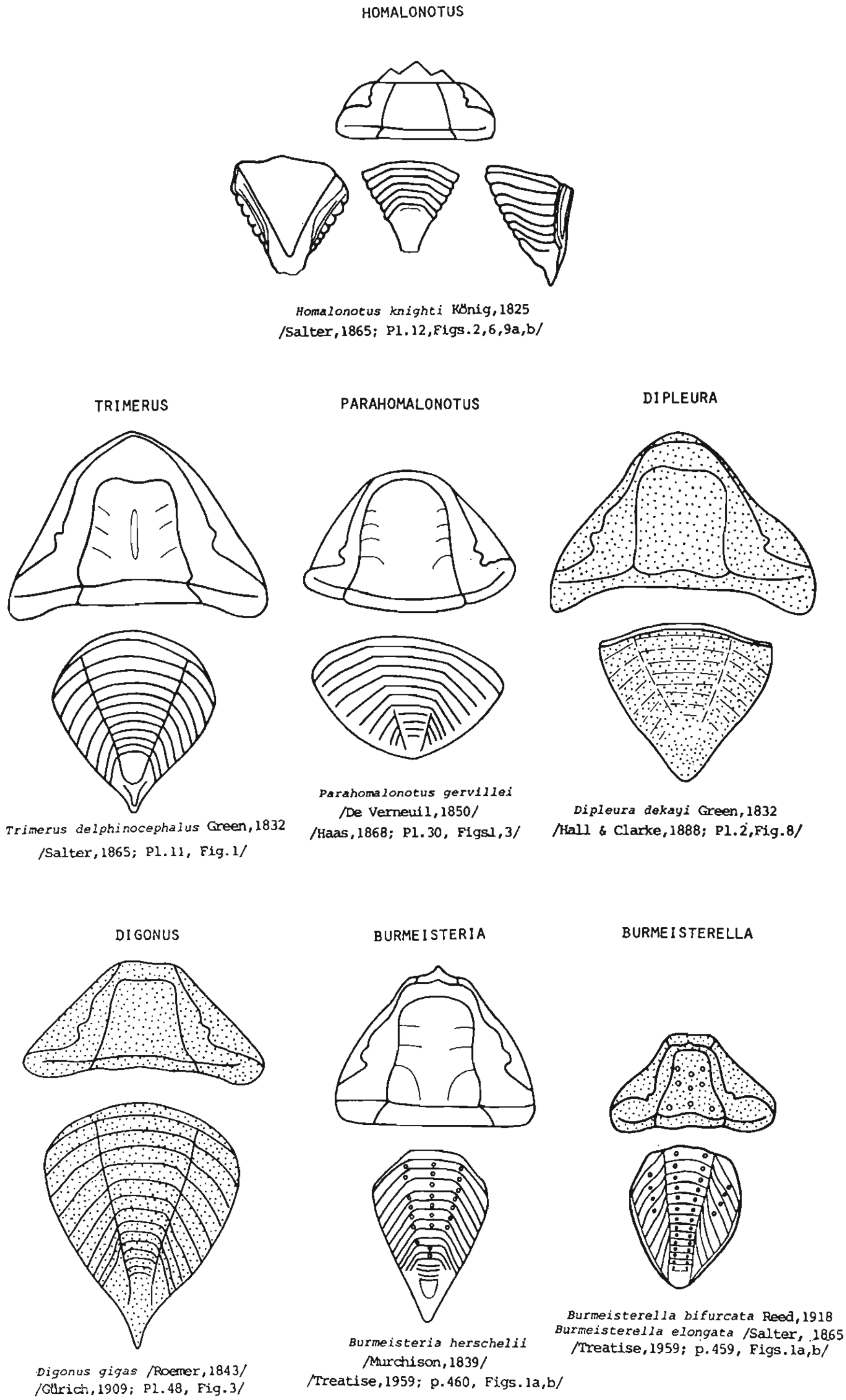


Fig. 3. A comparison of the type species representatives of the genera subfamily Homalonotinae.

TAXONOMIC CRITERIA OF THE HOMALONOTINAE

The shapes of rostral plate and rostral process (Reed, 1918; Richter & Richter, 1917, 1932), which make up taxonomic criteria of the Homalonotinae so far accepted generally, seem, however, to be insufficient. For, we can hardly assign to one and the same genus such clearly different species as *Digonus rhenanus* (Koch), *Burmeisterella armata armata* (Burmeister) and *Trimerus noticus* (Clarke) for the only reason that they have similar rostral process (Richter & Richter, 1917). The same as modifications of the anterior border in the Calymenidae (Tomczykowa, 1970), the presence of rostral process seems to be of an adaptative importance, but it is not in all cases that it may be suitable for taxonomic purposes, similarly as many other processes occurring in the trilobite (Whittington, 1956, 1971).

Setting in order the taxonomy of the Homalonotinae, the present writer has adopted new criteria, which allowed her to separate particular genera (Table V), that is, the width of the preglabellar field, the lobation of glabella and the trilobation and segmentation of pygidium.

The width (sag.) of the preglabellar field depends on the course of facial suture, particularly in the anterior part of cephalon. In the earliest Homalonotinae of the genus *Trimerus*, such as *T. delphinocephalus* Green, *T. cylindricus* (Salter), *T. johannis* (Salter) and *T. mongolicus* Tchernycheva, the preglabellar field is wide, much the same as in the latest Eohomalonotinae, such as *Brongniartella platynota* (Dalman), *B. bisulcata* (Salter) and *B. benderi* Wolfart. The atrophy of the preglabellar field is observed as late as in the Ludlovian forms, such as *Homalonotus knighti* König. In the species of the genus *Digonus*, the preglabellar field is mostly wide, while in *Burmeisteria herscheli* (Murchison) it is narrow and in *Burmeisterella armata westrami* (Dohm) almost disappears. *Dipleura dekayi* Green, like most species of the genus *Dipleura*, has a moderately wide preglabellar field, which is somewhat narrower than that in *Trimerus*. On the other hand, *Parahomalonotus gervillei* (Verneuil) is marked by a quite narrow preglabellar field, but the species of this genus, earlier stratigraphically, as *P. forbesi* (Rouault), have preglabellar field nearly as wide as those in *Digonus*.

The lobation of glabella in the last representatives of the subfamily Eohomalonotinae is mostly visible only on moulds, which may be observed in *Brongniartella platynota* (Dalman), in which glabellar furrows are visible on the mould and not on the exoskeleton (Kielan, 1959). In *Trimerus delphinocephalus* Green, the glabellar lobation is slight, which is termed by Salter (1865, p. 114) as "traces of three lateral furrows." At the same time, no lobation is observed in young holaspids, contrary to *Dipleura dekayi* Green, in which the glabellar lobation occurs only in juvenile individuals or "only under favorable preservation" (Hall & Clarke, 1888, p. 8), or on moulds, like in *Dipleura dekayi boliviensis* Wolfart (1968, pp. 58—61, Pl. 1, Figs 2—5, Pl. 2, Figs 1 and 2) and *Dip. lanvoiensis* Morzadec (1969, pp. 25 and 26, Pl. 2, Fig. 1a). In the Lower Devonian species of the genus *Trimerus,* the lobation is nearly invisible, but in the Silurian ones the glabellar lobation is either distinct, as in *T. lobatus,* or at least expressed in the form of faintly marked glabellar furrows of the first pair, as in *T. mongolicus* Tchernycheva. In *Parahomalonotus gervillei* (De Verneuil), the glabellar lobation is distinct, with clearly marked three or four pairs of glabellar furrows (Haas, 1968), while three pairs of such furrows occur in *Burmeisteria herscheli* (Murchison), the same as in *Burmeisterella armata westrami* (Dohm).

The trilobation of thorax in the Homalonotinae is on the whole faint and not very variable in particular genera, while the trilobation of pygidium, if we take into account its general shape and segmentation, seems to be of a fundamental importance to generic separation (Table V).

The Upper Ordovician species *Brongniartella bisulcata* (Salter), one of the phylogenetically youngest representatives of the Eohomalonotinae, is marked by a parabolic (Text-fig. 2a), elongate, multi-segmentary pygidium with a distinct segmentation and trilobation. *Trimerus delphinocephalus* Green have a cylindrical pygidium and shallow axial and pleural furrows and, consequently, its segmentation and trilobation, although shallow, are distinct (Table V). In *Dipleura dekayi* Green, the traces of the pygidial axial furrows are slightly marked on the mould, similarly as in *Dip. praecox* sp.n., while in *Dip. plana* (Sandberger), the pygidial trilobation and segmentation are obsolete. In the species of *Homalonotus,* the pygidial axial furrows are obsolete and the trilobation is marked due to a slightly convex axis, pygidial segments being bent posteriorly (Text-fig. 3), similarly as in all species of *Parahomalonotus,* in which pygidium is, however, semicircular and not triangular, as in *Homalonotus* (Table V). In all species of the genus *Digonus,* pygidium is triangular and more or less wide (tr.) anteriorly, with a very distinct trilobation and segmentation.

The shape of caudal terminations (Text-fig. 4), depending on the general shape of pygidium, is very characteristic of each genus (Text-figs 3 and 4).

Fig. 4. A comparison of the caudal termination of some species belonging to the subfamily Homalonotinae. *a Homalonotus knighti* König, 1825; *b Digonus elegans* sp.n.; *c Trimerus novus* sp.n.; *d Parahomalonotus forbesi* (Rouault, 1855).

DESCRIPTIONS

Family **Homalonotidae** Chapman, 1890
Subfamily **Homalonotinae** Chapman, 1890
Genus *Homalonotus* König, 1825

Type species: *Homalonotus* knighti König, 1825

Species assigned: see Table III.

Stratigraphical and geographical range: Upper Ludlovian in Britain, France, North America (Nova Scotia), Scannia, Gothland and Poland.

Revised diagnosis. — Cephalon wider than long, anterior margin tricuspid. Glabella trapezoidal, without lobation. Preglabellar field obsolete or very narrow. Thorax and pygidium with an almost obsolete trilobation. Pygidium triangular, pointed posteriorly, segmentation distinct.

Remarks. — The genus *Homalonotus,* originally including all the Homalonotidae, was accepted in such an extensive range, nearly to the end of last century. These trilobites were first divided "in five, or possibly six groups or subgenera" by Salter (1865, pp. 104 and 105), who erected for *Homalonotus s.s.* the name *Königia.* This name (ultimately acknowledged in Treatise, 1959 as a synonym of *Homalonotus* König, 1825) was backed up by Reed (1918) only. Recently this genus is represented by three species only (Table III).

Salter (1865) recognized *Homalonotus ludensis* Murchison, 1837 as a synonym of *H. knighti,* but, on the basis of a specimen of cranidium with a wide and anteriorly truncate preglabellar field, he erected a new species, *Homalonotus ludensis* Salter, 1865. These characters show that the specimen mentioned above belongs to the genus *Dipleura,* which in fact was suggested by Salter.

Reed (1918) related *Homalonotus knighti* and *Trimerus johannis* within the genus *Homalonotus,* explaining this by its anteriorly tricuspid rostral plate (Text-fig. 7b). However, *Trimerus johannis* differs from the type species of the genus *Homalonotus* in a large preglabellar field and a distinct pygidial trilobation.

Homalonotus knighti König, 1825

(Pl. I, Figs 1—11; Text-fig. 2*a*)

1825. *Homalonotus Knightii* König, Pl. 7, Fig. 85. (not seen)
1837. *Homalonotus Knightii* Murchison, Pl. 7, Figs 1, 2. (not seen).
1865. *Homalonotus Knightii* König; Salter, p. 119, Pl. 12, Figs 2—10, Pl. 13, Fig. 8.
1920. *Homalonotus* (*Digonus*) *Roemeri* de Koninck; Barrois, Pruvost & Dubois, p. 117, Pl. 15, Figs. 12, 13?.
1924. *Homalonotus knighti* Koenig; McLearn, p. 163, Pl. 26, Figs 12, 13.

Material. — A small, incomplete cranidium, two counterparts of cranidia, a complete pygidium, six incomplete pygidia, a fragmentary thorax and some remnants. (IG 1321.II.1—10; IG.8.II.350).

Remarks. — The best preserved specimen of pygidium from the Upper Ludlovian of the Holy Cross Mts differs only slightly from the holotype *Homalonotus knighti* König. The Polish specimen is larger than the holotype and has eight pygidial segments, like a specimen presented by Salter (1865, Pl. 12, Fig. 2), while the holotype has seven segments only.

Homalonotus rhinotropis Angelin, 1852, described from Scannia and Gothland, was recognized by Salter (1865) and afterwards by Lindström (1885) as a synonym of *H. knighti* König. *H. rhinotropis* was redescribed by Moberg & Grønwall (1909) as a subspecies of *H. knighti,* but the specimens they illustrated are sufficiently different to consider them as a separate species.

Specimens of *Homalonotus knighti* König from the Upper Siedlce Beds of Northern Poland (Gołdap borehole) are considerably smaller than those from the Holy Cross Mts (Pl. I, Figs 4—6). The tricuspid anterior margin of cephalon (Pl. I, Figs I and 3) gives ample evidence of their indubitable belonging to this species.

Occurrence. — Poland: Holy Cross Mts., Łężyce—Bełcz section: Lower Rzepin Beds — Upper Ludlovian; eastern part of the Peri-Baltic area, Gołdap borehole, 1161—1162 m, Upper Siedlce Series, Monograptus formosus Zone — Upper Ludlovian. Great Britain, France, North America (Nova Scotia) — Upper Ludlovian.

Genus *Dipleura* Green, 1832

Type species: *Dipleura dekayi* Green, 1832
Species assigned: see Table III
Stratigraphical and geographical range: Upper Silurian of Great Britain and Poland; Lower Devonian of Africa, Turkey, Rumania, Germany, France, Belgium; Lower and Middle Devonian of North and South America and France.

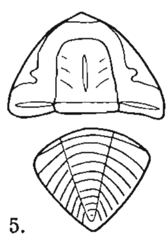
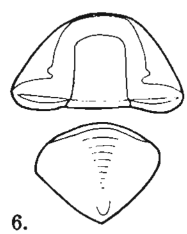
Revised diagnosis. — Cephalon less than half as long as wide. Glabella almost imperceptibly narrowing anteriorly, lobation recognizable only in young stages. Preglabellar field well developed. Pygidium obtusely pointed posteriorly, with a very indistinct trilobation and segmentation.

Remarks. — The author believes that there is ample evidence for considering *Dipleura* and *Trimerus* as separate genera (Table V). The differences between type species of these genera, that is, *Trimerus delphinocephalus* Green and *Dipleura dekayi* Green, concern the structure of pygidium and cephalon. According to Reed (1918), the features most characteristic of the genus *Dipleura* are an "obsolete trilobation and nearly obsolete segmentation of the pygidium". This is particularly visible in the holotype of the type species (Pl. I, Fig. 8a). Hall & Clarke (1888) noticed that in *Dip. dekayi* the pygidial segmentation is visible only in young holaspids, while in the adults it occurs only on the moulds. The same observation was made by the present author in *Dipleura praecox* (Pl. II, Figs 10 and 11), in which a faint segmentation of the axis is visible on the mould only, whereas *Trimerus delphinocephalus* Green and the remaining species of this genus have their pygidial segmentation and trilobation visible both on the moulds and exoskeleton, but have very shallow axial furrows (see *Trimerus lobatus* sp.n., Pl. II, Figs 7 and 8).

The genera *Trimerus* and *Dipleura* were connected with each other on the basis of poorly preserved specimens and insufficiently studied species such as *Trimerus kayseri* (Thomas, 1905) and *Trimerus mongolicus* Tchernycheva, 1937. Sometimes, species displaying characters of *Trimerus* were assigned to other genera such as, for example, *Trimerus accraensis*, assigned by Saul (1967) to *Digonus* (*Burmeisteria*) due to its pimple-like prominence on the rostral plate (see Text-fig. 7e).

Table VI depicts characters of *Dipleura praecox* sp.n. and *Trimerus lobatus* sp.n., two species very closely related to each other and occurring in the core within a 3 m-thick range of deposits.

Table VI

Characters	*Trimerus lobatus* sp. n.  Fig. 5.	*Dipleura praecox* sp. n.  Fig. 6.
Cephalon		
anterior outline	triangular	semicircular
Glabella		
shape	tapering anteriorly	rectangular
lobation	distinct	obsolete
surface	central ridge prominent axially	smooth, slightly protuberant
Pygidium		
shape	triangular, cylindrical	triangular, rounded
trilobation	faint	very indistinct on the mould
segmentation	distinct	very indistinct on the axis

Dipleura praecox sp.n.
(Pl. II, Figs 9—12; Text-fig. 6)

Holotype: a pygidium, IG 1321.II.23, Pl. II, Fig. 10.
Type horizon: Silurian, Upper Siedlce Beds, Upper Ludlow, Monograptus formosus Zone.
Type locality: Gołdap borehole, Peri-Baltic area, Poland.
Derivation of the name: Lat. *praecox* — premature, in connection with the appearance of a representative of this species as early as the Silurian.

Diagnosis. — Cephalon semicircular; glabella rectangular, slightly protuberant, smooth; pygidium rounded posteriorly, trilobation and segmentation of the exoskeleton obsolete, slightly visible on the mould, terminal axial piece slightly protruding.

Material. — An almost complete cephalon, two fragmentary cranidia, three pygidia, including two fragmentary (IG 1321.II.22—29)

Dimensions (in mm):

	IG 1321.II.22	IG 1321.II.23 holotype
Length of cranidium	20	
Length of glabella	15	
Width of glabella frontal	12	
basal	13	
Length of pygidium		10
Width of pygidium		11

Description. — Cephalon semicircular, rounded anteriorly, gently convex. Glabella rectangular, uniformly protuberant, smooth, devoid of lobation. Preglabellar field makes up one-fifth of the length of glabella. Eyes on the level situated one-third the length of glabella from its base, their distance from dorsal furrows amounts to almost a half of the width (tr.) of glabella. Occipital furrow distinct, occipital ring narrow, amounting to one-tenth of the length of glabella. Thorax unknown. Pygidium triangular, rounded posteriorly. Axial furrows faint, visible only on the moulds (Pl. II, Fig. 11), on which also a faint segmentation of the axis is marked. Terminal axial piece slightly protruding (Pl. II, Figs 10 and 12). Ornamentation obsolete.

Remarks. — *Dip.* ? *ludensis* (Salter) (non *Homalonotus ludensis* Murchison, 1837) is the only species known thus far in Silurian, which may be assigned to the genus *Dipleura*. Since the pygidium of this species is unknown, it is impossible to compare it with *Dip. praecox* sp.n., but the cranidia of the two species differ considerably. *Dip.* ? *ludensis* (Salter) has a trapezoidal glabella, elevated above the occipital ring and an occipital furrow considerably deeper and wider than that of *Dip. praecox* sp.n. Thus, they differ too much to be considered as conspecific.

The remaining species of *Dipleura*, much younger stratigraphically, are considerably larger than *Dip. praecox* sp.n. The new species differs from the holotype of the type species *Dipleura dekayi* (Pl. I, Fig. 8) in a triangular outline of the posterior part of pygidium and very faint segmentation and trilobation of pygidium outlined on the mould. The pygidium of *Dip. praecox* sp.n. is marked by a characteristic protuberance of the terminal axial piece, which is also observed in some specimens of *Dipleura dekayi* Green (Hall & Clarke, 1888 Pl. III, Fig. 4; Pl. V, Figs 13 and 14) and in *Dip. dekayi boliviensis* Wolfart (1968, Pl. II, Figs 4 and 5a). However, the pygidium of the new species is most similar, in shape and outline of axis, to that of *Dipleura simplex* Richter & Richter, but the latter is more convex. Since the cephalon of the German species is unknown, it is impossible to conduct any close comparison between the two species.

Occurrence. — Poland: Peri-Baltic area, Gołdap borehole, 1161—1163 m., Upper Ludlow, Upper Siedlce Series, Monograptus formosus Zone.

Genus *Trimerus* Green, 1832

Type species: *Trimerus delphinocephalus* Green, 1832.

Species assigned: see Table III.

Stratigraphical and geographical range: Silurian and Lower Devonian of North and South America, Africa, Australia, Poland and France; Silurian of Great Britain, Mongolia and Poland.

Revised diagnosis. — Cephalon triangular; glabella slightly tapering anteriorly, lobation occasionally distinct; preglabellar field well-developed; pygidium triangular, cylindrical, more or less acuminate posteriorly, trilobation faint, segmentation distinct.

Remarks. — The anteriorly triangular cephalon results, in the genus *Trimerus*, from the shape of the anterior margin of rostral plate, which is particularly clearly visible in *T. lobatus* sp.n. (Text-fig. 7*c*; Pl. II, Figs 5c-d). It seems that it is only in the British specimens of *Trimerus delphinocephalus* Green that the anterior sections of facial suture join each other axially to form a triangular shape of the frontal area of cranidium (Text-figs 2*b* and 3). On the other hand, in the holotype of *Trimerus delphinocephalus* (Pl. I, Fig. 7), the anterior sections of facial suture are poorly visible and some specimens of the type species, illustrated by Hall (1852, Pl. 68, Figs 4 and 7), have a straight rostral suture which is parallel to the anterior glabellar margin, much the same as in all other species of this genus. The triangular anterior cephalic outline in some species of the genus *Trimerus* may be emphasized by a rostral process or a prominence, as observed in *T. accraensis* (Saul) or *T. noticus* (Clarke).

In the genus *Trimerus*, the rostral plate is considerably variable (Text--fig. 7), but the triangular outline of its anterior margin occurs in all species. Its dorsal part is preserved only rarely (Text-fig. 7*a* and *c*). In the Silurian species the rostral plate is smooth, devoid of processes. A small node occurs in the Lower Siegenian species *Trimerus novus* sp.n. (Text-fig. 7*d*) and a stout, pimple-like prominence in *Trimerus accraensis* (Text-fig. 7*e*).

Fig. 7. A comparison of the rostral plates of some *Trimerus* species. *a T. delphinocephalus* Green (after Salter, 1865); *b T. johannis* (Salter, 1865); *c T. lobatus* sp.n. with marked dorsal part of the rostral plate; *d T. novus* sp.n., with a small rostral node; *e T. accraensis* (Saul, 1967), with a pimple-like rostral prominence.

A cylindrical shape of pygidium, observed in all species, with its length-width-ratio steadily mainted about a value of 1:1, is one of the most important characters of the genus *Trimerus*. A similar ratio is recorded in few species of *Digonus*, as *D. rhenanus* (Koch), but the length of pygidium in the representatives of this genus, is on the whole considerably larger than the width, with an acute-angled caudal termination (Richter & Richter, 1932, Figs 1a and 5a). In the present writer's opinion, some species hitherto assigned to *Digonus*, belong to *Trimerus*. It seems that the erroneous assignment was caused by paying insufficient attention to the depth of pygidial axial and pleural furrows and to the shape of pygidium. In *Trimerus*, the pygidial axial furrows are particularly shallow on the exoskeleton, while on the moulds they are well marked, but rather shallow, considerably more so than in species of the genus *Digonus*.

The genus Trimerus is known beginning with the Llandovery and above the Silurian it is recognized only in Australia (Gill, 1949). The present writer has described *Trimerus novus* sp.n. from the Lower Siegenian of Poland and, in addition, assigned to the genus *Trimerus*, among other species (Table III), two Lower Devonian ones, *T. accraensis* (Saul, 1967) and *T. noticus* (Clarke, 1913), closely related with. The two species have pygidia very similar to that of the holotype of *Trimerus delphinocephalus* (Pl. I, Fig. 7).

Trimerus lobatus sp.n.

(Pl. II, Figs 1—8; Text-figs 5 and 7*c*)

Holotype: a cephalon, Pl. II, Fig. 5; IG 1321.II.16.

Type horizon: Silurian, Upper Siedlce Beds, Upper Ludlow, Monograptus formosus Zone.

Type locality: Gołdap borehole, Peri-Baltic area, Poland.
Derivation of the name: Lat. *lobatus* — marked by distinct glabellar lobes.

Diagnosis. — Preglabellar field well-developed, rostral plate pentagonal, dorsally triangular; glabella with three pairs of lateral lobes and a longitudinal central ridge. Pygidium triangular, cylindrical, with ten axial rings and seven pleural ribs.

Material. — One complete and three incomplete cephalons, six incomplete pygidia and single pleura (IG 1321.II.11—21, 30, 31).

Dimensions (in mm):

	IG 1321.II.16 holotype	IG 1321.II.13
Length of cephalon	27	21
Width of cephalon	41	37
Length of glabella	17	14
Width of glabella frontal	12	9.5
basal	16	12
	IG 1321.II.18	IG 1321.II.21
Length of pygidium	~ 31	14
Width of pygidium	~ 32	14
Width of axis	14	5

Description. — Cephalon triangular in outline, wider (tr.) than long (sag.). Dorsal part of the rostral plate relatively large, triangular, axially equalling a half of the width of the preglabellar field; ventral part pentagonal, smooth. Preglabellar area equalling a quarter of the length of glabella. Glabella tapering anteriorly, with three pairs of lateral lobes, frontal lobe truncate anteriorly. Central glabellar area has a longitudinal central ridge, reaching from preoccipital furrows to the frontal lobe (Text-fig. 5; Pl. II, Fig. 5c). Axial furrows wide and shallow. Eyes small, situated opposite the median lateral glabellar lobes, slightly above the glabellar surface. Anterior sections of facial suture, slightly arcuate, running anteriorly. Rostral suture straight and, consequently, anterior cranidial margin also straight and not triangular like anterior cephalic margin. Occipital ring flat and narrow, equalling one-seventh of the length of glabella. Occipital furrow very narrow and shallow. Posterior sections of facial suture intersecting lateral cephalic margin opposite posterior edge of median lateral glabellar lobes. Postocular part of cheek wide (exs.) and not elongate (tr.). Free cheek triangular, small, narrow. A complete thorax unknown. Thoracic segment wide (sag. and exs.), with a faint trilobation, outer part of pleura (exs.) widens laterally, rounded. Pygidium triangular, cylindrical, slightly convex, with trilobation and segmentation particularly distinct on the moulds and shallower on the exoskeleton. Axis composed of ten rings and with its posterior portion rounded and fused with a smooth border area. Pleural region with eight pleural furrows, gradually shorter and shallower posteriorly and nearly reaching the pygidial margin. Exoskeleton smooth, mould very finely pitted.

Remarks. — *Trimerus lobatus* sp.n. was at first identified by the author (Tomczykowa, 1971) erroneously as *T. delphinocephalus* Green. The new species here described differs from *T. delphinocephalus* in the run of rostral suture, which in *Trimerus lobatus* sp.n. is parallel to the anterior glabellar margin. In addition, *T. lobatus* sp.n. has very distinct glabellar lobes and a longitudinal central ridge on glabella (Text-fig. 5; Pl. II, Fig. 5c). These two characters are displayed by the holotype of *Trimerus delphinocephalus* (Pl. I, Fig. 7), but are visible in British specimens of this species (Salter, 1865, Pl. 11, Fig. 1). Next, the pygidium of *Trimerus lobatus* sp.n. is more similar to that of the holotype of *T. delphinocephalus* in the shape, in the depth of segmentation and number of axial rings (ten), while British specimens of *T. delphinocephalus* have eleven rings and a spine-like caudal termination, whose length may, according to Salter (1865, p. 115), indicate the sex. In the holotype of *T. delphinocephalus* and *T. lobatus* sp.n., the caudal termination is conical.

Occurence. — Poland: Peri-Baltic area, Gołdap borehole, 1161—1163 m, Upper Ludlow, Upper Siedlce Series, Monograptus formosus Zone.

Trimerus novus sp.n.

(Pl. III, Figs 1—15; Text-figs 4c, 7d, 8)

Holotype: a pygidium, Pl. II, Fig. 7; Text-figs 4c, 8b—d; IG 1321.II.36.
Type horizon: Lower Devonian, Lower Ciepielovian, Trimerus novus Zone.
Type locality: Małochwiej borehole, Lublin area, Poland.
Derivation of the name: Lat. *novus* — a new representative of this genus in the Devonian.

Diagnosis. — Glabella slightly tapering anteriorly, axial furrows bend adaxially on the level of eyes. Pygidium cylindrical, obtusely angled; trilobation shallow, segmentation distinct.

Material. — Four incomplete cephalons, one incomplete cranidium, six pygidia (IG 1321.II.33—43, 81—84).

Dimensions (in mm):

	IG 1321.II 43	IG 1321.II 41	IG 1321.II 36 holotype	IG 1321.II 34
Length of glabella	24	21		
Width of glabella				
frontal	14	13		
basal	20	19		
Length of pygidium			23	24
Width of pygidium			24	25
Width of axis			12	14

Description. — Cephalon arcuate anteriorly. Anterior sections of facial suture bent exsagitally and joining rostral suture, which is very short, straight and parallel to the anterior glabellar margin. Dorsal part of rostral plate very small. Preglabellar field wide, making up a quarter of the length of glabella and slightly concave axially. Glabella tapering anteriorly, somewhat elevated above axial furrows, smooth; in some specimens (Pl. III, Figs 9 and 14), a faint, glabellar lobation is visible. Axial furrrows shallow, slightly depressed and bent adaxially on the level of eyes, shallowing anteriorly. Eyes small, slightly elevated above glabella, their distance from axial furrow equalling about one-fifth of the basal width of glabella. Posterior sections of facial suture intersecting the lateral cephalic margin on the level of the posterior edge of eye. Occipital furrow narrow and shallow. Occipital ring equalling one-seventh of the length of glabella. Thorax unknown. Pygidium triangular, cylindrical, uniformly convex, obtusely terminating; trilobation shallow, segmentation distinct. Pygidial axis moderately convex, with nine rings. Pleurae with eight ribs. Lateral and posterior outlines gently arcuate (Text-figs 8*c* and *d*). Exoskeleton smooth, mould very finely pitted, cephalic border and doublure with terrace lines. Pygidial exoskeleton very finely granulated, doublure with terrace lines.

Remarks. — The shape of glabella, the cylindrical pygidium with a shallow trilobation and distinct segmentation indicate that this species should be assigned to the genus *Trimerus* (Text-fig. 8).

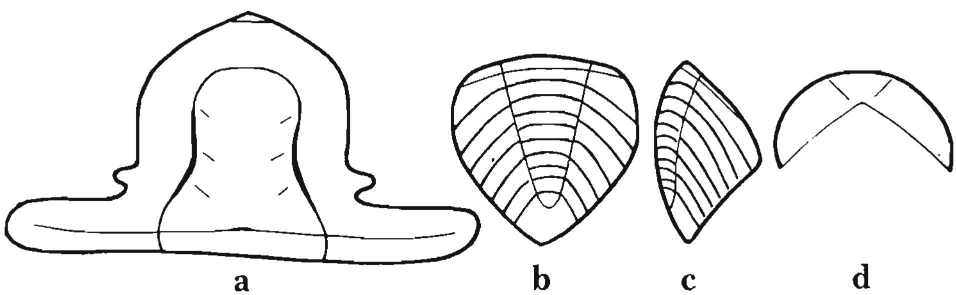


Fig. 8. *Trimerus novus* sp.n. *a* reconstructed cranidium; *b* pygidium; *c* lateral view; *d* posterior view.

The triangular anterior margin of cephalon, so distinct in *Trimerus delphinocephalus* Green and *T. lobatus* sp.n., in *T. novus* sp.n. is considerably less distinctly marked because of a very small dorsal part of rostral plate. In addition, the eyes of *T. novus* are situated considerably more posteriorly than in *T. lobatus* and *T. delphinocephalus.*

In *Trimerus novus,* the glabellar furrows are very faintly marked and visible only in oblique lighting. In this species, glabella is uniformly and slightly convex, and devoid of central ridge which occurs in *Trimerus lobatus.*

The pygidium of *Trimerus novus sp.n.* is somewhat similar to that of *T. acuminatus* (Tromelin & Lebesconte), but is slightly wider (tr.), shorter (sag.) and more obtusely terminating.

Occurrence. — Poland: Lublin area, boreholes: Małochwiej, 2937—2939 m; Zakrzew IG-3, 2490—2498 m; Rozkopaczew, 2109 m; Łopiennik, 2736—2738 m; Strzelce IG-2, 1650 m; Lower Devonian, Lower Ciepielovian, Trimerus novus Zone.

Trimerus sp.
(Pl. III, Fig. 4)

Material. — One pygidium, IG.1321.II.32.

Description. — Pygidium 17 mm long and wide, axis 8 mm wide, with ten rings plus three additional ones. Pleurae with nine ribs. Axial furrows very faint, having almost no depth, on the exoskeleton marked only by a smooth area between axis and pleurae. Pleural furrows shallow and narrow. Pygidium triangular in general outline, cylindrical, and obtusely terminating, with a flat axis. The surface of exoskeleton very finely granulated.

Remarks. — *Trimerus* sp. differs from *T. novus* in an exceptionally flat pygidial axis. *Trimerus* sp. has three additional furrows on the axis, which are outlined on the exoskeleton only.

The single specimen discussed does not entitle the author to erect a new species. At the same time, it is difficult to assign it to any of the species known thus far.

Occurrence. — Poland: Lublin area, Zakrzew IG-3 borehole, 2460 m; Lower Devonian, Lower Ciepielovian, Trimerus novus Zone.

Genus *Digonus* Gürich, 1909

Type species: *Digonus gigas* (Roemer, 1843).

Species assigned: see Table III.

Stratigraphical and geographical range: Lower Devonian of North and South America, Africa, New Zealand, Germany, Belgium, France, Spain and Poland.

Revised diagnosis. — Cephalon subtriangular; cranidium trapezoidal; glabella trapezoidal or rectangular, devoid of lobation. Anterior sections of facial suture more or less abruptly bent towards a straight or somewhat concave rostral suture. Pygidium triangular, pointed posteriorly and with a very distinct trilobation and segmentation.

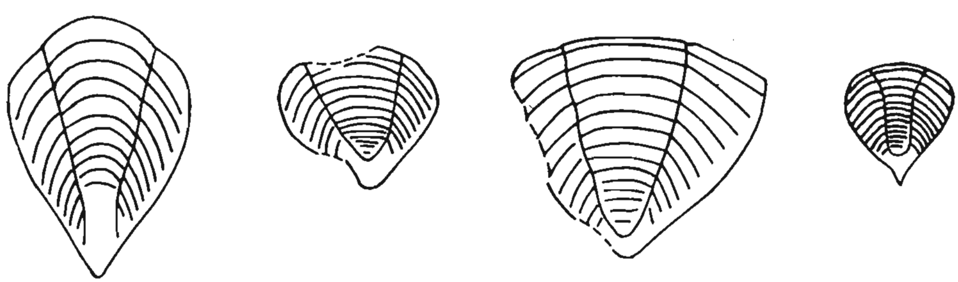
Remarks. — *D. gigas* (Roemer, 1843), a type species of the genus *Digonus,* has many synonyms, such as, for example, *Homalonotus crassicauda,* described by Roemer (1865, 1870) from the Sudetes. According to Kayser (in Koch, 1883) other synonyms are: *Homalonotus barrandei* Roemer, 1852, *H. latifrons* Roemer, 1855, *H. minor* Roemer, 1843, *H. granulosus* Trenkner, 1876 and *H. scabrosus* Koch, 1883. The last-named species, described and illustrated by Koch (1883, pp. 43—48, Pl. 3, Figs 8—10, Pl. 4) makes up a neotype of the type species (Gürich, 1909, p. 157, Text-fig. 42, Pl. 48, Fig. 3). The author succeeded in finding the holotype of *Digonus gigas* (Roemer). The holotype of *Homalonotus crassicauda* Roemer (1865, p. 593, Pl. 17, Fig. 12) got lost during World War II.

The revised diagnosis given above is based in part on Gürich's (1909) and Reed's (1918) diagnoses, corrected by the present writer as a result of the observation of species of the *Digonus ornatus* (Koch) group and of the descriptions given below. In his diagnosis, Sdzuy (1959, p. 461) took into account not all of the characters, which in the present paper are considered as diagnostic ones (Table V).

Species with an uncertain generic assignment (Table III) are also included in the genus *Digonus*. Here belong *D.* ? *armoricanus* (Pillet), whose cephalon corresponds to the genus *Digonus*, but its pygidium is shorter than it should be to correspond to this genus, the same as pygidia described by Richter & Richter (1954) as *Homalonotus* (*Digonus*) *roemeri* (Pl. I, Fig. 9) and *Homalonotus* (*Digonus*?) sp.E (Pl. I, Fig. 13).

The form, presented by Richter & Richter (1954) as *Homalonotus* (*Digonus*) *roemeri* De Koninck, 1876, does not correspond to the specimen described and figured by De Koninck. *Homalonotus roemeri* De Koninck, a species considered to be the oldest stratigraphically of the representatives of the genus *Digonus*, cited from many countries (Table II), should, therefore, be subject to revision. As follows from the identifications of Barrois, Pruvost & Dubois (1920), Richter & Richter (1954) and Balashova (1968), this species may be interpreted optionally, which is illustrated by diagrammatic drawings of pygidia assigned to this species (Text-fig. 9).

In species of the genus *Digonus* granulation appears gradually and becomes coarser and coarser in forms successively younger stratigraphically. In *D. bostoviensis* it is almost non-existent, occurring only on the



a b c d

Fig. 9. A comparison of the pygidium *Digonus*? *roemeri* (De Koninck 1876) presented by different authors. *a Homalonotus Roemeri* de Koninck, 1876; Pl. 1, Fig. 15b; *b Homalonotus Roemeri* de Kon.; Barrois, Pruvost & Dubois, 1920; Pl. 17, Fig. 7; *c Homalonotus* (*Digonus*) *roemeri* (De Koninck, 1876); Richter & Richter, 1954; Pl. 1, Fig. 9a; *d Homalonotus* (*Digonus*) *roemeri* Koninck; Balashova, 1968; Pl. 2, Fig. 9a.

anterior margin of cephalon. In *D. vialai,* it is very fine and does not appear practically in the axial part of exoskeleton; in *D. elegans* it is fine, but begins to differentiate as somewhat coarser grains occur in a fine, dense granulation. Of all the species described, the most distinct is the granulation of *Digonus* sp. (Pl. II, Fig. 5), which, in the Lower Siegenian of Poland, is the youngest stratigraphically and whose granulation is similar to that in *D. rhenanus* (Koch 1883, Pl. III, Fig. 6). The Middle and Upper Siegenian species of *Digonus* have a coarser and coarser ornamentation, as observed in *D. ornatus disornatus, D. ornatus perlornatus* and, finally, *D. gigas*. Later, this granulation is yet more variegated with nodes and spines in the representatives of *Burmeisteria* or *Burmeisterella*.

Digonus bostoviensis sp.n.

(Pl. IV, Figs 1—4)

Holotype: a cranidium, IG. 1321.II.44; Pl. IV, Fig. 2.
Type horizon: Lower Devonian, Upper Bostovian, Digonus bostoviensis Zone.
Type locality: Bostów, Holy Cross Mts, Poland.
Derivation of the name: *bostoviensis*, after the locality Bostów.

Diagnosis. — Cranidial frontal margin straight-truncate; glabella rectangular, smooth, nearly flat; eyes close to glabella; pygidium elongate; trilobation and segmentation very distinct.

Material. — Two cranidia, three incomplete pygidia, pleurae (IG.1321. II.44—46, 48—51).

Dimensions (in mm):

	IG 1321.II 44	49
Length of cranidium	27	17
Length of glabella	19	12
Width of glabella frontal	12	8
basal	13	9

Description. — Cranidium slightly convex. Anterior sections of facial suture parallel to axial furrows, anteriorly bending towards as straight rostral suture, which is parallel to the anterior margin of frontal lobe. Preglabellar field well-developed, more than a quarter of the length of glabella and axially displaying a slight concavity. Axial furrows fairly deep, parallel, uniform in depth both posteriorly and anteriorly. Frontal glabellars lobe somewhat elevated above the preglabellar field. Glabella nearly parallel-sided, moderately convex, devoid of lobation. Eyes small, situated close to glabella, at a distance equalling less than a quarter of the basal width of glabella, and close to the posterior cephalic margin. Occipital ring narrow, equalling less than one-sixth of the length of glabella. Occipital furrow fairly deep and narrow. Posterior sections of facial suture parallel to the posterior border furrows. Postocular part of cheek narrow (exs.) and long (tr.), but less than a double basal width of glabella. A complete thorax unknown. The segment of thorax rather narrow (exs.) with a very deep and fairly wide interpleural furrow. Distal end of a pleura rounded. Trilobation faint (Pl. IV, Fig. 3). Pygidium triangular in outline, anteriorly fairly wide. Trilobation and segmentation very distinct. Axis with eleven to thirteen rings, pleurae with ten ribs each. Pygidial axial and pleural furrows deep, the latter reaching the very margin of pygidium. Axis anteriorly wide, posteriorly tapering, slightly elevated above pleurae. Caudal termination pointed. Exoskeleton very finely granulated on the preglabellar field only.

Remarks. — *Digonus bostoviensis* sp.n. is probably closely related to *Digonus? roemeri sensu* Richter & Richter (1954, Pl. 1, Fig. 8) and to *D. vialai* (Gosselet), but differs from them in its rectangular glabella. This character is yet strongly marked in *D. elegans*. *D. bostoviensis* sp.n. differs from *D. vialai* (Gosselet) in a more elongate pygidium, which has more axial rings and pleural ribs. In the Lower Devonian of Poland, *D. bostoviensis* is the oldest species of the Homalonotinae, appearing as early as the Upper Bostovian (= Upper Gedinnian).

Occurrence. — Poland: Holy Cross Mts: Bostów; Lublin area; Krowie Bagno borehole, 1769—1771 m, Lower Devonian, Upper Bostovian, Digonus bostoviensis Zone.

Digonus elegans sp.n.

(Pl. V, Figs 1—8; Text-fig. 4b)

Holotype: a cephalon, IG. 1321.II.54; Pl. V, Fig. 2.
Type horizon: Lower Devonian, Lower Ciepielovian.
Type locality: Ciepielów borehole, 2276 m, Radom area, Poland.
Derivation of the name: Lat. *elegans* — graceful.

Diagnosis. — Glabella elongate, parallel-sided, anteriorly rounded and elevated above the preglabellar field; postocular part of cheek narrow and long (tr.).

Material. — An incomplete cephalon, two fragmentary cranidia, a free cheek and four incomplete pygidia (IG.1321.II.54—59, 67, 73, 85).

Dimensions (in mm):

	IG. 1321.II.54 holotype
Length of glabella	26
Width of glabella	16

Description. — Cephalon subtriangular, cranidium trapezoidal, slightly convex. Anterior sections of facial suture bent anteriorly and joining a straight rostral suture. Preglabellar field wide and flat. Glabella parallel--sided, distinctly elongate, slightly convex, devoid of lobation. Axial furrows parallel to the axis, shallow. Glabellar frontal lobe anteriorly rounded and elevated above the preglabellar field. Eyes small, close to glabella and not raised above it. Posterior sections of facial suture parallel to posterior cephalic margin. Posterior part of cheek longer (tr.) than glabella together with occipital ring. Occipital ring narrow, its width equalling one-ninth of the length of glabella. Free cheek wide, triangular.

Thorax unknown. Pygidium known in fragmentary form, probably having twelve axial rings and three accessory furrows at the posterior end of axis. Nine pleural ribs. Pygidial axial and pleural furrows deep. Terminal axial piece slightly convex, extending in a fanlike manner and reaching the posterior pygidial margin. Caudal termination pointed (Text-fig. 4*b*). A very fine granulation, visible on the exoskeleton, cephalic and pygidial moulds, varying from fine and dense to containing coarse and widely-spaced grains.

Remarks. — *Digonus elegans* sp.n. is very closely related to *D. bostoviensis* sp.n., from which it differs in a more elongate and somewhat narrower glabella, whose frontal lobe is more convex and rounded and axial furrows shallower, while the glabella of *D. bostoviensis* is flat and only slightly raised above the preglabellar field. In *D. elegans*, the preglabellar field is quite level and flat, while in *D. bostoviensis* slightly concave in the center. In addition, the two species differ in ornamentation of exoskeleton. In *D. elegans* it is granulated and in *D. bostoviensis* the exoskeleton and mould are smooth, except for the anterior part of the preglabellar field (Pl. IV, Fig. 1).

The two Polish species described above differ from the type species *D. gigas* (Roemer) in an elongate, rectangular glabella. In *D. gigas* and *D. ornatus ornatus* (Koch), glabella is trapezoidal and in *D. rhenanus* (Koch) subsquare. A rectangular glabella is, on the other hand, recorded in *D. rudersdorfensis* Richter & Richter, but this species, the same as those from the Lower Devonian of Germany mentioned above, have pygidia much more elongate and pointed than the Polish species of the genus *Digonus*.

Occurrence. — Poland: Radom—Lublin area; boreholes: Ciepielów, 2276—2277 m; Zakrzew IG-3, 2485—2492 m; Małochwiej, 2938 m; Strzelce IG-2, 1628—1646 m. Lower Devonian, Lower Ciepielovian.

Digonus vialai (Gosselet, 1912)
(Pl. IV, Figs 6—12)

1912. *Homalonotus Vialai* nov.sp. Gosselet; Gosselet, p. 11, Pl. 1, Fig. 1—13, Text-fig. 3.
1920. *Homalonotus Vialai* Gosselet; Barrois, Pruvost & Dubois, p. 115, Pl. 15, Figs 15, 16.
1954. *Homalonotus vialai* Gosselet; Richter & Richter, p. 32, Pl. 1, Figs 6—7.
1954. *Homalonotus* (*Digonus*) *roemeri* (De Koninck 1876); Richter & Richter, p. 32, Pl. 1, Figs 8, 10—12 (non 9).

Material. — Four nearly complete cranidia, three free cheeks, a pygidium with part of thorax, three small pygidia (IG.1321.II. 47, 52, 53, 68—72, 94—96, 98—100).

Remarks. — The cranidium from the Krowie Bagno section (Pl. IV, Fig. 9; IG.1321.II.52) completely corresponds to the holotype of *Digonus vialai* (Gosselet, 1912). The other two, smaller cranidia (Pl. IV, Figs 6 and 8; IG. 1321.II.53 and 96) are specimens of young holaspids, very similar to a young individual illustrated by Gosselet (1912, Pl. 1, Fig. 2). The species *D. vialai* may be recognized fairly easily by its slightly trapezoidal glabella, which is convex axially in the middle. Of the species of the genus *Digonus*, the oldest stratigraphically, only *D. vialai* has a trapezoidal glabella as opposed to a rectangular one in *D. bostoviensis* sp.n. and *D. elegans* sp.n., but most similar to a trapezeoidal glabella of the type species *D. gigas*.

According to Richter & Richter (1954), due to its pygidium, rounded in outline and sharply pointed at its caudal termination, *Digonus vialai* (Gosselet, 1912, Pl. 1, Fig. 10) is similar to *Parahomalonotus gervillei* (De Verneuil). The present writer agrees that in the shape of its pygidium *Digonus vialai* is similar to the pygidia of the representatives of *Parahomalonotus*, but it differs in a distinct pygidial trilobation emphasized by well-developed axial furrows (Pl. IV, Fig. 10) which give ample evidence that it is a species of the genus *Digonus*. At the same time, however, the writer believes that, on account of its wide glabella only slightly tending to lobate (Pl. IV, Fig. 9) and its wide, fairly flat pygidium, *Digonus vialai* is a form transitional to the genus *Parahomalonotus* (Table IV). The material, assigned by Richter & Richter (1954, Pl. 1, Figs 10 and 12) to *Homalonotus* (*Digonus*) *roemeri*, includes two young pygidia, very similar to those found by the present writer together with adult specimens of *Digonus vialai* (Gosselet).

Occurrence. — Poland: Lublin area; boreholes: Krowie Bagno, 1745—1747 m; Małochwiej, 2995 m; Białopole, 1405—1411 m. Lower Devonian, Upper Bostovian. Belgium, France, Germany and Morocco: Lower Devonian, Gedinnian.

Digonus sp.
(Pl. IV, Fig. 5)

Material. — Two small, incomplete cranidia (IG.1321.II.60 and 75).

Description. — Cranidium incomplete, small, flat, marked by a fairly wide and slightly convex glabella, which is somewhat wider at the base than in the anterior part and which is somewhat elevated above the preglabellar field, slightly wider (sag.) than one-fifth of the length of glabella. Preglabellar field slightly depressed in the middle. Occipital ring narrow, separated from glabella by a very narrow occipital furrow, which is axially slightly bent anteriorly. Surface of exoskeleton covered with a distinct, dense and fine granulation.

Remarks. — *Digonus* sp., represented by two small and incomplete specimens of cranidia, differs from the species of the genus *Digonus* described above, in the width-length ratio of glabella, which resembles rather that of *Digonus rhenanus* (Koch). The ornamentation of the cranidia *Digonus* sp. is very similar to a granulation displayed by *D. rhenanus* (Koch, 1883, Pl. 3, Fig. 6).

Occurrence. — Poland Radom—Lublin area; boreholes: Ciepielów, 2254 m, Rozkopaczew, 2054 m. Lower Devonian, Lower Ciepielovian.

Genus *Parahomalonotus* Reed, 1918

Type species: *Parahomalonotus gervillei* (De Verneuil, 1850).
Species assigned: see Table III.
Stratigraphical and geographical range: Lower Devonian of North Africa, Belgium, France, Germany, Poland, Rumania and Turkey.

Revised diagnosis. — Cephalon semicircular, glabella large, rounded anteriorly, lobation more or less visible; pygidium semicircular, with a faint trilobation and distinct segmentation; pygidial border smooth, not bounded by a border furrow; axis not reaching the posterior pygidial margin, fused with a more or less distinct postaxial ridge.

Remarks. — The wide and rather flat glabella and the semicircular outline of cephalon and pygidium are the most characteristic features of this genus. The remaining generic characters (Pl. V, Fig. 3) occur already earlier, in other genera of the Homalonotinae. The glabellar lobation appears in *Trimerus* and a very faint trilobation, with a distinct segmentation of pygidium, occur in the genus *Homalonotus*.

An accurate and proper diagnosis of the genus was given by Reed (1918), but its range he suggests arouses certain reservations. Reed tentatively includes in the genus *Parahomalonotus* the species *P. obtusus* (Sandberger) and *P. multicostatus* (Koch), but, on the other hand, he includes here unreservedly such species, marked by typical characters of the genus *Dipleura*, as *Dip. plana* (Sandberger) and *Dip. laevicauda* (Quenstedt), as well as *Burmeisteria*? *pradoana* (De Verneuil), a species with a rather doubtful generic assignment.

The range of the genus, given by the present author (Tab. III), includes six species, of which only the type species *Parahomalonotus gervillei* (De Verneuil) and *P. forbesi* (Rouault), with its synonymic species, *P. miloni* (Renaud), are known for both their pygidium and cephalon. The remaining species were described only on the basis of the specimens of pygidia. A complete specimen, recently described by Pillet (1972, p. 226, Pl. 38, Figs 1 and 2) and assigned by him to *Parahomalonotus miloni*, probably belongs to *P. obtusus* (Sandberger), which is indicated by the number of axial rings and pleural ribs on pygidium and the anterior outline of cephalon (corresponding to that of the rostrum of *P. obtusus* (Sandberger) presented by Koch (1883, Pl. VI, Fig. 3)).

Parahomalonotus forbesi (Rouault, 1855)
(Pl. V, Fig. 9; Pl. VI, Figs 1—6; Text-fig. 4*d*)

1855. *Homalonotus Forbesi* Rouault; M. Rouault, p. 1041, Text-fig.
1942. *Homalonotus Forbesi* Rouault; A. Renaud, p. 287.
1942. *Homalonotus Miloni* nov.sp.; A. Renaud, p. 288, Pl. 14, Fig. 1.
1972. *Parahomalonotus miloni* (Renaud) 1942); Pillet, p. 226, Pl. 62, Figs 10—12, non Pl. 38, Figs 1—2.

Material. — Three incomplete cranidia, two free cheeks, three complete and two fragmentary pygidia (IG 1321.II.61—65, 76—78, 97).

Remarks. — The holotype of *Parahomalonotus forbesi* (Rouault, 1855) is preserved complete, the same as the holotype of *P. miloni* (Renaud, 1942) described further. After examining the casts of the two holotypes, the present writer considers them to be conspecific. They come from various sections, but have a similar stratigraphic position. On the other hand, a form assigned by Pillet (1972, Pl. 38, Figs 1 and 2) to *Parahomalonotus miloni* (Renaud) comes from deposits considerably younger stratigraphically than *P. miloni* and occurs with *Parahomalonotus gervillei* (De Verneuil). It differs from *P. miloni* in a convex glabella with a longitudinal axial ridge and a distinct preglabellar furrow, outlining the front of glabella and separating it from the preglabellar field, as well as in a slightly arcuate anterior cephalic margin. On account of the number of pygidial axial rings and pleural ribs, the present writer considers this specimen as a representative of *Parahomalonotus obtusus* (Sandberger). The pygidium of *P. miloni* (Renaud) has ten rings and seven ribs, that is, the same as in the Polish specimens of this species.

The Polish specimens (Pl. VI, Figs 5 and 6) have a flat, large cranidium with wide and very shallow axial furrows. The traces of glabellar lobes are very faintly outlined on a broad and flat glabella. Frontal lobe, gently sloping (with a preglabellar furrow not marked), joins a straight, wide and flat preglabellar field (Pl. VI, Figs 5a and 6). The last-named character is particularly typical of the French specimens of *Parahomalonotus forbesi* (Rouault) (and *P. miloni* (Renaud)), differing this species from the type species. The last-named, that is, *Parahomalonotus gervillei* (De Verneuil), considerably younger stratigraphically (coming from the Upper Emsian), has a very narrow preglabellar field. *P. forbesi* (Rouault), the oldest species of this genus, has a considerably wide preglabellar field, which is ascribed by the present writer to its relationship to older representatives of the Homalonotinae such as *Trimerus* and *Digonus*, whose preglabellar fields are well-developed (Table V). Such a conclusion occurs in particular after a detailed study of the species *Digonus vialai* and after comparing it with *Parahomalonotus forbesi* (see p. 33), which, according to the writer's opinion, make up transitional links between *Digonus* and *Parahomalonotus* (Table IV).

Occurrence. — Poland: Radom—Lublin area; boreholes: Ciepielów, 2279 m, Białopole, 1402—1408 m, Rozkopaczew, 2054 m, Strzelce IG-2, 1669 m. France: Brittany and Normandy, Lower Devonian, Lower Siegenian.

Parahomalonotus angusticostatus sp.n.

(Pl. V, Figs 10 and 11)

Holotype: a pygidium, IG 1321.II.79; Pl. V, Fig. 10.
Type horizon: Lower Devonian, upper part of Lower Ciepielovian.
Type locality: Zakrzew IG-3, 2420 m, Lublin area, Poland.
Derivation of the name: Lat. *angusticostatus* — having narrow ribs on pygidium.

Diagnosis. — Pygidium flat, semicircular, with twelve axial rings and nine narrow ribs.

Material. — One complete and three incomplete pygidia (IG.1321.II.66, 79, 80, 86).

Description. — Pygidium flat, semicircular, with a faint trilobation; axis wide and flat, not elevated above the surface of pleurae, with twelve, distinctly marked rings, separated from each other by very narrow and rather shallow furrows. Nine ribs, distinctly separated by furrows, do not reach a narrow and smooth margin. Terminal axial piece flat, trapezoidal, extending posteriorly. The surface of exoskeleton finely and densely granulated, particularly so in the posterior part of pygidium.

Remarks. — *Parahomalonotus angusticostatus* sp.n. differs from *P. forbesi* (Rouault) in a greater number of pygidial axial rings and ribs and in deeper pleural furrows. It also differs from *P. multicostatus* (Koch) in a smaller number of rings and ribs (in *P. multicostatus* fifteen rings and twelve ribs), but these two species are most similar to each other in a general outline of their pygidia. A similar number of rings and ribs also occurs in the pygidium of *P.obtusus* (Sandberger), but it is considerably more convex than in *P. angusticostatus* sp.n.

Occurrence. — Poland: Radom—Lublin area; boreholes: Zakrzew IG-3, 2420 m, Ciepielów, 2244 m. Lower Devonian, upper part of Lower Ciepielovian.

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EWA TOMCZYKOWA

TRYLOBITY PODRODZINY HOMALONOTINAE Z GÓRNEGO SYLURU I DOLNEGO DEWONU POLSKI

Streszczenie

Opisane w niniejszej pracy Homalonotinae obejmują 12 gatunków, należących do 5 rodzajów, przy czym autorka wyróżniła 6 gatunków nowych, w tym dwa z górnego syluru (*Trimerus lobatus* i *Dipleura praecox*) i cztery z dolnego dewonu (*Trimerus novus*, *Digonus bostoviensis*, *D. elegans* i *Parahomalonotus angusticostatus*). Opisane trylobity są podstawą dla pierwszej dokumentacji biostratygraficznej morskich osadów górnego żedynu i dolnego zigenu w Polsce.

Pierwsze Homalonotinae pojawiają się w Polsce w dolnych warstwach rzepińskich w Górach Świętokrzyskich, oraz górnych warstwach siedleckich, we wschodniej części syneklizy perybałtyckiej (otwór Gołdap, Text-fig. 1). Są to, w pierwszym z regionów, *Homalonotus knighti* König, w drugim, *H. knighti*, *Trimerus lobatus* sp. n. i *Dipleura praecox* sp. n. Trylobity te reprezentują poziom biostratygraficzny górnej części serii siedleckiej, który może być korelowany z górnym ludlowem Wielkiej Brytanii (Tablica I).

W dolnym dewonie Homalonotinae pojawiają się w górnych warstwach bostowskich w Górach Świętokrzyskich oraz w obniżeniu radomsko-lubelskim (Text-fig. 1). Znacznie licznej występują w dolnych warstwach ciepielowskich, odpowiadających dolnemu zigenowi, przy czym takie gatunki jak: *Digonus vialai* (Gosselet) i *Parahomalonotus forbesi* (Rouault) świadczą o bliskich związkach paleogeograficznych między Polską i Francją w obrębie facji reńskiej. Znaczny rozwój Homalonotinae przypada na wyższe ogniwa zigenu oraz na ems (Tabela II), skąd znane są bardzo liczne gatunki poza obszarem Polski. W Polsce powyżej zasięgu warstw ciepielowskich zaczyna dominować sedymentacja oldredowa, W emsie z ponownie wkraczającym zbiornikiem morskim (Pajchlowa, 1959) na obszar Gór Świętokrzyskich przedostały się *Digonus gigas* (Roemer) wraz z inną fauną.

Podrodzina Homalonotinae obejmuje siedem odrębnych rodzajów (Tabela III), z których stratygraficznie najwcześniejszy jest rodzaj *Trimerus* (Tabela IV). Autorka traktuje łączone dotychczas rodzaje *Trimerus* z *Dipleura* oraz *Digonus* z *Burmeisteria*, rozdzielnie. Uważa ona, że rodzaj *Parahomalonotus* wywodzi się z *Digonus* za pośrednictwem form takich jak *Digonus vialai* (Gosselet) i *Parahomalonotus forbesi* (Rouault).

Do Homalonotinae należą trylobity osiągające duże rozmiary, o pokroju elipsoidalnym i o dość grubym pancerzu. Dotychczasowe kryteria taksonomiczne opierające się na kształcie rostrum i szwu rostralnego wydają się niewystarczające, toteż autorka przyjmuje za podstawowe dla podrodziny następujące cechy: kształt cefalonu, szerokość pola przedglabellarnego, lobację glabelli oraz kształt pygidium i głębokość jego trylobacji i segmentacji (Tabela V).

ЭВА ТОМЧИКОВА

ТРИЛОБИТЫ ПОДСЕМЕЙСТВА HOMALONOTINAE ИЗ ВЕРХНЕГО СИЛУРА И НИЖНЕГО ДЕВОНА ПОЛЬШИ

Резюме

Описанные в настоящей работе Homalonotinae охватывают 12 видов, относящихся к 5 родам. Кроме того, автором установлено 6 новых видов, в том числе два в верхнем силуре (*Trimerus lobatus* и *Dipleura praecox*) и четыре в нижнем девоне (*Trimerus novus, Digonus bostoviensis, D. elegans* и *Parahomalonotus angusticostatus*). Описанные трилобиты дали основу для первой биостратиграфической характеристики морских осадков верхнежединского и нижнезигенского возраста в Польше.

Первые Homalonotinae появляются в нижних жепинских слоях в Свентокшиских горах и в верхних седлецких слоях, в восточной части Прибалтийской синеклизы (скважина Голдап, фиг. 1). В первом регионе они представлены *Homalonotus knighti* König, во втором — *H. knighti, Trimerus lobatus* sp. n. и *Dipleura praecox* sp. n. Эти трилобиты представляют биостратиграфическую зону верхнего интервала седлецкой серии, которая коррелируется с верхним лудлову Великобритании (табл. I).

В нижнем девоне Homalonotinae появляются в верхних бостовских слоях Свентокшиских гор и Радом-Люблинского прогиба (фиг. 1). В значительно большем количестве они распространены в нижних цепелёвских слоях, эквивалентных нижнему зигену, причем такие виды как *Digonus vialai* (Gosselet) и *Parahomalonotus forbesi* (Roualt) знаменуют близкую палеогеографическую связь территории Польши и Франции в пределах рейнской фации. Значительное развитие Homalonotinae приходится на верхи зигена и эмс (табл. II), в которых за пределами Польши наблюдалось обильное количество видов. Выше цепелёвских слоев на территории Польши распространены преимущественно отложения олдредского типа. Во время новой трансгресси эмского века (Pajchlowa, 1959) на территорию Свентокшиских гор снова проникли трилобиты *Digonus gigas* (Roemer) вместе с другой фауной.

Подсемейство Homalonotinae охватывает семь родов (табл. III), среди которых самым ранним в стратиграфическом смысле является род *Trimerus* (табл. IV). Объединяемые до сих пор роды: *Trimerus* с *Dipleura* и *Digonus* с *Burmeisteria* автор рассматривает раздельно. Предполагается, что род *Parahomalonotus* выводится с рода *Digonus* посредством таких промежуточных форм как *Digonus vialai* (Gosselet) и *Parahomalonotus forbesi* (Rouault).

К Homalonotinae относятся трилобиты крупных размеров, элипсоидальной формы, с довольно крепким панцырем. Применяющиеся таксономические критерии, основанные на форме ростра и рострального шва, кажутся недостаточными и поэтому в диагностике подсемейства Homalonotinae следующие признаки: форма цефалона, ширина предглабелярного поля, форма глабелярных лопастей, форма пигидия и глубина его трехсоставной лопасти и сегментаци (табл. V)

EXPLANATION OF PLATES

Plate I

Homalonotus knighti König, 1825

Fig. 1. Young holaspid incomplete cranidium, partially exfoliated (IG. 1321.II.1). Borehole Gołdap, 1163 m. × 3
Fig. 2. Ventral view of incomplete young holaspid cranidium with marked right palpebral lobe (IG. 1321.II.3). Borehole Gołdap, 1163 m. × 3.
Fig. 3. Young holaspid cephalon, ventral view of exoskeleton (IG. 1321.II.2). Borehole Gołdap, 1163 m. × 3.
Fig. 4. Lateral part of thoracic segment, internal mould (IG. 8.II.350). Lipniczek, Holy Cross Mts. Nat. size.
Fig. 5. Pygidium, internal mould: *a* dorsal view, *b* lateral view, *c* ventral view showing doublure, *d* incomplete external mould showing fine ornamentation (IG. 1321.II.10). Łężyce—Bełcz, Holy Cross Mts. Nat. size.
Fig. 6. Enlarged ventral view of lateral part of pygidium, partially exfoliated (IG. 1321.II.6). Rzepin, Holy Cross Mts. × 2.

Upper Siedlce Series, Upper Ludlow Series

Trimerus delphinocephalus Green (1832, Fig. 1)

Fig. 7. Plaster cast, holotype, NYSM. II.4488. Lockport Limestone (Wenlock, on the banks of Lake Ontario, Monroe County, N.Y.

Dipleura dekayi Green (1832, Fig. 9)

Fig. 8. Plaster cast, holotype, enrolled specimen: *a* dorsal view of pygidium, *b* dorsal view of thorax, NYSM. II.4467. Hamilton Beds, Norhumberland, Pa. Nat. size.

Plate II

Trimerus lobatus sp.n.

Fig. 1. Holaspid cephalon, internal mould (IG. 1321.II.11). Borehole Gołdap, 1162 m. Nat. size.
Fig. 2. Anterior part of cephalon with exoskeleton (IG. 1321.II.15). Borehole Gołdap. 1163 m. × 2.
Fig. 3. Incomplete cephalon, partially exfoliated (IG. 1321.II.12). ...rehole Gołdap, 1162 m. × 2.
Fig. 4. Incomplete cephalon, internal mould; anterior part excavated to show doublure (IG. 1321.II.13). Borehole Gołdap,1162 m. Nat. size.
Fig. 5. Cephalon, holotype: *a* internal mould, *b* anterior cephalic portion excavated to show rostral plate and doublure, *c* latex cast showing palpebral lobes and dorsal part of rostral plate, *d* ventral view of exoskeleton (IG. 1321.II.16). Borehole Gołdap, 1163 m. Nat. size.
Fig. 6. Lateral part of thoracic segment with exoskeleton (IG. 1321.II.17). Borehole Gołdap, 1163 m. × 2.
Fig. 7. Pygidium with weathered exoskeleton (IG. 1321.II.21). Borehole Gołdap, 1162 m. × 2.

Fig. 8. Incomplete pygidium, internal mould (IG. 1321.II.18). Borehole Gołdap, 1162 m. Nat. size.

Dipleura praecox sp.n.

Fig. 9. Cephalon: *a* internal mould, *b* plaster cast showing position of the left eye and free cheek (IG. 1321.II.22). Borehole Gołdap, 1163 m. Nat. size.
Fig. 10. Pygidium, holotype, with exoskeleton (IG. 1321.II.23). Borehole Gołdap, 1163 m. × 3.
Fig. 11. Pygidium, internal mould (IG. 1321.II.26). Borehole Gołdap, 1161 m. × 2.
Fig. 12. Incomplete pygidium with exoskeleton (IG. 1321.II.29). Borehole Gołdap, 1162 m. × 3.

Upper Siedlce Series, Monograptus formosus Zone

Plate III

Trimerus novus sp.n.

Fig. 1. Early holaspid pygidium, exoskeleton (IG. 1321.II.81). Borehole Rozkopaczew, 2055 m. × 3.
Fig. 2. Rostral plate: *a* internal mould, *b* ventral view of exoskeleton (IG. 1321.II. 83). Borehole Łopiennik, 2736.9 m. × 0.5.
Fig. 3. Incomplete pygidium, partially exfoliated (IG. 1321.II.33). Borehole Rozkopaczew, 2055 m.
Fig. 5. Pygidium, partially exfoliated (IG. 1321.II.82). Borehole Strzelce IG-2, 1650 m.
Fig. 6. Incomplete pygidium with exoskeleton (IG. 1321.II.34). Borehole Rozkopaczew, 2109 m.
Fig. 7. Pygidium, holotype: *a* dorsal view of exoskeleton, *b* lateral view, *c* ventral view showing doublure (IG. 1321.II.36). Borehole Małochwiej, 2939 m.
Fig. 8. Incomplete pygidium, partially exfoliated (IG. 1321.II.38). Borehole Rozkopaczew, 2052 m.
Fig. 9. Cephalon: *a* ventral view of exoskeleton, *b* latex cast showing the traces of glabellar furrows (IG. 1321.II.84). Borehole Łopiennik, 2738 m.
Fig. 10. Incomplete, exfoliated pygidium (IG. 1321.II.40). Borehole Małochwiej 2939 m.
Fig. 11. Pygidium with crushed exoskeleton (IG. 1321.II.39). Borehole Małochwiej, 2939 m.
Fig. 12. Internal mould of incomplete pygidium (IG. 1321.II.37). Borehole Małochwiej, 2939 m.
Fig. 13. Incomplete cephalon, partially exfoliated: *a* dorsal view, *b* plaster cast showing shape of glabella (IG. 1321.II. 41). Borehole Małochwiej, 2937 m.
Fig. 14. Incomplete cephalon with exoskeleton (IG. 1321.II.42). Borehole Zakrzew Nat. size.
Fig. 15. Incomplete cephalon, partially exfoliated: *a* latero-dorsal view, *b* plaster cast (IG. 1321.II.43). Borehole Zakrzew IG-3, 2490 m.

Trimerus sp.

Fig. 4. Incomplete pygidium with exoskeleton (IG. 1321.II.32). Borehole Zakrzew IG-3, 2460 m.

Lower Ciepielovian, Trimerus novus Zone

All figures, except figs. 1 and 2, of natural size

Plate IV

Digonus bostoviensis sp.n.

Fig. 1. Young holaspid cranidium, partially exfoliated: *a* dorsal view, *b* plaster cast showing position of the eyes (IG. 1321.II.49). Borehole Krowie Bagno, 1171 m. Nat. size.
Fig. 2. Cranidium, holotype, internal mould (IG. 1321.II.44). Bostów—Łomno, shaft no. 2. Holy Cross Mts. Nat. size.
Fig. 3. Lateral part of thoracic segment, internal mould (IG. 1321.II.50). Bostów—Łomno, well no. 3, Holy Cross Mts. Nat size.
Fig. 4. Incomplete pygidium, internal mould (IG. 1321.II.45). Bostów—Łomno, shaft no. 1A, Holy Cross Mts. Nat. size.

Upper Bostovian, Digonus bostoviensis Zone

Digonus sp.

Fig. 5. Young, incomplete cranidium, exfoliated (IG. 1321.II.60). Borehole Ciepielów, 2254 m. × 3.

Lower Ciepielovian

Digonus vialai (Gosselet, 1912)

Fig. 6. Young holaspid cranidium, partially exfoliated (IG. 1321.II.96). Borehole Białopole, 1405 m. × 2.
Fig. 7. Right free and fixed cheek, partially exfoliated (IG. 1321.II.95). Borehole Białopole, 1405 m. × 2.
Fig. 8. Incomplete cranidium, partially exfoliated (IG. 1321.II.53). Borehole Białopole, 1411 m. Nat. size.
Fig. 9. Cranidium, partially exfoliated: *a* dorsal view, *b* plaster cast from exoskeleton showing slight traces of glabellar furrows (IG. 1321.II. 52). Borehole Krowie Bagno, 1747 m. Nat. size.
Fig. 10. Pygidium and three incomplete segments: *a* dorsal view of pygidium, partially exfoliated, *b* ventral view of exoskeleton, *c* latex cast (IG. 1321.II.47). Borehole Małochwiej, 2995 m.
Fig. 11. Young holaspid pygidium with exoskeleton (IG. 1321.II.69). Borehole Krowie Bagno, 1747 m. × 2.
Fig. 12. Incomplete small pygidium, exfoliated (IG. 1321.II.98). Borehole Łopiennik, 2760 m. × 2.

Upper Bostovian, Digonus bostoviensis Zone; Upper Gedinnian

Plate V

Digonus elegans sp.n.

Fig. 1. Internal mould of frontal area with fine ornamentation (IG. 1321.II.73). Borehole Strzelce IG-2, 1648 m.
Fig. 2. Incomplete cephalon, holotype, partially exfoliated: *a* dorsal view, *b* plaster cast from exoskeleton showing position of eye (IG. 1321.II.54). Borehole Ciepielów, 2276 m.
Fig. 3. Right side of frontal lobe: *a* internal mould with fine ornamentation, *b*

plaster cast from exoskeleton showing anterior and lateral margin of frontal lobe (IG. 1321.II.55). Borehole Zakrzew IG-3, 2486 m.

Fig. 4. Free cheek with exoskeleton (IG. 1321.II.85). Borehole Zakrzew IG-3, 2494 m. × 2.

Fig. 5. Internal mould of caudal termination (IG. 1321.II.67). Borehole Ciepielów, 2277 m.

Fig. 6. Incomplete pygidium, partially exfoliated (IG. 1321.II.56). Borehole Strzelce IG-2, 1628 m.

Fig. 7. Incomplete pygidium: *a* ventral view of exoskeleton, *b* plaster cast (IG. 1321.II.58). Borehole Zakrzew IG-3, 2485 m.

Fig. 8. Incomplete pygidium, exfoliated, (IG. 1321.II.57). Borehole Ciepielów, 2227 m.

Parahomalonotus forbesi (Rouault, 1855)

Fig. 9. Incomplete cranidium: *a* dorsal view of exoskeleton, *b* external mould showing fine ornamentation, *c* plaster cast (IG. 1321.II.61). Borehole Strzelce IG-2, 1669 m.

Parahomalonotus angusticostatus sp.n.

Fig. 10. Pygidium, partially exfoliated, holotype (IG. 1321.II.79). Borehole Zakrzew IG-3, 2420 m.

Fig. 11. Incomplete pygidium, partially exfoliated (IG. 1321.II.66). Borehole Ciepielów, 2244 m.

Lower Ciepielovian, Lower Siegenian

All figures, except Fig. 4, of natural size.

Plate VI

Parahomalonotus forbesi (Rouault, 1855)

Fig. 1. Young holaspid pygidium with exoskeleton (IG. 1321.II.76). Borehole Rozkopaczew, 2054 m.

Fig. 2. Crushed exoskeleton of pygidium: *a* left side, *b* right side (IG. 1321.II.65). Borehole Białopole, 1408 m.

Fig. 3. Pygidium with exoskeleton: *a* dorsal view, *b* external mould, *c* plaster cast (IG. 1321.II.78). Borehole Strzelce IG-2, 1669 m.

Fig. 4. Incomplete pygidium with exoskeleton: *a* right pleural field and caudal termination, *b* left pleural field (IG. 1321.II.77). Borehole Rozkopaczew, 2054 m. × 2.

Fig. 5. Incomplete cranidium, partially exfoliated: *a* dorsal view, *b* external mould, *c* latex cast (IG. 1321.II.63). Borehole Ciepielów, 2279 m.

Fig. 6. Incomplete cranidium with exoskeleton (IG. 1321.II.62). Borehole Białopole, 1402 m.

Lower Ciepielovian, Lower Siegenian

All figures, except fig. 4, of natural size.

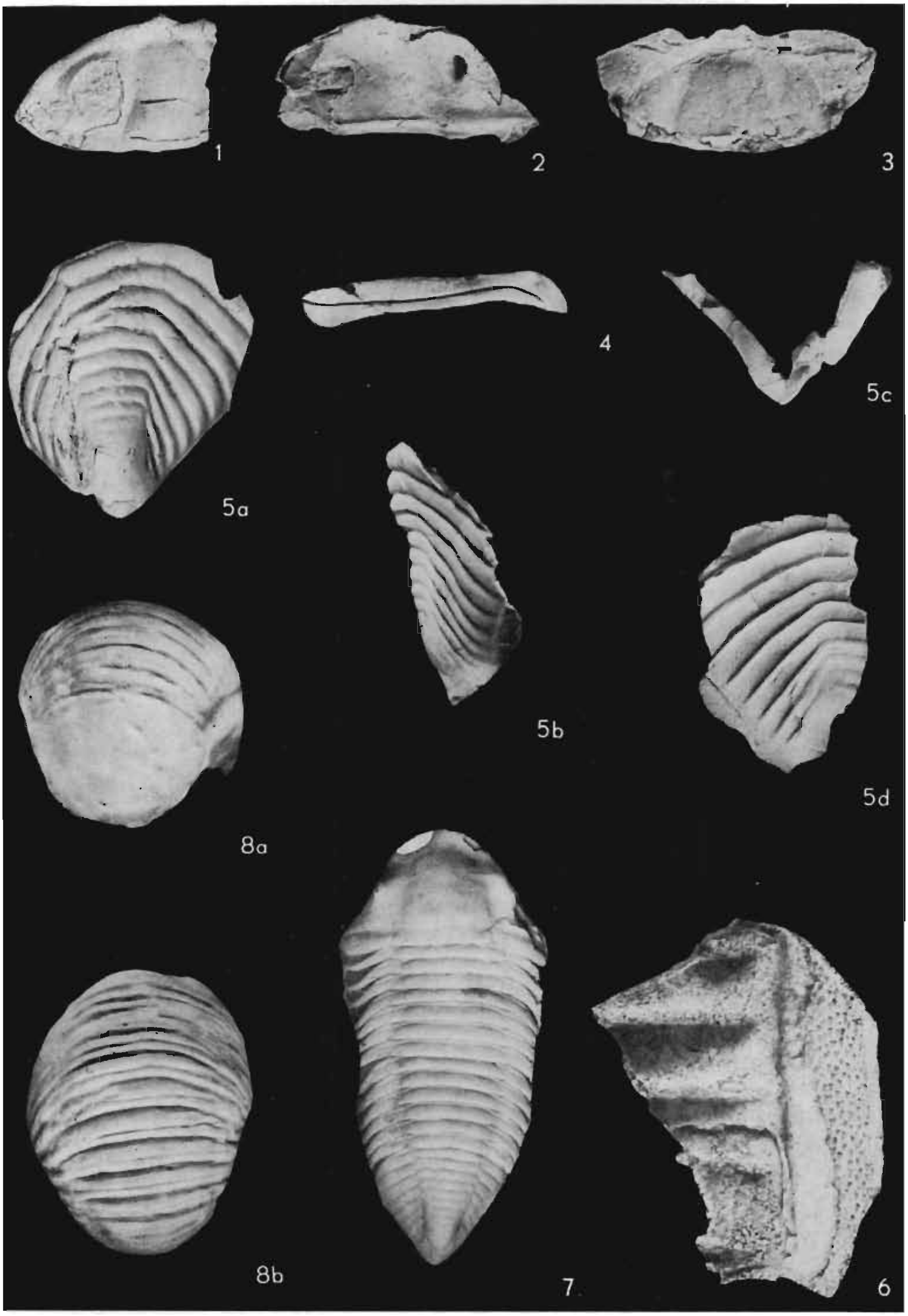
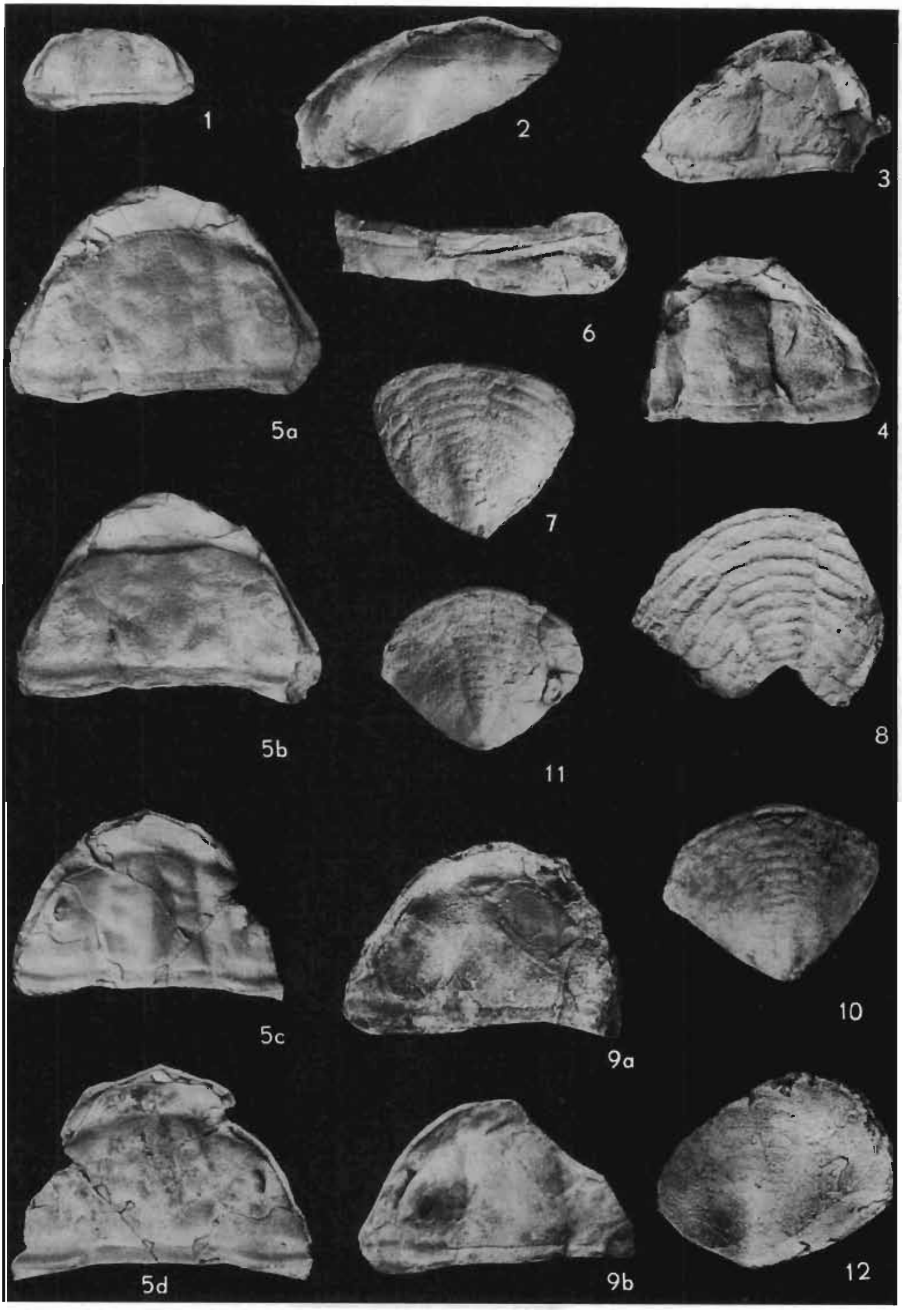


Photo: J. Modrzejewska



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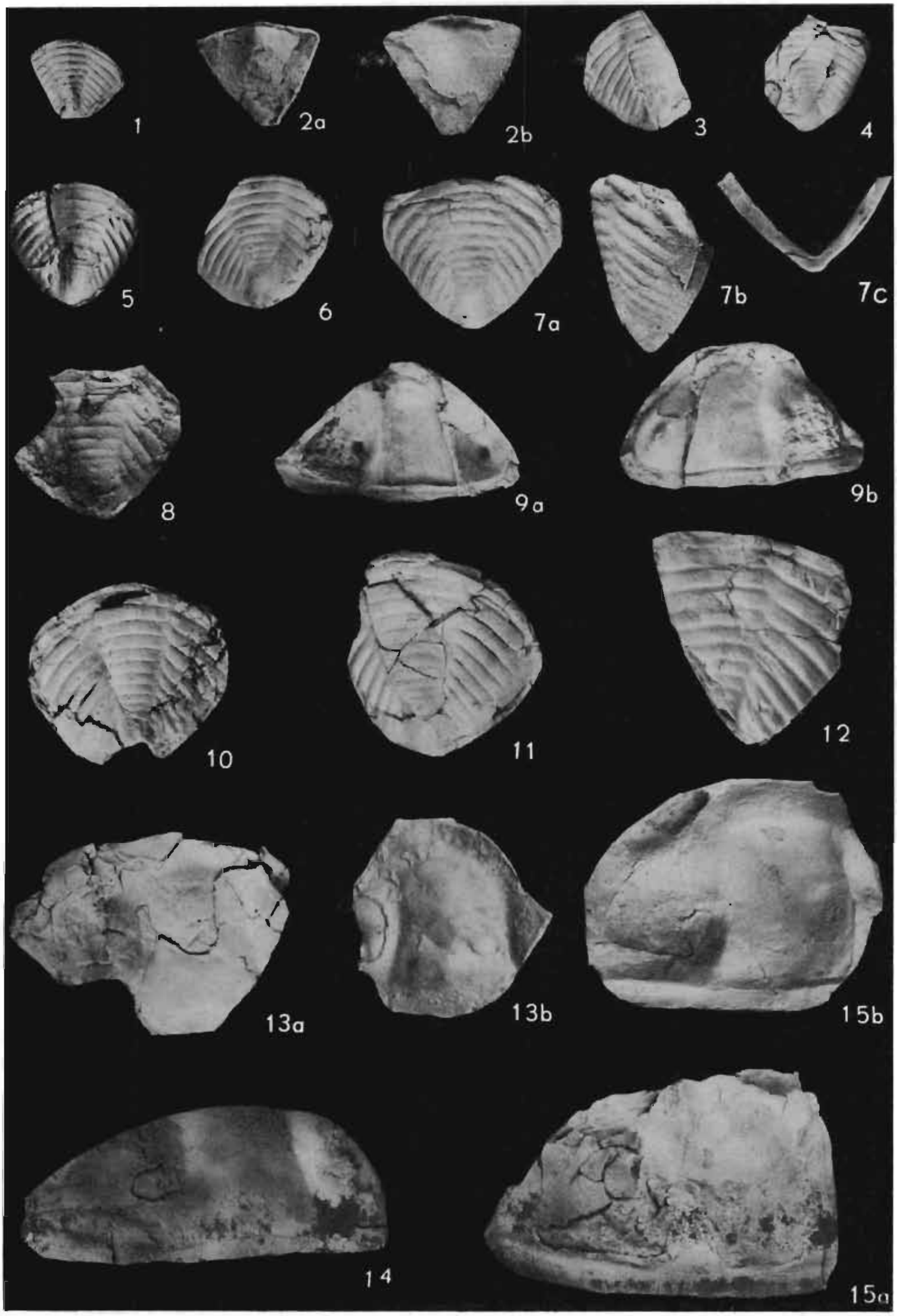

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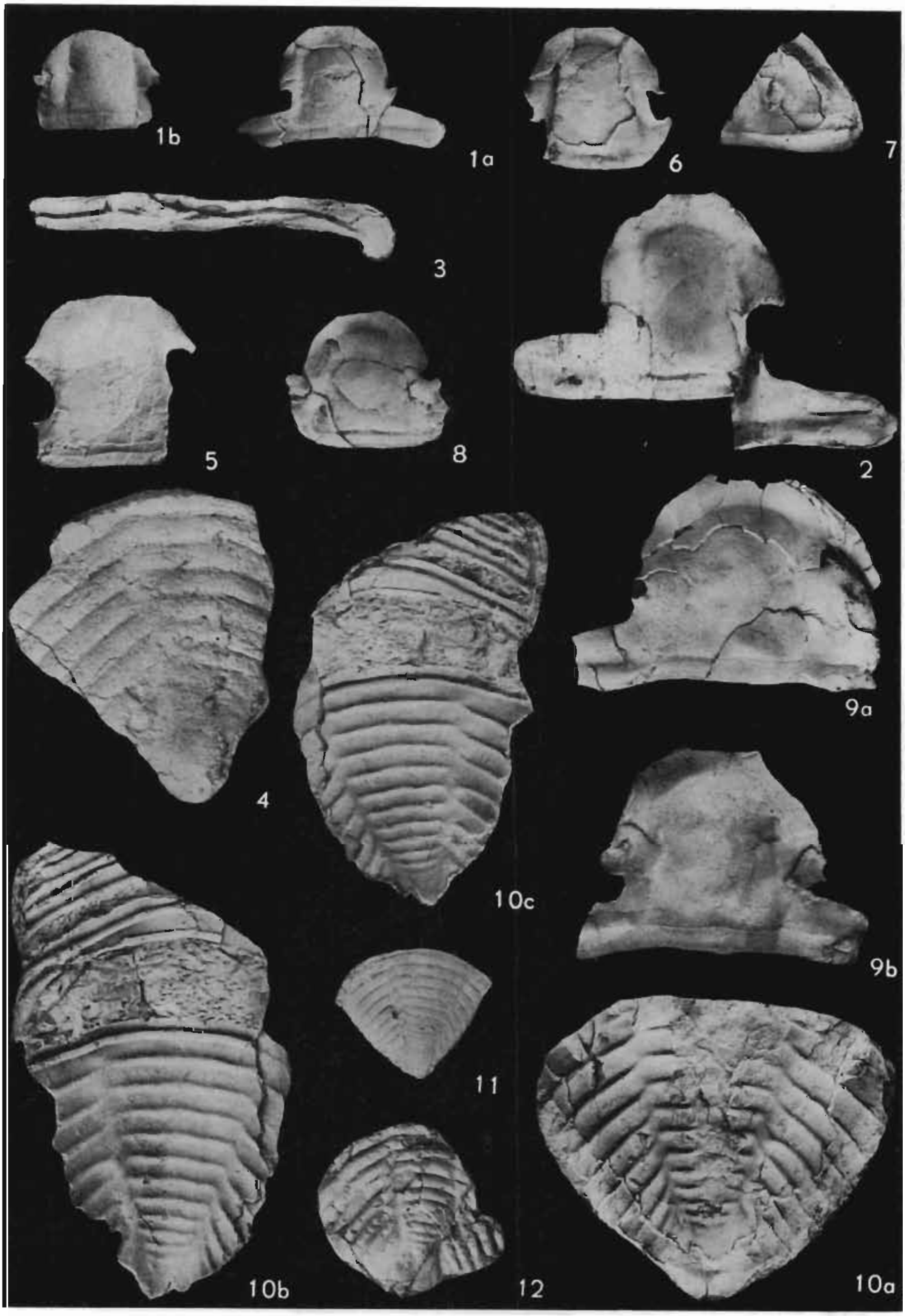

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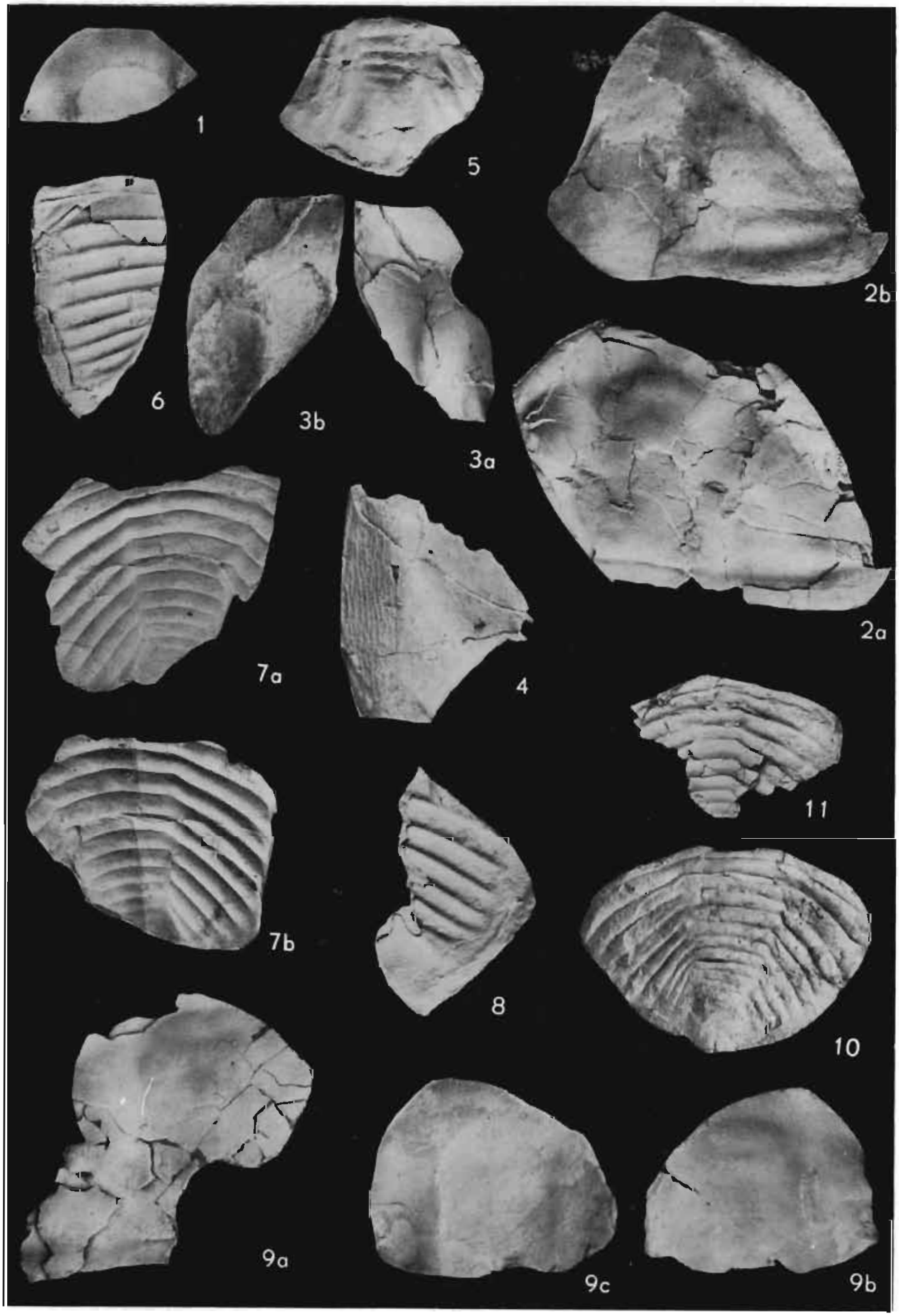

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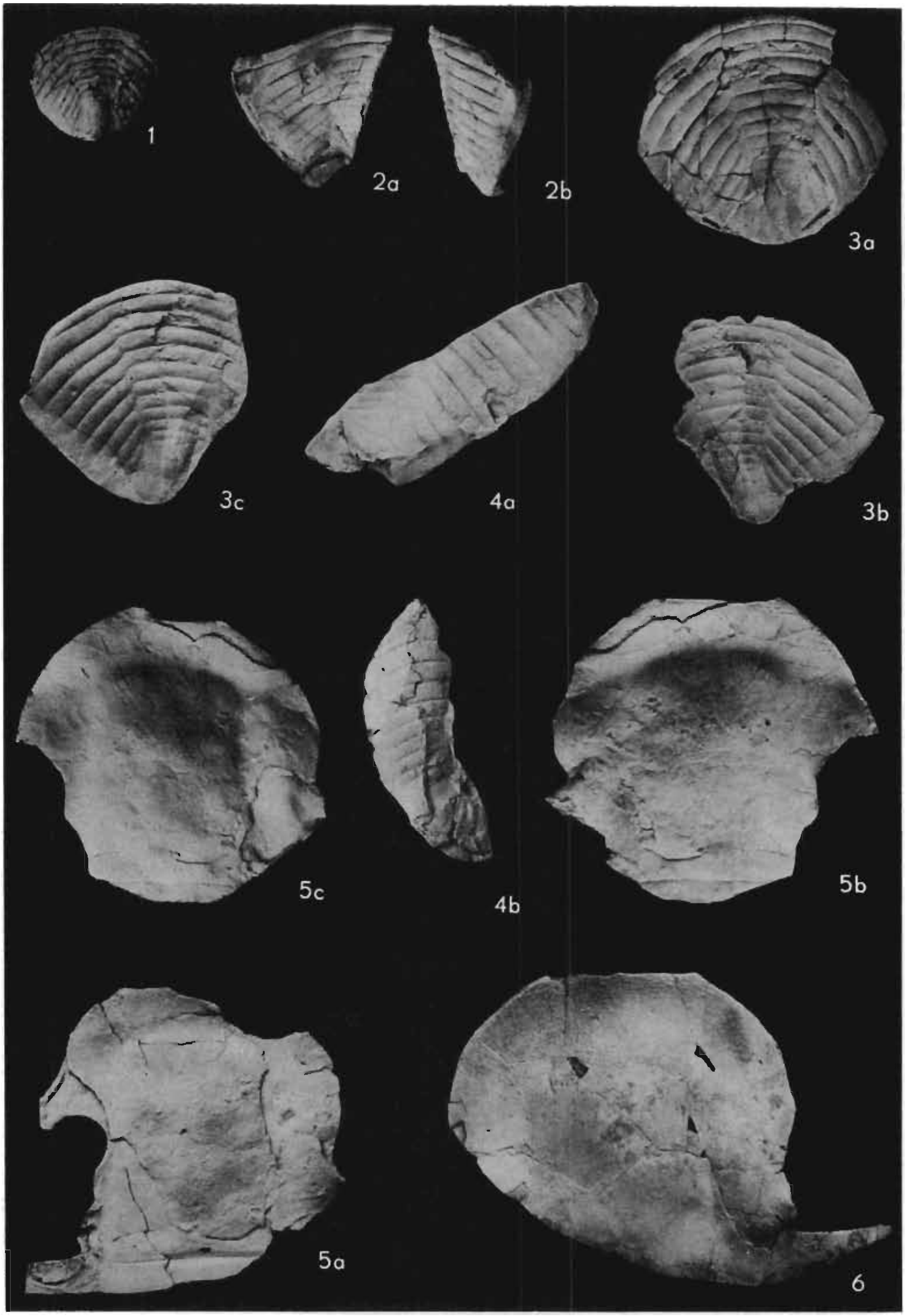

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