BARBARA ŻBIKOWSKA

MIDDLE TO UPPER DEVONIAN OSTRACODS FROM NORTHWESTERN POLAND AND THEIR STRATIGRAPHIC SIGNIFICANCE

(Plates 1–26)

ŻBIKOWSKA, B.,: Middle to Upper Devonian ostracods from northwestern Poland and their stratigraphic significance. Palaeontologia Polonica, 44:3–108, 1983.

The results of the studies on the Devonian ostracods from three deep test drillings (Chojnice 5, Koczała 1 and Miastko 2) situated in the vicinities of Chojnice, Western Pomerania, Poland are reported. The presence of Upper Givetian, Frasnian and Lower Fammenian deposits in these boreholes is documented on the basis of ostracods. The deposits are correlated with the Devonian deposits in different regions of Europe. The age of the Skały Formation in the Holy Cross Mountains (Góry Świętokrzyskie) is also discussed. The author believes that the upper part of this formation is of Givetian age. The diachronic character of some lithological complexes distinguished by R. DADLEZ (1978) in the studied area, in particular the sandy top of the Chojnice and Wyszebórz complexes, is indicated. A paleogeographical and lithological analysis of the Devonian of the Chojnice environs revealed the inexpediency to distinguish two lithofacial zones of the Devonian deposits in this area. A paleoecological analysis, based on the Upper Givetian assemblage of ostracods, allowed the author to reconstruct the environmental conditions. The sedimentation of the Upper Givetian deposits under study took place in a sublittoral zone at a depth not exceeding 200 m. The Upper Givetian ostracod assemblage corresponds to "Eifeler Ökotyp" in BECKER's meaning (*in*: BANDEL and BECKER 1975). The paper includes descriptions of 103 ostracod species assigned to 61 genera and subgenera representing orders: Palaeocopida, Platycopida, Metacopida, Podocopida and Myodocopida. 56 new species of 37 genera have been distinguished, 16 of these species being left in an open nomenclature. One new genus, *Gerbeckites* (Metacopida, Healdiacea) and one new family, Nezamysliidae (Palaeocopida, superfamily unknown) are erected. The systematic position of many known taxa is revised.

Key words: Biostratigraphy, Middle and Upper Devonian, Ostracoda, NW Poland.

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MAŁŻORACZKI Z DEWONU ŚRODKOWEGO I GÓRNEGO PÓŁNOCNO-ZACHODNIEJ POLSKI I ICH ZNACZENIE STRATYGRAFICZNE

Streszczenie. — W pracy przedstawiono rezultaty badań nad małżoraczkami dewońskimi z trzech głębokich wierceń z rejonu Chojnic na Pomorzu Zachodnim: Chojnice 5, Koczała 1 i Miastko 2. Na podstawie małżoraczków udokumentowano w tych profilach obecność osadów górnego żywetu, franu i dolnego famenu. Osady te skorelowano z osadami dewonu innych regionów Europy. Przedyskutowano problem wieku formacji skalskiej w Górach Świętokrzyskich. Górne partie tej formacji są, zdaniem autorki, wieku żyweckiego. Wykazano diachroniczność niektórych kompleksów litologicznych wyróżnionych na badanym obszarze przez R. Dadleza (1978), a zwłaszcza stropu piaszczystych kompleksów Chojnic i Wyszeborza. Przeprowadzono analizę paleogeograficzno-facjalną dla dewonu rejonu Chojnic, wykazując niecelowość wyróżniania dwóch stref litofacjalnych dla całego dewonu tego obszaru. Analiza paleoekologiczna, oparta o górnożywecki zespół małżoraczków, pozwoliła na odtworzenie warunków środowiska. Sedymentacja badanych osadów górnożyweckich odbywała się w strefie sublitoralnej na głębokości nie przekraczającej 200 m. Górnożywecki zespół małżoraczków reprezentuje "Eifeler Ökotyp" *sensu* Becker (*in*: Bandel and Becker 1975). Opisano 103 gatunki małżoraczków należące do 61 rodzajów i podrodzajów reprezentujących rzędy: Palaeocopida, Platycopida, Metacopida, Podocopida i Myodocopida. Wyróżniono 56 nowych gatunków należących do 37 rodzajów. 16 z tych gatunków pozostawiono w nomenklaturze otwartej. Utworzono nowy rodzaj *Gerbeckites* (Metacopida, Healdiacea) i nową rodzinę Nezamysliidae (Palaeocopida, nadrodzina nieznana). Zrewidowano pozycję systematyczną szeregu opisanych taksonów.

Pracę finansowała Polska Akademia Nauk w ramach problemu MR. I-16.

CONTENTS

INTRODUCTION

Several oil and gas prospecting deep borings by which, among other deposits, Devonian formations were discovered have been made since 1958 in the Koszalin-Chojnice area, north-western Poland. Despite numerous geological investigations the biostratigraphy of the Devonian in this region is as yet incomplete, in particular in regard to the Middle Devonian and Frasnian deposits.

Thus, the author described the ostracods occurring in the Devonian deposits of several selected boreholes, mostly in order to determine the age of those deposits.

Information on the occurrence of ostracods in the Polish Devonian outside the Holy Cross Mts. area has so far been very scanty. Several species from the Givetian and Frasnian deposits of Jamno IG-1 borehole in Western Pomerania (NEHRING 1971) and twenty species from the Lower Devonian deposits of Krowie Bagno IG-1 borehole in the Radom — Lublin area (NEHRING 1974) were so far described.

Samples were taken from the deposits drilled in three boreholes near Chojnice, that is, Chojnice 5, Koczała 1, and Miastko 2, made by the Oil Prospecting Enterprise at Piła in 1968—1971 (fig. 1).

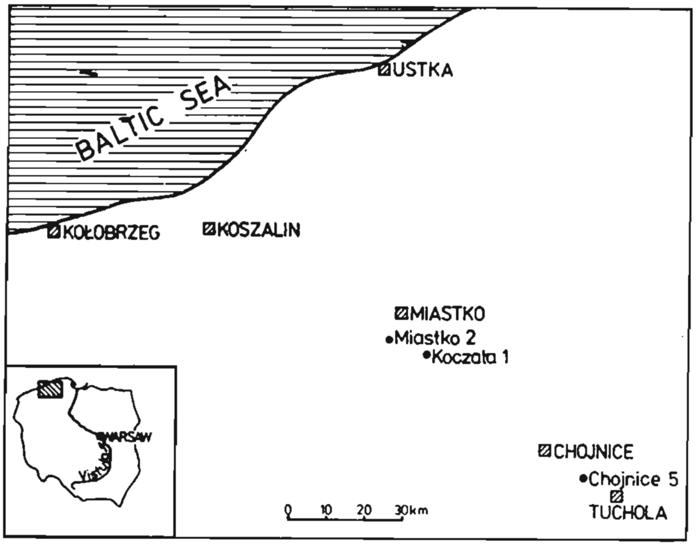


Fig. 1
Distribution of the studied boreholes in Western Pomerania.

Altogether, 90 samples were macerated in Na_2SO_4 and ostracods were found in 45 of them. The ostracods are preserved as non-silicified carapaces and single valves with pyritized specimens occurring very rarely. The presence of three Devonian stages, that is, Givetian, Frasnian and Famennian, in the deposits under study was documented on the basis of a rich and differentiated microfauna. Only the Givetian and Frasnian ostracods were studied in detail while the Famennian ones from Chojnice 5 and Koczała 1 boreholes were left for later studies.

The collection of ostracods discussed in the present paper consists of about 10,000 specimens. The author described and illustrated 103 species, including 56 new ones. The latter number includes sixteen species described in an open nomenclature. A new genus, *Gerbeckites* (Metacopida, Healdiacea) and a new family, Nezamysliidae (Palaeocopida, superfamily unknown) have also been erected.

All holotypes, as well as the remaining specimens illustrated in this paper, are stored in the Institute of Geological Sciences of the Polish Academy of Sciences abbreviated as ING.

The report was prepared in the Institute of Geological Sciences of the Polish Academy of Sciences in Warsaw in 1973—1978. The work was done under the supervision of Professor L. TELLER.

ACKNOWLEDGEMENTS

Several persons and institutions exerted their influence on the ultimate form of the presented paper, written at Professor LECH TELLER's (Warsaw) suggestion, to whom the author is indebted for advice and stimulating discussions. The samples together with archival data were rendered accessible by the Oil Prospecting Enterprise at Piła. Dr. HENRYK ŁOBANOWSKI's (Warsaw) experience was of great importance in regard to the selection of particular boreholes and his descriptions of their lithology offered to the author were very helpful in her paleoecological analysis. Dr. FRANCISZEK ADAMCZAK'S (Stockholm) criticism contributed to the abridgement of the original manuscript and a more precise form of the final text. Comparative materials, which had a decisive effect on reducing the number of new taxa were rendered available to the author by Dr. FRANCISZEK ADAMCZAK (Stockholm), Dr. GERHARD BECKER (Frankfurt a/Main), Dr. KLARA GUREVICH (Lvov), Professor VALDAR JAANUSSON (Stockholm), Professor ANDERS MARTINSSON (Uppsala), Dr. EWA OLEMPSKA (Warsaw), Dr. ELENA POLENOVA (Novosibirsk) and Dr. ANNA ROZHDESTVENSKAYA (Ufa). Several valuable papers on the Devonian ostracods were lent to the author by Dr. JEAN Le FEVRE (Pau). Photographs were taken by Mrs. LIDIA ŁUSZCZEWSKA and Ms. MAŁGORZATA RADZIKOWSKA.

The author's heartfelt thanks are extended to all the persons and institutions mentioned above.

DEVONIAN BIOSTRATIGRAPHY IN THE ENVIRONS OF CHOJNICE

The Devonian deposits in the environs of Chojnice have been discovered quite recently. The deposits of this age, overlaid by Permian rocks, were reached for the first time in the Chojnice 2 borehole (TOKARSKI 1959). Until now, the Devonian deposits in this area have been drilled or pierced by several boreholes, but an insufficient coring prevented more accurate studies of their stratigraphy. Preliminary data on the Devonian stratigraphy in the structural zone of Chojnice were published by ŁOBANOWSKI (1968). The presence of the Middle Devonian deposits was suggested by this author on the basis of brachiopods found in the cores of the Miastko 1 and Chojnice 5 boreholes.

The stratigraphy of the Devonian deposits described from the profile of the Człuchów IG-1 borehole (PAJCHLOWA 1977, OZONKOWA 1977) was based on fossils only to a small extent. The presence of the Givetian, Frasnian and Famennian deposits was determined, not very accurately, on the basis of macrofauna determined only to the level of genus. The Frasnian deposits were determined on the basis of the presence of *Buchiola* pelecypods, impressions of indeterminate goniatites and the algae *Girvanella*, while the Famennian was documented by the occurrence of foraminifers of the family Endothyridae. These stratigraphic estimations, although based on an insufficient amount of paleontological data, seem — in the light of the author's studies on the Devonian of the nearby profile of the Chojnice 5 borehole — not to arouse any major reservations.

The biostratigraphy of the Famennian in the environs of Chojnice was the object of studies by MATYJA (1972, 1975, 1976) who, on the basis of brachiopods and conodonts, documented the occurrence of Famennian deposits in the profiles of the Chojnice 2, Chojnice 4 and Babilon 1 boreholes.

Ostracods whose presence in some profiles was mentioned for the first time by ŁOBANOWSKI (1968), occur also fairly abundantly among other fossils from the drilled Devonian profiles of the environs of Chojnice. The author's studies revealed as well the presence of ostracods in the Devonian deposits from the Chojnice 5, Koczała 1 and Miastko 2 boreholes and their investigation enabled her to determine the stratigraphy of those deposits.

DEVONIAN LITHOLOGY IN THE ENVIRONS OF CHOJNICE

The simplified lithological profiles of the deposits under study are presented in fig. 2.

Chojnice 5 borehole

The data concerning the lithology of the Chojnice 5 profile come from ŁOBANOWSKI (1968) and J. DADLEZ (1975).

J. DADLEZ (1975) distinguished three following groups of deposits occurring in the Devonian of the Chojnice 5 profile which is 2,039 m in thickness and ranges between depths 4,890 and 2,851 m:

(1) clastics, subordinately marly or carbonate, transgressive deposits;
(2) marly, subordinately clayey deposits marking the period of the largest overdeepening of the basin;
(3) carbonate, subordinately marly, regressive deposits.

The first of these groups of deposits is composed at first of mutually intercalating, mostly non-calcareous or only slightly calcareous, dark-gray mudstones and claystones, subordinately with thin intercalations of gray, fine-grained sandstones, sandy limestones and dolomites (corresponding to the Tuchola and Silno complexes of R. DADLEZ 1978). Starting at the depth of 4,385 m, they pass into gray, fine-grained sandstones with muddy-clayey streaks and bands and sandy dolomites occurring at the top (= Chojnice complex of R. DADLEZ 1978).

The second group of deposits occurs at the depth of about 4,000 m and is represented by black, campact, calcareous claystones with goniatites and intercalations of light-gray, detrital limestones (corresponding to a lower marly subcomplex of Człuchów complex of R. DADLEZ), changing gradually (= transitional subcomplex of Człuchów complex of R. DADLEZ 1978) into the deposits of the third group, that is, that with a predominant occurrence of nodular limestones (= calcareous subcomplex of Człuchów complex of R. DADLEZ 1978).

Koczała 1 borehole

The lithological profile of the Devonian of the Koczała 1 borehole (according to Łobanowski's archival report of 1970), which is 1,015 m thick (between 3,127·4 and 2,112·3 m in depth), begins with intercalating, light-gray, very fine-grained sandstones, dark-gray claystones and siltstones and marly, locally fine-grained, gray limestones abounding in macrofauna (= Jamno complex plus Sianów complex of R. DADLEZ 1978). Upwards, beginning at the depth of 2,942 m, predominate dark-gray, fine-grained, clayey sandstones, locally cherry-red, with laminae and intercalations of dark-gray siltstones and mudstones (= Wyszebórz complex of R. DADLEZ 1978). In their top, at the depth of 2,734 m, there appear intercalations of marly and sandy limestones and dark-gray mudstones occurring within brown sandstones. Above the depth of 2,706·5 m, grayish limestones with intercalations of conglomerates, composed of gray and dark-gray pebbles of limestones, variegated and brown dolomites with few layers of breccia consisting of sharp-edged fragments of grayish limestones with a carbonate-marly cement are predominant deposits (= Koczała complex of R. DADLEZ 1978). Intercalations of grayish-green sandstones, mudstones and siltstones occur in the top of those limestones, beginning at the depth of 2, 635 m. Between depths 2,610 and 3,310 m (= lower marly subcomplex of Człuchów complex of R. DADLEZ 1978), dark-gray siltstones occur, at first with intercalations and thin layers of gray marly limestones and, subsequently, dark-gray calcareous siltstones with intercalations of gray nodular limestones occurring in the top. At the depth of 2,310—2,164 m, there occur dark-gray and, locally, grayish nodular, marly limestones overlaid, up to the top of the Devonian deposits (that is, up to the depth of 2,112.3 m) by a 50 m thick patch of grayish, fine-grained, cavernous dolomites (= transitional subcomplex plus calcareous subcomplex of Człuchów complex of R. DADLEZ (1978).

Miastko 2 borehole

In the Miastko 2 borehole, Devonian deposits 120 m thick, were drilled at the depths of 2,200 to 2,080 m. The lithological profile of this borehole (according to ŁOBANOWSKI'S and PAJCHLOWA'S 1968, unpublished data) is represented by intercalating greenish-gray and variegated calcareous mudstones, light-olive siltstones locally slightly calcareous and with intercalations of fine-grained, dark-gray limestones containing remains of brachiopods and corals. The intercalations of brown dolomites containing a recrystallized macrofauna occur in the top. All the Devonian deposits of this profile were included by R. DADLEZ (1978) in the Sianów complex.

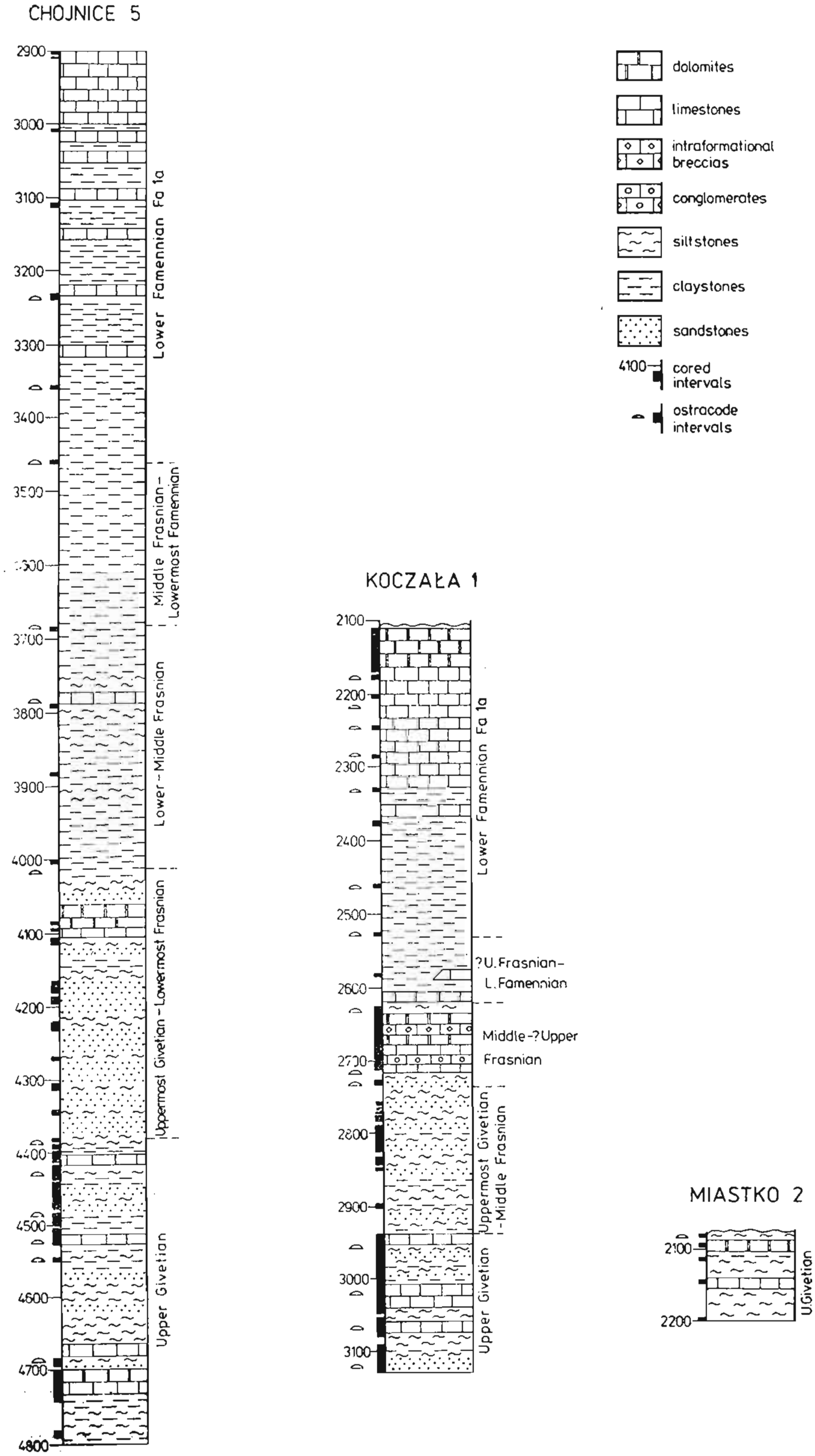


Fig. 2
Profiles of the studied boreholes.

Table 1

Distribution of ostracods in the Chojnice 5 borehole

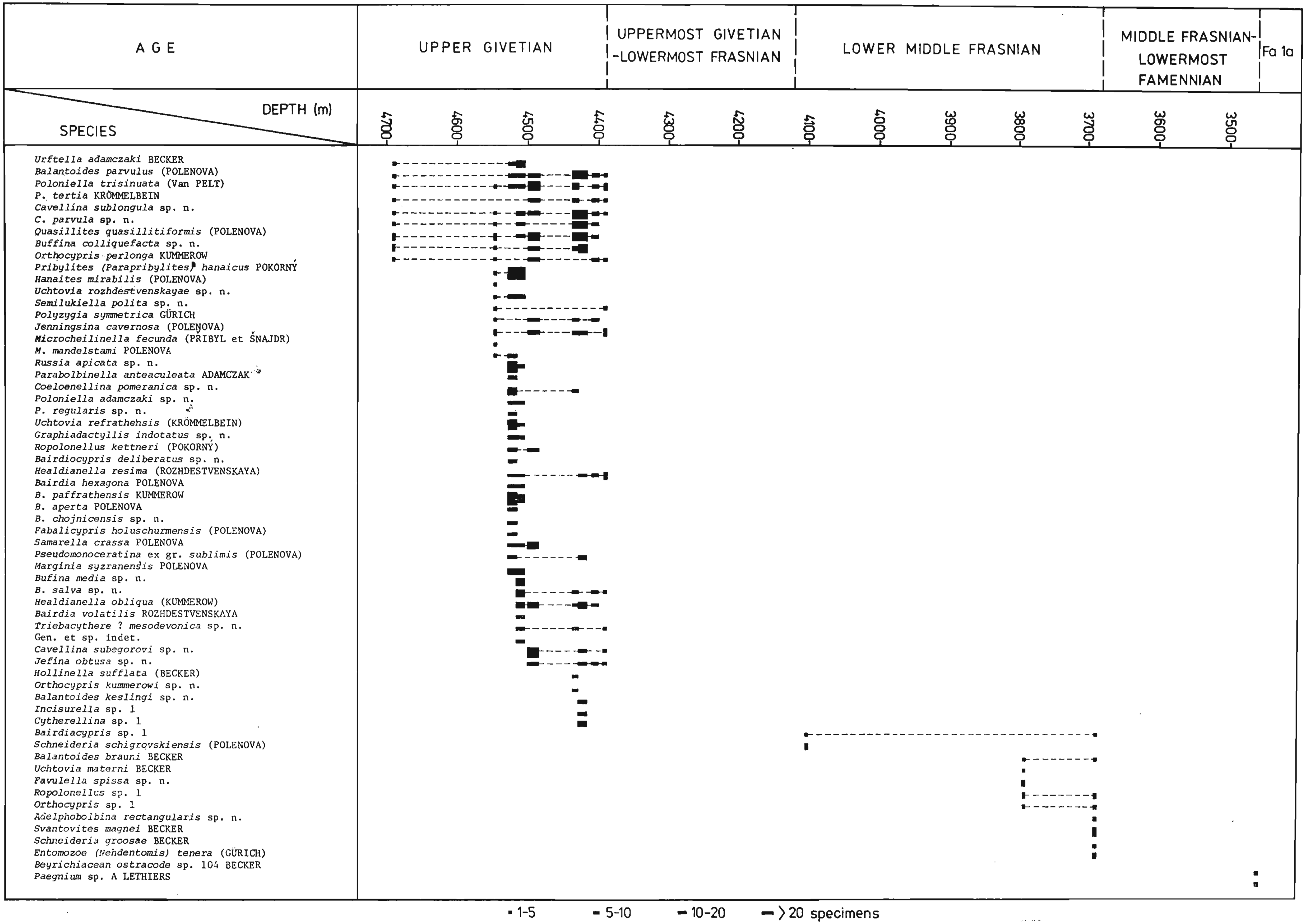
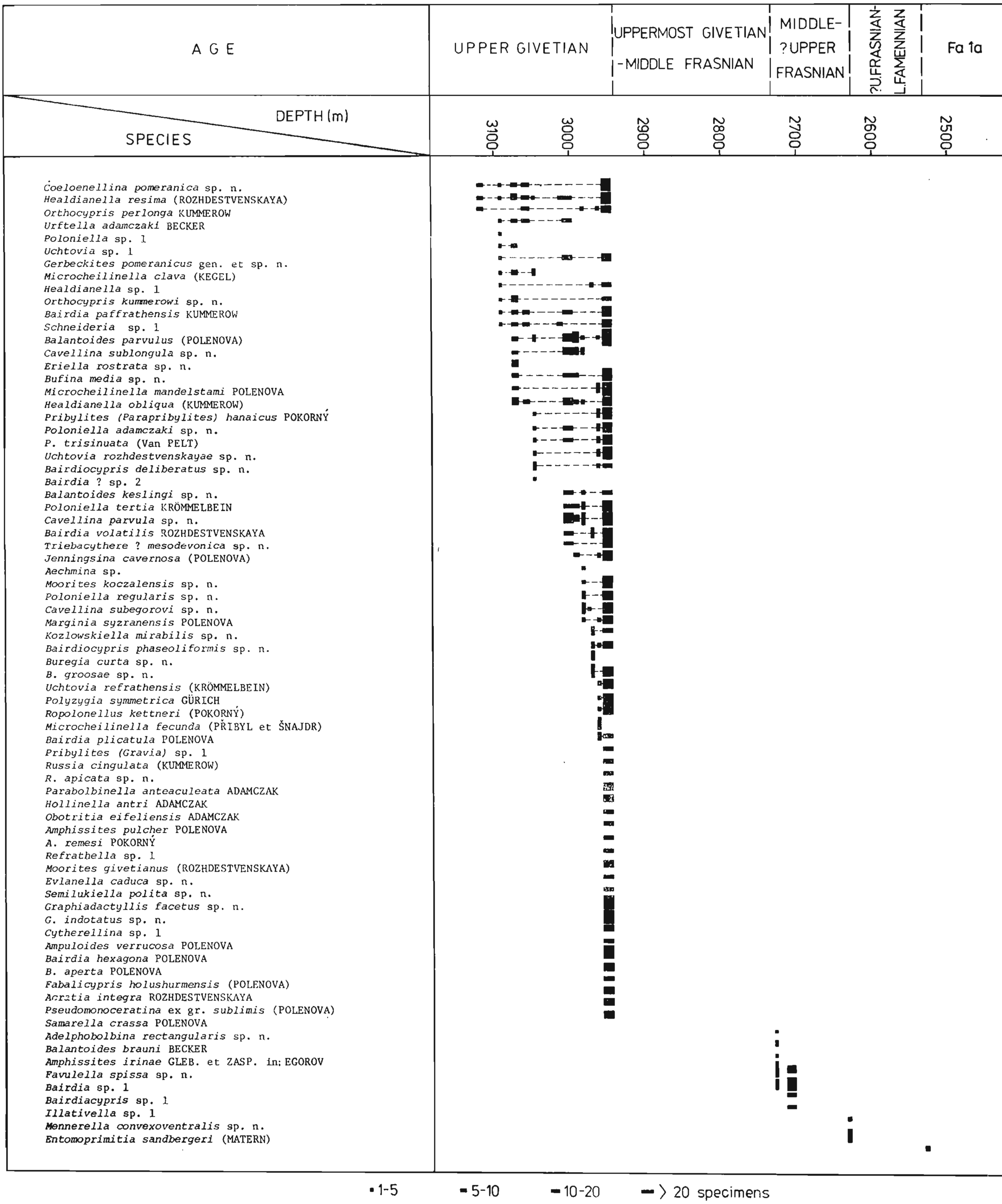


Table 2

Distribution of ostracods in the Koczała 1 borehole



THE DISTRIBUTION OF OSTRACODS IN THE DEVONIAN PROFILES OF THE ENVIRONS OF CHOJNICE AND THEIR STRATIGRAPHIC SIGNIFICANCE

The Givetian

The deposits of this age occur in the lowermost parts of the profiles of the Chojnice 5 (at depths of 4,691 to 4,390·1 m) and Koczała 1 (at depths of 3,119 to 2,938·3 m) boreholes, as well as at the depths of 2,085 to 2,080 m in the profile of the Miastko 2 borehole.

Chojnice 5 borehole. — A sector situated between the depths of 4,691.7 to 4,290.1 m is the lowermost sampled part of the profile in which ostracods were found. There occur only nine species represented mostly by single specimens (Tables 1 and 3). A considerably diversified assemblage of ostracods composed of 43 species, including all occurring in the previous sector of the profile, was found in samples taken betweeen the depths of 4,545·1 to 4,482 m (Tables 1 and 3). No ostracods were found at 4,482—4,436·4 m, while an assemblage of 24 species, including 19 from the previous parts of the profile discussed above was recorded between 4,436·4 to 4,398·2 m (Tables 1 and 3). An assemblage, consisting of a total of 48 species of ostracods, occurs in the Chojnice 5 profile in the deposits at the depths of 4,691·7 to 4,390·1 m which, on the basis of the ostracods, are assigned to the Givetian (see below).

Koczała 1 borehole. — The Givetian of the profile of the Koczała 1 borehole is marked by a yet more abundant and richer assemblage of ostracods than that of the profile of the Chojnice 5 borehole, as it is composed of 66 species (Tables 2 and 3).

24 species, including five whose range is limited only to this part of the profile, were found in the lowermost sector of the core between depths 3,119 and 3,041.8 m. The remaining 19 species also occur higher up. The presence of only 17 species, partly continuing their occurrence from lower parts of the profile, were recorded in an interval of 3,019 and 2,990.3 m. 7 species appeared for the first time at this depth. On the other hand, between the depths of 2,984.6—2,938.3 m, the most numerous ostracod assemblage occurs. It consists of 61 species (Tables 2 and 3), including 25 whose occurrence is continued from underlying deposits.

Miastko 2 borehole. — In the profile of this borehole, ostracods were presented only in samples coming from the depths between 2,085 to 2,080 m. 43 species (Table 3) were identified from this sector, including only 11 not recorded in the remaining profiles.

Discussion. — There occurs a considerable coincidence of the sections of three profiles discussed above. It is expressed in the similarity of facies and in considerable number of common species. The latter include 34 in the profiles of the Koczała 1 and Miastko 2 boreholes, 37 in those of the Koczała 1 and Chojnice 5 boreholes, 23 in those of the Chojnice 5 and Miastko 2 boreholes and, finally, 23 species common to all the three profiles (Table 3). This may suggest an equal age of deposits from the depth of 4,691.7 to 4,390.1 m of the Chojnice 5 borehole, from the depth of 3,119 to 2,938.3 m of the Koczała 1 borehole and from the depth of 2,085 to 2,080 m from the Miastko 2 borehole.

A total number of all species occurring in the parts of profiles discussed amounts to 87. This assemblage includes 43 species also known from other areas of Europe. The occurrence and stratigraphic ranges of those forms are given in Table 4. Twenty-one of them are known only from the Upper Givetian, 19 from the Upper Givetian and older deposits and only 3 species of this assemblage, that is, *Urftella adamczaki* BECKER, *Microcheilinella clava* (KEGEL) and *M. fecunda* (PŘIBYL and ŠNAJDR) did not so far been mentioned from younger deposits than the Lower or Middle Givetian. The whole assemblage studied indicates, therefore, the Upper Givetian age, since it displays a decisive predominance of the species known in other areas from the deposits of that age. Amounting to a total of 40, those species allow one to correlate the Givetian deposits of Western Pomerania with those of Southern Poland and adjacent countries (Table 5). The largest number of common species (26) are situated in the deposits of Starooskol horizon of the central and south-eastern regions of the East-European Platform, considered to be of the Upper Givetian age. Nine common species occur in the Upper Givetian Pelcha Beds, Volhynia, USSR. A total number of 21 species known from the Upper Givetian (the Starooskol horizon and its time equivalents) and two species known from the Lower Givetian (the Afonin horizon) deposits of the East-European Platform were identified in the Upper Givetian deposits of Western Pomerania.

The Holy Cross Mountains in central Poland are the area, nearest to Pomerania, in which the Middle Devonian ostracods were already studied (ADAMCZAK 1968, 1976; OLEMPSKA 1979). In the Upper Givetian ostracod assemblage of Pomerania, there occur 23 species common also for the assemblages of the Holy Cross Mts., including the following 13 species which occur in the Upper Givetian *Stringocephalus burtini* Beds of the Kielce Region: *Sulcatiella olempskae* sp. n., *Obotritia eifeliensis* ADAMCZAK, *Amphissites pulcher* POLENOVA, *Fellerites tuimazensis* (ROZHDESTVENSKAYA), *Microcheilinella mandelstami* POLENOVA, *Bairdiocypris vastus* POLENOVA, *Bairdia hexagona* POLENOVA, *B. paffrathensis* KUMMEROW, *B. plicatula* POLENOVA, *Fabalicypris holushurmensis* (POLENOVA), *Samarella crassa* POLENOVA, *Marginia syzranensis* POLENOVA and gen. et sp. indet. (Table 4).

In the Łysogóry Region of the Holy Cross Mts., there occur, on the other hand, 11 species common also to Pomerania, 4 of which, that is, *Obotritia eifeliensis* ADAMCZAK, *Poloniella trisinuata* (VAN PELT), *P. tertia* KRÖMMELBEIN and *Microcheilinella fecunda* (PIŘBYL and ŠNAJDR) occur in the Grzegorzowice Formation and 8 of which, that is, *Parabolbinella anteaculeata* ADAMCZAK, *Hollinella antri* ADAMCZAK, *H. suffllata* (BECKER), *Poloniella adamczaki* sp. n., *Polyzygia symmetrica* GÜRICH, *Ropolonellus kettneri* (POKORNÝ), *Microcheillinella clava* (KEGEL) and *M. fecunda* (PŘIBYL and ŠNAJDR) — in the Skały Formation. The deposits of the Grzegorzowice Formation are generally assigned to the Eifelian, while the age of the Skały Formation has not so far been determined accurately. According to ADAMCZAK (1968, 1976), the whole assemblage he described from the Skały Formation should be considered as Eifelian. His supposition is grounded on the fact that this ostracod assemblage displays the presence of species known from the Eifel Mountains from deposits which are exclusively of Eifelian age. In his opinion, their age is also confirmed here by several species of brachiopods known only from the Eifelian, but, at the same time, he does not preclude the possibility that the uppermost parts of the Skały Formation are of the lowermost Givetian age (ADAMCZAK 1976). Twenty-five out of the 54 species cited by ADAMCZAK (1976) from the Skały Formation are known at present from other areas than the Holy Cross Mts. In the uppermost part of this formation named by ADAMCZAK (1976) as the *H. antri — P. reticulata* Zone of the Skały and Świętomarz-Śniadka profiles and, in his opinion, corresponding to complexes XIV—XIX and XXI—XXIV (PAJCHLOWA 1957), there occur 21 ostracod species also known from other areas such as the Eifel Mountains and Rhenish Slate Mountains, the Bohemian Massif, the East-European Platform, and finally, West Pomerania. Only 4 species, *Tetrasacculus semireticulatus* ADAMCZAK, *Bufina europaea* PŘIBYL, *Ponderodictya aggeriana* GROOS and *Bairdiocypris biesenbachii* KRÖMMELBEIN have never been mentioned from younger deposits than the Eifelian. The remaining 17 of them have been cited from both the Eifelian and Givetian (10 species) or only from the Givetian (7 species). Five out of these 17 species have their stratigraphic range limited only to the lowermost Givetian, 5 — to the Middle Givetian and 7 (including one known also from the Frasnian) reach the uppermost Givetian. The above proportions of typically Eifelian to Givetian forms (4:17) are in the author's opinion the evidence that the upper parts of the Skały Formation are of Givetian age.

Relatively many (18) species of the Givetian ostracod assemblages of Pomerania are also known from the Middle Devonian, mostly Givetian, deposits of the Eifel Mts. and the Rhenish Slate Mts. (Table 4). Forms whose stratigraphic range reaches the uppermost Givetian (that

Table 3

Comparison of the occurrences of ostracods in the columns studied

OSTRACODA	number of specimens	MIASTKO 2	CHOJNICE 5					KOCZAŁA 1				
age		Givetian	Givetian			Frasnian		Givetian			Frasnian	
		Upper	Upper			Lower	Middle	Upper			Middle	?Upper
depth (in m)		2085.0–2080.0	4691.7–4683.7	4545.1–4482.0	4436.4–4398.2	4002.4–3999.6	3790.6–3685.4	3119.0–3041.8	3019.0–2990.3	2984.6–2938.3	2734.0–2705.0	2636.6–2633.3
PALAEOCOPIDA												
Pribylites (Gravia) sp. 1	1									+		
P. (Paraprybylites) hanaicus POKORNÝ	150	+		+				+		+		
Selebratina accommoda sp. n.	2	+										
Russia cingulata (KUMMEROW)	2									+		
R. apicata sp. n.	36			+								
Urftella adamczaki BECKER	31			+				+	+	+		
Sulcatiella olempskae sp. n.	11	+	+									
Hanaites mirabilis (POLENOVA)	2	+		+								
Parabolbinella anteaculeata ADAMCZAK	16	+		+						+		
Hollinella antri ADAMCZAK	6	+								+		
H. sufflata (BECKER)	1				+							
Adelphobolbina rectangularis sp. n.	5						+				+	
Kozlowskiella moderabilis sp. n.	19									+		
Illativella sp. 1	4											+
~~*Aechmina* sp.~~	1									+		
Amphissites irinae GLEB. et ZASP. *in*: EGOROV	1										+	
A. pulcher POLENOVA	6	+										
A. remesi POKORNÝ	2									+		
A. multicarinatus sp. n.	100	+										
Refrathella sp. 1	2									+		
Moorites givetianus (ROZHDESTVENSKAYA)	5									+		
M. koczalensis sp. n.	50									+		
Balantoides brauni BECKER	10						+				+	
B. parvulus (POLENOVA)	1550	+	+	+	+			+	+	+		
B. keslingi sp. n.	6				+			+	+	+		
Nezamyslia bicornuta sp. n.	1	+										
Obotritia eifeliensis ADAMCZAK	2	+								+		
Fellerites tuimazensis (ROZHDESTVENSKAYA)	20	+										
Evlanovia sp. 1	1	+										
Coeloenellina pomeranica sp. n.	120	+		+	+			+		+		
PLATYCOPIDA												
Poloniella tertia KRÖMMELBEIN	61	+	+	+	+				+	+		
P. trisinuata (VAN PELT)	100	+	+	+	+			+	+	+		
P. adamczaki sp. n.	36	+	+						+	+		
P. regularis sp. n.	100	+		+						+		
P. sp. 1	1							+				
P. sp. 2	1	+										
Uchtovia materni BECKER	2						+					
U. refrathensis (KRÖMMELBEIN)	76			+						+		
U. rozhdestvenskayae sp. n.	77	+		+						+		
U. sp. 1	5							+				
Evlanella caduca sp. n.	5									+		
Cavellina parvula sp. n.	2300	+	+	+	+			+	+	+		
C. subegorovi sp. n.	250			+	+				+			
C. sublongula sp. n.	65		+	+	+			+	+			
Mennerella convexoventralis sp. n.	50											+
Semilukiella polita sp. n.	14			+	+					+		
METACOPIDA												
Polyzygia symmetrica GÜRICH	15	+		+	+					+		
Favulella spissa sp. n.	450						+				+	
Quasillites quasillitiformis (POLENOVA)	72		+	+	+							
Jenningsina cavernosa (POLENOVA)	44	+		+	+				+	+		
Svantovites magnei BECKER	11											
Jefina obtusa sp. n.	31			+	+							
Eriella rostrata sp. n.	10							+			+	
Ponderodictya querula sp. n.	75											
Graphiadactyllis facetus sp. n.	50	+								+		
G. indotatus sp. n.	50	+		+						+		
Ropolonellus kettneri (POKORNÝ)	80	+		+						+		
R. sp. 1	3						+					
Bufina colliquefacta sp. n.	33		+	+	+							
B. intermedia sp. n.	50			+				+	+	+		
B. salva sp. n.	15			+	+							
Cytherellina sp. 1	29	+			+					+		
Incisurella sp. 1	1				+							
Gerbeckites pomeranicus gen. et sp. n.	27	+						+	+	+		
PODOCOPIDA												
Microcheilinella clava (KEGEL)	12							+				
M. fecunda (PŘIBYL et ŠNAJDR)	67			+						+		
M. mandelstami POLENOVA	700	+		+				+		+		
M. insignita sp. n.	10	+										
Ampuloides verrucosa POLENOVA	17	+								+		
Bairdiocypris vastus POLENOVA	50	+										
B. deliberatus sp. n.	9			+				+		+		
B. phaseoliformis sp. n.	13									+		
Healdianella obliqua (KUMMEROW)	185	+		+	+			+	+	+		
H. resima (ROZHDESTVENSKAYA)	92	+		+	+			+	+	+		
H. sp. 1	6							+		+		
Orthocypris perlonga KUMMEROW	54	+	+	+	+			+		+		
O. kummerowi sp. n.	13							+		+		
O. sp. 1	1						+					
Baschkirina miastkoensis sp. n.	4	+										
Rectella telleri sp. n.	200	+										
Bairdia aperta POLENOVA	16			+						+		
B. hexagona POLENOVA	56	+		+	+					+		
B. paffrathensis KUMMEROW	75			+				+		+		
B. plicatula POLENOVA	300	+								+		
B. volatilis ROZHDESTVENSKAYA	65			+					+	+		
B. chojnicensis sp. n.	5			+								
B. sp. 1	1										+	
B. ? sp. 2	4							+				
Bairdiacypris sp. 1	2					+					+	
Fabalicypris holushurmensis (POLENOVA)	29	+		+						+		
Acratia integra ROZHDESTVENSKAYA	13	+								+		
Acanthoscapha vel *Beecherella* sp. 1	1	+										
Schneideria groosae BECKER	4						+					
S. schigrovskiensis (POLENOVA)	15					+						
S. sp. 1	16							+		+		
Pseudomonoceratina ex gr. *sublimis* (POLENOVA)	12			+	+					+		
Triebacythere ? *mesodevonica* sp. n.	100	+		+	+				+	+		
Samarella crassa POLENOVA	15			+						+		
?PODOCOPIDA												
Marginia syzranensis POLENOVA	40	+		+						+		
MYODOCOPIDA												
Entomozoe (*Nehdentomis*) *tenera* (GÜRICH)	4						+					
INCERTAE ORDINIS												
Buregia curta sp. n.	20									+		
B. groosae sp. n.	550									+		
Gen. et sp. indet.	1			+								

Table 4

Distribution and stratigraphic ranges of Devonian ostracods in Western Pomerania and other areas

	ALGERIA (SAHARA)		SPAIN			BELGIUM and FRANCE (ARDENNES)							WEST GERMANY (RHENISH MASSIF)								ČSR		POLAND													EAST EUROPEAN PLATFORM Gurevich 1973, Polenova 1952, 1955, Rozhdestvenskaya 1962			
	Le Fevre 1971		Michel 1973			Becker 1974b, Becker and Bless 1974a, Casier 1975, Lethiers 1972, Magne 1965							Becker 1969a, Becker and Bless 1974b, Groos 1969								Pokorny 1950, Přibyl and Šnajdr 1950		Holy Cross Mts — Łysogóry region Adamczak 1976					Holy Cross Mts — Kielce region Olempska 1979			WEST POMERANIA					VOLHYNIA	CENTRAL PARTS & BASHKIRIA		
						Givetian			Frasnian			Famennian	Eifelian	Givetian			Frasnian			L. Famennian	Eifelian	Givetian	Eifelian — Givetian: Grzegorzowice fm		Skały Fm			U. Givetian				Frasnian				U. Givetian	Givetian		L. Frasnian
	U. Eifelian	Givetian	Eifelian	Givetian	Frasninan	Lower	Middle	Upper	F1 Fromelennes	F2 Frasnes	F3 Matagne	Fala Lower	Ahbach	Loogh-Cürten	Spickberg-Roder	Kerpen-Bolsdorf	O. Plattenkalk	Refrath	Tonschiefer	Nehden	Choteč Lmst	Red Coral Lmst.	B. cultrijugati -B. lamellaris	A. magna	P. abnormis	K. kozlowskii -P. trigonata	H. antri -P. reticulata	Stringocephalus burtini Beds	Frasnian	Famennian	U. Givetian	Lower	Middle	?Upper	L. Famennian	Pelcha	Afonin	Starooskol	Kynov
Pribylites (*Parapribylites*) *hanaicus* Pokorny														+	+	+						+									+								
Russia cingulata (Kummerow)														+	+	+															+								
Urftella adamczaki Becker														+																	+								
Sulcatiella olempskae sp. n.																												+			+								
Hanaites mirabilis (Polenova)																															+						+	+	
Parabolbinella anteaculeata Adamczak																+											+ +				+								
Hollinella antri Adamczak															+	+											+				+								
H. sufflata (Becker)													+	+	+												+				+								
Obotritia eifeliensis Adamczak													+	+	+	+							+	+	+			+			+						+		
Amphissites pulcher Polenova																												+			+					+		+	
A. remesi Pokorny															+	+						+									+								
Moorites givetianus (Rozhdestvenskaya)																															+					+		+	
Balantoides parvulus (Polenova)																															+					+		+	
Fellerites tuimazensis (Rozhdestvenskaya)																												+			+						+		
Poloniella trisinuata (Van Pelt)																							+	+	+						+					+		+	
P. adamczaki sp. n.																								+							+							+	
P. tertia Krömmelbein													+	+	+	+							+	+	+						+					+			
Uchtovia refrathensis (Krömmelbein)															+	+	+	+													+							+	
U. rozhdestvenskayae sp. n.																															+							+	
Polyzygia symmetrica Gürich	+	+	+	+	+	+							+	+	+	+											+ +				+							+	
Quasillites quasillitiformis (Polenova)																															+					+		+	
Jenningsina cavernosa (Polenova)																															+					+		+	
Ropolonellus kettneri (Pokorný)													+	+								+					+ +				+							+	
Gerbeckites pomeranicus gen. et sp. n.																															+							+	
Microcheilinella clava (Kegel)														+	+								+	+			+				+								
M. fecunda (Přibyl et Šnajdr)																					+						+ +				+								
M. mandelstami Polenova																												+			+						+	+	
Ampuloides verrucosa Polenova																															+							+	
Bairdiocypris vastus Polenova																												+			+					+		+	
Healdianella obliqua (Kummerow)													+	+	+	+															+								
H. resima (Rozhdestvenskaya)																															+					+		+	
Orthocypris perlonga Kummerow	+													+	+	+															+								
Bairdia aperta Polenova																															+							+	
B. hexagona Polenova																												+			+						+	+	
B. paffrathensis Kummerow										+				+	+	+	+	+										+			+							+	
B. plicatula Polenova															+	+												+			+						+	+	
B. volatilis Rozhdestvenskaya																															+							+	
Fabalicypris holushurmensis (Polenova)															+	+												+			+							+	
Acratia integra Rozhdestvenskaya																															+							+	
Pseudomonoceratina ex. gr. *sublimis* Polenova																															+							+	
Samarella crassa Polenova																												+			+							+	
Marginia syzranensis Polenova																												+			+							+	
Gen. et sp. indet.																												+			+								
Schneideria schigrovskiensis (Polenova)																																+							+
Amphissites irinae Gleb. et Zasp. *in* Egorov										+																							+						
Balantoides brauni (Becker)																		+															+						
Uchtovia materni Becker										+																							+						
Svantovites magnei Becker										+																							+						
Schneideria groosae Becker										+																							+						
Entomozoe (*Nehdentomis*) *tenera* (Gürich)											+						+	+	+	+									+	+			+		+				
Beyrichiacean ostracode sp. 104 Becker												+																							+				
Paegnium sp. A Lethiers												+																							+				
Entomoprimitia sandbergeri (Matern)												+								+															+				

is, up to the Kerpen Beds and Bolsdorf Beds of the Eifel Mts. and their time-equivalents from the Rhenish Slate Mts.) predominate among these species.

The uppermost Givetian deposits probably occur also above the depth of 4,398.2 m in the profile of the Chojnice 5 borehole, since the presence of the Frasnian (Lower) was documented in this profile only at the depth of 4,002.4 m. The boundary between the Middle and Upper Devonian runs, between those two depths, through terrigenous deposits with intercalations of sandy limestones and sandy dolomites occurring at the top. Unfortunately, due to a lack of paleontological documentation, its position cannot be determined precisely.

In the Koczała 1 borehole the Upper Givetian and Lower Frasnian and, possibly, also Middle Frasnian deposits occur in core depth between 2,938.3 and 2,734 m. Above 2,734 m there are already documented Middle Frasnian rocks.

And here, like in the profile of the Chojnice 5 borehole, despite a fairly proper sampling of the material, no fauna allowing one to localize the boundary between the Givetiän and Frasnian terrigenous deposits could be found.

The Frasnian

Frasnian deposits in the profile of the Chojnice 5 borehole have been documented at the depth of 4,002.4—3,685.4 m; in the Koczała 1 borehole at the depth of 2,734—2,705 m and, with a certain reservation, of 2,636.6—2,633.3 m.

Chojnice 5 borehole. — Here the Frasnian ostracod assemblage, considerably smaller as compared to the Givetian, is represented only by 13 species (Tables 1 and 3).

A dozen or so carapaces of *Schneideria schigrovskiensis* (POLENOVA) and one carapace of *Bairdiacypris* sp. 1 were found at the depth of 4,002.4—3,999.6 m. The former of described species originated from the Lower Frasnian (Kynov Beds) of Bashkiria, USSR (POLENOVA 1955) suggests the Lower Frasnian age of this sector of the profile.

A somewhat more abundant assemblage composed of *Balantoides brauni* (BECKER), *Ropolonellus* sp. 1, *Orthocypris* sp. 1, *Uchtovia materni* BECKER and *Favulella spissa* sp. n. occurs at the depth of 3,790.6—3,780.3 m.

In the depth interval 3,688.2—3,685.4 m, in addition to the first three species named above, there occur *Adelphobolbina rectangularis* sp., n., *Svantovites magnei* BECKER, *Schneideria groosae* BECKER and *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH). *Balantoides brauni* (BECKER) is known from the Refrath Beds in the Rhine Massif (BECKER 1968) which correspond to the lower part of the Middle Frasnian, while *Uchtovia materni* BECKER, *Schneideria groosae* BECKER and *Svantovites magnei* BECKER occurred in the Middle Frasnian (the Frasne Formation) in the Dinant Basin (BECKER 1971 *b*). The latter form was also cited by LETHIERS (1974) from Calcaire de Ferque of the Namur Basin (Middle Frasnian). Those four species specify, in the profile of the Chojnice 5 borehole, the Middle Frasnian age of the sector at a depth of 3,688.2—3,685.4 m. *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH), the only entomozoid occurring here, known from the deposits ranging between the lowermost Frasnian (from the *cicatricosa-torleyi* interzone, according to RABIEN'S division of 1954) and the Lower Famennian (the *Entomozoe* Zone) is insufficient for any precise determination of the age.

Between the depths of 3,683.4 and 3,460.8 m, where the documented Lower Famennian begins, there occurs an unsampled series of probably clayey (logging data) deposits of the Middle (?) and Upper Frasnian and Lower (?) Famennian. Within the limits of this complex of deposits about 220 m thick, there probably runs the Frasnian-Famennian boundary.

Koczała 1 borehole. — The Frasnian ostracod assemblage was identified in samples coming from the depths of 2,734—2,727.8 m and 2,710.6—2,705 m (Tables 2 and 3). The following species were identified: *Balantoides brauni* (BECKER), *Adelphobolbina rectangularis* sp. n., *Amphissites irinae* GLEB. et ZASP. *in*: EGOROV, *Favulella spissa* sp. n., *Ponderodictya querula* sp. n. and

Bairdia sp. 1. *Balantoides brauni* (BECKER), discussed before which occurs here, as well as *Adelphobolbina rectangularis* sp. n. and *Favulella spissa* sp. n. found in the sector of Chojnice 5 borehole considered as Middle Frasnian also indicate that the interval of the profile of the Koczała 1 borehole discussed is of Middle Frasnian age.

Due to the occurrence of only two new species *Mennerella convexoventralis* sp. n. and *Illativella* sp. 1, the age of the deposits of the next core section from the depth of 2,636.6—2,633.3 m cannot be determined accurately. The range of the genus *Mennerella* EGOROV is limited to the Frasnian only (EGOROV 1950; POLENOVA 1952; ROZHDESTVENSKAYA 1972). On this basis, one can assume that the deposits coming from the depth of 2,636.6—2,633.3 m belong still to the Frasnian, perhaps to its upper part. This probability is confirmed by the fact that the deposits belonging to Famennian already begin occurring at the depth of 2,532 m, that is, about 100 m higher up. Thus, the deposits in transition between the Frasnian and Famennian can be expected between depths 2,633.5 and 2,532 m.

The Famennian

In the profile of the Chojnice 5 borehole, the deposits of this age were identified at the depth of 3,460.8—3,457.6 m and in that of the Koczała 1 borehole — at the depth of 2,532—2,527 m.

Chojnice 5 borehole. — The Famennian age of the deposits in this core is documented by two species: Beyrichiacean ostracode sp. 104 BECKER and *Paegnium* sp. A LETHIERS, found at the depth of 3,460.8—3,457.6 m, known from the Lower Famennian (Fa 1) and lower part of the Upper Famennian (Fa 2) of the Dinant Basin (BECKER and BLESS 1974*a*; LETHIERS 1972). At this depth, also the conodonts (identified by MATYJA) represented by *Palmatolepis* cf. *tenuipunctata* SANNEMANN and *P. quadrantinodosolobata* SANNEMANN vel *P. triangularis* SANNEMANN transitional to *P. quadrantinodosolobata* were found. They come from the *P. triangularis* to *P. crepida* zones (ZIEGLER 1971, 1973) and, therefore, indicate the Lower Famennian (Fa 1a) age of these deposits.

An assemblage of a dozen or so new and not yet described species, including also *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH) occurs above the depth of 3,457.6—3,255.1 m.

Koczała 1 borehole. — In this profile, the Famennian age of the deposits is documented at the depth of 2,532—2,527 m by the presence of *Entomoprimitia sandbergeri* (MATERN) know from the Lower Famennian (the *Entomozoe* Zone) of the Ardennes and the Rhenish Slate Mountains (BECKER and BLESS 1974*b*). In overlying deposits, that is, up to the depth of 2,202.3 m, there occurs an ostracod assemblage similar to that found in the Famennian deposits of the profile of the Chojnice 5 borehole which contains a dozen or so common species.

The two Famennian profiles of the Chojnice 5 borehole (about 235 m in thickness) and Koczała 1 borehole (about 330 m in thickness) probably belong as a whole to the Lower Famennian.

STRATIGRAPHIC CORRELATION OF THE DEVONIAN OF THE ENVIRONS OF CHOJNICE, WITH REMARKS ON FACIES DEVELOPMENT

An informal lithostratigraphic division of the Devonian of Pomerania was presented by R. DADLEZ (1978), who separated several lithological complexes occurring in various drill profiles of the Devonian deposits in Pomerania and correlated them with each other. Due to the scarcity of paleontological data, the above mentioned author's correlation arouses certain doubts. A new light has been thrown on the age of the Middle and Upper Devonian litholo-

Table 5

Correlation of the Middle to Upper Devonian deposits in Western Pomerania with Central Poland and other regions of Europe

SYSTEM	SERIES	STAGE	AMMONOID ZONES	CONODONT ZONES House and Ziegler 1977	OSTRACOD ZONES Rabien 1954, 1960	ARDENNES Becker and Bless 1974*a*, *b*	RHENISH MASSIF Becker and Bless 1974*b*, Groos 1969	POLAND: Holy Cross Mts.: ŁYSOGÓRY Region Adamczak 1976	POLAND: Holy Cross Mts.: KIELCE Region Olempska 1979	POLAND: WEST POMERANIA	EAST-EUROPEAN PLATFORM Polenova 1952, 1953 Rozhdestvenskaya 1962
DEVONIAN	UPPER	FAMENNIAN	*CHEILOCERAS*	*triangularis*	*Entomozoe*	Fala	no data			Lower Famennian	
		FRASNIAN	*MANTICOCERAS*	*gigas*	*variostriata*	F3 Matagne	Tonschiefer			?U. Frasnian	no data
				Anc. triangularis							
					cicatricosa	F2 Frasnes	Refrath	no data	no data		
				assymetricus	*cicatricosa-torleyi*		Ob. Plattenkalk			M. Frasnian	Kynov
				hermanni cristatus	*torleyi*	F1 Fromelennes				L. Frasnian	
	MIDDLE	GIVETIAN	*MAENIOCERAS*	*varcus*	ostracode zones not established	Givet	Bolsdorf Kerpen Rodert	- ?- ?- ?- ?- ?- ? Skały	Stringocephalus Beds	Upper Givetian	Starooskol

gical complexes of the environs of Chojnice by the results of biostratigraphic studies based on the analyses of ostracod assemblages in the profiles of the Chojnice 5, Koczała 1 and Miastko 2 boreholes.

Tuchola and Silno complexes distinguished by R. DADLEZ (1978) in the profile of the Chojnice 5 borehole correspond in age to the Sianów complex in the profile of the Koczała 1and Miastko 2 boreholes. The Upper Givetian age of these deposits is documented by ostracods. Overlying the Silno complex in the profile of the Chojnice 5 borehole, the sandy Chojnice complex dated indirectly, through the age of under-and overlying deposits, as probably Upper Givetian — Lower Frasnian, corresponds only to the part (lower) of the sandy Wyszebórz complex in the profile of the Koczała 1 borehole which in turn is dated indirectly to be Upper Givetian (?) — Middle Frasnian. If the basal parts of the sandy complexes in the profiles of the Chojnice 5 and Koczała 1 boreholes may be very roughly estimated as isochronous (in the two profiles the beginning of their sedimentation falls to the uppermost Givetian), their upper limit are distinctly diachronous (the Givetian-Frasnian boundary in the profile of the Chojnice 5 borehole and the Middle Frasnian in the profile of the Koczała 1 borehole). The upper part of the Wyszebórz complex and the Koczała complex in the profile of the Koczała 1 borehole correspond in a large extent to the lower marly subcomplex of Człuchów complex in the profile of the Chojnice 5 borehole. The age of the complex of Koczała is determined by the ostracods as Middle (?) to Upper Frasnian. Under these circumstances, the appearance of clayey deposits of the Człuchów complex in the profiles of the Chojnice 5 and Koczała 1 boreholes is distinctly diachronous. In the profile of the Chojnice 5 borehole, the base of this complex falls to the Lower Frasnian deposits, while in the profile of the Koczała 1 borehole to the Upper Frasnian ones. On the other hand, the limit of the lower marly subcomplex and of the transitional subcomplex of the Człuchów complex in the two profiles under study is approximately isochronous and falls within the limits of deposits dated by ostracods and, in part, by conodonts to be Lower Famennian (Fa 1a). The transitional subcomplex of the profile of the Chojnice 5 borehole may be correlated with that of the profile of the Koczała 1 borehole, since both of them are of Lower Famennian age as indicated by the occurrence of ostracods.

Sixty km apart, the Chojnice 5 and Koczała 1 boreholes are situated in two elevated structural zones (R. DADLEZ 1974), the former in the Jamno-Miastko and the latter in the Człuchów-Chojnice zone. The Upper Givetian deposits, documented by the presence of ostracods, are developed in the two profiles in a similar manner, forming dark-gray mudstones and siltstones intercalating each other, with subordinate bands of fine-grained sandstones and sandy or marly limestones. The ostracods occurring in the clayey and marly intercalations represent assemblages which are not only isochronous, but also quantitatively and qualitatively similar to each other. The good state of their preservation, as manifested by a pronounced predominance of entire carapaces with intact ornamentation and the presence of both adult and juvenile specimens, indicates that they were buried near their dwelling area. These are typical, thick-shelled benthonic forms indicating that the sedimentation took place in a shallow, near-shore part of a marine basin whose depth seems to be approximately 50 to 100 m, that is, the same as that characteristic for biotopes 5 and 6 (zones of solitary corals and brachiopods), distinguished by STRUVE (1963) in the Eifel Mts. and confirmed by BECKER's (1969) studies on ostracods. The deposits of this type in the profile of the Chojnice 5 borehole are about 400 m, and in that of the Koczała 1 borehole — about 200 m thick. Above them, the sedimentation of very thick complexes of clastic deposits, composed mostly of fine-grained sandstones intercalated by mudstones and siltstones begins in the Upper Givetian in both the Człuchów-Chojnice and Jamno-Miastko zone. In the profile of the Chojnice 5 borehole, this complex includes a sector about 300 m thick covered with dark Lower Frasnian siltstones.

A distinct change in sedimentation is observed within the zones mentioned above, at the turn of the Middle to Upper Devonian. Part of the basin including Człuchów-Chojnice zone was then a subject to a considerable deepening and was fairly distant from the shore, as indicated by the presence of dark siltstones with the remains of nectonic fauna (cephalopods). In the Jamno-Miastko zone, on the other hand, the sedimentation of shallow-water and at first (Upper Givetian-Middle Frasnian) clastic deposits, with a predominance of fine-grained sandstones (in the profile of the Koczała 1 borehole, this complex is about 200 m thick) took place up to the Upper Frasnian and later (Middle Frasnian-Upper Frasnian) it included limestones with intercalations of dolomites, conglomerates and intraformational breccias. The profile of the latter complex, 80 m thick (Koczała 1 borehole), contains, in addition to ostracods, numerous Stromatoporoidea, Tabulata and solitary Tetracoralla. It was probably formed in a shallow--water zone, marked by strong waving and diminishing influx of terrigenous material.

The stabilization of sedimentary conditions in the environs of Chojnice took place as late as in the Upper Frasnian, as indicates the fact that a clayey facies formed in the neritic zone of shelf was then predominant in the whole area.

Facies differences between the Chojnice-Człuchów and the Jamno-Miastko zones, which occurred in the Lower, Middle and, partly, Upper Frasnian, were the result of an increased distance between the former zone and the shore and its only slightly larger depth. This statement is confirmed by the fact that similar assemblages of benthonic ostracods occur in variously developed Middle Frasnian deposits of the profiles of the Chojnice 5 and Koczała 1 boreholes.

In the Lower Famennian deposits of the Chojnice 5 and Koczała 1 boreholes, there appears, in clayey sediments, at first calcareous intercalations and, subsequently, nodular limestones with an abundant fauna of benthonic brachiopods and ostracods, an evidence of the shallowing of this part of the basin.

The Devonian deposits of the environs of Chojnice are of exceptional thickness. In the profile of the Koczała 1 borehole they reach about 1,000 m and in that of the Chojnice 5 borehole — about 2,000 m. Considerable differences in thickness occurred during the period from the Upper Givetian up to the Middle Frasnian when in the profile of the Koczała 1 borehole an accumulation of sediment amounting to about 400 m and in that of the Chojnice 5 borehole — to about 1,100 m can be recorded. In the Upper Frasnian and Lower Famennian, the two boreholes reveal less discrepant thicknesses, for example, about 600 m at Koczała 1 and about 800 m at Chojnice 5.

In the light of the facts presented above, the separation of two lithofacial zones (PAJCHLOWA 1971) for the entire Devonian of this region seems to be insufficiently justified. For, such zones are limited in time only to the Lower, Middle and maybe partly, Upper Frasnian as well. Uniform, although somewhat different conditions are observed in the entire Koszalin-Chojnice zone in the Upper Givetian and Lower Famennian. In regard to the Lower Givetian, Eifelian and (?) Lower Devonian, there exist no data which could make possible the reconstruction of facies pattern of these stages in the western part of the Koszalin-Chojnice zone, provided, of course, that the sediments of that age were deposited here at all.

PALEOECOLOGY OF THE UPPER GIVETIAN OSTRACODS OF NW POLAND

The assemblage of the Upper Givetian ostracods from the three boreholes of the environs of Chojnice here described may be considered as strongly differentiated. It is composed of 87 species of 52 genera and subgenera. Three species have been classified as *incertae ordinis* and the remaining 84 assigned to four orders. Among them, the most numerously represented are the Podocopida (30 species = 36 per cent) and Palaeocopida (26 species = 31 per cent). The orders Platycopida and Metacopida are represented by 14 species each (= 16.5 per cent).

The comparison of the taxonomic composition of this assemblage with those of other assemblages known from the Middle Devonian of various areas could be interesting. Such a comparison was conducted by ADAMCZAK (1971 *a*) who analyzed the composition of various ostracod taxa in assemblages occurring in North Africa (the Sahara), the State of New York, the Eifel Mts., the Rhenish Slate Mts., Thuringia, the Holy Cross Mts., Poland, as well as central and eastern parts of the Russian Platform (Russian Platform I and II). His studies, supplemented by the observations of the material from Western Pomerania, Poland are graphically presented in figs. 3 to 5. As follows from the percentage of species assigned to the four orders mentioned above (fig. 3), the Eifel Mts. constitute an area most similar in this respect to Pomerania. On the other hand, as compared with the Holy Cross Mts., the Platycopida and Podocopida play a larger and the Palaeocopida and Metacopida a smaller role in the ostracod assemblage in Pomerania. In the case of the Rhenish Slate Mts., characteristic is in turn a much larger part of the Platycopida and a smaller part of the Podocopida than those observed in Pomerania.

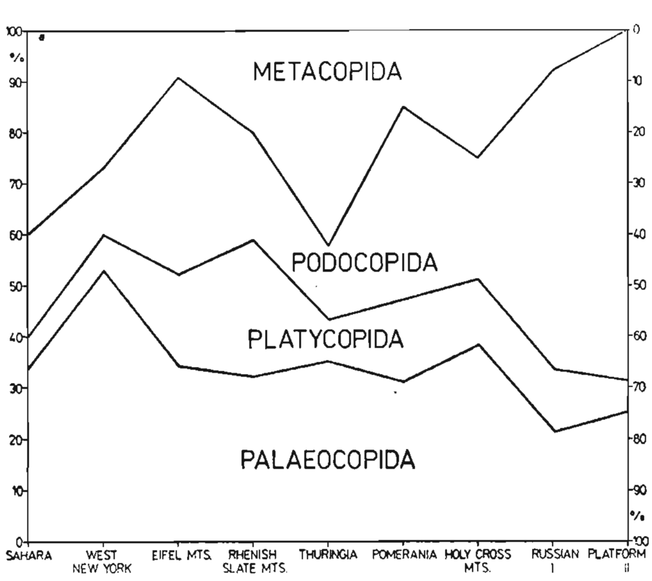


Fig. 3

Comparison of percentage distribution of 4 orders of Ostracoda in 9 regions (after ADAMCZAK 1971 *a* — supplemented).

A similar comparison was made by ADAMCZAK (1971 *a*) taking into account thirteen selected superfamilies (fig. 4). Comparing the assemblage of Pomerania with the Holy Cross Mts. and the Rhenish Slate Mts., the former is distinguished by a considerably smaller proportion of the Beyrichiacea and a larger one of the Kloedenellacea and Bairdiacea. Considerable discrepancies are observed as far as the number of individuals of particular species is concerned. Among 8,500 specimens from the Upper Givetian deposits excavated is Western Pomerania, a decisive majority, that is, about 80 per cent were carapaces and valves of only fourteen species (16 per cent of all taxa). The most numerously represented (by more than 100 specimens) are: *Pribylites* (*Parapribylites*) *hanaicus* POKORNÝ with 150 specimens; *Balantoides parvulus* (POLENOVA) — 1.550; *Amphissites multicarinatus* sp. n. — 100; *Coeloenellina pomeranica* sp. n. — 120 (Palaeocopida); *Poloniella trisinuata* (VAN PELT) — 100; *Poloniella regularis* sp. n. — 100; *Cavellina subegorovi* sp. n. — 250; *C. parvula* sp. n. — 2.300 (Platycopida); *Microcheilinella mandelstami* (POLENOVA) — 700; *Healdianella obliqua* (KUMMEROW) — 200; *Rectella telleri* sp. n. — 200; *Bairdia plicatula* POLENOVA — 300; *Triebacythere*? *mesodevonica* sp. n. — 100 (Podocopida); *Buregia groosae* sp. n. — 550 (*incertae ordinis*). Twenty five species (29 per cent) are represented by less than ten specimens each and the remaining 48 (55 per cent) occur in the number of several scores of specimens each.

Morphologically, the ostracod assemblage under study is predominated by ornamented form, in regard to the numbers of both species (55 = 63 per cent) and specimens (4,850 = 57 per cent). Among the ornamented forms, most species (33) are characterized by a coarse ornamentation composed of lobes, grooves, vela, etc. Species marked by a fine ornamentation composed of fine nodes, single spines, striae, reticulation, etc. constitute the minority. In regard to the part of those two most generally determined morphological types, the ostracod assemblage of Pomerania is almost identical with the Middle Devonian assemblage from the Eifel Mts. (fig. 5). The Rhenish Slate Mts. are marked by a considerably smaller and the Holy Cross Mts. by a somewhat larger amount of the ornamented species.

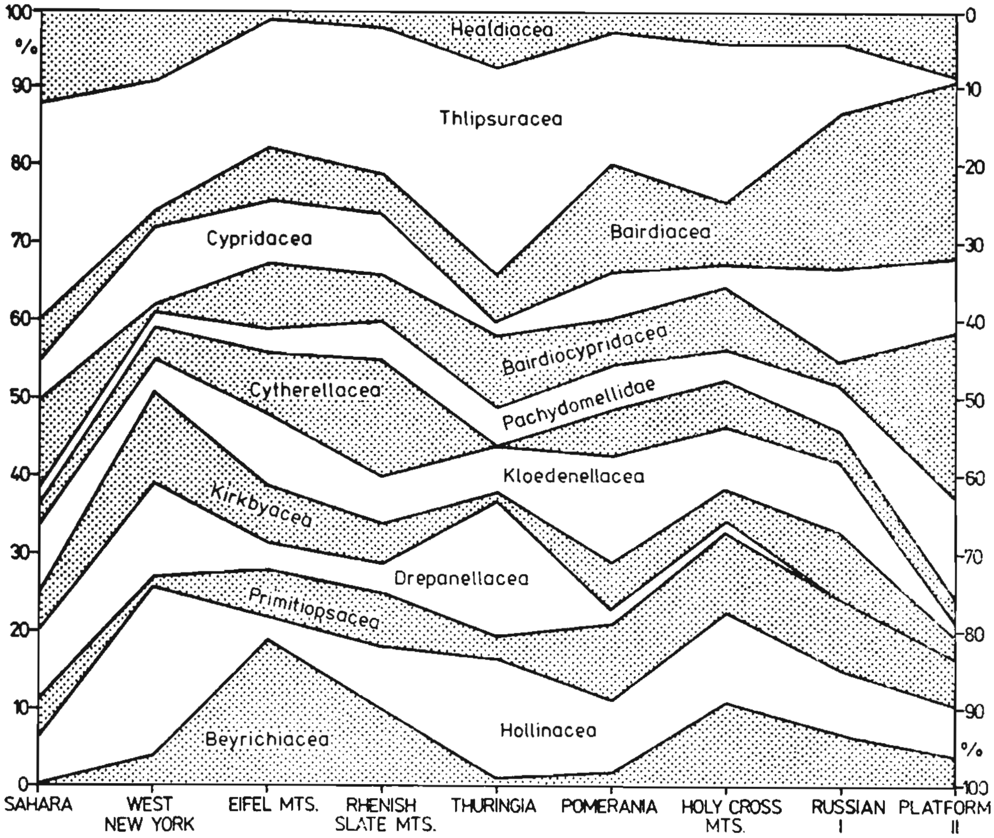


Fig. 4

Comparison of percentage distribution of 13 superfamilies of Ostracoda in 9 regions (after ADAMCZAK 1971*a* — supplemented).

The size of most carapaces examined varies within the limits of 0.3 and 2.3 mm. The largest dimensions (more than 1.4 mm) are reached by the genera: *Hollinella, Kozlowskiella, Amphissites, Fellerites, Poloniella, Cytherellina, Microcheilinella, Bairdiocypris* and *Bairdia.* There were twelve (14 per cent) large species (more than 1.4 mm), medium-sized (0.95—1.4 mm) — eighteen (20 per cent) and small (less than 0.95 mm) — fifty seven (66 per cent). The latter forms are also most numerous.

The entire Upper Givetian ostracod assemblage here described includes only benthonic forms, as indicated by thick carapaces of all species, usually very distinct ornamentation and, finally, the lack of forms having long lateral spines. The ostracods with strongly ornamented carapaces moved probably over the surface of substrate and were unable to swim or to bury themselves in the bottom, similarly as recent strongly ornamented forms (ELOFSON 1941). The smooth or only slightly ornamented forms of such genera as *Bairdia*, *Bairdiocypris* and *Cavellina* could presumably like present-day ostracods with smooth carapaces, ascend actively to the near-bottom waters (GORAK 1977). Also, analogously to the modern species (KILENYI 1971), some smooth Podocopida could bury themselves under the surface of sediment (e.g., the *Orthocypris*).

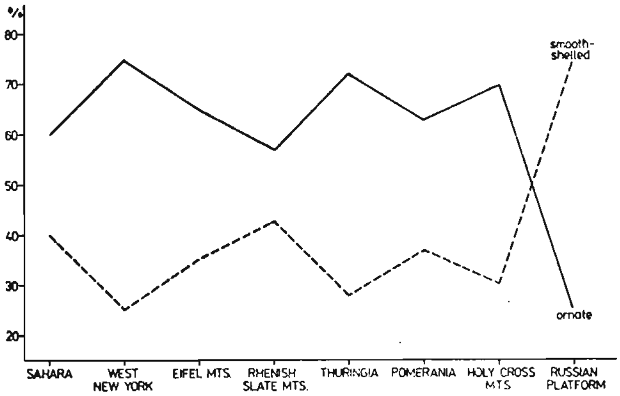


Fig. 5

Distribution of smooth-shelled and ornate Ostracoda in 9 regions (after ADAMCZAK 1971*a* — supplemented).

The good state of preservation of the studied ostracods represented by species with carapaces varying in size and, at the same time, the presence of individuals in various ontogenetic stages give evidence that we deal here with the autochthonous taphocenosis. A warm, shallow sea was probably the habitat of those ostracods. According to POKORNÝ (1971), the occurrence of ostracod assemblages abounding in both species and individuals is limited to shallow waters the depth of which probably does not exceed 200—300 m. The same author, as well as BECKER (1971*a*) indicate that the near-shore zone is marked by a small specific variability and that the diversification increases with the distance from the shore and the depth of water. As follows from BECKER'S (1971*a*) observations, also the zone of reefs is marked by such a small variability and a small number of individuals, which is probably due to an excessive turbulence of the water. The best conditions of living and development of the benthonic ostracods occurred in the fore-reef zone.

The frequency proportions of ornamented and smooth species, the predominance of small taxa and the presence of several identical species are indicative of the fact that the Upper Givetian ostracods of Pomerania lived in a zone similar to the biotopes separated by STRUVE (1963) in the Eifel Mts. and called a zone of solitary corals and a brachiopod zone. The ostracod assemblages of those biotopes were analyzed by BECKER (1969*b*, 1971*a*). It was a part of the sublittoral zone of the sea, stretching above the wave base what secured a proper oxygenation of water favourable for an exuberant development of benthos. The wave base in today's seas only very rarely reaches the depth of 200 m, mostly occurring at considerably smaller depths. Thus, we can assume that the depth of the part of the marine basin settled by the ostracod assemblage under study did not exceed 200 m.

The distinct predominance of complete carapaces over single valves observed in the material studied may give evidence of a rapid rate of sedimentation (OERTLI 1971; POKORNÝ 1965).

In regard to its taxonomic composition, morphological types and the character of the associated deposits, the ostracod assemblage here described corresponds closely to what is known as the Eifelian ecotype ("Eifeler Ökotyp") distinguished by BECKER (*in*: BANDEL and

BECKER 1975). Assemblages of this type were also found in the Devonian deposits in the Ardennes, the Eifel Mts., Rhenish Slate Mts., Harz Mts., Moravian Karst and the Holy Cross Mts. (both in their northern and southern parts).

SYSTEMATIC PALEONTOLOGY

General Remarks

Since the classifications given in "Treatise on Invertebrate Paleontology" (SCOTT 1961) and "Osnovy paleontologii" (ZANINA and POLENOVA 1960) were subject to essential changes during the last decade, the systematics of the species here described has mostly been based on the latest monographs of the Devonian ostracods by ADAMCZAK (1968, 1976) and BECKER and SANCHEZ de POSADA (1977).

The morphological terminology has been drawn from the following works: KESLING, 1951; SOHN, 1961*a*; MARTINSSON, 1962; ADAMCZAK, 1968, 1976); BECKER, 1964, 1965*a*, 1970*a*; BECKER and SANCHEZ de POSADA, 1977.

Abbreviations used:

C	— carapace	♀	— heteromorph
LV	— left valve	♂	— tecnomorph
RV	— right valve	l	— length of carapace
juv.	— juvenile form	h	— height of carapace
L	— lobe	w	— width of carapace
S	— sulcus		

Ostracoda LATREILLE, 1802
Order **Palaeocopida** HENNINGSMOEN, 1953
Superfamily **Primitiopsacea** SWARTZ, 1936
Family **Primitiopsidae** SWARTZ, 1936

Remarks. — The present writer does not accept any division applied so far to the Primitiopsacea (MARTINSSON 1960, 1961; BECKER 1970*a*; BECKER and SANCHEZ de POSADA 1977; GRÜNDEL 1977; WANG 1978; SCHALLREUTER 1979), since they do not explain phylogenetic relations within this superfamily and devaluate the rank of the family. For example, the divisions suggested by GRÜNDEL (1977) and SCHALLREUTER (1979) are based on conviction that only some genera are characterized by the presence of perimarginal structures occurring in heteromorphs. It seems, however, that all representatives of the Primitiopsacea have perimarginal structures (MARTINSSON, November 1979, personal communication), although they may be subject to a certain reduction, in extreme cases even to two perimarginal tubercles only (WANG 1978).

Until an indispensable revision of the systematics of the Primitiopsacea is conducted, the writer adopts ADAMCZAK's (1968) definition and, complying with this author's opinion on this group's considerable homogeny and, at the same time, its sharp delimitation from other Palaeocopida (ADAMCZAK 1968 and personal communication, September, 1979), she suggests for the time being to separate the only family Primitiopsidae with the following diagnosis.

Diagnosis (according to ADAMCZAK 1968 — supplemented). — Hinge margin long, straight. Hinges with distinct dents and dental sockets. Adventral structures present in both dimorphs, in one only or reduced. In heteromorphs, perimarginal structures occur always in the form of a ridge or two to five tubercles in the posterior part of valve. Right valve larger.

Genus *Pribylites* POKORNÝ, 1950

Type species: *Pribylites moravicus* POKORNÝ, 1950

Subgenus *Gravia* POLENOVA, 1952

Type species: *Gravia (Gravia) volgaensis* POLENOVA, 1952

Pribylites (Gravia) sp. 1

(pl. 1:8)

Material. — One damaged right valve, Koczała 1 borehole, depth 2,949.5—2,954.2 m.
Dimensions (in mm):

	l	h
RV ING O/8	0.69	0.47

Remarks. — The specimen probably represents a new species. It differs from *Pribylites (Gravia) aculeata* (POLENOVA) from the Frasnian of the Russian Platform (POLENOVA 1953) in a straight anterioı margin and a cylindrical shape of spine, as well as in its more posterior situation.

Occurrence. — Poland, Western Pomerania, Upper Givetian.

Subgenus *Parapribylites* POKORNÝ, 1950

Type species: *Pribylites (Parapribylites) hanaicus* POKORNÝ, 1950

Pribylites (Parapribylites) hanaicus POKORNÝ, 1950

(pl. 1:1–7; pl. 2:1:–4)

1950. *Pribylites (Parapribylites) hanaicus* n. gen. n. sp.; POKORNÝ: 592-593, pl. 1:2-3.
1964. *Pribylites (Parapribylites hanaicus*; BECKER: 58-59, pl. 9:5.
1969. *Pribylites (Parapribylites) hanaicus*; GROOS: 26-27, pl. 5:2–3.
1970*a*. *Pribylites (Parapribylites) hanaicus*; BECKER: 52–53, pl. 1:3–8.

Material. — Chojnice 5 borehole: several scores of carapaces of hetero- and tecnomorphs, from the depth of 4,482–4,545.1 m; Koczała 1 borehole: two carapaces from the depth of 3,041.8–3,119 m and several scores of carapaces of hetero- and tecnomorphs from a depth of 2,938.3–2,984.6 m; Miastko 2 borehole: one carapace of a tecnomorph and two valves of heteromorphs from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ♀ ING O/1	0.59	0.39
C ♀ ING O/2	0.55	0.37
C ♀ ING O/3	0.66	0.38
C ♀ ING O/7	0.63	0.39
C ♂ ING O/4	0.61	0.41
C ♂ ING O/5	0.58	0.36
C ♂ ING O/6	0.61	0.35
C ♂ ING O/9	0.65	0.42
C ♂ ING O/10	0.63	0.39
C ♂ ING O/11	0.58	0.35
C juv. ING O/12	0.48	0.31

Remarks. — The specimens under study are marked by a very slightly outlined ridge of the adventral structure in both hetero-and tecnomorphs. Mostly, only posteroventral nodes are visible. As follows from the present writer's observations, these nodes are similarly situated in both adult tecnomorphs and heteromorphs, which does not corroborate the dimorphism of adventral structures suggested by BECKER (1970*a*). The nodular termination of adventral structure is situated slightly more anteriorly only in juvenile specimens. A certain variability in the situation of these nodes in relation to perimarginal tubercles is observed in heteromorphs. They may occur at the level of the lowermost perimarginal tubercle as well as somewhat above or below it.

Occurrence. — Poland: W. Pomerania — Upper Givetian; W. Germany: Eifel Mts. — Givetian (Loogh to Rodert Beds), Rhenish Slate Mts. — Upper Givetian (Honseler and Bücheler Beds); Bohemia — Givetian.

Genus *Selebratina* POLENOVA, 1953

Type species: *Gravia* (*Selebratina*) *dentata* POLENOVA, 1953

Selebratina accommoda sp. n.

(pl. 2:5–6)

Holotype: Heteromorph carapace, ING 0/14; pl. 2:6.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: Upper Givetian.
Derivation of the name: Lat. *accommodus* — appropriate, adequate.

Material. — One carapace of a heteromorph and one of a tecnomorph, Miastko 2 borehole, depth 2,080–2,085 m.

Diagnosis. — Carapace large, semicircular in lateral outline. Upper and lower perimarginal tubercles of heteromorphs situated nearer the margin than the middle ones. Posteroventral spine in heteromorphs at midheight and somewhat lower and nearer the margin of valve of tecnomorphs.

Dimensions (in mm):

	l	h
C♀ holotype ING O/14	0.93	0.45
C♂ ING O/13	0.93	0.40

Description. — Heteromorph: Carapace relatively large, semicircular in lateral outline. Anterior and posterior margin uniformly rounded, posterior somewhat lower. Dorsal and posterior margin form a right angle. Right valve larger than the left. Hinge line somewhat depressed. Three perimarginal tubercles occur on the posterior margin of each valve. Central tubercle more withdrawn from the margin than the upper and lower ones. Posteroventral spine fairly thick and massive, situated at midheight between the central and lower marginal tubercle. Tecnomorph: Its carapace differs from that of heteromorph in an almost equal height of anterior and posterior margin and a more delicate spine situated somewhat lower and nearer the posterior margin. Carapace convex, especially so in its posterior part. Lateral surface smooth. Marginal structure finely denticulate.

Remarks. — The form described resembles in outline *Selebratina tuimazensis* POLENOVA, from the Lower Frasnian of Bashkiria (POLENOVA 1953) from which it differs in larger dimensions and more massive and higher situated posteroventral spine.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Genus *Russia* POLENOVA, 1952

Type species: *Gravia* (*Russia*) *unicostata* POLENOVA, 1952

1968. *Kielciella* gen. n.: ADAMCZAK: 39–43, figs. 29–30; pl. 6:1–2; pl. 7:1–3.

Diagnosis (after ADAMCZAK 1968). — A medium-sized primitiopsid with a smooth carapace and adventral structure occurring along ventral margin in tecnomorphs and along ventral and posterior margins in heteromorphs. Heteromorphs with a perimarginal ridge. Adductor muscle field displaying many scars.

Remarks. — A holotype of the type species of the genus *Russia* POLENOVA, reexamined by the present writer, displays all characteristic features of the genus *Kielciella* ADAMCZAK 1968, including perimarginal structures in the form of ridges. For this reason, the genus *Kielciella* ADAMCZAK should be treated as a junior synonym of the genus *Russia* POLENOVA. The latter includes the following species: *R. apicata* sp. n., *R. cingulata* (KUMMEROW), *R. fastigans* (BECKER) and *R. unicostata* POLENOVA.

Russia cingulata (KUMMEROW, 1953)

(pl. 3:4)

1953. *Saccelatia cingulata* n. sp.; KUMMEROW: 26–27, pl. 2:14.
1964. *Pribylites (Parapribylites) cingulatus* (KUMMEROW); BECKER: 59–60, pl. 9:2–3.
1956*b*. *Pribylites (Parapribylites) cingulatus* (KUMMEROW); BECKER: 165, pl. 3:2.
1969. *Kielciella cingulata* (KUMMEROW); GROOS: 28, pl. 5:1.
1970*b*. *Kielciella cingulata* (KUMMEROW); BECKER: 379, pl. 1:1–3.

Material. — Koczała 1 borehole: one carapace of hetero- and tecnomorph each from the depth of 2,949.5–2,954.2 m.

Dimensions (in mm):

	l	h
C ♂ (specimen lost)	0.76	0.48

Remarks. — Two specimens, rather poorly preserved but completely complying with BECKER'S (1964) diagnosis of *R. cingulata* (KUMMEROW) make up the material available for studies. In its semicircular outline and long adventral structure, this species differs from both *R. apicata* sp. n. and *R. fastigans* (BECKER).

Occurrence. — Poland: W. Pomerania — U. Givetian; W. Germany: Eifel Mts. — Givetian (Cürten and Rodert Beds), Rhenish Slate Mts. — U. Eifelian and Givetian (lower Honseler to Bücheler Beds).

Russia apicata sp. n.

(pl. 3:1–3)

Holotype: Heteromorph carapace; ING O/16; pl. 3:2.
Type locality: Chojnice 5 borehole, depth 4,517.4–4,526.1 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *apicatus* — having an apex.

Material. — Chojnice 5 borehole: several scores of carapaces of both tecno- and heteromorphs, from the depth of 4,482–4,545.1 m; Koczała 1 borehole: one heteromorph carapace from the depth of 2,945–2,949.5 m.

Diagnosis. — Carapace with a long dorsal margin and auriculate posterodorsal part. Adventral structures short, limited to ventral and posterior margins in heteromorphs and only to the central part of ventral margin in tecnomorphs.

Dimensions (in mm):	l	h
C♀ holotype ING O/16	0.84	0.48
C♀ ING O/15	0.71	0.45
C♂ ING O/17	0.74	0.52

Description. — Heteromorph: Carapace subelliptical in lateral outline. Dorsal margin long, straight. Anterior margin rounded, posterior straight. Anterior margin equal in height or somewhat lower than posterior. Posterior cardinal angle acute and the posterodorsal part of carapace extended in the form of a triangular auriculum. Adventral structure strongly developed, stretching along ventral and posterior margins. Its distance from the free margin is the smallest in the anterior part and the largest in the middle of the posterior margin. Perimarginal ridge occurs in posterior part of valve. Carapace is the widest in its middle part. Marginal structure finely denticulate. Surface smooth. Tecnomorph: Having its anterior margin higher than the posterior one, the carapace of tecnomorph is distinctly preplete as compared with that of heteromorph. Adventural structure very short, limited only to the anterior and median parts of ventral margin.

Remarks. — In the outline and course of its adventral structures, the form described resembles *Russia fastigans* (BECKER 1964) from the Eifelian of the Eifel Mts., but differs from it in a shorter adventral structure and a triangular process occurring in the posterodorsal part of its valve.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Genus *Urftella* BECKER, 1970

Type species: *Urftella adamczaki* BECKER, 1970

Urftella adamczaki BECKER, 1970

(pl. 3:5–7)

1970*a*. *Urftella adamczaki* n. sp.; BECKER: 58–59, pl. 2:1–3.

Material. — Chojnice 5 borehole: one heteromorph carapace from the depth of 4,683.7–4,691.7 m. and eleven tecnomorph carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: seven tecnomorph carapaces from the depth of 3,041.8–3,119 m, one tecnomorph carapace from the depth of 2,990.3–3,019 m and nine tecnomorph carapaces from the depth of 2,938.8–2,984.6 m; Miastko 2 borehole: two tecnomorph carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C♂ ING O/18	0.80	0.51
C♂ ING O/19	0.77	0.45
C juv. ING O/20	0.34	0.21

Remarks. — The specimens under study fully correspond to BECKER's (1970*a*) diagnosis and illustrations of this species. *Urftella adamczaki* BECKER has so far been the only known species of the genus *Urftella* BECKER.

Occurrence. — Poland: W. Pomerania — U. Givetian; W. Germany: Eifel Mts. — L. Givetian (Loogh and Cürten Beds).

Family? **Primitiopsidae** SWARTZ, 1936

Genus *Sulcatiella* POLENOVA, 1968

Type species: *Sulcatiella crassa* POLENOVA, 1968

Remarks. — No dimorphism has so far been found in the studied specimens of *S. olempskae* sp. n. and representatives of other species of the genus (POLENOVA 1968; ROZHDESTVENSKAYA 1962). The present writer's supposition that this may be a genus of the family Primitiopsidae is based on a considerable extent of similarity between the genera *Sulcatiella* POLENOVA and *Skalyella* ADAMCZAK. This similarity concerns the outline of the carapace, the presence of a bend and flattening of the posterior part, of a cylindrical swelling occurring along the ventral and posterior margins of valves and the presence of an adductorial sulcus. The differences consist in different marginal structures which in the *Skalyella* occur as a row of fine denticles and in the *Sulcatiella* as a smooth list, as well as in the presence of dimorphic structures in the form of thin perimarginal ridges situated on cylindrical swellings in posterior parts of heteromorphic carapaces which occur in *S. mesodevonica* (PŘIBYL) (ADAMCZAK 1968), so far the only representative of the genus *Skalyella.*

Genera marked by the occurrence of both the denticulate marginal structure, for example, the *Guerichiella* ADAMCZAK, *Clavofabellina* POLENOVA and *Skalyella* ADAMCZAK and marginal list, for example, *Urftella* BECKER are known within the range of the family Primitiopsidae. Thus, of decisive importance may be only the development of dimorphic characters which, however, have not so far been observed in the representatives of the genus *Sulcatiella* POLENOVA. Supposedly, this results only from the lack of heteromorphs in the material available for studies or from a rather poor state of preservation of specimens which precluded the identification of very delicate perimarginal ridges. Until this matter can be explained, the present writer suggests to include tentatively the genus *Sulcatiella* POLENOVA to the family Primitiopsidae.

Sulcatiella olempskae sp. n.

(pl. 4:1–2)

1979. *Pribylites* ? sp.; *Olempska*: 82–83, pl. 12:2–3.
Holotype: Carapace ING O/21; pl. 4:1.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After Dr. EWA OLEMPSKA, Polish ostracodologist.

Material. — Miastko 2 borehole: 14 carapaces and one valve from the depth of 2.080–2.085 m.

Diagnosis. — A species of *Sulcatiella* with median sulcus divided transversely into two smaller sulci the upper of which is small, shallow and round and the lower one is elongate and deep. Lateral surface finely punctate.

Dimensions (in mm):

	l	h
C holotype ING O/21	0.92	0.51
C juv. ING O/22	0.55	0.30

Description. — Carapace semi-elliptical in lateral outline. Dorsal margin straight, somewhat shorter than the largest length of carapace. Anterior and posterior margins symmetrically rounded, equal in height or the anterior one somewhat higher. They join the dorsal margin at almost identical, slightly obtuse angles. Ventral margin subrectilinear or slightly convex. Adductorial sulcus, divided by a transverse partition, forms two smaller sulci the upper one of which is small, shallow and circular and the lower one deep and elongate. A characteristic bend of the surface of valve, especially distinct in juvenile specimens, occurs in the ventral and posteroventral parts.

Contact line situated in a depression formed by cylindrical swellings most strongly developed along the ventral and posterior margins. Marginal structure in the form of a thin list. The largest convexity of carapace occurs in its posteroventral part and hence the carapace is subtriangular in transverse section. Surface uniformly and densely punctate.

Remarks. — *S. olempskae* sp. n. differs from other species of *Sulcatiella* POLENOVA in the presence of two circular sulci situated one above another, instead of a single elongate sulcus. It is most similar to *S. zinchenkoensis* POLENOVA from the Lower Devonian in the NE Salair, (POLENOVA 1968), from which it differs in its bend occurring slightly higher up, less strongly developed marginal lists, punctate surface and presence of two sulci.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds); W. Pomerania — U. Givetian.

Superfamily **Hollinacea** SWARTZ, 1936
Family **Hollinidae** SWARTZ, 1936
Genus *Hanaites* POKORNÝ, 1950
Type species: *Haliella (Hanaites) givetiana* POKORNÝ, 1950

Hanaites mirabilis (POLENOVA, 1952)
(pl. 4:5)

1952. *Eurychilina mirabilis* sp. n.; POLENOVA: 74–76, pl. 1:5.
1962. *Eurychilina mirabilis* POLENOVA; ROZHDESTVENSKAYA: 186, pl. 6: 1–2.
1974. *Hanaites mirabilis* (POLENOVA); POLENOVA: 30.

Material. — Chojnice 5 borehole: two internal molds of left valves from the depth of 4,543.6–4,545.1 m.

Dimensions (in mm):

	l	h
LV ING O/25	1.31	0.58

Description. — See POLENOVA (1952).

Remarks. — The present writer had at her disposal only two internal molds with a distinctly visible adductorial sulcus, traces of dorsal spines, a trace of an anterior spine and an adventral structure. These features, as well as a characteristic outline and sculpture of valves, allowed her to assign the specimens to *Hanaites mirabilis* (POLENOVA).

H. mirabilis (POLENOVA) is most similar in outline to *H. linearis* BERDAN et COPELAND from the Siegenian of the NW part of North America (Alaska and NW Canada) (BERDAN and COPELAND 1973; COPELAND 1977) from which it differs in a flat and more elongate carapace, spines occurring at the anterior and posterior ends of its hinge margin and a finer reticulation.

Occurrence. — Poland: W. Pomerania — U. Givetian; USSR: Russian Platform — U. Givetian (Starooskol Horizon), Bashkiria — Eifelian and Givetian (Biya and Afonin Beds).

Genus *Parabolbinella* ADAMCZAK, 1968
Type species: *Parabolbinella postaculeata* ADAMCZAK, 1968

Parabolbinella anteaculeata ADAMCZAK, 1968
(pl. 4:3–4)

1968. *Parabolbinella anteaculeata* sp. n.; ADAMCZAK: 55–56, fig. 38; pl. 15:2; pl. 16:3–4.
1969. *Parabolbinella anteaculeata* ADAMCZAK; GROOS: 25, Abb. 12, fig. 1.

Material. — Koczała 1 borehole: one carapace and five valves of tecnomorphs from the depth of 2,949.5–2,954.2 m; Miastko 2 borehole: 9 valves of tecnomorphs from a depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ♂ ING O/24	0.90	0.53
LV ♂ ING O/23	0.87	0.32

Remarks. — The species is very similar to *Parabolbinella postaculeata* ADAMCZAK from which it differs primarily in a more anterior situation of the posterior adventral spine.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; W. Germany: Rhenish Slate Mts. — U. Givetian.

Family **Hollinellidae** BLESS et JORDAN, 1971

Genus *Hollinella* CORYELL, 1928

Type species: *Hollinella dentata* CORYELL 1928

Holinella antri ADAMCZAK, 1968

(pl. 4:6–7)

1968. *Holinella antri* sp. n.; ADAMCZAK: 58–59, fig. 16, 39A, 40; pl. 17:4–5; pl. 18:4–5.
1969. *Holinella antri* ADAMCZAK; GROOS: 24, Abb. 12, fig. 2.

Material. — Koczała 1 borehole: seven incomplete valves from the depth of 2,949.5–2,954.2 m; Miastko 2 borehole: three carapaces and a dozen or so damaged valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C♀ ING O/26	1.58	0.90
RV juv. ING O/27	1.17	0.64

Description. — See ADAMCZAK (1968).

Remarks. — *Hollinella antri* ADAMCZAK differs from the most closely related species *H. sufflata* (BECKER) in a smaller postadductorial lobe which does not protrude beyond the hinge line, in adventral structures converging in the anterior part and in marginal structures developed in the form of several rows of tubercles.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; W. Germany: Rhenish Slate Mts. — U. Givetian.

Hollinella sufflata (BECKER, 1964)

(pl. 4:8)

1964. *Falsipollex sufflatus* sp. n.; BECKER: 65–66, pl. 10:4–5.
1968. *Hollinella sufflata* (BECKER); ADAMCZAK: 59–60, fig. 41; pl. 18:1–3.
1969*a*. *Hollinella sufflata* (BECKER); BECKER: 261–262, pl. 1:8.

Material. — Chojnice 5 borehole: one carapace from a depth of 4,429.4–4,436.4 m.

Dimensions (in mm):

	l	h
C♂ ING O/28	1.21	0.68

Description. — See ADAMCZAK (1968).

Remarks. — The species is most closely related to *Hollinella antri* ADAMCZAK, differing from it in the features discussed in the latter's description.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; W. Germany: Eifel Mts. — U. Eifelian and Givetian.

Genus *Adelphobolbina* STOVER, 1956

Type species: *Ctenobolbina papillosa* ULRICH, 1891

Adelphobolbina rectangularis, sp. n.

(pl. 5:1–2)

Holotype: Tecnomorph carapace ING O/30; pl. 5:2.
Type locality: Koczała 1 borehole, depth 2,730–2,743 m, W. Pomerania.
Type horizon: M. Frasnian.
Derivation of the name: Lat. *rectangularis* — rectangular.

Material. — Chojnice 5 borehole: two carapaces and one valve of tecnomorphs from the depth of 3,685.4–3,688.2 m; Koczała 1 borehole: two carapaces of tecnomorphs from the depth of 2,730–2,734 m.

Diagnosis. — Carapace long, sub-elliptical in lateral outline. Postadductorial lobe flat, rectangular in outline, not projecting beyond the hinge line. Preadductorial lobe not marked. Lateral surface papillose. Adventral structure terminating in a spinelike swelling occurring in prolongation of the posterior border of postadductorial lobe.

Dimensions (in mm):

	l	h
C ♂ holotype ING O/30	1.05	0.59
C ♂ ING O/29	0.97	0.48

Description. — Carapace elongate, preplete, sub-elliptical in lateral outline. Its height equals a half of its length. Anterior and posterior margins uniformly rounded. Preadductorial lobe fused with anterior lobe, hardly outlined at all. Postadductorial lobe wide, flat, rectangular, not projecting beyond the hinge line. Adductorial sulcus relatively narrow and short, reaching midheight of valve. In the lower part, the sulcus narrows and slightly bends anteriorly. Adventral structure begins halfway the height of anterior margin relatively close to it. It terminates in the posterior part with a spinelike thickenning located below the postadductorial lobe on the prolongation of its posterior border. Subadventral surface gradually extends posteriorly. Posterior part of the surface of valve elongate, its width equals or is somewhat larger than the width of the postadductorial lobe. Lateral surface papillose.

Remarks. — *A. rectangularis* sp. n. is most closely related with *A. europaea* BECKER et BLESS from the Middle Frasnian of the Dinant Basin, Belgium (BECKER and BLESS 1971). The main differences consist in a more elongate posterior part of valve, rectangular postadductorial lobe, not marked preadductorial lobe, narrow and short adductorial sulcus, shorter and divergently running adventral structure and papillose surface observed in *A. rectangularis.*

Occurrence. — Poland: W. Pomerania — M. Frasnian.

Superfamily **Beyrichiacea** MATHEW, 1886

Family **Treposellidae** HENNINGSMOEN, 1954

Genus *Kozlowskiella* PŘIBYL, 1953

Type species: *Ulrichia* (*Kozlowskiella*) *kozlowskii* PŘIBYL, 1953

Kozlowskiella moderabilis sp. n.

(pl. 5:6–7)

Holotype: Tecnomorph carapace ING O/34; pl. 5:7.
Type locality: Koczała 1 borehole, depth 2,966–2,969.3 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *moderabilis* — moderate.

Material. — Koczała 1 borehole: two carapaces of heteromorphs, 14 carapaces and five valves of tecnomorphs from the depth of 2,945–2,969.3 m.

Diagnosis. — Carapace relatively flat, amplete. Anterior and adductorial sulci perpendicular to hinge margin. Anterior lobe and syllobium provided with dorsal nodes, not projecting beyond hinge line. Preadductorial lobe subspherical in outline, strongly convex. Posterior cardinal angle = 90°. Subadventral surface narrow. Lateral surface delicately reticulate. The meshes of reticulation irregular and, in the ventral half of valve, horizontally elongate.

Dimensions (in mm):

	l	h
C ♂ holotype ING O/34	1.14	0.68
C ♀ ING O/35	1.45	1.0

Description. — Tecnomorph: Carapace semi-elliptical in lateral outline, relatively flat, amplete. Hinge margin long, straight. Anterior margin rounded. Posterior margin straight in the dorsal part, perpendicular to hinge margin. Anterior lobe and syllobium flat, not projecting beyond hinge line. Slightly outlined nodes occur in the dorsal part of these lobes. Preadductorial lobe strongly convex, subcircular. In its dorsal part, anterior sulcus perpendicular to hinge margin. It is relatively shallow and gradually narrowing downwards and bending around preadductorial lobe, reaches the midheight of valve. Adductorial sulcus, also perpendicular to hinge margin, reaches below midheight where it bends anteriorly in a hooklike manner. Syllobium relativelly flat, reaching the ridge of the adventral structure in the posterior part of the valve. Adventral structure runs along the entire free margin of valves. Subadventral surface narrow. Lateral surface delicately and irregularly reticulate. In the ventral part, the meshes of reticulation are horizontally elongate. Heteromorph: Preadductorial lobe ovally elongated. Crumina occurs in the ventral part of valves.

Remarks. — *K. moderabilis* sp. n. slightly resembles *K. corbis* (DAHMER) from the Lower Eifelian of the Harz Mts., Eifel Mts. and Holy Cross Mts. (ADAMCZAK 1958; GROOS 1969; PŘIBYL 1962) from which it differs in a somewhat different outline of carapace and posterior cardinal angle = 90°, anterior sulcus perpendicular (and not oblique) to hinge margin, only one node occurring on syllobium and a more delicate ornamentation. In its lateral outline and trace of its anterior sulcus, *K. moderabilis* sp. n. also resembles *K. jurkowicensis* OLEMPSKA from the Upper Givetian of the Holy Cross Mts. (OLEMPSKA 1974), from which it differs, however, in a flattened and wide syllobium, flat ventral part of valve, single, obtuse nodes occurring on the anterior lobe and syllobium and, finally, in lobes which do not protrude above the hinge line.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Genus *Illativella* ZANINA, 1960

Type species: *Illativella clivosa* ZANINA, 1960

Illativella sp. 1

(pl. 5:8–9)

Material. — Koczała 1 borehole: one damaged carapace and four incomplete valves from the depth of 2,633.3–2,636.6 m.

Dimensions (in mm):

	l	h
C juv. ING O/37	0.85	0.64
LV ♀ ING O/36	1.32	1.28

Description. — Heteromorph: Valve subrectangular in lateral outline, very high. Dorsal margin straight, slightly convex., Anterior and posterior margins equal in height, subrectilinear. Anterior sulcus short, indistinct. Adductorial sulcus narrow, situated halfway the length. Preadductorial lobe narrow, flat, only slightly outlined. Syllobium wide (occupying a half of the length of valve), flat, with a convex upper edge, slightly protruding beyond the hinge line and with a spine in its dorsal part. A small, narrow adventral ridge runs along the free margin close to the edge of valve. Ventral part of valve inflated, overhanging below contact line. The largest convexity observed in the posterior part of valve. Lateral surface finely granulated.

Tecnomorph: Lobes and sulci much less developed than those in the heteromorph. Spine robust, long.

Remarks. — The from described is most similar in outline to *Illativella alta* BUSHMINA from the Lower Tournaisian of the Kolyma Massif (BUSHMINA 1975) from which it differs in a half as large dimensions, syllobium protruding beyond hinge line, shorter and less strongly developed anterior sulcus, less rounded anterior margin and a longer spine on posterior lobe. The specimens available for studies are very poorly preserved which precludes the possibility of erecting a new taxon.

Occurrence. — Poland: W. Pomerania — ?U. Frasnian.

Superfamily **Drepanellacea** ULRICH et BASSLER, 1923
Family **Aechminidae** BOUČEK, 1936
Genus *Aechmina* JONES et HALL, 1869
Type species: *Aechmina cuspidata* Jones et Hall, 1869

Aechmina sp.
(pl. 6:1)

Material. — Koczała 1 borehole: one damaged and deformed carapace from the depth of 2,978.1–2,984.6 m.

Dimensions (in mm):

	l	h
C ING O/38	O.51	0.29

Remarks. — Due to a poor state of its preservation, it is impossible to compare it with other species of this genus.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Superfamily **Kirkbyacea** ULRICH et BASSLER, 1906
Family **Amphissitidae** KNIGHT, 1928
Genus *Amphissites* GIRTY, 1910
Type species: *Amphissites rugosus* GIRTY, 1910

Amphissites irinae GLEB. et ZASP. *in*: EGOROV, 1953
(pl. 6:3)

1953. *Amphissites irinae* GLEB. et ZASP. (in litt.); EGOROV: 53–54, pl. 1: 1–8.
1964. *Amphissites* sp. F; MAGNE: 137, pl. 25:190.
1970*b*. *Amphissites irinae* EGOROV; LETHIERS: 114, pl. 11:1.

Material. — Koczała 1 borehole: one poorly preserved carapace from the depth of 2,730–2,734 m.

Dimensions (in mm):

	l	h
C juv. ING O/40	0.67	0.38

Description. — See EGOROV (1953).

Remarks. — The only specimen available for studies probably represents a juvenile form as indicated by its very fine reticulation. The surface of its valves is strongly corroded, the internal ridge almost completely broken off and inner carinae outlined only in the form of elongate convexities on the carapace. However, general proportions and an outline of carapace, in particular a strongly convex central node situated near the dorsal margin, allow one to assign this specimen to *Amphissites irinae* GLEB. et ZASP. in EGOROV.

Occurrence. — Poland: W. Pomerania — M. Frasnian; France: Dinant Basin — M. Frasnian (Matagne Beds); USSR: Russian Platform — M. Frasnian (Semiluka Beds).

Amphissites pulcher POLENOVA, 1952
(pl. 6:4–5)

1952. *Amphissites pulcher* sp. n.; POLENOVA: 115–116, pl. 9:2–3; pl. 10:1.
1961. *Amphissites pulcher* POLENOVA; SOHN: 121.
1972. *Amphissites (Amphissites) pulcher* POLENOVA; GUREVICH: 314–315, pl. 7:1.
1979. *Amphissites pulcher* POLENOVA; OLEMPSKA: 88, pl. 13:8; pl. 14:1–2.

Material. — Miastko 2 borehole: two carapaces and five valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/41	1.48	0.81
C juv. ING O/42	0.96	0.58

Description. — See POLENOVA (1952).

Remarks. — The specimens under study differ from the most similar species *Amphissites remesi* POKORNÝ from the Givetian of Bohemia (POKORNÝ 1950) in its less strongly developed central node, shorter outer carinae running parallel to the inner ridge and a more strongly bent dorsal carina.

Occurrence. — Poland: Holy Cross Mts. — U. Givetian (*Stringocephalus burtini* Beds W. Pomerania — U. Givetian; USSR: Russian Platform — U. Givetian (Starooskol Horizon), Volhynia — U. Givetian (Pelcha Beds).

Amphissites remesi POKORNÝ, 1950
(pl. 6:6)

1950. *Amphissites remesi* sp. n.; POKORNÝ: 604–607, pl. 5:10.
1968. *Amphissites* sp. A; ADAMCZAK: 87, pl. 39:8.
1969. *Amphissites remesi* POKORNÝ; GROOS: 36–38, fig 20–21, pl. 19:1–6.
1974. *Amphissites remesi* POKORNÝ; BLUMENSTENGEL: 22, pl. 2:1–4.

Material. — Koczała 1 borehole: two valves from the depth of 2,949.5–2,954.2 m.

Dimensions (in mm):

	l	h
LV ING O/43	1.09	0.56

Description. — See POKORNÝ (1950).

Remarks. — The material under study includes two single valves only. Their sharp, outwardly directing internal carinae and their distinct elongate central node allow one to assign them to *Amphissites remesi* POKORNÝ.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; W. Germany: Rhenish Slate Mts. — U. Eifelian to U. Givetian; E. Germany — Harz Mts. — U. Eifelian; Bohemia — Givetian.

Amphissites multicarinatus sp. n.
(pl. 6:2)

Holotype: Carapace ING O/39; pl. 6:2.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *multicarinatus* — having many carinae.

Diagnosis. — Lateral outline preplete. Inner carinae long, incurved. Many secondary carinae run obliquely downwards from inner carinae. One of them, the most strongly developed and angularly bent, runs from the antero-dorsal to antero-ventral part of the valve through the central node.

Dimensions (in mm):

	l	h
C holotype ING O/39	0.98	0.64

Description. — Carapace semi-elliptical in lateral outline. Posterior margin higher than the anterior. Inner carinae long, perpendicular to hinge margin in their upper and incurved in their lower parts. The anterior inner carina less strongly developed than the posterior one. Many secondary carinae, directed obliquely downwards, run out- and inwards from inner carinae. The longest of them and most distinct starting from a corner formed by a dorsal and anterior inner carinae, runs towards the upper part of central node where it bends, intersects its middle and subsequently turns once again anteriorly along the anterior margin of the adductorial pit. Central node small and distinctly outlined. Dorsal carina distinct only in the anterior and posterior parts where it forms a V-shaped bend, sharper and higher in the posterior part. In the middle part, dorsum very narrow. Surface reticulate.

Remarks. — The variability of adult forms is expressed mostly in a varying degree of development of secondary carinae which may be either numerous and distinct, or almost invisible, except for an oblique carina, strating at the junction of an anterior inner carina and dorsal carina, running through the middle of the central node and remaining always distinctly visible. Also variable is the height of the anterior and posterior margins of valves; sometimes, they are almost symmetrical.

The juvenile forms are marked by an identical height of both anterior and posterior margins, central node more convex than that in adult forms and more robust, high inner carinae. Except for the carina described above, they are as a rule devoid of other secondary carinae.

A. multicarinatus sp. n. differs from other species of the genus *Amphissites*, having secondary carinae, in the fact that its carinae branch from inner carinae always obliquely downwards and never upwards.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Family **Kirkbyellidae** Sohn, 1961
Genus *Refrathella* Becker, 1967
Type species: *Refrathella struvei* Becker, 1967

Refrathella sp. 1
(pl. 7:1)

Material. — Koczała 1 borehole: two damaged valves from the depth of 2,949.5–2,954.2 m.
Dimensions (in mm):

	l	h
RV ING O/44	0.56	0.26

Description. — Valves strongly elongated, semi-elliptical in lateral outline. Dorsal margin long, straight. Anterior margin rounded. Ventral margin parallel to the dorsal, slightly concave in the middle part. Posterior margin lower than the anterior, in the dorsal part straight and perpendicular to hinge margin, in the ventral part obliquely truncate. An elongate, oval, distinct adductorial sulcus is situated in the dorsomedian part of valve. Ventral lobe elongate, terminating posteriorly in a blunt node. Two smooth lists can be distinguished — the longer upper and the shorter lower on the lobe surface. These parallel lists do not contact each other. A narrow depression occurs between them. A wide, smooth marginal ridge runs along the free margin. Lateral surface finely reticulate.

Remarks. — The distinctly outlined ventral lobe, with ornamentation in the form of smooth lists and the smooth marginal ridge allow one to assign the form under study to the genus *Refrathella* BECKER.

Its strongly elongated valve, long adductorial sulcus and the low situation of its ventral lobe having two separate, parallel lists, differ this form from all known species of the genus *Refrathella*. The scarcity of material, prevents one, however, from erecting a new species.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Superfamily **Youngiellacea** KELLET, 1933
Family **Youngiellidae** KELLET, 1933
Genus *Moorites* CORYELL et BILLINGS, 1932

Type species: *Glyptopleurina ? minuta* WARTHIN, 1930 (= *Moorites hewetii* CORYELL et BILLINGS, 1932).

Moorites givetianus (ROZHDESTVENSKAYA, 1962)
(pl. 7:3)

1962. *Youngiella givetiana* sp. n.; ROZHDESTVENSKAYA: 192–193, pl. 6:9.

Material. — Koczała 1 borehole: five carapaces from the depth of 2,949.5–2,954.2 m. Dimensions (in mm):

	l	h
C holotype ING O/46	0.35	0.19

Description. — Carapace strongly compressed, elongated, rectangular in lateral outline. Dorsal margin almost straight, anteriorly slightly concave, terminating in small auricles. Hinge line running in a small depression. Anterior margin rounded and higher than the posterior. Posterior margin subrectilinear, perpendicular to the ventral. Ventral margin slightly concave. A cylindrical marginal ridge runs along the free margin. A small, shallow pit surrounded ventrally and posteriorly by a small swelling occurs in the anterior half of valve somewhat above midheight. The largest width of carapace occurs in its anterior part. Surface smooth.

Remarks. — The Polish specimens are identical with those from Bashkiria.

Occurrence. — Poland: W. Pomerania — U. Givetian; USSR: Bashkiria — U. Givetian (Starooskol Horizon).

Moorites koczalensis sp. n.
(pl. 7:2)

Holotype: Carapace ING O/45; pl. 7:2.
Type locality: Koczała 1 borehole, depth 2,949.5–2,954.2 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: after the locality Koczała.

Material. — Koczała 1 borehole: ca 50 carapaces from the depth of 2,949.4–2,984.6 m.

Diagnosis. — Carapace small, subrectangular in lateral outline. Height equalling 0.6 of length. A very indistinct swelling present near the anterior and posterior margin. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/45	0.30	0.19

Description. — Carapace small, rectangular in lateral outline, with almost symmetrically rounded anterior and posterior margins. Anterior margin somewhat higher than the posterior. Dorsal and ventral margins slightly convex. Height of carapace equalling about 0.6 of its length. Indistinct, cylindrical swellings run along the anterior and posterior margin close to the edges of valves. Lateral surface smooth.

Remarks. — The variability of the specimens studied concerns mostly the degree of elongation of the carapace. The species under study is similar to *Moorites fallax* BECKER from the Middle Frasnian of the Dinant Basin, Belgium (BECKER 1971 b), from which it differs in a shorter carapace, less rounded anterior and posterior margin, less distinct marginal ridge and smaller cardinal angles.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Superfamily uncertain

Family **Aechminellidae** SOHN, 1961

Genus *Balantoides* MOREY, 1935

Type species: *Balantoides quadrilobatus* MOREY, 1935

Remarks. — In his revision of the family Aechminellidae, SOHN (1975) included in *Balantoides* MOREY species which were formely assigned by himself (SOHN 1961*a*) and BECKER (1968) to *Aechminella* HARLTON and by POLENOVA (1955) to *Pseudonodellina* POLENOVA.

The present writer's suggestion is to include in the synonymy of *Balantoides* MOREY also the genus *Stictobolbina* erected by KESLING and CHILMAN (1978), since its characters correspond to SOHN's (1975) diagnosis of the genus *Balantoides*. This diagnosis should be supplemented as follows: the species of the genus *Balantoides* MOREY may also have a smooth surface (for example, *B. minimus* (LETHIERS) and *B. parvulus* (POLENOVA)) and a central lobe not always projecting above the hinge line (for example, *B. allethaae* (COLEY)).

Balantoides brauni (BECKER, 1969)

(pl. 7:8)

1968. *Aechminella brauni* sp. n.; BECKER: 558–560, figs. 3–4; pl. 1:3–5.

Material. — Chojnice 5 borehole: seven carapaces and three valves from the depth of 3,685.4–3,688.2 m and one carapace from the depth of 3,768.3–3,790.6 m; Koczała 1 borehole: seven carapaces from the depth of 2,730–2,734 m.

Dimensions (in mm):

	l	h
C ING O/51	0.35	0.26

Description, — See BECKER (1968).

Remarks. —The specimens under study correspond to the description of *Balantoides brauni* presented by BECKER (1968). They are not very well preserved and this is probably the reason why no ornamentation was observed on their surface. In some specimens, the cusp of central lobe is not so strongly pointed as in those illustrated by BECKER (1968). The specimen discussed differs from *Balantoides minimus* (LETHIERS) in its long posterior sulcus curved near the ventral margin and from *B. parvulus* (POLENOVA) in higher anterior end, elongated adductorial sulcus, less distinct dorsal connection of the anterior and central lobe and smaller dimensions.

Occurrence. — Poland: W. Pomerania — M. Frasnian; W. Germany — Rhenish Slate Mts. — Frasnian (Refrath Beds).

Balantoides parvulus (POLENOVA, 1952)
(pl. 7:4–5)

1953. *Nodella* (?) *parvula* sp. n.; POLENOVA: 26, pl. 1:6.

Material. — Chojnice 5 borehole: one valve from the depth of 4,683.7–4,691.7 m, eight carapaces from the depth of 4,482–4,545.1 m and 14 carapaces and five valves from the depth of 4,398.2–4,436.4 m; Koczała 1 borehole: six carapaces from the depth of 3,041.8–3,119 m, 16 carapaces and three valves from the depth of 2,990.3–3,019 m, and more than 1,000 carapaces from the depth of 2,938.3–2,984.6 m; Miastko 2 borehole: several hundred carapaces and single valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/48	0.39	0.29
C ING O/47	0.47	0.34

Description. — Carapace subcircular in lateral outline, trilobate. Hinge margin short (about 0.7 of the length). Anterior, ventral and posterior margins rounded, anterior of equal height as posterior or only slightly higher. Anterior and central lobe protruding above the hinge line. A short, rounded or tear-shaped adductorial sulcus does not separate entirely the lobes and therefore their dorsal connection remains and is more distinct on the larger, left valve. The cusp of central lobe may be slightly pointed. Posterior sulcus straight, relatively short, reaching only somewhat below the midheight of valve. Carapace strongly convex, the most so in the anterior part. Surface smooth.

Remarks. — Only a very small variability concerning the degree of pointedness of the cusp of central lobe was observed among the vast number of specimens.

The form under study differs from the most similar species, *Balantoides minimus* (LETHIERS) from the Lower Frasnian of Boullonais, France (LETHIERS 1970*a*), in a circular lateral outline, adductorial sulcus developed as a round pit, shorter hinge margin and equal height of the anterior and posterior margins.

Occurrence. — Poland: W. Pomerania — U. Givetian; USSR: Russian Platform — U. Givetian (Starooskol Horizon), Volhynia — U. Givetian (Pelcha Beds).

Balantoides keslingi sp. n.
(pl. 7:6–7)

Holotype: Carapace ING O/49, pl. 7:6.
Type locality: Koczała 1 borehole, depth 2,996.4–3,006.1 m. W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: in honour of Professor ROBERT V. KESLING, American ostracologist.

Material. — Chojnice 5 borehole: one carapace from the depth of 4,415.2–4,429.4 m; Koczała 1 borehole: one damaged carapace from the depth of 3,089–3,094 m, two carapaces from the depth of 2,978.1–2,984.6 m and two valves from the depth of 2,949.5–2,954.2 m.

Diagnosis. — Carapace small, sub-elliptical in lateral outline, quadrilobate. Anterior and posterior sulci long, reaching almost the ventral margin. Adductorial sulcus shorter than a half of the height. Central lobe slightly protruding above the hinge line. Posterior lobe situated very close to the posterior margin. Surface reticulate.

Dimensions (in mm):

	l	h
C holotype ING O/49	0.35	0.21
C ING O/50	0.42	0.22

Description. — Carapace small, elongate, subelliptical in lateral outline. Hinge margin straight. Anterior margin higher than the posterior, rounded. Ventral margin straight or slightly convex. Posterior margin rounded. Four distinct lobes, of which only the central one slightly protrudes above the hinge line, are visible on the surface of valves. Anterior sulcus long, narrow, straight, reaching almost the ventral margin. Adductorial sulcus shorter, not reaching the midheight, strongly extending upwards, shaped like an inverted triangle. Posterior sulcus very wide, lunular, reaching almost the ventral margin. Posterior lobe situated very close to the posterior margin. The surface of sulci and of the ventral connection of the anterior and central lobe reticulate.

Remarks. — *B. keslingi* is veiy similar to *B. allethaae* (COLEY) from the Silica formation (Middle Devonian) of North America (KESLING and CHILMAN 1978), from which it differs only in a wider adductorial sulcus and a posterior lobe situated closer to the posterior margin.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Nezamysliidae fam. n.

Type genus: *Nezamyslia* PŘIBYL, 1955

Diagnosis. — Palaeocopida with a flat, semioval carapace. Hinge margin long, straight, provided with an anterior and, sometimes, posterior cardinal spine. Adventral structure connected with dorsal ridge in a ringe-like structure. A smooth adductorial spot (in the genus *Obotritia* ADAMCZAK) or a single or, sometimes, a group of three adductorial pits (in *Nezamyslia* PŘIBYL) occur in the anterodorsal part of the valve. A ventral carina may also occur. Lateral surface reticulated or pitted. Dimorphism not recorded.

Remarks. — Dimorphism in the species *Nezamyslia magnifica* POLENOVA was described by POLENOVA (1974). On this basis, as well as due to considerable similarity to some Primitiopsidae, that author (*l.c.*) assigned the genus *Nezamyslia* PŘIBYL to this family, tentatively, since the dimorphism of this type (ventral dolon) is characteristic of the Eurychilinacea rather and not of Primitiopsacea. In the present writer's opinion, *N. magnifica* probably belongs to the Eurychilinacea and certainly could not be assigned either to the genus *Nezamyslia*, or to other representatives of the Nezamysliidae fam. n. For, this species differs from the Nezamysliidae in strongly covex valves, lack of a distinct adductorial pit and an oblique position of the adventral structure in relation to the lateral surface. Thus, dimorphism in the Nezamysliidae remains unknown, which precludes the possibility of assigning this group to the existing superfamilies of the Palaeocopida.

The genera *Nezamyslia* PŘIBYL and *Obotritia* ADAMCZAK have so far been assigned to the Kirkbyacea (PŘIBYL 1955; ADAMCZAK 1968; COPELAND 1977). However, the absence of what is known as a "kirkbyan pit" characteristic of this superfamily makes such a classification impossible. A connection of the adventral structure with the dorsal ridge is known, apart from the Kirkbyacea, also in other groups of the Palaeocopida, for example, in the Eurychilinacea and Primitiopsacea. The representatives of the Nezamysliidae fam. n. differ from those of the Eurychilinacea in a narrow, smooth, ridge-like adventral structure perpendicular to the lateral surface, the presence of cardinal spines and a more anterior situation of the adductorial pit or adductorial spot.

On the other hand, we observe a great similarity of the Nezamysliidae to some Primitiopsacea, to the genera *Limbinaria* SWARTZ et WHITMORE and *Limbinariella* SARV (POLENOVA, 1974). The lack of dimorphic perimarginal structures is the only obstacle in assigning it to this superfamily.

The family Nezamysliidae fam. n. includes the following genera: *Nezamyslia* PŘIBYL, 1955 and *Obotritia* ADAMCZAK, 1968.

In the present writer's opinion, *N. carinata* REYNOLDS and *N. walliseri* GROOS-UFFENORDE, described from the Emsian of Australia and southern France (REYNOLDS 1978; GROOS-UFFENORDE 1979), marked by the presence of a ventral carina and wide, radially striate adventral structure should form a separate genus of the family Nezamysliidae fam. n.

Age: Lower and Middle Devonian of Eurasia, Australia and North America.

Genus *Nezamyslia* PŘIBYL, 1955

Type species: *Kirkbya* (?) *bohemica* PŘIBYL et ŠNAJDR, 1950

Diagnosis (revised). — Nezamysliidae with or without a ventral carina and with a single or a group of three adductorial pits. A small preadductorial node occurs sometimes. Adventral ridge low, smooth, sometimes with a spine in its anterodorsal part. Surface reticulate. The meshes of reticulation large, polygonal.

Remarks. — *Obotritia* ADAMCZAK was regarded by some authors (GROOS 1969; POLENOVA 1974; OLEMPSKA 1979), as junior synonym of the genus *Nezamyslia* PŘIBYL. In the present writer's opinion the external form of the muscle scar has a high generic rank within the Palaeocopida and, for this reason, she suggests to treat both taxa mentioned above as two separate genera, following BERDAN and COPELAND (1973).

The genus *Nezamyslia* includes the following species: *N. bohemica* (PŘIBYL et ŠNAJDR, 1950) (= *Arcyzona gemmula* WEYANT, 1966), *N. circularis* COPELAND, *N. jucunda* POLENOVA, *N. perforata* COPELAND and *N. bicornuta* sp. n.

Nezamyslia bicornuta sp. n.

(pl. 5:3–4)

Holotype: Tecnomorph carapace ING O/31; pl. 5:3.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *bicornutus* — bicornate.

Material. — Miastko 2 borehole: one carapace and one damaged valve from the depth of 2,080–2,085 m.

Diagnosis. — Carapace postplete, with anterior cardinal spine and an anterior adventral spine. Adductorial pit and a small preadductorial node encircled form below and on the sides by a thin ridge. Surface ornamented by reticulation in the form of large, shallow, polygonal meshes separated from each other by fine, thin walls. Ventral margin denticulate.

Dimensions (in mm):

	l	h
C holotype ING O/31	1.01	0.61
RV ING O/32	1.24	0.68

Description. — Carapace flat, elongate, semi-elliplical in lateral outline. Hinge margin long, straight, with anterior cardinal spine occuring on each valve. Anterior and posterior margins rounded, the anterior lower than the posterior. Ventral margin slightly convex. Adventral structure in the form of a narrow, smooth ridge running parallel to margins, except for the upper corners of valves, in particular the posterior one a large part of which remains outside the ridge. In the anterodorsal part of valve, the adventral ridge is provided with a short, triangular spine. Anterior connection of the adventral and dorsal ridge indistinct. Anterior part of dorsal ridge runs very close to hinge margin.

Antero-dorsal part of valve slightly depressed. An adductorial pit, with a small preadductorial node, is situated in the lower part of this depressed area. This part of valve is surrounded from below and on the sides by a thin ridge formed by the walls of the nearest meshes of the reticulation. Reticulation of the lateral surface of valves is very fine and consists of large tetra- and pentagons. The walls of meshes make up very thin ridges. Subadventral area smooth. Free margin denticulate. Maximum width occurring in the anterior part of carapace.

Remarks. — *N. bicornuta* sp. n. is most similar to *N. jucunda* POLENOVA from the Lower Devonian of the Arctic regions of the USSR (POLENOVA 1974), from which it differs in its anterior cardinal spine directed anteriorly in horizontal position, in the presence of an anterior adventral spine, in an indistinct connection of the adventral and dorsal ridge in the anterior part of valve and in the position of its larger convexity in the anterior part of carapace.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Genus *Obotritia* ADAMCZAK, 1968

Type species: *Obotritia eifeliensis* ADAMCZAK, 1968

Obotritia eifeliensis ADAMCZAK, 1968

(pl. 5:5)

1959. *Nezamyslia bohemica* (PŘIBYL et ŠNAJDR); ROZHDESTVENSKAYA: 192, pl. 6:7.
1964. *Ostracodarum* gen. ind. sp. A; BECKER: 89, pl. 6:5.
1968. *Obotr'tia eifeliensis* sp. n.; ADAMCZAK: 85–86, pl. 38: 1–3.
1969a. *Obotritia eifeliensis* ADAMCZAK; BECKER: 262–263, pl. 1:6.
1969. *Nezamyslia eifeliensis* (ADAMCZAK); GROOS: 39–40, pl. 19:14.
1979. *Nezamyslia eifeliensis* (ADAMCZAK); OLEMPSKA: 87-88, pl. 13:5.

Material. — Koczała 1 borehole: one left valve from the depth of 2,949.5–2,954.2 m; Miastko 2 borehole: a fragmentary right valve from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
LV ING O/33	1.14	0.77

Remarks. — *Obotritia eifeliensis* ADAMCZAK differs from *Obotritia* ? sp. from the Lower Devonian of Alaska (BERDAN and COPELAND, 1973) in its reticulate surface and adventral ridge running parallel to free margin.

Occurrence. Poland: Holy Cross Mts., Łysogóry Region — Eifelian (Grzegorzowice Formation), Kielce Region — U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania — U. Givetian; W. Germany: Eifel Mts., and Rhenish Slate Mts. — U. Eifelian to M. Givetian; USSR: Bashkiria — Eifelian and Givetian (Biya and Afonin Beds).

Family **Rozhdestvenskayitidae** MC GILL, 1966

Genus *Fellerites* GRÜNDEL, 1962

Type species: *Fellerites bohlenesis* GRÜNDEL, 1962

Fellerites tuimazensis (ROZHDESTVENSKAYA, 1959)

(pl. 7:11)

1959. *Aparchites tuimazensis* sp. n.; ROZHDESTVENSKAYA: 132–133, pl. 1:1–4.
1960. *Aparchites auriculiferus* ROZHDESTVENSKAYA sp. n.; ROZHDESTVENSKAYA: 284–285, pl. 58:2.
1962. *Aparchites auriculiferus* ROZHDESTVENSKAYA; ROZHDESTVENSKAYA: 171–172, pl. 1:1a–b, 2a–b
1979. *Rozhdestvenskayites tuimazensis* (ROZHDESTVENSKAYA); OLEMPSKA: 85–86, pl. 13:1.

Material. — Miastko 2 borehole: a dozen or so carapaces and single valves from a depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/54	1.53	1.19

Description. — See ROZHDESTVENSKAYA (1959).

Remarks. — The presence of auriculate processes developed in cardinal angles and of a marginal ridge allow one to assign this species to the genus *Fellerites* GRÜNDEL.

Occurrence. — Poland: Holy Cross Mts. — U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania — U. Givetian; USSR: Bashkiria — Eifelian (*Calceola* and Biya Beds).

Family uncertain

Genus *Evlanovia* EGOROV, 1950

Type species: *Evlanovia tichonovichi* EGOROV, 1950

Remarks. — The genus *Evlanovia* EGOROV was assigned by SOHN (1961) and BRAUN (1967) to the family Aechminellidae. It follows, however, from SOHN'S (1975) revision of this family that its representatives are characterized by the lack of marginal ridge and nodes in the ventral half of carapace. For this reason, the genus *Evlanovia* should be excluded from this family. No family to which this genus could be assigned is known to the present writer.

Evlanovia sp. 1

(pl. 7:12)

Material. — Miastko 2 borehole: one damaged RV from a depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
RV ING O/55	0.61	0.42

Remarks. — This single specimen, assigned to the genus *Evlanovia* EGOROV on the basis of its general outline and the presence of nodes and a marginal ridge, is noteworthy inasmuch as it is surely a representative of the genus *Evlanovia* met within deposits older than the Upper Devonian ones. Like *E. tichonovichi* EGOROV from the Frasnian of the Russian Platform (EGOROV 1950), the Polish form has two ventral nodes, but differs from this species in its reticulate and not smooth surface and in an obtuse and not pointed posterodorsal node.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Genus *Coeloenellina* POLENOVA, 1952

Type species: *Coeloenellina parva* POLENOVA, 1952

Coeloenellina pomeranica sp. n.

(pl. 7:9–10)

Holotype: Carapace ING O/53; pl. 7:9.
Type locality: Chojnice 5 borehole, depth 4,429.4–4,436.4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After the name of the Pomerania Province, Poland.

Material. — Chojnice 5 borehole: ten carapaces from the depth of 4,517.4–4,526.1 m and two carapaces from the depth of 4,429.4–4,436.4 m; Koczała 1 borehole: six carapaces from the depth of 3,041.8–3,119 m and several scores of carapaces from the depth of 2,938.3–2,984.6 m Miastko 2 borehole: 15 carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace small, slightly convex, oval in lateral outline. Dorsal margin straight ventral slightly convex. Anterior and posterior margins symmetrically rounded. Hinge line and ventral part of contact line occurring in narrow depressions. Marginal ridges thin. Lateral surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/53	0.51	0.35
C ING O/54	0.53	0.35

Description. — Carapace small, oval in lateral outline. Dorsal margin straight. Anterior and posterior margins equal in height, symmetrically rounded. Ventral margin slightly convex. Right valve, somewhat larger than left, overlapping the latter most strongly along the antero- and posterodorsal margin. Hinge line situated in a narrow depression. A similar depression is developed on the ventral surface of carapace. Thin marginal ridges run along the free margin of each valve. The largest convexity of carapace occurs in its middle part. Carapace, viewed dorsally, in the form of a flat rhomb. Surface smooth.

Remarks. — As compared with the known representatives of the genus *Coeloenellina* POLENOVA, the species described differs from them in the presence of a depression onə the ventra surface of carapace. In its outline, *C. pomeranica* resembles to the greatest extent *C. parva* POLENOVA from the Starooskol Horizon of the Russian Platform (POLENOVA 1952), differing from it in a flattened carapace, symmetry of anterior and posterior margins, almost equal height of both valves and the presence of a ventral depression.

Occurrence. — Poland: W. Pomerania — U. Givetian.

Order **Platycopida** SARS, 1866

Superfamily **Kloedenellacea** ULRICH et BASSLER, 1908

Family **Kloedenellidae** ULRICH et BASSLER, 1908

Genus *Poloniella* GÜRICH, 1896

Type species: *Poloniella devonica* GÜRICH, 1896

Diagnosis (revised). — Trisulcate kloedenellids with left valve overlapping the right one and having a wide stragulum (covering as much as one-fourth of the length of hinge line), not clearly set off from the hinge line.

Remarks. — A diagnosis of the genus *Dizygopleura* ULRICH et BASSLER was presented by BERDAN (1972) who thus explained a so far controversial subject of either the congenerity or separate character of the genera *Dizygopleura* and *Poloniella* GÜRICH. The manner of developing the stragulum was considered by that author as the most important character differing the two genera. According to this new interpretation, the genus *Dizygopleura* is marked by the presence of a narrow stragular process occurring above S_1 which fits into a deep narrow notch in the right valve (BERDAN 1972), while *Poloniella* displays a wide stragulum overlapping the right valve in the form of a gentle arc.

The two genera are marked by a considerable variability of lobation. Species having ventral connections S_1 and S_3, as well as those devoid of them occur in each of these genera. This variability is, however, interspecific and never intraspecific, as it was suggested by ADAMCZAK (1961).

BERDAN'S (1972) logical conception was accepted by not all authors, even American ones. KESLING and CHILMAN (1978) continue to employ the former division based on lobation and assign, for example, *D. cingulata* (WARTHIN), having a narrow, pointed stragulum typical of *Dizygopleura*, to *Poloniella* and *P. trisinuata* (VAN PELT), having a wide and gently arcuate stragulum, to *Dizygopleura*.

Poloniella tertia KRÖMMELBEIN, 1953
(pl. 8:4–6)

1953. *Poloniella tertia* sp. n.; KRÖMMELBEIN: 58, pl. 3:3.
1961. *Poloniella tertia* KRÖMMELBEIN; ADAMCZAK: 303–306, fig. 10–11, pl. 4:1–2.
1964. *Poloniella* cf. *claviformis* (KUMMEROW); BECKER: 77, pl. 13: 5–6.
1969. *Poloniella tertia* KRÖMMELBEIN; GROOS: 44, pl. 6:3.
1972. *Dizygopleura cingulata* (WARTHIN); GUREVICH: 320, pl. 7:8.

Material. — Chojnice 5 borehole: one heteromorph and one tecnomorph carapace from the depth of 4,683.7–4,691.7 m, two heteromorph carapaces and one valve from the depth of 4,482–4,545.1 m and one heteromorph carapace and three tecnomorph valves from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: one heteromorph and one tecnomorph valve from the depth of 2,990.2–3,019 m, 11 heteromorph carapaces and 17 tecnomorph carapaces and 17 tecnomorph valves from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: one tecnomorph carapace and one tecnomorph valve from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ♀ ING O/61	0.95	0.52
C ♂ ING O/59	0.85	0.46
C ♂ ING O/60	0.84	0.48

Remarks. — The material the present writer had at her disposal included, in addition to carapaces of adults, those of juvenile forms. However, the existence of a ventral connection of sulci S_1 and S_3 suggested by ADAMCZAK (1961) was not found in any ontogenetic stage.

Occurrence. – Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; W. Germany: Eifel Mts. — Eifelian and Givetian, Rhenish Slate Mts. — M. Givetian; USSR: Volhynia — U. Givetian (Pelcha Beds).

Poloniella trisinuata (VAN PELT, 1933)
(pl. 9:8; pl. 10:1)

1933. *Dizygopleura trisinuata* VAN PELT; 328, pl. 19:61–62.
1934. *Dizygopleura oblonga* WARTHIN: 211, pl. 1:8.
1936. *Dizygopleura oblonga* WARTHIN; STEWART: 750–751, pl. 101:1–4.
1945. *Dizygopleura trisinuata* VAN PELT; STEWART and HENDRIX: 90, pl. 10:9–11.
1950. *Dizygopleura trisinuata* VAN PELT; STEWART: 660–661, pl. 86:1–3.
1952. *Dizygopleura clara* sp. n.; POLENOVA: 104–106, pl. 6:8–9.
1961. *Poloniella diversa* sp. n.; ADAMCZAK: 306–307, fig. 12–13, pl. 5:2a–c.
1972. *Poloniella oblonga* (WARTHIN); GUREVICH: 317–318, pl. 7:5.
1978. *Dizygopleura trisinuata* VAN PELT; KESLING and CHILMAN: 77, 79, pl. 44:13–16; pl. 45:5–24; pl. 47:43–54; pl. 103:25–28.

Material. — Chojnice 5 borehole: two tecnomorph valves from the depth of 4,683.7–4,691.7 m, one heteromorph carapace and six tecnomorph carapaces and 18 valves from the depth of 4,482–4,545.1 m and two heteromorph valves and four tecnomorph carapaces and 15 valves from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: one tecnomorph carapace from the depth of 3,041.8–3,119 m, one tecnomorph carapace from the depth of 2,990.2–3,019 m and nine heteromorph carapaces and 24 tecnomorph carapaces and five valves from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: three tecnomorph carapaces and two valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h	w
C ♂ ING O/70	0.74	0.40	0.41
C ♂ ING O/71	0.77	0.43	—

Remarks. — *P. trisinuata* (VAN PELT) differs from the most closely related species *P. claviformis* (KUMMEROW) in a longer S_2, which reaches much below midheight and is, at the same time, more contracted and bent in its lower part and in S_1 more strongly incurved in the ventral part.

In the material under study, both adult and juvenile specimens are marked by the lack of ventral connection between S_1 and S_3. This does not, therefore, corroborate ADAMCZAK'S (1961) suggestion that such a connection exists in the youngest ontogenetic stages of this species.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; USSR: Russian Platform — U. Givetian (Starooskol Horizon), Volhynia — U. Givetian (Pelcha Beds); USA: northwestern Ohio and northeastern Michigan — M. Devonian (Silica Formation).

Poloniella adamczaki sp. n.

(pl. 8:1–3)

1952. *Dizygopleura clara* sp. n.; POLENOVA: pl. 7:1.
1961. *Poloniella cingulata* WARTHIN; ADAMCZAK: 308–311, fig. 14, pl. 6:1–2.
Holotype: Heteromorph carapace ING O/57; pl. 8:2.
Type locality: Koczała 1 borehole, depth 2,949.4–2,959.2 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After the name of Dr. FRANCISZEK ADAMCZAK, ostracodologist.

Material. — Chojnice 5 borehole: one heteromorph and two tecnomorph carapaces from the depth of 4,483.7–4,691.7 m; Koczała 1 borehole: one tecnomorph and one heteromorph carapace from the depth of 3,041.8–3,048 m, one tecnomorph carapace from the depth of 2,996.4–3,006.1 m and five heteromorph carapaces and three tecnomorph carapaces and seven valves from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: five tecnomorph valves from the depth of 2,080–2,085 m.

Diagnosis. — Carapace preplete, with the posterior end truncate in both the hetero- and tecnomorphs. Ventral margin slightly concave, parallel to dorsal. S_3 long, reaching almost the dorsal margin, with its upper part slightly deflected posteriorly. S_1 and S_3 connected ventrally. A crest occurs on L_4 of both tecno- and heteromorphs.

Dimensions (in mm):

	l	h
C ♀ ING O/56	1.03	0.58
C♀ ING O/57	0.90	0.51
C juv. ING O/58	0.74	0.43

Description. — Heteromorph: Carapace oval in lateral outline, slightly preplete. Dorsal margin slightly convex, ventral slightly concave, parallel to the former. Anterior margin rounded. Posterior part of carapace truncate. Sulci relatively wide and deep. S_1 and S_3 parallel to one another and inclined at an angle of about 100° to dorsal margin, connected ventrally. S_2, reaching below the midheight of carapace, runs diagonally, contracting uniformly downwards, with a slight anterior bend occurring halfway its length. S_3 long, almost reaching the dorsal margin, with a slight sigmoidal posterior bend observed in its upper part. A not very sharp, gently arcuate crest occurs on L_4. L_1 and L_4 are connected ventrally by a narrow ventral ridge devoid of any sharp edge and parallel to both the ventral and dorsal margin.

Stragulum wide overlapping the right valve in the form of a gentle arc. Marginal ridge relatively wide.

Tecnomorph: Tecnomorphs differ from heteromorphs in a more strongly posteriorly narrowing lateral outline of their carapaces and in their narrow L_4.

Remarks. — Specimens of *P. adamczaki* sp. n. from the Holy Cross Mts. have been described by ADAMCZAK (1961) as *P. cingulata* WARTHIN. Unfortunately however, they have little in common with the last-named species which in fact belongs to *Dizygopleura*. Primarily, they have a wide stragulum, whereas *D. cingulata* (WARTHIN) displays a narrow, pointed triangular tooth. Also different is the outline of carapaces: in *P. adamczaki* the dorsal and ventral margins are parallel to one another, whereas in *D. cingulata* they converge. In *P. adamczaki*, the sulci are wider and deeper and S_3 reaching almost the dorsal margin, while in *D. cingulata* this sulcus reaches only the midheight of carapace. In *P. adamczaki*, L_4 of heteromorphs is provided with a crest which is lacking in those of the other species. In addition, *P. adamczaki's* ventral ridge is devoid of a sharp edge and its marginal ridge is wide in contrast to that of *D. cingulata.*

In its outline and the shape of its sulci and lobes, *P. adamczaki* sp. n. is unusually similar to *P. tertia* KRÖMMELBEIN. A ventral connection between sulci S_1 and S_3 occurring in *P. adamczaki* and lacking in *P. tertia* is the only essential difference between the two species.

Occurrence. — Poland: Holy Cross Mts. — Givetian (Skały Formation), W. Pomerania — U. Givetian; USSR: Russian Platform — U. Givetian (Starooskol Horizon).

Poloniella regularis sp. n.
(pl. 9:1–7)

Holotype: Tecnomorph carapace ING O/66; pl. 9:1.
Type locality: Koczała 1 borehole, depth 2,978.1–2,984.6 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *regularis* — regular.

Material. — Chojnice 5 borehole: one tecnomorph carapace from the depth of 4,482–4,545.1 m; Koczała 1 borehole: six heteromorph carapaces and two valves, as well as 36 tecnomorph carapaces and 13 valves from the depth of 2,947.6–2,984.6 m; Miastko 2 borehole: one heteromorph carapace and several valves, six tecnomorph carapaces and several scores of valves from the depth of 2,080–2,085 m.

Diagnosis. — Carapace flat, subrectangular in lateral outline, with a rounded anterior and slightly truncate posterior end. Ventral margin slightly concave. Sulci narrow, perpendicular to hinge margin. S_3 straight, S_1 sinusoidally depressed halfway the height, connected with one another ventrally. L_2 semicircularly extended dorsally, wider on the left valve. Lobe L_4 straight, narrow in tecnomorph and extended and inflated in heteromorphs. Surface of lobes flat, with an indistint reticulation.

Dimensions (in mm):

	l	h
C ♂ holotype ING O/66	0.97	0.55
C ♂ ING O/68	0.84	0.41
LV ♀ ING O/69	1.03	0.44
C ♀ ING O/67	0.92	0.48
C juv. ING O/65	0.66	0.37
C juv. ING O/64	0.53	0.32
C juv. ING O/63	0.43	0.24

Description. — Heteromorph: Carapace large, oval, elongate, very regular and subrectangular in lateral outline, flattened. Dorsal margin straight, ventral slightly concave. Anterior margin uniformly rounded, posterior slightly truncate. S_1 and S_3 narrow, perpendicular to dorsal margin, connected ventrally with a ventral sulcus which is perpendicular to them. The distance between anterior margin and S_1 equals that between S_3 and posterior margin. S_1 sinusoidally bent in its middle part. This bend, very distinctly visible even in juvenile specimens, is formed as a result of the extension of L_2 in its dorsal part. S_2 comma-shaped, reaching mid-height. S_3 straight, long, reaching the dorsal margin. Lobes flattened. L_2 semicircularly extended in the dorsal part. L_4 strongly inflated, wide, occupying the whole posterior part of the valve. Surface of lobes flat, indistinctly reticulate. Ventral ridge distinct, of equal thickness and height.

Tecnomorph: Posterior lobe L_4 on tecnomorph carapaces narrow, with a distinct crest in its posterior margin. Beyond this crest, the surface of L_4 obliquely and, at first, fairly steeply descends towards the posterior margin of valves.

Remarks. — *P. regularis* sp. n, differs from other species of the genus *Poloniella* GÜRICH in its regular, rectangular outline, vertical S_1 and S_3 the anterior one of which is characteristically bent in its middle part and in flat surfaces of its lobes.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Poloniella sp. 1
(pl. 8:7)

Material. — Koczała 1 borehole: one tecnomorph carapace from the depth of 3,089–3,094 m.

Dimensions (in mm):

	l	h
C ♂ ING O/62	0.74	0.43

Description. — Tecnomorph: Carapace subrectangular in outline, with a rounded anterior and narrower, ventrally slightly truncate, posterior margin. S_1 straight, running slightly obliquely toward the anterior part. S_2 fairly long, comma-shaped. S_3 arcuate, connected ventrally with S_1. L_2 widened fairly strongly in its middle part toward S_2. L_3 strongly widening ventrally. L_4 narrow, arcuate, provided in its posterior part with a crest. Part of carapace behind L_4 strongly shortened and, consequently, the posterior end, as viewed dorsally, is truncate. Surface reticulate.

Remarks. — The form described is most similar in its outline and shape of S_3 and L_4 to *Poloniella trisinuata* VAN PELT, from which it differs in an obliquely running S_1, strongly widened L_2, longer and more oblique S_2, shorter part of carapace behind L_4 and, what is most important, in ventral connection of S_1 and S_3. The last-named character approached this form to *Poloniella adamczaki* sp. n. from which in turn *Poloniella* sp. 1 differs, however, in an arcuate S_3, more rectangular outline of carapace and its shortened posterior part, as well as in a more strongly widened L_2. It is probably a new species.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Poloniella sp. 2
(pl. 10:8)

Material. — Miastko 2 borehole: one left heteromorph valve from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
LV ♀ ING O/78	1.31	0.51

Description. — Heteromorph: Valve large, with a high and rounded anterior and lower, truncate posterior margin. Sulci wide, deep, perpendicular to the dorsal margin. Lobes narrow. L_2 only slightly widened in its dorsal part. S_1 gently bent posteriorly in the ventral part. S_3 widening towards the posterior end where it bends anteriorly in a hooklike manner. S_2 very wide and long, reaching below the midheight and slightly anteriorly. L_2 joins L_3 in the form of the letter U slightly widened in its lower part. S_1 not connected ventrally with S_3. A distinct, sharp crest runs obliquely and posteriorly over an inflated L_4. Behind the crest, the surface of lobe slopes at an angle of 45° towards the posterior margin of valve which is conspicuous in ventral view. Valve is twice as wide in its posterior than anterior part.

Remarks. — The specimen under study resembles heteromorphs of *Poloniella spriesterbachii* ZAGORA from the Lower Eifelian of Thuringia (ZAGORA 1968). *Poloniella* sp. 2 is marked, however, by the lack of ventral connection between S_1 and S_3, S_3 more strongly widened in the lower part and in its crest which is more distinct on L_4 of the heteromorph. This specimen belongs most certainly to a new species.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Uchtovia* EGOROV, 1950

Type species: *Uchtovia polenovae* EGOROV, 1950

Uchtovia materni BECKER, 1971

(pl. 10:2)

1964. *Cavellina*? *abundans* POKORNÝ; MAGNE, pl. 30:263–267.
1971*b*. *Uchtovia materni* sp. n.; BECKER: 32–33, pl. 4:36–39; pl. 9:79.

Material. — Chojnice 5 borehole: two carapaces of tecnomorphs from the depth of 3,786.3–3,790.6 m.

Dimensions (in mm):

	l	h
C♂ ING O/72	0.92	0.43

Description. — See BECKER (1971*b*).

Remarks. — The specimens under study are rather poorly preserved, but, on the basis of the general outline of valve and shape of two sulci, they may be most certainly assigned to *Uchtovia materni* BECKER.

Occurrence. — Poland: W. Pomerania, M. Frasnian; France: Dinant Basin, M. Frasnian.

Uchtovia refrathensis (KRÖMMELBEIN, 1954)

(pl. 10:3–7)

1954. *Sulcella refrathensis* sp. n.; KRÖMMELBEIN: 252–253, pl. 1:5.
1959. *Uchtovia dissimilis* sp. n.; ROZHDESTVENSKAYA: 145–146, pl. 11:1–2.
1969. *Sulcella refrathensis* KRÖMMELBEIN; GROOS: 53, pl. 9:2.
1969. *Sulcella* sp. Gruppe *S. refrathensis-speculaea*; GROOS: 53, pl. 9:1.

Material. — Chojnice 5 borehole: five carapaces and one valve of a heteromorph and one tecnomorph carapace from the depth of 4,482-4,545.1 m; Koczała 1 borehole: five heteromorph carapaces and 14 carapaces and the valves of tecnomorphs from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C♀ ING O/73	0.93	0.49
C♀ ING O/74	0.97	0.49

C♀ ING O/75	1.0	0.53
C juv. ING O/76	0.77	0.45
C juv. ING O/77	0.64	0.35

Description. — See Krömmelbein (1954) and Rozhdestvenskaya (1959).

Remarks. — The first description of the species was based on specimens of tecnomorphs only (Krömmelbein 1954). The present writer had also at her disposal specimens of heteromorphs which are marked by a strongly inflated posterior part of carapace, higher posterior margin and truncate posterior part of carapace. The degree of pointedness of the posterior end is, however, variable. For, there also occur specimens with a rounded posterior end. In heteromorphs, the preadductorial sulcus is generally very slightly outlined or not developed at all. Forms described by Groos (1969) as *Sulcella* sp. Gruppe *S. refrathensis-speculaea* should be assigned to this species.

Occurrence. — Poland: W. Pomerania, U. Givetian: W. Germany: Rhenish Slate Mts., U. Givetian and L. Frasnian; USSR: Bashkiria, U. Givetian (Starooskol Horizon).

Uchtovia rozhdestvenskayae sp. n.
(pl. 11:1–4)

1959. *Uchtovia abundans* (Pokorný); Rozhdestvenskaya: 143–145, pl. 10:1–5.
Holotype: Tecnomorph carapace ING O/79; pl. 11:1.
Type locality: Koczała 1 borehole, depth 2,949.5–2,954 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After Dr. Anna Rozhdestvenskaya, Soviet ostracodologist.

Material. — Chojnice 5 borehole: eight tecnomorph carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: five heteromorph carapaces and several dozen tecnomorph carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: five carapaces and two valves of tecnomorphs from the depth of 2,080–2,085 m.

Diagnosis. — Carapace elongated, oval in lateral outline. Anterior and posterior margins almost symmetrically rounded, in tecnomorphs the posterior one slightly truncate in its lower half. A narrow compression area occurs along the anterior margin. Adductorial sulcus elongated, shallow. A posterior shoulder, most distinct in very young specimens, occurs in tecnomorphs. Ventral margin concave in adult and straight in juvenile forms.

Dimensions (in mm):

	l	h
C ♂ holotype ING O/79	1.06	0.55
C♀ ING O/81	1.25	0.61
C juv. ING O/80	0.74	0.42
C juv. ING O/82	0.72	0.47

Description. — Heteromorph: Carapace elongated, oval in lateral outline. Dorsal margin straight. The length of stragulum equalling about 1/3 of the entire length of carapace. Posterior part of hinge margin situated in a narrow and shallow depression. Anterior and posterior margins almost equal in height and uniformly rounded. A narrow compression area occurs along the anterior margin of valve. Ventral margin concave. A shallow and narrow adductorial sulcus, not reaching the dorsal margin, is situated in the anterodorsal part of valve. It occurs at midlength of stragulum. Carapace strongly convex posteriorly, most so at 1/6 of the distance from the posterior margin. Slight keels are present along the middle part of ventral margin. Marginal ridges occur on the free margin of the right valve. Surface smooth.

Tecnomorph: The carapaces of tecnomorphs differ from those of heteromorphs in the presence of a distinct shoulder in the posterior part of valve, turning into a ventral keel in the lower part of valve. In addition, tecnomorphs have a preadductorial sulcus, less distinctly outlined than the adductorial one. Dorsal and ventral margins convex.

Remarks. — *U. rozhdestvenskayae* resembles in its outline *Uchtovia refrathensis* (KRÖMMELBEIN) from the Lower Frasnian of the Rhenish Slate Mts., W. Germany (KRÖMMELBEIN 1954), differing from it in a less strongly developed, narrow, elongate adductorial sulcus.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Bashkiria, U. Givetian (Starooskol Horizon).

Uchtovia sp. 1
(pl. 11:5–6)

Material. — Koczała 1 borehole: two heteromorph carapaces and eight tecnomorph carapaces, not very well preserved from the depth of 3,041.8–3,119 m.

Dimensions (in mm):

	l	h
C♀ ING O/84	1.19	0.61
C juv. ING O/83	0.79	0.42

Remarks. — In their outline the carapaces of heteromorphs and tecnomorphs of *Uchtovia* sp. 1 resemble *Uchtovia rozhdestvenskayae* sp. n., but differ from them in the presence of a small, round (and not elongate), pit and in a less distinct shoulder in the posterior part of carapace in tecnomorphs. This is probably a new species.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Evlanella* EGOROV, 1950
Type species: *Evlanella ljaschenkoi* EGOROV, 1950

Evlanella caduca sp. n.
(pl. 11:7–8)

Holotype: Heteromorph carapace ING O/85; pl. 11:7.
Type locality: Koczała 1 borehole, depth 2,949.5–2,954.2 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *caducus* — falling.

Material. — Koczała 1 borehole: one carapace of a heteromorph and three of tecnomorphs from the depth of 2,949.5–2,954.2 m.

Diagnosis. — *Evlanella* species with an incomplete spiral ridge devoid of its anterior and anterodorsal parts. Dorsal margin fairly strongly convex. Surface reticulate.

Dimensions (in mm):

	l	h
C♀ holotype ING O/85	0.80	0.48
C♂ ING O/86	0.60	0.42

Description. — Heteromorph: Carapace oval in lateral outline, slightly preplete. Dorsal margin convex. Anterior and posterior margins uniformly rounded, almost equal in height. Ventral margin concave in its middle part. Spiral ridge incompletely developep, most distinct in its posterior and ventral parts and less so in the dorsal part. No spiral ridge occurs, on the other hand, in the posterior and anterodorsal parts of valve. Adductorial sulcus shallow, widening upwards. A slightly outlined preadductorial lobe occurs before the adductorial sulcus. A depression occurring before the posterior ridge continues in the form of a narrow sulcus running along the ventral ridge. Surface reticulate.

Tecnomorph: The carapaces of tecnomorphs differ from those of heteromorphs in a less distinctly outlined posterior depression.

Remarks. — An incomplete spiral ridge devoid of its anterior and anterodorsal parts, a convex dorsal and uniformly rounded posterior margin are characters which differ the species described from other so far known representatives of this genus. In regard to morphology, the form under study constitutes a transitional link between species of the genus *Evlanella* EGOROV with typically strongly developed spiral ridge and those of the genus *Eoevlanella* POLENOVA which are marked by the presence of only ventral and dorsal parts of this ridge (POLENOVA 1974). An extremely strong reduction of a ridge limited only to ventral parts is illustrated by *Evlanella mitis* and *E. mirabilis* erected by ADAMCZAK (1968). Their assignement to the genus *Evlanella* is rather doubtful as POLENOVA (1974) created the genus *Eoevlanella*.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Superfamily **Cytherellacea** SARS, 1866
Family **Cavellinidae** EGOROV, 1950

Genus *Cavellina* CORYELL, 1928
Type species: *Cavellina pulchella* CORYELL, 1928

Cavellina parvula sp. n.
(pl. 12:2).

Holotype: Carapace ING O/88; pl. 12:2.
Type locality: Koczała 1 borehole, depth 2,978.1–2,984.6 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *parvulus* — very small.

Material. — Chojnice 5 borehole: one carapace from the depth of 4,683.7–4,691.7 m, ten carapaces from the depth of 4,482–4,545,1 m and several dozen carapaces from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: more than 1,000 carapaces from the depth of 2,990.3–3,019 m; Miastko 2 borehole: about 1,000 carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace small, symmetrically outlined. Dorsal margin convex, most strongly bent in its middle part, arcuate on the right and angular on the left valve. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/88	0.55	0.37

Description. — Carapace small, amplete. Dorsal margin bent in its middle, gently and arcuately on the right and angularly on the left valve. Anterior and posterior margins symmetrically rounded, equal in height. Ventral margin straight. The largest height in the middle part of carapace equals about 0.62 of the length. The largest convexity of heteromorph carapaces, observed in the posterior and of tecnomorph ones in the middle part where it equals about 0.45 of the height. Lateral surface smooth.

Remarks. — The species abundantly occurs in all the profiles studied. It is most similar to *Cavellina mesodevonica* POKORNÝ (1950) from the Givetian of Bohemia and *C. accurata* POLENOVA (1952) from the Starooskol Horizon of the Russian Platform. It differs from the two species in a more symmetrical outline of carapace, angularly bent middle part of the dorsal margin of the left valve and more strongly convex carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Cavellina subegorovi sp. n.
(pl. 12:1)

Holotype: Carapace ING O/87; pl. 12:1.
Type locality: Koczała 1 borehole, depth 2,978.1–2,984.6 m. W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: The name suggests a similarity to the species *Cavellina egorovi* SHISHKINSKAYA.

Material. — Chojnice 5 borehole: 15 carapaces from the depth of 4,482–4,545.1 m and one carapace from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: several dozen carapaces from the depth of 2,990.3–3,019 m; Miastko 2 borehole: five carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace elongate, oval in lateral outline. The strongest bend of the dorsal margin occurs in the middle part of carapace. Anterior margin lower than the posterior. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/87	0.72	0.43

Description. — Carapace oval, elongate. Anterior and posterior margins uniformly rounded, anterior lower than the posterior. Dorsal margin forms an arc whose strongest bend occurs halfway the length of carapace. A slightly angular bend occurs in this place on the dorsal margin of the left valve. Ventral margin straight. Maximum height equals about 0.58 of the length in the middle part of carapace. Maximum width occurs in the middle part of tecnomorph carapace where it equals 0.40 of the length and in the posterior part of heteromorphs where it equals about 0.43 of the length. Surface smooth.

Remarks. — *Cavellina subegorovi* sp. n. is most similar in outline to *C. egorovi* SHISHKINSKAYA from the Upper Givetian of the Saratov District (SHISHKINSKAYA 1959), but differs from it in the position of a bend of its dorsal margin in the middle part of carapace, in a uniform convexity of carapace and in the shape of the margins of the right valve which are not thickened.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Cavellina sublongula sp. n.

(pl. 12:3)

Holotype: Carapace ING O/89; pl. 12:3.
Type locality: Chojnice 5 borehole, depth 4,429.4–4,436.4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: The name suggests a similarity to *Cavellina longula* COOPER.

Material. — Chojnice 5 borehole: two carapaces from the depth of 4,683.7–4,691.7 m, 11 from the depth of 4,482–4,545.1 m and 30 from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: one carapace from the depth of 3,041.8–3,119 m and 20 from the depth of 2,990.3–3,019 m.

Diagnosis. — Carapace irregularly oval in lateral outline, amplete. Anterior margin lower than the posterior. Dorsal margin strongly bent in the middle part. An arcuate depression occurs on the lateral surface of valve near the anterior margin. Right valve considerably larger than the left. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/89	0.76	0.45

Description. — Carapace irregularly oval in lateral outline. Dorsal margins of both valves strongly bent in the middle part. Anterior and posterior margins rounded, anterior lower than the posterior. Ventral margin of the right valve straight and of the left concave. An arcuate depression occurs on each valve near the anterior margin. Maximum height, equalling 0.47 of the length occurs in the middle part of carapace. Maximum convexity — in its posterior part. Right valve, considerably larger, overreaches the left one along all margins. Surface smooth.

Remarks. — This species resembles *Cavellina longula* COOPER from the Upper Carboniferous of North America (COOPER 1941) from which it differs, however, in the position of a maximum bend of the dorsal margin in its middle part, occurrence of a depression in the anterior part of valve and in somewhat different proportions (shorter and wider carapace).

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Mennerella* EGOROV, 1950

Type species: *Mennerella tuberosa* EGOROV, 1950

Menerella convexoventralis sp. n.

(pl. 12:6–8)

Holotype: Heteromorph carapace ING O/92; pl. 12:6.
Type locality: Koczała 1 borehole, depth 2,633.3–2,636.6 m, W. Pomerania.
Type horizon.? U. Frasnian.
Derivation of the name. Lat. *convexus* — convex, *ventrum* — ventral surface.

Material. — Koczała 1 borehole: several dozen poorly preserved heteromorph carapaces and two carapaces and several valves of tecnomorphs from the depth of 2,633.3–2,636.6 m.

Diagnosis. — This species of the genus *Mennerella* has a convex ventral margin in both heteromorphs and tecnomorphs and maximum width of carapace occuring in its posterior part at a distance, equalling one-third of the length, from the posterior margin. A strong dimorphism is observed; tecnomorphs display two dorsal nodes and a thick ventral lobe.

Dimensions (in mm):

	l	h	w
C♀ holotype ING O/92	1.39	0.75	0.61
C♀ ING O/93	1.30	0.77	0.58
C juv. ING O/94	0.98	0.70	—

Description. — Heteromorph: Carapace oval in lateral outline. Dorsal margins of both valves gently convex. Anterior and posterior margins rounded, posterior slightly truncate in the lower part. Ventral slightly convex. Two shallow, elongate sulci occur in the anterodorsal part of valve. Maximum convexity of carapace is observed in the posterior one-third of length. Hinge margin of the right, larger valve is provided over its whole length with a hinge groove corresponding to a sharp edge of the left valve. This groove continues, unbroken, into the contact groove of the free margin. Surface smooth or indistinctly granulose.

Tecnomorph: Tecnomorphs strongly differ from heteromorphs. Dorsal margin straight. Sulci considerably less distinct. Two nodes, the anterior one situated just before the anterior sulcus and posterior one — behind the posterior sulcus, occur in the dorsal part of valve. An arcuate ventral lobe, with a nodularly swelled posterior part, is situated in the ventral part of carapace.

Remarks. — *M. convexoventralis* sp. n. differs from others of the genus *Mennerella* EGOROV in a convex ventral margin and location of the maximum width of carapace in the posterior one-third of the length. The presence of the continuous groove on the inner margins of the right valve in the representatives of this genus induces the present writer to assign it to the Cavellinidae and not to the Kloedenellidae as it has so far been done by EGOROV (1950), POLENOVA (1953) and ROZHDESTVENSKAYA (1972).

Occurrence. — Poland: W. Pomerania, ?U. Frasnian.

Genus *Semilukiella* EGOROV, 1950

Type species: *Semilukiella zaspelovae* EGOROV, 1950

Semilukiella polita sp. n.

(pl. 12:4–5)

Holotype: Heteromorph carapace ING O/91; pl. 12:5.
Type locality: Chojnice 5 borehole, depth 4,390.1–4,395,4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *politus* — elegant.

Material. — Chojnice 5 borehole: two heteromorph and two tecnomorph carapaces from the depth of 4,482–4,545.1 m and one heteromorph carapace and seven tecnomorph carapaces and one valve from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: one heteromorph carapace from the depth of 2,945–2,949.5 m.

Diagnosis. — Carapace oval in lateral outline, with an oblique adductorial pit. Dorsal margin slightly concave in the anterior part and angularly bent over the pit. Anterior margin lower than the posterior. Surface reticulate.

Dimensions (in mm):

	l	h
C♀ holotype ING O/91	0.61	0.39
C♀ ING O/90	0.63	0.30

Description. — Heteromorph: Carapace oval in lateral outline. Dorsal margins of both valves angularly bent in the middle part. Its anterior part is slightly concave. Posterior part of the hinge line lies in a depression. Anterior margin lower than the posterior, uniformly rounded. Posterior margin slightly truncate in its lower half. Ventral margin straight or slightly concave. An elongate adductorial pit with a somewhat oblique axis occurs in the anterodorsal part of valves. Maximum convexity in the posterior part of carapace. Surface finely and closely reticulate.

Tecnomorph: It differs from heteromorph in a smaller degree of convexity of the posterior part of carapace. The carapaces of juvenile individuals are shorter and marked by an identical height of their ends, arcuately bent dorsal margin and finer reticulation.

Remarks. — The species described strongly resembles *Cavellina caduca* MC GILL from the Givetian of Canada (MC GILL 1963) from which it differs, however, in a larger, obliquely situated adductorial pit, slightly concavely outlined anterior part of the dorsal margin and a lower anterior end.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Order **Metacopida** SYLVESTER-BRADLEY, 1961
Superfamily **Thlipsuracea** ULRICH, 1894
Family **Thlipsuridae** ULRICH, 1894
Genus *Polyzygia* GÜRICH, 1896

Type species: *Polyzygia symmetrica* GÜRICH, 1896

Polyzygia symmetrica GÜRICH, 1896

(pl. 13:1–2)

1896. *Polyzygia symmetrica* n. gen, n. sp.; GÜRICH: 387–388, pl. 14:8–9.
1952. *Polyzygia gürichi* sp. n.; POLENOVA: 77–78, pl. 2:5.
1953. *Polyzygia symmetrica* GÜRICH; PŘIBYL: 321–322, pl. 2:2–11.
1953. *Polyzygia gürichi* sp. n.; KRÖMMELBEIN: 54–55, pl. 3:1.
1953. *Polyzygia geesensis* sp. n.; KRÖMMELBEIN: 56, pl. 3:2.
1969. *Polyzygia symmetrica* GÜRICH; GROOS: 21, pl. 4:9.
1972. *Polyzygia symmetrica* GÜRICH; MICHEL: 229–231, fig. 31–33, pl. 12:1–3 (with synonymy).

Material. — Chojnice 5 borehole: one carapace and one valve from the depth of 4,482–4,545.1 m and three valves from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: three carapaces and six valves from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: two carapaces and two valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/95	0.72	0.39
C ING O/96	0.87	0.51

Remarks. — This species is widely distributed in the Devonian of Europe. Its synonymy and extensive description was given by MICHEL (1972).

Occurrence. — Poland: Holy Cross Mts., Eifelian and Givetian; W. Pomerania, U. Givetian; W. Germany: Eifel Mts. and Rhenish Slate Mts., Eifelian and Givetian; France: Dinant Basin, Givetian; Spain: Eifelian, Givetian and Frasnian; Algeria: Sahara, U. Eifelian and Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Genus *Favulella* SWARTZ et SWAIN, 1941

Type species: *Bythocypris favulosa* JONES, 1889

Favulella spissa sp. n.

(pl. 13:3–6)

Holotype: Carapace ING O/99; pl. 13:5.
Type locality: Koczała 1 borehole, depth 2,730–2,734 m, W. Pomerania.
Type horizon: M. Frasnian.
Derivation of the name: Lat. *spissus* — dense.

Material. — Chojnice 5 borehole: three carapaces and two valves from the depth of 3,786.3–3,790.6 m; Koczała 1 borehole: several hundred carapaces and single valves from the depth of 2,727.8–2,734 m.

Diagnosis. — Carapaces outlined like an elongated triangle. Anterior margin higher than the posterior. The most anterior point of carapace is situated in its lower half. Except for their posterodorsal and posterior parts, the margins of valves are surrounded by a ridge. Ventral margin straight or slightly convex. An indistinct shallow groove is outlined only along the anterior part of ridge. Surface finely reticulate.

Dimensions (in mm):

	l	h	w
2 holotype ING O/99	0.85	0.52	0.38
C ING O/100	0.85	0.58	0.43
C juv. ING O/97	0.58	0.37	—
C juv. ING O/98	0.64	0.34	—

Description. — Carapace outlined like an elongate, rounded triangle. Maximum height occurs in the anterior part. Dorsal margin arcuately, asymmetrically curved, with anterior part shorter and more convex. Hinge line situated in a depression occurring in the posterior part of dorsal margin. Anterior margin higher than the posterior. Ventral margin straight or slightly convex. A sharp-edged ridge runs along the ventral and anterior margins and anterior part of the ventral margin. A slightly outlined, shallow groove occurs along the anterior part of the ridge. Surface finely and closely reticulate. In the middle part, reticulation is obliterated on a circular adductorial spot. Maximum convexity of carapace occurs in the posterior part. A tripartite hinge of the left, longer valve is composed of two hinge grooves in the posterior and anterior parts of the margin connected with contact groove and a hinge list between them. Contact groove interrupted in its ventral part.

Remarks. — Among the largest specimens in the studied material there occur slim and elongate forms (?tecnomorphs), as well as shorter and wider ones, with their maximum convexity situated in the middle part (?heteromorphs). The juvenile forms are marked by an oval lateral outline, lack of anterior groove and a short ridge limited only to the anterior part of carapace. The species described differs from *Favulella lecomptei* BECKER from the Middle Frasnian of the Dinant Basin (BECKER 1971*b*) in a longer carapace, shorter and less distinct groove, a sharp-edged ridge developed only in the anterodorsal, anterior and ventral parts, a straight or convex ventral margin and in a finer and closer reticulation. Specimens illustrated by MAGNE (1964, pl. 27, figs. 218–222; pl. 30, figs. 272-274) and identified as *Ropolonellus*? sp. F. from the Middle and Upper Frasnian of the Dinant Basin, France probably belong to *Favulella spissa* sp. n. and not to *F. lecomptei* BECKER (1971*b*). Due to a poor quality of photographs published in MAGNE'S work (1964), this problem cannot be decisively solved at present.

Occurrence. — Poland: W. Pomerania, M. Frasnian.

Family **Quasillitidae** CORYELL et MALKIN, 1936

Genus *Quasillites* CORYELL, et MALKIN, 1936

Type species: Quasillites obliquus CORYELL et MALKIN, 1936

Quasillites quasillitiformis (POLENOVA, 1952)

(pl. 14:1-9)

1952. *Costatia quasillitiformis* gen. et sp. n.; POLENOVA: 112–113, pl. 9:1.

Material. — Chojnice 5 borehole: six carapaces and four valves from the depth of 4,683.7–4,691.7 m, 17 carapaces from the depth of 4,482–4,545.1 m and several dozen carapaces and single valves from the depth of 4,390–4,436.4 m.

Dimensions (in mm):

	l	h
C ING O/109	0.90	0.48
C juv. ING O/110	0.77	0.40
C juv. ING O/108	0.77	0.40
C juv. ING O/111	0.72	0.43
C juv. ING O/107	0.62	0.39
C juv. ING O/106	0.55	0.35
C juv. ING O/105	0.48	0.29
C juv. ING O/104	0.37	0.25
C juv. ING O/103	0.30	0.19

Remarks. — The drawing of the holotype presented by POLENOVA'S (1952) slightly departs from its actual appearance. However, after comparing the specimens from Pomerania with the holotype, the present writer was able to assign them to POLENOVA'S genus. The presence of a stronger anterior shoulder in adult and a more genty outlined one in juvenile individuals is an important specific character not mentioned by POLENOVA (1952). This character differs *Q. quasillitiformis* from other species of the genus *Quasillites* CORYELL et MALKIN.

Occurrence. — Poland: W. Pomerania, U. Givetian: USSR: Russian Platform, U. Givetian (Starooskol Horizon), Volhynia, U. Givetian (Pelcha Beds).

Genus *Jenningsina* CORYELL et MALKIN, 1936

Type species: *Graphiodactylus catenulatus* VAN PELT, 1933

Jenningsina cavernosa (POLENOVA), 1952

(pl. 14:10–11; pl. 15:1–5)

1952. *Costatia cavernosa* gen. et sp. n.; POLENOVA: 111–112, pl. 8:4.

1953. *Amphissites inornatus* n. sp.; KUMMEROW: 47–48, pl. 2:10.

1972. *Jennigsina inornata* (KUMMEROW); GUREVICH: 288.

Material. — Chojnice 5 borehole: five carapaces and two valves from the depth of 4,482–4,545.1 m and five carapaces and six valves from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: one valve from the depth of 3,019–3,041.8 m and twenty-three carapaces and five valves from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: one valve from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/116	0.68	0.35
C ING O/118	0.64	0.37
C ING O/117	0.64	0.32
RV ING O/113	0.68	0.32
C juv. ING O/112	0.58	0.35
C juv. ING O/115	0.50	0.30
C juv. ING O/114	0.30	0.19

Remarks. — The drawing of the holotype published by POLENOVA (1952) departs from its actual appearance. The ridges in the anterior part of valves do not converge in the antero-ventral part as suggested by the illustration presented in this work, but run concentrically parallel to the anterior and ventral margins. Considerable variability in ornamentation, emphasized by POLENOVA (1952) has also been corroborated by the material from Pomerania, but there also occurs the type of ornamentation composed of ridges only (pl. 15:5 in the present paper) not mentioned by that author (*ibidem*).

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon), Volhynia, U. Givetian (Pelcha Beds).

Genus *Svantovites* POKORNÝ, 1950

Type species: *Svantovites primus* POKORNÝ, 1950

Svantovites magnei BECKER, 1971

(pl. 15:6–8)

1964. *Costatia* sp. F_3; MAGNE: pl. 24:171; pl. 31:284–288.
1971*b*. *Svantovites magnei* n. sp.; BECKER: 55–56, pl. 10:97–103.
1972. *Svantovites* n. sp.; LETHIERS: tab. 1, pl. 25: 48.
1974*b*. *Svantovites magnei* BECKER; LETHIERS: 49–50, pl. 8:24–25.

Material. — Chojnice 5 borehole: seven carapaces and several valves from the depth of 3,685.4–3,688.2 m.

Dimensions (in mm):

	l	h
C ING O/119	0.77	0.34
C ING O/120	0.64	0.35
C ING O/121	0.42	0.23

Description. — See BECKER (1971*b*).

Remarks. — The species differs from the most similar *Svantovites inops* BECKER from the Middle Frasnian of the Dinant Basin, Belgium (BECKER, 1971*b*) in a larger number of ribs.

Occurrence. — Poland: W. Pomerania, M. Frasnian; Belgium: Dinant Basin, M. Frasnian and L. Famennian; France: Namur Basin, M. Frasnian.

Genus *Jefina* ADAMCZAK, 1976

Type species: *Jefina celebris* ADAMCZAK, 1976

Jefina obtusa sp. n.
(pl. 16:1–2)

Holotype: Carapace ING O/125; pl. 16:2.
Type locality: Chojnice 5 borehole, depth 4,415.2–4,429.4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *obtusus* — obtuse.

Material. — Chojnice 5 borehole: one carapace from the depth of 4,482–4,501 m and several dozen carapaces from the depth of 4,390.1–4,436.4 m.

Diagnosis. — Carapace outline as parallelogram, with its width almost uniform over the entire lenght. Left valve considerably larger than the right. A wide, slightly arcuate, bow--shaped projection occurs.

Dimensions (in mm):

	l	h
C holotype ING O/125	0.71	0.40
C ING O/124	0.72	0.40

Description. — Carapace outlined as parallelogram in lateral view. Dorsal margin slightly convex. Anterior margin irregularly rounded, with the most anterior point in the ventral half of carapace. Posterior margin identical in height with the anterior, with the most posterior point in the dorsal part. Ventral margin slightly concave. Lateral walls of carapace almost completely flat over its entire length and strongly turned inwards near margins. Left valve, considerably larger than the right, overlaps the latter and overreaches it along all margins. In the ventral part, the left valve overlaps the right one to the greatest extent in the form of a very wide and gently arcuate bow-shaped projection. Surface smooth.

Remarks. — From *Jefina celebris* ADAMCZAK from the Grzegorzewice Formation (Eifelian) of the Holy Cross Mts. (ADAMCZAK 1976) *J. obtusa* sp. n. differs in its equilateral outline, almost uniform width of carapace almost over its entire length and a less arcuate and wider bow-shaped projection occurring on the ventral margin of the left valve.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Eriella* STEWART et HENDRIX, 1945

Type species: Eriella robusta STEWART et HENDRIX, 1945

Eriella ıostrata sp. n.
(pl. 13:7–8)

Holotype: Carapace ING O/101; pl. 13:7.
Type locality: Koczała 1 borehole, depth 3,065.1–3,071.1 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *rostratus* — provided with a rostrum.

Material. — Koczała 1 borehole: ten carapaces from the depth of 3,041.8–3,119 m.

Diagnosis. — Carapace large, relatively flat, elongate, oval in lateral outline. Anterior margin higher than the posterior, provided in its middle part with a nodular spine. Postero-ventral spine very small. Ornamentation in the form of an indistinct reticulation.

Dimensions (in mm):

	l	h
C holotype ING O/101	1.08	0.61
C ING O/102	0.65	0.42

Description. — Carapace elongate, oval, amplete. Dorsal margin convex. Hinge line situated in a narrow, long depression. Anterior and posterior margins uniformly rounded, anterior higher than the posterior. Ventral margin convex. A small nodular spine occurs on the anterior margin of each valve. A very fine spine is present in the posteroventral part of each valve. Maximum width is recorded in the middle part of carapace. Except for the marginal area and adductorial spot, the entire surface is finely reticulate.

Remarks. — The juvenile forms are marked by a proportionally shorter carapace, large disproportion in the height of ends, lack of anterior spines and more strongly developed posteroventral spines. *Eriella rostrata* sp. n. is similar to *Eriella*? *cribraria* GREEN from the Lower Carboniferous of the Province of Alberta, Canada (GREEN 1963), from which it differs in larger anterior spines, higher posterior margin, more fusiform outline as seen dorsally, finer sculpture and larger adductorial spot.

Occurrence. — W. Pomerania, U. Givetian.

Genus *Ponderodictya* CORYELL et MALKIN, 1935

Type species: *Leperditia punctulifera* HALL, 1860

Ponderodictya querula sp. n.

(pl. 16:3-5)

Holotype: Carapace ING O/127; pl. 16:4.
Type locality: Koczała 1 borehole; depth 2,710.6–2,716.2 m, W. Pomerania.
Type horizon: M. Frasnian.
Derivation of the name: Lat. *querulus* — doleful.

Material. — Koczała 1 borehole: 51 carapaces and 9 valves from the depth of 2,705–2,743 m.

Diagnosis. — Carapace small, oval in lateral outline. Anterior margin lower than the posterior, both rounded. Dorsal and ventral margins uniformly convex. A small, posteroventral spine occurs on each valve near the margin. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/127	0.97	0.65
C ING O/126	1.0	0.58
C ING O/128	0.77	0.45

Description. — Carapace oval in lateral outline, slightly postplete. Dorsal margin convex. The middle part of hinge line runs in a depression. Anterior and posterior margins rounded, posterior somewhat higher. Ventral margin convex. A small spine occurs in the posteroventral part of each valve. A thin marginal ridge runs along the free margin of the right, smaller valve. A bow-shaped projection of the ventral margin of the left valve is slightly curved. Maximum width of carapace occurs in its middle part. Surface smooth. The hinge of the left, larger valve is tripartite, composed of two hinge grooves continuing into a contact groove. A relatively short hinge list is situated between a long anterior and short posterior groove. Contact groove interrupted in the middle of the ventral part. The hinge of the right valve is composed of a groove occupying the anterior one-third of the hinge margin and of the posterior list situated behind it. Juvenile carapaces are marked by a more regular, subrectangular outline with their maximum height occurring in their middle parts.

Remarks. — The species described was assigned to the genus *Ponderodicta* CORYELL et MALKIN on the basis of the structure of its hinge, oval, postplete outline of its carapace, occurrence of a marginal ridge along the free margin of its left valve and its posterodorsal spines. It differs from other species in a lack of any traces of ornamentation on the lateral surface of valves and in the situation of its posteroventral spines close to the margins of valves. The last-named character relates the species described with some representatives of *Eriella* STEWART et HENDRIX, from which it can be easily distinguished by, among other characters, its anterior end which is lower than the posterior and by the presence of a bow-shaped projection on its left valve.

Occurrence. — Poland: W. Pomerania, M. Frasnian.

Genus *Graphiadactyllis* ROTH, 1929

Type species: *Kirkbya lindahli arkansana* GIRTY, 1910

Remarks. — The genus *Graphiadactyllis* ROTH is a heterogenous taxon. The species assigned to it are marked by either well or poorly developed anterior marginal flange (GRÜNDEL, 1975) and either the presence or lack of posteroventral spines (BLUMENSTENGEL 1975).According to GREEN (1963), the presence of a well developed anterior marginal flange, posterior shoulder and posteroventral spines are the first-rank criterion of generic classification within the Quasillitidae. GREEN also maintains that "a partial presence of a feature is considered more important than partial absence" (GREEN 1963:172), for example, the presence of a posteroventral spine on only one of the two valves. According to this principle, the species having only one spine, described in BLUMENSTENGEL'S (1975) work, should be assigned to the genus *Eriella* STEWART et HENDRIX rather, and not to *Graphiadactyllis* ROTH.

The genus *Graphiadactyllis* requires revision. Maybe, such species as *G. facetus* sp. n. and *G. indotatus* sp. n., marked by a poor development of the anterior marginal flange, should be excluded from this genus. At present, however, it is not possible, mostly due to a scarcity of the material which the present writer has at her disposal.

Graphiadactyllis facetus sp. n.

(pl. 15:10)

Holotype: Carapace ING O/123; pl. 15:10.
Type locality: Koczała 1 borehole, depth 2,949.5- 2,954 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *facetus* — delicate.

Material. — Koczała 1 borehole: several dozen carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: three carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace short, oval in lateral outline, amplete. Anterior marginal flange poorly developed. Ornamentation delicate of the "fingerprint" type. Adductorial pit indistinct.

Dimensions (in mm):

	l	h
C holotype ING O/123	0.61	0.34

Description. — Carapace small, short, oval in lateral outline. Ends uniformly rounded, equal in height. Maximum height in the middle, maximum width in the posterior part of carapace. Anterior marginal flange narrow, poorly developed. The entire surface of valves covered with delicate, very closely spaced, concentric striae forming a pattern of the "fingerprint" type. An indistinct adductorial pit occurs in the central part of valves somewhat above midheight.

Remarks. — *G. facetus* sp. n. differs from other species of *Graphiadactyllis* ROTH in a short, oval carapace, uniform height of ends and a very delicate and closely spaced striation.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Graphiadactyllis indotatus sp. n.
(pl. 15:9)

Holotype: Carapace ING O/122; pl. 15:9.
Type locality: Chojnice 5 borehole, depth 4,517.4–4,526.1 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *indotatus* — unprovided, poor.

Material. — Chojnice 5 borehole: two carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: 14 carapaces from the depth of 2,942.6–2,984.5 m; Miastko 2 borehole: one carapace from the depth of 2,080–2,085 m.

Diagnosis — Carapace elongate, rectangular-oval in lateral outline, slightly preplete. Ornamentation in the form of barely visible concentric striae.

Dimensions (in mm):

	l	h
C holotype ING O/122	0.71	0.36

Description. — Carapace rectangular-oval in lateral outline. Dorsal margin straight. Anterior and posterior margins rounded, anterior somewhat lower and slightly truncate in the dorsal part, while posterior slightly truncate in the anterior half. Ventral margin slightly concave. Maximum height in the anterior half. Carapace uniformly convex, cylindrical in dorsal outline. Maximum width in the posterior part. Ornamentation in the form of very thin, barely visible, concentric striae.

Remarks. — The species described differs from *Graphiadactyllis facetus* sp. n. in a longer carapace, subrectangular in lateral and cylindrical in dorsal outline and in a considerably less distinct ornamentation.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Family **Ropolonellidae** CORYELL et MALKIN, 1936
Genus *Ropolonellus* VAN PELT, 1933
Type species: *Ropolonellus papillatus* VAN PELT, 1933

Ropolonellus kettneri (POKORNÝ, 1950)
(pl. 16:6; pl. 17:1–2)

1950. *Bairdia* (*Varicobairdia*) *kettneri* n. sp.; POKORNÝ: 610–611, pl. 2:6.
1959. *Birdsalella* (?) *aznajevaensis* sp. n.; ROZHDESTVENSKAYA: 207–208, pl. 13:4.
1960. *Varicobairdia kettneri* POKORNÝ; SOHN: 12, pl. 1:1–3.
1965*a*. *Varicobairdia kettneri* (POKORNÝ); BECKER: 413, pl. 33:6.
1976. *Ropolonellus* cf. *kettneri* (POKORNÝ); ADAMCZAK: 381–382, pl. 27:164.

Material. — Chojnice 5 borehole: two carapaces and one valve from the depth of 4,482–4,545.1 m; Koczała 1 borehole: three carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: 14 carapaces and one valve from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/129	0.68	0.48
C ING O/130	0.47	0.30
C ING O/131	0.53	0.35

Remarks. — This species is similar to *Ropolonellus robustus* ADAMCZAK, 1976 from the Grzegorzowice Formation (Eifelian) of the Holy Cross Mts., from which it differs, however, in a depressed anterior and posterior parts, strongly convex middle part of carapace, smaller extramarginal tubercles and the presence of marginal tubercles on the posterior margin of valve.

Occurrence. — Poland: Holy Cross Mts., Eifelian (Grzegorzowice Formation), W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., U. Eifelian and L. Givetian, Eifel Mts., U. Eifelian; Bohemia, Givetian; USSR: Bashkiria, U. Givetian (Starooskol Horizon).

Ropolonellus sp. 1
(pl. 17:3)

Material. — Chojnice 5 borehole: one valve from the depth of 3,786.3–3,790.6 m, as well as one complete and one damaged carapace from the depth of 3,685.4–3,688.2 m.

Dimensions (in mm):

	l	h
C ING O/132	0.84	0.45

Remarks. — The present writer had at her disposal only one well preserved specimen which, in its nodulous surface, long hinge margin and relatively slightly outlined depressions near the ends, differs from other species known to this writer and probably represents a new one.

Occurrence. — Poland: W. Pomerania, M. Frasnian.

Family **Bufinidae** Sohn et Stover, 1961

Genus *Bufina* Coryell et Malkin, 1936

Type species: *Moorea bicornuta* Ulrich, 1891 (syn. = *Bufina elata* Coryell et Malkin, 1936)

Bufina colliquefacta sp. n.
(pl. 17:5)

Holotype: Carapace ING O/134; pl. 17:5.
Type locality: Chojnice 5 borehole, depth 4,429.4–4,436.4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *colliquefactus* — dissolved, melted.

Material. — Chojnice 5 borehole: four carapaces and two valves from the depth of 4,683.7–4,591.7 m, 16 carapaces and two valves from the depth of 4,390–4,436.4 m.

Diagnosis. — Carapace oval in lateral outline. Anterior and posterior margin equal in height, rounded. Dorsal and ventral margins uniformly convex. Anterior ridge semicircular, narrow, low. Posterior ridge on the left valve completely reduced and on the right valve in the form of a small ventral spine.

Dimensions (in mm):

	l	h
C holotype ING O/134	0.79	0.44

Description. — Carapace oval in outline, amplete. Anterior and posterior margins equal in height, strongly rounded. Dorsal and ventral margins uniformly convex. Posterior part of hinge line situated in a slight depression. A narrow and low anterior ridge runs near and parallel to anterior margin. Posterior part of the left, larger valve smooth. A very indistinct, short posterior ridge is outlined in the posteroventral part of the right valve. Maximum width in the posterior part. Surface of valves smooth.

Remarks. — From the species of the genus *Bufina* Coryell et Malkin described in the present paper, *B. colliquefacta* sp. n. differs in the most advanced reduction of ridges and in asymmetry of valves, the right one of which is devoid of any elevated elements in its posterior part.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Bufina intermedia sp. n.

(pl. 17:6)

Holotype: Carapace ING O/135; pl. 17:6.
Type locality: Koczała 1 borehole; depth 2,949.5–2,954.2 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *intermedius* — intermediate.

Material. — Chojnice 5 borehole: one carapace from the depth of 4,482–4,545.1 m; Koczała 1 borehole: two carapaces from the depth of 3,041.8–3,119 m and 33 carapaces and three valves from the depth of 2,942.6–2,984.6 m.

Diagnosis. — Carapace rectangular-oval in lateral outline, elongate, plano-convex. Anterior and posterior margins equal in height, rounded. Dorsal and ventral margins straight. Hinge line running in a depression occupying the posterior two-thirds of the length of hinge margin. A narrow ridge occurs in the posterior part of each valve. In the posterior part of the right valve, there occur two spines and of the left valve — only one, dorsal spine. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/135	0.87	0.52

Description. — Carapace large, elongate, rectangular-oval in lateral outline. Dorsal margin straight. Posterior part of hinge line situated in a narrow depression. Anterior and posterior margins equal in height, symmetrically rounded. Lateral walls of valves flat, straight in dorsal outline. Width of carapace, gradually increasing posteriorly, reaches its maximum at a distance from the posterior margin equalling one-fifth of the length of carapace. A narrow, sharp-edged anterior ridge, thickened in the dorsal part, runs close and parallel to the anterior margin. Small spines are developed in the posterodorsal and posteroventral parts of the right, smaller valve, while a posterodorsal spine on the left valve is only indistinctly outlined. No posteroventral spine is present. Surface smooth.

Remarks. — The species described differs from *Bufina colliquefacta* sp. n. in a more elongate carapace, which is subrectangular in outline, in an almost equal width of carapace over its entire length and in the presence of two posterior spines on the right valve. In regard to morphology, this species makes up a transitional type between *B. salva* sp. n. with non-reduced ridges, and *B. colliquefacta* sp. n. From the morphologically most related species *B. europaea* PŘIBYL from the Skały Formation of the Holy Cross Mts. (PŘIBYL 1953), *B. media* sp. n. differs in a more elongate and, in the posterior part, narrower carapace, equal length of ends, lack of a depression behind the anterior, shorter, narrower and sharp-edged, ridge, smaller posterior spines situated nearer the margin and in a less distinct ornamentation of the left than the right valve.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Bufina salva sp. n. [1]

Superfamily **Healdiacea** HARLTON, 1933
Family **Healdiidae** HARLTON, 1933
Genus *Cytherellina* JONES et HALL, 1869

Type species: *Beyrichia siliqua* JONES, 1855

Remarks. — A considerable external similarity of particular species of the genera *Cytherellina* JONES et HALL and *Healdianella* POSNER has already been emphasized by POLENOVA (1960) who suggested that if the muscle scars of the representatives of these two genera turn out to be identical then the genus *Healdianella* should be considered as a junior synonym of the *Cythe-*

[1] For diagnosis and description see Addendum on p. 108.

rellina. Discussing the two taxons, BECKER and SANCHEZ de POSADA (1977) found that the species which have valves with vertical, inner swelling characteristic of the type species *Cytherellina siliqua* JONES et HALL should be assigned to the *Cytherellina* and those in which such swellings do not occur or cannot be observed — to the *Healdianella*. According to ADAMCZAK (1976), it is not the character of a muscle scar, but only the structure of the contact margin which may constitute a basis for classifying these morphologically related forms. On the basis of a distinct contact groove, interrupted in its middle on the left, larger valve occurring in its type species, the same author assigns the genus *Cytherellina* to the Metacopa. A well developed contact groove interrupted in its middle part was also observed by the present writer on the left valves of the Upper Silurian species *C. magna* NECKAYA from boreholes situated in the Łeba Elevation, N. Poland, as well as in the species described below.

Cytherellina sp. 1

(pl. 18:4–5)

Material. — Chojnice 5 borehole: ten carapaces, three valves and several internal molds from the depth of 4,390.1–4,545.1 m; Koczała 1 borehole: five carapaces and two valves from the depth of 2,942.6–3,019 m; Miastko 2 borehole: several damaged valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/140	1.16	0.59
C ING O/141	1.38	0.72

Description. — Carapace large, thick-walled, elongate-oviform in lateral outline. Dorsal margin convex, ventral subrectilinear. Ends rounded, posterior one considerably higher than the anterior. Dorsal part of carapace flattened, without a hinge depression. The left, larger valve slightly overlaps the right one along the middle and anterior part of hinge margin, more so in the ventral part where it overlaps the right valve in the form of a wide, slightly curved tongue. Maximum height and width in the posterior part. Surface smooth. A distinct, finely and transversely denticulate hinge groove, the widest in the anterior part, runs along the hinge margin of the left valve. At its anterior and posterior ends, the hinge groove continuously passes into a contact groove, narrow along the anterior and posterior margins and extending in the ventral part. The groove disappears in the ventromedial part of contact margin. A hinge list is situated on the hinge margin of the right valve, with a narrow groove running over it in the posterodorsal part of the margin. A contact list runs along the free margin of the right valve. A thin marginal ridge, invisible when the valves are closed, may be observed on the anterior margin of the right valve. Two elongate swellings widening upwards are present on the inner side of valves in their anterodorsal part. An oval depression occurs between them. A relatively small circular adductor muscle scar is situated in the lower part of this depression below the midheight of a valve. No details of its structure could be observed.

Remarks. — The presence of inner swellings on valves suggests that this species belongs to the genus *Cytherellina* JONES et HALL. At the same time, the structure of the hinge and contact margins indicates that it is a representative of the order Metacopida (superfamily Healdiacea). In its lateral outline, *Cytherellina* sp. 1 resembles *C.* sp. A from the Spickberg Beds of the Eifel Mts. (BECKER 1965*a*), differing from it, however, in a more cylindrical dorsal outline. A poor state of preservation of the material prevents the present writer from erecting a new species.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Incisurella* COOPER, 1941

Type species: *Incisurella prima* COOPER, 1941

Incisurella sp. 1

(pl. 17:7)

Material. — Chojnice 5 borehole: one carapace from the depth of 4,415.1–4,429.4 m.
Dimensions (in mm)

	l	h
C ING O/136	0.71	0.42

Remarks. — The specimen under study is marked by the dorsal margin slightly bent in its posterior part and by the furrow in the posterior part of carapace which on the right valve is less developed. From the types species *I. prima* COOPER from the Lower Carboniferous of the State of Illinois, USA (COOPER 1941), it differs in its oval outline, longer and narrower furrow on the left valve, and in various development of this furrow on each valve.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Gerbeckites* gen. n.

Type species: *Gerbeckites pomeranicus* sp. n.

Derivation of the name: Named in honor of Dr. GERHARD BECKER, German ostracodologist, the first letters of whose first and last name combine to form the name of the species.

Diagnosis. — Healdiidae with a small (less than 1 mm in lenght) carapace, triangular and preplete in lateral outline. Dorsal margin angularly bent in the anterior part. Anterior margin rounded, considerably higher than the posterior. Posterior margin narrowly rounded. Ventral margin straight, slightly convex or slightly concave. Maximum width in the posteroventral part of carapace. A thin spine turned outwards and posteriorly, occurs in the place of maximum width or somewhat below it. On the left, larger valve, this spine is usually reduced to a small elevation. Surface smooth. Hinge not differentiated, of holosenic type (*sensu* POKORNÝ 1958).

Remarks. — This genus differs from other ones of the Healdiidae in a triangular-oval outline, maximum height occurring in the anterior part and the presence of a ventral spine. The structure of hinge is characteristic of the family. In addition to the type species, the present writer assigns to the genus *Gerbeckites* gen. n. the specimens described by BECKER and SANCHEZ de POSADA (1977) as Genus 3 sp. A and Genus 3 sp. B, certainly representing two other species.

Stratigraphic range. — Lower to Middle Devonian.

Occurrence. — Poland: W. Pomerania, U. Givetian; N. Spain: U. Emsian and L. Eifelian (Moniello Formation); USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Gerbeckites pomeranicus sp. n.

(pl. 18:1-3)

Holotype: Carapace ING O/137; pl. 18:1.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After the name of the Pomerania Province, Poland.

Material. — Koczała 1 borehole: one carapace from the depth of 3,041.8–3,119 m and one carapace from the depth of 2,990.3–3,019 m; Miastko 1 borehole: 17 carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace triangular-oval in lateral outline, preplete. Dorsal margin angularly bent in the anterior part, with a swollen apex on the left valve. Anterior margin considerably lower than the posterior. Ventral margin slightly convex. Ventral spine situated somewhat below the point of maximum width of valve. On the left valve, the spine is less developed than on the right. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/137	0.59	0.35
C juv. ING O/138	0.32	0.20
C juv. ING O/139	0.42	0.26

Description. — Carapace triangular-oval in lateral outline, preplete. Dorsal margin angularly bent at a quarter of the length of carapace on both valves. Dorsal margin of the right valve provided with a swollen, slightly outwardly deflected cusp. Anterior margin widely rounded, considerably higher than the posterior. Maximum width of carapace in its posteroventral part, close to midlength. A thin spine with a wide base occurs somewhat below this place on the right valve. This spine is directed outwards and posteriorly. On the right valve, the spine is strongly reduced and occurs in the form of a small elevation, or even is not outlined at all. Carapace rhomboidal in dorsal outline. Surface smooth. Hinge of the left valve in the form of a hinge groove passing gradually to a continuous contact groove.

Remarks. — The species discussed differs from Genus 3 sp. A (BECKER and SANCHEZ de POSADA 1977) in a more strongly bent dorsal and smaller posterior margin.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Bashkiria, U. Givetian (Starooskol Horizon).

Order **Podocopida** MÜLLER, 1894
Suborder **Cypridocopina** JONES, 1901
Superfamily **Bairdiocypridacea** SHAVER, 1961
Family **Pachydomellidae** BERDAN et SOHN, 1961
Genus *Microcheilinella* GEIS, 1933
Type species: *Microcheilus distortus* GEIS, 1932

Microcheilinella clava (KEGEL, 1932)
(pl. 18:6)

1932. *Bythocypris (Bairdiocypris) clava* sp. n.; KEGEL: 246–247, pl. 13:2.
1953. *Microcheilinella clava* (KEGEL); KUMMEROW: 60, pl. 2:6.
1955. *Pachydomella clava* (KEGEL); KRÖMMELBEIN: 300–301, pl. 1:8–11, pl. 2:26.
1965*b*. *Tubulibairdia clava* (KEGEL); BECKER: 177, pl. 6:7.
1969. *Tubulibairdia clava* (KEGEL); GROOS: 67, pl. 13:3.
1976. *Microcheilinella clava* (KEGEL); ADAMCZAK: 336–339, fig. 30, 36–37; pl. 9:43–45; pl. 10:47–51; pl. 11:55; pl. 12:59–61.

Material. — Koczała 1 borehole: two carapaces from the depth of 3,041.8–3,119 m.
Dimensions (in mm):

	l	h
C ING O/142	0.90	0.58

Remarks. — The two carapaces assigned to *M. clava* (KEGEL) probably represent juvenile forms. They do not show a dorsal papilla which, according to ADAMCZAK (1976), constitutes an important diagnostic element for *M. clava*. Unfortunately, the diagnostic value of this papilla is diminished by the fact that, due to its small dimensions, its presence depends to a considerable extent on the state of preservation of specimens. This has been confirmed by the present writer's examination of a collection of *M. clava* from the Holy Cross Mts. made available to her by Dr. F. ADAMCZAK. In this collection, the papilla is visible only in very well preserved specimens.

Occurrence. — Poland: Holy Cross Mts., Eifelian and Givetian (Grzegorzowice and Skały Formations), W. Pomerania, U. Givetian; W. Germany: Eifel Mts., Eifelian and L. Givetian, Rhenish Slate Mts., U. Eifelian and L. Givetian.

Microcheilinella fecunda (PŘIBYL et ŠNAJDR, 1950)
(pl. 18:7; pl. 19:4)

1950. *Bythocypris (Bairdiocypris) fecunda* n. sp.; PŘIBYL and ŠNAJDR: 161, pl. 2:5–8.
1976. *Microcheilinella* cf. *fecunda* (PŘIBYL et ŠNAJDR); ADAMCZAK: 339–340, pl. 11:52–54.

Material. — Chojnice 5 borehole: two carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: several dozen carapaces from the depth of 2,492.6–2,984.8 m.

Dimensions (in mm):

	l	h	w
C ING O/143	1.22	0.76	—
C ING O/147	1.30	0.80	0.65

Remarks. — This species differs from *Microcheilinella clava* (KEGEL, 1932) in its subtriangular outline, sharp posterior margin and better outlined bow-shaped projection on the left valve.

Occurrence. — Poland: Holy Cross Mts., Givetian (Skały Formation), W. Pomerania, U. Givetian; Bohemia, M. Devonian ((Hlubočepy Beds and Choteč Formation).

Microcheilinella mandelstami POLENOVA, 1952
(pl. 19:1–2)

1952. *Microcheilinella mandelstami* sp. n.; POLENOVA: 126–127, pl. 12:3.
1979. *Microcheilinella mandelstami* POLENOVA; OLEMPSKA: 121, pl. 25:6.

Material. — Chojnice 5 borehole: five carapaces from a depth of 4,482–4,545.1 m; Koczała 1 borehole: one carapace from the depth of 3,041.8–3,119 m and several dozen carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 boreholes: hundreds of carapaces and single valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/144	0.55	0.29
C ING O/145	0.61	0.26

Description. — See POLENOVA (1952).

Remarks. — *M. mandelstami* sp. n. differs from *M. seminalis* KUMMEROW from the Givetian of the Eifel Mts. and Rhenish Slate Mts. (KUMMEROW 1953; GROOS 1969) in a more rectangular and shorter carapace.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Microcheilinella insignita sp. n.
(pl. 19:3)

Holotype: Carapace ING O/146; pl. 19:3.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *insignitus* — easily identifiable.

Material. — Miastko 2 borehole: four carapaces and three valves from a depth of 2,080–2.085 m.

Diagnosis. — Carapace fusiform in lateral outline. Anterior and posterior margins equal in height, pointed. Keels occur along the anterior and posteroventral margins of the left valve and along anterior and posterior margins of the right valve. Lateral surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/146	0.92	0.53

Description. — Carapace medium-sized, fusiform in lateral outline. Hinge line running in a small depression. Dorsal and ventral margins uniformly convex. Anterior and posterior margins equal in height, pointed. Posterior margin more pointed. Valves strongly asymmetrical. A short keel runs along the anterior margin of the left valve and another, considerably longer — along the middle and posterior parts of the ventral and along the posterior margin. An area between the keel and the margin of the left valve is characteristically flattened. Two keels also occur on the right valve, running in the anterior and posterior parts of valve close to the contact line. Maximum height and width in the middle part of carapace. Lateral surface smooth.

Remarks. — From the most related species *Microcheilinella chlupaci* ROZHDESTVENSKAYA from the Givetian (Mullin Beds) of Western Bashkiria (ROZHDESTVENSKAYA 1962), the species described differs in its more regular outline, the most anteriorly and posteriorly protruding points occurring at midheight, maximum height and width observed in the middle part of carapace and in the lack of keels along the dorsal margins of valves.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Ampuloides* POLENOVA, 1952

Type species: *Ampuloides verrucosa* POLENOVA, 1952

Ampuloides verrucosa POLENOVA, 1952

(pl. 19:5)

1952. *Ampuloides verrucosa* gen. et sp. n.; POLENOVA: 138–140, pl. 14:3–4.

Material. — Koczała 1 borehole: two carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: 16 carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/148	0.45	0.26

Description. — See POLENOVA (1952).

Remarks. — No dimorphic forms with a groove characteristic of the genus, separating the most inflated part of carapace, have been found in the material under study, which thus probably includes the carapaces of tecnomorphs only. The species described differs from *Ampuloides parvus* BLUMENSTENGEL from the Frasnian (*gigas* Zone) of the Harz Mts. (BLUMENSTENGEL 1970) in a rectangular outline, straight ventral margin and less distinct posterior cardinal angle.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Family **Bairdiocyprididae** SHAVER, 1961

Genus *Bairdiocypris* KEGEL, 1932

Type species: *Bythocypris* (*Bairdiocypris*) *gerolsteinensis* KEGEL, 1932

Bairdiocypris vastus POLENOVA, 1952

(pl. 19:7)

1952. *Bairdiocypris vastus* sp. n.; POLENOVA: 135–136, pl. 14:1–2.
1972. *Bairdiocypris vastus* POLENOVA; GUREVICH: 288.
1979. *Bairdiocypris vastus* POLENOVA; OLEMPSKA: 113, pl. 22:1–2.

Material. — Miastko 2 borehole: several dozen carapaces from the depth of 2,080–2,085 m.
Dimensions (in mm):

	l	h
C ING O/150	1.10	0.82

Description. — See POLENOVA (1952).

Remarks. — The material under study includes carapaces of both adult and juvenile forms. The latter are marked by a strongly, apically bent middle part of the dorsal margin of the left valve, by arcuated dorsal margin of the right valve and by a more triangular outline.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon), Volhynia, U. Givetian (Pelcha Beds).

Bairdiocypris deliberatus sp. n.

(pl. 19:6; pl. 20:1–3)

Holotype: Carapace ING O/151; pl. 20:1.
Type locality: Koczała 1 borehole, depth 3,041.8–3,048 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *deliberatus* — considered, discussed.

Material. — Chojnice 5 borehole: one carapace from the depth of 4,482–4,545.1 m; Koczała 1 borehole: five carapaces from the depth of 3,041.8–3.119 m and three from the depth of 2,942.6–2,984.6 m.

Diagnosis. — Carapace subtriangular in lateral and fusiform in dorsal outline. Anterior margin rounded, posterior pointed. Apical region high (apical index 12.1). Ridges occur in the dorsal and ventral parts of the left and depressions in the anterior and posterior parts of the right valve. Maximum width in midlength, maximum height posteriorly of midlength.
Dimensions (in mm):

	l	h
C holotype ING O/151	1.51	0.86
C ING O/152	1.25	0.72
C ING O/153	1.16	0.72
C ING O/149	2.29	1.49

Description. — Carapace subtriangular in lateral and fusiform in dorsal outline. Dorsal margin arcuate. Apical region (as designated by ADAMCZAK 1976) high (apical index 12.1). Anterior margin rounded, posterior pointed. Ventral margin concave anteriorly. A depression occurs near the anterior and posterior margin of the right valve. Arcuate ridges run along the dorsal and ventral margins of valves. A wide, bow-shaped projection occupies about a half of the length of carapace. Maximum height of carapace in its posterior and maximum width in its anterior part. Lateral surface smooth.

Remarks. — In its outline, the species discussed strongly resembles *Bairdiocypris* cf. *rauffi rauffi* KRÖMMELBEIN from the Lower Givetian of the Rhenish Slate Mts. (GROOS 1969), from which it differs, however, in the lack of anterodorsal depressions on its valves and in its ventral margin which is concave in the anterior part. It is also related to a form described by GROOS (1969) from the uppermost Givetian of the Rhenish Slate Mts. as *Bairdiocypris* sp. aff. *moravica* (KEGEL), from which it differs in a lower anterior margin and a higher stituation of the most posterior point of carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Bairdiocypris phaseoliformis sp. n.
(pl. 20:4–5)

Holotype: Carapace ING O/154; pl. 20:4.
Type locality: Koczała 1 borehole, depth 2,949.5–2,954.2 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *phaseoliformis* — beanlike.

Material. — Koczała 1 borehole: 12 carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: one carapace from the depth of 2,080–2,085 m.

Diagnosis. — Carapace beanlike in lateral outline. Apical region very low (apical index 3.5). Anterior and posterior margins rounded. Posterior end lowered. Bow-shaped projection very long, indistinct. Surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/154	1.03	0.58
C juv. ING O/155	0.76	0.50

Description. — Carapace beanlike in outline. Apical region very low (apical index 3.5). Dorsal margin of the right valve arcuate and of the left valve angularly bent in its anterior part. Anterior and posterior margins rounded, almost equal in height. Ventral margin concave. The right valve slightly protrudes beyond the left along all margins. Maximum height and width of carapace in its middle part. Surface smooth.

Remarks. — This species displays a considerable degree of variability. Both short and long specimens occur in the material. The last-named ones are marked by a more convex ventral margin. Its beanlike outline, equal height of ends and concave ventral margins are characters in which this species differs from the most closely related *Bairdiocypris soetenica* BECKER (1965*a*) from the Eifelian (Nohn and Junkenberg beds) of the Eifel Mts.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Healdianella* POSNER, 1951
Type species: *Healdianella darwinuloides* POSNER, 1951

Healdianella obliqua (KUMMEROW, 1953)
(pl. 20:9–10)

1953. *Orthocypris obliqua* n. sp.; KUMMEROW: 56, pl. 7:8.
1965*a*. *Cytherellina ? obliqua* (KUMMEROW); BECKER: 385–387, pl. 30:2–3.
1965*b*. *Cytherellina ? obliqua* (KUMMEROW); BECKER: 175–176, pl. 7:6.
1969. *Cytherellina obliqua* (KUMMEROW); GROOS: 63–64, pl. 12:7, 9.

Material. — Chojnice 5 borehole: 11 carapaces from the depth of 4,482–4,545.1 m and four from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: ten carapaces from a depth of 3,041.8–3,119 m, eight from the depth of 2,990.3–3,019 m and three from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: four carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/159	0.69	0.35
C ING O/160	0.77	0.47

Description. — See BECKER (1965*a*).
Occurrence. — Poland: W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., Eifelian and Givetian.

Healdianella resima (ROZHDESTVENSKAYA, 1959)
(pl. 20:6–8)

1959. *Cavellina* (*Cavellinella*) *resima* sp. n.; ROZHDESTVENSKAYA: 143, pl. 11:3–4.
1972. *Cavellina resima* ROZHDESTVENSKAYA; GUREVICH: 341–342, pl. 13: 5–6.

Material. — Chojnice 5 borehole: three carapaces from a depth of 4,482–4,545.1 m and four from the depth of 4.390.1–4,436.4 m; Koczała 1 borehole: nine carapaces from the depth of 3,041.8–3,119 m, two from the depth of 2,990.3–3,019 m and 11 from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: ten carapaces from the depth of 2,080–2,085 m.
Dimensions (in mm):

	l	h
C ING O/156	0.53	0.32
C ING O/158	0.53	0.34
C juv. ING O/157	0.37	0.26

Description. — See ROZHDESTVENSKAYA (1959).
Remarks. — This species differs from *Healdianella modesta* (ROZHDESTVENSKAYA) from the Lower Givetian of Bashkiria (ROZHDESTVENSKAYA 1959) in a shorter carapace having a higher anterior and less arcuate dorsal margin.
Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Bashkiria, U. Givetian (Staro-oskol Horizon).

Healdianella sp. 1
(pl. 21:1)

Material. — Koczała 1 borehole: two carapaces from the depth of 3,089–3,094 m and two from the depth of 2,942.6–2,984,6 m.
Dimensions (in mm):

	l	h
C ING O/161	0.92	0.53

Remarks. — In its lateral outline, *Healdianella* sp. 1 resembles to the largest extent *H. brassicalis* BECKER from the Freilingen and Cürten beds of the Eifel Mts. (BECKER 1965*a*). Certain small differences are observed in a larger symmetry of the dorsal margin (an equal degree of sloping towards both ends) and in a distinct incurvature of the anterior part of ventral margin, characters which occur in *Healdianella* sp. 1.
Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Orthocypris* KUMMEROW, 1953

Type species: *Bythocypris recta* KUMMEROW, 1953

Orthocypris perlonga KUMMEROW, 1953

(pl. 21:4–5)

1953. *Orthocypris perlonga* n. sp.; KUMMEROW: 55, pl. 7:7.
1963. *Cytherellina* cf. *perlonga* (KUMMEROW); LE FEVRE: 74, pl. 9:150–151.
1965*a*. *Cytherellina perlonga* (KUMMEROW); BECKER: 391–392, pl. 30: 4–5.
1965*b*. *Cytherellina perlonga* (KUMMEROW); BECKER: 175, pl. 7:5.
1969*a*. *Cytherellina perlonga* (KUMMEROW); BECKER: pl. 3:4.
1969. *Cytherellina perlonga* (KUMMEROW); GROOS: 64, pl. 12:10.
1971. *Cytherellina* cf. *perlonga* (KUMMEROW); LE FEVRE: 823, 825, pl. 5B:62.
1977. *Orthocypris* cf. *perlonga* KUMMEROW; BECKER and SANCHEZ de POSADA: 170, pl. 9:5–7.

Material. — Chojnice 5 borehole: three carapaces from the depth of 4,683.7–4,691.7 m, six from the depth of 4,482–4,545.1 m four from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: four carapaces from the depth of 3,041.8–3,119 m and five from the depth of 2.942.6–2,984.6 m; Miastko 2 borehole: three carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/164	0.77	0.42
C ING O/165	0.68	0.33

Description. — See BECKER (1965*a*).

Occurrence. — Poland: W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., Eifelian; N. Spain: Eifelian; Algeria: Sahara, Eifelian.

Orthocypris kummerowi sp. n.

(pl. 21:6–7)

Holotype: Carapace ING O/167; pl. 21:7.
Type locality: Koczała 1 borehole, depth 2,945–2,949.5 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: after Dr. EGMONT KUMMEROW, German paleontologist.

Material. — Chojnice 5 borehole: two carapaces from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: seven carapaces from the depth of 3,041.8–3,119 m and four from the depth of 2,942.6–2,984.6 m.

Diagnosis. — Carapace subrectangular in lateral and cigar-shaped in dorsal outline. Anterior and posterior margins equal in height. Posterior subrectilinear in ventral part. Bow-shaped projection distinct, occupying almost the whole length of the ventral margin.

Dimensions (in mm):

	l	h
C holotype ING O/167	0.70	0.37
C ING O/166	0.66	0.33

Description. — Carapace subrectangular in lateral and cigar-shaped in dorsal outline. Height of carapace almost uniform almost over its whole length and equaling about a half of it. Dorsal and ventral margins straight, parallel to one another. Anterior and posterior margins equal in height, anterior rounded. Posterior margin rounded in the dorsal and subrectilinear in the ventral part where it forms a right angle with the ventral margin. Left, larger valve overlaps the right one only in the ventral part where it forms a distinct bow-shaped projection occupying almost the whole length of ventral margin. Maximum width in the posterior part of carapace. Surface smooth.

Remarks. — In its lateral outline, this species is similar to *Orthocypris subparalellus* (POLENOVA) from the Upper Givetian of the Russian Platform (POLENOVA 1952), from which it differs, however, in less rounded anterior and posterior margins and in a more uniform convexity of carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Orthocypris sp. 1
(pl. 21:8)

Material. — Chojnice 5 borehole: one carapace from the depth of 3,786.3–3,790.6 and two from the depth of 3,685.4–3,688.2 m.

Dimensions (in mm):

	l	h
C ING O/168	0.55	0.27

Description. — Carapace laterally compressed, subrectangular in lateral outline. Height equals half a length. Dorsal and ventral margins straight, parallel to one another, ventral shorter. Anterior and posterior margins rounded, anterior more so and higher. Left valve overlaps the right one along the ventral margin. Maximum width of carapace in its posterior part. Surface smooth.

Remarks. — A shorter carapace, with the anterior margin higher than the posterior and symmetrically rounded are characters in which *Orthocypris* sp. 1 differs from the most closely related species *O. parilis* ROZHDESTVENSKAYA from the Lower Frasnian of Southern Ural (ROZHDESTVENSKAYA 1972). The specimens under study probably represent a new species which, however, cannot be here erected due to the scarce and poorly preserved material.

Occurrence. — Poland: W. Pomerania, M. Frasnian.

Family **Gerodiidae** GRÜNDEL, 1962

Genus *Baschkirina* ROZHDESTVENSKAYA, 1959

Type species: *Baschkirina memorabilis* ROZHDESTVENSKAYA, 1959

Baschkirina miastkoensis sp. n.
(pl. 21:9)

Holotype: Carapace ING O/169; pl. 21:9.
Type locality: Miastko 2 borehole, depth 2,080-2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After the locality Miastko in W. Pomerania, Poland.

Material. — Miastko 2 borehole: two carapaces and three right valves from the depth of 2,080–2,085 m.

Diagnosis. — Carapace subtrapezoidal in lateral outline, preplete. Dorsal margin convex, with the largest convexity occurring in its anterior part. Anterior margin higher than the posterior. Ventral margin convex. Transition of the posterior into ventral margin angular. Spine occurs in the posteroventral part of the right valve.

Dimensions (in mm):

	l	h
C holotype ING O/169	0.56	0.39

Description. — Carapace subtrapezoidal in lateral outline, preplete, relatively short (height = 0.6 of length). Carapace oval-fusiform in dorsal outline, with maximum width occurring in the middle part. Dorsal margin convex, with its largest, almost angular, bend occurring in the anterior part. Anterior and posterior margins rounded, anterior higher. Transition of the posterior into ventral margin angular (about 100°). Ventral margin of the left, larger valve convex, of the right — straight. A small spine occurs in the posteroventral part of the right valve. Lateral surface smooth.

Remarks. — The species described resembles to the greatest extent *Baschkirina sublimis* ROZHDESTVENSKAYA from the Eifelian of Western Bashkiria (ROZHDESTVENSKAYA 1962) from which it differs in a shorter carapace, convex ventral margin, angular connection of the posterior and ventral margins and in its more oval dorsal outline.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Family **Rectellidae** NECKAYA, 1966

Genus *Rectella* NECKAYA, 1952

Type species: Mica inaegalis NECKAYA, 1952

Rectella telleri sp. n.

(pl. 21:2–3)

Holotype: Carapace ING O/163; pl. 21:3.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After Professor LECH TELLER, Polish geologist.

Material. — Miastko 2 borehole: several dozen well preserved carapaces from the depth of 2,080–2,085 m.

Diagnosis. — Carapace subtrapezoidal in lateral and fusiform in dorsal outline, amplete. Dorsal margin straight, ventral slightly convex and longer than dorsal. Hinge line in a wide depression. Anterior and posterior margins equal in height. Posterior cardinal angle larger than the anterior. Lateral surface smooth.

Dimensions (in mm):

	l	h
C holotype ING O/163	0.69	0.34
C ING O/162	0.68	0.37

Description. — Carapace subtrapezoidal in lateral and fusiform in dorsal outline. Height equalling a half of length. Dorsal margin straight, its length equalling about 0.6 of the length of the whole carapace. Hinge line situated in a distinct, wide depression. Anterior and posterior margins equal in height, almost symmetrical, slightly pointed in the lower half. Cardinal angles obtuse, anterior of about 120°, posterior of about 140°. Ventral margin slightly convex, longer than the dorsal (about 0.8 of the length of carapace). Left, larger valve overlaps the right one along the entire free margin. Lateral surface smooth.

Remarks. — A rather small variability of this species is mostly expressed in a variable height of its carapaces fluctuating within limits of 0.50 and 0.58 of the length. The outline of the posterior end also varies from a rounded to an almost pointed in the lower half. In the outline of its carapace, *Rectella telleri* sp. n. strongly resembles *R. trapezoides* ZASPELOVA from the Middle Devonian (Narov Horizon) of Byelorussia (POLENOVA 1966), from which it differs, however, in a longer carapace and wider dorsal depression.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Superfamily **Bairdiacea** SARS, 1888
Family **Bairdiidae** SARS, 1888
Genus *Bairdia* MC COY, 1844
Type species: *Bairdia curta* MC COY, 1844

Bairdia aperta POLENOVA, 1952
(pl. 22:5–7)

1952. *Bairdia aperta* sp. n.; POLENOVA: 133–134, pl. 13:3.

Material. — Chojnice 5 borehole: five carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: 14 carapaces from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C juv. ING O/174	1.0	0.51
C juv. ING O/175	0.72	0.37
C juv. ING O/176	0.88	0.45

Description. — See POLENOVA (1952).

Remarks. — *Bairdia aperta* POLENOVA displays a considerable similarity to *B. crebra* ROZHDESTVENSKAYA from the Eifelian of Bashkiria (ROZHDESTVENSKAYA 1962), from which it differs in a stronger bend of its dorsal margin, slighter bend of its antero- and postero- dorsal margins, less sharp and less upturned posterior margin and the place of maximum height in the anterior part of carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Bairdia hexagona POLENOVA, 1952
(pl. 22:1–2; fig. 6)

1952. *Bairdia hexagona* sp. n.; POLENOVA: 128–129, pl. 13:5–6.
1962. *Bairdia hexagona* POLENOVA; ROZHDESTVENSKAYA: 254, pl. 32:3.
1979. *Bairdia (Rectobairdia) hexagona* POLENOVA; OLEMPSKA: 105–106, pl. 19:3.

Material. — Chojnice 5 borehole: 12 carapaces from the depth of 4,482–4,545.1 m and one from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: several dozen carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: five carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/170	0.87	0.41
C ING O/171	0.84	0.43

Description. — See POLENOVA (1952).

Remarks. — The specimens of *Bairdia hexagona* POLENOVA from W. Pomerania are marked by considerable degree of variability (see fig. 6). In their lateral outline, the elongated forms resemble typical specimens of *B. paffrathensis* (KUMMEROW), from which they differ in their parallel middle parts of the lateral walls of carapace.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (Stringocephalus burtini Beds), W. Pomerania, U. Givetian; USSR: Russian Platform and Bashkiria, U. Givetian (Starooskol Horizon).

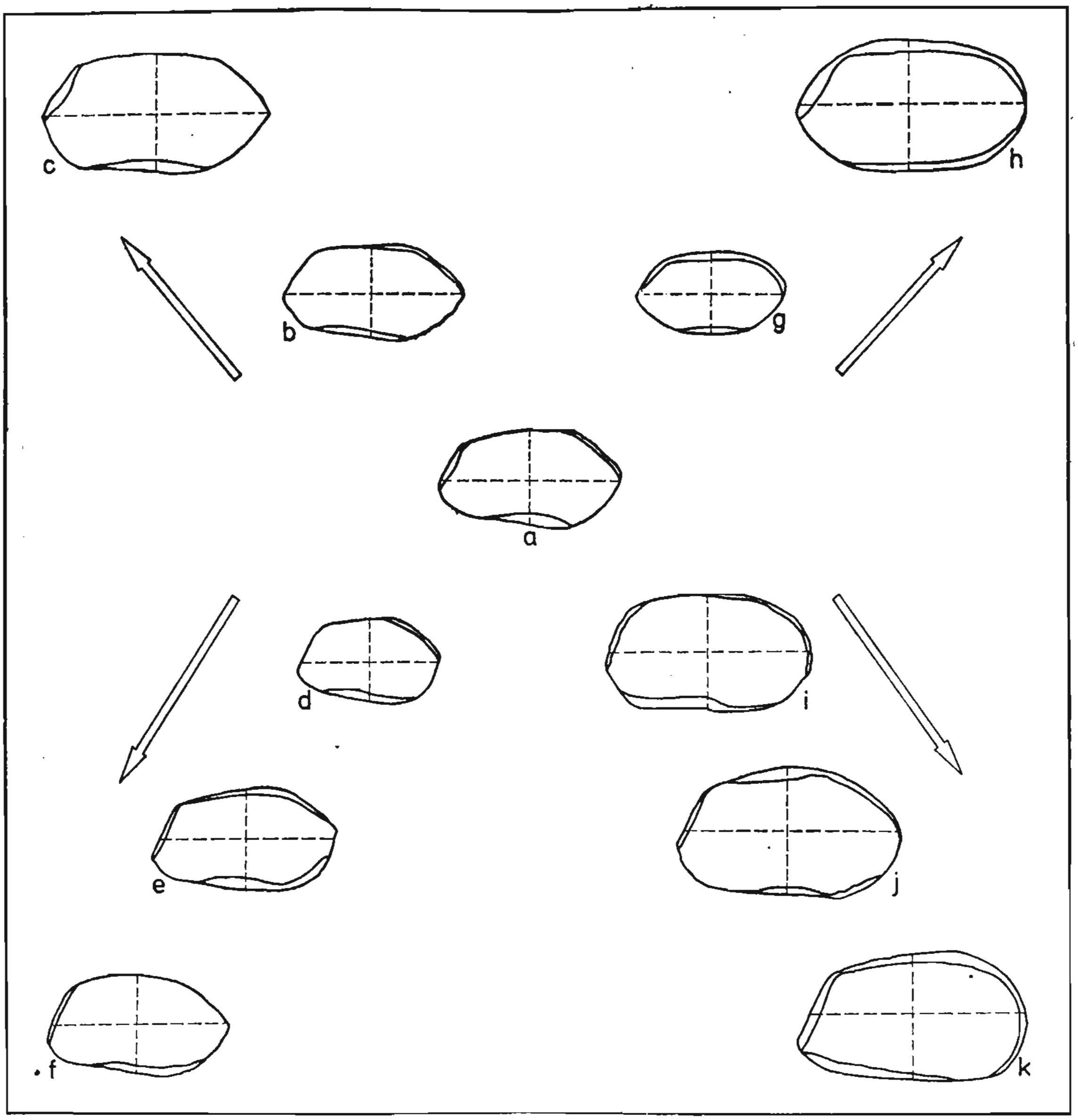


Fig. 6
Intraspecific variability of *Bairdia hexagona* POLENOVA (Koczała 1 borehole, depth 2,945–2,954.2 m): *a* specimen most similar to the holotype, *b–f* specimens with pointed anterior margin, *b–c* specimens with posterior point at the midheight *d–f* specimens with posterior point below the midheight *g–k* specimens with rounded anterior margin, *g–h* specimens with posterior point at the midheight, *i–k* specimens with posterior point below the midheight.

Bairdia paffrathensis KUMMEROW, 1953
(pl. 22:3–4; fig. 10)

1953. *Bairdia paffrathensis* n. sp.; KUMMEROW: 52, pl. 5:10.
1953. *Bairdia tantilla* n. sp.; KUMMEROW: 52, pl. 5:8.
1960. *Bairdiacypris ? paffrathensis* (KUMMEROW); SOHN: 45, 58, 59.
1965*a*. *Bairdia* (*Rectobairdia*) *paffrathensis* KUMMEROW; BECKER: 417–419, pl. 35:3–4.
1965*b*. *Bairdia* (*Rectobairdia*) *paffrathensis* KUMMEROW; BECKER: 180–181, pl. 7:3.
1969. *Bairdia* (*Rectobairdia*) *paffrathensis* KUMMEROW; GROOS: 72, pl. 15:1–4.
1971*b*. *Bairdia* (*Rectobairdia*) *paffrathensis* KUMMEROW; BECKER: 64, pl. 12:116.
1979. *Bairdia* (*Rectobairdia*) aff. *paffrathensis* KUMMEROW; OLEMPSKA: 106, pl.19:4.

Material. — Chojnice 5 borehole: several dozen carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: four carapaces from the depth of 3,041–3,119 m, one from the depth of 2,990.3–3,019 m and 27 from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C ING O/172	0.92	0.43
C ING O/173	1.09	0.48

Description. — See BECKER (1965*a*).

Remarks. — Considerable intraspecific variability of the taxon discussed has already been pointed out by other authors (BECKER 1965*a*, 1971*b*; GROOS 1969), who, at the same time, emphasized the fact of the presence of continuous transitions between its various morphological types. Similar is the case of the material under study in which differences may be observed which are even more distinct than those described by these authors (see fig. 7). The polymorphism observed within this species is the reason why it is similar to several other species which was discussed in detail by BECKER (1965*a*) who suggested the possibility of the conspecificity of *B. paffrathensis* KUMMEROW with *B.* (*Rectobairdia*) *fragosa* MOREY, *B. saxifraga* KRÖMMELBEIN and *B. scaphula* ROZHDESTVENSKAYA. *B. tikhyi* POLENOVA may be also added to this group of presumable synonyms. For, among the Pomeranian specimens, marked by the presence of strongly developed antero- and posterodorsal margins, upturned posterior and extended anterior end, there were those almost identical with a holotype of *B. tikhyi* (see pl. 22:4) illustrated by POLENOVA (1952).

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; W. Germany: Eifel Mts. and Rhenish Slate Mts., Eifelian and Givetian, Rhenish Slate Mts., L. Frasnian (Refrath Beds); Belgium: Dinant Basin, M. Frasnian (F2i); USSR: Volhynia, U. Givetian (Pelcha Beds).

Bairdia plicatula POLENOVA, 1952
(pl. 23:1–2)

1952. *Bairdia plicatula* sp. n.; POLENOVA: 127–128, pl. 13:1–2.
1953. *Bairdia plicatula* POLENOVA; (in litt.); EGOROV: 26–27, pl. 9:1–7.
1960. *Bekena ? plicatula* (POLENOVA); SOHN: 45, 82.
1962. *Bairdia plicatula* POLENOVA; ROZHDESTVENSKAYA: 256, pl. 32:3.
1969. *Bairdia* (*Bairdia*) *plicatula* POLENOVA; GROOS: 72–73, fig. 31, pl. 15:5–8; pl. 20:8.
1979. *Bairdia* (*Bairdia*) *plicatula* POLENOVA; OLEMPSKA: 102, pl. 19:2.

Material. — Koczała 1 borehole: five carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: several hundred carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/182	1.50	0.87
C ING O/183	0.58	0.32

Description. — See POLENOVA (1952).

Remarks. — This species displays a considerable degree of variability (EGOROV 1953; GROOS 1969) which has also recently been confirmed by the material from W. Pomerania. It probably includes forms described as *Bairdia siliklensis* ROZHDESTVENSKAYA (ROZHDESTVENSKAYA 1962) and *B.* (*Rectobairdia*) *lepidocentri* ssp. A BECKER (BECKER 1969*a*).

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., U. Givetian; USSR: Russian Platform and Bashkiria, U. Givetian (Starooskol Horizon).

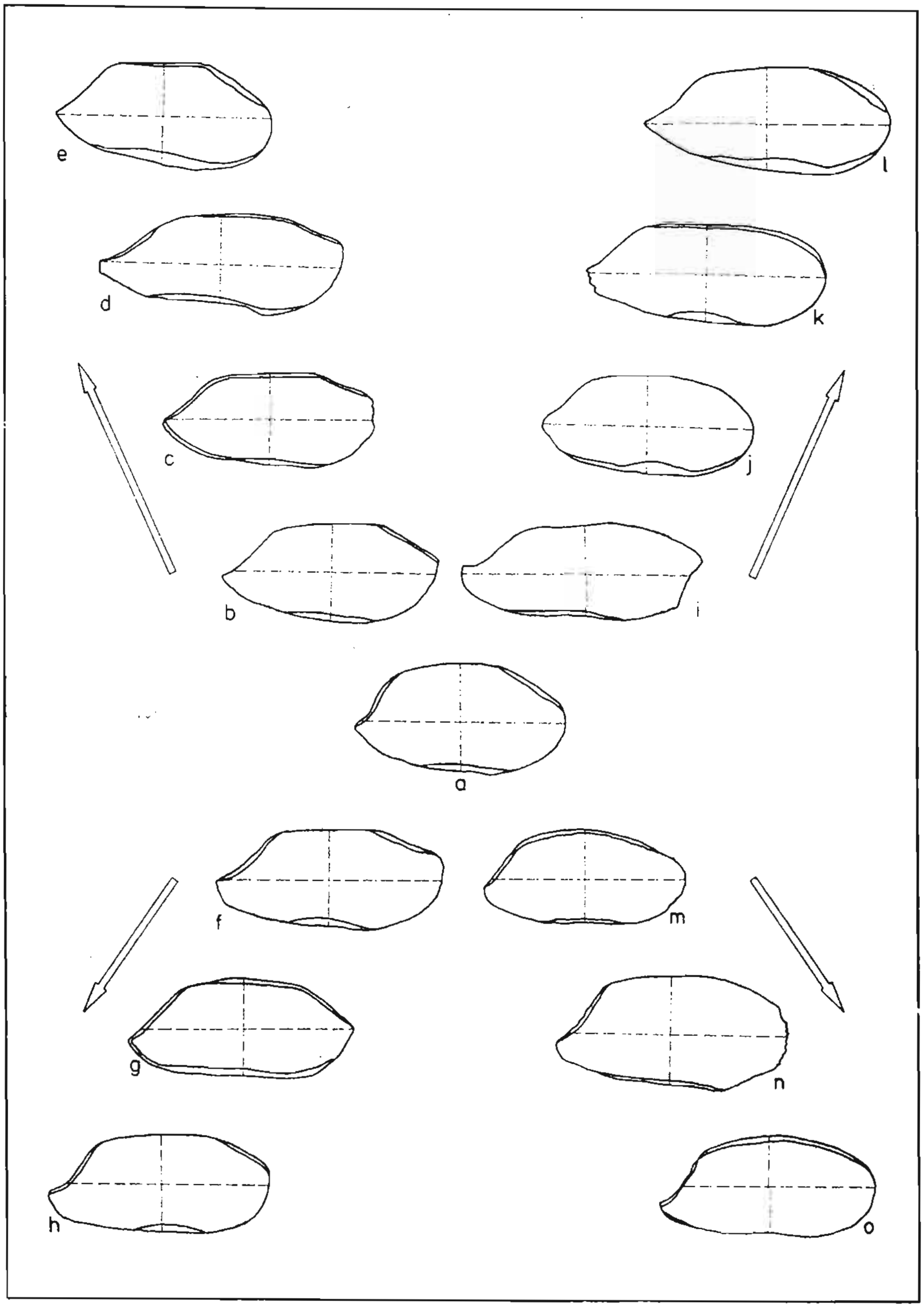


Fig. 7

Intraspecific variability of *Bairdia paffrathensis* KUMMEROW (Koczała 1 borehole, depth 2,945–2,954.2 m): *a* specimen most similar to the holotype, *b–h* specimens with straight anteriodorsal slope and pointed anterior margin, *b–e* specimens with posterior point near or at the midheight, *f–h* specimens with posterior point below the midheight, *i–o* specimens with rounded anteriodorsal slope and anterior margin: *i–l* specimens with posterior point near or at the midheight, *m–o* specimens with posterior point below the midheight.

Bairdia volatilis ROZHDESTVENSKAYA, 1962
(pl. 22:8–9)

1962. *Bairdia volatilis* sp. n.; ROZHDESTVENSKAYA: 254–255, pl. 31:1.

Material. — Chojnice 5 borehole: five carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: two carapaces from the depth of 2,990.3–3,019 m and 50 from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C ING O/177	0.90	0.37
C ING O/178	0.98	0.37

Description. — See ROZHDESTVENSKAYA (1962).

Remarks. — In its lateral outline this species is most similar to *Bairdia actuaria* Rozhdestvenskaya from the Eifelian of Bashkiria (ROZHDESTVENSKAYA 1962), from which it differs, however, in a more convex dorsal margin, higher anterior end and situation of maximum width in the middle part of carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Bashkiria, Givetian (Afonin Beds).

Bairdia chojnicensis sp. n.
(pl. 22:10–11)

Holotype: Carapace ING O/179; pl. 22:10.
Type locality: Chojnice 5 borehole, depth 4,517.4–4,526.1 m. W. Pomerania
Type horizon: U. Givetian.
Derivation of the name: After the Chojnice borehole.

Material. — Chojnice 5 borehole: five carapaces from the depth of 4,517.4–4,526.1 m.

Diagnosis. — Carapace small, short. Dorsal margin arcuate, with a slightly convex anterior and slightly concave posterior slope. Posterior margin high, vertically truncate. Maximum convexity of carapace in its dorsal part. Surface ornamented by fine, longitudinal striae.

Dimensions (in mm):

	l	h
C holotype ING O/179	0.58	0.36
C ING O/180	0.58	0.32

Description. — Carapace postplete in lateral outline, small (about 0.6 mm long). Maximum height equalling 0.6 of length. Dorsal margin strongly convex, with a slightly convex anterior and slightly concave posterior slope. Anterior margin rounded. Posterior margin high, vertically truncate, pointed above the level of midheight of carapace. Bow-shaped projection barely outlined. Maximum convexity of carapace in its dorsal half. Lateral surface ornamented by fine, longitudinal striae.

Remarks. — *Bairdia chojnicensis* sp. n. differs from all other species of the genus *Bairdia* MC COY in its small dimensions, ornamentation in the form of striae, high, vertically truncate posterior margin and maximum convexity situated in the dorsal part of carapace.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Bairdia sp. 1
(pl. 22:12)

Material. — Koczała 1 borehole: one damaged carapace from the depth of 2,710.6–2,716.2 m.

Dimensions (in mm):

	l	h	w
C ING O/181	1.0	0.47	0.42

Remarks. — This specimen considerably resembles forms described by ROZHDESTVENSKAYA (1972) and identified by her as *Bairdia quarziana* EGOROV. As compared with a specimen illustrated by her in pl. 31:4 (ROZHDESTVENSKAYA 1972), *Bairdia* sp. 1 has a yet more rounded anterior margin, somewhat longer and lower placed posterior margin, maximum convexity of carapace in its posterior and not anterior part and a slightly incurved and not straight dorsal margin. The forms described by ROZHDESTVENSKAYA (1972) most certainly do not belong to *B. quarziana* EGOROV, since, in this respect, of decisive importance is primarily the different dorsal outline which, in *B. quarziana* EGOROV is fusiform and in the species described by ROZHDESTVENSKAYA, like in *Bairdia* sp. 1, hexagonal, which results from the presence of a convexity occurring in the anterior and posterior part of carapace.

Occurrence. — Poland: W. Pomerania, M. Frasnian.

Bairdia ? sp. 2
(pl. 23:3)

Material. — Koczała 1 borehole: five incomplete carapaces from the depth of 3,041.8–3,048 m.

Dimensions (in mm):

	l	h
C ING O/184	1.37	0.61

Remarks. — Due to a poor state of preservation of the specimens examined, it is impossible to determine accurately taxonomic position. Such characters as their bent dorsal margin, pointed anterior and posterior margins and strong overlapping of the right, smaller valve by the left on the ventral side suggest that they belong to the genus *Bairdia* MC COY and, according to SOHN'S (1960) classification, to the genus *Cryptobairdia* SOHN, from the representatives of which *Bairdia*? sp. 2 differs in its anterior margin more elongated and pointed than the posterior.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Genus *Bairdiacypris* BRADFIELD, 1935
Type species: *Bairdiacypris deloi* BRADFIELD, 1935

Bairdiacypris sp. 1
(pl. 23:8–9)

Material. — Chojnice 5 borehole: one internal mold of the right valve from a depth of 3,999.6–4,002,4 m; Koczała 1 borehole: one carapace from a depth of 2,705–2,710.6 m.

Dimensions (in mm):

	l	h
C ING O/189	1.03	0.42
RV ING O/190	1.09	0.47

Remarks. — In its lateral outline, *Bairdiacypris* sp. 1 strongly resembles *B. quarziana* (EGOROV) from the Upper Frasnian of the Russian Platform (EGOROV 1953), from which it differs, however, in a more elongated carapace and slightly convex dorsal margin. The scarcity of material and the poor state of its preservation preclude any possibility of more accurate comparisons.

Occurrence. — Poland: W. Pomerania, L. and M. Frasnian.

Genus *Fabalicypris* COOPER, 1946

Type species: *Fabalicypris wileyensis* COOPER, 1946

Fabalicypris holuschurmensis holuschurmensis (POLENOVA, 1955)

(pl. 23:10)

1955. *Bairdia* (?) *holuschurmensis* var. *holuschurmensis* sp. et var. n.; POLENOVA: 235, pl. 12:1.
1962. *Fabalicypris holuschurmensis* var. *holuschurmensis* (POLENOVA); ROZHDESTVENSKAYA: 257–258, pl. 31:4.
1969. *Fabalicypris* ? cf. *holoschurmensis* (POLENOVA); GROOS: 74–75, pl. 16:7.
1979. *Fabalicypris holuschurmensis* (POLENOVA); OLEMPSKA: 115–116, pl. 23:3.

Material. — Chojnice 5 borehole: two carapaces from the depth of 4,482–4,545.1 m; Koczała 1 borehole: four carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: 25 carapaces from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/191	0.77	0.35

Remarks. — This species displays a considerable similarity to *Bairdia* (?) *volaformis* POLENOVA from the Upper Givetian of the Russian Platform (POLENOVA 1952), from which it differs, however, in a more elongated carapace, less convex ventral and more widely rounded posterior margin.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., U. Givetian (Bücheler Beds); USSR: Russian Platform and Bashkiria, U. Givetian (Starooskol Horizon).

Genus *Acratia* DELO, 1930

Type species: *Acratia typica* DELO, 1930

Acratia integra ROZHDESTVENSKAYA, 1962

(pl. 23:5–7)

1962. *Acratia* (?) *integra* sp. n.; ROZHDESTVENSKAYA: 259–260, pl. 33:2.

Material. — Koczała 1 borehole: seven carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: six carapaces and three valves from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/188	0.85	0.37
C ING O/186	0.87	0.42
C ING O/187	0.69	0.30

Description. — See ROZHDESTVENSKAYA (1962).

Remarks. — In its lateral outline, this species is related to *A. evlanensis* EGOROV and *A. samoilovae* SHISHKINSKAYA, but differs from them in a stronger bend of its dorsal margin, more elongated and pointed anterior margin and in a spine which occurs on the posterior end of each valve.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Bashkiria, U. Givetian (Staro-oskol Horizon).

Family **Beecherellidae** ULRICH, 1894

Genus *Acanthoscapha* ULRICH et BASSLER, 1923

Type species: *Beecherella navicula* ULRICH, 1891

Acanthoscapha vel *Beecherella* sp. 1

(pl. 23:4)

Material. — Miastko 2 borehole: one carapace from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C ING O/185	0.64	0.23

Remarks. — The species combines characters of two genera: *Acanthoscapha* ULRICH et BASSLER and *Beecherella* ULRICH. A strong lateral compression of the ends of its valves, maximum length in the upper half of carapace and what is known as a *Bairdia*-like outline are features characteristic of the former genus, while maximum convexity in the ventral half of its carapace, flattening of the ventral side, presence of posteroventral spines and a vestigial carina the extension of which is formed by these spines are features ascribed to the genus *Beecherella* (cf. BECKER and SANCHEZ de POSADA 1977). The species *Acanthoscapha* vel *Beecherella* sp. B was described by BECKER and SANCHEZ de POSADA (1977) from the Moniello Formation (Lower Devonian) of Northern Spain. The specimen from Poland differs from the last-named species in a more strongly curved margin and in the lack of the anterodorsal spine.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Superfamily **Cypridacea** BAIRD, 1845

Family uncertain

Genus *Schneideria* KOTSCHETKOVA, 1960

Type species: *Schneideria kazanica* KOTSCHETKOVA, 1960

Schneideria groosae BECKER, 1971

(pl. 24:1)

1971*b*. *Schneideria ? groosae* sp. n.; BECKER: 67–68, pl. 5:47–50.

Material. — Chojnice 5 borehole: three juvenile carapaces from the depth of 3,685.4–3,688.2 m.

Diagnosis. (emended). — Carapace short. Left valve slightly larger than the right. Anterior and posterior margins almost equal in height, anterior sometimes somewhat higher. Posterior margin uniformly, semicircularly rounded, anterior obtusely truncate. Maximum convexity of carapace in the posterior part of its upper half.

Dimensions (in mm):

	l	h
C ING O/194	0.45	0.28

Remarks. — BECKER (1971*b*) assigned this species, with a reservation, to *Schneideria* KOTSCHETKOVA emphasizing that the size relation of its valves is quite reverse than in the diagnosis of the genus. He found that, the same as in *S. schigrovskiensis* (POLENOVA), the right valve of his species was larger. However, as follows from POLENOVA's (1953) description, *S. schigrovskiensis* has the left and not right valve larger, although in the explanations of figures (*ibidem*, pl. 5: 1–3) smaller (right) valves were erroneously determined as left ones. Specimens of *S. groosae* from Belgium are marked by their maximum convexity situated in the middle part of carapace which may pose certain problems in orienting them correctly. Specimens from Pomerania are identical in lateral outline with the forms described from Belgium (BECKER 1971*b*), but their maximum convexity is shifted distinctly to the area near the lower, semicircularly rounded margin. This margin is precisely a posterior margin and, therefore, it is the left and not right valve which is larger. Thus, the orientation of the carapaces of *S. groosae* is opposite to that suggested by BECKER (*ibidem*) and the size relations of valves are in conformity with KOTSCHETKOVA's (1960) diagnosis of the genus *Schneideria*.

Occurrence. — Poland: W. Pomerania, M. Frasnian; Belgium: Dinant Basin, M. Frasnian (F2i).

Schneideria schigrovskiensis (POLENOVA, 1955)
(pl. 23: 11–12)

1955. *Indivisia* (?) *schigrovskiensis* sp. n.; POLENOVA: 220–221, pl. 5: 1–3.

Material. — Chojnice 5 borehole: a dozen or so carapaces from the depth of 3,999.6–4,002.4 m.

Dimensions (in mm):

	l	h
C ING O/192	0.79	0.40
C ING O/193	0.43	0.22

Remarks. — *S. schigrovskiensis* POLENOVA differs from the most closely related species *S. edita* AVERJANOV from the Eifelian of the eastern part of the Russian Platform (AVERJANOV 1968) in a more elongated carapace.

Occurrence. — Poland: W. Pomerania, L. Frasnian; USSR: Eastern Russian Platform and Western Ural, L. Frasnian (Kynov Beds).

Schneideria sp. 1
(pl. 24: 2)

Material. — Koczała 1 borehole: five poorly preserved carapaces from the depth of 3,041.8–3,119 m, one carapace from the depth of 2,990.3–3,019 m and five from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C ING O/195	0.61	0.32

Remarks. — This form differs from other species of the genus *Schneideria* KOTSCHETKOVA in an almost perfectly symmetrical carapace, parallel dorsal and ventral margins, semicircularly rounded anterior and posterior margins which are equal in height and strongly convex valves which are almost equal in size. A very poorly preserved material precludes, however, any more accurate classification of the specimens examined.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Suborder **Cytherocopina** GRÜNDEL, 1967
Superfamily **Cytheracea** BAIRD, 1850
Family **Bythocytheridae** SARS, 1926
Subfamily **Editiinae** KNÜPFER, 1967
Genus *Pseudomonoceratina* GRÜNDEL et KOZUR, 1971
Type species: *Monoceratina celsalobata* COOPER, 1941

Pseudomonoceratina ex gr. *sublimis* (POLENOVA, 1952)
(pl. 24:3–6)

1952. *Monoceratina sublimis* sp. n.; POLENOVA: 80–81, pl. 3:1–2, 4.
1952. *Monoceratina sublimis* var. *spinosa* sp. et var. n.; POLENOVA: 81–82, pl. 3:3.

Material. — Chojnice 5 borehole: three carapaces from the depth of 4,482–4,545.1 m and one from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: four carapaces and one valve from the depth of 2,942.6–2,984.6 m.

Dimensions (in mm):

	l	h
C ING O/196	0.45	0.21
C ING O/197	0.45	0.27
C ING O/198	0.45	0.22
C ING O/199	0.45	0.22

Remarks. — Several specimens considerably differing from each other were illustrated by POLENOVA (1952) who assigned them all to one species, *Monoceratina sublimis*. She expressed the supposition that the differences they displayed in the development of the ventral parts of their valves could be a symptom of sexual dimorphism. Since at present, the lack of sexual dimorphism is considered as a feature characteristic of the entire family Bythocytheridae (GRÜNDEL and KOZUR 1971, 1973) it should be assumed that POLENOVA had to do with specimens of different species. Specimens corresponding to various morphological types illustrated by POLENOVA (1952) were also found in the Upper Givetian deposits of W. Pomerania. A small number of the specimens available precludes the possibility of separating new species. In GRÜNDEL'S and KOZUR'S (1971) revisions of the genus *Monoceratina* ROTH, POLENOVA'S species has been excluded from this and included in the newly erected *Pseudomonoceratina*.

Occurrence. — Poland: W. Pomerania, U. Givetian; USSR: Russian Platform, U.Givetian (Starooskol Horizon).

Genus *Triebacythere* GRÜNDEL et KOZUR, 1971
Type species: *Monoceratina hartmanni* KOZUR, 1970

Triebacythere ? *mesodevonica* sp. n.
(pl. 24:7–10)

Holotype: Right valve ING O/202; pl. 24:9.
Type locality: Miastko 2 borehole, depth 2,080–2,085 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *mesodevonicus* — Middle Devonian.

Material. — Chojnice 5 borehole: one valve from the depth of 4,482–4,545.1 m and one from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: 17 valves and two carapaces from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: several dozen single valves from the depth of 2,080–2,085 m.

Diagnosis. — Lateral outline subrectangular. Anterior and posterior marginal ridges wide, ellipsoidal in outline. Median depression shallow. Wing-like ventral extension short, with a flat ventral side. Dorsum narrow. Lateral surface covered with a dense reticulation.

Dimensions (in mm):

	l	h
RV holotype ING O/202	0.58	0.34
LV ING O/203	0.58	0.34
LV ING O/200	0.47	0.27
RV ING O/201	0.45	0.24

Description. — Valve subrectangular in lateral outline, postplete. Dorsal margin long (= 0.84 of the length of valve), anterior margin gently rounded, somewhat higher than the posterior. Posterior margin narrowly rounded in the dorsal and truncate in the ventral part. Ventral margin convex. Anterior marginal ridge in the form of a convexity ellipsoidal in outline. Posterior marginal ridge wide. A wing-like extension occupying one-third of the length of valve and terminating in a short, obtuse spine directed downwards and, sometimes, slightly outwards, is present in the ventral part of valve. Ventral surface of valve flattened. A flattened dorsal part of valve forms a narrow, posteriorly extending dorsum. Median and dorsomedian parts of valve are occupied by a shallow depression, the deepest in its anterior part. The entire surface of valve is covered with a fine reticulation. Reticulation meshes are arranged in rows running along the anterior and ventral margin. Hinge adont, with a smooth list in the left and a groove in the right valve.

Remarks. — This species is strongly related morphologically to the representatives of the Triassic genus *Triebacythere* GRÜNDEL et KOZUR. Unfortunately, the present writer did not succeed in studying the internal structure of valves, in particular the character of their muscle scars. An inner lamella has not been found. For these reasons, the assignement of this species to the genus *Triebacythere* may be questionable. Its finer reticulation, wide, ellipsoidal anterior and posterior marginal ridges, less differentiated height of the anterior and posterior parts of valve, narrower dorsum and longer spine of the ventral wing-like extension are the characters in which the species described differs from the most closely related *T. hartmanni* KOZUR from the Middle Triassic of Thuringia (KOZUR 1968).

Occurrence. — Poland: W. Pomerania, U. Givetian.

Suborder **Paraparchitocopina** GRAMM, 1975

Superfamily **Paraparchitacea** SCOTT, 1959

Family? **Paraparchitidae** SCOTT, 1959

Genus *Samarella* POLENOVA, 1952

Type species: *Samarella crassa* POLENOVA, 1952.

Remarks. — The taxonomic position of this genus is uncertain. POLENOVA placed it among "genera *incertae sedis*". SOHN (1960) assigned it to his new family Rishonidae and his standpoint was accepted later by many other authors, including MC GILL (1967), ROZHDESTVENSKAYA (1972) and POLENOVA (1974). In their revision of this family, ADAMCZAK and WEYANT (1973) decidedly excluded from it other genera, except for *Rishona* SOHN. The soundest seems to be the opinion of BECKER (1964) who assigned this genus with a certain reservation to the Paraparchitidae. The correctness of his suggestion is corroborated by the fact that what is known as a "reversal overlapping of the valves", so characteristic of species of the genus *Samarella*, may also be observed among the genera of the Paraparchitidae. The genus discussed displays the largest external similarity to *Chamishaella* SOHN, but differs from it in less rounded ends and only slightly convex ventral margin.

Samarella crassa POLENOVA, 1952
(pl. 24:11; pl. 25:1)

1952. *Samarella crassa* gen. et sp. n.; POLENOVA: 137–138, pl. 15:1–2.
1962. *Samarella crassa* POLENOVA; ROZHDESTVENSKAYA: 229–230, pl. 20:5.
1969. *Samarella crassa* POLENOVA; GROOS: 55, Abb. 29, fig. 1–3.
1979. *Samarella* aff. *crassa* POLENOVA; OLEMPSKA: 124, pl. 14:9.

Material. — Chojnice 5 borehole: ten, mostly deformed, carapaces from the depth of 4,482–4,541.1 m; Koczała 1 borehole: five carapaces from the depth of 2,942.6–2,984.6 m.
Dimensions (in mm):

	l	h
C ING O/204	0.63	0.42
C ING O/205	1.03	0.65

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds) W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., U. Givetian (Bücheler Beds); USSR: Russian Platform, U. Givetian (Starooskol Horizon).

? **Podocopida**
Superfamily uncertain
Family **Knoxitidae** EGOROV, 1950

Remarks. — The family Knoxitidae has so far been assigned to the Kloedenellidae (EGOROV 1950; POLENOVA 1952; ROZHDESTVENSKAYA 1974). The family Kloedenellidae, as well as the Cytherellidae, was included by ADAMCZAK (1966) to the Platycopa. The "kloedenellid type" of dimorphism (ADAMCZAK 1966), expressed in the inflation of the posterior part of heteromorph carapace, accompanied always by the presence of an inner partition called limen on the inner surface of valves, is a characteristic feature of the Platycopa. In ADAMCZAK'S (1976) opinion, the widening of the posterior part of heteromorph carapaces alone is not a sufficient character for assigning the forms, marked by it, to the Platycopa. He cites several examples of genera of suborders other than the Platycopa which display an inflation in the posterior part of their heteromorph carapaces. However, such forms have never displayed the presence of the inner partition.

The representatives of the family Knoxitidae are also devoid of limen, and, therefore, according to ADAMCZAK (1966, 1976) cannot be assigned to the Platycopa. ADAMCZAK (1976) believed that the species *Knoxiella accepta* POLENOVA, devoid of limen, but having a strongly developed duplicature (GRÜNDEL 1967; ADAMCZAK 1961) should be assigned to the Podocopa. If such is the case, the Knoxitidae would probably be a family of this suborder.

Genus *Marginia* POLENOVA, 1952
Type species: *Marginia sculpta* POLENOVA, 1952

Remarks. — The genus *Marginia* was assigned by the Soviet authors (POLENOVA 1952; ROZHDESTVENSKAYA 1959, 1962, 1974) to the family Knoxitidae EGOROV and by MC GILL (1967) and COPELAND (1977) to the family Beyrichiopsidae HENNINGSMOEN, while JONES (1968), believing that the similarities to the genus *Beyrichiopsis* JONES and KIRKBY, suggested by POKORNÝ (1958), did not result from the homology of admarginal structures, placed the genus *Marginia* within the family Geisinidae SOHN. The *Knoxites* EGOROV, *Knoxiella* EGOROV and others were mentioned by SOHN (1961 *b*) within the range of the Gesinidae. It is not unlikely that the name of this family is a junior synonym of the Knoxitidae and, for this reason, the present writer assigns here the genus *Marginia* to the Knoxitidae.

Marginia syzranensis POLENOVA, 1952
(pl. 25:2–6)

1952. *Marginia syzranensis* sp. n.; POLENOVA: 100–101, pl. 5:4–5.
1979. *Marginia syzranensis* POLENOVA; OLEMPSKA: 93–94, pl. 15:4–5.

Material. — Chojnice 5 borehole: one carapace and six valves of tecnomorphs from the depth of 4,482–4,545.1 m; Koczała 1 borehole: nine heteromorph carapaces and one carapace and six valves of tecnomorphs from the depth of 2,942.6–2,984.6 m; Miastko 2 borehole: one heteromorph carapace and four carapaces and 11 valves of tecnomorphs from the depth of 2,080–2,085 m.

Dimensions (in mm):

	l	h
C♀ ING O/207	1.29	0.77
C juv. ING O/208	1.0	0.53
C juv. ING O/209	0.71	0.34
C juv. ING O/210	0.59	0.32
C juv. ING O/206	0.55	0.30

Description. — See POLENOVA (1952).

Remarks. — *M. syzranensis* is related to *M. ollii* ROZHDESTVENSKAYA from the Eifelian of Southern Ural (ROZHDESTVENSKAYA 1960), from which it differs in larger dimensions, more rounded and higher anterior end, slightly outlined preadductorial node and shorter depression of hinge margin.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian; USSR: Russian Platform, U. Givetian (Starooskol Horizon).

Order **Myodocopida** SARS, 1866
Suborder **Entomozocopina** GRÜNDEL, 1969
Superfamily **Entomozoacea** PŘIBYL, 1950
Family **Entomozoidae** PŘIBYL, 1950
Genus *Entomozoe* PŘIBYL, 1950
Type species: *Entomis tuberosa* JONES, 1861
Subgenus *Nehdentomis* MATERN, 1929
Type species: *Entomozoe* (*Nehdentomis*) *nehdensis* MATERN, 1929

Entomozoe (*Nehdentomis*) *tenera* (GÜRICH, 1896)
(pl. 26:6)

1896. *Entomis tenera* nov. nom.; GÜRICH: 375, pl. 10:15.
1929. *Entomis* (*Nehdentomis*) *tenera* GÜRICH; MATERN: 57, pl. 4:48.
1954. *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH); RABIEN: 98–99.
1975. *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH); CASIER: 18, pl. 2:6.
1979. *Entomozoe* (*Nehdentomis*) *tenera* (GÜRICH); OLEMPSKA: 134–135, pl. 29:4–6.

Material. — Chojnice 5 borehole: one carapace and three internal molds of valves from the depth of 3,685.4–3,688.2 m and three valves from the depth of 3,457.6–3.460.8 m; Koczała 1 borehole: two carapaces from the depth of 2,376–2,382 m.

Dimensions (in mm):

	l	h
C ING O/216	1.11	0.63

Occurrence. — Poland: Holy Cross Mts., Frasnian and L. Famenian, Sudeten Mts., U. Devonian, W. Pomerania, M. Frasnian and L. Famennian; W. Germany: Rhenish Slate Mts., L. Frasnian to L. Famennian (cicatricosa-torleyi to *Entomozoe* Zone); E. Germany: Thuringia, L. Famennian; Belgium, U. Frasnian (Matagne Formation); SW England, Frasnian.

Incertae ordinis
Family **Buregiidae** POLENOVA, 1953
Genus *Buregia* ZASPELOVA *in*: POLENOVA, 1953
Type species: *Buregia bispinosa* ZASPELOVA *in*: POLENOVA, 1953

Remarks. — The taxonomic position of the genus, as well as the family the only representative of which it is, is uncertain. A dozen or so species of the genus *Buregia* are known at present. Most of them were described from the Middle and Upper Devonian of the Russian Platform (POLENOVA 1953); SHISHKINSKAYA 1959; ROZHDESTVENSKAYA 1972), as well as from the Middle Devonian of the Rhenish Slate Mts., W. Germany (GROOS 1969) and Holy Cross Mts., Poland (OLEMPSKA 1979). On the basis of the sexual dimorphism expressed in a larger convexity of the posterior end of carapace in heteromorphs observed by Soviet authors (POLENOVA 1953; ROZHDESTVENSKAYA 1972), the Buregiidae was assigned by ROZHDESTVENSKAYA (1972) to the Kloedenellacea. However, the soundness of this classification is precluded by the lack of limen, an element characterictic of the so-called "kloedenellid" type of dimorphism (ADAMCZAK 1968, 1976). The lack of data on the details of internal structure, in particular on the type of hinge and on the presence or absence of duplicature, prevents the possibility of deciding whether the genus *Buregia* should be assigned to the Podocopida or Palaeocopida. Its general outline and the presence of a ridge running along the free margin relate *Buregia* to *Urftella* BECKER (Primitiopsacea, Palaeocopida). What is known as "perimarginal" dimorphism characteristic of the Primitiopsacea does not, however, occur in *Buregia*. A hypothetical possibility of the existence of entirely non-dimorphic families was assumed by BECKER (1970*a*) and GRÜNDEL (1977) on the basis of a tendency to reducing dimorphic structure which they observed in the superfamily Primitiopsacea. The family Buregiidae may presumably be one of them.

Buregia curta sp. n.
(pl. 26:3–4)

Holotype: Carapace ING O/213; pl. 26:3.
Type locality: Koczała 1 borehole, depth 2,966–2,969.3 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *curtus* — short.

Material. — Koczała 1 borehole: 16 poorly preserved carapaces from the depth of 2,966–2,969.3 m.

Diagnosis. — Carapace short, truncate-circular in outline, strongly convex. Ends equal in height, slightly rounded. Cardinal angles indistinct. Ventral margin convex. Spines small. Surface smooth or indistinctly punctate.

Dimensions (in mm):

	l	h
C holotype ING O/213	0.98	0.69
C juv. ING O/214	0.55	0.41

Description. — Carapace medium-sized, relatively short (height = 0.7 of length), truncate-circular in outline, strongly convex. Anterior and posterior margins equal in height, slightly rounded. Ventral margin slightly convex, parallel to the dorsal. A delicate list with small spines in the ventral part of the anterior and posterior margins runs parallel to the free margin of each valve. Anterior and posterior spines of the right and left valve are situated at the same level, whereas the posterior spine of the left valve is always situated somewhat higher than the posterior spine of the right valve. Maximum convexity of carapace in the posteroventral part of carapace. Carapace subcircular in transverse section. Surface smooth or indistinctly punctate. Carapaces of juvenile individuals differ from those of adult ones only in size.

Remarks. — No dimorphism was observed among the largest carapaces and so it was likely that only tecnomorph carapaces were in this material. In its lateral outline and stronger convexity, the species discussed resembles *Buregia benigna* ROZHDESTVENSKAYA from the Upper Famennian of *Bashkiria* (ROZHDESTVENSKAYA 1972). It differs from it in less distinctly outlined cardinal angles, equal height of the anterior and posterior margins and lack of keels on the ventral surface of valves.

Occurrence. — Poland: W. Pomerania, U. Givetian.

Buregia groosae sp. n.
(pl. 26:1–2)

1969. *Buregia* sp. aff. *B. krestovnikovi* POLENOVA; GROOS: 40, pl. 18:14.
Holotype: Carapace ING O/211; pl. 26:1.
Type locality: Koczała 1 borehole, depth 2,966–2,969.3 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: After Dr. HELGA GROOS-UFFENORDE, German researcher of the Devonian ostracods.

Material. — Chojnice 5 borehole: hundreds, mostly deformed carapaces from a depth of 2,942.6–2,984.6 m.

Diagnosis. — Carapace rectangular in lateral outline. Anterior and posterior margins rounded, almost equal in height or anterior somewhat higher. Posterior cardinal angle more distinctly outlined than the anterior. Ventral margin slightly convex or subrectilinear, parallel to the dorsal. Spines small. Surface closely and finely punctate.

Dimensions (in mm):

	l	h
C holotype ING O/211	1.21	0.72
C juv. ING O/212	0.48	0.30

Description. — Carapace rectangular-oval in lateral outline. Dorsal margin straight. Posterior cardinal angle more distinctly outlined than the anterior. Anterior and posterior margins almost equal in height, symmetrical or anterior slightly higher. Ventral margin rectilinear or slightly convex. Maximum convexity of carapace situated close behind the midlength, in its ventral half, which gives a triangular outline of its transverse section. Right valve, somewhat larger, slightly overlaps the left one along the free margin. Free margin of each valve is bordered by a thin list, with small spines in its anterior and posterior parts. Anterior spines of both right and left valves are situated at the same level, while the posterior spine of the left valve occurs always considerably higher than the posterior spine of the right valve. The entire lateral surface finely and closely punctate. No differences which could suggest the existence of sexual dimorphism were found among the largest carapaces examined. Maybe, this material included tecnomorphs only.

Remarks — The species here described differs from the most closely related species *Buregia krestovnikovi* POLENOVA from the Upper Frasnian of the Russian Platform (POLENOVA 1953) in an equal height of ends, finely punctate surface and different situation of the posterior spine on the right and left valve.

Occurrence.. — Poland: W. Pomerania, U. Givetian; W. Germany: Rhenish Slate Mts., U. Givetian (Grövensteinen Beds).

Family uncertain

Gen. et sp. indet.

(pl. 26:5)

1979. Gen. et sp. indet; OLEMPSKA: 132, pl. 28:7.

Material. — Chojnice 5 borehole: one left valve from the depth of 4,507.8–4,517.4 m. Dimensions (in mm):

	l	h
LV ING O/215	2.13	1.22

Description. — Valve large, suboval in outline. Dorsal margin straight, passing, in the form of gentle aics, into the anterior and posterior margins. Anterior and posterior margins widely rounded, anterior considerably lower than the posterior. Ventral margin gently convex. Maximum height in the posterior part. Surface smooth.

Remarks. — The specimen described by OLEMPSKA (1979) from the Upper Givetian of the Holy Cross Mts. is only slightly smaller than that under study and shows, as a results of partial corrosion of the surface of valve, a round, large muscle scar situated in the middle part of its valve. The structure of hinge and internal part of the free margin could not be traced in the specimen studied by OLEMPSKA (1979), as well as in the material from Pomerania. This precludes any possibility of settling its taxonomic position even at the level of order.

Occurrence. — Poland: Holy Cross Mts., U. Givetian (*Stringocephalus burtini* Beds), W. Pomerania, U. Givetian.

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EXPLANATION OF PLATES 1–26

PLATE 1

Page

Pribylites (*Parapribylites*) *hanaicus* POKORNÝ 21

1. Heteromorph carapace: *a* — left lateral view, *b* — ventral view, *c* — posterior view, *d* — dorsal view, × 60 (ING O/1); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
2. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior viev, × 60 (ING O/2); locality, depth and age as above.
3. Heteromorph carapace; *a* — right lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/3); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
4. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/4); locality, depth and age as above.
5. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/5); locality, depth and age as above.
6. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/6); locality, depth and age as above.
7. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/7); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Pribylites (*Gravia*) sp. 1 21

8. Tecnomorph valve; *a* — right lateral view, *b* — ventral view, × 60 (ING O/8); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

PLATE 2

Pribylites (*Parapribylites*) *hanaicus* POKORNÝ 24

1. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/9); Chojnice 5 borehole, depth 4,517.4–4,526,1 m, Upper Givetian.
2. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/10); locality, depth and age as above.
3. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, × 60 (ING O/11); locality, depth and age as above.
4. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/12); locality, depth and age as above.

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Selebratina accommoda sp. n. 22

5. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/13); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
6. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60, holotype (ING O/14); locality, depth and age as above.

PLATE 3

Russia apicata sp. n. 22

1. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/15); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
2. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60, holotype (ING O/16); locality, depth and age as above.
3. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/17); locality, depth and age as above.

Russia cingulata (KUMMEROW). 23

4. Tecnomorph carapace; left lateral view, × 60 (specimen lost); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Urftella adamczaki BECKER 24

5. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/18); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
6. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 60 (ING O/19); locality, depth and age as above.
7. Juvenile carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/20); Chojnice 5 borehole, depth 4,507.8–4,517.4 m, Upper Givetian.

PLATE 4

Sulcatiella olempskae sp. n. 25

1. Carapace; *a* — right lateral view, *b* — dorsal view, *c* — posterior view, × 60, holotype (ING O/21); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
2. Juvenile carapace; *a* — right lateral view, *b* — dorsal view, *c* — posterior view, × 60 (ING O/22); locality, depth and age as above.

Parabolbinella anteaculeata ADAMCZAK 26

3. Tecnomorph valve; *a* — left lateral view, *b* — ventral view, × 40 (ING O/23); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
4. Tecnomorph carapace: *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/24); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

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Hanaites mirabilis (POLENOVA) 26

5. Valve; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/25); Chojnice 5 borehole, depth 4.543,6–4,545,1 m, Upper Givetian.

Hollinella antri ADAMCZAK 27

6. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/26); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
7. Fragmentary juvenile valve; *a* — right lateral view, *b* — dorsal view, × 40 (ING O/27); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Hollinella sufflata (BECKER) 27

8. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/28); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.

PLATE 5

Adelphobolbina rectangularis sp. n. 28

1. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/29); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.
2. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 40, holotype (ING 0/30); Koczała 1 borehole, depth 2,730–2,734 m, Middle Frasnian.

Nezamyslia bicornuta sp. n. 37

3. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, *e* — anterior view, × 50 holotype (ING O/31); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
4. Valve; *a* — right lateral view × 50 (ING O/32); locality, depth and age as above.

Obotritia eifeliensis ADAMCZAK 38

5. Juvenile valve; left lateral view, × 50 (ING O/33); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Kozlowskiella moderabilis sp. n. 28

6. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 40, holotype (ING O/34); Koczała 1 borehole, depth 2,966.0–2,969.3 m, Upper Givetian.
7. Heteromorph carapace; right lateral view, × 40 (ING O/35); locality, depth and age as above.

Illativella sp. 1 29

8. Heteromorph valve; *a* — left lateral view, *b* — dorsal view, *c* — ventral view, × 40 (ING O/38); Koczała 1 borehole, depth 2,633.3–2,636,6 m, ? Upper Frasnian.
9. Fragmentary juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — dorsal view, *d* — ventral view, × 40 (ING O/37); locality, depth and age as above.

PLATE 6

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Aechmina sp. 30

1. Fragmentary carapace; *a* — left lateral view, *b* — right lateral view, *c* — dorsal view, *d* — ventral view, × 60 (ING O/38); Koczała 1 borehole, depth 2,978.1–2,984.6 m, Upper Givetian.

Amphissites multicarinatus sp. n. 32

2. Carapace; *a* — left lateral view, *b* — dorsal view, *c* — ventral view, × 60, holotype (ING O/39); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Amphissites irinae Gleb. et Zasp. *in*: EGOROV 30

3. Juvenile carapace; *a* — left lateral view, *b* — dorsal view, *c* — ventral view, × 60 (ING O/40); Koczała 1 borehole, depth 2,730–2,734 m, Middle Frasnian.

Amphissites pulcher POLENOVA 31

4. Carapace; *a* — left lateral view, *b* — dorsal view, *c* — ventral view, × 60 (ING O/41); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
5. Carapace; *a* — right lateral view, *b* — dorsal view, *c* — ventral view, × 60 (ING O/42); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Amphissites remesi POKORNÝ 31

6. Valve; *a* — left lateral view, *b* — dorsal view, × 60 (ING O/43); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian

PLATE 7

Refrathella sp. 1. 32

1. Valve; *a* — right lateral view, *b* — ventral view, × 60 (ING O/44); Koczała 1 borehole, depth 2,949.5–2,954.2 m Upper Frasnian.

Moorites koczalensis sp. n. 33

2. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, × 60, holotype (ING O/45); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Moorites givetianus (ROZHDESTVENSKAYA) 33

3. Carapace; *a* — left lateral view, *b* — ventral view, × 80, holotype (ING O/46); locality, depth and age as above.

Balantoides parvulus (POLENOVA) 35

4. Carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING 0/47); locality, depth and age as above.
5. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 80 (ING O/48); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

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Balantoides keslingi sp. n. 35

6. Carapace; *a* — right lateral view, *b* — dorsal view, *c* — ventral view, × 80, holotype (ING O/49); Koczała 1 borehole depth 2,996.4–3,006.1 m, Upper Givetian.
7. Carapace; right lateral view, × 80 (ING O/50); Chojnice 5 borehole, depth 4,415.2–4,429.4 m, Upper Givetian.

Balantoides brauni (BECKER) 34

8. Carapace; *a* — left lateral view, *b* — dorsal view, × 80 (ING O/51); Chojnice 5 borehole, depth 3,685.4–3,688.2 m Middle Frasnian.

Coeloenellina pomeranica sp. n.. 39

9. Carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/52); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
10. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/53); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.

Fellerites tuimazensis (ROZHDESTVENSKAYA). 38

11. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/54); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Evlanovia sp. 1 39

12. Valve; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/55); locality, depth and age as above.

PLATE 8

Poloniella adamczaki sp. n. 42

1. Heteromorph carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/56); Chojnice 5 borehole, 4,507.8–4,517.4 m, Upper Givetian.
2. Heteromorph carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/57); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
3. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/58); locality, depth and age as above.

Poloniella tertia KRÖMMELBEIN 41

4. Tecnomorph carapace; right lateral view, × 60 (ING 0/59); locality, depth and age as above.
5. Juvenile carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/60); locality, depth and age as above.
6. Heteromorph carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/61); locality, depth and age as above.

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Poloniella sp. 1 44

7. Tecnomorph carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/62); Koczała 1 borehole, depth 3,089–3,094 m, Upper Givetian.

PLATE 9

Poloniella regularis sp. n. 43

1. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/63); Koczała 1 borehole, depth 2,978.1–2,984.6 m, Upper Givetian.
2. Juvenile carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/64); locality, depth and age as above.
3. Juvenile carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/65); locality, depth and age as above.
4. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/66); locality, depth and age as above.
5. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/67); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
6. Tecnomorph carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/68); locality, depth and age as above.
7. Heteromorph valve; left lateral view, × 60 (ING O/69); locality, depth and age as above.

Poloniella trisinuata (VAN PELT) 41

8. Tecnomorph carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING 0/70); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

PLATE 10

Poloniella trisinuata (VAN PELT) 41

1. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/71); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Uchtovia materni BECKER 45

2. Tecnomorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/72); Chojnice 5 borehole, depth 3,786.3–3,790.6 m, Middle Frasnian.

Uchtovia refrathensis (KRÖMMELBEIN) 45

3. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/73); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
4. Heteromorph carapace; *a* — left lateral view, *b* — dorsal view, × 60 (ING O/74); Koczała borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

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5. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/75); locality, depth and age as above.
6. Juvenile carapace; *a* — left lateral view, *b* — ventral view, × 60 (ING O/76); locality, depth and age as above.
7. Juvenile carapace; left lateral view, × 60 (ING O/77); locality, depth and age as above.

Poloniella sp. 2 44

8. Heteromorph valve; *a* — left lateral view, *b* — ventral view, × 60 (ING O/78); Miastko 2 borehole, depth 2,080–2.085 m, Upper Givetian.

PLATE 11

Uchtovia rozhdestvenskayae sp. n. 46

1. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, × 60, holotype (ING O/79); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
2. Juvenile carapace; *a* — left lateral view, *b* — ventral view, × 60 (ING O/80); locality, depth and age as above.
3. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, × 60 (ING O/81); locality, depth and age as above.
4. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/82); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Uchtovia sp. 1 47

5. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/83); Koczała 1 borehole depth 3,089–3,094 m, Upper Givetian.
6. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/84); locality, depth and age as above.

Evlanella caduca sp. n.. 47

7. Heteromorph carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/85); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
8. Tecnomorph carapace; *a* — left lateral view, *b* — ventral view, × 60 (ING O/86); locality, depth and age as above.

PLATE 12

Cavellina subegorovi sp. n. 48

1. Carapace; *a* — left lateral view, *b* — ventral view, × 60, holotype (ING O/87); Koczała 1 borehole, depth 2,978.1–2.984.6 m, Upper Givetian.

Cavellina parvula sp. n.. 48

2. Carapace; *a* — left lateral view, *b* — ventral view, × 60, holotype (ING O/88); locality, depth and age as above.

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Cavellina sublongula sp. n. 49

3. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, × 60, holotype (ING O/89); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.

Semilukiella polita sp. n. 51

4. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/90); Chojnice 5 borehole, depth 4,543.6–4,545.1 m, Upper Givetian.
5. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/91); Chojnice 5 borehole, depth 4,390.1–4,395.4 m, Upper Givetian.

Mennerella convexoventralis sp. n. 50

6. Heteromorph carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40, holotype (ING O/92); Koczała 1 borehole, depth 2,633.3–2,636.6 m, ? Upper Frasnian.
7. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — dorsal view, *d* — ventral view, × 40 (ING O/93); locality, depth and age as above.
8. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/94); locality, depth and age as above.

PLATE 13

Polyzygia symmetrica GÜRICH 51

1. Carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING O/95); Koczała 1 borehole, depth 2,949.5–2,954.2 Upper Givetian.
2. Carapace; *a* — right lateral view, *b* — dorsal view, *c* — ventral view, × 60 (ING O/96); Chojnice 5 borehole, depth 4,398.2–4,413.8 m, Upper Givetian.

Favulella spissa sp. n. 52

3. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/97); Koczała 1 borehole, depth 2,730–2,734 m, Middle Frasnian.
4. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/98); Chojnice 5 borehole, depth 3,786.3–3,790.6 m, Middle Frasnian.
5. Carapace; *a* — left lateral view, *b* — right lateral view. *c* — ventral view. *d* — dorsal view, × 60, holotype (ING O/99); Koczała 1 borehole, depth 2,730–2,734 m, Middle Frasnian.
6. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/100); locality, depth and age as above.

Eriella rostrata sp. n. 55

7. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/101); Koczała 1 borehole, depth 3,065.1–3,071.1 m, Upper Givetian.
8. Juvenile carapace; right lateral view, × 60 (ING O/102); locality, depth and age as above.

PLATE 14

Quasillites quasillitiformis (POLENOVA) 53

1. Juvenile carapace; *a* — right lateral view *b* — ventral view, × 60 (ING O/103); Chojnice 5 borehole, depth 4,415.2–4,429.4 m, Upper Givetian.

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2. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/104); locality, depth and age as above·
3. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/105); locality, depth and age as above.
4. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/106); locality, depth and age as above.
5. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/107); locality, depth and age as above.
6. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, × 60 (ING O/108); locality, depth and age as above.
7. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/109); locality depth and age as above.
8. Carapace; *a* — right lateral view *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING 0/110); locality, depth and age as above.
9. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, × 60 (ING O/111); locality, depth and age as above.

Jenningsina cavernosa (POLENOVA) 53

10. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/112); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.
11. Valve; *a* — right lateral view, *b* — inner view, × 60 (ING O/113); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

PLATE 15

Jenningsina cavernosa (POLENOVA) 53

1. Juvenile carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/114); Koczała 1 borehole, depth 2,978.1–2,984.6 m, Upper Givetian.
2. Juvenile carapace; left lateral view, × 60 (ING O/115); locality, depth and age as above.
3. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/116); locality, depth and age as above.
4. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/117); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
5. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/118); locality, depth an age as above.

Svantovites magnei BECKER 54

6. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/119); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.
7. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/120); locality, depth and age as above.
8. Juvenile carapace; *a* — left lateral view, *b* — dorsal view, × 60 (ING O/121); locality, depth and age as above.

Graphiadactyllis indotatus sp. n. 58

9. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/122); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Graphiadactyllis facetus sp. n.. 57

10. Carapace; *a* — right lateral view, *b* — dorsal view, *c* — ventral view, × 60, holotype (ING O/123); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

PLATE 16

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Jefina obtusa sp. n. 55

1. Carapace; *a*— left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/124); Chojnice 5 borehole, depth 4,415.2–4,429.4 m, Upper Givetian.
2. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/125); locality, depth and age as above.

Ponderodictya querula sp. n. 56

3. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/126); Koczała 1 borehole, depth 2,710.6–2,716.6 m, Middle Frasnian.
4. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/127); locality, depth and age as above.
5. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60, (ING O/128); locality, depth and age as above.

Ropolonellus kettneri (POKORNÝ) 58

6. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, *e* — posterior view, × 80. (ING O/129); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

PLATE 17

Ropolonellus kettneri (POKORNÝ) 58

1. Juvenile carapace; *a* — right lateral view, *b* — dorsal view, *c* — posterior view, × 80 (ING O/130); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
2. Juvenile carapace; *a* — right lateral view, *b* — dorsal view, *c* — posterior view, × 80 (ING O/131); Chojnice 5 borehole, depth 4,507.8–4,517.4 m, Upper Givetian.

Ropolonellus sp. 1 59

3. Carapace; right lateral view, × 60 (ING 0/132); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.

Bufina salva sp. n. 59

4. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/133); Chojnice 5 borehole, depth 4,390.1–4,395.4 m, Upper Givetian.

Bufina colliquefacta sp. n. 59

5. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/134); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.

Bufina intermedia sp. n. 60

6. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/135); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

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Incisurella sp. 1 62

7. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/136); Chojnice 5 borehole, depth 4,415.1–4,429,4 m, Upper Givetian.

PLATE 18

Gerbeckites pomeranicus gen. et sp. n. 62

1. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, × 80, holotype (ING O/137); Miastko 2 borehole, depth 2,080.0–2,085.0 m, Upper Givetian.
2. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, × 80 (ING O/138); locality, depth and age as above.
3. Juvenile carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/139); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Cytherellina sp. 1 61

4. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/140); Chojnice 5 borehole, depth 4.415.1–4.429.4 m, Upper Givetian.
5. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/141); Koczała 1 borehole, depth 2,942.6–2,945 m, Upper Givetian.

Microcheilinella clava (KEGEL) 63

6. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/142); Koczała 1 borehole, depth 3,089–3,095 m, Upper Givetian.

Microcheilinella fecunda (PŘIBYL et ŠNAJDR) 64

7. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/143); Chojnice 5 borehole, depth 4,543.6–4,545.1 m, Upper Givetian.

PLATE 19

Microcheilinella mandelstami POLENOVA 64

1. Carapace; *a* — right lateral view, *b* — left lateral view. *c* — ventral view, *d* — dorsal view, × 80 (ING O/144), Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
2. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 80 (ING O/145); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Microcheilinella insignita sp. n. 64

3. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, *d* — posterior view, × 40, holotype (ING O/146); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

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Microcheilinella fecunda (PŘIBYL et ŠNAJDR) 64

4. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/147); Koczała 1 borehole, depth 2,960.7–2,965.2 m, Upper Givetian.

Ampuloides verrucosa POLENOVA 65

5. Carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/148); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Bairdiocypris deliberatus sp. n. 66

6. Carapace; *a* — right lateral view, *b* — dorsal view, × 40 (ING O/149); Koczała 1 borehole, depth 2,960.7–2,965.2 m, Upper Givetian.

Bairdiocypris vastus POLENOVA 66

7. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/150); Miastko 2 borehole, depth 2,080–2.085 m, Upper Givetian.

PLATE 20

Bairdiocypris deliberatus sp. n. 66

1. Carapace; *a* — right lateral view, *b* — dorsal view, × 40, holotype (ING O/151); Koczała 1 borehole, depth 3,041–3,048 m, Upper Givetian.
2. Carapace; *a* — right lateral view, *b* — dorsal view, × 40 (ING O/152); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
3. Carapace; *a* — right lateral view, *b* — ventral view, × 40, (ING O/153); locality, depth and age as above.

Bairdiocypris phaseoliformis sp. n. 67

4. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40, holotype (ING O/154); locality, depth and age as above.
5. Juvenile carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/155); locality, depth and age as above.

Healdianella resima (ROZHDESTVENSKAYA) 68

6. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 80 (ING O/156); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
7. Juvenile carapace; right lateral view, × 80 (ING O/157); Koczała 1 borehole, depth 2,978.1–2,984.6 m, Upper Givetian.
8. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/158); locality, depth and age as above.

Healdianella obliqua (KUMMEROW). 67

9. Carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/159); locality, depth and age as above.
10. Carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING O/160); Koczała 1 borehole, depth 2,949.5–2,954.2 m), Upper Givetian.

PLATE 21

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Healdianella sp. 1 68

1. Carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING O/161); Koczała 1 borehole, depth 3,089–3,094 m, Upper Givetian.

Rectella telleri sp. n. 71

2. Carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING O/162); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
3. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/163); locality, depth and age as above.

Orthocypris perlonga KUMMEROW 69

4. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/164); Chojnice 5 borehole, depth 4,429.4–4,436.4 m, Upper Givetian.
5. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/165); locality, depth and age as above.

Orthocypris kummerowi sp. n. 69

6. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, × 60 (ING O/166); Koczała 1 borehole, depth 3,089–3,094 m, Upper Givetian.
7. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60, holotype (ING O/167); Koczała 1 borehole, depth 2,945–2,949.5 m, Upper Givetian.

Orthocypris sp. 1 70

8. Carapace; *a* — right lateral view, *b* — ventral view, × 60 (ING O/168); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.

Baschkirina miastkoensis sp. n. 70

9. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60, holotype (ING O/169); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

PLATE 22

Bairdia hexagona POLENOVA 72

1. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/170); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
2. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/171); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

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Bairdia paffrathensis KUMMEROW 73

3. Carapace; *a* — right lateral view, *b* — ventral view, × 40, (ING O/172); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
4. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/173); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Bairdia aperta POLENOVA 72

5. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/174); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
6. Juvenile carapace; *a* — right lateral view, *b* — dorsal view, × 40 (ING 0/175); locality, depth and age as above.
7. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/176); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Bairdia volatilis ROZHDESTVENSKAYA 76

8. Carapace; *a* — right lateral view, *b* — ventral view, × 40, (ING O/177); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
9. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/178); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Bairdia chojnicensis sp. n. 76

10. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 80, holotype (ING O/179); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
11. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/180); locality, depth and age as above.

Bairdia sp. 1 77

12. Carapace, *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 40 (ING O/181); Koczała 1 borehole, depth 2,710.6–2,716.2 m, Middle Frasnian.

PLATE 23

Bairdia plicatula POLENOVA 74

1. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 40 (ING O/182); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
2. Juvenile carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/183); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Bairdia? sp. 2 77

3. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/184); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

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Acanthoscapha vel *Beecherella* sp. 1 79

4. Carapace; *a* — right lateral view, *b* — dorsal view, × 60, (ING O/185); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Acratia integra ROZHDESTVENSKAYA 78

5. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/186); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
6. Juvenile carapace; left lateral view, × 60 (ING 0/187); locality, depth and age as above.
7. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/188); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.

Bairdiacypris sp. 1 77

8. Carapace; *a* — right lateral view, *b* — ventral view, × 40 (ING O/189); Koczała 1 borehole, depth 2,705–2.710 m, Middle Frasnian.
9. Valve; *a* — right lateral view, *b* — ventral view, × 40 (ING O/190); Chojnice 5 borehole, depth 3,999.6–4.002.4 m, Lower Frasnian.

Fabalicypris holushurmensis holushurmensis (POLENOVA) 78

10. Juvenile carapace; right lateral view, × 40 (ING O/191); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

Schneideria schigrovskiensis (POLENOVA) 80

11. Carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 60 (ING O/192); Chojnice 2 borehole, depth 3,999.6–4,002.4 m, Lower Frasnian.
12. Juvenile carapace; *a* — right lateral view, *b* — dorsal view, × 60 (ING O/193); locality, depth and age as above.

PLATE 24

Schneideria groosae BECKER 79

1. Carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 80 (ING O/194); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.

Schneideria sp. 1 80

2. Carapace; *a* — left lateral view, *b* — dorsal view, × 80 (ING O/195); Koczała 1 borehole, depth 3,089–3,094 m, Upper Givetian

Pseudomonoceratina ex gr. *sublimis* (POLENOVA) 81

3. Carapace; *a*— right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 80 (ING O/196); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
4. Carapace; *a* — right lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/197); locality, depth and age as above.

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5. Carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/198); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.
6. Carapace; *a* — left lateral view, *b* — ventral view, *c* — dorsal view, × 80 (ING O/199); locality, depth and age as above.

Triebacythere? *mesodevonica* sp. n. 81

7. Juvenile valve; left lateral view, × 80 (ING 0/200); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.
8. Juvenile valve; *a* — right lateral view, *b* — ventral view, × 80 (ING O/201); locality, depht and age as above.
9. Valve; *a* — right lateral view, *b* — ventral view, × 80, holotype (ING O/202); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
10. Valve; *a* — left lateral view, *b* — ventral view, × 80 (ING 0/203); locality, depth and age as above.

Samarella crassa POLENOVA 81

11. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, × 60 (ING O/204); Koczała 1 borehole, depth 2,949.5–2,954.2 m, Upper Givetian.

PLATE 25

Samarella crassa POLENOVA 83

1. Carapace; *a* — right lateral view, *b* — left lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/205); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

Marginia syzranensis POLENOVA 84

2. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 60 (ING O/206); Miastko 2 borehole, depth 2,080–2,085 m, Upper Givetian.
3. Heteromorph carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 50 (ING O/207); locality, depth and age as above.
4. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 50 (ING O/208); locality, depth and age as above.
5. Juvenile carapace; *a* — left lateral view, *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 50 (ING O/209); Koczała 1 borehole, depth 2,978.1–2,984.6 m, Upper Givetian.
6. Juvenile carapace; *a* — left lateral view *b* — right lateral view, *c* — ventral view, *d* — dorsal view, × 50 (ING O/210); Chojnice 5 borehole, depth 4,517.4–4,526.1 m, Upper Givetian.

PLATE 26

Buregia groosae sp. n. 85

1. Carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, *d* — anterior view, × 40, holotype (ING O/211); Koczała 1 borehole, depth 2,966–2,969.3 m, Upper Givetian.
2. Juvenile carapace; *a* — left lateral view, *b* — ventral view, × 40 (ING O/212); locality, depth and age as above.

Buregia curta sp. n. 85

3. Carapace; *a* — left lateral view, *b* — ventral view, *c* — posterior view, *d* — anterior view, × 40, holotype (ING O/213); locality, depth and age as above.
4. Juvenile carapace; *a* — left lateral view, *b* — ventral view, × 40 (ING O/214); locality, depth and age as above.

Genus et sp. indet. 87

5. Valve; *a* — left lateral view, *b* — ventral view, × 40 (ING O/215); Chojnice 5 borehole, depth 4,507.8–4,517.4 m, Upper Givetian.

Entomozoa (Nehdentomis) tenera (GÜRICH) 84

6. Carapace; *a* — right lateral view, *b* — left lateral view, × 40 (ING O/216); Chojnice 5 borehole, depth 3,685.4–3,688.2 m, Middle Frasnian.

ADDENDUM

Bufina salva sp. n.
(pl. 17:4)

Holotype: carapace ING O/133; pl. 17:4.
Type locality: Chojnice 5 borehole, depth 4,390.1–4,395.4 m, W. Pomerania.
Type horizon: U. Givetian.
Derivation of the name: Lat. *salvus* — unscathed, survived.

Material. — Chojnice 5 borehole: four carapaces and five valves from the depth of 4,482.9–4,545.1 m, and three carapaces and one valve from the depth of 4,390.1–4,436.4 m; Koczała 1 borehole: three carapaces from the depth of 2,990.3–3,019 m.

Diagnosis. — Carapace oval in lateral outline. Anterior and posterior margins equal in height, symmetrically rounded. Ventral margin somewhat more convex then the dorsal. Two ridges — anterior and posterior — occur on the each valve. Surface of valves smooth.

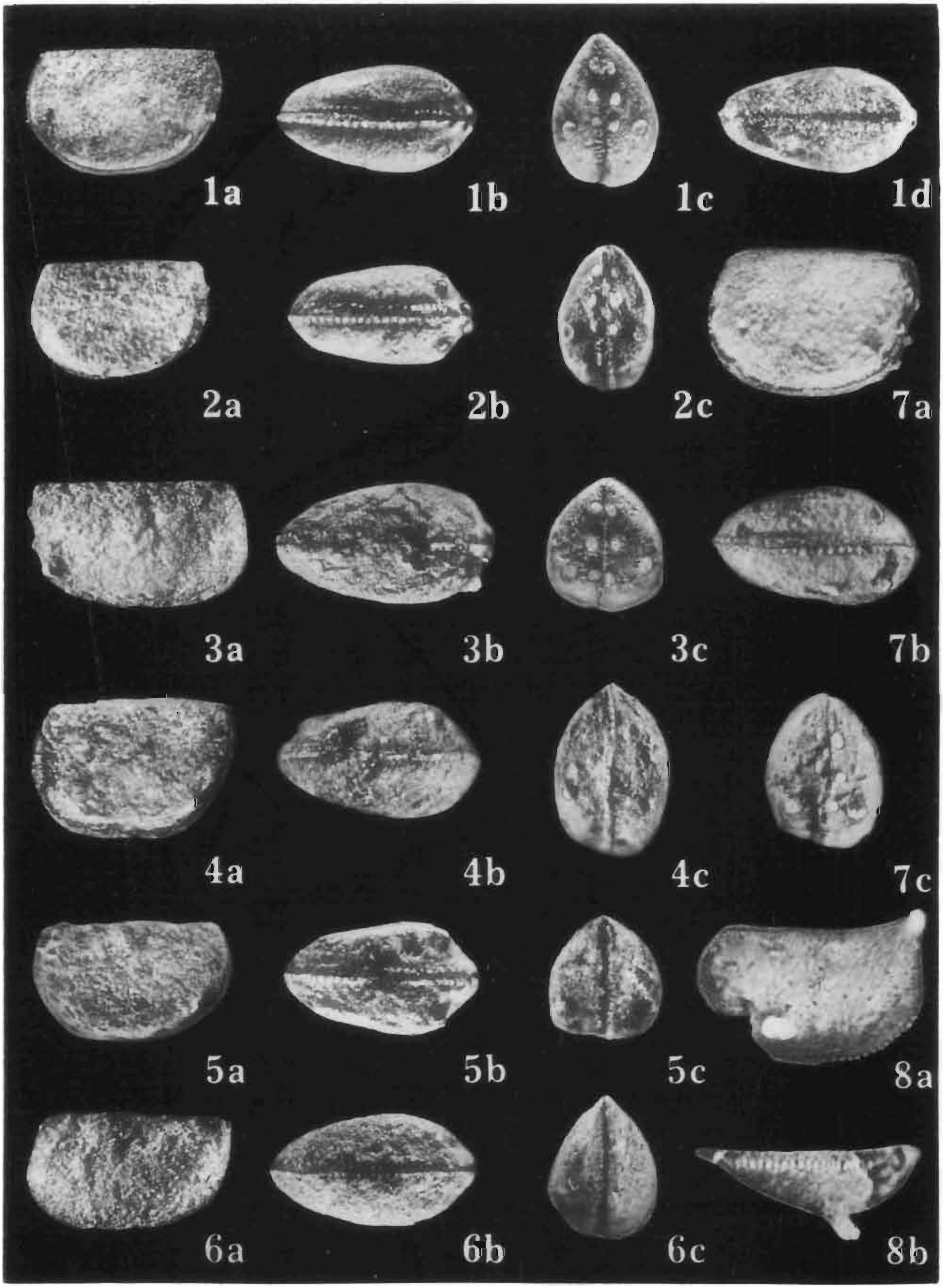
Dimensions (in mm):

	l	h
C holotype ING O/133	0.82	0.45

Description. — Carapace oval in lateral outline. Dorsal margin convex. Anterior and posterior margins equal in height, symmetrically rounded. Ventral margin somewhat more convex then the dorsal. Maximum height and width in the middle part. Low, narrow ridges run parallel to anterior and posterior margins. Posterior ridge more curved. It is shorter and less developed on the left valve. Suıface smooth.

Remarks. — From *Bufina colliquefacta* sp. n. and *B. media* sp. n. the species described differs in the presence of ridges near the both anterior and posterior margins. In this character *B. salva* is similar to *B. granulifera* ADAMCZAK from the Grzegorzowice Formation (Eifelian) of the Holy Cross Mts. (ADAMCZAK 1976), from which it differs in oval outline, shorter and less developed ridges and in a smooth surface.

Occurrence. — Poland: W. Pomerania, U. Givetian.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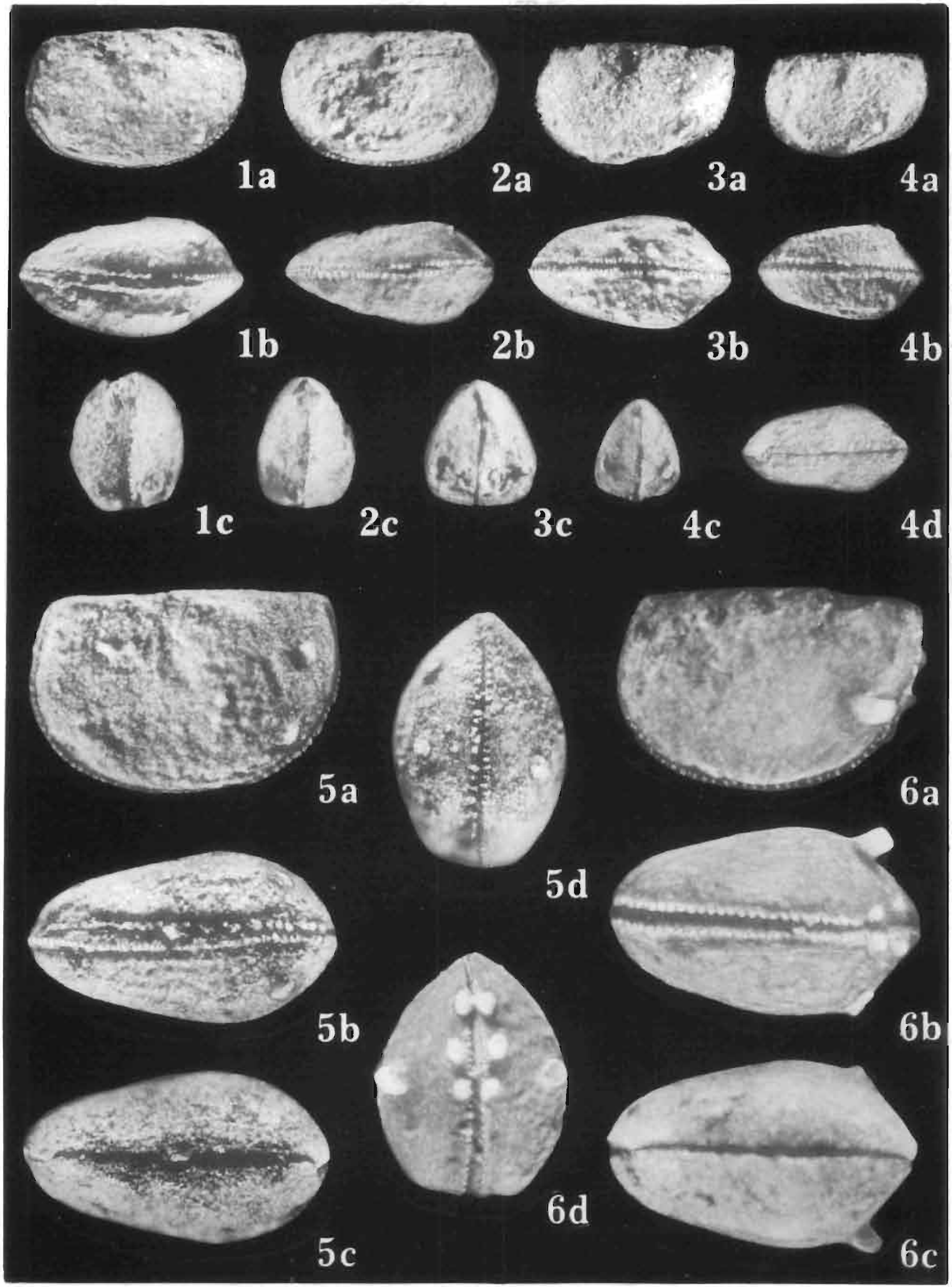

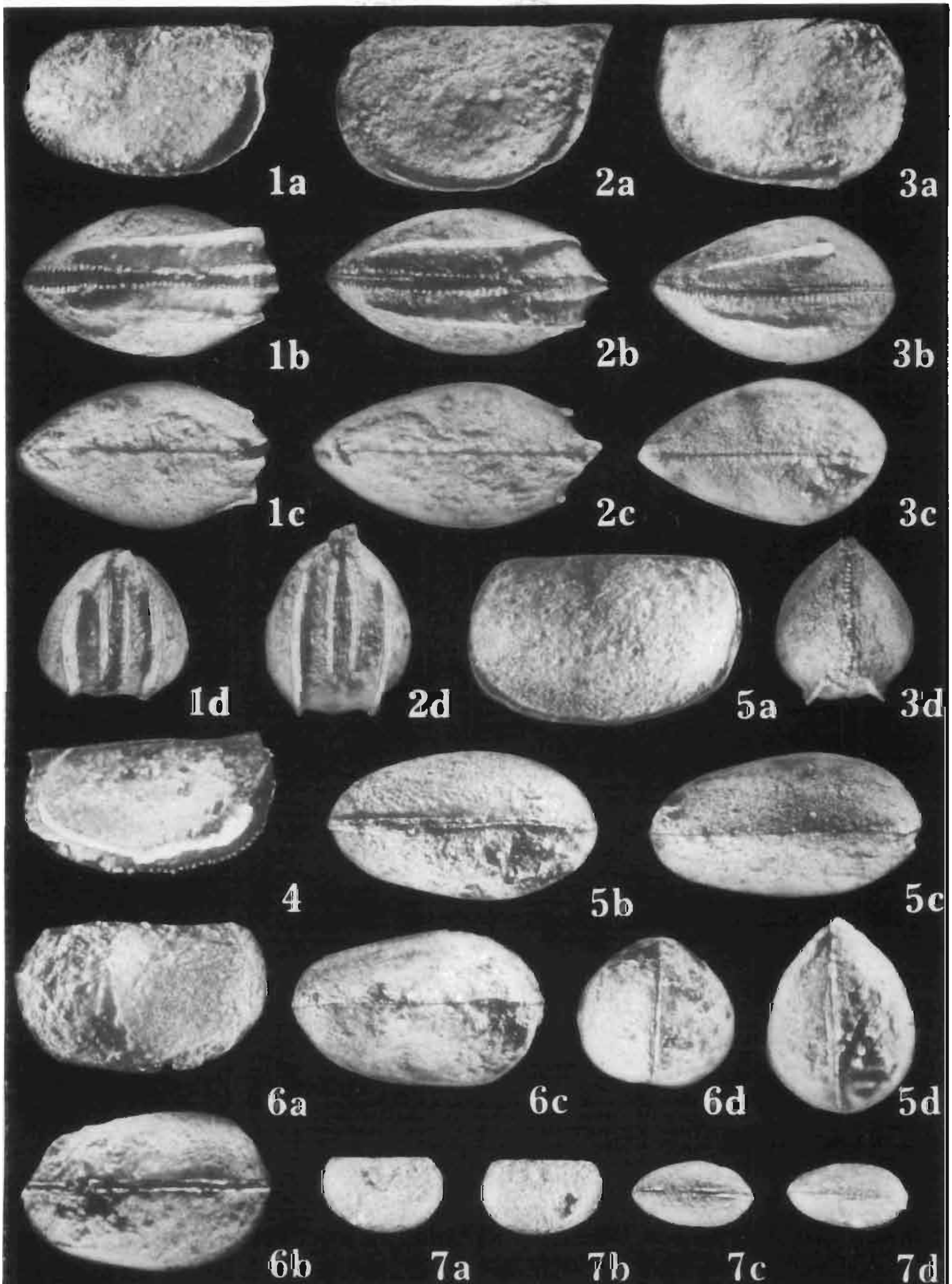
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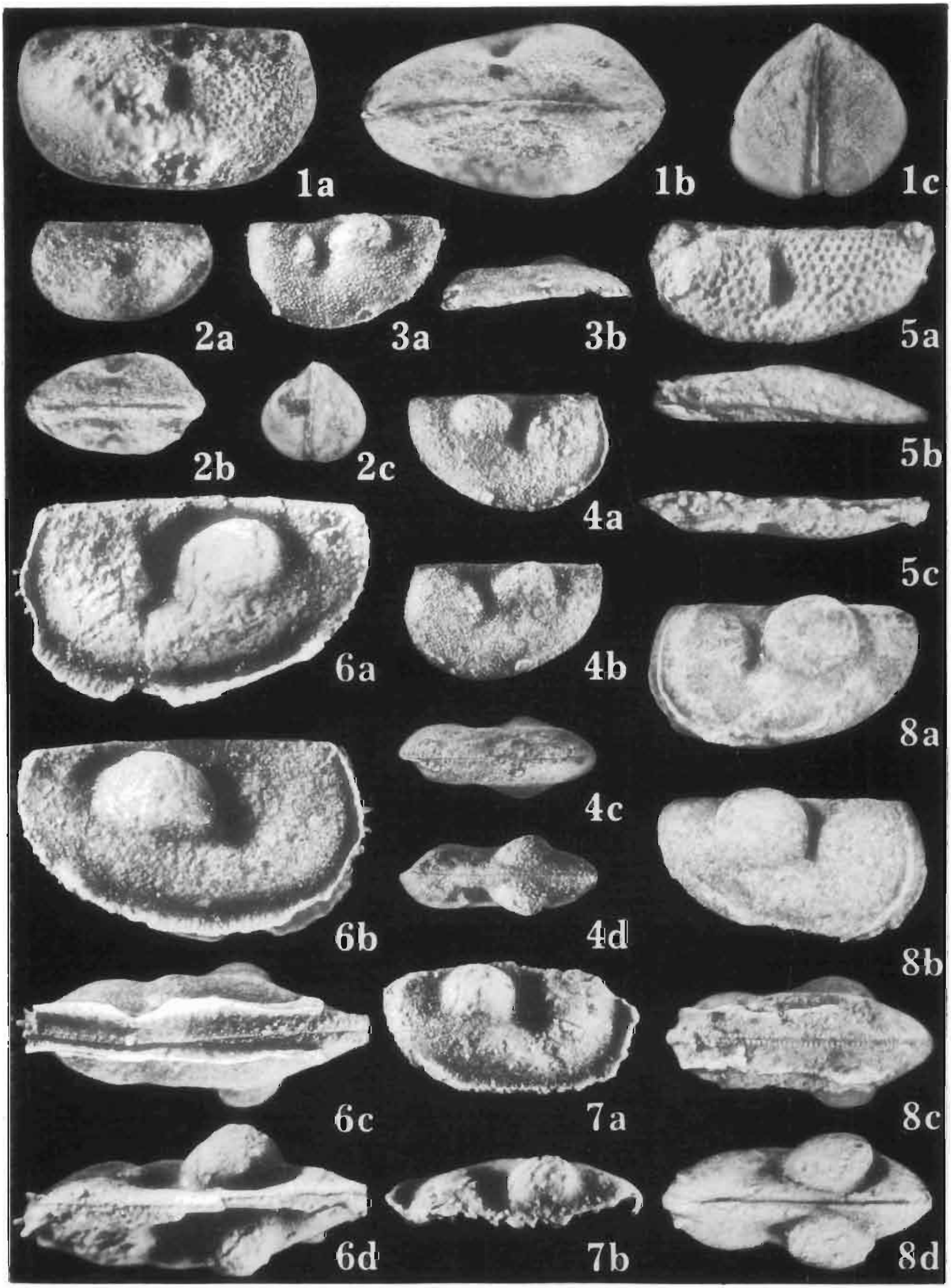
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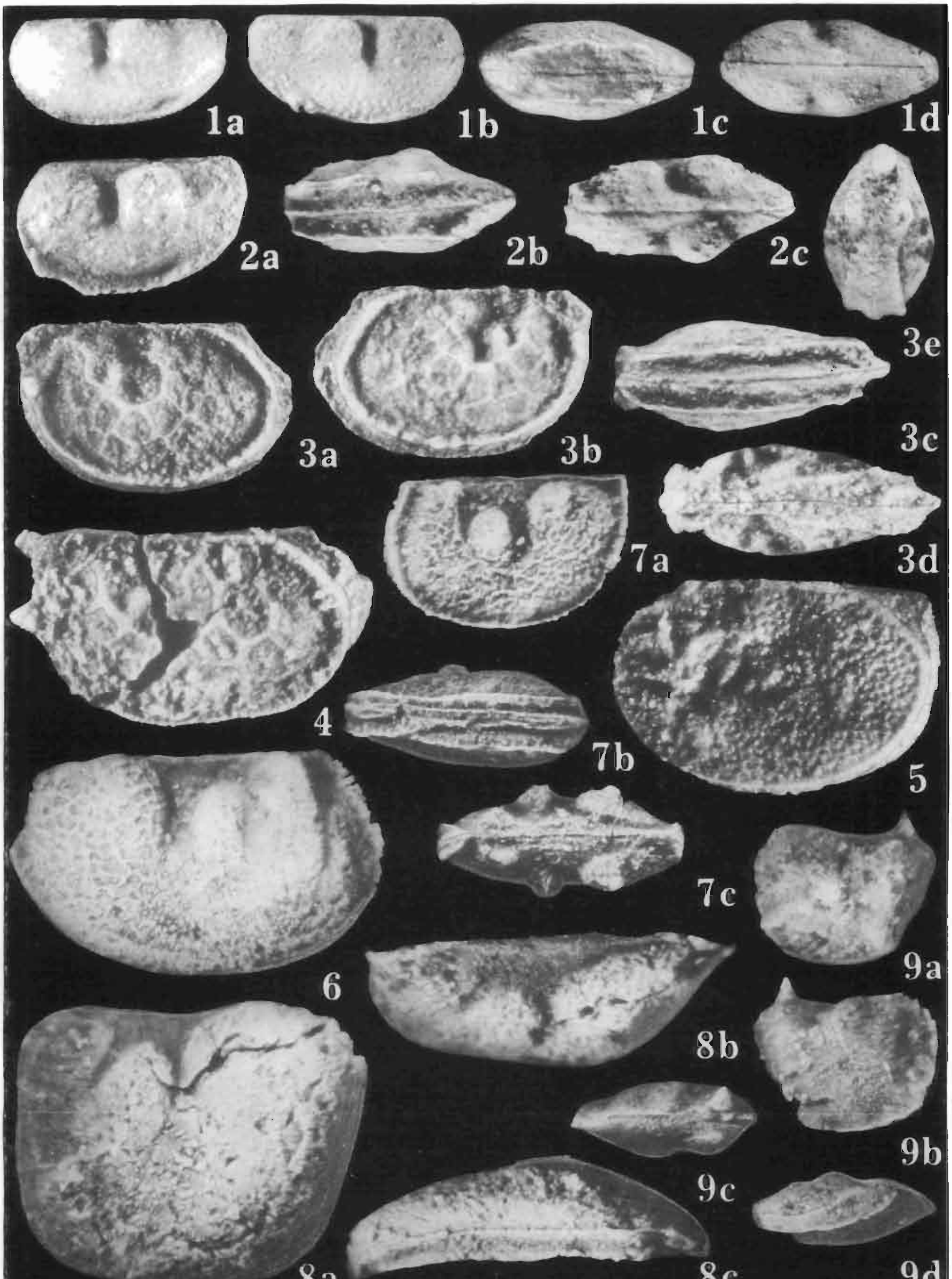
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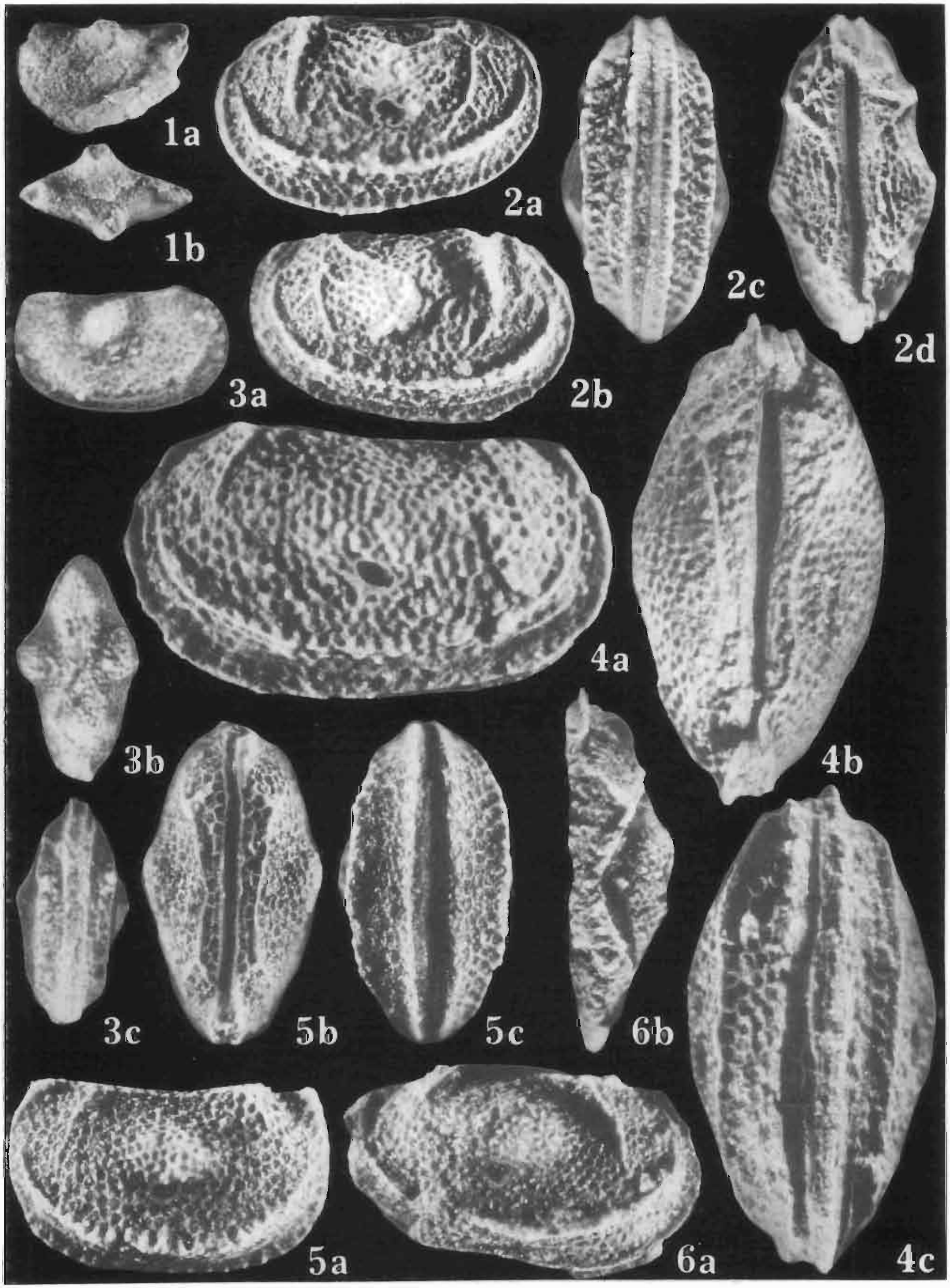
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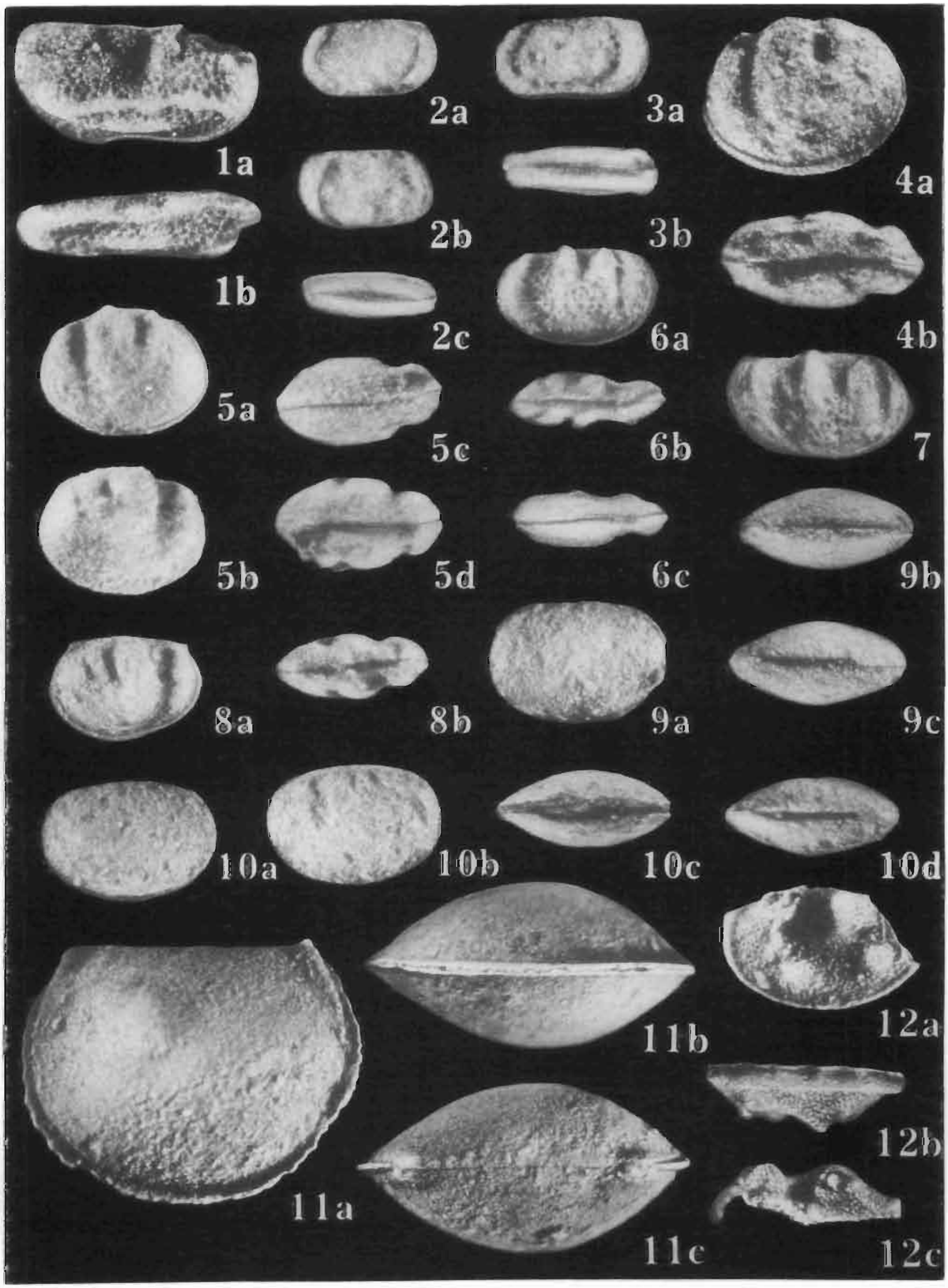
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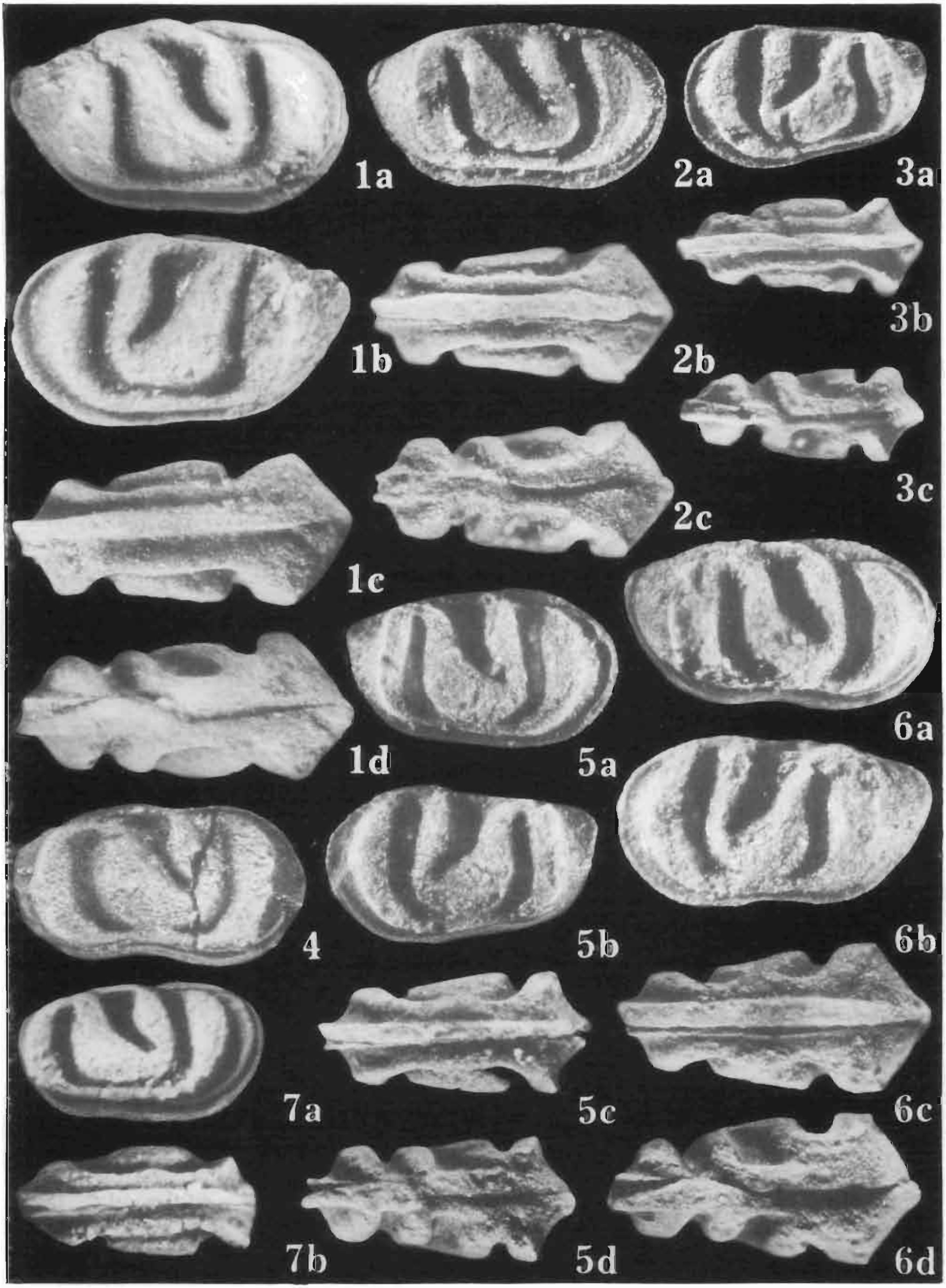
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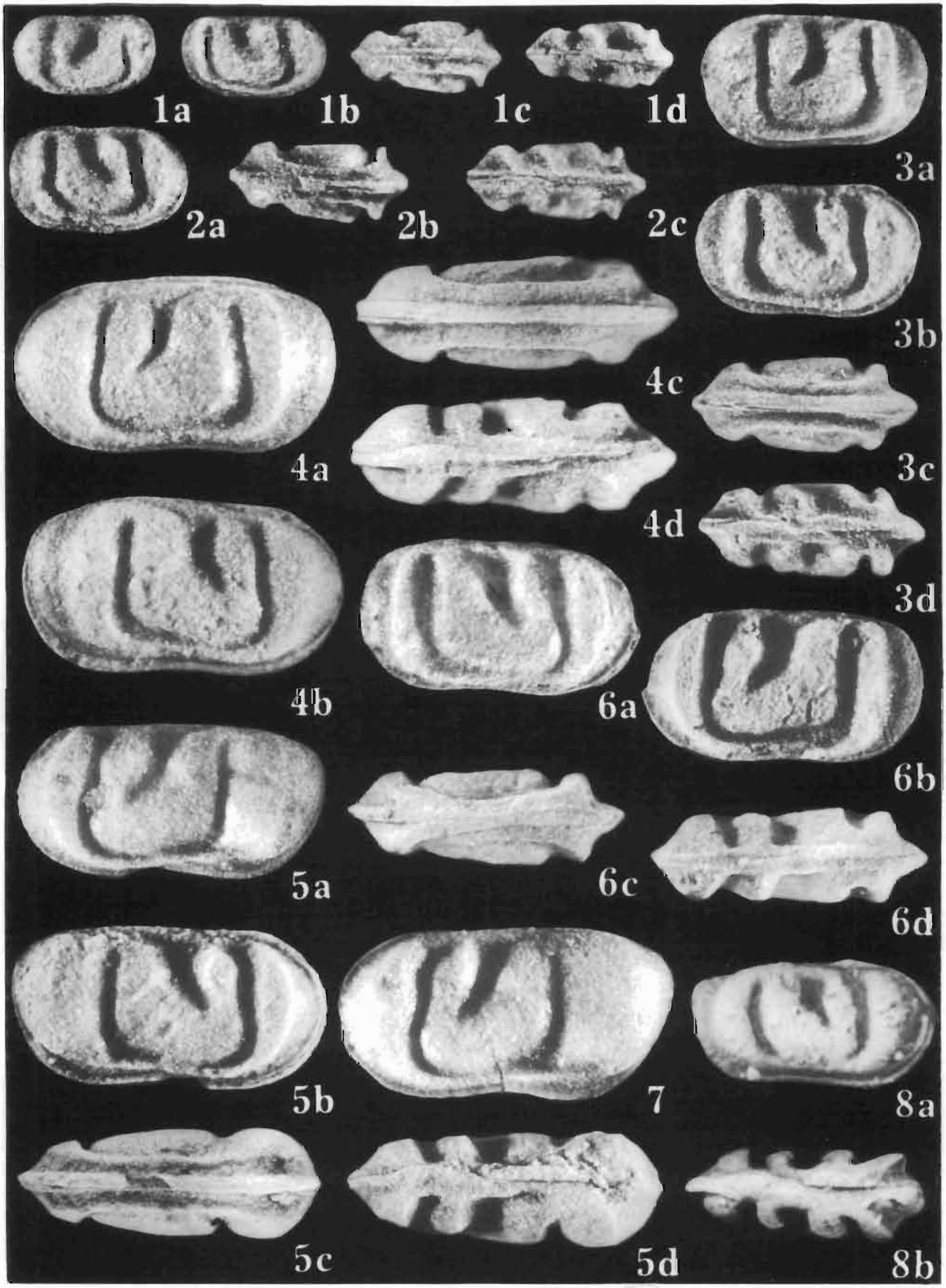
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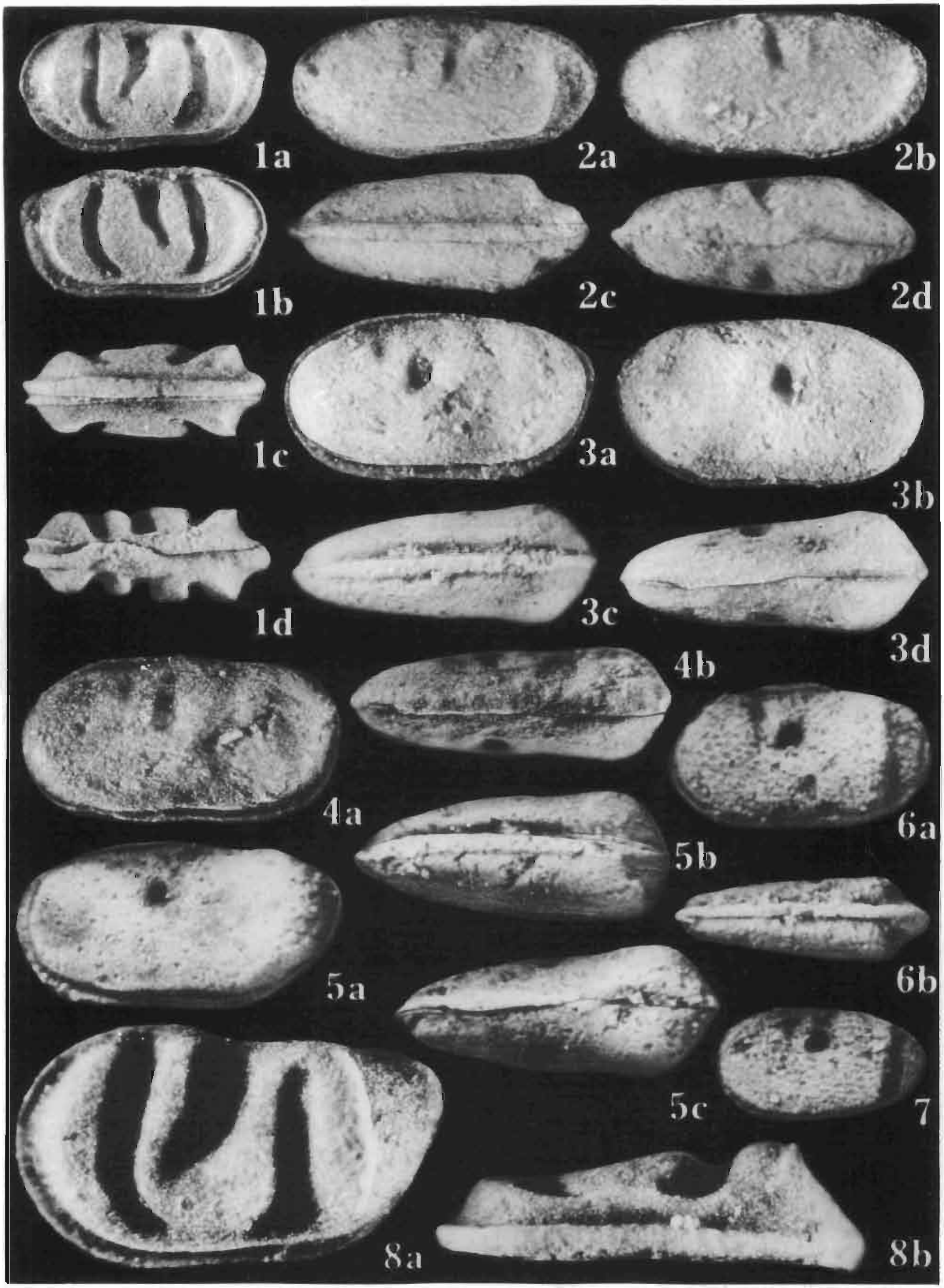
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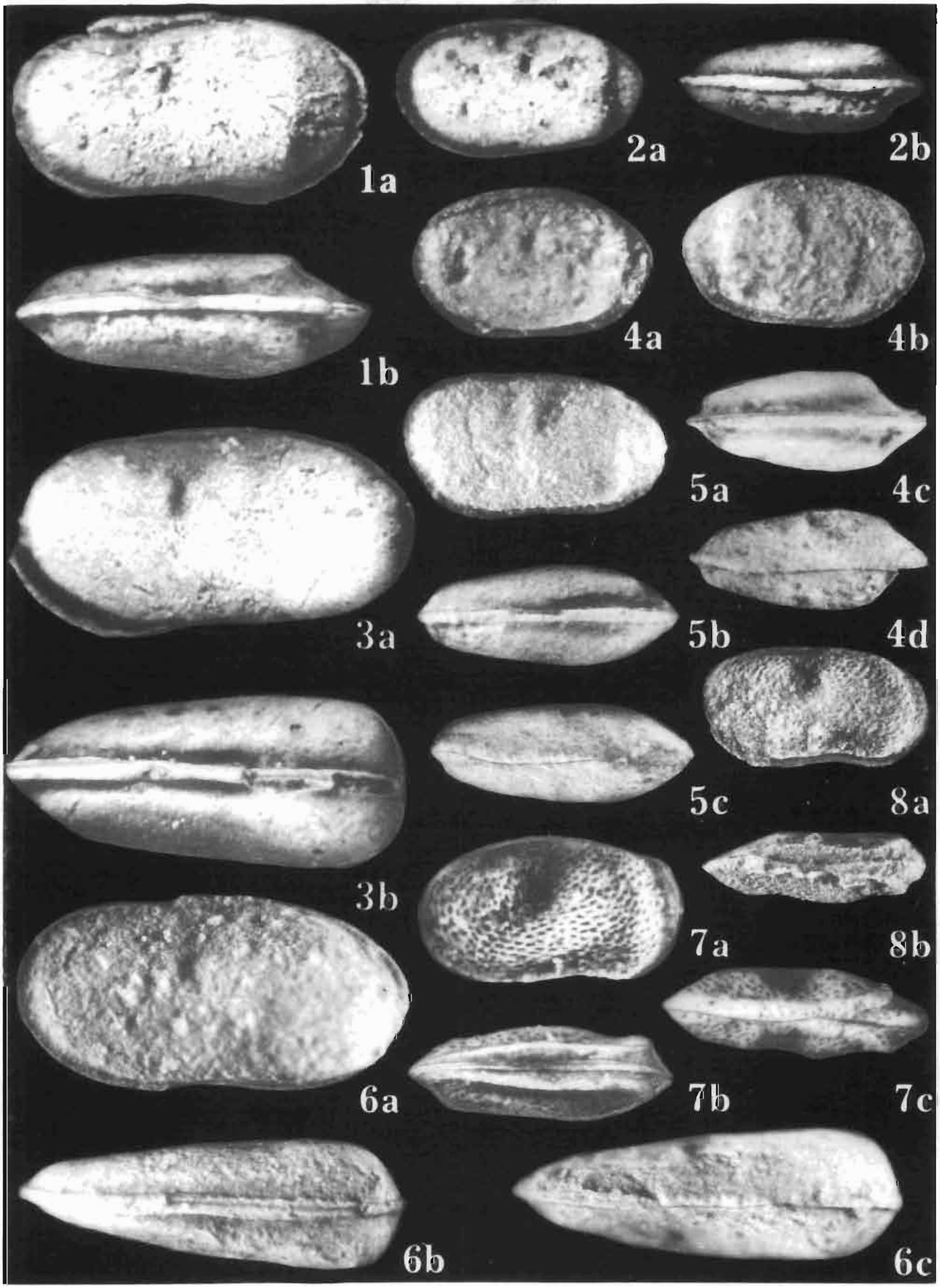
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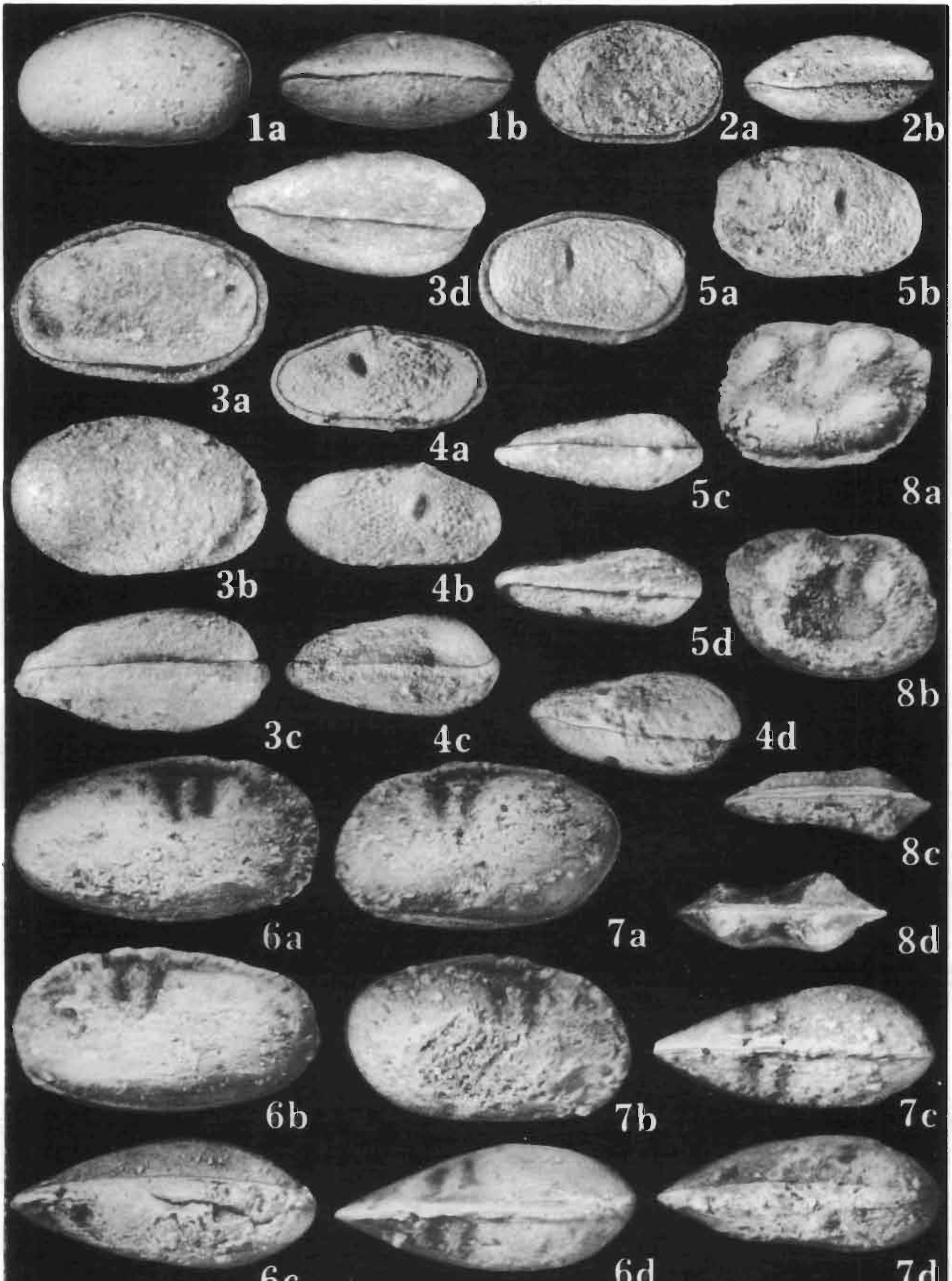
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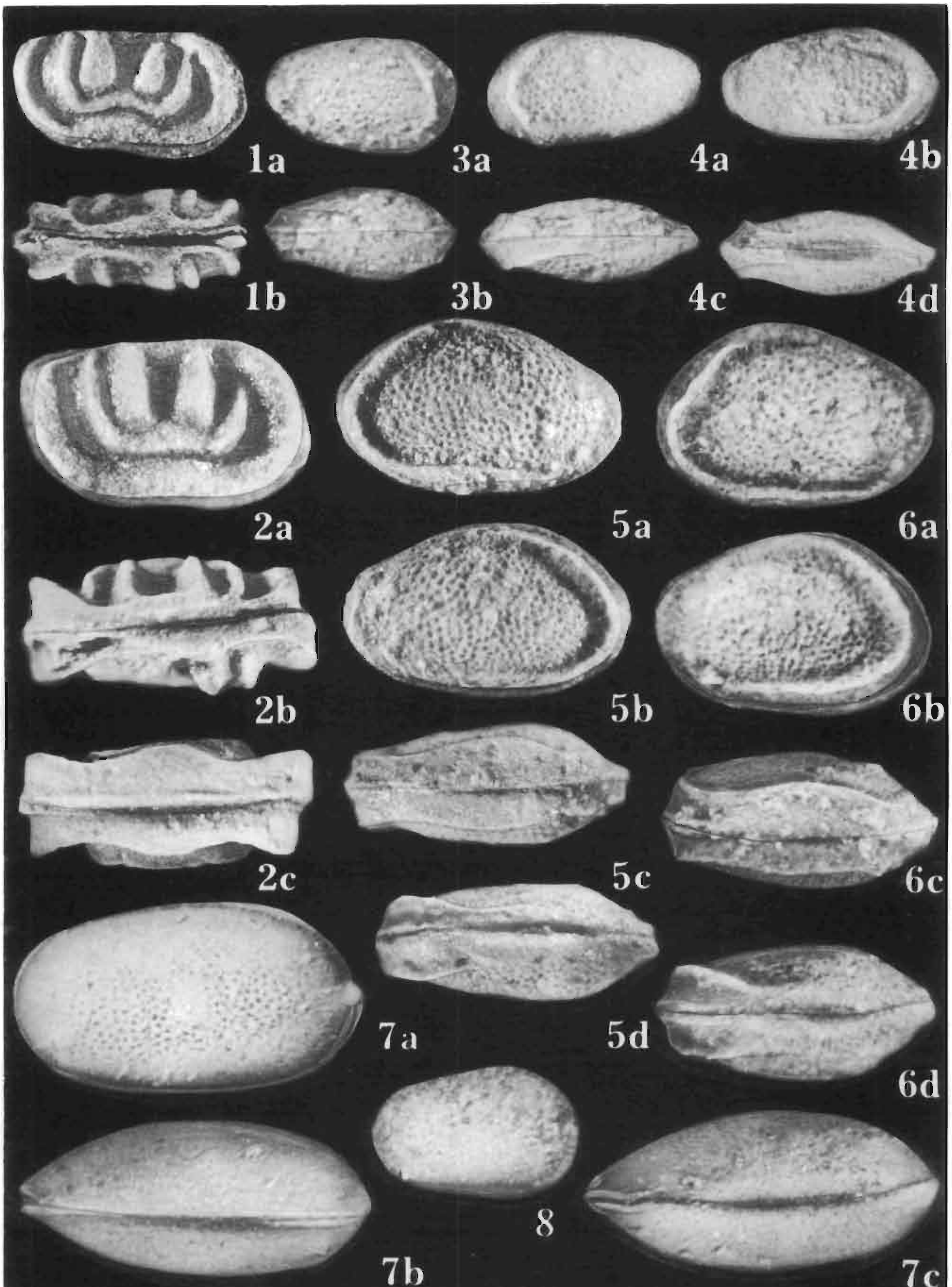
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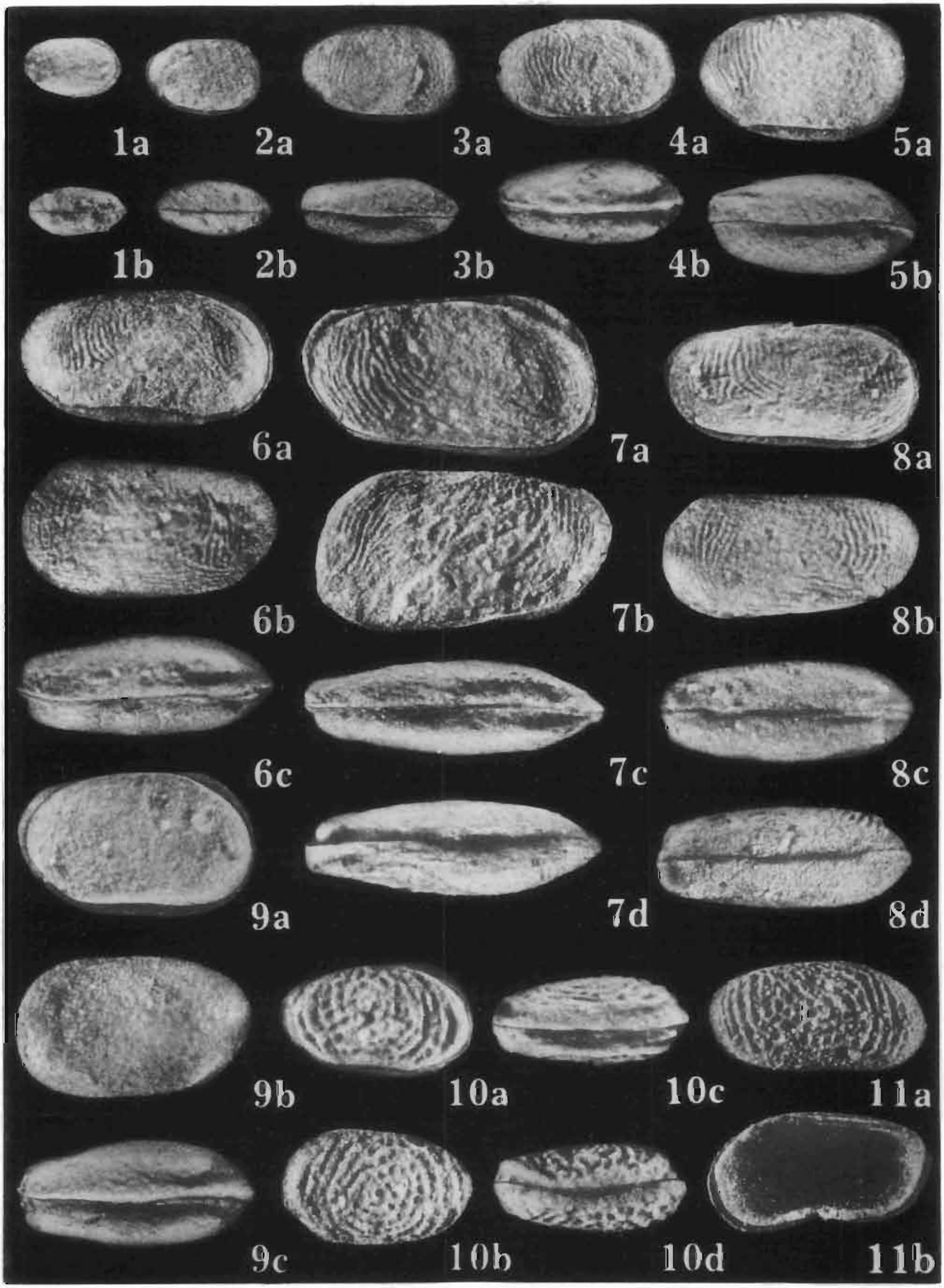
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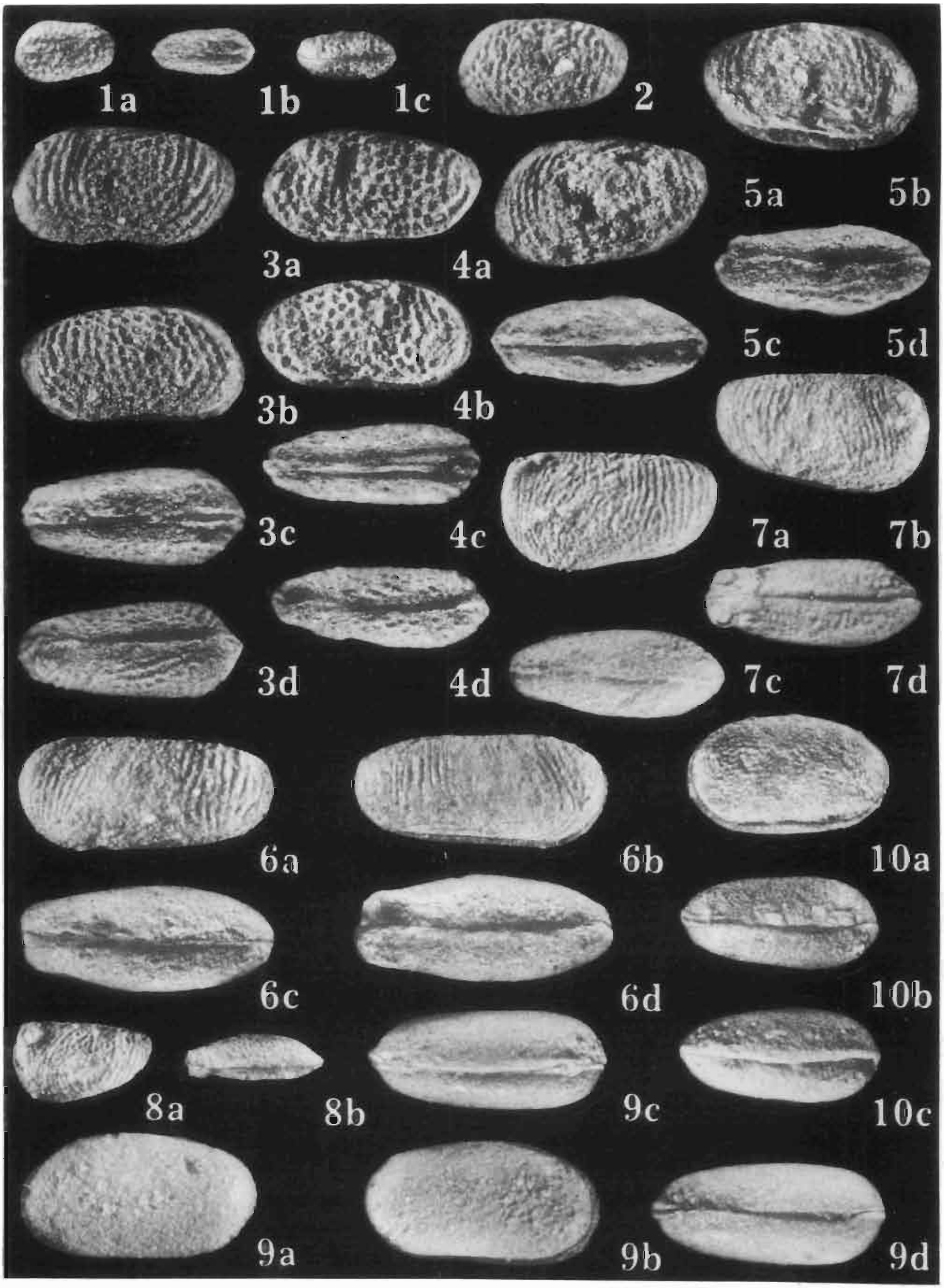
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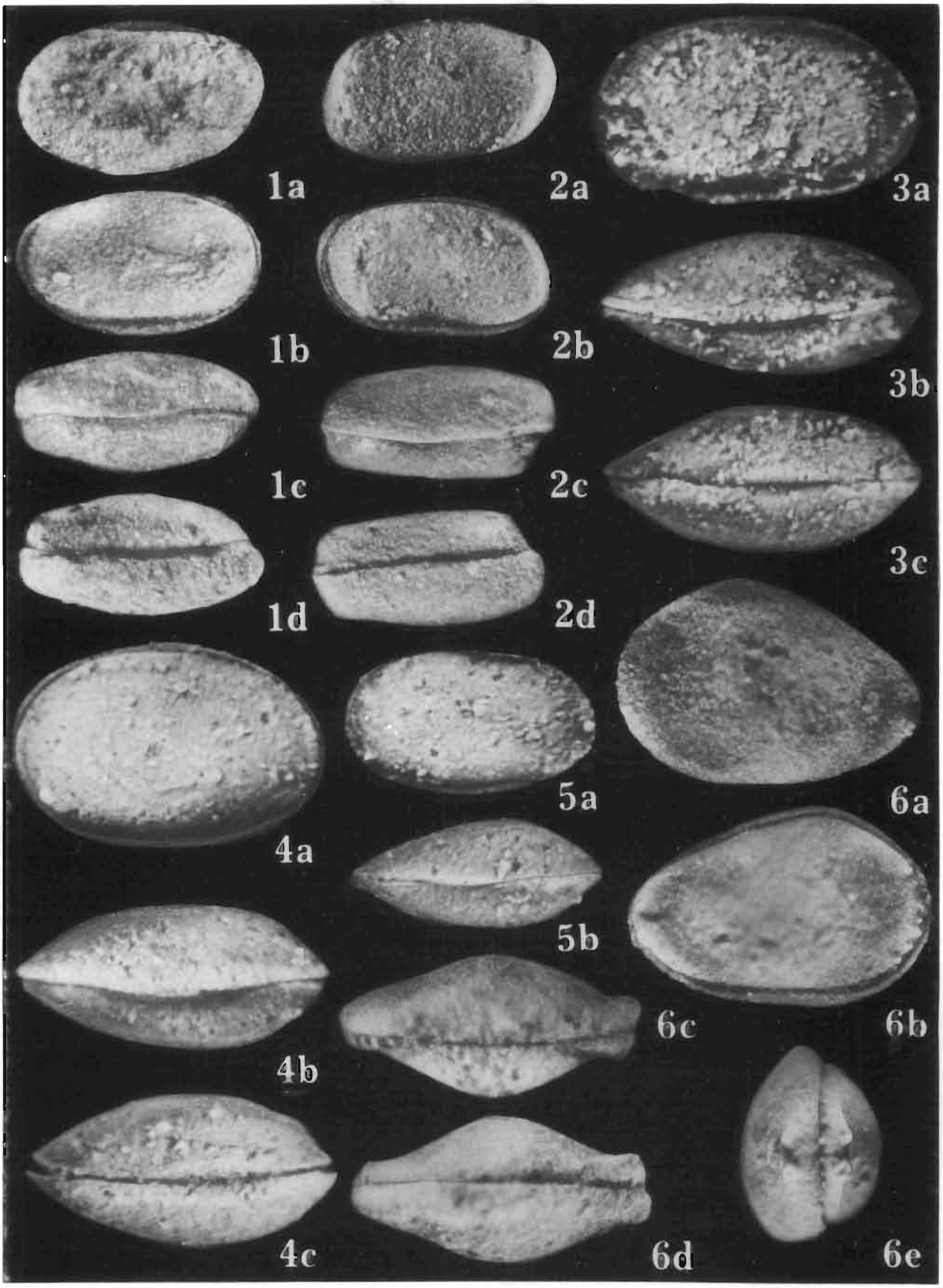
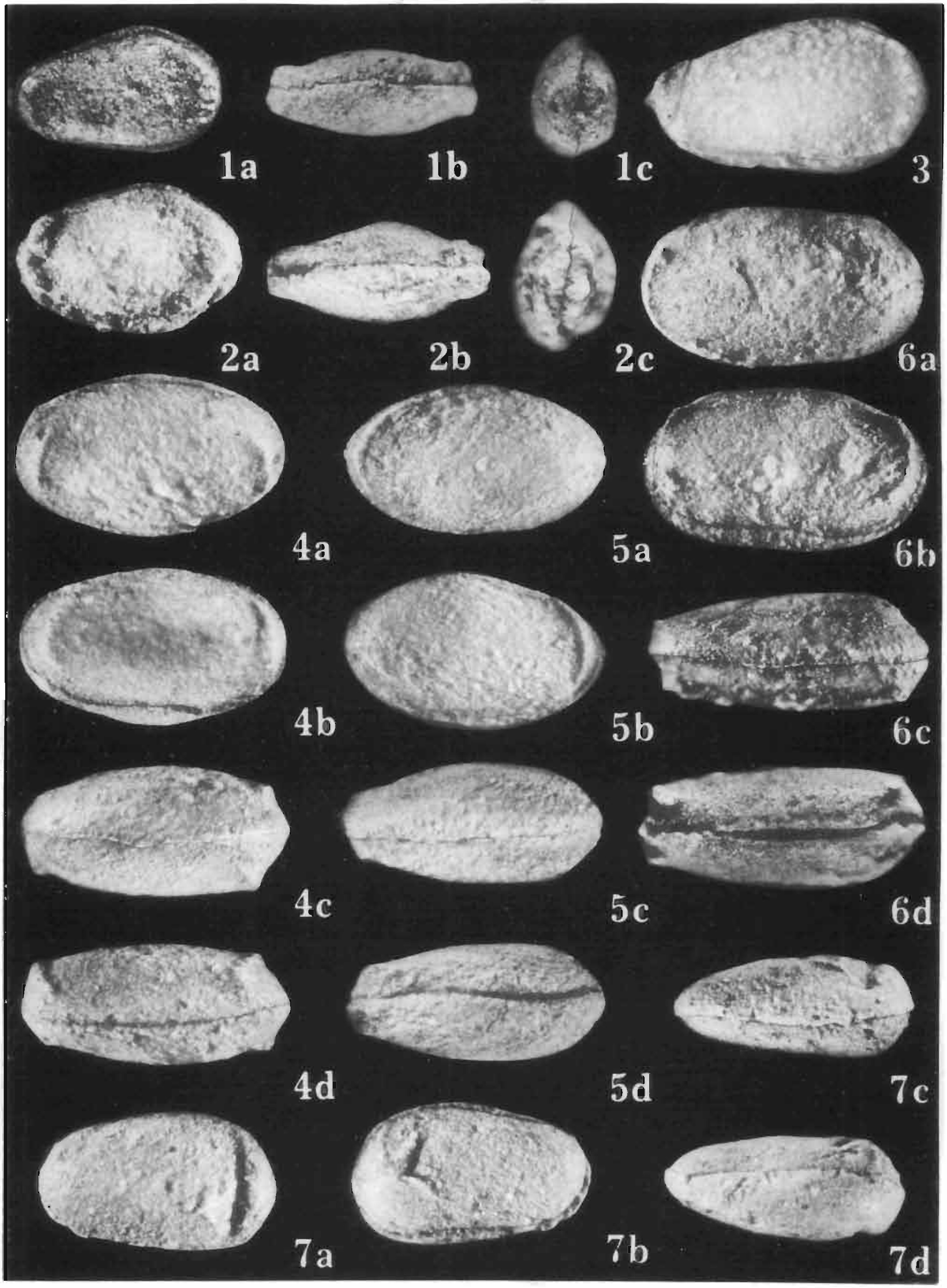


B. ŻBIKOWSKA: DEVONIAN OSTRACODS from NW POLAND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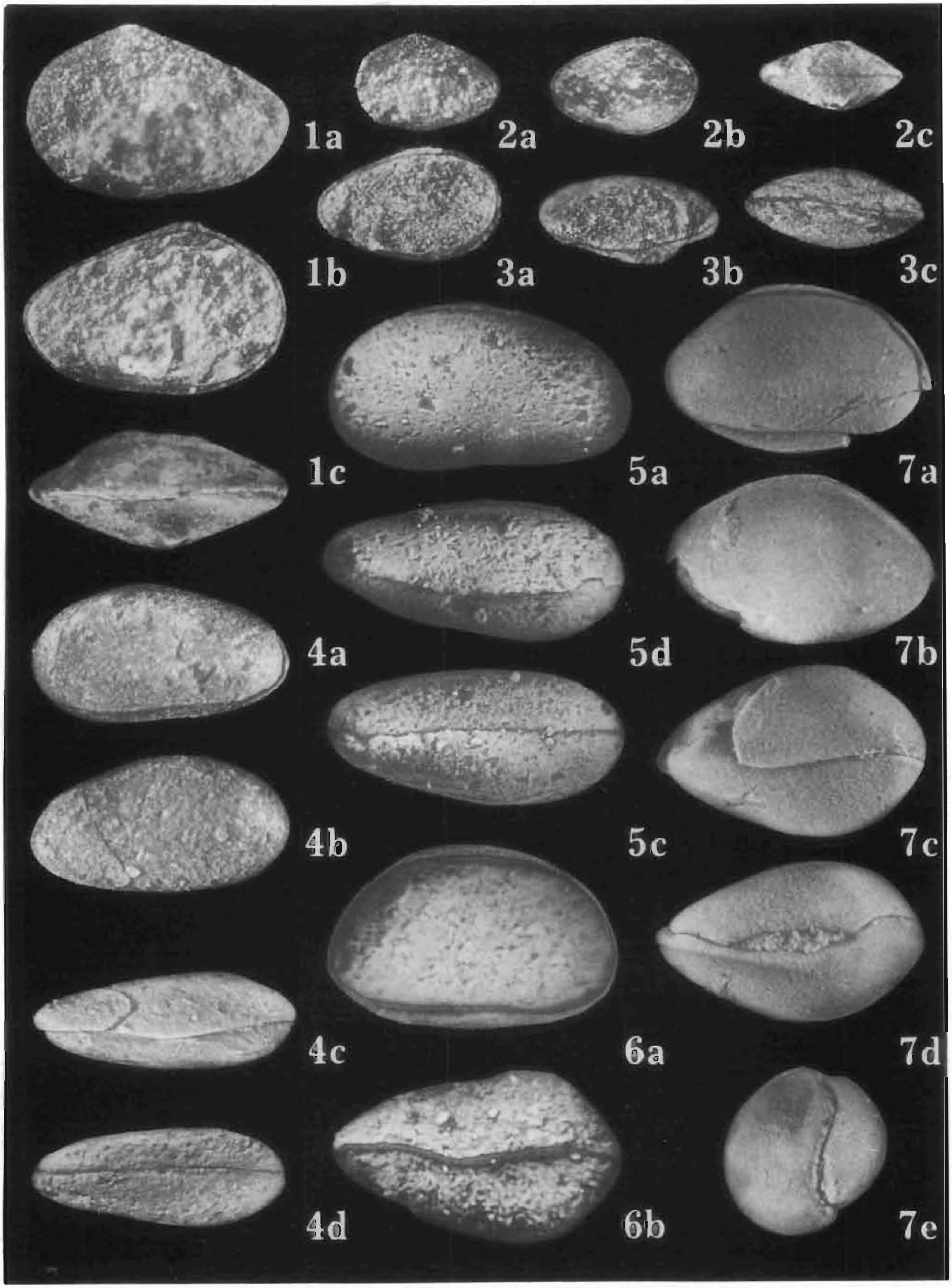
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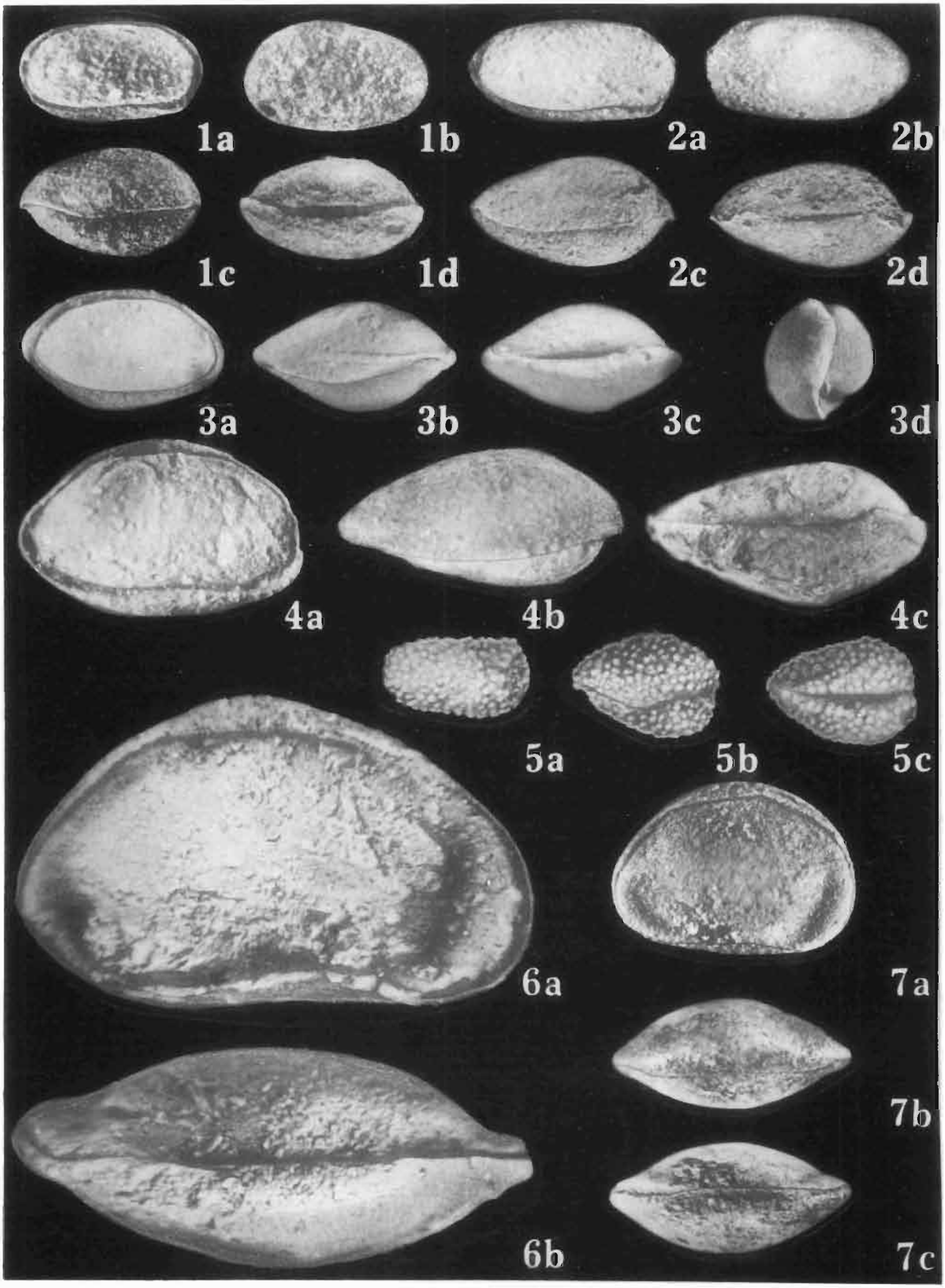
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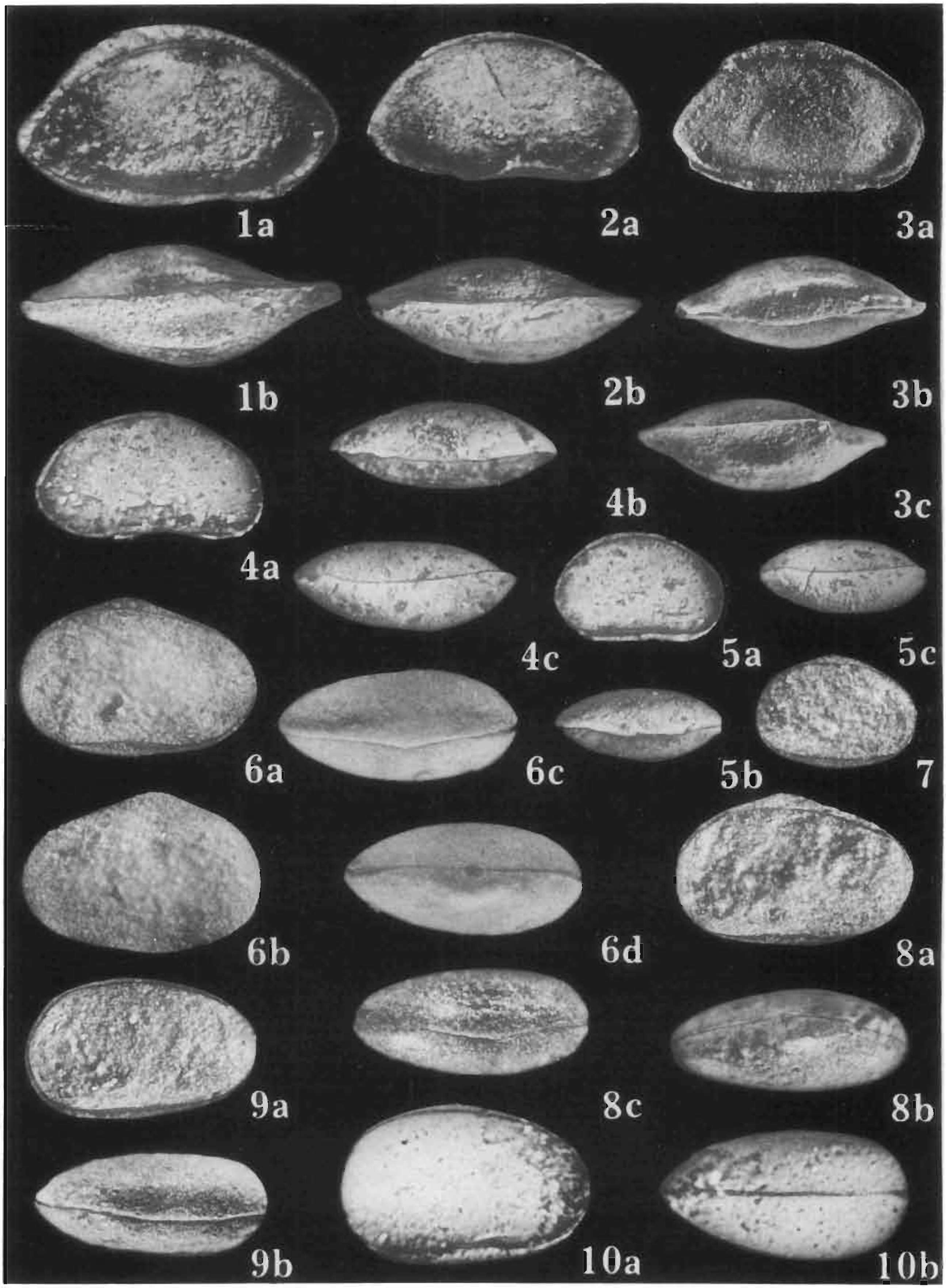
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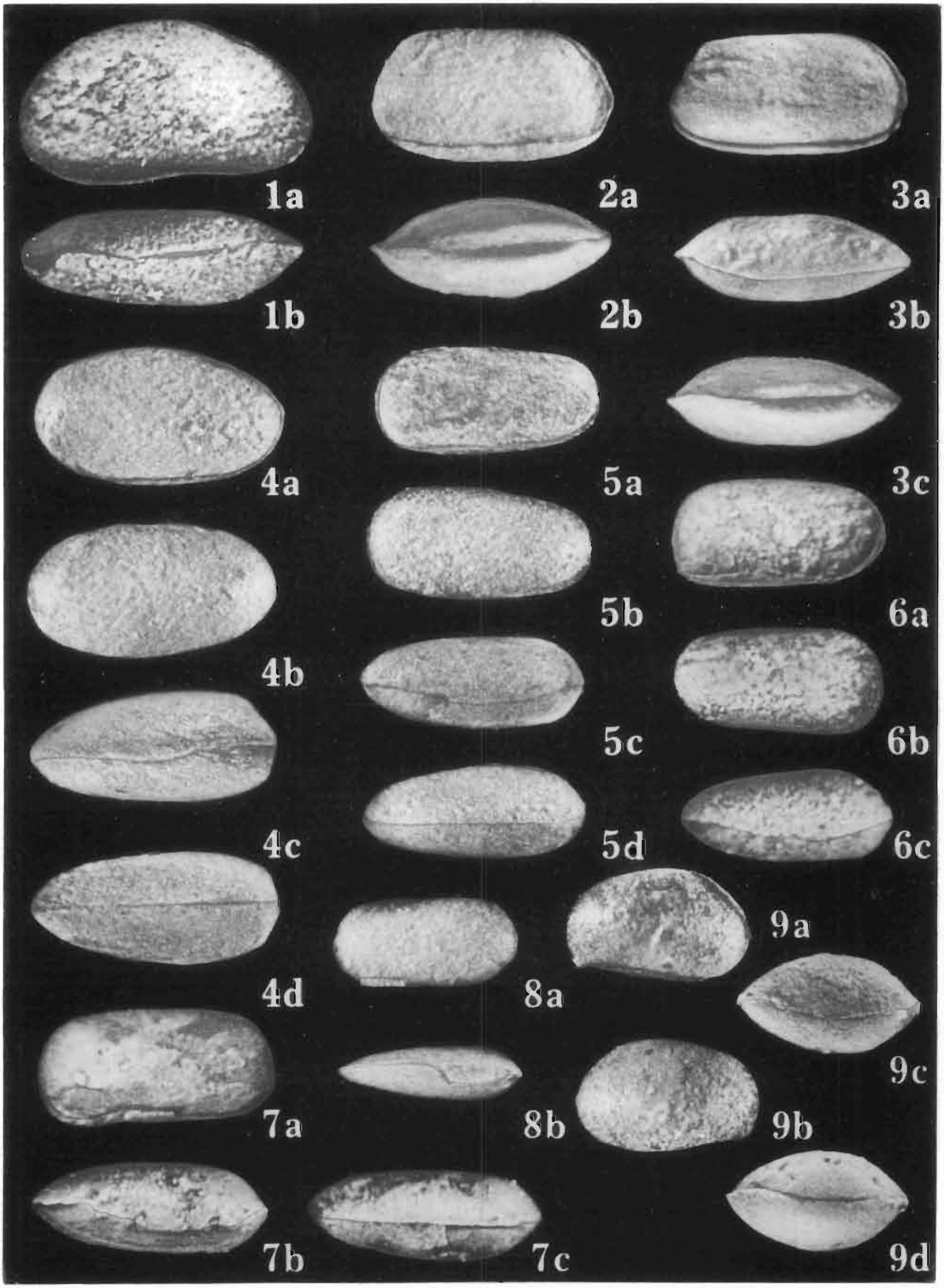
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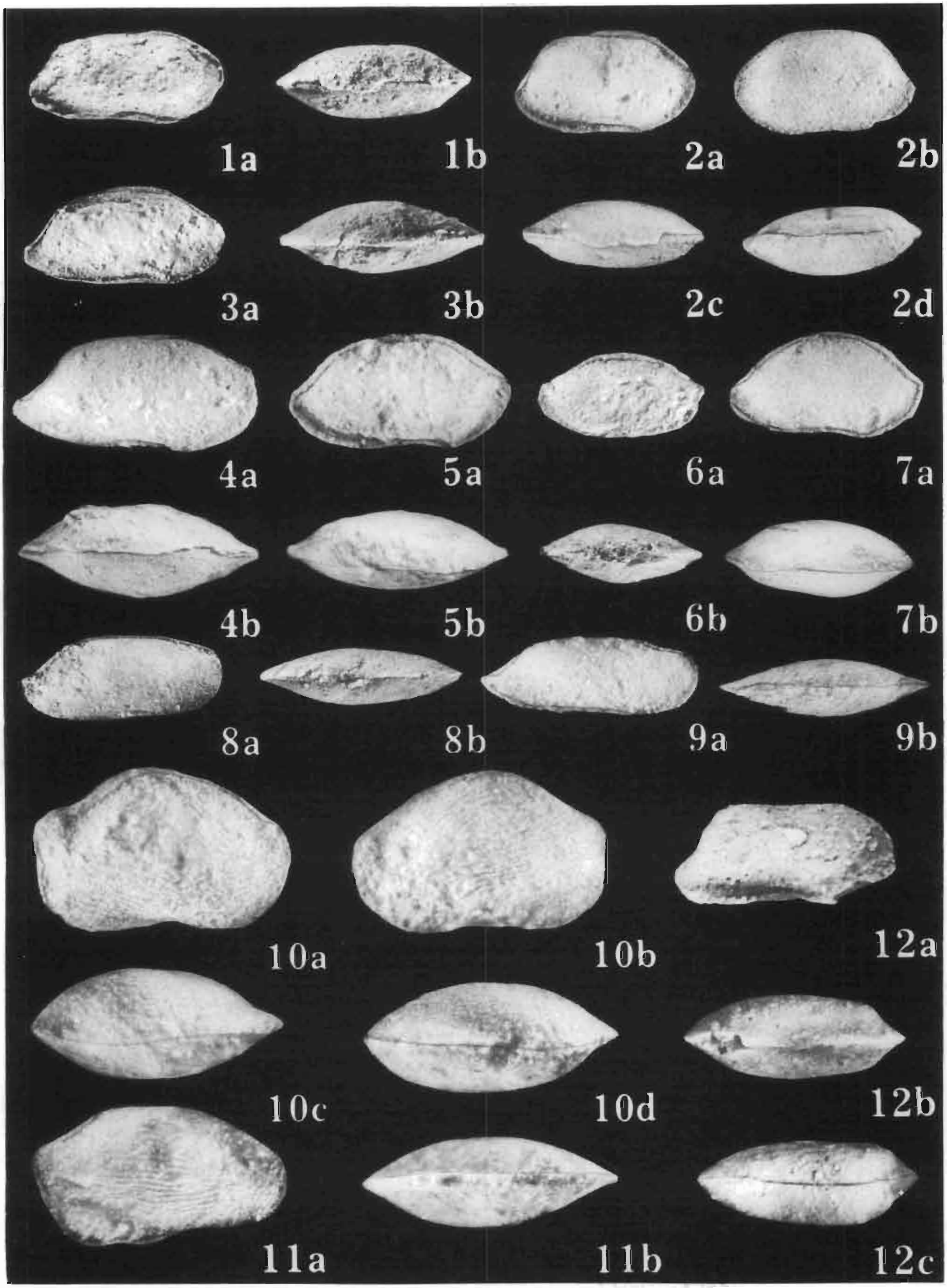
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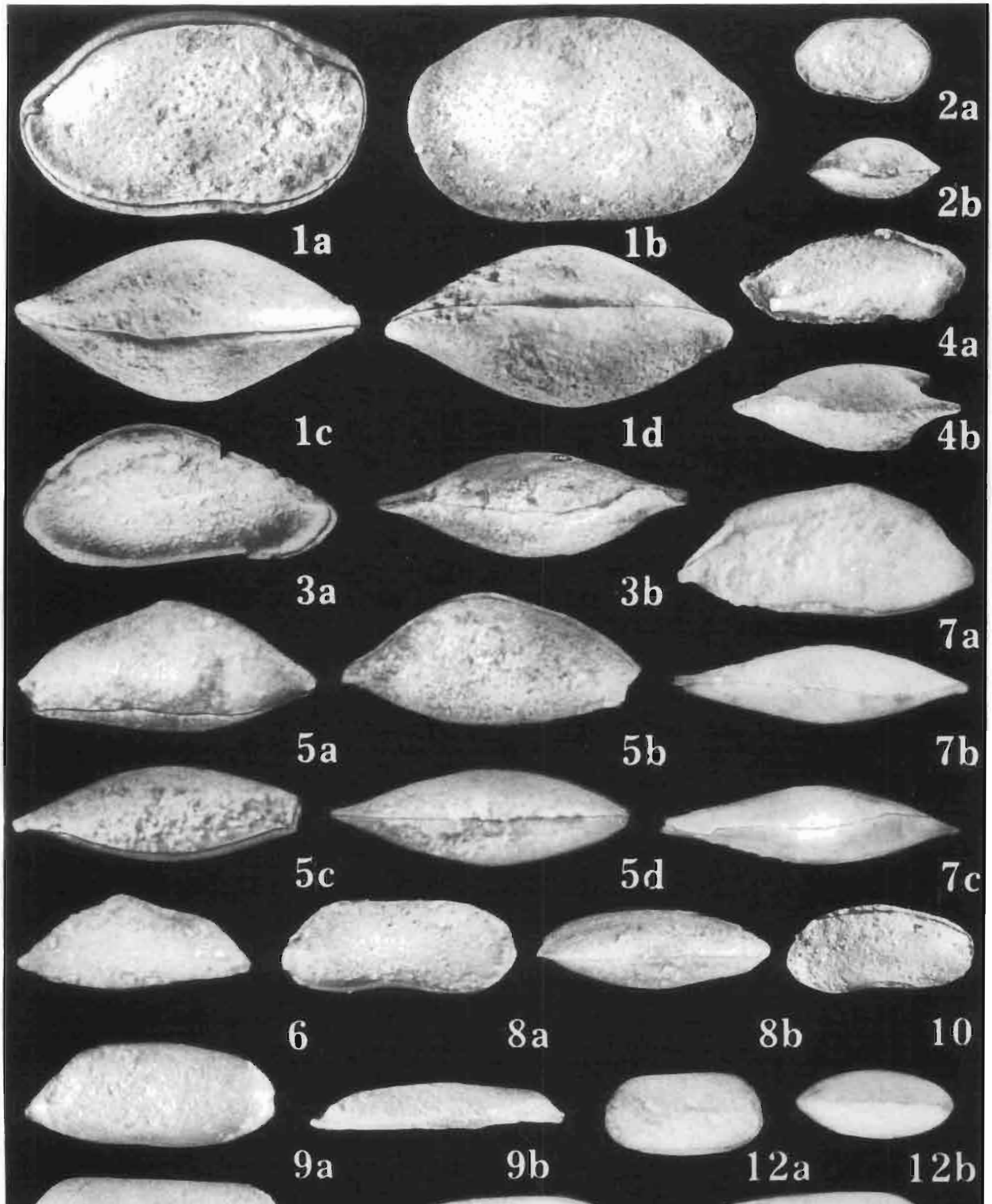
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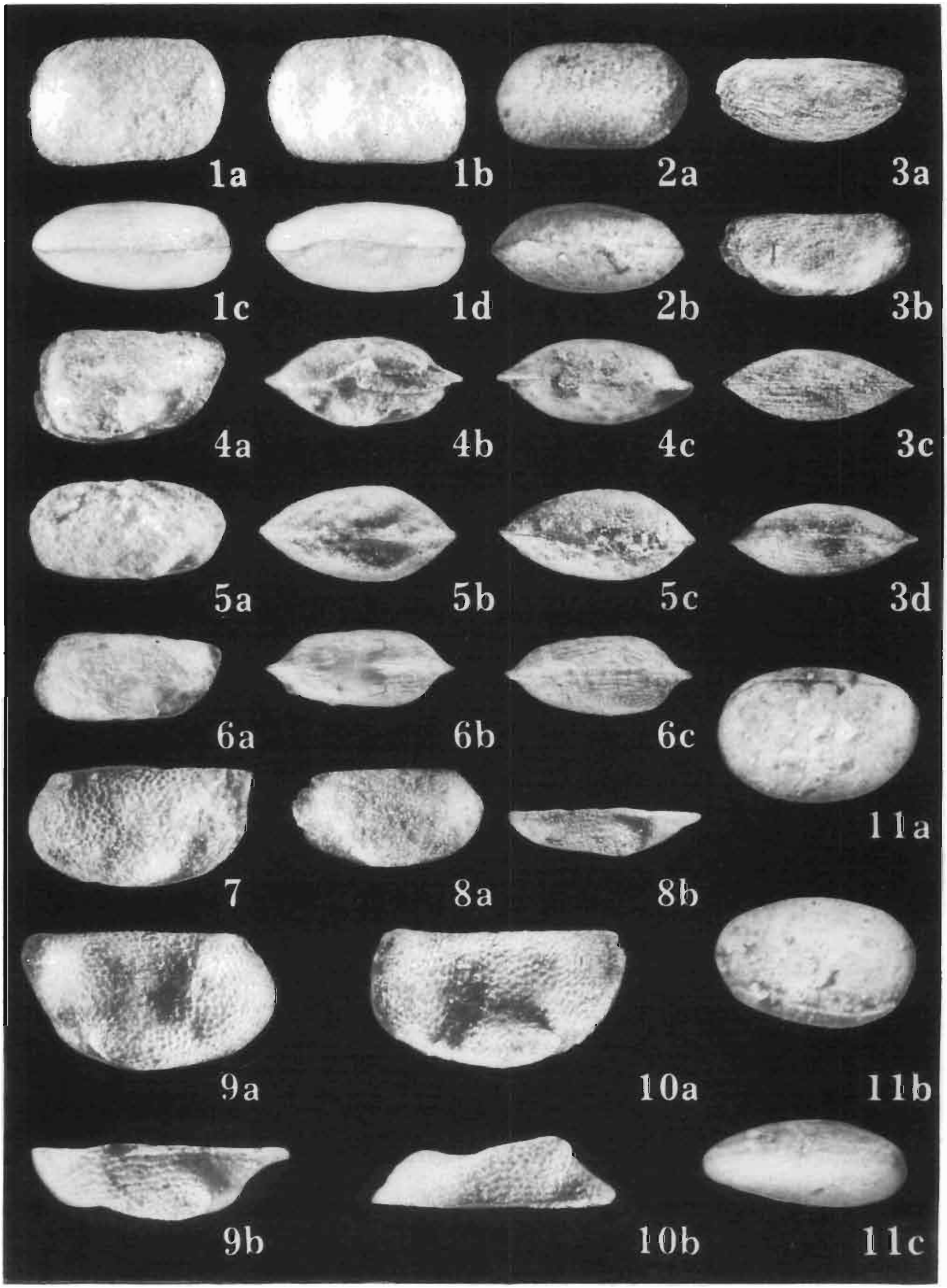
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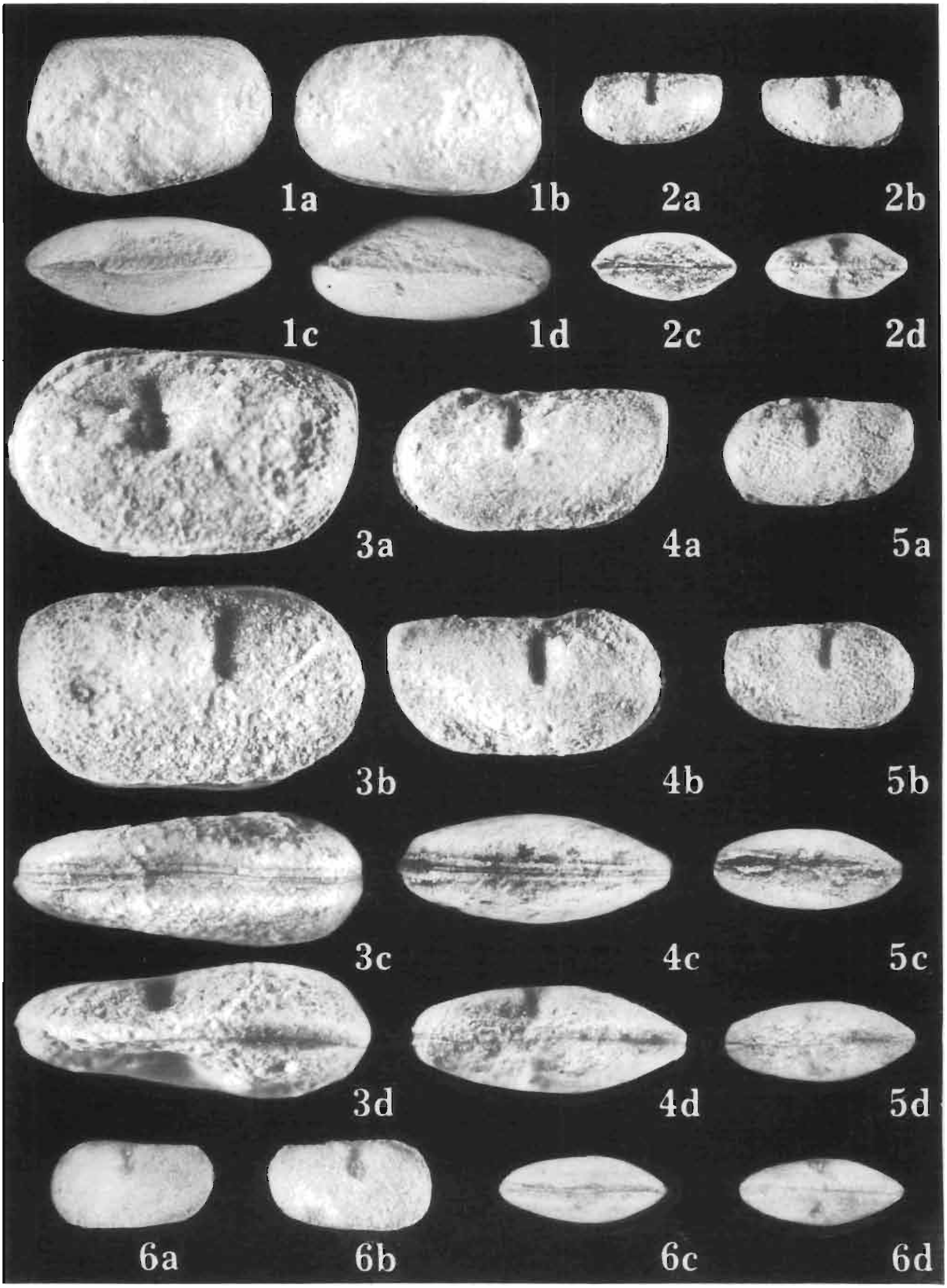
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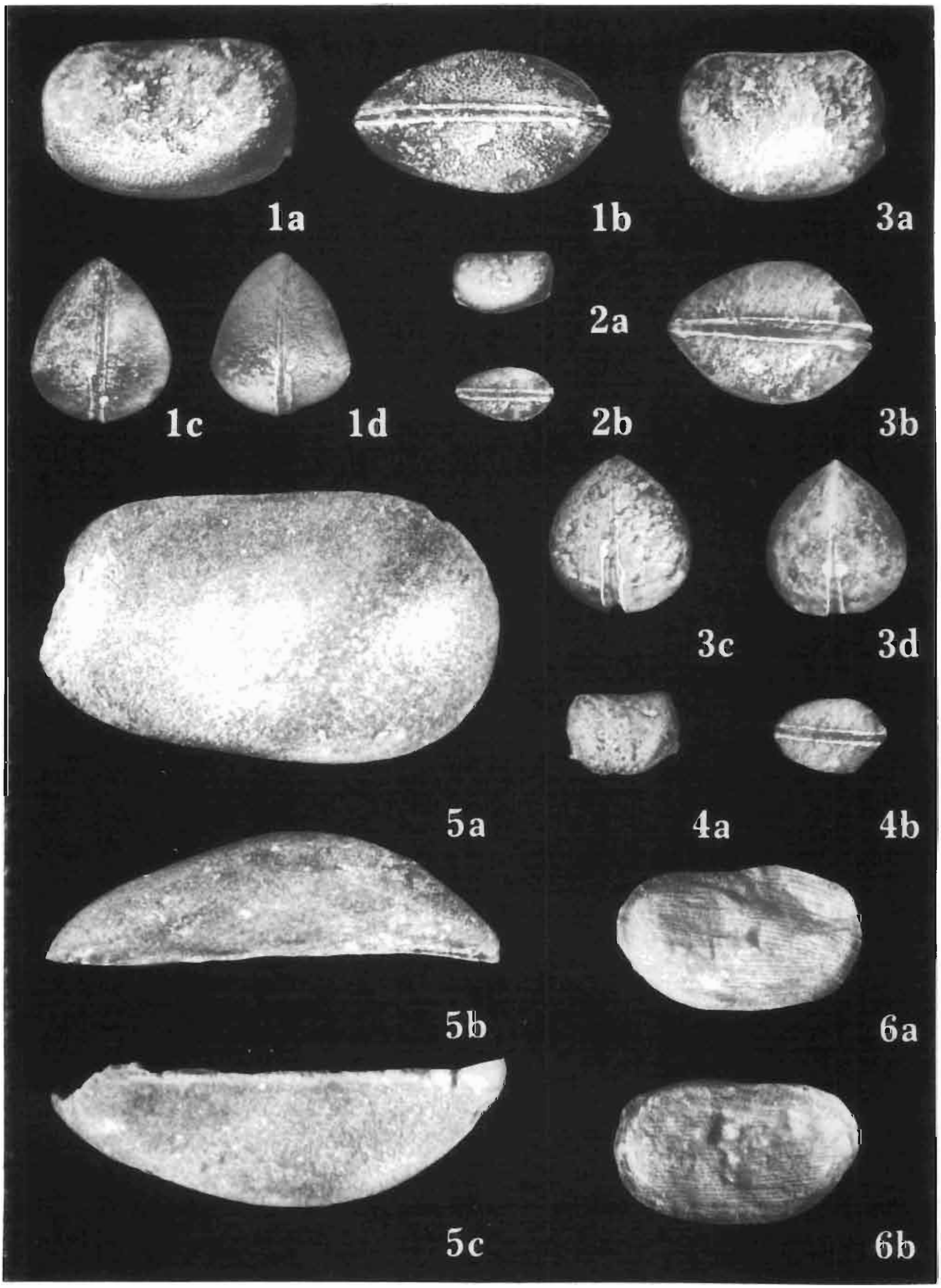
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ANDRZEJ GAŹDZICKI

FORAMINIFERS AND BIOSTRATIGRAPHY OF UPPER TRIASSIC AND LOWER JURASSIC OF THE SLOVAKIAN AND POLISH CARPATHIANS

(plates 27–41)

GAŹDZICKI A.,: Foraminifers and biostratigraphy of Upper Triassic and Lower Jurassic of the Slovakian and Polish Carpathians. Palaeontologia Polonica, 44:109–169. 1983.

Numerous benthonic foraminifer assemblages (comprising 104 species) were found in Upper Triassic-Lower Jurassic strata in the West Carpathians of Slovakia and Poland. A sequence of three foraminifer zones is recognized: *Triasina oberhauseri* Partial-range Zone (Norian), *Glomospirella friedli* and *Triasina hantkeni* Assemblage Zone (Rhaetian), and *Ophthalmidium leischneri* and *Ophthalmidium walfordi* Assemblage-Zone (Hettangian-?Sinemurian) — defining basal part of the Jurassic system in the Carpathians. This subdivision is correlated with standard ammonoid and conodont zonations. The studied foraminifer assemblages were related to lagoon areas and biostromal elevations in shelf zone with predominating carbonate sedimentation. Evolutionary trends in Involutinidae and Ammodiscidae in Late Triassic and Early Jurassic are analysed. In taxonomic composition and stratigraphic distribution the Triassic and Jurassic foraminifer assemblages of the West Carpathians do not differ from contemporaneous assemblages known from other parts of the Tethys Realm. The Lower Jurassic assemblage from West Carpathians displays some similarity to foraminifer assemblage known from epicontinental basin of north-western Europe.
Andrzej Gaździcki, Zakład Paleobiologii, Polska Akademia Nauk, Al. Żwirki i Wigury 93, 02-089 Warszawa, Poland. Received: August, 1980.
Key words: Foraminifers, Upper Triassic — Lower Jurassic, Biostratigraphy, West Carpathians.

Project no. 4
„Triassic of the Tethys Realm"

OTWORNICE I BIOSTRATYGRAFIA GÓRNEGO TRIASU I DOLNEJ JURY SŁOWACKICH I POLSKICH KARPAT

Streszczenie. — Opracowano zespoły otwornic bentonicznych z osadów górnego triasu i dolnej jury Karpat Słowackich i Polskich obejmujące 104 gatunki. W zbadanej sekwencji osadów wyróżniono trzy poziomy otwornicowe: poziom ścieśniony *Triasina oberhauseri* (noryk), poziom zespołowy *Glomospirella friedli* i *Triasina hantkeni* (retyk) oraz poziom zespołowy *Ophthalmidium leischneri* i *Ophthalmidium walfordi* (hetang — ?synemur) definiujący podstawę systemu jurajskiego w Karpatach. Poziomy otwornicowe skorelowano ze standardowymi poziomami głowonogowymi i konodontowymi. Wykazano, że zbadane otwornice związane były z szelfowymi lagunami i biostromalnymi elewacjami o dominującej sedymentacji węglanowej. Rozważono charakter ewolucyjnych zmian w obrębie górnotriasowych i dolnojurajskich Involutinidae i Ammodiscidae. Stwierdzono, że zespoły otwornic z Karpat Zachodnich nie różnią się pod względem składu taksonomicznego i rozprzestrzenienia stratygraficznego

od równowiekowych zespołów z innych rejonów Tetydy. Ponadto zespół dolnojurajski z Karpat Zachodnich wykazuje pewne podobieństwo do równowiekowego zespołu z epikontynentalnego basenu północno-zachodniej Europy.

Praca była finansowana przez Polską Akademię Nauk w ramach problemu MR II-3.

CONTENTS

INTRODUCTION

Marine Upper Triassic and Lower Jurassic strata exposed in the West Carpathians of Slovakia and Poland contain numerous biostratigraphically significant benthonic foraminifers. The 33 representative sections of the investigated strata in the Tatricum, Fatricum, Hronicum and Silicicum have been measured and sampled in order to establish a vertical dis-

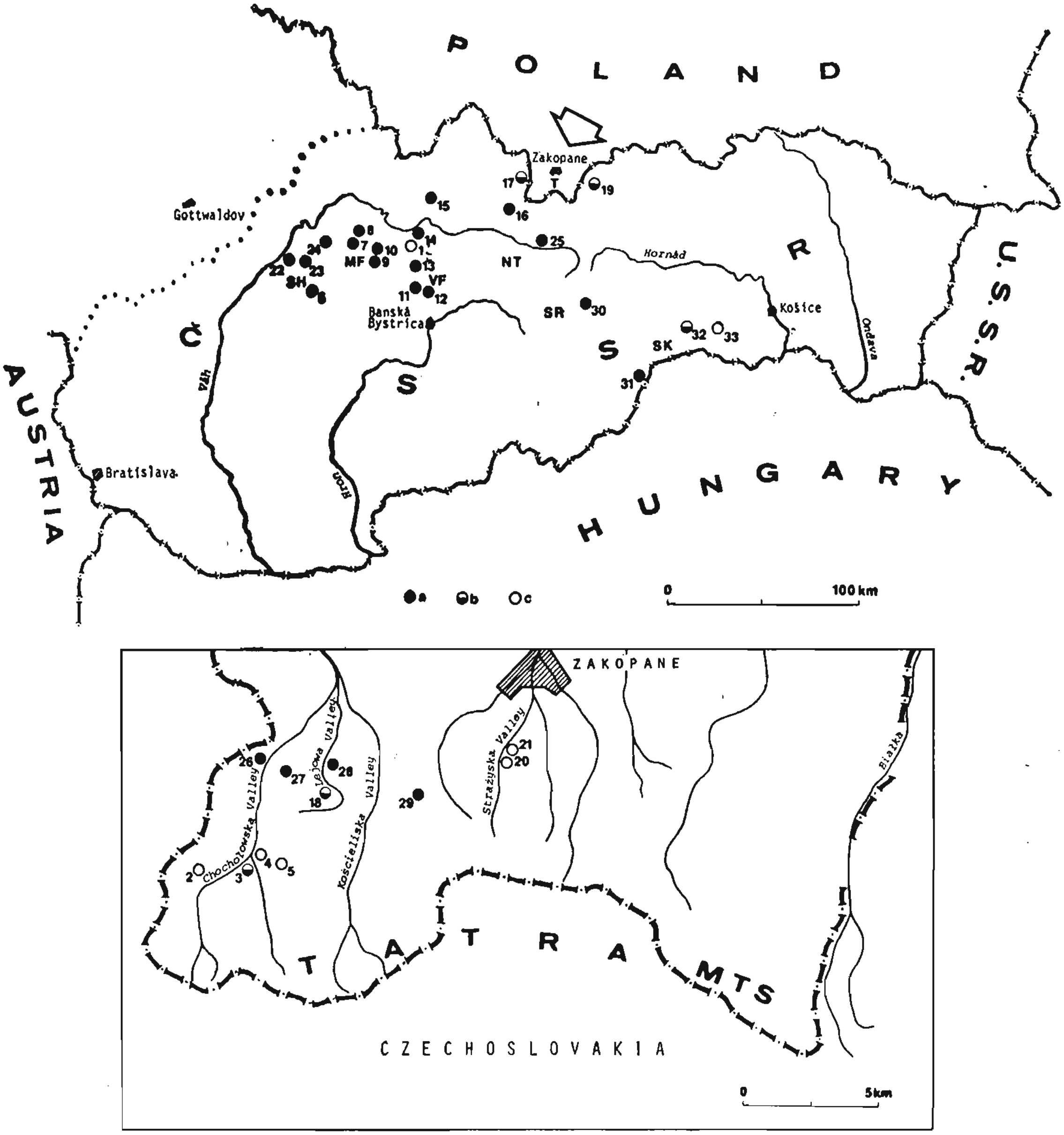

Fig. 1

Locality maps of the Upper Triassic and Lower Jurassic sections in the West Carpathians of Slovakia and Poland sampled for foraminifers (arrow indicates the Tatra Mts. region shown in detail below the main location map). — 1–5 — Tatricum: *1* Rúbaň Skala, *2* Bobrowiec Mt., *3* Kopieniec Staroroboсiański Mt., *4* Dudziniec Mt., *5* Kobyla Głowa Crag; 6–21— Fatricum, *6* Hireška, *7* Lesnianska Valley, *8* Široka Valley, *9* Suchá Valley, *10* Slovianska Valley, *11* Dedošova Valley, *12* Križna Valley, *13* Belianska Valley, *14* Ráztoky, *15* Zázrivská Valley, *16* Bobrovček-Hrádky, *17* Velká Furkaska Mt., *18* Lejowa Valley I, *19* Štefanský žlab, *20* Strążyska Valley I, *21* Strążyska Valley II; 22–29 — Hronicum: *22* Norovica Mt., *23* Rovnianska Valley, *24* Tŕstie, *25* Hybe, *26* Chochołowska Valley, *27* Wielka Sucha Valley, *28* Lejowa Valley II, *29* Przysłop Miętusi; 30–33 — Silicicum: *30* Skalka, *31* Malý Mlynský vrch Mt., *32* Bleskový prameň, *33* Miglinc. SH — Strážovská hornatina Mts., MF — Malá Fatra Mts., VF — Velká Fatra Mts., NT — Nizke Tatry Mts., T — Tatra Mts., SR — Slovenské rudohorie Mts., SK — Slovenský kras

a — profiles enclosing Upper Triassic deposits, *b* — profiles enclosing Upper Triassic and Lower Jurassic deposits, *c* — profiles enclosing Lower Jurassic deposits.

tribution of the foraminifers and associated biota (fig. 1). About 1,100 thin sections have been prepared, over 800 of which contained foraminifers. One hundred and four benthonic foraminifer species have been found in the investigated sequence. Of these, 79 are calcareous forms and 25 are agglutinated. Foraminifers are fairly common in the deposits of the Norovica and Fatra Formations (uppermost Triassic) and lower and upper limestones of Kopieniec Formation (Lower Lias).

The stratigraphic position of the Upper Triassic strata from the West Carpathians was determined by conodont studies (MOCK 1971, 1975; KOZUR and MOCK 1974*a*; GAŹDZICKI 1978*a*, *b*; GAŹDZICKI *et al.* 1978, 1979*a*). This made possible the determination of the age of foraminifer-bearing samples and correlation of stratigraphic ranges of foraminifers in West Carpathians and other regions of the Tethys Realm.

Occurrence of foraminifers in the Upper Triassic and Lower Jurassic strata was reported from the Slovakian Carpathians by MIŠIK (1961, 1964, 1966), SALAJ and JENDREJÁKOVÁ (1967), SALAJ *et al.* (1967), SALAJ (1969*a*, *b*; 1977*a*, *b*; 1978), JENDREJÁKOVÁ (1970, 1972), MIŠIK and BORZA (1976), GAŹDZICKI *et al.* (1978, 1979*a*, *b*), MICHALIK and JENDREJÁKOVÁ (1978), MICHALÍK *et al.* (1979), and from the Polish Tatra Mts by SAXL (*in* GOETEL 1917), GAŹDZICKI (1970, 1974, 1975, 1977), GAŹDZICKI and ZAWIDZKA (1973), and GAŹDZICKI and MICHALÍK (1980).

The investigated foraminifer collections (thin sections) are housed in: Institute of Paleobiology of the Polish Academy of Sciences, Warszawa; Institute of Geology of the Slovak Academy of Sciences, Bratislava; Department of Geology and Paleontology of the Faculty of Natural Sciences J. A. Comenius University, Bratislava; and Institute of Geology of the Warsaw University, Warszawa.

ACKNOWLEDGEMENTS

Warm thanks are due to my Slovak colleagues, Dr. J. MICHALÍK, Dr. R. MOCK, and Dr. M. SÝKORA (all from Bratislava) for making available significant materials for studies, cooperation in field work, as well as for fruitful discussions and help. Thanks are also due to Dr. O. JENDREJÁKOVÁ and Dr. J. SALAJ (Bratislava), Prof. E. VÉGH-NEUBRANDT (Budapest), Dr. J. HOHENEGGER and Dr. W. PILLER (Wien), Dr. G. K. MELNIKOVA (Dushanbe) and Dr. S. K. SKWARKO (Canberra) for making available comparative materials from the Carpathians, Bakony and Gerecse Mts., Alps, Pamir Mts. and New Guinea and for valuable comments. I am grateful to Prof. O. PAZDRO, Prof. A. RADWAŃSKI, Dr. J. TRAMMER and K. WÓJCIK M. Sc. (all from Warsaw) for valuable suggestions during completion of this paper. Gratitude is expressed to Dr. G. D. STANLEY Jr. (Washington) for final review that led to the improvement of the text. Thanks are also extended to the following persons from the technical staff of the Institute of Paleobiology, Polish Academy of Sciences in Warsaw: Miss E. GUTKOWSKA for text-figures and to Mrs M. NOWIŃSKA for thin sections. Photographs were taken by S. WOŹNIAK (pls 1–4), and by the author. Separate thanks are extended to the Management of the Tatra National Park at Zakopane for permission to carry out fieldworks in the Tatra Mts.

Abbreviations used:

GUSAV — Institute of Geology, Slovak Academy of Sciences, Bratislava
IGP — Institute of Geology, University of Warsaw, Warsaw
PFUK — Department of Geology and Paleontology, J. A. Comenius University, Bratislava
ZPAL — Institute of Paleobiology, Polish Academy of Sciences, Warsaw

MATERIAL AND METHODS

The studies on benthonic foraminifers of the Upper Triassic and Lower Jurassic of the West Carpathians were carried out on thin sections from samples carefully taken in individual sections (figs 1, 5–12). In the studied rocks, foraminifers are fairly common and relatively well-preserved. A great variability of sections of foraminifer tests made fairly accurate and reliable identifications (figs 5–12) possible. The studies covered about 1,100 thin sections (about 2.5 cm × 3.0 cm in size), over 800 of which yielded foraminifers. The number of foraminifers in a thin section is ranging from a few to over 300, about 50 on the average. About 25,000 of various sections of foraminifer tests were analysed in detail, the majority of which was identifiable (see pls 31–41).

The thin section method is especially useful in studies on foraminifers of the family Involutinidae, fairly common in the Upper Triassic and Lower Jurassic and of high stratigraphic and paleogeographic value. Generic and specific identifications of involutinids are based on internal structure of the test, observable in thin sections. Even in the case of random orientation, two or three sections are sufficient for determination of structural type of a test.

It should be noted that the thin section method appeared highly successful and it becomes increasingly popular in studies on calcareous foraminifers, especially those occurring in hard carbonate rocks.

GEOGRAPHIC AND GEOLOGIC SETTING

Upper Triassic and Lower Jurassic rocks crop out in several place in the West Carpathians of Slovakia and Poland (fig. 1). They are highly variable in facies development, reflecting changes in sedimentary basin of the Carpathians at the turn of the Triassic and Jurassic. The changes are indicated by lateral variability and succession of rocks in individual paleotectonic-facies zones in the West Carpathians (fig. 2).

The present study covers outcrops of the relevant rocks in the Strážovská hornatina Mts., Malá Fatra Mts., Velká Fatra Mts., Nizke Tatry Mts., Tatra Mts., Slovenské rudohorie Mts., and Slovenský kras (see fig. 1). Thirty three sections of the investigated strata were measured and sampled in order to establish succession of facies and distribution of foraminifers and associated biota. A special attention was paid to rocks of the Fatra Formation and Kopieňiec Formation in the Fatricum, Norovica Formation and Hybe Beds in the Hronicum, Bleskový prameň Lmst., and Zlambach Beds in the Silicicum and Lias of the Tatricum in the Velká Fatra Mts., on account of the presence of very rich and highly diversified assemblages of benthonic foraminifers.

The studies recently carried out by Michalík *et al.* (1979), Gaździcki *et al.* (1979b), Gaździcki and Michalík (1980) and Michalík (1980) made possible lithostratigraphical subdivision of the Upper Triassic and Lower Jurassic sequences in the Fatricum and Hronicum in the West Carpathians (figs 3–4).

The Fatricum sequence was divided into four formal lithostratigraphic units: Carpathian Keuper Group and Fatra, Kopieniec and Janovky Formations, further subdivided into several informal members (see fig. 3). This sequence is about 200 m thick, ranging in age from Norian to Sinemurian (Gaździcki *et al.* 1979*b*).

The uppermost Triassic deposits of the Hronicum (Norovica Formation) are only fragmentarily preserved, as in several places they have underwent an erosion due to Early Kimmerian tectonic phase (Gaździcki and Michalík 1980, fig. 1). The Norovica Formation overlies the Hauptdolomit and underlies the Lower Lias crinoidal limestones (fig. 4). Three members are

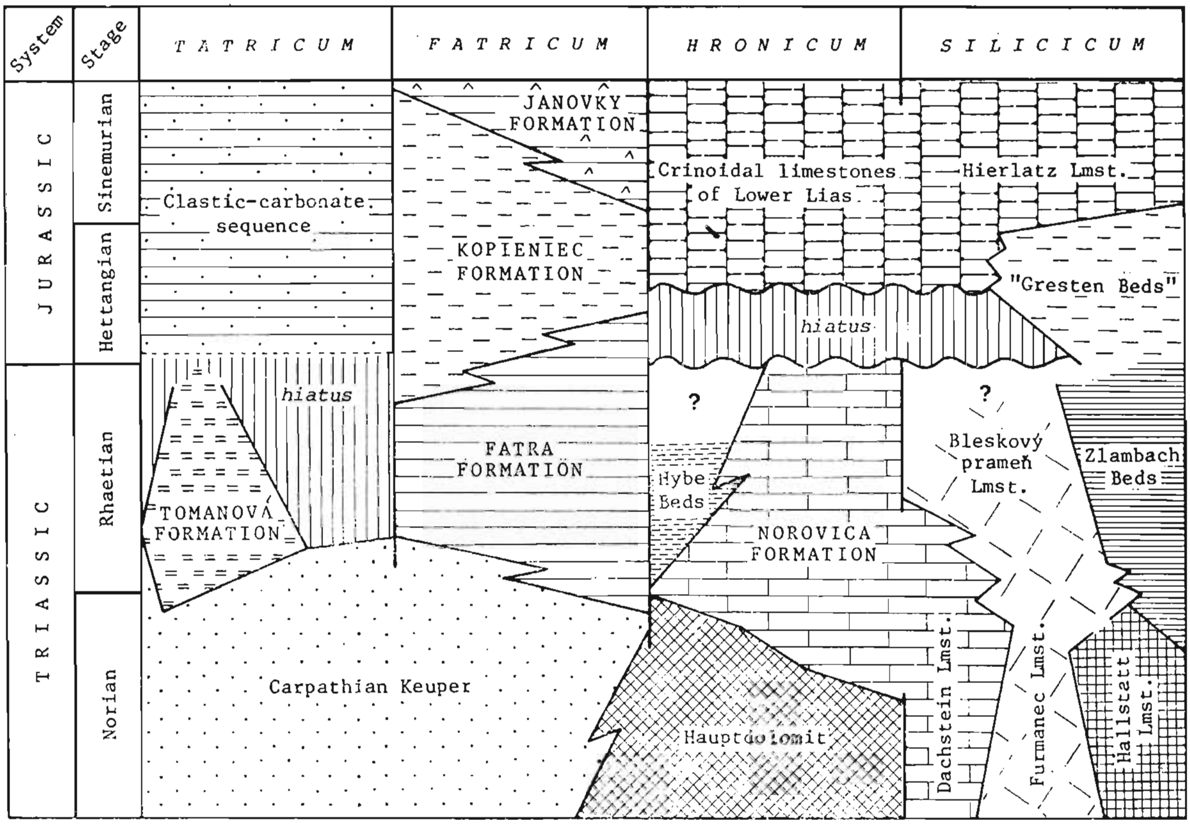

Fig. 2
Scheme of stratigraphic and regional facies distribution in Upper Triassic and Lower Jurassic of the Slovakian and Polish Carpathians. For details see MELLO 1974, MICHALÍK 1977*a*, GAŹDZICKI *et al.* 1979*b*, GAŹDZICKI and MICHALÍK 1980, MICHALÍK 1980.

distinguished: Lower Limestone, Siwa Woda Limestone and Mojtin Limestone Members. This Formation is up to 50 m thick and ranges in age from the Upper Norian (Sevatian) to the Upper Rhaetian (GAŹDZICKI and MICHALIK 1980).

DISTRIBUTION OF FORAMINIFERS AND ASSOCIATED BIOTA

A detailed analysis of distribution of foraminifers and associated biota in deposits of the Upper Triassic and Lower Jurassic covers eight sections (figs 5–12) representing different paleotectonic-facies units in the West Carpathians (fig. 2). Sedimentary sequences and frequency distribution of foraminifers in the sections studied are given separately for Upper Triassic and Lower Jurassic.

Upper Triassic sequences

Foraminifers are especially numerous in rocks of the uppermost Triassic in the Fatricum, Hronicum and Silicicum but they are also present in the Tatricum in the Tatra Mts.

Tatricum. — The uppermost Triassic deposits of this unit in the Tatra Mts are developed either as clastic complex with plant remains (Tomanová Formation) or clastic-carbonate rocks with marine fauna (RADWAŃSKI 1968, MICHALÍK *et al.* 1976, MICHALÍK 1980). Foraminifers were found in clastic-carbonate complex in Mt. Kopieniec Staroröbociański section only (3), where they are represented by single, poorly preserved tests of the genus *Frondicularia*, occurring in sandy biomicrites. Moreover, RADWAŃSKI (1968) reported the presence of *Lenticulina*

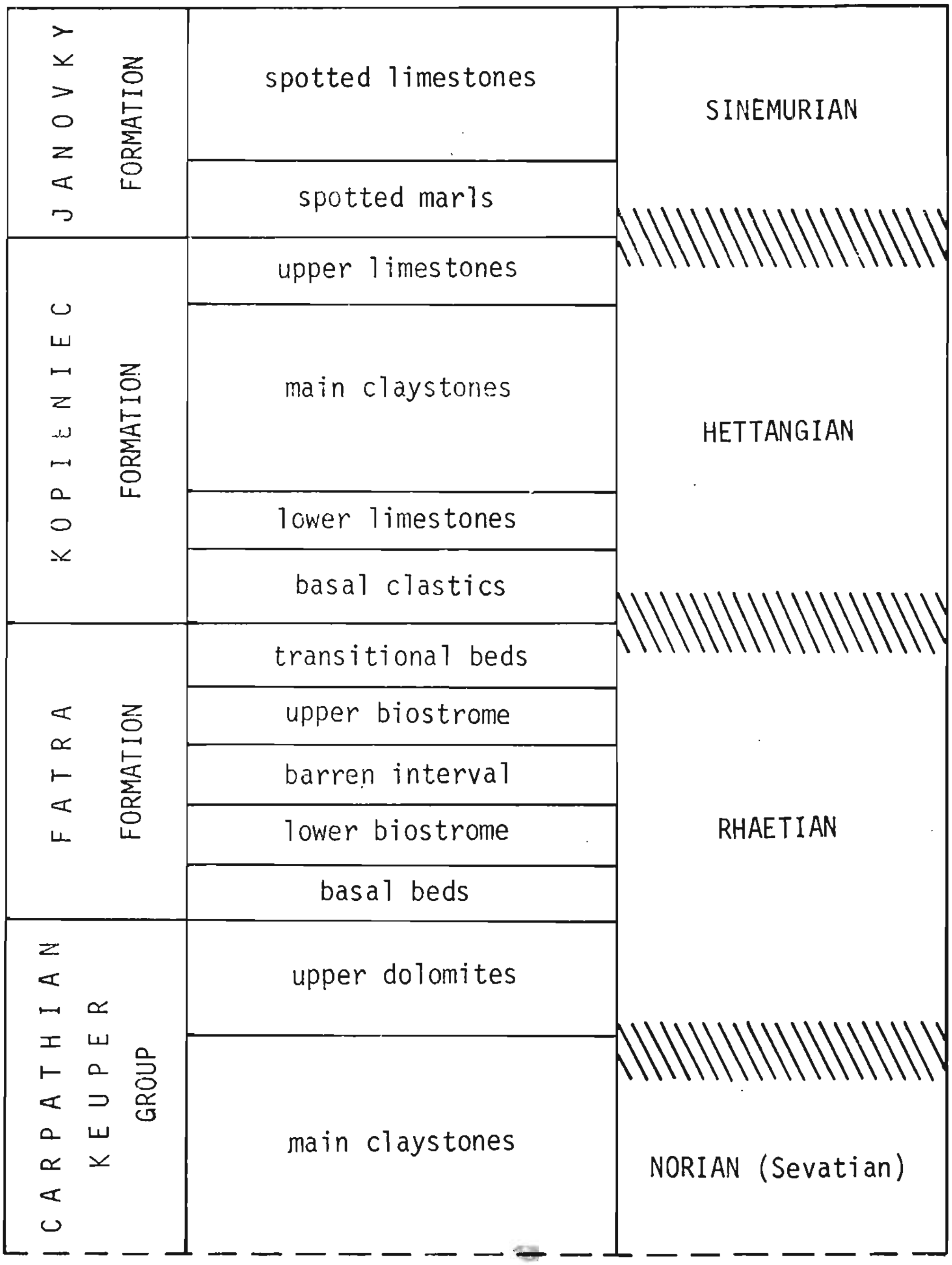

Fig. 3
Lithostratigraphic subdivision of the Upper Triassic and Lower Jurassic sequence of the Fatricum in the West Carpathians.

sphaerica KÜBLER and ZWINGLI, *Frondicularia woodwardi* HOWCHIN and *Cornuspira* sp. from the Za Kiczerem Valley section but the latter are without any greater stratigraphic value.

Fatricum. — In that paleotectonic-facies unit, the Upper Triassic sequence is represented by the Carpathian Keuper Group and Fatra Formation (figs 2–3). Rocks of that age are cropping out in several places in the West Carpathians of Slovakia and Poland (fig. 1, see also GOETEL 1917, MICHALÍK 1973, 1974, 1977, 1978*a*, *b*, GAŹDZICKI 1974, GAŹDZICKI *et al.* 1979*b*). The sequence is here characterized in reference to the Mt. Velká Furkaska section (17) in the Tatra

<table>
<tr><td colspan="2">Crinoidal limestones of Lower Lias</td><td>HETTANGIAN</td></tr>
<tr><td rowspan="3">NOROVICA FORMATION</td><td>Mojtin Limestone Member</td><td rowspan="2">RHAETIAN</td></tr>
<tr><td>Siwa Woda Limestone Member</td></tr>
<tr><td>Lower Limestone Member</td><td>?NORIAN (Sevatian)</td></tr>
<tr><td colspan="2">Hauptdolomit</td><td>NORIAN
CARNIAN</td></tr>
</table>

Fig. 4
Lithostratigraphic subdivision of the uppermost Triassic sequence of the Hronicum in the West Carpathians.

Mts and Križna Valley section (12) in the Velká Fatra Mts (figs. 5–6). Foraminifers are exceptionally rare in rocks of the Carpathian Keuper Group, except for upper dolomites in the Mt. Velká Furkaska section (17). In that locality, numerous representatives of *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN (pl. 37: 1–5), were found to occur along with single ostracodes in dolomicrite matrix. Foraminifers were also found in the Lejowa Valley I section (18) in identical stratigraphic position. The findings are worth noting as these are first records of foraminifers in the Carpathian Keuper Group.

The overlying Fatra Formation comprises dark-gray compact organodetrital limestones with intercalations of loferitic dolomites, marls, and shales rich in faunal remains (figs 5–6, see also GOETEL 1917, GAŹDZICKI 1974, MICHALÍK and JENDREJÁKOVÁ 1978, MICHALÍK 1978*a*, *b*). The Formation was subdivided into some informal lithostratigraphic units: basal beds, lower biostrome, barren interval, upper biostrome, and transitional beds (figs. 3, 5–6; see also MICHALIK *et al.* 1979, GAŹDZICKI *et al.* 1979*b*).

Rich foraminifer assemblages comprising representatives of the families Ammodiscidae and Involutinidae mainly occur in lower and upper biostromes (see figs 5–6). In subordinate amount, there also occur Tetrataxidae, Miliolidae and Nodosariidae, whereas associations comprising the highest numbers of individuals are formed by *Glomospirella friedli* KRISTAN-TOLLMANN (pl. 27: 1), *Triasina hantkeni* MAJZON (pl. 27: 2, pl. 30:3, 5) as well as *Aulotortus tumidus* (KRISTAN-TOLLMANN) (pl. 30: 1) and *Tolypammina gregaria* WENDT (pl. 27: 1). The foraminifers were found in organodetrital limestones, mainly brachiopod-crinoid-coral biomicrites and biosparites (pl. 27: 1–2). Some predominance of the genera *Glomospira* and *Glomospirella* is noted in rocks containing admixture of detrital quartz.

In rocks of the Fatra Formation, foraminifers are most often accompanied by algae: *Thaummatoporella parvovesiculifera* (RAINERI) and *Aciculella* sp., corals: *Retiophyllia clathrata* (EMMRICH), *Astraeomorpha crassisepta* REUSS and *Phacelostylophyllum robustum* RONIEWICZ, brachiopods mainly belonging to *Rhaetina gregaria* (SUESS) and *Zugmayerella uncinata* (SCHAF-

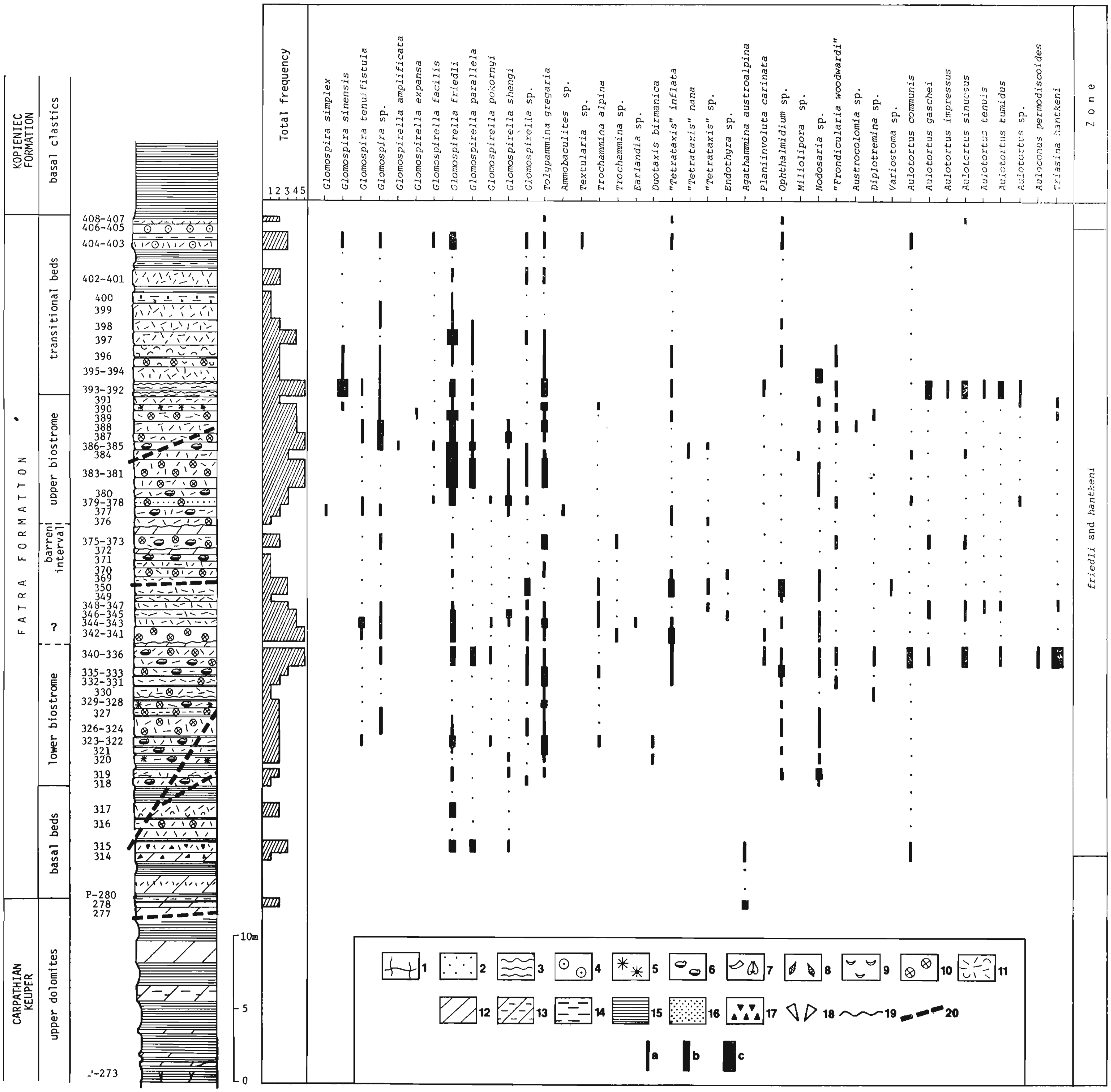

Fig. 5

Detailed section of the Carpathian Keuper and the Fatra Formation (Upper Triassic) at the Veľká Furkaska Mt., West Tatra Mts.; the section (17 in fig. 1) comprises lithology as well as frequency and distribution of foraminifers

Lithology: *1* limestone, *2* sandy limestone, *3* nodular limestone, *4* oolitic limestone, *5* coral limestone, *6* brachiopod limestone, *7 Megalodon* limestone, *8* gastropod limestone, *9* lumachelles, *10* crinoid limestone, *11* organodetrital limestone, *12* dolomite, *13* loferitic dolomite, *14* marl, *15* marly shale, *16* sandstone, *17* breccia, *18* belemnites, *19* erosion surfaces, *20* dislocations

Total frequency of foraminifers: 1:1–10 specimens, 2:11–30 specimens, 3:31–50 specimens, 4:51–70 specimens, 5: more than 70 specimens in thin section from a given layer.

Distribution of foraminifers presenting number of specimens of a definite species or genus in thin section from a given layer: *a* — rare (1–5 specimens), *b* — frequent (6–25 specimens), *c* — abundant (more than 25 specimens).

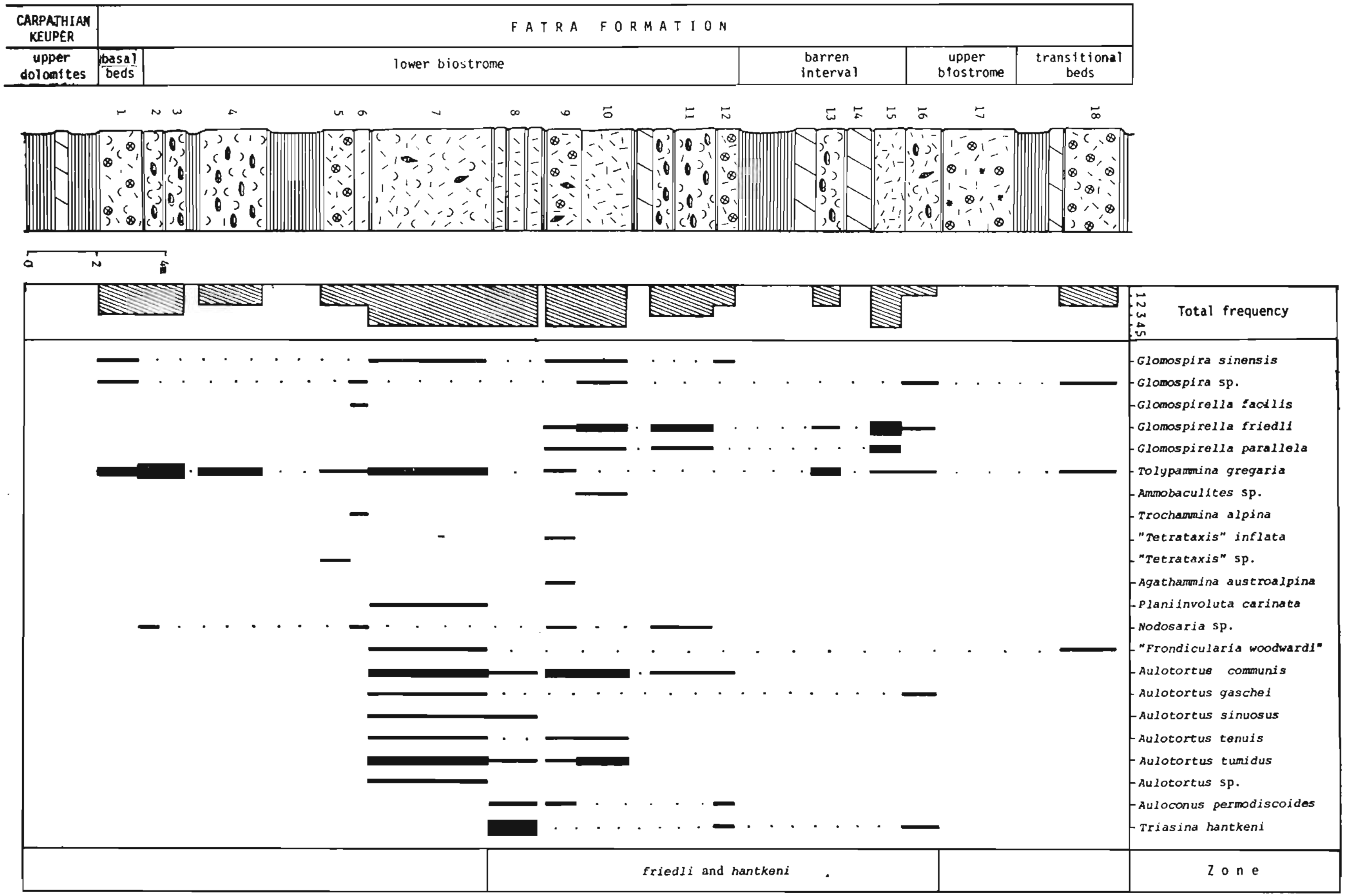

Fig. 6

Detailed section of the Fatra Formation (uppermost Triassic) in the Križna Valley, Velká Fatra Mts. (12 in fig. 1); explanations as for fig. 5.

HÄUTL) and pelecypods: *Chlamys winkleri* STOPPANI, *Lopha haidingeriana* (EMMRICH) and *Placunopsis alpina* WINKLER (comp. MICHALÍK and JENDREJÁKOVÁ 1978, GAŹDZICKI *et al.* 1979*b*, MICHALIK *et al.* 1979).

Hronicum. — The uppermost Triassic deposits in the Hronicum of the West Carpathians are fragmentarily preserved (figs. 1–2). These are mostly light-grey, compact, organodetrital limestones resembling Dachstein Limestones. The sequence is assigned to the Norovica Formation (GAŹDZICKI and MICHALÍK 1980). Only in Hybe section (Hybe Beds), the uppermost Tria-

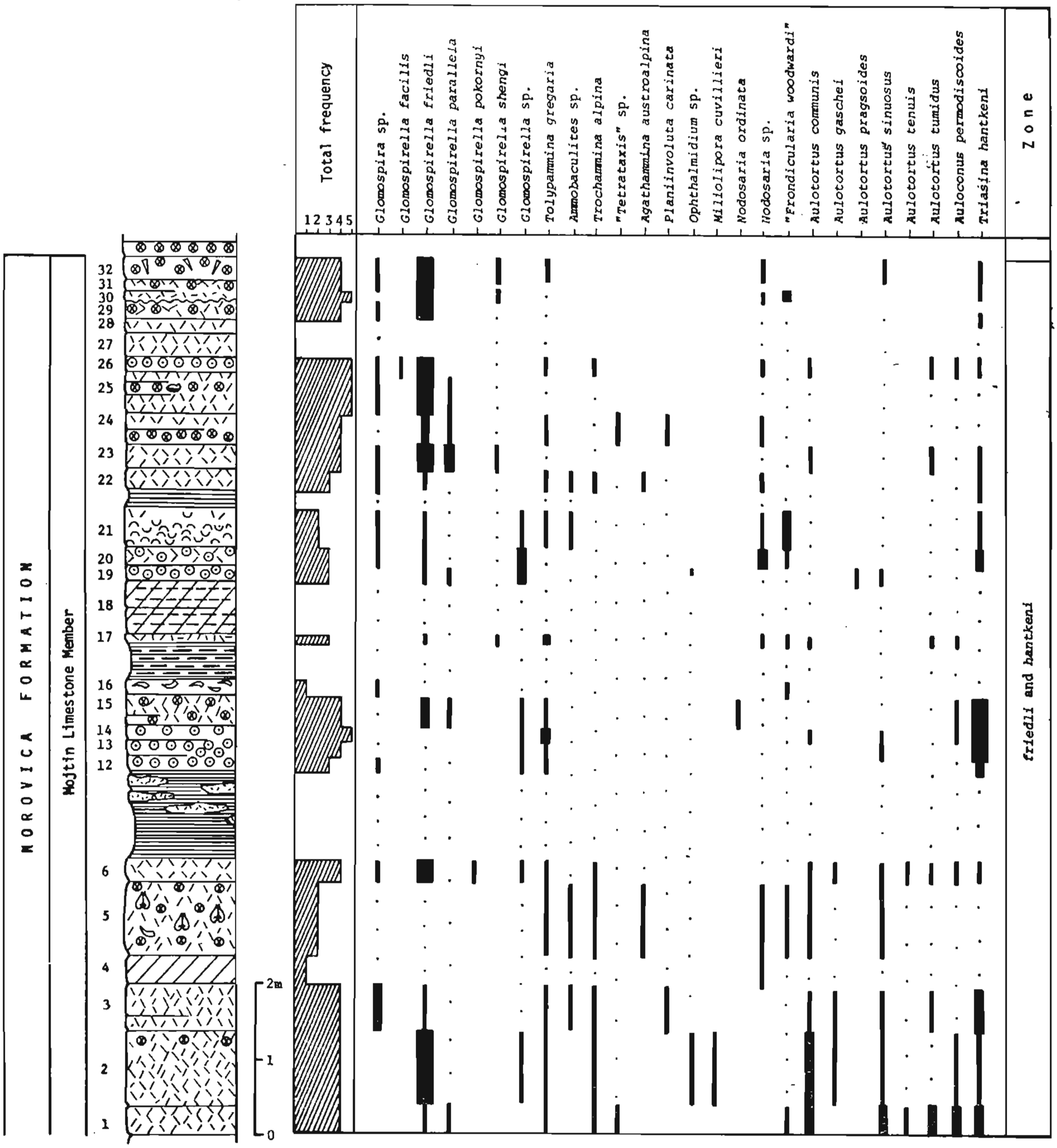

Fig. 7
Detailed stratotype section of the Norovica Formation (uppermost Triassic) at the Norovica Mt., Strážovská hornatina Mts. (22 in fig. 1); explanations as for fig. 5.

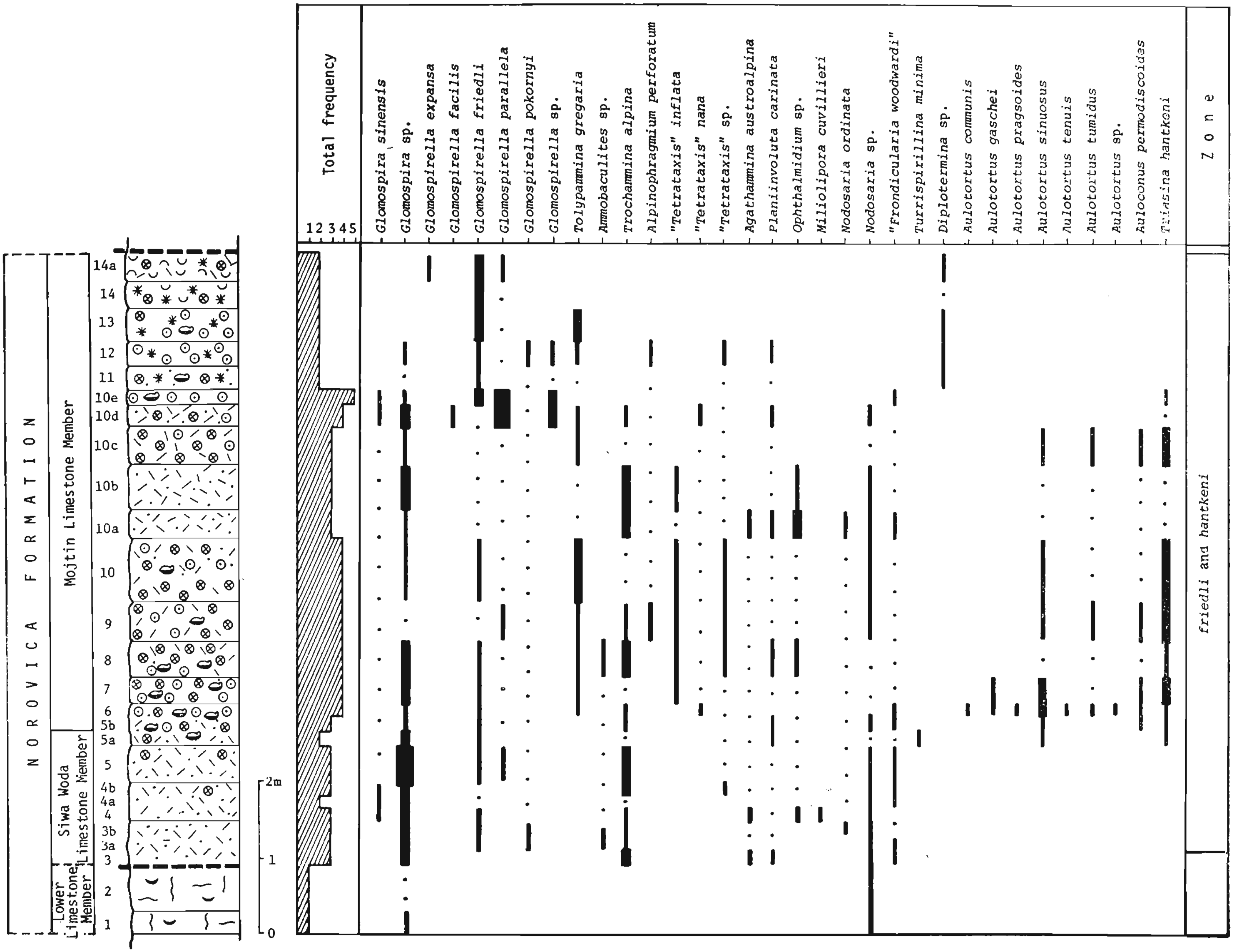

Fig. 8

Detailed hypostratotype section of the Norovica Formation (uppermost Triassic) in the Chochołowska Valley, West Tatra Mts. (26 in fig. 1); explanations as for fig. 5.

ssic strata are represented by dark limestones intercalated by marls and marly shales (STACHE 1868, MICHALIK 1973, GAŹDZICKI *et al.* 1979*a*).

Sedimentary sequence and frequency distribution of foraminifers in Norovica Formation is presented in reference to Mt. Norovica section (22) in the Strážovská hornatina Mts (fig. 7) and Chochołowska Valley section (26) in the Tatra Mts (fig. 8). Foraminifers were found in both Siwa Woda Limestone and Mojtin Limestone Members (figs. 7–8).

In the Chochołowska Valley section (26), sandy biopelsparites of the Siwa Woda Limestone Member yield innumerous foraminifers identified as *Glomospira* sp., *Trochammina alpina* KRISTAN-TOLLMANN, *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN, *Nodosaria* sp., and very rare *Glomospirella friedli* KRISTAN-TOLLMANN (fig. 8). *Triasina hantkeni* MAJZON appears at the top of this member. It is worth to note that *Triasina hantkeni* co-occurs in the uppermost part of this member with stratigraphically important conodonts *Misikella posthernsteini* KOZUR and MOCK (see GAŹDZICKI 1978*a*, *b*; GAŹDZICKI and MICHALIK 1980). This is the first locality where these fossils so important for stratigraphy of the uppermost Triassic made their appearance.

Very rich foraminifer assemblages comprising representatives of the families Involutinidae and Ammodiscidae were encountered in crinoid-brachiopod oosparites of the Mojtin Limestone Member (figs. 7–8). Here the abundant associations of *Triasina hantkeni* MAJZON (pl. 28: 2, pl. 30: 4) and *Glomospirella friedli* KRISTAN-TOLLMANN (pl. 28: 1) were also found. It should be noted that the frequence of involutinids in those rocks is incomparably higher than in the remaining uppermost Triassic sequences in the West Carpathians.

Besides the above mentioned conodonts *Misikella posthernsteini* KOZUR and MOCK, the fossils accompanying foraminifers (see figs. 7–8) most often include algae *Aciculella* sp., corals *Phacelostylophyllum robustum* RONIEWICZ, and *Cyathocoenia schafhautli* (WINKLER), brachiopods *Rhaetina gregaria* (SUESS) and *Zugmayerella uncinata* (SCHAFHÄUTL), and pelecypods *Atreta intusstriata* (EMMRICH), *Rhaetavicula contorta* (PORTLOCK) and *Placunopsis alpina* WINKLER (see GAŹDZICKI and MICHALÍK 1980).

HYBE (25) is the best known locality of so called "Kössen Beds" in the Slovak Carpathians, a classical locality on account of its rich fauna (GOETEL 1917, KOUTEK 1927, MICHALÍK 1973, 1975, 1976, 1977b). The Upper Triassic sequence is represented here (fig. 9) by Hauptdolomit of Carnian and Norian age, bedded light-grey Dachstein Limestone (Norian), and the Hybe Beds — consists of black limestones and marls with rich Rhaetian fauna.

In this sequence the following foraminifers were found (for location of samples see fig. 9).

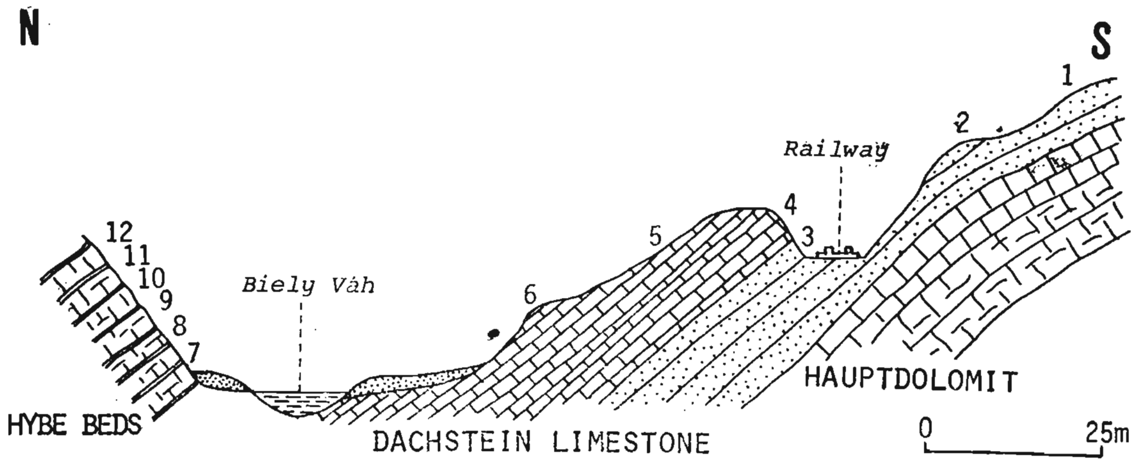

Fig. 9
Section of the Upper Triassic deposits near Hybe, Nizke Tatry Mts. (25 in fig. 1); numbers denote the sampling sites. Section adopted from KOUTEK 1927.

Samples 1–3 (biopelmicrites) yielded:

Aulotortus sp.
Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN)

Samples 4–8 (mainly biooosparites) yielded:

Trochammina alpina KRISTAN-TOLLMANN
Alpinophragmium perforatum FLÜGEL
Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN
Miliolipora cuvillieri BRÖNNIMANN and ZANINETTI
Nodosaria ordinata TRIFONOVA
Aulotortus communis (KRISTAN)
Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN)
Aulotortus tenuis (KRISTAN)
Triasina oberhauseri (KOEHN-ZANINETTI and BRÖNNIMANN (fig. 21a, b)
Auloconus permodiscoides (OBERHAUSER)

Such association of foraminifers suggests the Norian (?Sevatian) (*Triasina oberhauseri* Zone) age of rocks bearing them.
Samples 9–12 (brachiopod-crinoid biosparite) yielded:

Glomospirella friedli KRISTAN-TOLLMANN
Glomospirella pokornyi (SALAJ)
Glomospirella parallela KRISTAN-TOLLMANN
Trochammina alpina KRISTAN-TOLLMANN
Tetrataxis inflata KRISTAN
Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN
Miliolipora cuvillieri BRÖNNIMANN and ZANINETTI
Planiinvoluta carinata LEISCHNER
Nodosaria ordinata TRIFONOVA
Lingulina aff. *placklensis* KRISTAN-TOLLMANN
Aulotortus communis (KRISTAN)
Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN)
Aulotortus tumidus (KRISTAN-TOLLMANN)
Aulotortus sinuosus WEYNSCHENK
Triasina oberhauseri KOEHN-ZANINETTI and BRÖNNIMANN
Auloconus permodiscoides (OBERHAUSER)

The foraminifer association is indicative of the Rhaetian age — *Glomospirella friedli* and *Triasina hantkeni* Zone as defined here. However, it should be noted that one of the index fossils, *Triasina hantkeni* MAJZON, is still unknown from the Hybe section (see GAŹDZICKI 1978*b*, GAŹDZICKI *et al.* 1979*a*).

Hybe Beds yield rich assemblages of brachiopods, pelecypods, corals and echinoderms (GOETEL 1917, MICHALÍK 1973, 1975, 1976, 1977*b*). Moreover, ammonites *Arcestes* (*Rhaetites*) cf. *rhaeticus* CLARK and conodonts *Misikella posthernsteini* KOZUR and MOCK, were found in this sequence (ANDRUSOV 1934, MAJERSKÁ 1973).

Silicicum. — In this region, the uppermost Triassic is represented by Bleskový prameň Limestone and Zlambach Beds (fig. 2).

The Bleskový prameň Limestone forms lenses of grey crinoidal limestones above top part of the Furmanec Limestone near Drnava in Slovenský kras (fig. 10). These crinoid-coquinal limestones contain rich macrofaunal assemblages composed mainly of brachiopods, pelecypods and cephalopods (KOLLÁROVÁ-ANDRUSOVOVÁ and KOCHANOVÁ 1973, MELLO 1974).

The following foraminifers were found (sampling as shown in fig. 10).

Glomospirella sp.
Ammobaculites sp. (pl. 36:14)
Tolypammina gregaria WENDT

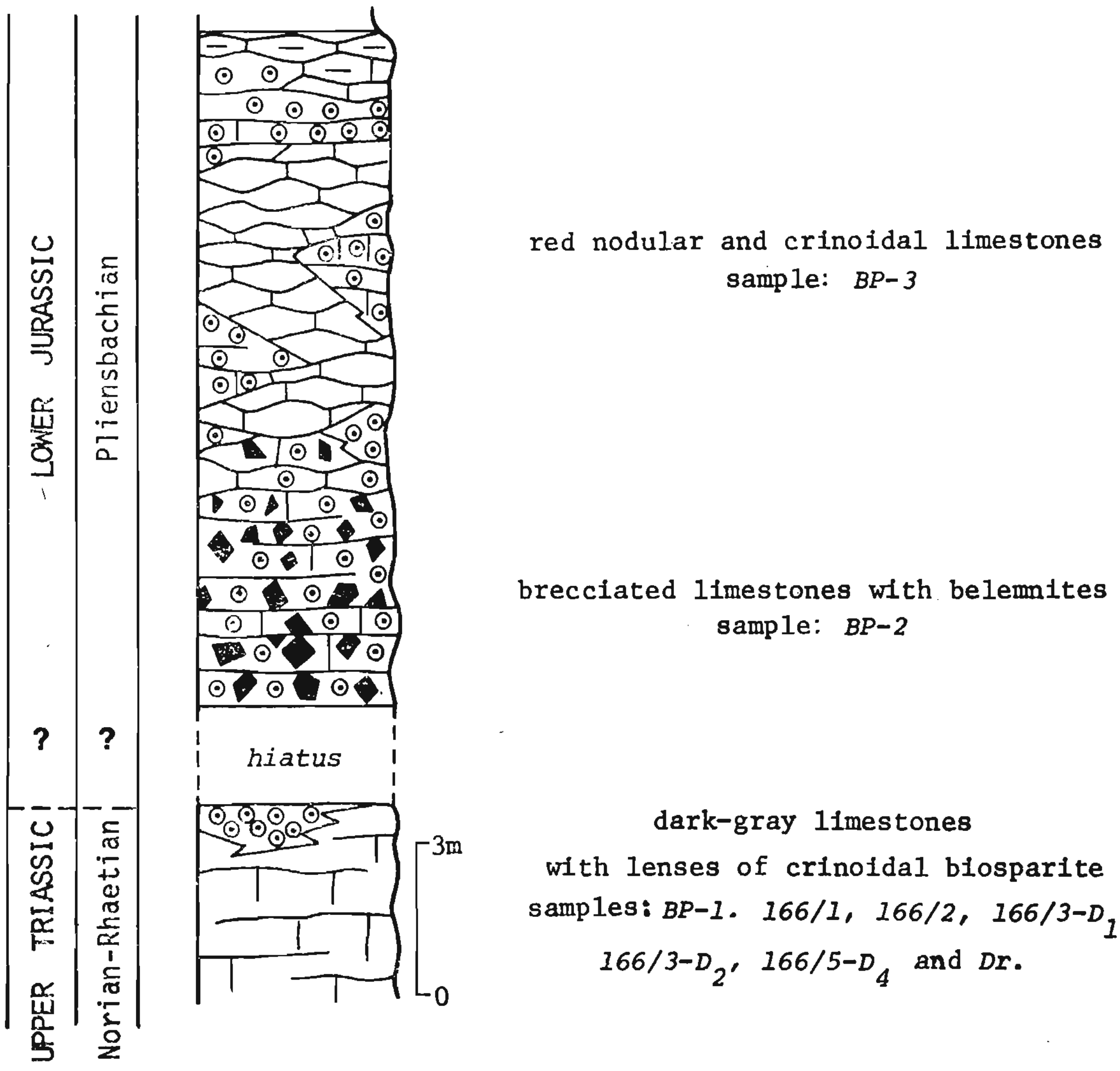

Fig. 10
Section of the Upper Triassic and Lower Jurassic deposits at Bleskový prameň, Slovenský kras (32 in fig. 1). Section adopted from Mello and Bystrický, 1973.

Trochammina alpina Kristan-Tollmann
Agathammina austroalpina Kristan-Tollmann and Tollmann
Planiinvoluta carinata Leischner
Ophthalmidium "carinatum" (Leischer)
Ophthalmidium cf. *carpathicum* (Gaździcki) (pl. 37:11)
Ophthalmidium martanum (Farinacci) (pl. 37:12)
Galeanella cf. *tollmanni* (Kristan) (pl. 37:15).
Miliolipora cuvillieri Brönnimann and Zaninetti
Diplotremina sp.
Aulotortus communis (Kristan)
Aulotortus gaschei (Koehn-Zaninetti and Brönnimann)
Aulotortus tenuis (Kristan)
Involutina turgida Kristan
Triasina hantkeni Majzon
Auloconus permodiscoides Oberhauser

The presence of the species *Galeanella* cf. *tollmanni*, *Involutina turgida* and *Triasina hantkeni* indicates the Rhaetian age of Bleskový prameň Limestone (*sensu* GAŹDZICKI *et al.* 1979*a*).

The Malý Mlynský vrch is the best locality of Zlambach Beds in the Slovenský kras (figs. 1–2, see also MOCK 1973). These deposits comprise grey marly pelmicrites and marly and sandy shales. Conodonts and holothurian sclerites are listed in MOCK (1973) and KOZUR and MOCK (1974*a*, *b*). Cephalopods are represented here by the genus *Choristoceras*. The rocks range in age from the Norian (Sevatian) to Rhaetian (see GAŹDZICKI *et al.* 1979*a*).

The following foraminifers were found

Glomospirella cf. *pokornyi* (SALAJ)
Tolypammina gregaria WENDT
Trochammina alpina KRISTAN-TOLLMANN (pl. 36:7)
Ammobaculites sp.
Planiinvoluta carinata LEISCHNER
Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN
Agathammina? *iranica* ZANINETTI, BRÖNNIMANN, BOZORGNIA and HUBER
Ophthalmidium "carinatum" (LEISCHNER)
Ophthalmidium carpathicum (GAŹDZICKI) (pl. 37:9–10)
Ophthalmidium martanum (FARINACCI)
Ophthalmidium triadicum (KRISTAN)
Nodosaria sp.
Austrocolomia cf. *rhaetica* OBERHAUSER
Turrispirillina cf. *minima* PANTIĆ

In this sequence, involutinids are missing. This may be explained by differences in facies development.

Lower Jurassic sequence

Foraminifers are fairly numerous in Lias rocks of the Fatricum and Silicicum. They were also found in Lias sequences of the Tatricum in the Velká Fatra Mts and Tatra Mts.

Tatricum. — Lias rocks of that unit were studies in the Rúbaň Skala section (1), the Velká Fatra Mts (fig. 1, see also SÝKORA 1975; POLAK 1978). Here mainly crinoid biomicrites with foraminifer assemblages comprising *Involutina liassica* (JONES), *Trocholina umbo* FRENTZEN, numerous nodosariids (*Nodosaria*, *Frondicularia*, *Astacolus*, and *Lenticulina*), *Ophthalmidium leischneri* (KRISTAN-TOLLMANN), and *Ophthalmidium* sp. (pl. 29:1) occur. Attention should be paid to the presence of *Ophthalmidium leischneri* — the index fossil of *leischneri* and *walfordi* Zone (Hettangian — ?Sinemurian). This was the first locality in which that species made their appearance in the Tatricum region.

Foraminifers are accompanied by rich fauna of pelecypods including *Eopecten rollei* (STOLICZKA), *Plagiostoma punctata* SOWERBY, and *Entolium lunare* (ROEMER), and brachiopods — *Lobothyris punctata* (SOWERBY), *Spiriferina alpina* OPPEL, and *Spiriferina pinguis* (OPPEL), confirming the Hettangian — Sinemurian age of the rocks bearing them (see SÝKORA 1975).

In the Tatra Mts. Lias rocks are known, among others from following outcrops: Mt. Bobrowiec (2), Mt. Kopieniec Staroroboeiański (3), Mt. Dudziniec (4), and Kobyla Głowa crag (5) (fig. 1, see also RADWAŃSKI, 1959; WÓJCIK 1979, 1981). They are represented by sandy biopelsparites and crinoid biosparites. Foraminifers are very rare here, being represented by *Glomospira* sp. (pl. 39:14), *Textularia* sp. and nodosariids (*Nodosaria*, *Frondicularia*, and *Lenticulina*), which do not have a stratigraphic value.

Fatricum. — In this unit, the Lower Lias is represented by detrital rocks: marly shales and quartz sandstones with marly and limestone intercalations (GOETEL 1917; MIŠIK 1964; GAŹDZICKI 1975), assigned to the Kopieniec and Janovky Formations (fig. 3, see also GAŹDZICKI *et al.* 1979*b*). The Kopieniec Fm. rests in sedimentary continuity on the Fatra Fm. It is subdivided into the following informal lithostratigraphic units: basal clastics, lower limestones, main claystones, and upper limestones (figs. 3, 11–12; see also GAŹDZICKI *et al.* 1979*b*).

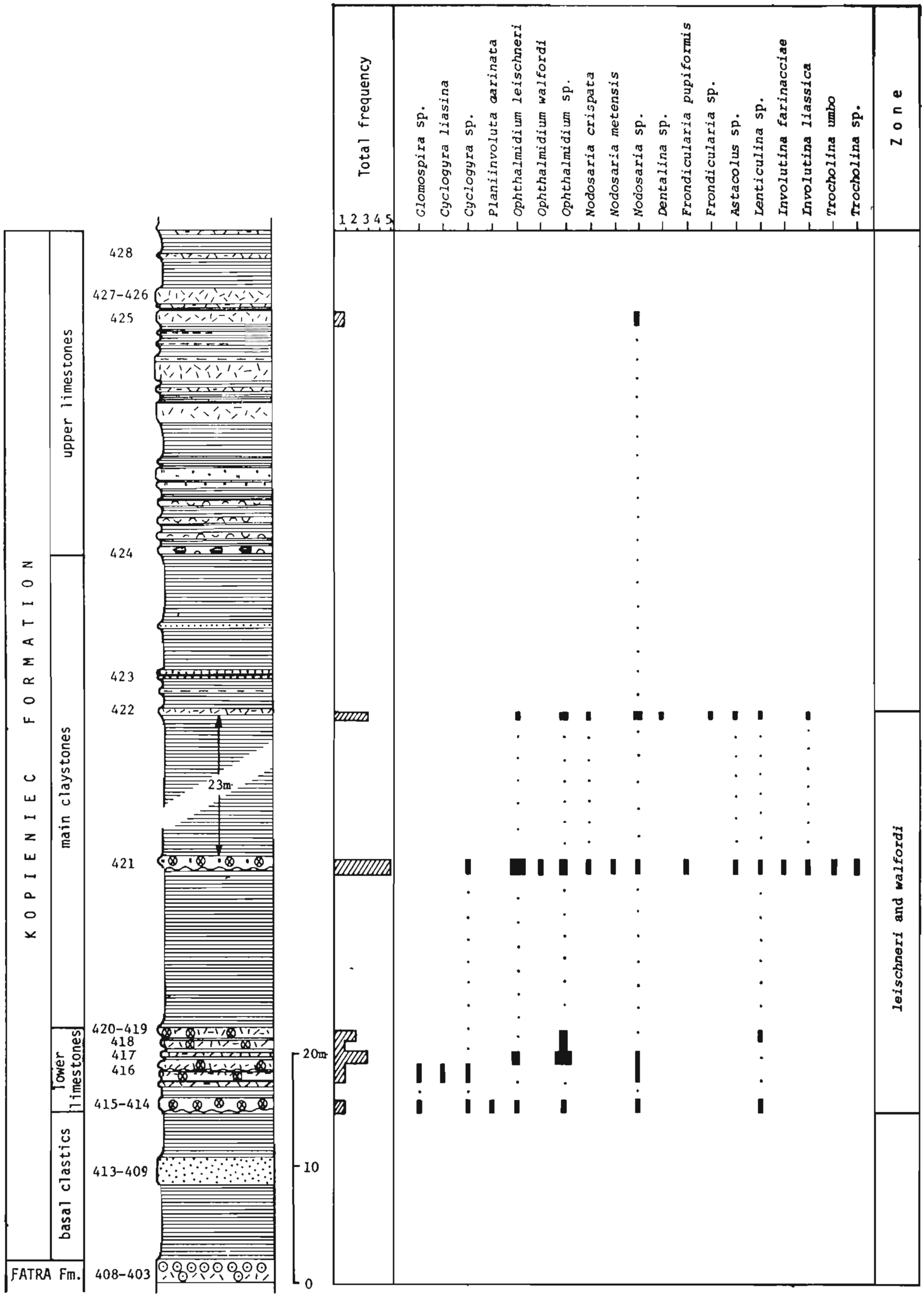

Fig. 11

Detailed section of the Kopieniec Formation (Lower Liassic) at the Velká Furkaska Mt., West Tatra Mts. (17 in fig. 1); explanations as for fig. 5.

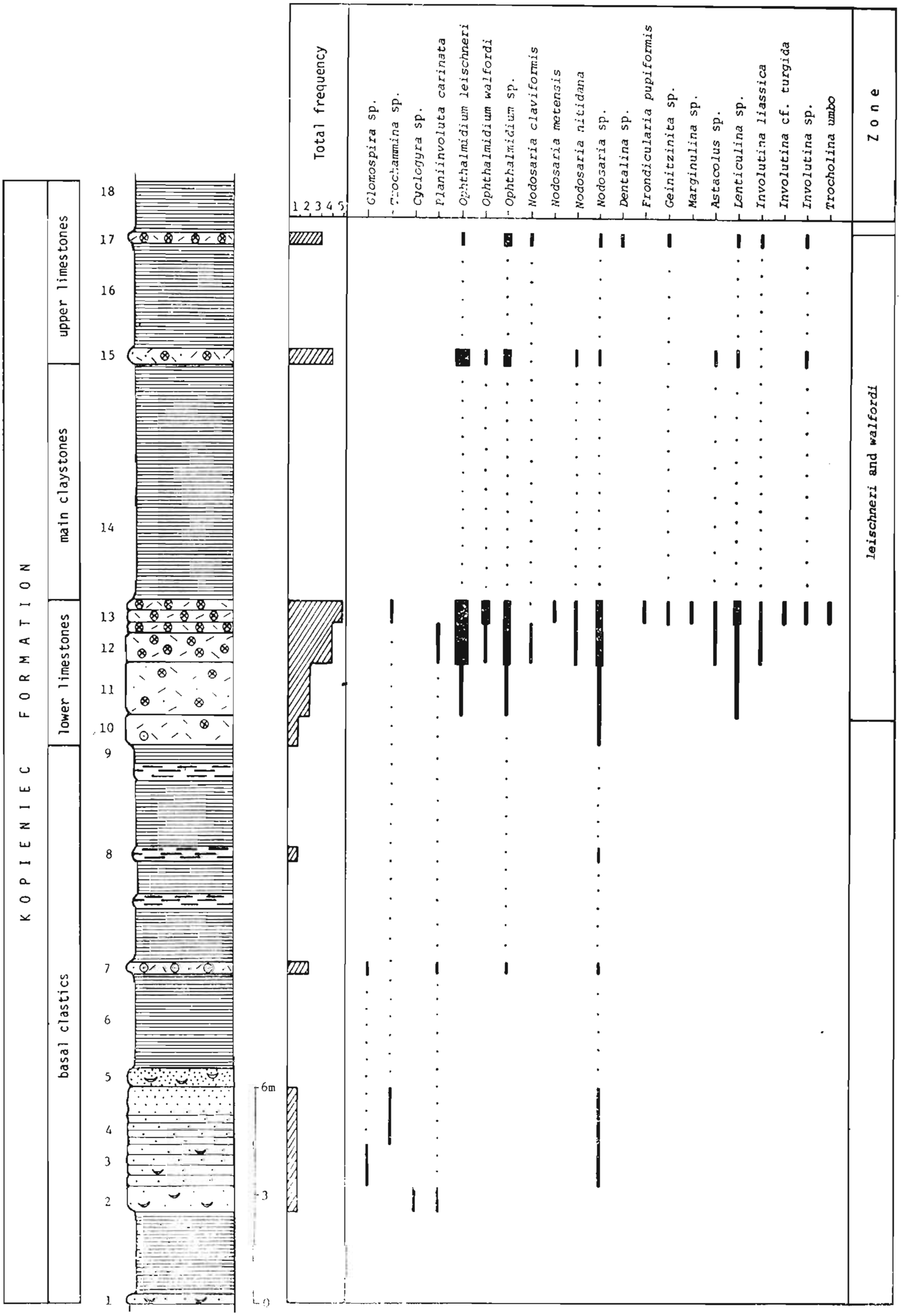

Fig. 12
Detailed section of the Kopieniec Formation (Lower Liassic) in the Strążyska Valley II, Tatra Mts. (21 in fig. 1); explanations as for fig. 5.

The sedimentary sequence was characterized in reference to the Mt. Velká Furkaska (17) and Strążyska Valley II (21) sections in the Tatra Mts (figs. 11–12). Foraminifers are most common in lower and upper limestones of the Kopieniec Formation especially in crinoid-biopelmicrites (pl. 29:2), being represented by the families Miliolidae, Nodosariidae and Involutinidae. Here predominate *Ophthalmidium leischneri* (KRISTAN-TOLLMANN), *Ophthalmidium walfordi* HÄUSLER, *Involutina liassica* (JONES), *Involutina farinacciae* BRÖNNIMANN and KOEHN-ZANINETTI, *Trocholina umbo* FRENTZEN and nodosariids are fairly common (figs 11–12). The co-occurring fauna includes *Gryphea arcuata* LAMARCK and *Pentacrinus* cf. *tuberculatus* MILLER (see GAŹDZICKI 1975) as well as numerous ostracodes.

Silicicum. — In that unit, Lias rocks are known to occur in the Bleskový prameň and Miglinc localities (fig. 1). In lower parts, they are represented by brecciated limestones with belemnites, passing upwards into red nodular and crinoidal limestones (fig. 10). Foraminifers mainly found in crinoidal biomicrites (pl. 29:3), include nodosariids (*Nodosaria*, *Lenticulina*, and *Geinitzinita*) and single *Semiinvoluta* sp. (pl. 39:1) and *Trocholina turris* FRENTZEN (pl. 39:7).

TAXONOMIC COMPOSITION OF FORAMINIFER FAUNA

One hundred and four foraminifer species have been found in the investigated Upper Triassic — Lower Jurassic sequences of the Tatricum, Fatricum, Hronicum and Silicicum in the West Carpathians of Slovakia and Poland. Of these, 25 are agglutinated forms and 79 are calcareous.

The majority of the recorded species are well known from other areas of the Tethys Realm (see ZANINETTI 1976) and also from epicontinental basin of the north-western Europe (see FRANKE 1936, BROUWER 1969 and SCHLOZ 1972), and therefore they are not systematically characterized herein. The systematic part includes besides species recorded for the first time in the West Carpathians also taxa of disputable systematic position and those of correlative importance.

The majority of the investigated foraminifers are, however, figured here (pls 27–41) to show their variability and to facilitate further discussion.

The taxonomy of the recorded foraminifers follows diagnoses and remarks given by the following authors: HO 1959, KRISTAN-TOLLMANN 1961, 1963, 1964*a*, *b*, 1970; OBERHAUSER 1964, LOEBLICH and TAPPAN 1964, 1974; SELLIER de CIVRIEUX and DESSAUVAGIE 1965, KOEHN-ZANINETTI 1969, ZANINETTI 1976, SALAJ 1969*b*, 1976; SALAJ *et al.* 1967, PAZDRO 1972, GUŠIĆ 1975, HOHENEGGER and PILLER 1975, 1977, TAPPAN 1976, and PILLER 1978.

Upper Triassic

In the studied Norian-Rhaetian rocks, 65 species were identified and assigned to 16 families and 29 genera. Calcareous forms predominate here (43 species), being accompanied by the agglutinated ones (22 species).

The Upper Triassic (Norian-Rhaetian) foraminifer assemblage comprises following taxa:

Family **Ammodiscidae** REUSS, 1862

Ammodiscus multivolutus REITLINGER, 1949 — pl. 31:3.
Ammodiscus sp.
Glomospira simplex HARLTON, 1928
Glomospira sinensis HO, 1959 — pl. 31:14–15.
Glomospira tenuifistula HO, 1959
Glomospira sp. — pl. 31:10.

Glomospirella amplificata KRISTAN-TOLLMANN, 1970
Glomospirella expansa KRISTAN-TOLLMANN, 1964 — pl. 31:7–8.
Glomospirella facilis HO, 1959 — pl. 31:11–13.
Glomospirella friedli KRISTAN-TOLLMANN, 1962; emend. BRÖNNIMANN and ZANINETTI, 1970 — pl. 27:1; pl. 28: 1; pl. 32:1–6.
Glomospirella parallela KRISTAN-TOLLMANN, 1964
Glomospirella pokornyi (SALAJ, 1967) — pl. 31:1–2, 4–5.
Glomospirella shengi HO, 1959 — pl. 31:16.
Glomospirella sp. — pl. 31:6; pl. 32:7–8.
Tolypammina gregaria WENDT, 1969 — pl. 27:3; pl. 33:15; pl. 35:9; pl. 36:2–6.

Family **Lituolidae** de BLAINVILLE, 1825

Ammobaculites rhaeticus KRISTAN-TOLLMANN, 1964 — pl. 36:17.
Ammobaculites cf. *rhaeticus* KRISTAN-TOLLMANN, 1964 — pl. 37:15.
Ammobaculites sp. — pl. 36:14, 16.

Family **Textulariidae** EHRENBERG, 1838

Textularia sp.

Family **Trochamminidae** SCHWAGER, 1877

Trochammina alpina KRISTAN-TOLLMANN, 1964 — pl. 36:7.
Trochammina sp. — pl. 36:8.
?*Trochammina* sp. — pl. 36:9.

Family **Caligellidae** REITLINGER, 1959

Alpinophragmium perforatum FLÜGEL, 1967

Family **Moravamminidae** POKORNÝ, 1951

Earlandia sp.

Family **?Tetrataxidae** GALLOWAY, 1933

Duotaxis birmanica ZANINETTI and BRÖNNIMANN, 1975
"*Tetrataxis*" *inflata* KRISTAN, 1957 — pl. 36:11–12.
"*Tetrataxis*" *nana* KRISTAN-TOLLMANN, 1964
"*Tetrataxis*" sp. — pl. 36:10, 13.

Family **Endothyridae** BRADY, 1884

Endothyra sp.

Family **Fischerinidae** MILLET, 1898

Agathammina austroalpina KRISTAN-TOLLMANN and TOLLMANN, 1964 — pl. 37:1–5.
Agathammina? *iranica* ZANINETTI, BRÖNNIMANN, BOZORGNIA and HUBER, 1972
Planiinvoluta carinata LEISCHNER, 1961 — pl. 36:1.

Family **Miliolidae** EHRENBERG, 1839

(*Ophthalmidium* KÜBLER and ZWINGLI was hitherto assigned to the family Nubeculariidae JONES 1875. However, studies on wall microstructure, the mode of coling, length of chambers in relation to whorl, and geometry of chamber interior and peristome (PAZDRO 1971), permit to classify that genus along with *Palaeomiliolina* LOEBLICH and TAPPAN to the family Miliolidae EHRENBERG).

Ophthalmidium "carinatum" (LEISCHNER, 1961)
Ophthalmidium carpathicum (GAŹDZICKI, 1979) — pl. 37: 9–10.
Ophthalmidium cf. *carpathicum* (GAŹDZICKI, 1979) — pl. 37:11.
Ophthalmidium martanum (FARINACCI, 1959) — pl. 37:12.
Ophthalmidium triadicum (KRISTAN, 1957)
Ophthalmidium sp. — pl. 11:13–14.

Family **Milioliporidae** BRÖNNIMANN and ZANINETTI, 1971

Galeanella cf. *tollmanni* (KRISTAN, 1957) — pl. 37:15.
Miliolipora cuvillieri BRÖNNIMANN and ZANINETTI, 1971
Miliolipora sp.

Family **Nodosariidae** EHRENBERG, 1838

Nodosaria ordinata TRIFONOVA, 1965
Nodosaria sp. — pl. 37:8.

"*Frondicularia woodwardi*" HOWCHIN, 1895 — pl. 37:6–7.
Austrocolomia cf. *rhaetica* OBERHAUSER, 1967
Austrocolomia sp.
Lingulina aff. *placklesensis* KRISTAN-TOLLMANN, 1970

Family **Variostomatidae** KRISTAN-TOLLMANN, 1963

Diplotremina sp. — pl. 37:16.
Variostoma sp.

Family **Involutinidae** BÜTSCHLI, 1880

Aulotortus communis (KRISTAN, 1957) — pl. 33:1.
Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN, 1968) — pl. 32:9–16.
Aulotortus impressus (KRISTAN-TOLLMANN, 1964) — pl. 34:4.
Aulotortus pragsoides (OBERHAUSER, 1964)
Aulotortus cf. *pragsoides* (OBERHAUSER, 1964) — pl. 34:1.
Aulotortus sinuosus WEYNSCHENK, 1956 — pl. 28:2; pl. 34:2–3, 5, 7–12.
Aulotortus tenuis (KRISTAN, 1957) — pl. 33:9–11.
Aulotortus tumidus (KRISTAN-TOLLMANN, 1964) — pl. 30:1, pl. 33:3–8.
Aulotortus sp. — pl. 33:2, 13–16; pl. 34:6.
Auloconus permodiscoides (OBERHAUSER, 1964) — pl. 30:2, pl. 35:1–6.
Trocholina acuta OBERHAUSER, 1964
Trocholina crassa KRISTAN, 1957
Triasina hantkeni MAJZON, 1954 — pl. 27:2; pl. 28:2; pl. 30:2–6; pl. 35:7–15.
Triasina oberhauseri KOEHN-ZANINETTI and BRÖNNIMANN, 1968 — fig. 21a, b

Family **Planispirillinidae** PILLER, 1978

?*Semiinvoluta* sp. — pl. 33:12.

Family indet.

Turrispirillina minima PANTIĆ, 1967

The families Ammodiscidae and Involutinidae predominate in number of both species and individuals in the above foraminifer assemblage, being represented by 15 and 14 species, respectively. A special attention should be paid to numerous associations of foraminifers: *Glomospirella friedli* KRISTAN-TOLLMANN (pl. 27:1, pl. 28:1), *Glomospirella pokornyi* (SALAJ) (pl. 31:1), *Tolypammina gregaria* WENDT (pl. 27:3), *Aulotortus tumidus* (KRISTAN-TOLLMANN) (pl. 30:1), and *Triasina hantkeni* MAJZON (pl. 27:2, pl. 30:2–6), locally of rock-forming importance. There are six species of the family Miliolidae represented by single individuals only. The family Fischerinidae is represented by three species of which *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN is locally (in upper dolomites of the Carpathian Keuper Group) fairly common (pl. 37:1). The remaining families occur in subordinate numbers. It should be noted that the studied material does not comprise *Semiinvoluta clari* KRISTAN which was previously reported from the West Carpathians (Hybe and Červená Skala sections) by SALAJ (1976, pl. 1:5; 1977, pl. 5:8), SALAJ *et al.* (1967, pl. 6:1, 3) and GAŹDZICKI *et al.* (1979*a*). A thorough analysis of thin sections from Hybe has not confirmed these reports. The misidentified forms represent subaxial sections of *Aulotortus tumidus* (KRISTAN-TOLLMANN).

Lower Jurassic

In the studied Lias rocks, there were identified 39 taxa of the specific or generic rank. They are assigned to eight families and 16 genera. Calcareous forms predominate here (36 species), being accompanied by only three agglutinated taxa.

The Lower Jurassic (Hettangian — Pliensbachian) foraminifer assemblage comprises the following taxa:

Family **Ammodiscidae** REUSS, 1862

Glomospira sp. — pl. 39 : 14.

Family **Textulariidae** EHRENBERG, 1838

Textularia sp. — pl. 39 : 17.

Family **Trochamminidae** SCHWAGER, 1877

Trochammina sp. — pl. 39 : 15.

Family **Fischerinidae** MILLET, 1898

Cyclogyra liasina (TERQUEM, 1866)
Cyclogyra sp. — pl. 39 : 16.
Planiinvoluta carinata LEISCHNER, 1961 — pl. 39 : 8.
Planiinvoluta sp. — pl. 39 : 9.

Family **Miliolidae** Ehrenberg, 1839

Ophthalmidium leischneri (Kristan-Tollmann, 1962) — pl. 40:1–12.
Ophthalmidium cf. *leischneri* (Kristan-Tollmann, 1962) — pl. 39:12.
Ophthalmidium martanum (Farinacci, 1959) — pl. 39:11.
Ophthalmidium walfordi Häusler, 1887 — pl. 40:13–16.
Ophthalmidium sp. — pl. 39:10, 13.

Family **Nodosariidae** Ehrenberg, 1838

Nodosaria claviformis Terquem, 1866
Nodosaria cf. *claviformis* Terquem, 1866
Nodosaria crispata Terquem, 1866
Nodosaria metensis Terquem, 1863
Nodosaria cf. *metensis* Terquem, 1863 — pl. 41:1–2.
Nodosaria nitidana Brand, 1937
Nodosaria cf. *nitidana* Brand, 1937 — pl. 41:4.
Nodosaria sp. — pl. 41:8.
?*Nodosaria* sp. — pl. 41:9.
Dentalina sp.
Frondicularia pupiformis Häusler, 1881
Frondicularia sp. — pl. 41:6.
Geinitzinita sp. — pl. 41:5.
?*Geinitzinita* sp. — pl. 41:7.
Marginulina sp.
Astacolus sp. — pl. 41:10–12.
Lenticulina sp. — pl. 41:13–16.

Family **Involutinidae** Bütschli, 1880

Involutina farinacciae Brönnimann and Koehn-Zaninetti, 1969 — pl. 28:13.
Involutina liassica (Jones, 1853) — pl. 29:1; pl. 38:1–12, 15.
Involutina turgida Kristan, 1957 — pl. 38:14.
Involutina sp. — pl. 38:16.
?*Involutina* sp. — pl. 39:2.
Trocholina umbo Frentzen, 1941 — pl. 39:3–4.
Trocholina cf. *umbo* Frentzen, 1941 — pl. 39:6.
Trocholina turris Frentzen, 1941 — pl. 39:7.
Trocholina sp. — pl. 39:5.

Family **Planispirillinidae** Piller, 1978

Semiinvoluta sp. — pl. 39:1.

In this assemblage the families Nodosariidae and Involutinidae predominate in number of both species and individuals, being represented by 17 and nine species, respectively. Nodosariids are markedly diversified. Best represented in number of individuals are the genera *Nodosaria* and *Lenticulina*. Among involutinids the most important and numerous are *Involutina liassica* (Jones) and *Trocholina umbo* Frentzen.

The family Miliolidae is represented by the genus *Opthalmidium*. *O. leischneri* (Kristan-Tollmann) forms monotypic associations composed of large numbers of individuals and is locally of marked rock-forming value in the studied Lower Lias sequence. *Ophthalmidium* *walfordi* HÄUSLER, was so far known only from the epicontinental basin of the north-western Europe.

The families Fischerinidae (with four genera) and Ammodiscidae, Textulariidae, Trochamminidae and Planispirillinidae (with one genus each) occur in subordinate numbers.

EVOLUTIONARY TRENDS

The character of evolutionary trends of Triassic and Early Jurassic families Involutinidae and Ammodiscidae is analysed in reference to variability in size and microstructure of test, number and arrangement of whorls and chambers as well as stratigraphic distribution in the studied sequences of the West Carpathians. Attention is also paid to evolutionary changes traceable in most important representatives of the genus *Ophthalmidium* KÜBLER and ZWINGLI.

Involutinidae. — The family comprises two-chambered forms consisting of spherical proloculus and tubular deuteroloculus, the coiling of which may be streptospiral, planispiral, oscillating or trochospiral. Segmentation of deuteroloculus first appears in the genus *Triasina* MAJZON and development of umbilical masses composed of numerous pillars — in the genera *Involutina* TERQUEM and *Trocholina* PAALZOW. Wall structure is built of numerous aragonite crystal needles, another important feature (see HOHENEGGER and PILLER 1977*a*, PILLER 1978).

Involutinids, on account of similarities in wall structure and test morphology, should be regarded as derivatives of Paleozoic family Archaediscidae CUSHMAN 1928. The genus *Permodiscus* DUTKEVICH in CZERNYSHEVA 1948 (fig. 13, see also OBERHAUSER 1964) may represent a direct ancestor of the earliest involutinids.

Figure 13 inferred evolutionary trends of Triassic and Early Jurassic Involutinidae BÜTSCHLI from the West Carpathians. Broken lines show probable evolutionary connections.

The first link in evolutionary lineages of involutinids is *Mesodiscus eomesozoicus* (OBERHAUSER) which appeared in the Scythian and persisted at least till the end of the Carnian (see GAŹDZICKI *et al.* 1975, PILLER 1978). That species is characterized by planispiral coiling which may help tracing its origin back to the genus *Permodiscus*.

More advanced forms, representing the genus *Aulotortus* WEYNSCHENK, first appeared in the Middle Triassic (Anisian). They include *A. pragsoides*, *A. sinuosus*, and *A. praegaschei*. The latter is characterized by the most primitive type of test, including streptospiral pattern of test structure, and *Aulotortus sinuosus* and *A. pragsoides* — by planispiral coiling of deuteroloculus. It should be added here that *A. sinuosus* still displays marked oscillations within the last whorls (pl. 34:7–9). It seems that the above species have evolved from the genus *Mesodiscus* in the latest Scythian.

A marked acceleration in evolution and radiation of involutinids may be noted in the Upper Triassic (Norian-Rhaetian). This is reflected by appearance of numerous new species of the genus *Aulotortus* (see fig. 13), including *A. impressus*, *A. communis*, *A. tenuis*, and *A. tumidus*. The species are characterized by planispiral pattern of test structure but they differ markedly from one another in test shape and number and arrangement of whorls. In the Norian, there also appears the genus *Triasina*. That genus is represented by highly characteristic and, at the same time, very short evolutionary line *T. oberhauseri* → *T. hantkeni*. The appearance of segmentation of deuteroloculus represents a new element in evolutionary lineage of involutinids and further evidence for progress in their radiation (see fig. 13). The above mentioned forms presumably evolved from the genus *Aulotortus* (most probably from *A. pragsoides*) in the Late Carnian.

In the Norian, trochospiral *Auloconus permodiscoides* (OBERHAUSER) appears. These forms

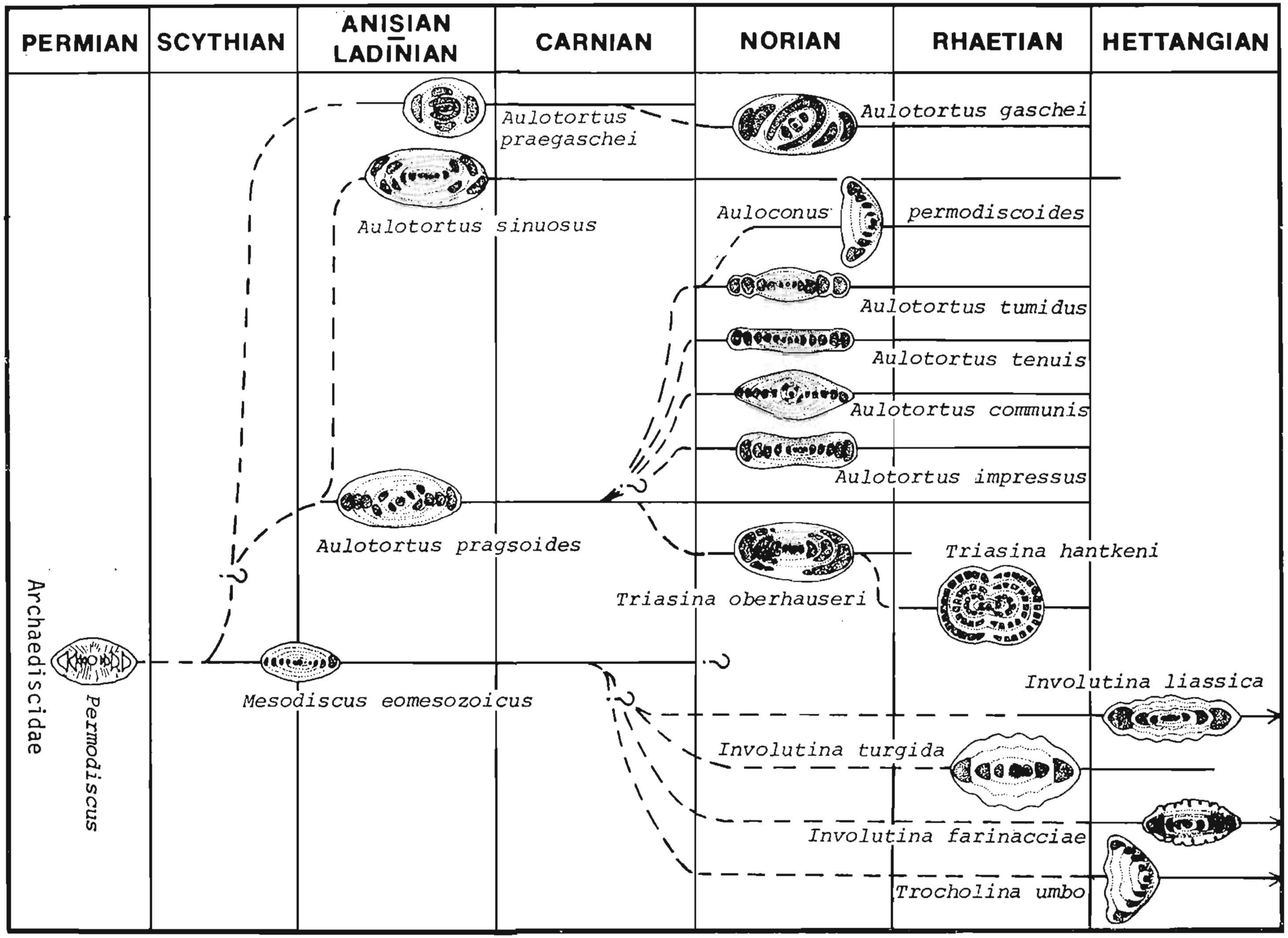

Fig. 13
Stratigraphic distribution and suggested evolutionary trends within the family Involutinidae Bütschli, 1880 in Triassic and Lower Jurassic of the West Carpathians.

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may be also regarded as derivatives of the genus *Aulotortus* (most probably from the species *A. tumidus*).

The accelerated radiation of involutinids in the Norian-Rhaetian times has been followed by sudden extinction of all of them at the turn of the Rhaetian and Hettangian (= Triassic/Jurassic boundary), except for *A. sinuosus*. The crisis was also survived by a few other species of *Involutina* and *Trocholina*, which did not appear before the Late Rhaetian: e.g. *Involutina liassica*, *I. turgida*, *I. farinacciae*, and *Trocholina umbo*, known also from the Lias. The latter species are characterized by planispiral or trochospiral pattern of coiling and umbilical masses composed of numerous pillars. The appearance of pillars most probably is a new element in evolutionary line of involutinids. Both *Involutina* and *Trocholina* seem to represent derivatives of the genus *Mesodiscus*, from which they may have evolved at the turn of the Carnian and Norian.

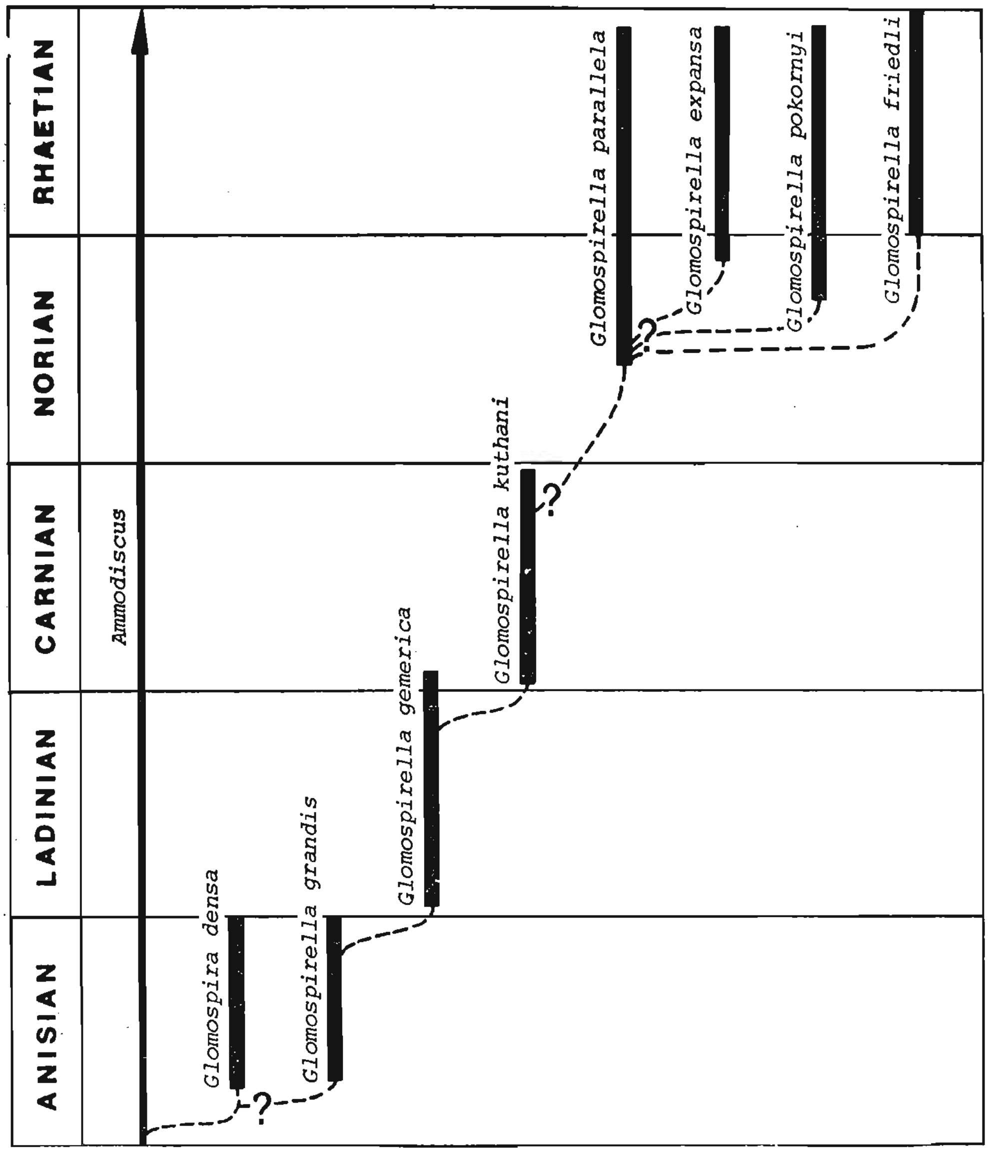

Fig. 14
Stratigraphic distribution and suggested evolutionary trends of most important Triassic representatives of the family Ammodiscidae Reuss, 1862 in the West Carpathians.

Ammodiscidae. — In analysis of that family, attention was mainly paid to the genera *Glomospira* RZEHAK and *Glomospirella* PLUMMER. They are characterized by irregular and planispiral pattern of test structure and test consisting of proloculus and undivided planispirally enrolled tubular chamber. Walls are very finelly agglutinated. The family is especially common in the Middle and Upper Triassic of the West Carpathians.

Stratigraphically significant Anisian foraminifers include *Glomospira densa* and *Glomospirella grandis* (see SALAJ *et al.* 1967, BORZA 1970, BEŁKA and GAŹDZICKI 1976), which are presumably derivatives of the genus *Ammodiscus* REUSS.

In the Ladinian-Carnian strata, Ammodiscidae are rather innumerous and of limited value, except for the representatives of *Glomospirella gemerica* and *G. kuthani* (fig. 14, see also SALAJ 1976).

Similarly as in the case of Involutinidae, the evolution of Ammodiscidae became markedly accelerated at the turn of the Norian and Rhaetian. At that time, a marked radiation took place (fig. 14) and several new species appeared: *Glomospirella parallela*, *G. expansa*, *G. pokornyi*, and finally *G. friedli* (figs. 5–9, see also MICHALÍK *et al.* 1979).

The above mentioned crisis at the turn of the Triassic and Jurassic affected also Ammodiscidae. All their species known from the Norian-Rhaetian sequences in the West Carpathians became extinct at the end of the Triassic and only innumerous *Glomospira* sp. are present in the Lower Lias (pl. 39:14).

Ophthalmidiinae. — The analysis of phylogenetic relations within this subfamily is markedly impeded by insufficient knowledge, especially in the case of Triassic forms. In the studied sections, this subfamily is primarily represented by individuals of the genus *Ophthalmidium* (fig. 15). The oldest representative of that genus in the West Carpathians is *Ophthalmidium chialingchiangensis* (HO 1959), first recorded in the Upper Scythian and known to be especially numerous in the Anisian (see GAŹDZICKI and ZAWIDZKA 1973, SALAJ 1977, 1980). That taxon presumably evolved from representatives of the Paleozoic genus *Hemigordius* SCHUBERT 1908 (see ZANINETTI and BRÖNNIMANN 1969). *Ophthalmidium tricki* (LANGER 1968) and *O. exiguum* KOEHN-ZANINETTI 1968 are known from the Anisian-Ladinian, and the latter — also from the Lower Carnian (GAŹDZICKI *et al.* 1978, SALAJ 1980).

Ophthalmidium is fairly rare in the Upper Carnian-Lower Norian strata of the West Carpathians, becoming more common and therefore of higher stratigraphic value from the Middle Norian upwards. This is connected with appearance of new species: *O. carpathicum*, *O. triadicum*, *O.* "*carinatum*" and *O. martanum*, the last two known also from the Lower Lias (fig. 15).

In the studied foraminifer assemblages from the West Carpathians, *Ophthalmidium* begin to predominate from the lowermost Lias (Hettangian-Sinemurian) upwards. The association of *O. leischneri*, often accompanied by *O. walfordi*, are especially numerous. Upper parts of the Jurassic section display maximum development of the genus *Ophthalmidium* (see PAZDROWA 1958, PAZDRO 1972).

The recognized evolutionary lineages of foraminifers are especially important for evaluating stratigraphic value of these microfossils and for better understanding of their taxonomy.

SEDIMENTARY ENVIRONMENT WITH REMARKS ON FORAMINIFERAL PALEOECOLOGY AND TAPHONOMY

In the West Carpathians, the richest associations of Upper Triassic-Lower Jurassic benthonic foraminifers were found in rocks of the Fatra and Norovica Formations, Hybe Beds, Skalka Limestone, Bleskový prameň Limestone and Kopieniec Formation. The rocks originated in relatively shallow marine environments. Such nature of the environments is evidenced by

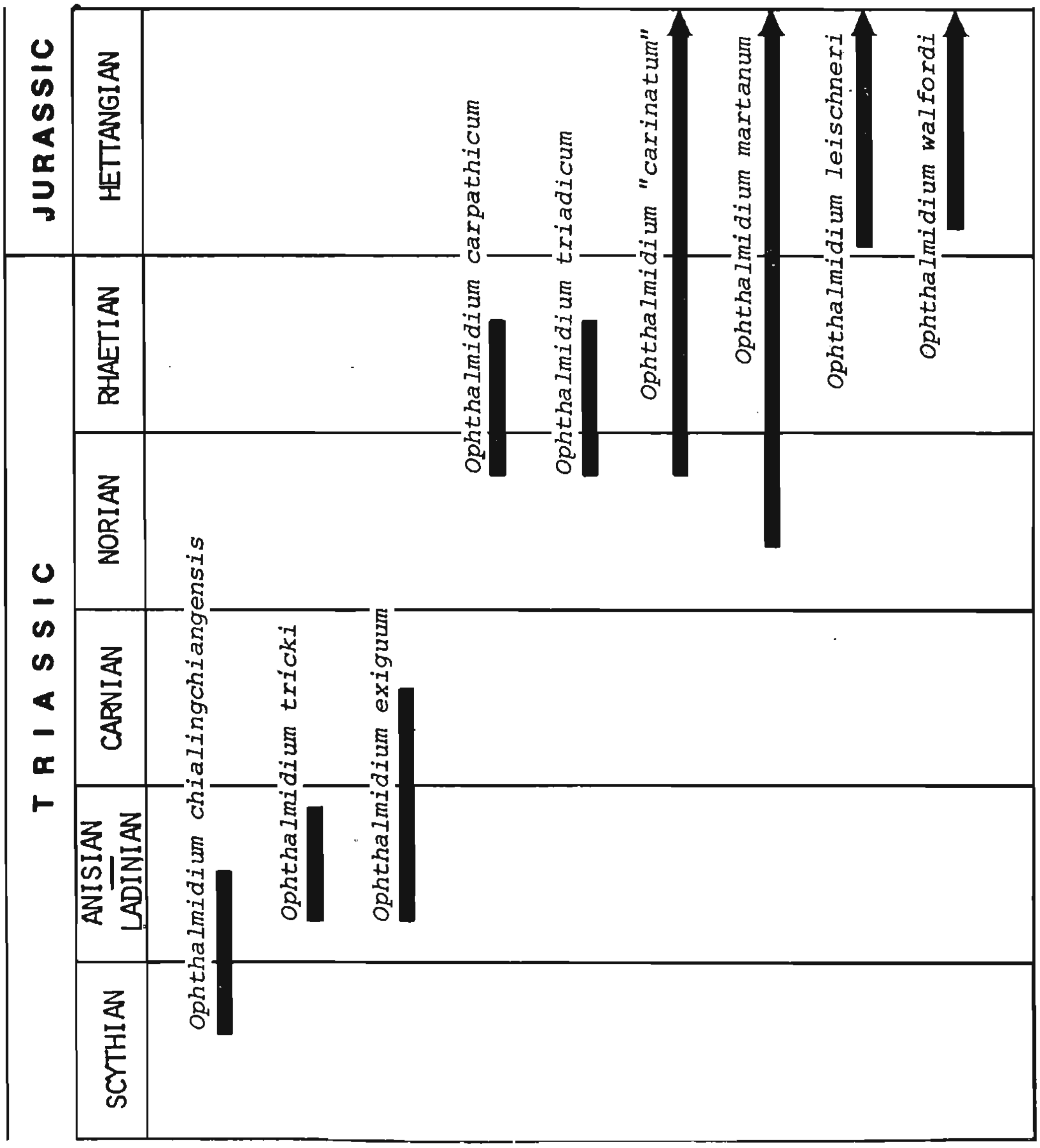

Fig. 15
Stratigraphic distribution of most important representatives of the genus *Ophthalmidium* KÜBLER and ZWINGLI, 1870 in Triassic and Lower Jurrassic of the West Carpathians.

the wealth of ooids and oncoids as well as various skeletal fragments. Among the later, there are present both fragments of sessile (sponges, corals, brachiopods, pelecypods, and crinoids) and vagile benthonic forms (gastropods, ophiuroids, echinoids and starfishes (see ČEPEK 1970, GAŹDZICKI 1974, 1975, MICHALÍK 1978*b*, MICHALÍK and JENDREJÁKOVÁ 1978, GAŹDZICKI and MICHALÍK 1980). Locally, foraminifers are the major microfaunal components of the communities (see pls. 27: 1–2, 28; 2, 29: 1–2, 30: 1–6). Algal coatings around bioclasts or foraminifers tests are common (pls. 27:3, 29:1–2, 38:13–15), giving further support to deposition in photic zone under shallow-marine conditions (see SELLWOOD 1978). The abundance of calcarenites is typical of shallow subtidal zone with high agitation of waters (HECKEL 1972). The general lithological character of the rocks reflects some significant facies changes, related to uplifting movements from the turn of the Triassic and Jurassic (Early Kimmerian phase). The movements resulted in marked decrease of depth of the sedimentary basin in relation to that from the Late Triassic, some sea regression at the turn of the Rhaetian and Hettangian (not leading, however, to emergence of land), and predominance of clastic deposits in basal part of Lias sequence (figs. 11–12). A new marine transgression has begun at the beginning of the Jurassic (Hettangian-Sinemurian). It is reflected by numerous intercalations of carbonate rocks rich in marine fossils in Lower Lias clastic sequence (figs. 11–12, see also ČEPEK 1970, GAŹDZICKI *et al.* 1979*b*).

Ecological distribution of benthonic foraminifers was analysed on the basis of the best known succession of the Fatra Formation (see MICHALÍK and JENDREJÁKOVÁ 1978, MICHALÍK 1978*a*, *b*; GAŹDZICKI *et al.* 1979*b*). Foraminifers are here primarily limited to biostromal elevations and lagoons in shelf zone, characterized by marked predominance of shallow-water carbonate deposits (fig. 16). The foraminifers display a specific pattern of distribution and, therefore, they appear to be good facies indicators (see fig. 16).

The foraminifers are most common in areas of biostromal elevations (fig. 16), built by algae, sponges, corals, and brachiopods. The elevations are inhabited mainly by Involutinidae and Ammodiscidae. The representatives of the sessile genus *Tolypammina*, often encrustating coral colonies, are especially numerous in central parts of such elevations. They are sometimes accompanied by *Alpinophragmium*. The family Involutinidae is here mainly represented by the genera *Aulotortus*, *Auloconus*, and *Triasina*, most common in inner parts of the elevations and forming associations especially rich in individuals (pls. 27:2, 30:3, 5). It is worth to note that involutinids inhabitating that zone are characterized by massive structure, and large (about 1 mm in size) and relatively thick walled tests. Such features of tests may be explained by high water turbulence (see MURRAY 1973, BOLTOVSKOY and WRIGHT 1976). In the area of biostromal elevations, the representatives of the genera *Glomospira* and *Glomospirella* appear somewhat less frequent than involutinids.

Involutinids and ammodiscids also predominate in lagoon zones, characterized by marly and marly limestone facies. Here predominate representatives of the genera *Aulotortus*, *Glomospira* and *Glomospirella*. The last two genera are mainly found in lagoon zones affected by supply of terrigenic material of psammite size from neighbouring land areas (see BEŁKA and GAŹDZICKI 1976). Relatively smaller associations are formed by *Triasina*, *Auloconus*, *Trochammina*, "*Tetrataxis*" and nodosariids. Involutinids occurring in the lagoon zone are characterized by smaller and finer tests than those from the biostromal elevations (see pl. 30:1), which may be explained by less turbulent waters as well as lower availability of $CaCO_3$ (see GREINER 1974, DOUGLAS 1979).

Foraminifers are also locally recorded in rocks formed in hypersaline environments of the restricted shelf zone. In that zone, they are represented by associations of *Agathammina* (pl. 37:1) and *Glomospira* and *Glomospirella* (pl. 31:9), the only taxons capable to accomodate to the changed sedimentary conditions. Involutinids are completely missing in that environment (see SALAJ 1980).

It should be noted that common fluctuations in bathymetry and salinity, typical for sedimentary environment of the Fatra Formation (see MICHALIK 1980), were unfavourable for development of foraminifers. They are here somewhat impoverished in number of taxa and individuals in relation to foraminifers from rocks of the Norovica Formation (see GAŹDZICKI and MICHALÍK 1980).

An interesting association of foraminifers is formed by *Involutina liassica*, *I. turgida*, *I. farinacciae* and *Trocholina umbo* in deposits of the Kopieniec Formation. The foraminifers are characterized by development of umbilical masses composed of pillars (see pl. 38:1–16). As stated above, the appearance of pillars is treated as a new element in evolutionary development of "post-Triassic" Involutinidae (BRÖNNIMANN and KOEHN-ZANINETTI 1969). It is highly probable that the appearance of pillars was similarly related to adaptation to new environmental conditions connected with a change in the sedimentary basin in the Early Lias (see GAŹDZICKI

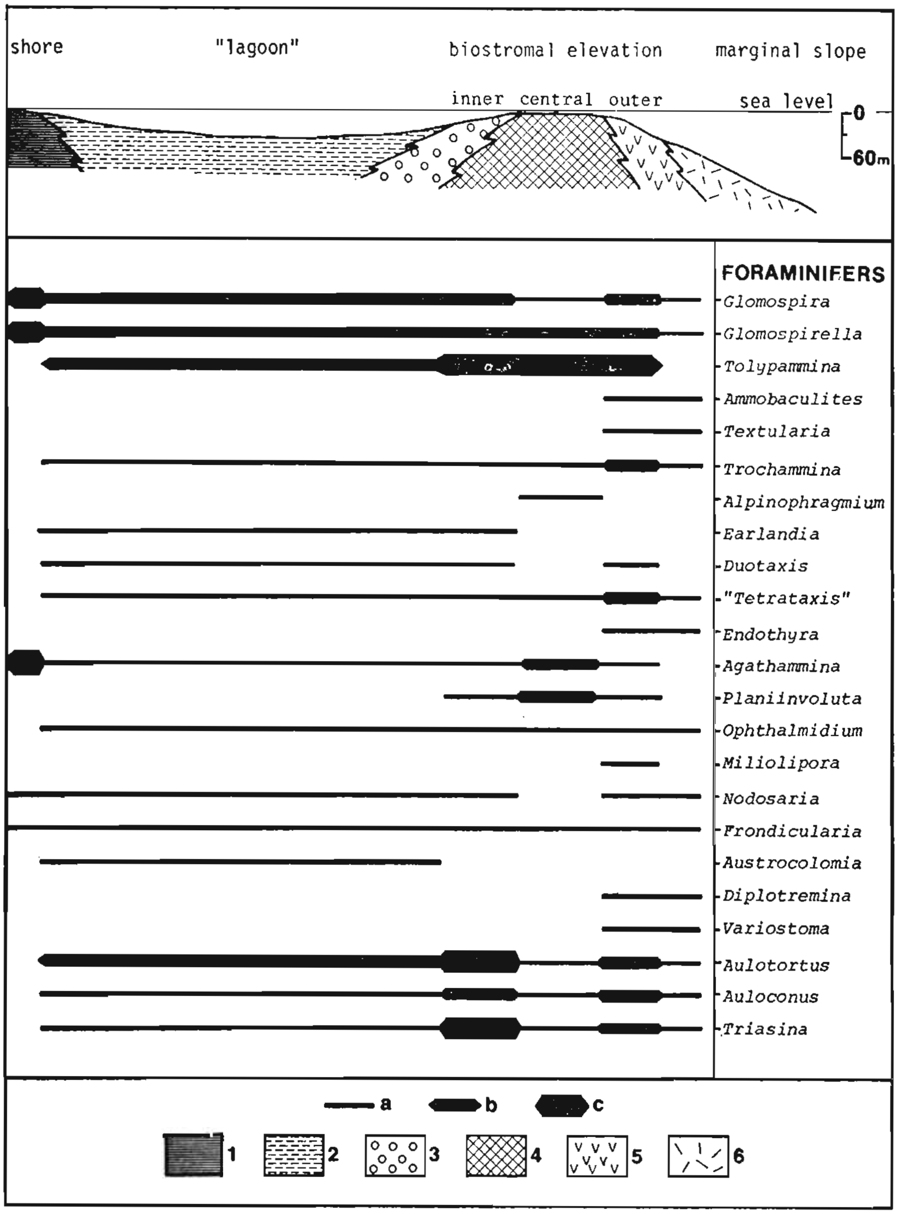

Fig. 16
Ecologic distribution and frequency of the foraminifers in the lithofacies of the Fatra Formation (uppermost Triassic of the Križna unit). *1* dolomite and marly dolomite; *2* marl and marly limestone with pelecypods and gastropods, sometimes sandy limestone; *3* skeletal limestone (calcarenite) with megalodonts and algae; *4* coral and sponge limestone; *5* brachiopod (*Rhaetina*) lumachelles; *6* crinoid limestone.
Frequency of foraminifers: *a* rare, *b* frequent, *c* abundant

et al. 1979*b*). Be this the case, the appearance of pillars should be treated as phenotypic variability in involutinids (see ZANINETTI 1976, PILLER 1978).

Regeneration of tests is fairly rare in the studied foraminifer assemblages. The phenomenon appears most common in Lower Lias species *Ophthalmidium leischneri*. Individuals of that species, especially microspheric forms could easily loose outer whorl due to mechanical breakage on account of fine structure of their tests. Regeneration of tests damaged in that way is connected with reconstruction of one or two last chambers which, however, follow a different structure pattern than the preceding ones (see pl. 40:12).

Tests of many foraminifers (mainly involutinids) occurring in the studied rocks, especially in the Mojtin Limestone Member of the Norovica Formation, are often broken (pl. 28:2). The destruction took place during their post mortem transportation by local bottom currents. The co-occurring brachiopods and crinoids are also crushed (see pl. 28:2).

Foraminifer tests are often covered with onkolitic crusts (pls. 27:2, 30:5, 38:14), visible in thin sections as thin uniform envelopes (pl. 38:13) or thick irregular coatings (pl. 38:15). The origin of onkolitic crusts, envelopes and coatings is connected with the activity of blue-green algae (see BATHURST 1971). Algal crusts enveloping foraminifer tests from all sides, give evidence for movement of the tests on sea floor.

Foraminifer tests with oolitic coatings (pl. 30:4) have also been found. In that case,the tests acted as nuclei and the final shape of an ooid reflects that of the test (pls. 31:3, 38:16). Coatings of *Girvanella* NICHOLSON and ETHERIDGE are less common. The algae either form overgrowths (pl. 33:16) or continuous coatings of foraminifer tests (pl. 35:7).

Some tests of large foraminifers of the genera *Aulotortus and Triasina* were found to provide a substratum for attachment of sessile foraminifers *Tolypammina gregaria* WENDT. Tolypamminas were not only inhabitating the surface of the large tests but they were also entering their interior, living in some chambers (see pls. 33:15, 35:9).

Diagenetic alternations often resulted in the deformation as well as recrystallization of foraminifer tests. Deformations of tests of *Triasina hantkeni* MAJZON due to compaction were mainly recorded in marly limestones of the Norovica Formation (pls. 30:6, 35:8). Tests of foraminifers, mainly those of the family Involutinidae, more often display sparitization (pls. 27:2, 28:2, 30:1–3). Sparitization was usually progressing from the test center, inaccessible for micritic mud (see pls. 30:1–2, 35:12, 15). In some cases, the whole interior of the test is filled with sparite crystals (pls. 30:1–2, 35:6, 15). Advancing recrystallization may lead to obliteration of internal structure of foraminifer tests (see pls. 30:2–3, 35:15).

FORAMINIFER BIOSTRATIGRAPHY

The zonation of Upper Triassic and Lower Jurassic strata was carried out in reference to the results of studies on foraminifer successions in 33 sections in different tectonic units of the West Carpathians (fig. 1). The recognized evolutionary lineages and the rates of evolutionary changes in test morphology of representatives of the families Involutinidae and Ammodiscidae and the subfamily Ophthalmidiinae permit to separate a few stratigraphically important species and to use them in establishing relatively precise zonation. A sequence of three foraminifer zones — *Triasina oberhauseri* (Norian), *Glomospirella friedli* and *Triasina hantkeni* (Rhaetian), *Ophthalmidium leischneri* and *Ophthalmidium walfordi* (Hettangian — ?Sinemurian) Zones — is recognized as the first appearance and extinction of individual species in the sections studies is taken into account (figs. 5–12). Lower boundaries of the above zones are defined by first appearance of their index species. The above subdivision represents at the same time a revision of those previously proposed by SALAJ (1969*a*, 1977) and GAŹDZICKI (1974, 1977).

Triasina oberhauseri Zone

Partial-range Zone; Norian (*sensu* KOZUR 1972, 1980)

Definition. — Interval with zonal marker, from its first occurrence to the first occurrence of *Triasina hantkeni* or *Glomospirella friedli*.

Type locality. — Hybe (section 25, layers 4–8), Nizke Tatry Mts (Czechoslovakia). — see fig. 9.

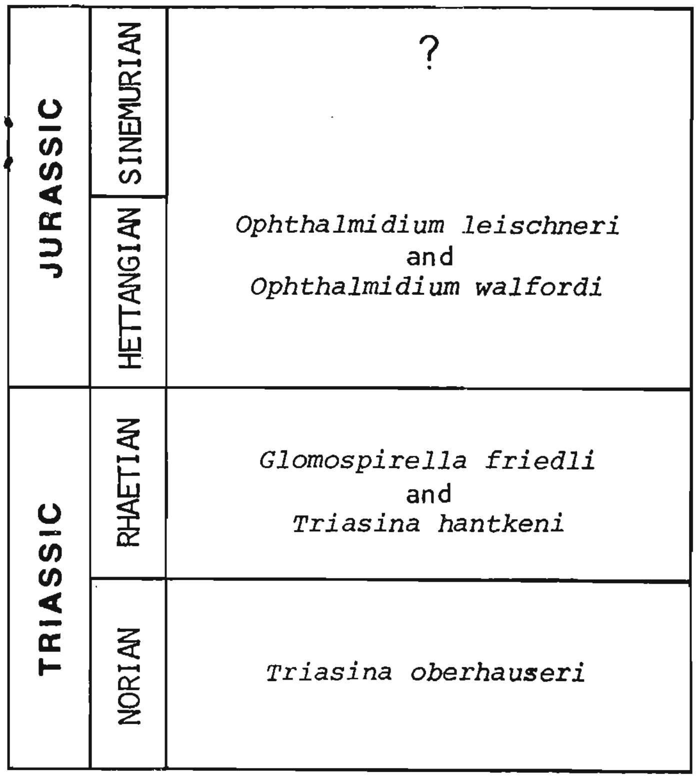

Fig. 17
Foraminifer biostratigraphy of the uppermost Triassic and lowermost Jurassic in the West Carpathians.

Remarks. — SALAJ (1977) differentiated the *Semiinvoluta clari* and *Triasina oberhauseri* Assemblage-Zone in Middle Norian (Alaunian) strata. However, the forms assigned to *Semiinvoluta clari* by SALAJ (1976, pl. 1:5, 1977, pl. 5:8) and GAŹDZICKI *et al.* (1979*a*) appeared to be misidentified and the majority of them represent the species *Aulotortus tumidus*. There is no evidence for the presence of *Semiinvoluta clari* in the Norian of the West Carpathians and, consequently, it cannot be used as index fossil.

It was also found that the stratigraphic range of *Triasina oberhauseri*, the other zonal marker, comprises the Lower Norian (Lacian) — lowermost Rhaetian interval and this species is a direct ancestor of *Triasina hantkeni*. This gives support to differentiation of *Triasina oberhauseri* Partial-range Zone in the Norian. It should be noted that *Triasina oberhauseri* was also found in samples from Norian Dachstein Limestone of Bakony Forest in Hungary, kindly supplied by Prof. E. VÉGH-NEUBRANDT.

Geographic distribution. — Czechoslovakia (SALAJ 1976, GAŹDZICKI *et al.* 1979*a*), Hungary (GAŹDZICKI, this paper), Austria (KOEHN-ZANINETTI and BRÖNNIMANN 1968), USSR (EFIMOVA 1974), Turkey (ZANINETTI 1976), China (HE YAN 1980).

Glomospirella friedli and *Triasina hantkeni* Zone

Assemblage Zone; Rhaetian (*sensu* KOZUR 1973, see also GAŹDZICKI *et al.* 1979*a*)

Definition. — The range of this zone is defined by stratigraphic ranges of the species *Glomospirella friedli* and *Triasina hantkeni*. This zone is also characterized by the association of index fossils with *Glomospirella pokornyi* (only on lower part of the zone).

Type locality. — Mt. Velká Furkaska (section 17, layers 317–404), Tatra Mts (Czechoslovakia). — see fig. 5.

Remarks. — On the basis of foraminifer microfauna, the Rhaetian was divided into the Lower — the *pokornyi* and *friedli* Zone, and the Upper — the *hantkeni* Zone (SALAJ 1969*a*, 1977; GAŹDZICKI 1974, 1977). However, further detailed analysis of stratigraphic distribution of foraminifers in sections of the uppermost Triassic in the West Carpathians has shown that the index fossil, *Glomospirella friedli*, is present in both lower and upper parts of the Rhaetian (figs 5–8), whereas the index fossil of the Upper Rhaetian, *Triasina hantkeni*, already appears in the lowermost Rhaetian. These findings preclude the use of the above mentioned subdivision of the Rhaetian and, therefore, the previously proposed *pokornyi* and *friedli* Zone and *hantkeni* Zone are here treated as a single, *Glomospirella friedli* and *Triasina hantkeni* Assemblage Zone, comprising the whole Rhaetian Stage in the West Carpathians.

Geographic distribution. — Czechoslovakia (SALAJ *et al.* 1967, SALAJ 1969*a*, 1977) Poland (GAŹDZICKI 1970, 1974, 1977), Hungary (MAJZON 1954, ORAVECZ-SCHEFFER 1973), Romania (GAŹDZICKI, this paper), Austria (KRISTAN-TOLLMANN 1962, OBERHAUSER 1964, PAPP and TURNOVSKY 1970), France (ZANINETTI 1977*a*, *b*), Switzerland (WEIDMANN and ZANINETTI 1974), Italy (ANONYMOUS 1959, BOSELLINI and BROGLIO LORIGA 1965, FUGANTI and MOSNA 1966), Yugoslavia (RADOIČIĆ 1966, PANTIĆ 1967, PANTIĆ-PRODANOVIĆ 1975, GUŠIĆ 1975), Greece (CHRISTODOULOU and TSAILA-MONOPOLIS 1972, ZANINETTI and THIEBAULT 1975), Morocco (RAOULT 1962), Tunisia (SALAJ and STRANIK 1970), Turkey (BRÖNNIMANN *et al.* 1970, ZANINETTI 1976), Iran (BRÖNNIMANN *et al.* 1972, ZANINETTI *et al.* 1972), Afghanistan (LYS and MARIN 1973), China (HO YEN and HU LAN-YING 1977, HE YAN 1980), Philippines (FONTAINE *et al.* 1979) and Papua New Guinea (GAŹDZICKI 1978).

Ophthalmidium leischneri and ***Ophthalmidium walfordi*** Zone

Assemblage Zone; Hettangian — ?Sinemurian

Definition. — The range of this zone is defined by stratigraphic ranges of the species *Ophthalmidium leischneri* and *Ophthalmidium walfordi*. The zone is also characterized by an association of the index fossils and *Involutina liassica*, *Involutina farinacciae* and *Trocholina umbo*.

Type locality. — Mt. Velká Furkaska (section 17, layers 414–442), Tatra Mts. Czechoslovakia) — see fig. 11.

Remarks. — In the West Carpathians, the basal part of the Hettangian and, therefore, the base of the Lias are defined by the first appearance of *Involutina liassica* (see SALAJ 1969*a*). That species is, however, inconvenient as index fossil as its range straddles the Rhaetian/Hettangian boundary, extending from upper part of the Rhaetian through the Jurassic up to the Lower Cretaceous (KRISTAN 1957, RADOIČIĆ 1962, PILLER 1978). That is why the author (GAŹDZICKI 1974, 1977) has proposed to single out "*Vidalina*" *leischneri* Range Zone in Lower Lias of the Tatra Mts. According to newly obtained data on Lower Lias sections of the West Carpathians (figs. 11–12), *Ophthalmidium leischneri* occurs together with *Ophthalmidium walfordi*, hitherto known from coeval rocks of epicontinental basin in north-western Europe only (FRANKE 1936, WOOD and BARNARD 1946). Be this the case, the distinction of the *Ophthalmidium leischneri* and *Ophthalmidium walfordi* Assemblage Zone should make it possible to correlate Lias sections of the Tethys Realm and those of epicontinental basin in the north-western Europe. This also indicates that the lower boundary of this zone delineates the boundary between the Triassic and Jurassic in the West Carpathians. It should be added that upper boundary of that zone is still poorly defined as a detailed analysis of higher stratigraphic members is till missing in the region studied.

Geographic distribution. — Czechoslovakia (GAŹDZICKI, this paper), Poland (GAŹDZICKI, 1974, 1975), Austria (LEISCHNER 1961, KRISTAN-TOLLMANN 1962, PAPP and TURNOVSKY 1970), Federal Republic of Germany (ISSLER 1908, FRANKE 1936), Great Britain (WOOD and BARNARD 1946), France (ZANINETTI 1977*a*), Italy (CITA 1965), Yugoslavia (RAMOVŠ and REBEK 1970, GUŠIĆ 1975), Turkey (BRÖNNIMANN *et al.* 1970).

STRATIGRAPHIC CORRELATION

Foraminifer zonation of the uppermost Triassic in the West Carpathians has been correlated with orthostratigraphic ammonoid zonation of the Norian and Rhaetian *sensu* KOZUR (1973, 1980), concordant with the GÜMBEL'S (1861) subdivision (fig. 18, see also GAŹDZICKI *et al.* 1979*a*). *Triasina oberhauseri* Zone, as interpreted above, extends from *Mojsisovicsites kerri* Zone to *Cochloceras suessi* Zone (Norian). *Glomospirella friedli* and *Triasina hantkeni* Zone may be correlated with ammonoid *Choristoceras haueri* and *Choristoceras marshi* Zones (Rhaetian) and its extent corresponds to that of the conodont *Misikella posthernsteini* Zone (GAŹDZICKI 1978*a,b*; GAŹDZICKI *et al.* 1979*a*). In turn, the extent of Lower Lias *Ophthalmidium leischneri* and *Ophthalmidium walfordi* Zone corresponds to that of the ammonoid *Psiloceras planorbis Schlotheimia angulata* and presumably *Arietites bucklandi* Zones (Hettangian — ?Sinemurian); (GAŹDZICKI *et al.* 1979*b*, see also KRISTAN-TOLLMANN 1962).

STAGE	RHAETIAN		HETTANGIAN	
Substage	Lower	Upper	Lower	Upper
Ammonoid zones	*Choristoceras haueri*	*Choristoceras marshi*	*Psiloceras planorbis*	*Schlotheimia angulata*
Conodont zones	*Misikella posthernsteini*		—	
Foraminifer zones	*Glomospirella friedli* and *Triasina hantkeni*		*Ophthalmidium leischneri* and *Ophthalmidium walfordi*	

Fig. 18
Stratigraphic correlation of the ammonoid, conodont and foraminifer zones in the Rhaetian and Hettangian of the Alpine-Carpathian region. For stratigraphic comments see GAŹDZICKI *et al.* 1979 *a*.

REMARKS ON CHRONOSTRATIGRAPHIC BOUNDARIES

The foraminifer zonation given above makes it possible to single out the following stages: Norian (*Triasina oberhauseri* Zone), Rhaetian (*Glomospirella friedli* and *Triasina hantkeni* Zone), and Hettangian — ?Sinemurian (*Ophthalmidium leischneri* and *Ophthalmidium walfordi* Zone). At the same time, it makes possible reanalysis of the question of stratigraphic boundaries between Carnian and Norian, Norian and Rhaetian and Rhaetian and Hettangian (= Triassic/Jurassic boundary) in the West Carpathians.

Carnian/Norian boundary. — The boundary is passing in the interval delineated from below by the last occurrence of *Glomospirella kuthani* (SALAJ), index fossil of the *kuthani* Zone *sensu* SALAJ (1969*a*, 1977), and from above — by first appearance of *Triasina oberhauseri* KOEHN-ZANINETTI and BRÖNNIMANN, index fossil of the *oberhauseri* Zone *sensu* GAŹDZICKI (this paper).

Strata of the Carnian age are out of scope of this paper so it should be noted that in the West Carpathians they are dated by several foraminifers including *Glomospirella kuthani* (SALAJ, *Mesodiscus eomesozoicus* (OBERHAUSER), *Aulotortus praegaschei* (KOEHN-ZANINETTI), *Lamelliconus biconvexus* (OBERHAUSER), *L. procerus* (LIEBUS), *Pachyphloides klebelsbergi* (OBERHAUSER), and *P. oberhauseri* SELLIER de CIVRIEUX and DESSAUVAGIE (see SALAJ 1969*a*, 1977; SALAJ and JENDREJÁKOVÁ 1967; SALAJ *et al.* 1967; JENDREJÁKOVÁ 1973, GAŹDZICKI *et al.* 1978).

Norian/Rbaetian boundary. — Lower boundary of the Rhaetian Stage is defined by the first appearance of *Glomospirella friedli* or *Triasina hantkeni* (see figs. 5–10). The underlying strata are of the Norian (Sevatian) age. The boundary is passing within the Carpathian Keuper or Fatra Formation in the Fatricum and within the Norovica Formation in the Hronicum (fig. 2).

Rhaetian/Hettangian boundary. — In the sections studied (figs. 5, 11–12), the uppermost layer yielding index fossils of the Rhaetian, *Glomospirella friedli* or *Triasina hantkeni*, and the lowermost layer with index fossils of the Hettangian — ?Sinemurian, *Ophthalmidium leischneri* or *O. walfordi*, are separated by a series of clastic deposits without any foraminifers, 10 to 15 m thick. The Rhaetian/Hettangian boundary (= Triassic/Jurassic boundary) in the West Carpathians is drawn within this series, interpreted as the correlation error interval.

DIACHRONISM OF THE LITHOSTRATIGRAPHIC UNITS

A detailed biostratigraphic zonation of the Upper Triassic and Lower Jurassic of the West Carpathians, established on the basis of foraminifers, shows that boundaries of the Carpathian Keuper, and Fatra and Kopieniec Formations in the Fatricum and Norovica Formation in the Hronicum are diachronous and they cannot be used as time lines (figs 2, 5–10). Upper part of the Carpathian Keuper Group in the sections Mt. Velká Furkaska (section 17) and Lejowa Valley I (section 18), widely assumed to be of the Carnian-Norian age (SOKOŁOWSKI 1959, KOTAŃSKI 1963, 1979), was found to be of the Rhaetian age (GAŹDZICKI *et al.* 1979b). Sedimentation of rocks of the Fatra and Norovica Formations was recently shown to begin as early as the Late Norian (GAŹDZICKI and IWANOW 1976, GAŹDZICKI and MICHALIK 1980) whereas the Kopieniec Formation began to originate not before the Rhaetian (*friedli* and *hantkeni* Zone) on the Štefanský žlab section (19) and even not before the Hettangian — ?Sinemurian (*leischneri* and *walfordi* Zone) in the Mt. Velká Furkaska section (18). This disappearance of carbonate facies of the Fatra Formation and development of clastic facies of the Kopieniec Formation in the Carpathian sedimentary basin in Late Triassic and Early Jurassic times prove an increasing regression related to uplifting movements of the Early Kimmerian phase. In the West Carpathians, the movements began in the Rhaetian (*friedli* and *hantkeni* Zone) and their maximum activity was marked in the Early Lias (*leischneri* and *walfordi* Zone).

PALEOGEOGRAPHIC DISTRIBUTION

In the Late Triassic and Early Jurassic, geographic distribution of benthonic foraminifer faunas, mainly comprising representatives of the families Involutinidae, Ammodiscidae, and Miliolidae, was controlled by facies pattern.

In the analysis of the distribution, attention should be paid to Involutinidae. Representatives of that family form associations comprising large numbers of individuals in Triassic rocks. The occurrence of such associations appears clearly related to areas of lagoons and biostromal elevations in shelf zones, where a carbonate sedimentation was prevailing.

The analysis of distribution of Upper Triassic facies in Europe and North Africa (fig. 19) has shown that shallow-water carbonate facies, characterized by the wealth of sponge, corals, brachiopods, pelecypods, and echinoderms, fairly well coincides with areas of occurrence of involutinids (fig. 20). According to paleogeographic distributions (SMITH and BRIDEN 1977, figs. 12, 25, 51, see also MICHALÍK 1978*a*, fig. 1), such shallow-water carbonate facies of the Upper Triassic were related to shelf areas, mainly those of the northern coast of the Tethyan Ocean. Therefore, the distribution of involutinids in the uppermost Triassic of the Tethys is found to coincide with that of the shallow-water facies (fig. 20). It follows that for the late Triassic, involutinids are a sensitive paleogeographic indicator for the Tethys Realm.

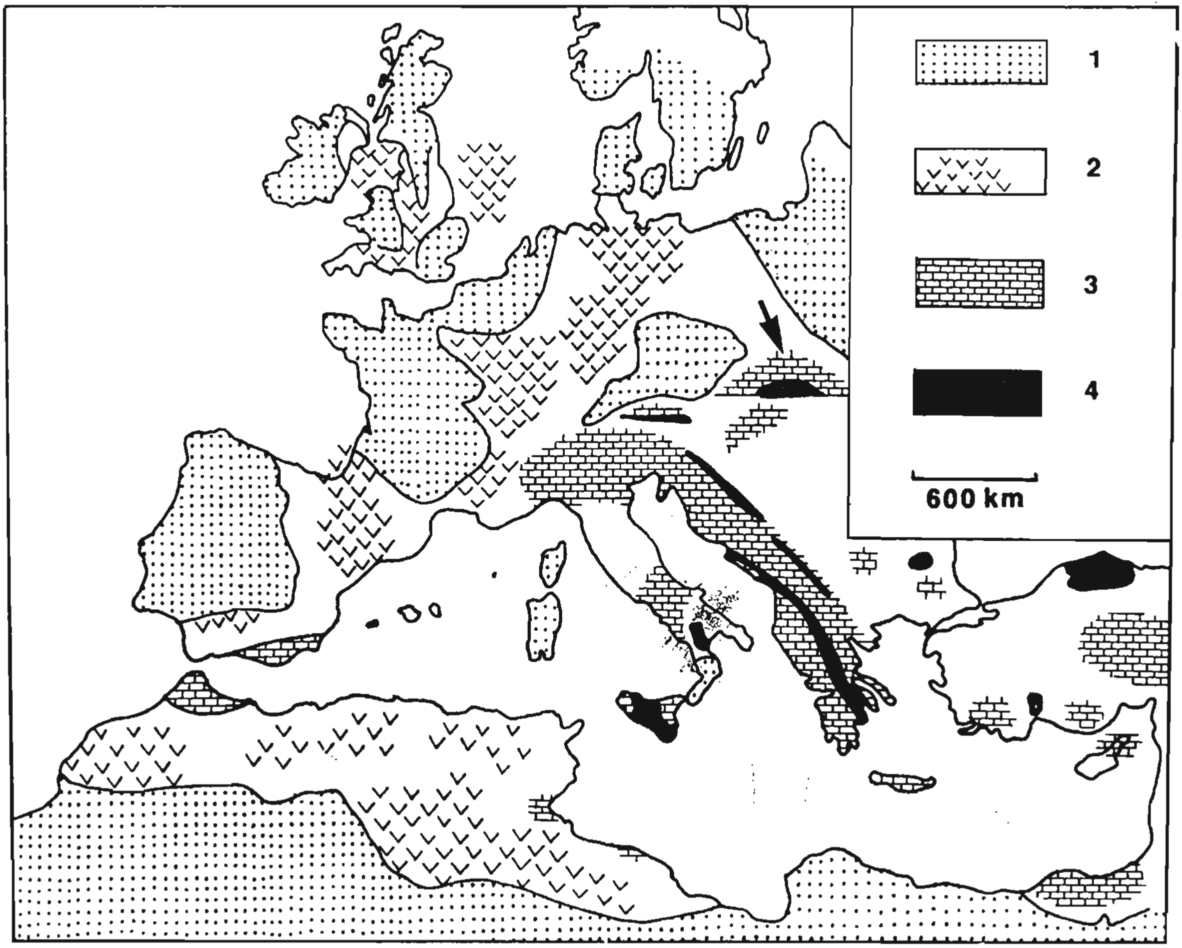

Fig. 19
Present distribution of the Late Triassic facies in Europe and North Africa (arrow indicates the area investigated in the present paper): *1* continental facies (red beds); *2* evaporite facies with main halite deposits (vvv); *3* shallow-water carbonate facies (platform carbonates with more or less subsidence); *4* deeper water facies (Hallstatt Limestone and related facies). (Adopted from BOSELLINI and HSÜ, 1973, figs 1–3).

The studied Norian-Rhaetian foraminifer assemblages of the West Carpathians (in the Fatra and Norovica Formations, Hybe Beds, Skalka Limestone and Bleskový prameň Limestone) are very similar to contemporaneous assemblages in other parts of the Tethys Realm in both taxonomic composition and stratigraphic succession of individual associations. The similarities are not confined to assemblages from neighbouring areas in the Alpine Europe (GAŹDZICKI 1974, ZANINETTI 1976, SALAJ 1980), being equally high in other parts of the Tethys Realm: from Rif Mts. in Morocco to Calamian Islands of Philippines as well as Papua New

Guinea (fig. 20, see also ZANINETTI 1976, GAŹDZICKI and SMIT 1977, FONTAINE *et al.* 1979, HE YAN 1980 and GAŹDZICKI and GUPTA 1981)[1].

The investigated Lower Lias foraminifer assemblages from the West Carpathians (mainly those from the Kopieniec Formation and from the Tatricum in the Velká Fatra Mts.) also do not differ from contemporaneous assemblages of the Tethys Realm in specific composition or stratigraphic distribution. Lower Lias foraminifers characterized by vast geographic distribution, especially in the Tethys Realm. They are known from Hungary (FÜLÖP 1976), Lower Austria (KRISTAN-TOLLMANN 1962, FUCHS 1970, PAPP and TURNOVSKY 1970), Northern Limestone Alps (LEISCHNER 1961, FABRICIUS 1966, TOLLMANN 1976), Haute-Savoie (ZANINETTI 1977*a*) Southern Alps (CITA 1965, COUSIN and NEUMANN 1971, TSAMANTOURIDIS 1971), Apen-

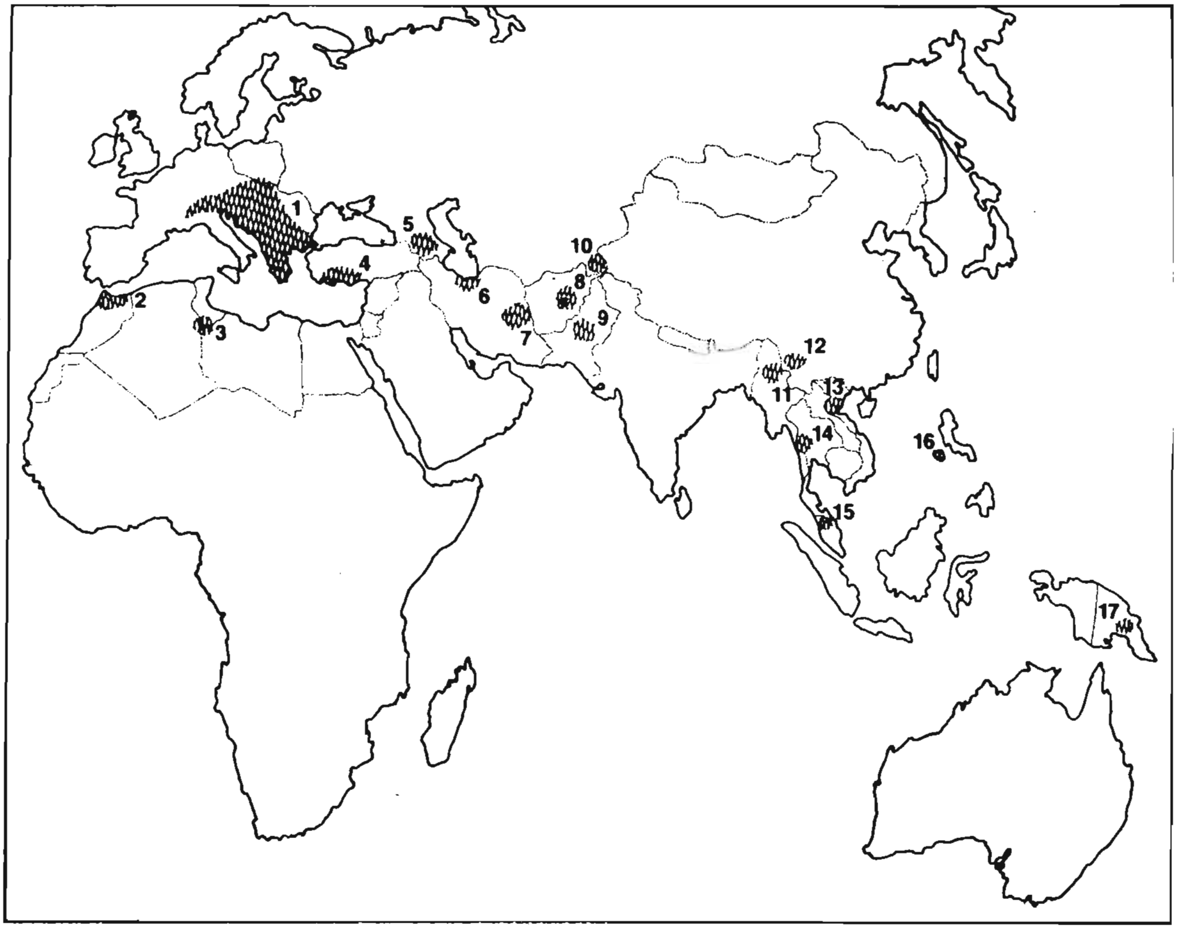

Fig. 20
Geographic distribution of Involutinidae in the uppermost Triassic deposits of the Tethys Realm
1 Alpine Europe (GAŹDZICKI 1974, ZANINETTI 1976); *2* Rif Mts., Morocco (RAOULT 1962); *3* Djebel Fkirine, Tunisia (SALAJ and STRANIK 1970); *4* Taurus Mts., Turkey (BRÖNNIMANN *et al.* 1970); *5* Caucasus Mts., Soviet Union (EFIMOVA 1974); *6* Alborz Mts., Iran (ZANINETTI *et al.* 1972); *7* Kuh-e-Nayband Mts., Iran (BRÖNNIMANN *et al.* 1972); *8* Wardak Mts., Afghanistan (LYS and MARIN 1973); *9* Samana Suk, Pakistan (ZANINETTI and BRÖNNIMANN 1975); *10* Pamir Mts. Soviet Union (DRONOV *et al.* 1982); *11* Kyaukme-Longtawkno area, Burma (BRÖNNIMANN *et al.* 1975); *12* Yunnan, China (HO YEN and HU LAN-YING, 1977); *13* Hoang Mai, Vietnam (LIEM 1966); *14* Si Sawat, Thailand (KEMPER *et al.* 1976); *15* Kodiang, Malaysia (GAŹDZICKI and SMIT 1977); *16* Busuanga, Calamian Islands, Philippines (FONTAINE *et al.* 1979); *17* Gurumugl, Papua New Guinea (GAŹDZICKI in preparation)

[1] Recently the assemblage of Norian involutinids *Aulotortus gaschei*, *A. sinuosus* and *Triasina oberhauseri* was found (GAŹDZICKI and REID *in press*) to be also present in the North America (Lime Peak, Yukon, Canada).

nines (FARINACCI 1967, PASSERI 1971), Sicily (BARBIERI 1964), Karavanken Mts. (RAMOVŠ and REBEK 1970), Croatia (GUŠIĆ 1975), Dinaric Alps (RADOIČIĆ 1966), Taurus Mts (BRÖNNIMANN *et al.* 1970) and Western Highlands of Papua New Guinea (HAIG 1979).

The foraminifer assemblage from the Kopieniec Formation (Hettangian — ?Sinemurian) of the West Carpathians also somewhat resemble those of the "Oolithenbank" in the Baden-Wuerttembergian Hettangium, representing typical epicontinental deposits (SCHLOZ 1972). The above similarities may be also traced within Lower Lias sequences in other parts of the north-western Europe (see FRANKE 1936, WOOD and BARNARD 1946, DREXLER 1958 and BROUWER 1969).

The record of the species *Ophthalmidium walfordi* HÄUSLER, hitherto known from the Lower Lias of the epicontinental basin of the north-western Europe only (ISSLER 1908, FRANKE 1936, WOOD and BARNARD 1946), in the Tatra Mts. is of interest. From the Lower Lias of the two sedimentary basins are also known some other species including *Involutina liassica*, *Trocholina umbo* and numerous representatives of family Nodosariidae (see BROUWER 1969).

Taking into account the present state of knowledge of Lower Lias foraminifers, it may be stated that they occur both in geosynclinal and epicontinental basins at those times.

At the same time the presented data indicate that the environmental conditions prevailing in the Carpathian geosyncline and epicontinental basin of the north-western Europe were quite similar during the Early Lias, which was undoubtedly determined by the existence of effective marine connections between those basins. This point of view is further supported by earlier observations of GOETEL (1917), who emphasized a marked resemblance of the sandstone with *Cardinia* from the Tatra Mts and Lower Lias sandstones of Swabia in petrological characteristic and composition of faunal assemblages.

FINAL REMARKS

The benthonic foraminifers of Upper Triassic and Lower Jurassic seem to be good environmental indices for shelf areas of the Tethyan Ocean. Their wide geographic distribution, mass occurrence and relatively high rate of evolution, give them significant stratigraphic value.

The Involutinidae, Ammodiscidae and Miliolidae are most common in the sequences studied. Their distribution was related to extensive shelf areas with predominating carbonate sedimentation. Ammodiscidae, most common in onshore zones characterized by supply of psammitic terrigenous material were the exception.

A special stratigraphic value is attributed to the Involutinidae and Ammodiscidae as their evolution during Late Triassic underwent marked acceleration. Fast species alternation permits to use them for relatively precise zonation.

A major part of involutinids became extinct at the Rhaetian/Hettangian (= Triassic/Jurassic) boundary and only some of them are present in Lias and younger strata. From the base of the Lias (Hettangian-Sinemurian) upwards, the analysed foraminifer assemblages begin to display predominance of Ophthalmidiinae, the peak in development of which took place already in the Jurassic.

The mass occurrence of the foraminifers, particularly in the Upper Triassic, results in their high stratigraphic value comparable with that of cephalopods and conodonts, i.e. the groups giving the basis for biostratigraphy of that epoch.

The intercorrelation of the proposed foraminifer zones with standard cephalopod and conodont zones makes possible the use of foraminifers in local, regional, and intercontinental stratigraphic correlations, especially in those parts of the Tethys Realm where the cephalopods and conodonts are scarce or absent.

SYSTEMATIC PALEONTOLOGY

Suborder **Textulariina** DELAGE and HÉROUARD, 1896
Superfamily **Ammodiscacea** REUSS, 1862
Family **Ammodiscidae** REUSS, 1862
Subfamily **Ammodiscinae** REUSS, 1862
Genus *Glomospirella* PLUMMER, 1945
Glomospirella friedli KRISTAN-TOLLMANN, 1962
emend. BRÖNNIMANN and ZANINETTI, 1970
(pl. 27:1; pl. 28:1; pl. 31:1–6)

1962. *Glomospirella friedli* KRISTAN-TOLLMANN: 229, pl. 1:1–9, 12–17.
1970. *Glomospirella friedli* KRISTAN-TOLLMANN; BRÖNNIMANN and ZANINETTI: 10, pl. 1:4–8, fig. 4 (*in* BRÖNNIMANN *et al.* 1970).
1976. *Glomospirella friedli* KRISTAN-TOLLMANN; ZANINETTI: 96, pl. 8:1–5 (with synonymy).
1978. *Aulotortus friedli* (KRISTAN-TOLLMANN); PILLER: 5, pl. 1:1.

Material. — Over 1,000 fairly well preserved specimens in thin sections.

Association. — Usually with *Glomospira sinensis*, *Glomospira* sp., *Glomospirella parallela*, *G. pokornyi*, *G. shengi*, *Tolypammina gregaria*, *Trochammina alpina*, "*Tetrataxis*" *inflata*, *Agathammina austroalpina*, "*Frondicularia woodwardi*", *Nodosaria* sp., sometimes with involutinids (*Aulotortus communis*, *A. gaschei*, *Auloconus permodiscoides*, and *Triasina hantkeni*).

Description. — as given by KRISTAN-TOLLMANN (1962), BRÖNNIMANN and ZANINETTI (*in* BRÖNNIMANN *et al.* 1970) and ZANINETTI (1976).

Dimensions of the test (in μm)

	pl. 32:2	pl. 32:3	pl. 32:4
diameter	440	400	580
thickness	360	320	340
diameter of the proloculus	—	50	50

Remarks. — The specimens of *Glomospirella friedli*, very numerous and particularly well-preserved in the uppermost Triassic of the West Carpathians, make some important conclusions possible. The studied forms (pl. 6:1–6) are characterized by test outline ovate in axial and oblique sections and circular in the equatorial. A special attention should be paid to the mode of coiling of test. Central part of test is streptospirally coiled and it comprises 6 to 8 whorls (pl. 32:2–4). It is followed by elements of sigmoidal coiling, passing into planispiral, comprising four whorls at the average (pl. 32; 1–3). Wall microstructure of tests which escaped recrystallization is very finely agglutinated and, sometimes, incrusted with single crystals of pyrite. The above features clearly evidence that the forms belong to the genus *Glomospirella* PLUMMER. It should be noted, however, that HOHENEGGER and PILLER (1975) and PILLER (1978) interpreted *Glomospirella friedli* as a synonym of *Aulotortus gaschei* (KOEHN-ZANINETTI and BRÖNNIMANN), taking into account identify of the mode of coiling and wall microstructure of recrystallized tests. The mode of coiling is similar but, nevertheless, some differences remain. Planispiral part is well-developed in *Glomospirella friedli* and rarely visible in sections of *Aulotortus gaschei*, comprising about four and usually less than two whorls, respectively. Umbilical masses, typical of involutinids, are well developed in *Aulotortus gaschei* and missing in *Glomospirella friedli*. Walls of tests of the former often display perforation (see pl. 32:9–10), whereas those of *Glomospirella friedli* are imperforate.

It should be admitted, however, that the tests of the two species are difficult to separate when recrystallized, which may explain the above viewpoint of HOHENEGGER and PILLER. When the material is well preserved as in the present case, it may be easily shown that the species are separate and assignable to two different families, Ammodiscidae and Involutinidae.

The marked similarity in size, shape, and mode of coiling of these species is an excellent example of advanced homeomorphy.

Occurrence. — West Carpathians (Strážovská hornatina Mts, sections: 6 — Hireška, 22 — Norovica Mt., 23 — Rovnianska Valley, 24 — Tŕstie; Malá Fatra Mts. sections: 7 — Lesnianska Valley, 8 — Široka Valley, 9 — Suchá Valley, 10 — Slovianska Valley, 15 — Zázrivská Valley; Velká Fatra Mts., sections: 11 — Dedošova Valley, 12 — Križna Valley, 13 — Belianska Valley, 14 — Ráztoky; Nizke Tatry Mts., section: 25 — Hybe; Tatra Mts., sections: 16 — Bobrovček-Hrádky, 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 19 — Štefanský žlab, 26 — Chochołowska Valley, 38 — Lejowa Valley II, 29 — Przysłop Miętusi; Slovenské rudohorie Mts. section: 30 — Skalka: Rhaetian (*friedli* and *hantkeni* Zone; the conodont *posthernsteini* Zone).

It is also know from uppermost Triassic (mostly Rhaetian) of Bakony Forest (ORAVECZ-SCHEFFER 1973), Apuseni Mts., Tarcaita Dolomite of the Dieva nappe (GAŹDZICKI, unpublished) and Western Alps (KRISTAN-TOLLMANN 1962, KOEHN-ZANINETTI 1969, BRÖNNIMANN *et al.* 1969, HOHENEGGER and LOBITZER 1971, WEIDMANN and ZANINETTI 1974, HOHENEGGER and PILLER 1975, ZANINETTI 1976, 1977; PILLER 1978, GAŹDZICKI *et al.* 1979*a*), Dolomites (CROS and NEUMANN 1964, BOSELLINI and BROGLIO LORIGA 1965), Apennines (BOCCALETTI *et al.* 1969), Dinaric Alps (PANTIĆ-PRODANOVIĆ 1975), Prokletije Mts. (PANTIĆ 1974), Macedonia (UROŠEVIĆ and DUMURDANOV 1976), Stara Planina Mts. (UROŠEVIĆ and ANDELKOVIĆ 1970), Taygète Mts. of Greece (ZANINETTI and THIEBAULT 1975), Caucasus Mts. (EFIMOVA 1975), Eastern Atlas Mts. of Tunisia (SALAJ and STRANIK 1970), Taurus Mts. of Turkey (BRÖNNIMANN *et al.* 1970), Kuh-e-Nayband Mts. and Alborz Mts. of Iran (BRÖNNIMANN *et al.* 1971, ZANINETTI *et al.* 1972), Wardak Mts. of Afghanistan (LYS and MARIN 1973), Yunnan province of China (HO YEN and HU LAN-YING 1977) and Kuta Formation of Papua New Guinea (GAŹDZICKI 1978).

Glomospirella pokornyi (SALAJ, 1967)
(pl. 31:1–2, 4–5)

1967. *Angulodiscus pokornyi* SALAJ: 128, pl. 6 :4*a, b* (*in* SALAJ *et al.*).
1977. *Glomospirella pokornyi* (SALAJ); GAŹDZICKI: 93 pl. 1:6–13 (with synonymy).
non 1978. *Aulotortus pokornyi* (SALAJ); PILLER: 61, pl. 11:1–7.

Material. — About 200 specimens in thin sections.

Association. — Most often with *Glomospira* sp., *Glomospirella friedli*, *G. parallela*, *Glomospirella* sp., *Trochammina alpina*, *Agathammina austroalpina*, "*Tetrataxis inflata*", *Nodosaria* sp., "*Frondicularia woodwardi*", *Diplotremina* sp.; occasionally with *Aulotortus communis*, *A. sinuosus*, *A. tumidus*, *Auloconus permodiscoides*, and *Triasina hantkeni*.

Description. — as given by SALAJ (*in* SALAJ *et al.* 1967).
Dimensions of the test (in μm):

	pl. 31:2	pl. 31:4	pl. 31:5
diameter	410	440	450
thickness	80	80	—

Remarks. — The species described was originally assigned by SALAJ (*in* SALAJ *et al.* 1967) to *Angulodiscus* (KRISTAN 1957, which is treated by PILLER (1978) as a junior synonym of *Aulotortus* WEYNSCHENK 1956.

The analysis of representatives of this species from the uppermost Triassic of the West Carpathians has shown that their test walls are very finely agglutinated. This, along with the arrangement of whorls in both axial and equatorial sections (pl. 31:1–2, 4–5) is typical of the genus *Glomospirella* PLUMMER 1945.

It should be also noted that the specimens from the Norian-Rhaetian of the Northern Limestone Alps, assigned to *Aulotortus pokornyi* (SALAJ by PILLER (1978, pl. 11:1–7), do not match the diagnosis of that species, differing mainly in having a calcareous wall. These forms would be best assigned to *Aulotortus communis* (KRISTAN 1957).

Occurrence. — West Carpathians (Strážovská hornatina Mts., sections: 6 — Hireška, 24 — Tŕstie; Malá Fatra Mts., sections: 7 — Lesnianska Valley, 8 — Široka Valley, 10 — Slovianska Valley, 15 — Zázrivská Valley; Velká Fatra Mts., sections: 1 — Dedosova Valley, 14 — Ráztoky, Nizke Tatry Mts., section: 25 — Hybe; Tatra Mts., sections: 16 — Bobrovček-Hrádky, 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 19 — Štefanský žlab, 26 — Chochołowska Valley, 29 — Przysłop Miętusi; Slovenský kras, section: 31 — Malý Mlynský vrch Mt.): Rhaetian (*friedli* and *hantkeni* Zone; conodont *posthernsteini* Zone).

This species was also reported from the Rhaetian of the Eastern Atlas Mts. in Tunisia (SALAJ and STRANIK 1970).

Suborder **Miliolina** DELAGE and HÉROUARD, 1896
Superfamily **Miliolacea** EHRENBERG, 1839
Family **Miliolidae** EHRENBERG, 1839
Subfamily **Ophthalmidiinae** WIESNER, 1920
Genus *Ophthalmidium* KÜBLER and ZWINGLI, 1870
Ophthalmidium carpathicum (GAŹDZICKI, 1979)
(pl. 37:9–10)

1979. "*Vidalina*" *carpathica* GAŹDZICKI: 98, pl. 4:3–5 (*in* GAŹDZICKI *et al.* 1979*a*).

Material. — Fifteen specimens in thin sections.

Association. — With *Glomospira* sp., *Glomospirella* sp., *Trochammina alpina*, *Agathammina austroalpina*, *Ophthalmidium* "*carinatum*", *Nodosaria ordinata*, *Austrocolomia* sp. and *Diplotremina* sp.

Description. — as given by GAŹDZICKI (*in* GAŹDZICKI *et al.* 1979*a*).
Dimensions of the test (in μm):

	pl. 37:9	pl. 37:10
diameter	350	360
thickness	60	70
diameter of the proloculus	40	—

Remarks. — *Ophthalmidium carpathicum* differs from the remaining Upper Triassic — Lower Jurassic species of *Ophthalmidium* KÜBLER and ZWINGLI in constriction between central part and the ultimate whorl, especially well visible in axial section (pl. 37:9–10). The constriction may be responsible for breaking-off of the ultimate whorls as the representatives of that species are often found incomplete, i.e. represented by proloculus and two inner whorls only (see pl. 37:11). It should be noted that the forms devoid of the ultimate whorl are very close to megalospheric forms of the species *Ophthalmidium* "*carinatum*" (LEISCHNER 1961) = *Involutina carinata* LEISCHNER 1961 (see LEISCHNER 1961, pl. 2:15a–c) known from the uppermost Triassic and Lower Lias of Northern Limestone Alps.

In accordance with the suggestions of WERNLI (1972) and DECROUEZ *et al.* (1978), the species is here assigned to *Ophthalmidium* KÜBLER and ZWINGLI 1870 on acount of its multilocular test structure, and not to *Vidalina* SCHLUMBERGER 1900, characterized by bilocular structure and not known from rocks older than the Late Cretaceous.

Occurrence. — West Carpathians Slovenský kras, section: 31 — Malý Mlynsky vrch Mt.: Upper Norian (Sevatian); 32 — Bleskový prameň: Rhaetian (*friedli* and *hantkeni* Zone).

Ophthalmidium leischneri KRISTAN-TOLLMANN, 1962
(pl. 40:1–12)

1962. *Neoangulodiscus leischneri* (KRISTAN-TOLLMANN: 230, pl. 2:25–34.
1976. *Ophthalmidium leischneri* (KRISTAN-TOLLMANN); ZANINETTI: 144, pl. 7:14–16 (with synonymy).
1977. "*Vidalina*" *leischneri* (KRISTAN-TOLLMANN); GAŹDZICKI: 94, pl. 3:9–12, 16 (with synonymy).

Material. — Over 500 well-preserved specimens in thin sections.
Association. — Most often together with *Ophthalmidium walfordi*, *Involutina liassica*, *I. turgida*, *I. farinacciae*, *Trocholina umbo*, and nodosariids (*Astacolus*, *Nodosaria*, *Frondicularia* and *Lenticulina*), occasionally with *Trochammina* sp. and *Planiinvoluta carinata*.
Description. — as given by KRISTAN-TOLLMANN (1962).
Dimensions of the test (in μm):

	pl. 40:1	pl. 40:5	pl. 40:8
diameter	200	210	270
thickness	80	80	—
diameter of the proloculus	50	—	30

Remarks. — Large populations of *Ophthalmidium leischneri*, found in analysed Lower Lias rocks, permit to recognize megalo- and microspheric forms. The former, biconvex in axial section (pl. 40:1–2), with 3–5 chambers and proloculus about 50 microns in size on the average, are less common here than the latter, with depressed umbilical masses (pl. 40:5–6), 7–8 chambers, and proloculus about 30 microns in size.

Single equatorial sections (pl. 40:8, 10), clearly showing internal structure of test, fully confirm assignment of that species to *Ophthalmidium* KÜBLER and ZWINGLI.

Occurrence. — West Carpathians (Velká Fatra Mts., section: 1 — Rúbaň Skala; Tatra Mts., sections: 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 20–21 — Strążyska Valley I and II); Hettangian — ?Sinemurian (*leischneri* and *walfordi* Zone).

This species was reported from the Lower Lias of Northern Limestone Alps (LEISCHNER 1961), substratum of the Vienna Basin (KRISTAN-TOLLMANN 1962), Haute-Savoie (ZANINETTI 1977), Southern Alps (CITA 1965, TSAMANTOURIDIS 1971), Karavanken Mts. (RAMOVŠ and REBEK 1970), Croatia (GUŠIĆ 1975) and from Taurus Mts. (BRÖNNIMANN *et al.* 1970).

Ophthalmidium walfordi HÄUSLER, 1887
(pl. 40:13–16)

1887. *Ophthalmidium walfordi* HÄUSLER: 192, pl. 6:7–11.
1936. *Ophthalmidium walfordi* HÄUSLER; FRANKE: 122, pl. 12:16.
1946. *Ophthalmidium walfordi* HÄUSLER; WOOD and BARNARD: 91, fig. 6.

Material. — Forty specimens in thin sections.
Association. — Mainly with *Ophthalmidium leischneri*, *Involutina liassica*, *I. turgida*, *I. farinacciae*, *Trocholina umbo*, *Nodosaria* sp., and *Lenticulina* sp.
Description. — as given by HÄUSLER (1887).
Dimensions of the test (in μm):

	pl. 40:13	pl. 40:14	pl. 40:16
diameter	360	440	360
thickness	40	50	—
diameter of the proloculus	25	—	—

Remarks. — *Ophthalmidium walfordi* differs from the remaining representatives of the genus *Ophthalmidium* KÜBLER and ZWINGLI in specific development of the last chamber. The chamber is straight and markedly diverges from the planispiral part of the test (pl. 40:16), and its length is most equal to diameter of the planispiral part (pl. 40:13–15). The recorded number of chambers ranges from seven to eight.

A characteristic final chamber, initiating the development of the linear series of chambers, suggests attachment of that species to foreign bodies during its life.

Occurrence. — West Carpathians (Tatra Mts., sections: 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 20–21 — Strążyska Valley I and II): Hettangian — ?Sinemurian (*leischneri* and *walfordi* Zone).

Hitherto known from the Lias of the epicontinental basin of north-western Europe (ISSLER 1908, FRANKE 1936, WOOD and BARNARD 1946). This is the first record of that species not only from the Carpathians but from the whole Tethys Realm.

Ophthalmidium sp.

(pl. 37:13–14)

Material. — Seven specimens in thin sections.

Association. — *Glomospira* sp., *Trochammina alpina*, *"Tetrataxis" inflata* and *Triasina hantkeni*.

Description. — Test lenticular in outline in axial sections (pl. 37:13–14), somewhat elongate, with well-marked neck. Chambers, 5–7 in number, spirally coiled; the last two chambers comprise a major part of the test, forming the outer whorl. Proloculus circular, located in the center of the test. Aperture terminal, with distinct prominent lip. Variability in size of individuals is fairly high.

Dimensions of the test (in μm):

	pl. 37:13	pl. 37:14
diameter	200	490
thickness	70	180
diameter of the proloculus	30	—

Remarks. — Test outline and internal structure match well the diagnosis of the genus *Ophthalmidium*. However, the specimens are poorly preserved, sections innumerous, and variability in size is fairly high which makes specific identification hazardous.

Occurrence. — West Carpathians (Tatra Mts., sections: 17 — Velká Furkaska Mt., 26 — Chochołowska Valley): Rhaetian (*friedli* and *hantkeni* Zone, the conodont *posthernsteini* Zone).

Suborder **Involutinina** HOHENEGGER and PILLER, 1977
Superfamily **Involutinacea** BÜTSCHLI, 1880
Family **Involutinidae** BÜTSCHLI, 1880
Genus *Aulotortus* WEYNSCHENK, 1956

Aulotortus gaschei (KOEHN-ZANINETTI and BRÖNNIMANN, 1968)

(pl. 32:9–16)

1968. *Angulodiscus? gaschei* KOEHN-ZANINETTI and BRÖNNIMANN: 74, pl. 1:A–F, pl. 2:A–F, fig. 3.
1976. *Involutina gaschei* (KOEHN-ZANINETTI and BRÖNNIMANN); ZANINETTI: 159, pl. 9:13–15 (with synonymy).
1978. *Aulotortus friedli* (KRISTAN-TOLLMANN); PILLER: 55, pl. 8:3–8, pl. 9:1–16.

Material. — About 200 specimens in thin sections.

Association. — Most often with involutinids (*Aulotortus sinuosus*, *A. tenuis*, *A. tumidus*, *A. communis*, *Auloconus permodiscoides*, *Triasina hantkeni*, *T. oberhauseri*); and sometimes with *Glomospira sinensis*, *Glomospirella friedli*, *G. parallela*, *Tolypammina gregaria*, *Trochammina alpina*, "*Tetrataxis*" *inflata*, *Agathammina austroalpina* and "*Frondicularia woodwardi*".

Description. — as given by KOEHN-ZANINETTI and BRÖNNIMANN (1968) and ZANINETTI (1976).

Dimensions of the test (in μm):

	pl. 32:9	pl. 32:13	pl. 32:16
diameter	440	760	720
thickness	260	—	480

Remarks. — *A. gaschei* appears to be a homeomorph of *Glomospirella friedli* (comp. p. 145) differing from the latter by streptospiral coiling of the first 6–8 whorls (pl. 32:9–16) which are obscured by the outer, planispirally coiled whorls. It differs clearly from *G. friedli* in the presence of umbilical masses and somewhat in test size (about 700 μm and 500 μm on the average, respectively). Moreover, the representatives of *A. gaschei* studied are characterized by calcareous wall sometimes displaying perforation (pl. 32:9–10). *Aulotortus gaschei* differs from its direct ancestor, *A. praegaschei* KOEHN-ZANINETTI, known from the Ladinian-Carnian, in planispirally coiled outer whorls.

Occurrence. — West Carpathians (Nizke Tatry Mts., section: 25 — Hybe): Norian (*oberhauseri* Zone); Strážovská hornatina Mts., sections: 6 — Hireška, 22 — Norovica Mt., 24 — Tŕstie; Malá Fatra Mts., sections: 8 — Široka Valley, 9 — Suchá Valley, 10 — Slovianska Valley; Velká Fatra Mts., sections: 12 — Križna Valley, 14 — Ráztoky; Nizke Tatry Mts., section: 25 — Hybe; Tatra Mts., section: 16 — Bobrovček -Hrádky, 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 26 — Chochołowska Valley, 28 — Lejowa Valley II; Slovenské rudohorie Mts., section: 30 — Skalka; Slovenský kras, section: 32 — Bleskový prameň): Rhaetian (*friedli* and *hantkeni* Zone; the conodont *posthernsteini* Zone).

This species was also fairly often reported from the Norian-Rhaetian sequences of Northern Limestone Alps (KOEHN-ZANINETTI and BRÖNNIMANN 1968, HOHENEGGER and LOBITZER 1971, PILLER 1978, SCHÄFER 1979), Dolomites (CROS and NEUMANN 1964), Croatia (GUŠIĆ 1975), Dinaric Alps (PANTIĆ-PRODANOVIĆ 1975), Prokletije Mts. (PANTIĆ 1974), Stara Planina Mts. (UROŠEVIĆ and ANDELKOVIĆ 1970), Taygète Mts in Greece (ZANINETTI and THIEBAULT 1975), Caucasus Mts. (EFIMOVA 1974), Taurus Mts. (BRÖNNIMANN *et al.* 1970), Wardak Mts. of Afganistan (LYS and MARIN 1973), Kyaukme-Longtawkno area in Burma (BRÖNNIMANN *et al.* 1975) and Kodiang Limestone Formation in Malaysia (GAŹDZICKI and SMIT 1977).

Genus *Involutina* TERQUEM, 1862
Involutina liassica (JONES, 1853)
(pl. 29:1; pl. 38:1–12, 15)

1853. *Nummulites*? *liassicus* JONES: 275.
1961. *Involutina liassica* (JONES); MIŠIK: 179, pl. 29:1–2.
1969. *Involutina liassica* (JONES); KOEHN-ZANINETTI: 82, figs 22–24 (with synonymy).
1978. *Involutina liassica* (JONES); PILLER: 65, pl. 13:1–9.

Material. — Over 100 specimens in thin sections.

Association. — *Involutina turgida*, *I. farinacciae*, *Trocholina umbo*, *Ophthalmidium leischneri*, *O. walfordi*, *Planiinvoluta carinata*, *Trochammina* sp. and nodosariids (*Astacolus*, *Frondicularia*, *Lenticulina* and *Nodosaria*).

Description. — as given by KOEHN-ZANINETTI (1969) and PILLER (1978).

Dimensions of the test (in μm):

	pl. 38:1	pl. 38:5	pl. 38:15
diameter	520	650	580
thickness	190	280	260
diameter of the proloculus	60	120	70

Remarks. — *I. liassica* is characterized by umbilical masses composed of numerous pillars (pl. 38:7–8). The appearance of pillars is a new element in evolution of Involutinidae, typical of the so-called "post-Triassic" involutinids. The dimorphism is clearly marked in this species. Megalospheric forms (pl. 38:5, 15) are characterized by large proloculus (about 100 μm in diameter) and, usually, three whorls, and the microspheric — by almost twice smaller proloculus (about 60 μm in diameter) and up to 6 whorls. This species was previously recorded in the Lias of the West Carpathians by MIŠIK (1961). It should be noted, however, that the form figured as *Involutina* cf. *liassica* from Dachstein Limestone of Muránska planina by MIŠIK (1961, pl. 30:2) does not display features typical of this species (e.g. pillars are almost completely missing) and it most probably represent *Aulotortus communis* (KRISTAN).

Occurrence. — West Carpathians (Velká Fatra Mts., section: 1 — Rúbaň Skala; Tatra Mts., sections: 17 — Velká Furkaska Mt., 20–21 — Strążyska Valley I and II): Hettangian — ?Sinemurian (*leischneri* and *walfordi* Zone).

It is known also from the Rhaetian of Hohen Wand and Fischerwiese in Austria (KRISTAN 1957, KRISTAN-TOLLMANN 1964) and fairly often from the Lias of Eastern, Western and Southern Alps (LEISCHNER 1961, KRISTAN-TOLLMANN 1962, CITA 1965, FABRICIUS 1966, PAPP and TURNOVSKY 1970, COUSIN and NEUMANN 1971, ZANINETTI 1977, PILLER 1978); Apennines (FARINACCI and RADOIČIĆ 1964), Karawanken Mts. (RAMOVŠ and REBEK 1970), Croatia (GUŠIĆ 1975), Dinaric Alps (RADOIČIĆ 1966), Tunisia (BISMUTH *et al.* 1967), Taurus Mts. (BRÖNNIMANN *et al.* 1970), Western Highlands of Papua New Guinea (HAIG 1979) and from epicontinental basin of north-western Europe (FRANKE 1936, DREXLER 1958, BROUWER 1969 and SCHLOZ 1972).

Genus *Triasina* MAJZON, 1954

Triasina hantkeni MAJZON, 1954

(pl. 27:2; pl. 28:2; pl. 30:2–6; pl. 25:7–17)

1954. *Triasina hantkeni* MAJZON: 245, pl. 1:1–2, pl. 2:3–5, pl. 3:6.
1954. *Triasina hantkeni* var. *elliptica* MAJZON: 245, pl. 3:7.
1976. *Triasina hantkeni* MAJZON; ZANINETTI: 172, pl. 15:2–3 (with synonymy).
1978. *Triasina hantkeni* MAJZON; PILLER: 70, pl. 15:1–15 (with synonymy).

Material. — Over 1000 specimens in thin sections; locally forming very large, rock-forming accumulations.

Association. — Most often with involutinids (*Auloconus permodiscoides*, *Aulotortus communis*, *A. gaschei*, *A. impressus*, *A. pragsoides*, *A. sinuosus*, *A. tenuis* and *A. tumidus*); also with *Glomospira sinensis*, *Glomospirella friedli*, *Glomospirella parallela*, *Tolypammina gregaria*, "*Tetrataxis*" *inflata*, *Ophthalmidium* sp., "*Frondicularia woodwardi*", *Nodosaria* sp. and *Diplotremina* sp.

Description. — as given by MAJZON (1954) and PILLER (1978).

Dimensions of the test (in μm):

	pl. 35:10	pl. 35:12	pl. 35:14
diameter	760	1,000	1,500
diameter of the proloculus	90	—	—

Remarks. — *Triasina hantkeni* is a well know species which makes it easy to be identifies in thin sections. It is primarily characterized by segmentation of deuteroloculus, well visible in sections (pl. 35:9–12). The segmentation of deuteroloculus is a new element in evolution of

Late Triassic involutinids. About 7 to 8 whorls were recorded. *T. hantkeni* was previously reported from the West Carpathians by SALAJ *et al.* (1967) and GAŹDZICKI (1970).

Occurrence. — West Carpathians (Strážovská hornatina Mts., sections: 22 — Norovica Mt., 24 — Třstie; Malá Fatra Mts., sections: 9 — Suchá Valley, 15 — Zázrivská Valley; Velká Fatra Mts., sections: 11 — Dedošova Valley, 12 — Križna Valley, 13 — Belianska Valley; Tatra Mts., sections: 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 26 — Chochołowska Valley, 27 — Wielka Sucha Valley, 28 — Lejowa Valley II; Slovenské rudohorie Mts., section: 30 — Skalka; Slovenský kras, section: 32 — Bleskový prameň): Rhaetian (*friedli* and *hantkeni* Zone; the conodont *posthernsteini* Zone).

This species is also known from the Rhaetian (the ammonoid *haueri* and *marshi* Zones; the conodont *posthernsteini* Zone) of Bakony Forest, Gerecse Mts and Vértes Mts (MAJZON 1954), Lower Austria (OBERHAUSER and PLÖCHINGER 1968, KRISTAN-TOLLMANN 1970, PAPP and TURNOVSKY 1970), Northern Limestone Alps (HAGN 1955, OBERHAUSER 1964, FABRICIUS 1966, TOLLMANN 1976, HOHENEGGER and PILLER 1977*b*, SCHÄFER and SENOWBARI-DARYAN 1978, PILLER 1978, SCHÄFER 1979), Lombardian Alps (WIDEMAYER 1963), Dolomites (CROS and NEUMANN 1964, BOSELLINI and BROGLIO LORIGA 1965), Northern Italy (ANONYMOUS, 1959, FUGANTI and MOSNA 1966), Dinaric Alps (PANTIĆ and RAMPNOUX 1972, PANTIĆ-PRODANOVIĆ 1975), Croatia (GUŠIĆ 1975), Stara Planina Mts. (UROŠEVIĆ and ANĐELKOVIĆ 1970), Eastern Hellenic Zone (CHRISTODOULOU and TSAILA-MONOPOLIS 1972), Rif Mts. (RAOULT 1962), Eastern Atlas Mts. (SALAJ and STRANIK 1970), Taurus Mts (ZANINETTI 1976), Sichuan of China (HE YAN 1980), and Calamian Islands, Philippines (FONTAINE *et al.* 1979).

Triasina oberhauseri KOEHN-ZANINETTI and BRÖNNIMANN, 1968
(fig. 21a, b)

1968. *Triasina oberhauseri* KOEHN-ZANINETTI and BRÖNNIMANN: 1, pl. 1:1–2, fig. 1.
1976. *Triasina oberhauseri* KOEHN-ZANINETTI and BRÖNNIMANN; ZANINETTI: 173, pl. 14: 23, pl. 15:1 (with synonymy).
1979. *Triasina oberhauseri* KOEHN-ZANINETTI and BRÖNNIMANN; GAŹDZICKI *et al.* 1979a: pl. 1:9.

Material. — Five specimens in thin sections.

Association. — Co-occurring with *Aulotortus communis, A. gaschei, A. sinuosus, A. tumidus, Auloconus permodiscoides, Tolypammina gregaria* and *Nodosaria* sp.

Description. — as given by KOEHN-ZANINETTI and BRÖNNIMANN (1968).

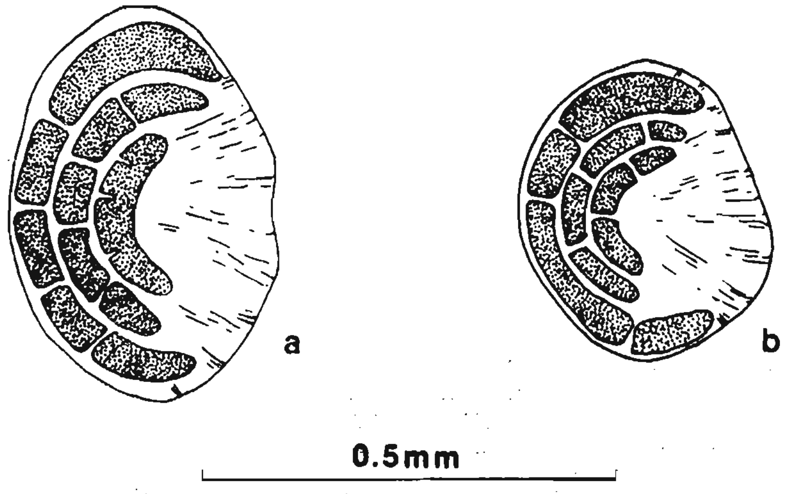

Fig. 21
Triasina oberhauseri KOEHN-ZANINETTI and BRÖNNIMANN, subaxial sections. Hybe (section 25, sample 8). Lowermost part of Hybe Beds. Norian (Sevatian). ZPAL F. XXVIII/25-8.

Dimensions of test (in μm):

	fig. 21a	fig. 21b
diameter	440	360
thickness	320	280

Remarks. — The tests of *Triasina oberhauseri* (fig. 21a, b) studied are almost identical with representatives of this species from the Upper Norian of Northern Limestone Alps (KOEHN-ZANINETTI and BRÖNNIMANN 1968, fig. 1). The Carpathian specimens are characterized by 3–5 whorls and an underdeveloped segmentation of deuteroloculus best visible in the case of the last whorls.

It is worth to note that *Triasina oberhauseri*, first described by KOEHN-ZANINETTI and BRÖNNIMANN (1968), represents a transitional form between involutinid *Aulotortus pragsoides* and *Triasina hantkeni*, the existence of which has been earlier inferred by OBERHAUSER (1964, fig. 1) in this theoretical analysis. It should be also noted here that the existence of such transitional form gives support to the allocation of Triasina in the family Involutinidae BÜTSCHLI. The form recently described and figured as *Triasina hantkeni* MAJZON from the Upper Norian ("Maantang" Formation) of Sichuan (China) by HE YAN (1980, pl. 73:11), displays underdeveloped segmentation of deuteroloculus, so it is assigned here to *Triasina oberhauseri* KOEHN-ZANINETTI and BRÖNNIMANN, 1968.

Occurrence. — West Carpathians (Nizke Tatry Mts., section: 25 — Hybe): Upper Norian (Sevatian) (*oberhauseri* Zone).

T. oberhauseri is also known from the Norian of Bakony Forest (GAŹDZICKI unpublished), Caucasus Mts. (EFIMOVA 1974) and from the Upper Norian of Northern Limestone Alps (KOEHN-ZANINETTI and BRÖNNIMANN 1968, KOEHN-ZANINETTI 1969), Taurus Mts. (BRÖNNIMANN *et al.* 1970) and Sichuan province of China (HE YAN 1980).

Genus *Auloconus* PILLER, 1978
Auloconus permodiscoides (OBERHAUSER, 1964)
(pl. 30:2; pl. 35:1–6)

1964. *Trocholina permodiscoides* OBERHAUSER: 207, pl. 2:13–15, 18, 20, 22; pl. 3:1.
1976. *Trocholina permodiscoides* OBERHAUSER; ZANINETTI: 178, pl. 10: pl. 12:9–11 (with synonymy).
1978. *Auloconus permodiscoides* (OBERHAUSER); PILLER: 74, pl. 20:1–8 (with synonymy).

Material. — Over 200 well preserved specimens in thin sections.

Association. — Commonly with *Triasina hantkeni*, *Aulotortus sinuosus*, *A. communis*, *A. gaschei*, *A. impressus*, *A. tumidus*, *A. tenuis*, *Tolypammina gregaria*; sometimes with *Glomospira* sp., *Glomospirella friedli*, *G. parallela*, "*Tetrataxis*" *inflata*, *Ophthalmidium* sp., and "*Frondicularia woodwardi*".

Description. — as given by OBERHAUSER (1964) and PILLER (1978).

Dimensions of the test (in μm):

	pl. 35:1	pl. 35:4	pl. 35:5
diameter of the base	560	840	760
height	280	560	680

Remarks. — The specimens studied are characterized by conical shape with rounded apical part and elongate base in axial (vertical) sections (pl. 35:1–6). Trochospiral coiling; number of whorls usually ranging from 6 to 8. These features, along with the lack of pillars, well match the diagnosis of *Auloconus permodiscoides*. One of the specimens figured (pl. 35:3), displaying not more than three whorls, may represent a megalospheric form. Some of the specimens studied are low-trochospirally coiled, except for planispiral coiling of first 2–3 whorls (pl. 35:1). Such features bring them closer to the genus *Aulotortus*. This gives support to the interpretation of trocholinids as trochospirally coiled involutinids (see OBERHAUSER 1964, KOEHN-ZANINETTI 1969, and GUŠIĆ 1975).

Occurrence. — West Carpathians (Nizke Tatry Mts., section: 25 — Hybe): Norian (*oberhauseri* Zone); Strážovská hornatina Mts., sections: 6 — Hireška, 22 — Norovica Mt., 24 — Tŕstie; Malá Fatra Mts., section: 9 — Suchá Valley; Velká Fatra Mts., sections: 12 — Križna Valley, 13 — Belianska Valley; Nizke Tatry Mts., section: 25 — Hybe; Tatra Mts., sections: 17 — Velká Furkaska Mt., 18 — Lejowa Valley I, 26 — Chochołowska Valley, 28 — Lejowa Valley II; Slovenské rudohorie Mts., section: 30 — Skalka): Rhaetian (*friedli* and *hantkeni* Zone; the conodont *posthernsteini* Zone).

A. permodiscoides is also known from the Norian-Rhaetian strata of Northern Limestone Alps (OBERHAUSER 1964, KOEHN-ZANINETTI 1969, PILLER 1978, SCHÄFER 1979), Dolomites (BOSELLINI and BROGLIO LORIGA 1965), Croatia (GUŠIĆ 1975), Dinaric Alps (PANTIĆ and RAMPNOUX 1972, PANTIĆ-PRODANOVIĆ 1975), Taygète Mts. in Greece (ZANINETTI and THIEBAULT 1975), Taurus Mts. (BRÖNNIMANN *et al.* 1970), Caucasus Mts. (EFIMOVA 1974), Kuh-e-Nayband Mts. in Iran (ZANINETTI and BRÖNNIMANN 1974), Kyaukme-Longtawkno area in Burma (BRÖNNIMANN *et al.* 1975), Yunnan and Sichuan provinces of China (HO YEN and HU LAN-YING 1977, HE YAN 1980).

Genus *Trocholina* PAALZOV, 1922
Trocholina umbo FRENTZEN, 1941
(pl. 39:3–4)

1941. *Trocholina umbo* FRENTZEN: 306, pl. 1:12.
1941. *Trocholina granosa* FRENTZEN: 304, pl. 1:11.
1978. *Trocholina umbo* FRENTZEN; PILLER: 81, pl. 20:9–11, 13–14, 16–17 (with synonymy).

Material. — Twenty specimens in thin sections.

Association. — Commonly with *Involutina liassica*, *I. turgida*, *I. farinacciae*, *Ophthalmidium leischneri*, *O. walfordi*, *Nodosaria* sp., *Astacolus* sp., and *Lenticulina* sp.

Description. — as given by FRENTZEN (1941) and PILLER (1978).
Dimensions of the test (in μm):

	pl. 39:3	pl. 39:4
diameter of the base	300	280
height	130	120

Remarks. — The specimens studied are characterized by a conical shape with markedly rounded apical part in axial (vertical) sections (pl. 39:3–4), deuteroloculus markedly semitubular in shape (pl. 39:3), trochospiral coiling and a number of discernible whorls equalling 4–6, so they fully match the diagnosis of *Trocholina umbo*.

Occurrence. — West Carpathians (Velká Fatra Mts., section: 1 — Rubaň Skala; Tatra Mts., sections: 17 — Velká Furkaska Mt., 20–21 — Strążyska Valley I and II): Hettangian — ?Sinemurian (*leischneri* and *walfordi* Zone).

T. umbo was reporter from a pebble of Lias limestone from conglomerates of the Santonian-Campanian age of Slovakia (SAMUEL *et al.* 1972). It is also known from the Lias of Eastern and Western Alps (LEISCHNER 1961, KRISTAN-TOLLMANN 1962, PAPP and TURNOVSKY 1970, TOLLMANN 1976, ZANINETTI 1977, PILLER 1978), Apennines (FARINACCI 1967), Karavenken Mts. (RAMOVŠ and KRISTAN-TOLLMANN 1967), Dinaric Alps RADOIČIĆ 1966), Croatia (GUŠIĆ 1975), and from the epicontinental basin of the north-western Europe (BROUWER 1969, SCHLOZ 1972).

Trocholina turris FRENTZEN, 1941
(pl. 39:7)

1941. *Trocholina turris* FRENTZEN: 306, pl. 1:13.
1975. *Trocholina turris* FRENTZEN; GUŠIĆ: 25, pl. 8:1–7 (with synonymy).
1978. *Trocholina turris* FRENTZEN; PILLER: 83, pl. 20: 12, 15, 16 (with synonymy).

Material. — Four poorly preserved specimens in thin sections.

Association. — *Nodosaria* sp., *Lenticulina* sp., *Astacolus* sp., and *Ophthalmidium* sp.

Description. — as given by FRENTZEN (1941) and PILLER (1978).
Dimensions of the test (in μm):

	pl. 39:7
diameter of the base	200
height	160

Remarks. — *T. turris* was identified is single subaxial and oblique sections only. The preservation is unsatisfactory because of an advanced recrystallization (sparitization) of tests but, nevertheless, high trochospiral coiling (pl. 39:7) and whorl number equalling 6–8 make the assignment of the specimens to *T. turris* possible. This species was hitherto unknown from the Carpathians.

Occurrence. — West Carpathians (Slovenský kras, section: 32 — Bleskový prameň): Pliensbachian.

It is also known from the Lias of Eastern, Western and Southern Alps (KRISTAN-TOLLMANN 1962, PAPP and TUROVSKY 1970, COUSIN and NEUMANN 1971, TOLLMANN 1976, ZANINETTI 1976, 1977*a*; PILLER 1978), Karavanken Mts. (RAMOVŠ and REBEK 1970), Croatia (GUŠIĆ 1975), Dinaric Alps (RADOIČIĆ 1966), Taurus Mts. (BRÖNNIMANN *et al.* 1970), and also from the epicontinental basin of the north-western Europe (FRENTZEN 1941).

Family **Planispirillinidae** PILLER, 1978
Genus *Semiinvoluta* KRISTAN, 1957
Semiinvoluta sp.
(pl. 39:1)

Material. — Two specimens in thin sections.

Association. — *Nodosaria* sp., *Lenticulina* sp., *Geinitzinita* sp., and *Ophthalmidium* sp.

Description. — Test consisting of proloculus and planispirally coiled deuteroloculus with umbilical depression on one side. In axial (vertical) sections (pl. 39:1), whorls are symmetrically crescent, with rounded ends. Number of whorls ranges from 4 to 5. Wall calcareous.
Dimensions of the test (in μm):

	pl. 39:1
diameter	360
maximum thickness	130

Remarks. — The form studied is most close to *Semiinvoluta* sp. 2 described by GUŠIĆ (1975, pl. 11:1–3) from the Lias of Medvednica Mt., Northern Croatia.

Occurrence. — West Carpathians (Slovenský kras, section: 32 — Bleskový prameň): Pliensbachian.

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EXPLANATION OF PLATES 27–41

PLATE 27

1. Abundant foraminifers *Glomospirella friedli* KRISTAN-TOLLMANN in coral-crinoid-brachiopod biomicrite. Tatra Mts., Lejowa Valley I (section 18, sample 49); Fatra Formation, upper biostrome; Rhaetian, ZPAL F. XXVIII/18–49.

2. Foraminifer biosparite with *Triasina hantkeni* Majzon. Tatra Mts., Velká Furkaska Mt. (section 17, sample 338); Fatra Formation, lower biostrome; Rhaetian. ZPAL F. XXVIII/17–338.
3. Biosparrudite composed of pelecypod and gastropod debris with onkolitic envelopes and sessile foraminifers *Tolypammina gregaria* Wendt. Velká Fatra Mts., Dedošova Valley (section 11, sample 3); Fatra Formation, lower biostrome, GUSAV 268/3.

All × 10

PLATE 28

1. Numerous foraminifers *Glomospirella friedli* KRISTAN-TOLLMANN in crinoid-brachiopod-pelecypod biosparite. Strážovská hornatina Mts., Norovica Mt. (section 22, sample 25); Norovica Formation, Mojtin Limestone Member; Rhaetian, GUSAV N/25.
2. Foraminifer assemblage enclosing *Triasina hantkeni* MAJZON, *Aulotortus sinuosus* WEYNSCHENK, *A. tumidus* (KRISTAN-TOLLMANN), *A. gaschei* (KOEHN-ZANINETTI and BRÖNNIMANN) and *Auloconus permodiscoides* (OBERHAUSER) in brachiopod-crinoid biosparite containing bioclass with onkolitic crusts. Tatra Mts., Lejova Valley I (section 28, sample 13); Norovica Formation, Mojtin Limestone Member; Rhaetian. ZPAL F. XXVIII/28–13.
3. Biosparrudite composed of pelecypod and gastropod debris with onkolitic crusts; ooids and rare foraminifers *Aulotortus sinuosus* WEYNSCHENK, "*Tetrataxis*" *inflata* KRISTAN and *Ophthalmidium* sp. are also visible. Slovenské rudohorie Mts. (Muránska planina), Skalka (locality 30, sample 1); Dachstein Limestone; Rhaetian. ZPAL F. XXVIII/30–1.

All × 10

PLATE 29

1. Foraminifer assemblage enclosing *Involutina liassica* (JONES), *Nodosaria* sp., *Frondicularia* sp., *Astacolus* sp., *Lenticulina* sp. and *Ophthalmidium* sp. seen in crinoid biomicrite. Velká Fatra Mts., Rúbaň Skala (locality 1, sample 9718) Lias of the Tatricum in the Velká Fatra Mts., Sinemurian. PFUK 9719.
2. Crinoid-gastropod biopelmicrite with foraminifers *Ophthalmidium leischneri* (KRISTAN-TOLLMANN), *Involutina liassica* (JONES), *Involutina farinacciae* BRÖNNIMANN and KOEHN-ZANINETTI, *Nodosaria* sp. and *Lenticulina* sp. Tatra Mts., Strążyska Valley I (section 20, sample S_{26}); Kopieniec Formation, lower limestones; Hettangian —? Sinemurian. ZPAL F. XXVIII/20–S_{26}.
3. Crinoid biomicrite with rare foraminifers *Nodosaria* sp. and *Lenticulina* sp. Slovenský kras, Bleskový prameň (section 32, sample BP-2); Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32–BP–2.

All × 10

PLATE 30

1. Strongly recrystallized tests of *Aulotortus tumidus* (KRISTAN-TOLLMANN). Velká Fatra Mts., Dedošova Valley (section 11, sample 8); Fatra Formation, lower biostrome; Rhaetian. GUSAV 268/8.
2. Obliteration of internal structure through recrystallization in *Triasina hantkeni* MAJZON, *Aulotortus sinuosus* WEYNSCHENK and *Auloconus permodiscoides* (OBERHAUSER). Strážovská hornatina Mts., Tŕstie (section 24, sample 23); Morovica Formation, Mojtin Limestone Member; Rhaetian. GUSAV T/23.
3. Various stages of progressing recrystallization (sparrytization) of *Triasina hantkeni* MAJZON tests. Tatra Mts., Lejowa Valley (section 18, sample 17/; Fatra Formation, lower biostrome; Rhaetian. ZPAL F. XXVIII/18–17.
4. Tests of foraminifers *Triasina hantkeni* MAJZON with oolitic coatings (arrowed) in bioosparite. Strážovská hornatina Mts., Norovica Mt. (section 22, sample 15); Norovica Formation, Mojtin Limestone Member; Rhaetian. GUSAV N/15.

5. Numerous test of foraminifers *Triasina hantkeni* MAJZON with onkolitic envelopes (arrowed). West Tatra Mts., Velká Furkaska Mt. (section 17, sample 338); Fatra Formation, lower biostrome; Rhaetian. ZPAL F. XXVIII/17-338.
6. Compactional deformation of *Triasina hantkeni* MAJZON tests (arrowed) in marly limestone. Tatra Mts., Wielka Sucha Valley (locality 27, sample 2); Norovica Formation, Mojtín Limestone Member; Rhaetian. ZPAL F. XXVIII/27-2.

All × 10

PLATE 31

1. *Glomospirella pokornyi* (SALAJ) in pelecypod-crinoid biomicrite. Štefanský žlab (section 19, sample 10). Fatra Formation. Rhaetian. PFUK 298/10. × 30.
2. *Glomospirella pokornyi* (SALAJ), subaxial section. Štefanský žlab (section 19, sample 10). Fatra Formation. Rhaetian. PFUK 298/10. × 80.
3. *Ammodiscus multivolutus* REITLINGER with oolitic envelopes, axial section. Hireška (section 6, sample 24). Fatra Formation. Rhaetian. GUSAV 119/24. × 80.
4. *Glomospirella pokornyi* (SALAJ), axial section. Tŕstie (section 24, sample 20). Norovica Formation. Rhaetian. GUSAV T/20. × 80.
5. *Glomospirella pokornyi* (SALAJ), equatorial section. Štefanský žlab (section 19, sample 10). Fatra Formation. Rhaetian. PFUK 298/10. × 80.
6. *Glomospirella* sp., axial section. Tŕstie (section 24, sample 15). Norovica Formation. Rhaetian. GUSAV T/15. × 90.
7. *Glomospirella expansa* KRISTAN-TOLLMANN, axial section. Chochołowska Valley (section 26, sample 14a). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-14a. × 80.
8. *Glomospirella expansa* KRISTAN-TOLLMANN, axial section. Velká Furkaska Mt. (section 17, sample 389). Fatra Formation. Rhaetian. PFUK 352/389. × 80.
9. Foraminifer biopelsparite with numerous *Glomospira* and *Glomospirella*. Hireška (section 6, sample 23). Fatra Formation. Rhaetian. GUSAV 119/23. × 30.
10. *Glomospira* sp. Hireška (section 6, sample 23), Fatra Formation. Rhaetian. GUSAV 119/23. × 160.

11–13. *Glomospirella facilis* Ho, *11* — axial section, *12* — oblique section, *13* — equatorial section. Hireška (section 6, sample 23). Fatra Formation. Rhaetian. GUSAV 119/23. × 160.

14. *Glomospira sinensis* Ho. Przysłop Miętusi (section 29, sample 5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/29-5. × 180.
15. *Glomospira sinensis* Ho. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-13. × 180.
16. *Glomospirella shengi* Ho. Velká Furkaska Mt. (section 17, sample 344). Fatra Formation. Rhaetian. PFUK 352/344. × 180.

PLATE 32

1. Foraminifer biomicrite with *Glomospirella friedli* KRISTAN-TOLLMANN. Lejowa Valley I (section 18, sample 49). Fatra Formation. Rhaetian. ZPAL F. XXVIII/18-49. × 30.

2–4. *Glomospirella friedli* KRISTAN-TOLLMANN; *2* — equatorial section, *3* — axial and equatorial sections, *4* — oblique section. Lejowa Valley I (section 18, sample 49). Fatra Formation. Rhaetian. ZPAL F. XXVIII/18-49. × 80.

5. *Glomospirella friedli* KRISTAN-TOLLMANN, oblique section. Široka Valley (section 8, sample 13). Fatra Formation. Rhaetian. GUSAV 062/13. × 110
6. *Glomospirella friedli* KRISTAN-TOLLMANN, oblique section. Norovica Mt. (section 22, sample 25). Norovica Formation. Rhaetian. GUSAV N/25. × 80.

7–8. *Glomospirella* sp., oblique sections. Norovica Mt. (sections 22, sample 24). Norovica Formation. Rhaetian. GUSAV N/24. × 80.

9–10. *Aulotortus gaschei* (KOEHN-ZANINETTI and BRÖNNIMANN), *9* — axial section, *10* — subaxial section. Velká Furkaska Mt. (section 17, sample 392). Fatra Formation. Rhaetian. ZPAL F. XXVIII/17-392 × 80.

11. *Aulotortus gaschei* (Koehn-Zaninetti and Brönnimann), oblique section. Chochołowska Valley (locality 26, sample II-5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26–II-5. × 50.

12–14. *Aulotortus gaschei* (Koehn-Zaninetti and Brönnimann), *12* — equatorial section, *13—14* — subequatorial sections. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-13. × 50.

15. *Aulotortus gaschei* (Koehn-Zaninetti and Brönnimann), subaxial section. Chochołowska Valley (locality 26, sample II-5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26–II-5. × 50.

16. *Aulotortus gaschei* (Koehn-Zaninetti and Brönnimann), subaxial section. Lejowa Valley I (section 18, sample 38). Fatra Formation. Rhaetian. ZPAL F. XXVIII/18–38. × 60.

PLATE 33

1. *Aulotortus communis* (Kristan), axial section. Lejova Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28–13. × 60.
2. *Aulotortus* sp., subaxial section. Chochołowska Valley (locality 26, sample II-5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26–II-5. × 50.
3. *Aulotortus tumidus* (Kristan-Tollmann), subaxial section. Chochołowska Valley (locality 26, sample II–5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26–II-5. × 35.

4–5. *Aulotortus tumidus* (Kristan-Tollmann), *4* — axial section, *5* — oblique section. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28–13. 4 × 75, 5 × 40.

6. *Aulotortus tumidus* (Kristan-Tollmann), axial section. Lejowa Valley II (section 18, sample 12). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28–12. × 65.
7. *Aulotortus tumidus* (Kristan-Tollmann), subaxial section. Suchá Valley (section 9, sample 2). Fatra Formation. Rhaetian. GUSAV 088/2. × 50.
8. *Aulotortus tumidus* (Kristan-Tollmann), subaxial section. Široka Valley (section 8, sample 5). Fatra Formation Rhaetian. GUSAV 062/5. × 65.
9. *Aulotortus tenuis* (Kristan), axial section. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28–13. × 65.
10. *Aulotortus tenuis* (Kristan), axial section. Velká Furkaska Mt. (section 17, sample 392). Fatra Formation. Rhaetian. ZPAL F. XXVIII/17–392. × 75.
11. *Aulotortus tenuis* (Kristan), axial section. Tŕstie (section 24, sample 21). Norovica Formation. Rhaetian. GUSAV T/21. × 50.
12. ?*Semiinvoluta* sp., axial section. Velká Furkaska Mt. (section 17, sample 392). Fatra Formation. Rhaetian. ZPAL F. XXVIII/17–392. × 65.
13. *Aulotortus* sp., subaxial section. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian· ZPAL F. XXVIII/28–13. × 40.
14. *Aulotortus* sp., subequatorial section. Velká Furkaska Mt. (section 17, sample 392). PFUK 352/392. × 75.
15. *Aulotortus* sp., subaxial section. The last whorls of the test settled by *Tolypammina gregaria* Wendt (arrowed). Križna Valley (section 12, sample 7). Fatra Formation. Rhaetian. GUSAV 253/7. × 50.
16. *Aulotortus* sp. with test encrusted by *Girvanella*. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28–13. × 45.

PLATE 34

1. *Aulotortus* cf. *pragsoides* (Oberhauser), axial section. Test with oolitic envelopes. Norovica Mt. (section 22, sample 19). GUSAV N/19.

2–3. *Aulotortus sinuosus* Weynschenk, axial sections. Chochołowska Valley (locality 26, sample II–5). ZPAL F. XXVIII/26–II–5.

4. *Aulotortus impressus* (Kristan-Tollmann), subaxial section. Lejowa Valley II (section 28, sample 13). ZPAL F. XXVIII/28–13.

5. *Aulotortus sinuosus* WEYNSCHENK, subaxial section. Test with onkolitic crusts. Lejowa Valley II (section 28, sample 13). ZPAL F. XXVIII/28-13.
6. *Aulotortus* sp., axial section. Chochołowska Valley (locality 26, sample II-5). ZPAL F. XXVIII/26-II-5.
7-9. *Aulotortus sinuosus* WEYNSCHENK, subaxial sections. Chochołowska Valley (locality 26, sample II-5). ZPAL F. XXVIII/26-II-5.
10. *Aulotortus sinuosus* WEYNSCHENK, oblique section. Lejowa Valley II (section 28, sample 13). ZPAL F. XXVIII/28-13.
11-12. *Aulotortus sinuosus* WEYNSCHENK, *11* — oblique section, *12* — subequatorial section. Chochołowska Valley (section 26, samples 6/11/ and 7/12/). ZPAL F. XXVIII/26-6 and 7.

Norovica Formation, Rhaetian

All × 40

PLATE 35

1-2. *Auloconus permodiscoides* (OBERHAUSER), subaxial sections. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-13. × 75.
3. *Auloconus permodiscoides* (OBERHAUSER), subaxial section. Lejowa Valley (locality 28, sample II-6). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-II-6. × 80.
4. *Auloconus permodiscoides* (OBERHAUSER), subaxial section. Chochołowska Valley (locality 26, sample II-5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-II-5. × 50.
5. *Auloconus permodiscoides* (OBERHAUSER), axial section. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-13. × 50.
6. *Auloconus permodiscoides* (OBERHAUSER), axial section. Tŕstie (section 24, sample 25). Norovica Formation. Rhaetian. GUSAV T/25. × 50.
7. *Triasina hantkeni* MAJZON. Test encrusted by *Girvanella*. Chochołowska Valley (locality 26, sample II-5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-II-5. × 50.
8. *Triasina hantkeni* MAJZON. Test deformed by compaction. Wielka Sucha Valley (locality 27, sample 2). Norovica Formation. Rhaetian. ZPAL F. XXVIII/27-2. × 40.
9. *Triasina hantkeni* MAJZON. Chambers of the test inhabited by sessile foraminifer *Tolypammina gregaria* WENDT (arrowed). Lejowa Valley (section 28, sample 13). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-13. × 50.
10-15. *Triasina hantkeni* MAJZON, equatorial and oblique sections. Obliteration of internal structure through progressing recrystallization of tests.
   10 — Norovica Mt. (section 22, sample 13). Norovica Formation. Rhaetian. GUSAV N/13. × 65.
   11 — Chochołowska Valley (section 26, sample 5a). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-5a. × 75.
   12 — Lejowa Valley II (locality 28, sample II-6). Norovica Formation. Rhaetian. ZPAL F. XXVIII/28-II-6. × 50
   13 — Velká Furkaska Mt. (section 17, sample 338). Fatra Formation. Rhaetian. ZPAL F. XXVIII/17-338. × 40.
   14 — Norovica Mt. (section 22, sample 20). Norovica Formation. Rhaetian. GUSAV N/20. × 30.
   15 — Tŕstie (section 24, sample 23). Norovica Formation. Rhaetian. GUSAV T/23, × 30.

PLATE 36

1. *Planiinvoluta carinata* LEISCHNER, vertical section. Chochołowska Valley (section 26, sample 8). Norovica Formation Rhaetian. ZPAL F. XXVIII/26-8. × 80.
2. *Tolypammina gregaria* WENDT, vertical section. Hireška (section 6, sample 21). Fatra Formation. Rhaetian. GUSAV 119/21. × 80.
3. *Tolypammina gregaria* WENDT, vertical section. Przysłop Miętusi (section 29, sample 5). Norovica Formation. Rhaetian. ZPAL F. XXVIII/29-5. × 55.
4. *Tolypammina gregaria* WENDT, vertical section. Lejowa Valley II (section 28, sample 13). Norovica Formation. Rhaetian ZPALF. XXVIII/28-13. × 75.

5. *Tolypammina gregaria* WENDT, vertical section. Hireška (section 6, sample 21). Fatra Formation. Rhaetian. GUSAV 119/21. × 30.
6. *Tolypammina gregaria* WENDT, vertical section. Dedošova Valley (section 11, sample 3). Fatra Formation. Rhaetian. GUSAV 268/3. × 35.
7. *Trochammina alpina* KRISTAN-TOLLMANN, vertical section. Malý Mlynský vrch Mt. (section 31, sample 1). Zlambach Beds. Upper Norian (Sevatian) — *Misikella hernsteini* — Assemblage — Zone. ZPAL F. XXVIII/31-1. × 190.
8. *Trochammina* sp., vertical section. Velká Furkaska Mt. (section 17, sample 375). Fatra Formation. Rhaetian. PFUK 352/375. × 150.
9. ?*Trochammina* sp., transversal section. Chochołowska Valley (section 26, sample 3). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-3. × 200.
10. "*Tetrataxis*" sp., transversal section. Velká Furkaska Mt. (section 17, sample 376). Fatra Formation. Rhaetian. PFUK 352/376. × 80.
11. "*Tetrataxis*" *inflata* KRISTAN, vertical section. Velká Furkaska Mt. (section 17, sample 335). Fatra Formation. Rhaetian. PFUK 352/335. × 80.
12. "*Tetrataxis*" *inflata* KRISTAN, vertical section. Velká Furkaska Mt. (section 17, sample 332). Fatra Formation. Rhaetian. PFUK 352/332. × 80.
13. "*Tetrataxis*" sp., oblique section. Tŕstie (section 24, sample 4). Norovica Formation. Rhaetian. GUSAV T/4. × 100.
14. *Ammobaculites* sp., axial section. Bleskový prameň (section 32, sample 166/3-D_1). Limestone of Bleskový prameň. Rhaetian. ZPAL F. XXVIII/32-166/3-D_1. × 60.
15. *Ammobaculites* cf. *rhaeticus* KRISTAN-TOLLMANN, section through planispiral part. Tŕstie (section 24, sample M-23). Norovica Formation. Rhaetian. GUSAV T/M-23. × 60.
16. *Ammobaculites* sp., axial section. Norovica Mt. (section 22, sample 21). Norovica Formation. Rhaetian. GUSAV N/21. × 60.
17. *Ammobaculites rhaeticus* KRISTAN-TOLLMANN, axial section. Tŕstie (section 24, sample M-21). Norovica Formation. Rhaetian. GUSAV T/M-21. × 50.

PLATE 37

1. *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN in dolomicrite. Lejowa Valley I (section 18, sample 1). Upper dolomites of Carpathian Keuper Group. Rhaetian. ZPAL F. XXVIII/18-1. × 40.

2–4. *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN, oblique sections. Lejowa Valley I (section 18, sample 1). Upper dolomites of Carpathian Keuper Group. Rhaetian. ZPAL F. XXVIII/18-1. × 130.

5. *Agathammina austroalpina* KRISTAN-TOLLMANN and TOLLMANN, axial section. Palenica Lendacka Mt. (section 6, sample 3 *in* GAŹDZICKI 1974). Fatra Formation. Upper Norian (?Sevatian). ZPAL F. XXVIII/1974:6-3. × 110.

6. "*Frondicularia woodwardi*" HOWCHIN, subaxial sections. Norovica Mt. (section 22, sample 17). Norovica Formation. Rhaetian. GUSAV N/17. × 80.

7. "*Frondicularia woodwardi*" HOWCHIN, axial section. Tŕstie (section 24, sample 8). Norovica Formation. Rhaetian. GUSAV T/8. × 80.

8. *Nodosaria* sp., axial section. Velká Furkaska Mt. (section 18, sample 388). Fatra Formation. Rhaetian. PFUK 352/388. × 120.

9–10. *Ophthalmidium carpathicum* (GAŹDZICKI), axial sections. Malý Mlynský vrch Mt. (section 31, sample 4). Zlambach Beds. Norian (Sevatian). ZPAL F. XXVIII/31-MWV-4. × 130.

11. *Ophthalmidium* cf. *carpathicum* (GAŹDZICKI), axial section. Bleskový prameň (section 32, sample 166/5-D_4). Limestone of Bleskový prameň. Rhaetian. ZPAL F. XXVIII/32-166/5-D_4. × 200.

12. *Ophthalmidium martanum* FARINACCI, subaxial section. Bleskový prameň (section 32, sample 166/2). Limestone of Bleskový prameň. Rhaetian. ZPAL F. XXVIII/32-166/2. × 120.

13. *Ophthalmidium* sp., axial section. Velká Furkaska Mt. (section 17, sample 335). Fatra Formation. Rhaetian. PFUK 352/335. × 200.

14. *Ophthalmidium* sp., axial section. Chochołowska Valley (section 26, sample 8). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-8. × 80.

15. *Galeanella* cf. *tollmanni* (KRISTAN), oblique section. Bleskový prameň (section 32, sample 166/2). Limestone of Bleskový prameň. Rhaetian. ZPAL F. XXVIII/32-166/2. × 80.

16. *Diplotremina* sp., subequatorial section. Chochołowska Valley (section 26, sample 12). Norovica Formation. Rhaetian. ZPAL F. XXVIII/26-12. × 80.

PLATE 38

1–2. *Involutina liassica* (JONES), axial sections, microspheric forms. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. 1 — × 80, 2 — × 70.

3. *Involutina liassica* (JONES), axial section, microspheric form. Velká Furkaska Mt. (section 17, sample 422). Kopieniec Formation. Lias (Hettangian-?Sinemurian). PFUK 352/422. × 80.

4. *Involutina liassica* (JONES), axial section. Rúbaň Skala (locality 1, sample 9720). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9720. × 80.

5. *Involutina liassica* (JONES), axial section, megalospheric form. Rúbaň Skala (locality 1, sample 9720). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9720. × 80.

6. *Involutina liassica* (JONES), subaxial section. Rúbaň Skala (locality 1, sample 9718). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9718. × 80.

7–8. *Involutina liassica* (JONES), oblique sections. Rúbaň Skala (locality 1, sample 9720). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9720. 7 — × 80, 8 — × 90.

9–10. *Involutina liassica* (JONES), subequatorial sections. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 80.

11. *Involutina liassica* (JONES), equatorial section, microspheric form. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. ×80.

12. *Involutina liassica* (JONES), equatorial section. Rúbaň Skala (locality 1, sample 9720). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9720. × 50.

13. *Involutina farinacciae* BRÖNNIMANN and KOEHN-ZANINETTI, axial section. Test with thin uniform onkolitic envelopes. Strążyska Valley I (section 20, sample S_{2b}). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_2b. × 135.

14. *Involutina turgida* KRISTAN, axial section. Test with onkolitic crusts. Strążyska Valley I (section 20, sample S_2). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_2. × 80.

15. *Involutina liassica* (JONES), axial section, megalospheric form. Test with thick irregular onkolitic coatings. Strążyska Valley I (section 20, Sample S_{2b}). Kopieniec Formation. Lias (Hettangian-Sinemurian). ZPAL F. XXVIII/20-S_{2b}. × 80.

16. *Involutina* sp., axial section. Test with oolitic envelopes. Strążyska Valley (section 20, sample S_2). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_2. × 80.

PLATE 39

1. *Semiinvoluta* sp., axial section. Bleskový prameň (section 32, sample BP-2). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-2. × 80.

2. ?*Involutina* sp., axial section. Strążyska Valley II (section 21, sample 13). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/21-13. × 150.

3. *Trocholina umbo* FRENTZEN, subaxial section. Strążyska Valley I (section 20, sample S_{2a}). Kopieniec Formation Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_{2a}. × 200.

4. *Trocholina umbo* FRENTZEN, axial section. Test with onkolitic coatings. Strążyska Valley II (section 21, sample 13). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/21-13. ×160.

5. *Trocholina* sp., axial section. Rúbaň Skala (section 1, sample 9720). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9720. × 80.

6. *Trocholina* cf. *umbo* FRENTZEN, subaxial section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 90.

7. *Trocholina turris* FRENTZEN, axial section. Bleskový prameň (section 32, sample BP-3). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-3. × 200.

8. *Planiinvoluta carinata* LEISCHNER, vertical section. Strążyska Valley I (section 20, sample S_2). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_2. × 200.

9. ?*Planiinvoluta* sp., vertical section. Strążyska Valley I (section 20, sample S_2). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_2. × 150.

10. *Ophthalmidium* sp., axial section. Velká Furkaska Mt. (section 17, sample 421). Kopieniec Formation. Lias (Hettangian- ?Sinemurian). PFUK 352/421. × 170.

11. *Ophthalmidium martanum* FARINACCI, axial section. Rúbaň Skala (locality 1, sample 9861). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9861. × 130.

12. *Ophthalmidium* cf. *leischneri* (KRISTAN-TOLLMANN), axial section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 150.
13. *Ophthalmidium* sp., subequatorial section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 80.
14. *Glomospira* sp. Kopieniec Starorobociański Mt. (section 3, sample 16). Lias of the Tatricum in the Tatra Mts. Hettangian-Sinemurian. IGP/16. × 190.
15. *Trochammina* sp., oblique section. Lejowa Valley I (section 18, sample L-8). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/18-L-8. × 150.
16. *Cyclogyra* sp., subequatorial section. Lejowa Valley I (section 18, sample L-4). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/18-L-4. × 190.
17. *Textularia* sp., axial section. Bobrowiec Mt. (locality 2, sample I/7). Lias of the Tatricum in the Tatra Mts. Hettangian-Sinemurian. IGP/I/7. × 100.

PLATE 40

Ophthalmidium leischneri (KRISTAN-TOLLMANN)

1. axial section, megalospheric form. Velká Furkaska Mt. (section 17, sample 421). PFUK 352/421. × 150.
2. axial section, megalospheric form. Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 150.
3. axial section, Strążyska Valley I (section 20, sample S_{2b}). ZPAL F. XXVIII/20-S_{2b}. × 150.
4. axial section, Strążyska Valley I (section 20, sample S_2). ZPAL F. XXVIII/20-S_2. × 150.
5. axial section, microspheric form. Strążyska Valley I (section 20, sample S_2). ZPAL F. XXVIII/20-S_2 . × 150.
6. subaxial section, microspheric form. Strążyska Valley I (section 20, sample S_{2b}). ZPAL F. XXVIII/20-S_{2b}. × 150.
7. oblique section, megalospheric form. Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 150.
8. equatorial section. Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 150.

9–10. subequatorial sections, Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 150.

11. axial section; a specimen with attached foreign test. Strążyska Valley I (section 20, sample S_{2b}). ZPAL F. XXVIII/20-S_{2b}. × 150.
12. axial section: a specimen with regenerated last chamber (arrowed), situated asymmetrically to the foregoing chambers. Strążyska Valley I (section 20, sample S_{2b}). ZPAL F. XXVIII/20-S_{2b}. × 150.

Ophthalmidium walfordi HÄUSLER

13. axial section. Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 100.
14. axial section. Strążyska Valley II (section 21, sample 13). ZPAL F. XXVIII/21-13. × 100.
15. subaxial section. Strążyska Valley I (section 20, sample S_{2a}). ZPAL F. XXVIII/20-S_{2a}. × 100.
16. subequatorial section. Lejowa Valley I (section 18, sample L-8). ZPAL F. XXVIII/18-L-8. × 100.

All from Kopieniec Formation. Lias (Hettangian-?Sinemurian)

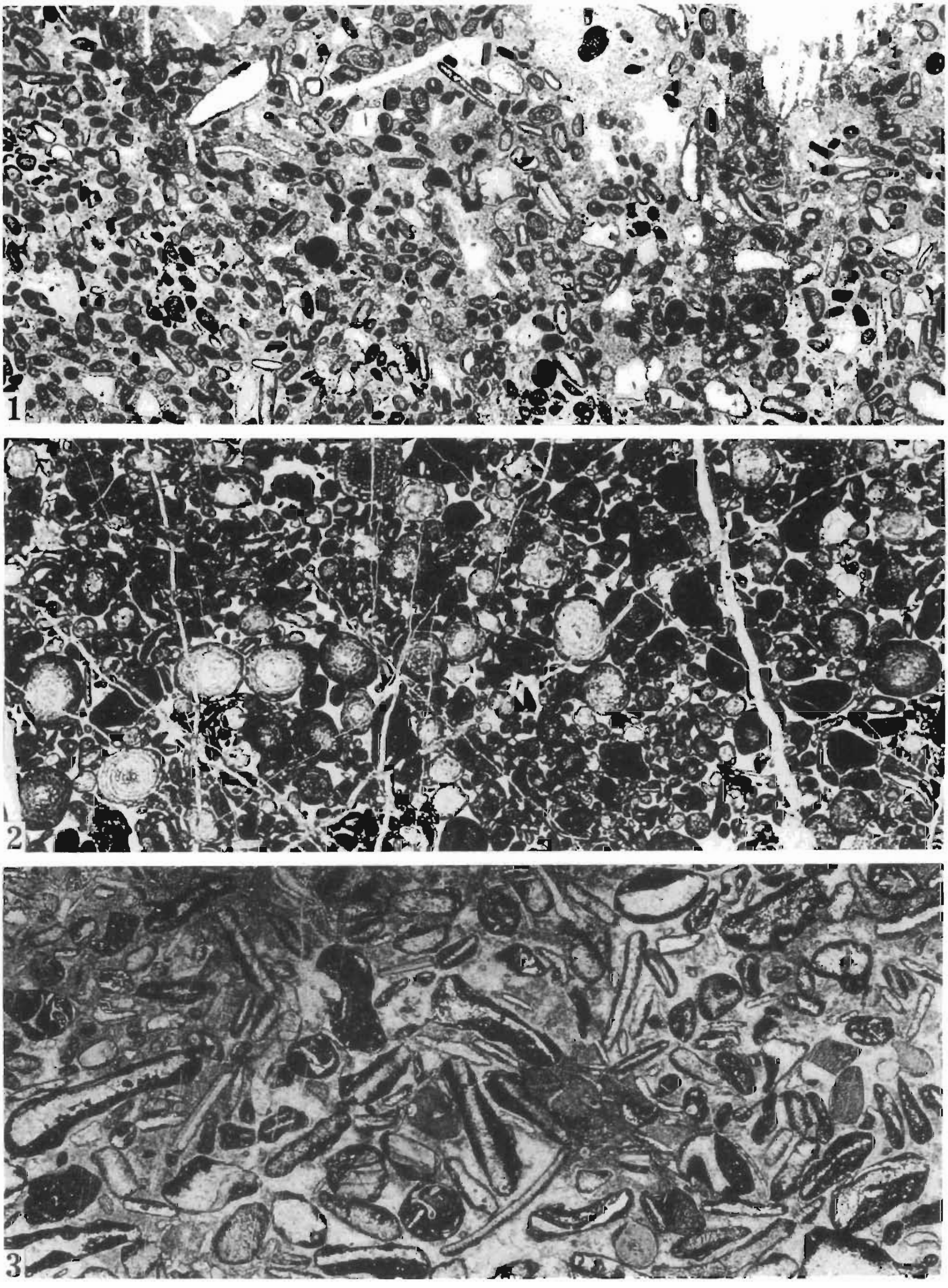
PLATE 41

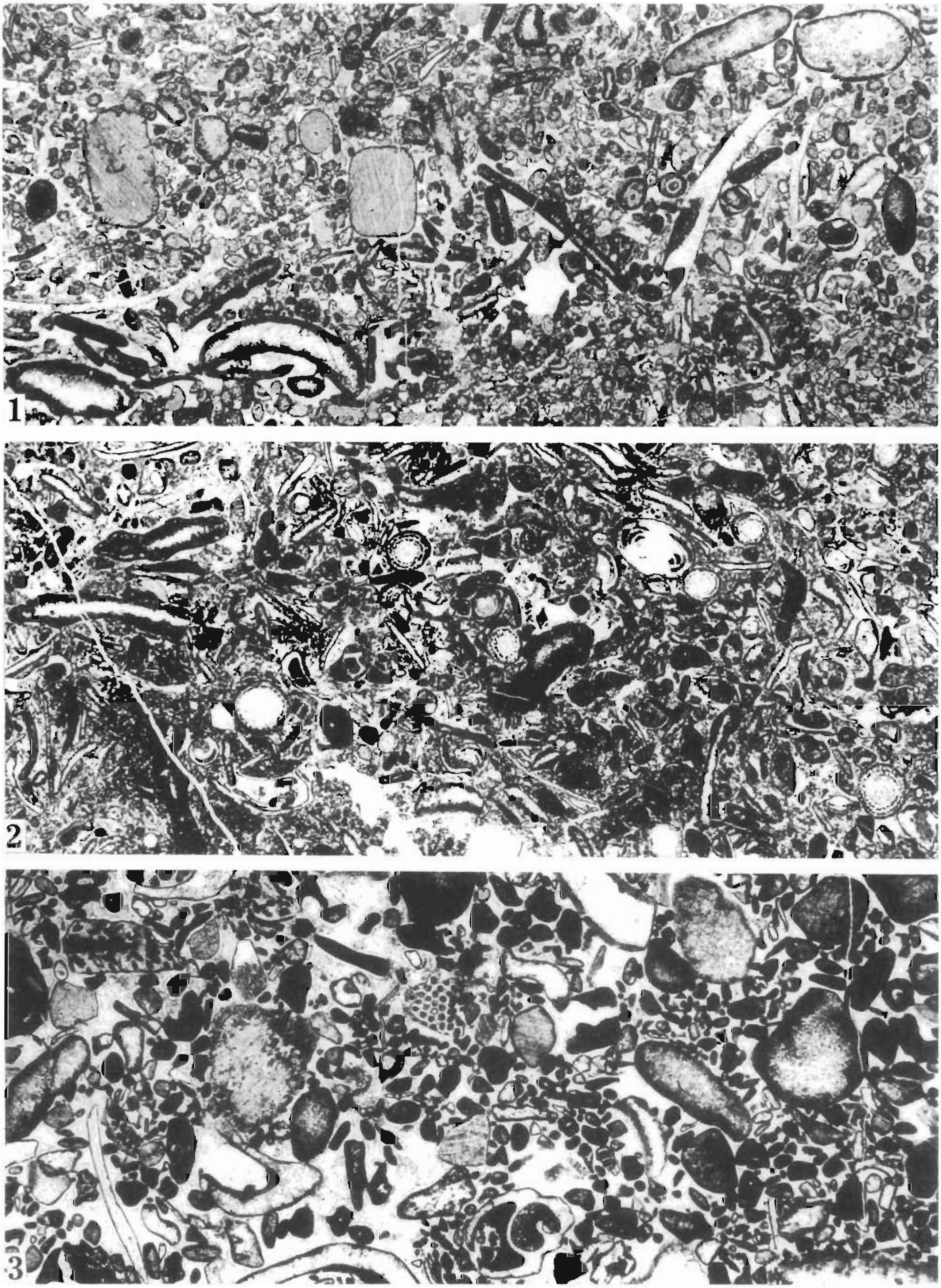
1. *Nodosaria* cf. *metensis* TERQUEM, transversal section. Test with thin uniform onkolitic envelopes. Strążyska Valley (section 20, sample S_{2a}). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_{2a}. × 150.
2. *Nodosaria* cf. *metensis* TERQUEM, oblique section. Test with onkolitic envelopes. Strążyska Valley I (section 20, sample S_{2b}). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/20-S_{2b}. × 150.
3. *Nodosaria* cf. *claviformis* TERQUEM, longitudinal section. Test with onkolitic crusts. Strążyska Valley II (section 21, sample 13). Kopieniec Formation. Lias (Hettangian-?Sinemurian). ZPAL F. XXVIII/21–13. × 100.
4. *Nodosaria* cf. *nitidana* BRAND, longitudinal section. Rúbaň Skala (locality 1, sample 9718). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9718. × 80.
5. *Geinitzinita* sp., longitudinal section. Bleskový prameň (section 32, sample BP-2). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-2. × 100.
6. *Frondicularia* sp., longitudinal section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 80.

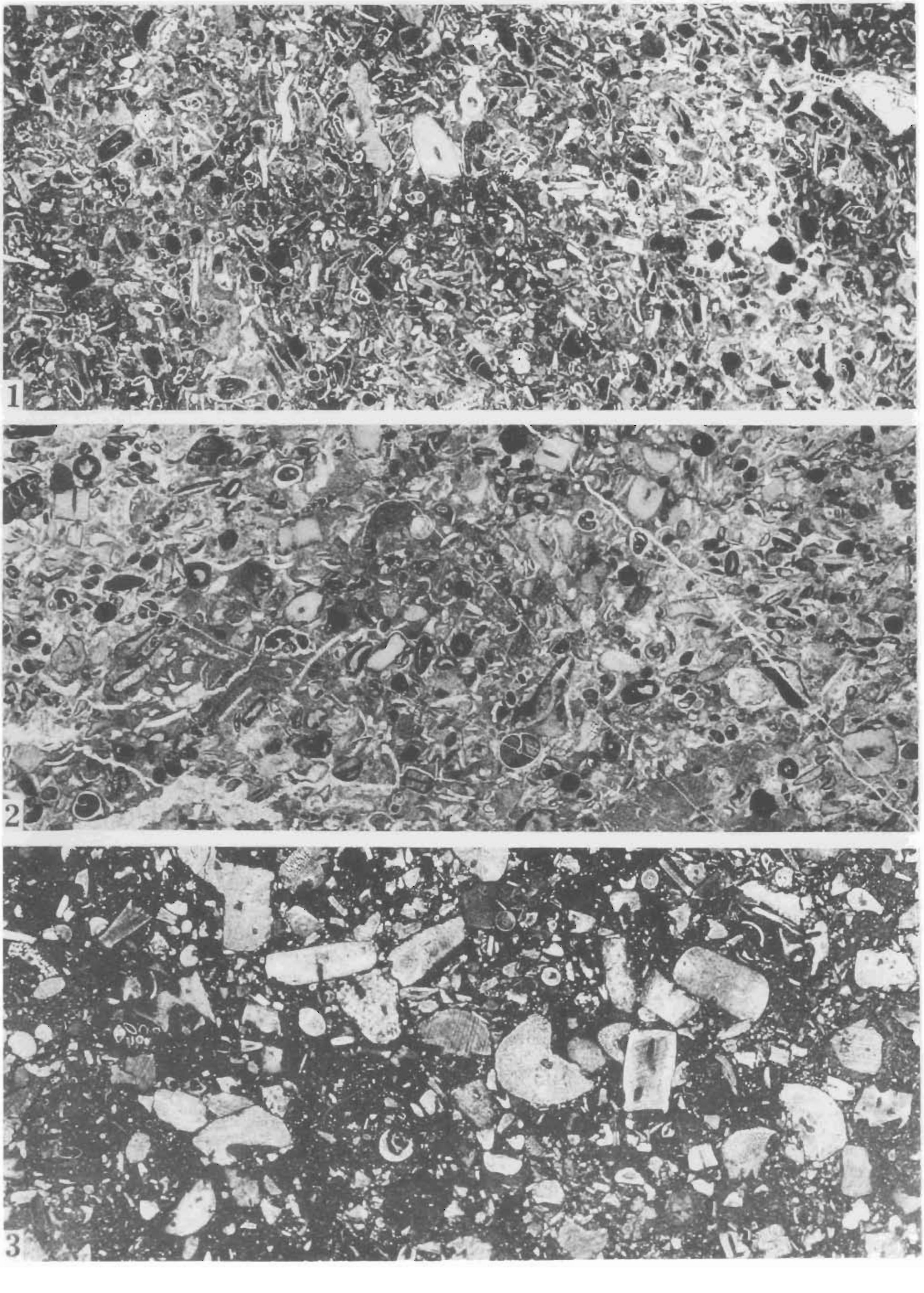
7. ?*Geinitzinita* sp., longitudinal section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 80.
8. *Nodosaria* sp., longitudinal section. Rúbaň Skala (locality 1, sample 9861). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9861. × 80.
9. ?*Nodosaria* sp., longitudinal section. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 50.

10–12. *Astacolus* sp., sections in coiling plane. Rúbaň Skala (locality 1, sample 9719 (*10* and *12*) and 9718 (*11*). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719 and 9718. *10*– ×40, *11* — × 50, 12– × 80.

13. *Lenticulina* sp., subaxial section. Bleskový prameň (section 32, sample BP-2). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-2. × 50.
14. *Lenticulina* sp., section in plane of coiling. Bleskový prameň (section 32, sample BP-2). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-2. × 80.
15. *Lenticulina* sp., section in plane of coiling. Rúbaň Skala (locality 1, sample 9719). Lias of the Tatricum in the Velká Fatra Mts. Sinemurian. PFUK 9719. × 100.
16. *Lenticulina* sp., section in plane of coiling. Bleskový prameň (section 32, sample BP-2). Lias of the Silicicum in the Slovenský kras. Pliensbachian. ZPAL F. XXVIII/32-BP-2. × 80.



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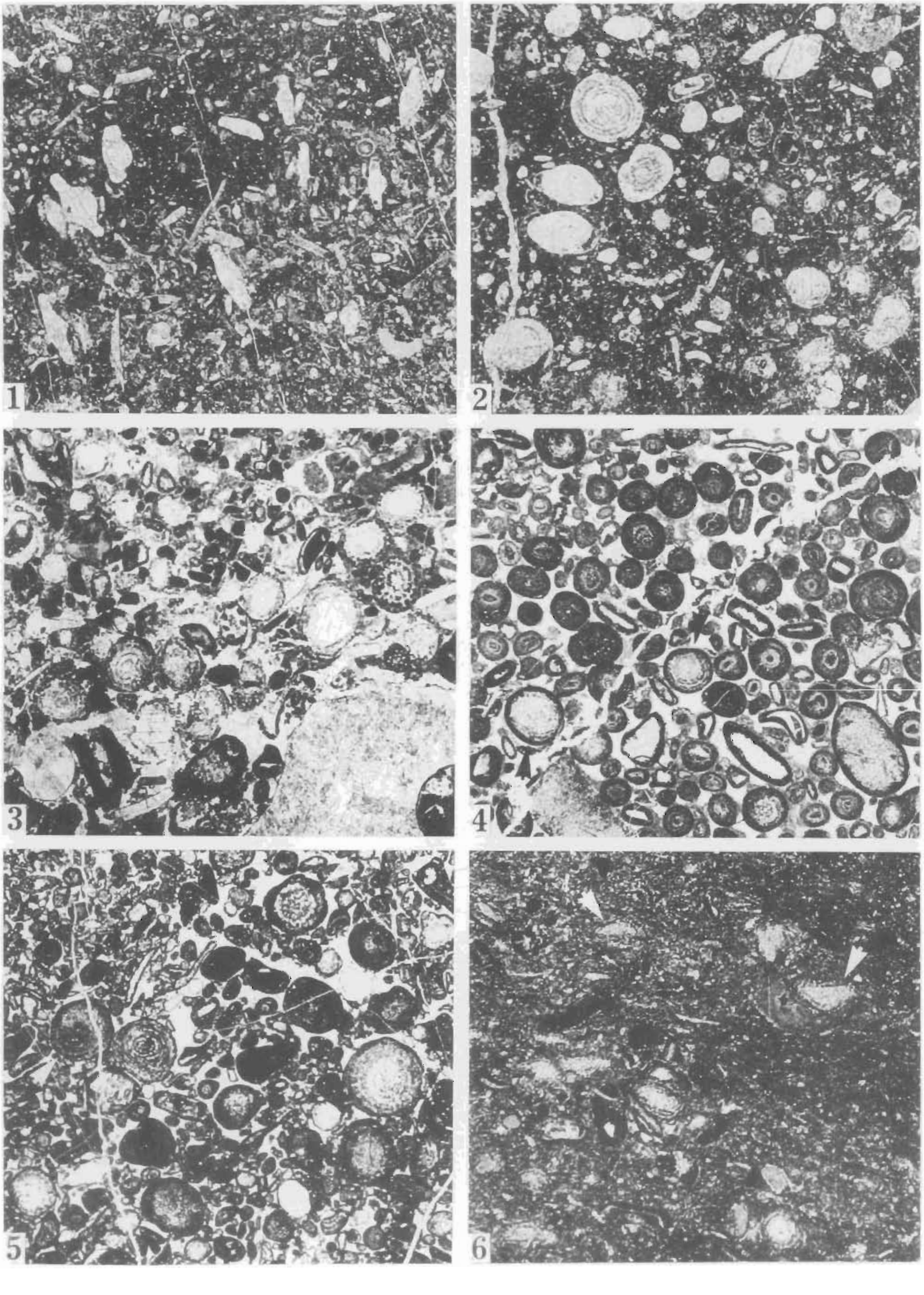
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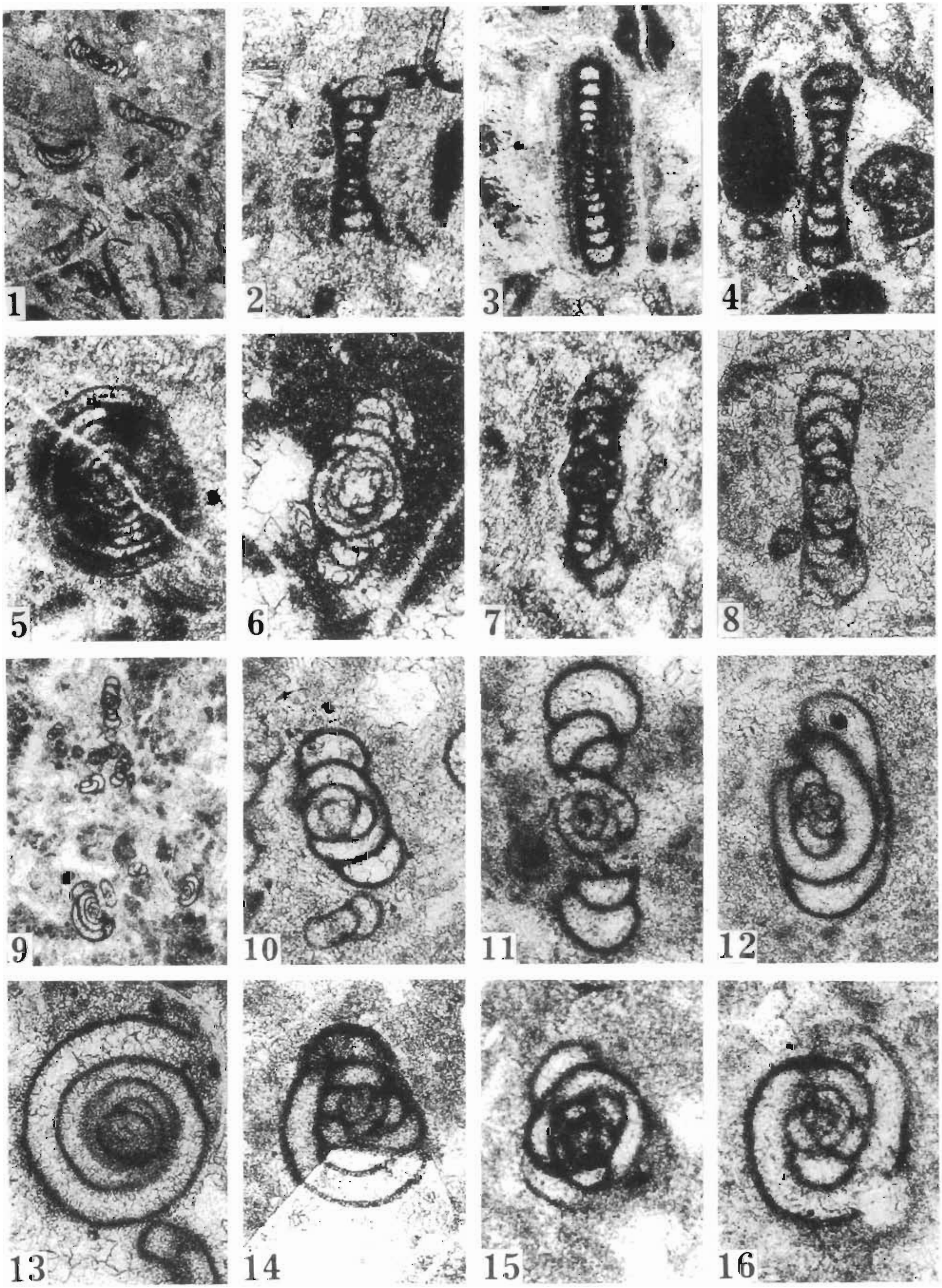
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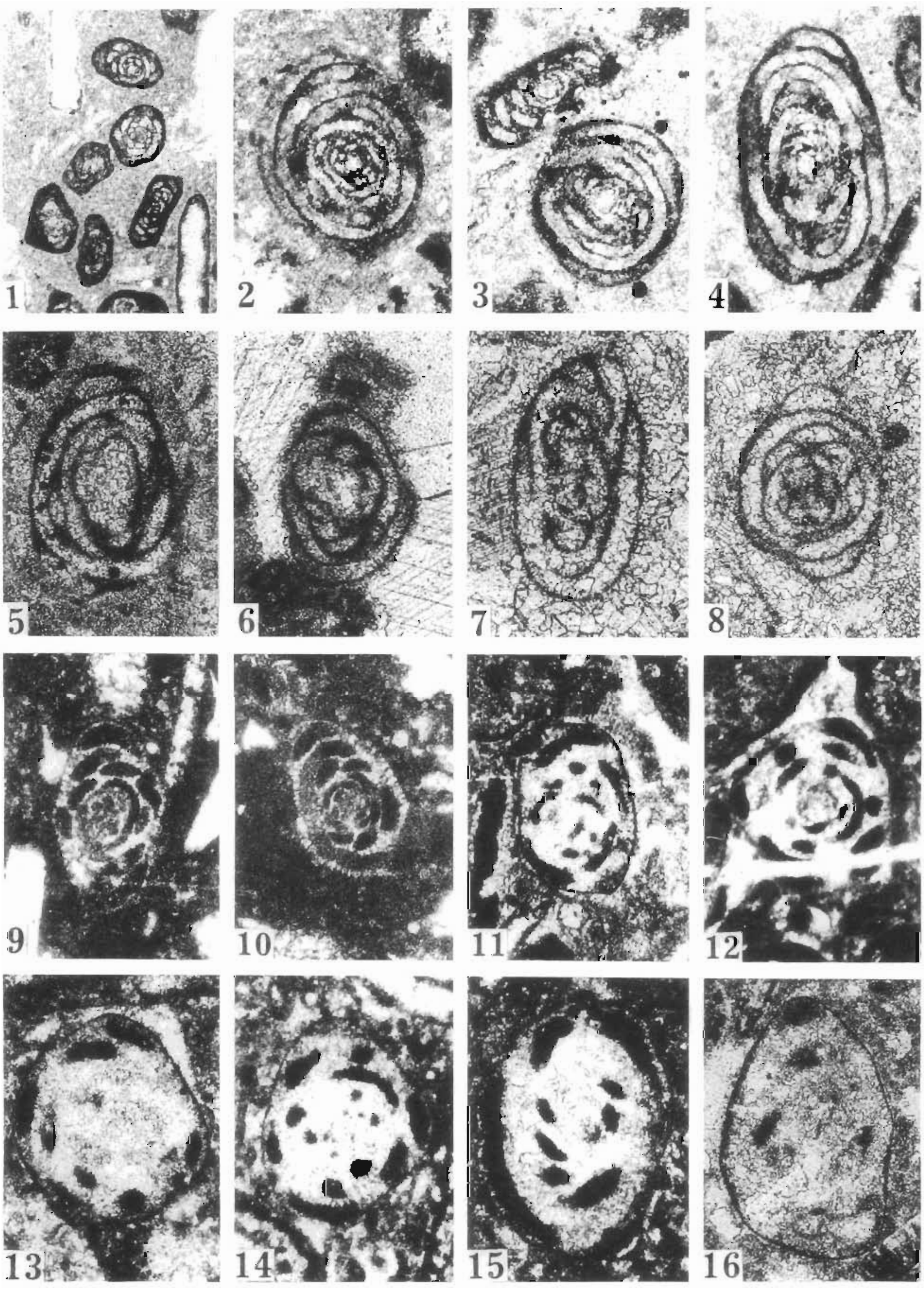
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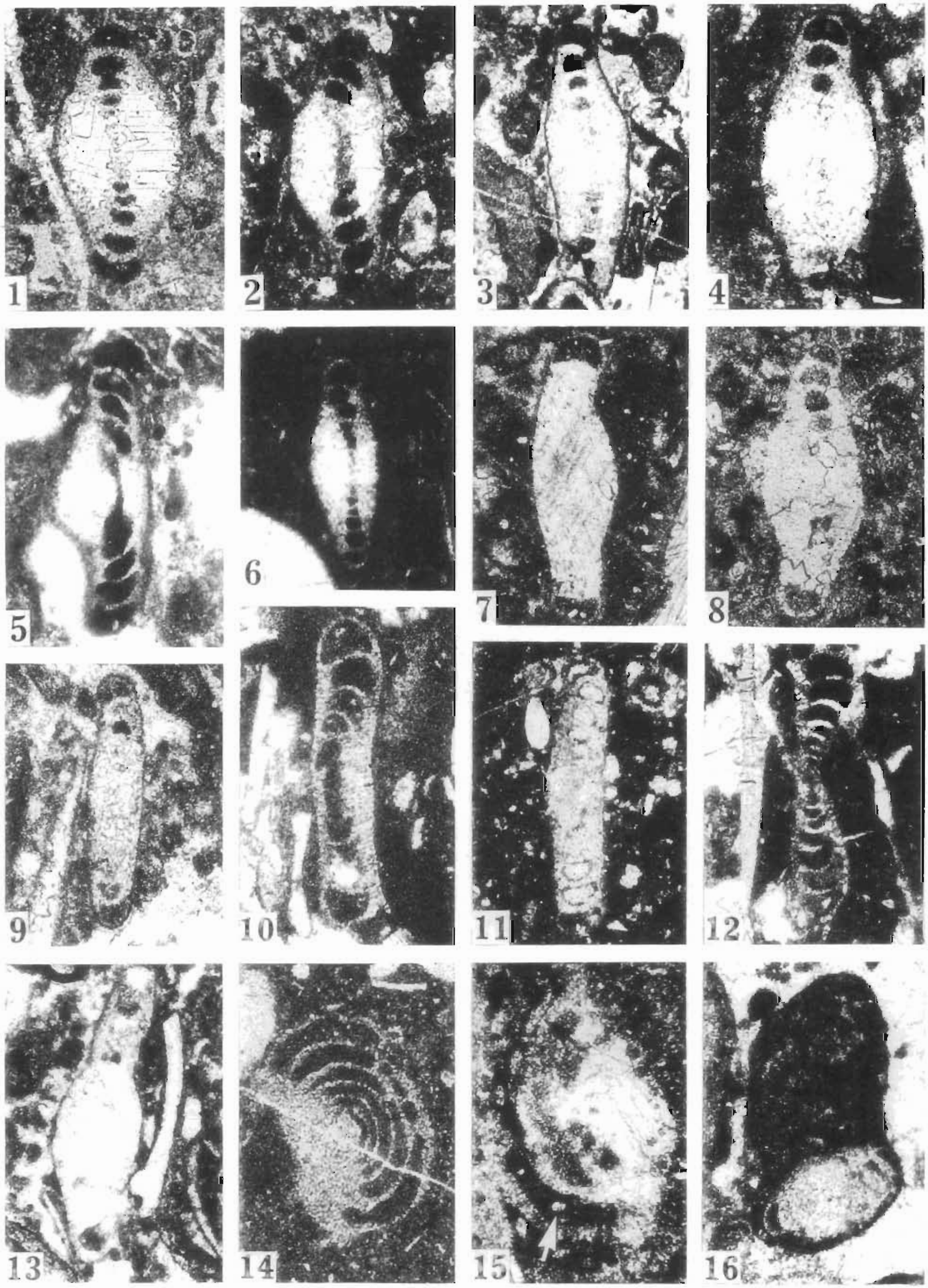

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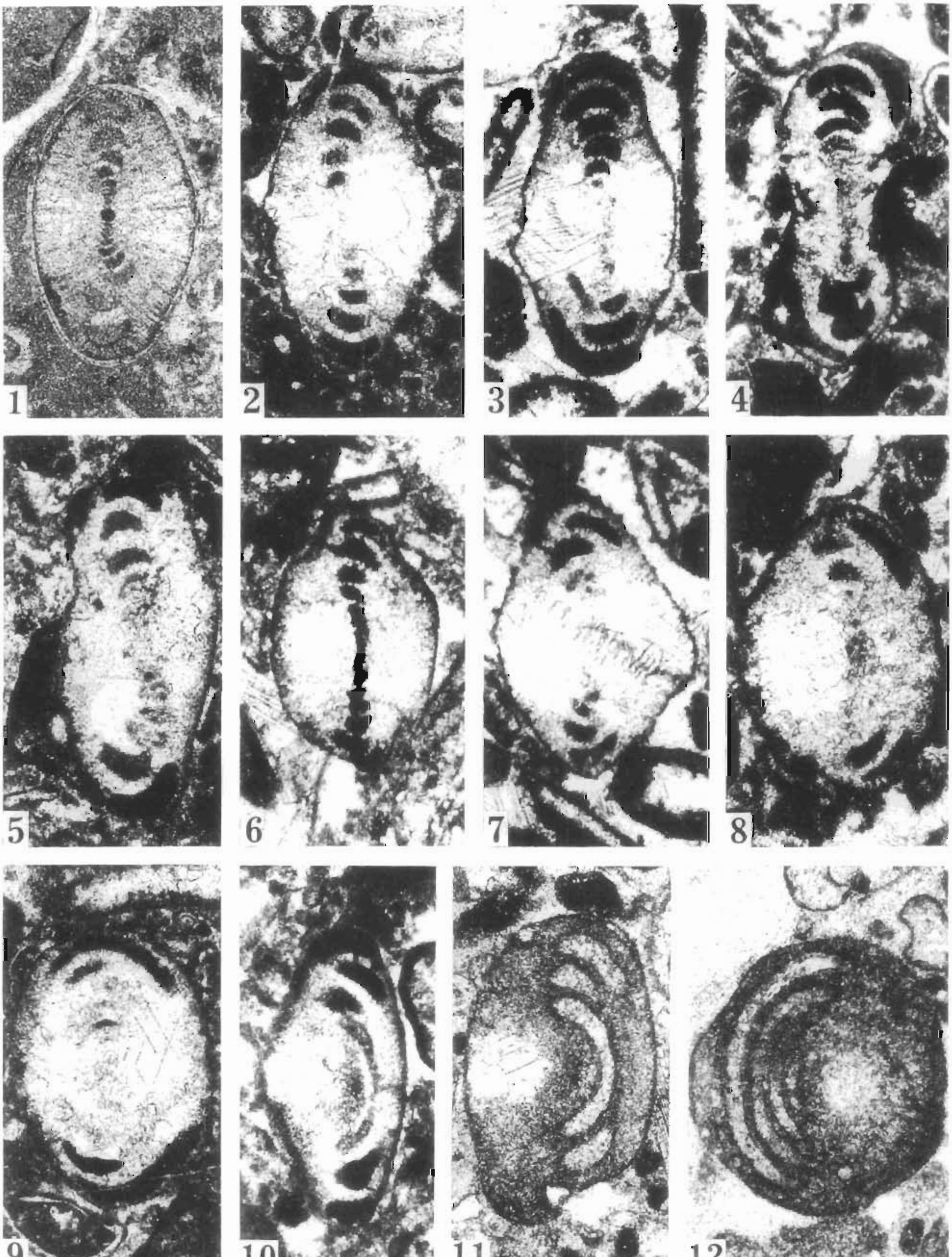
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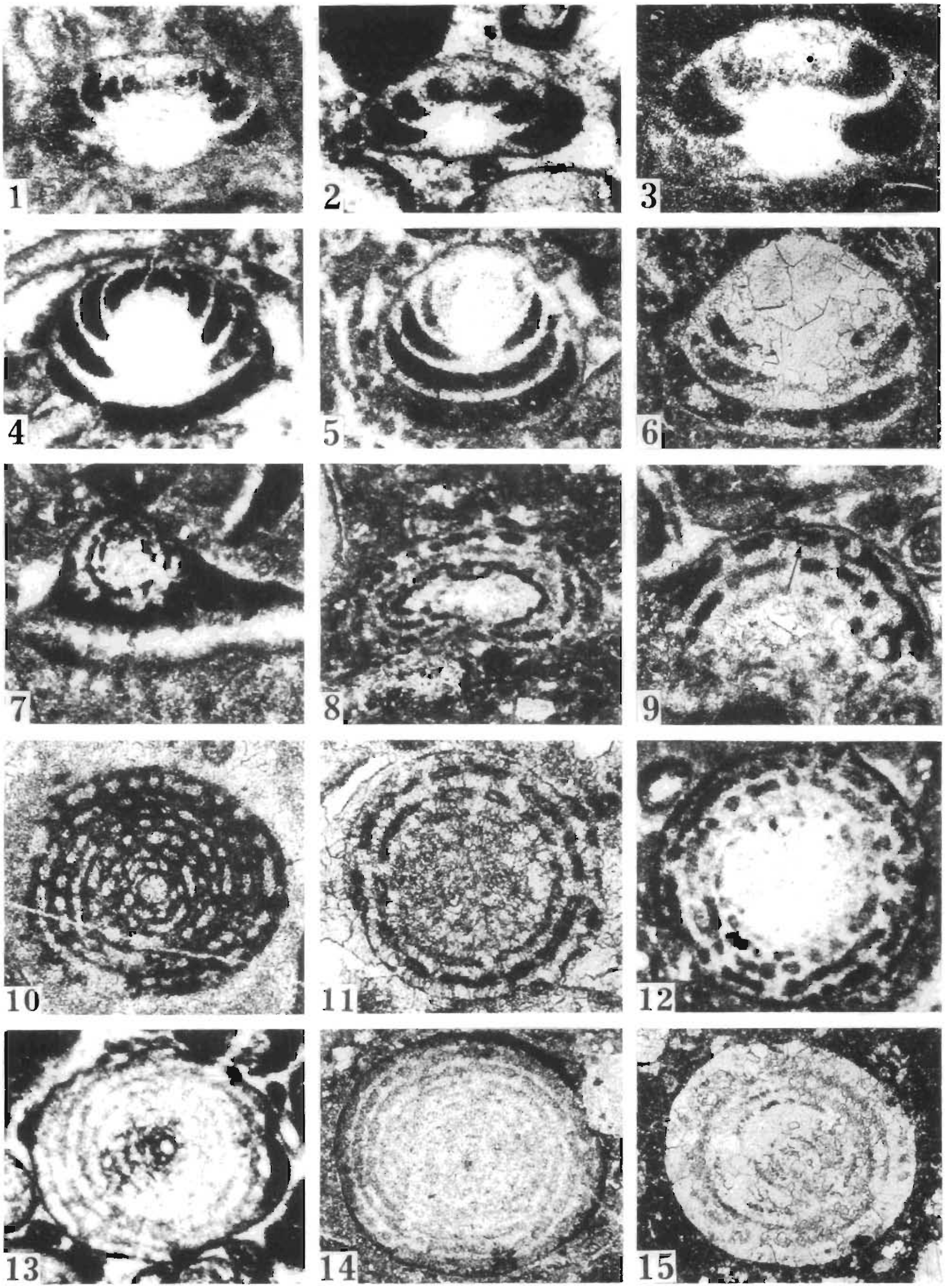

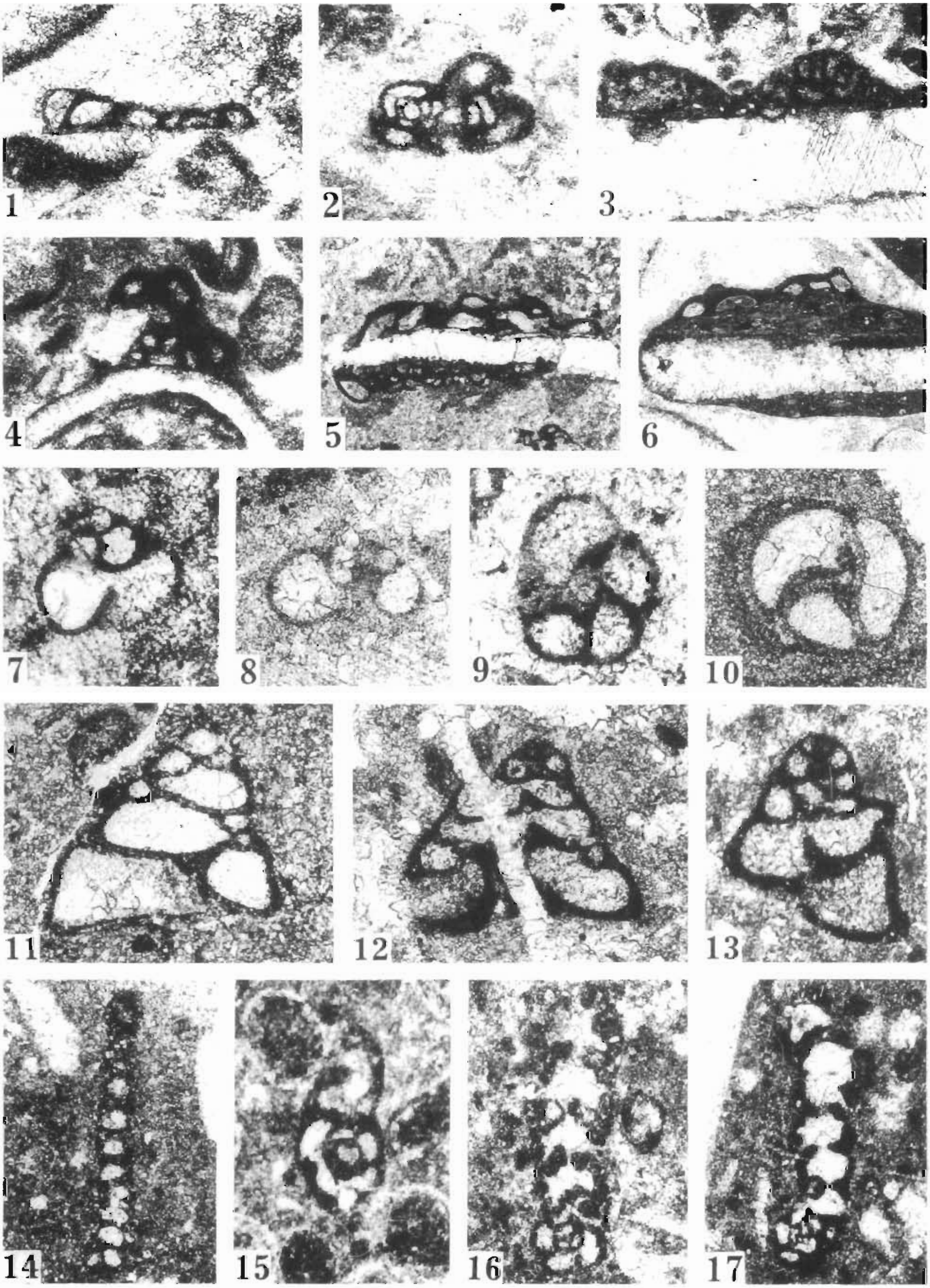
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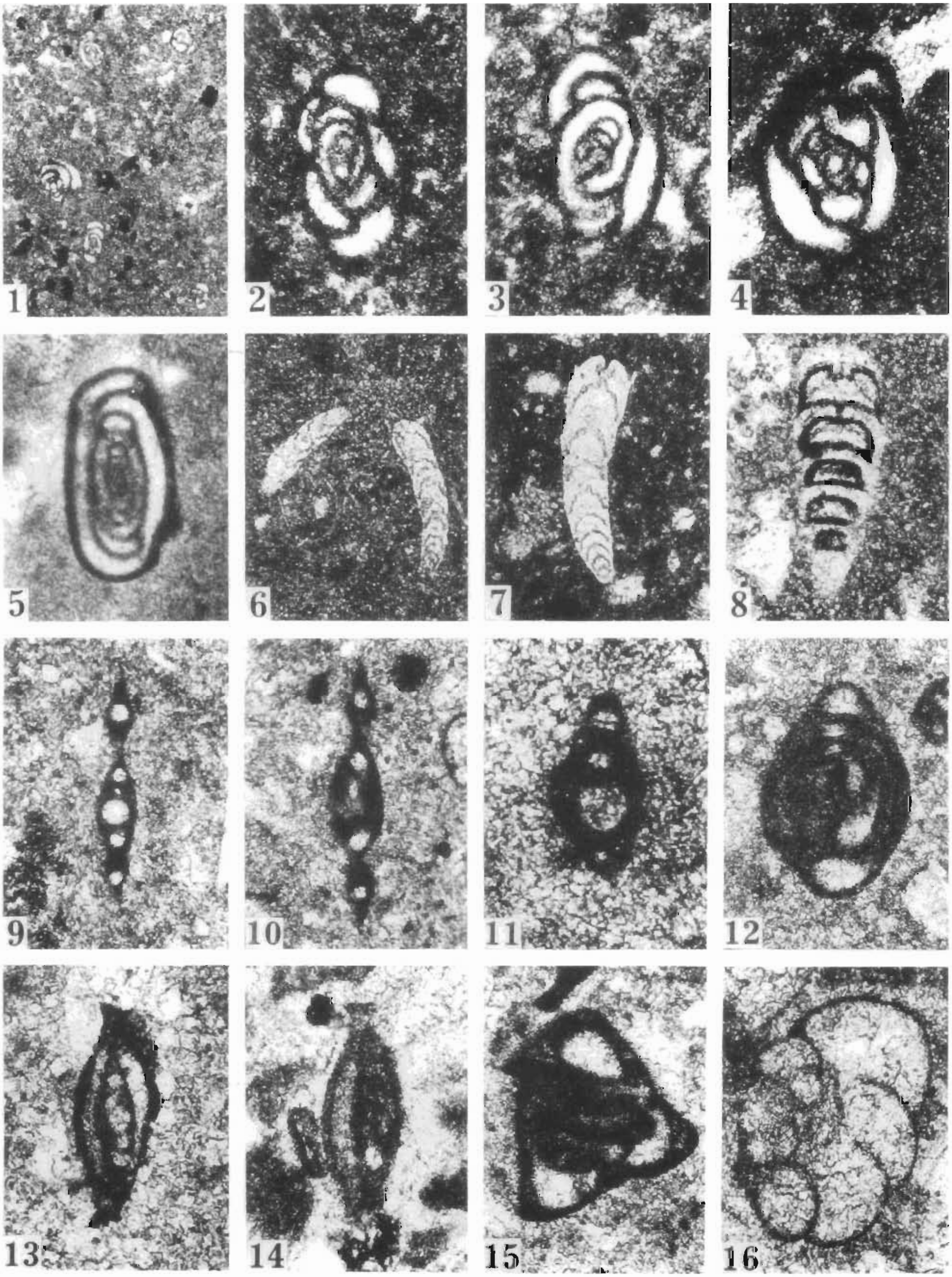
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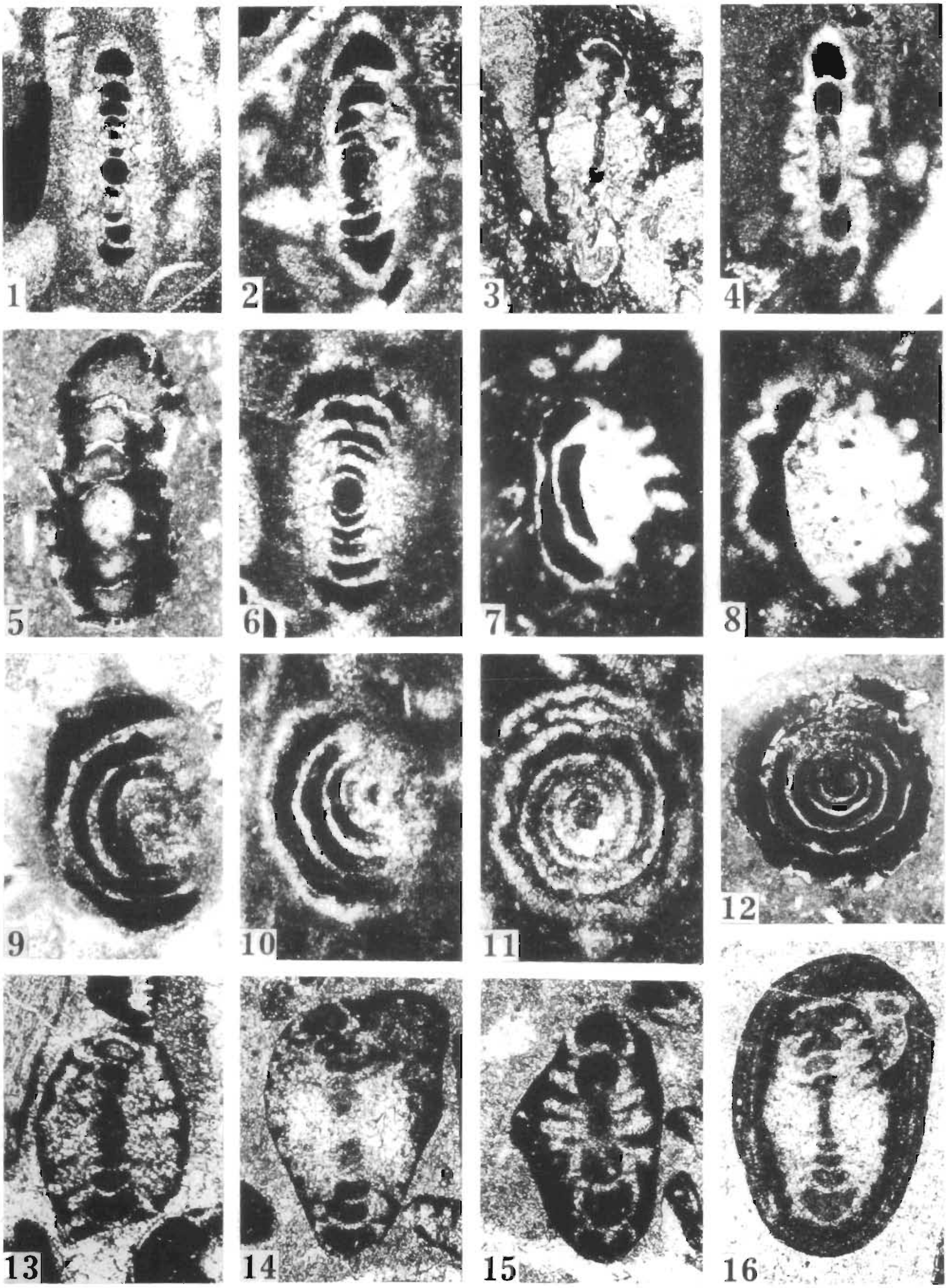
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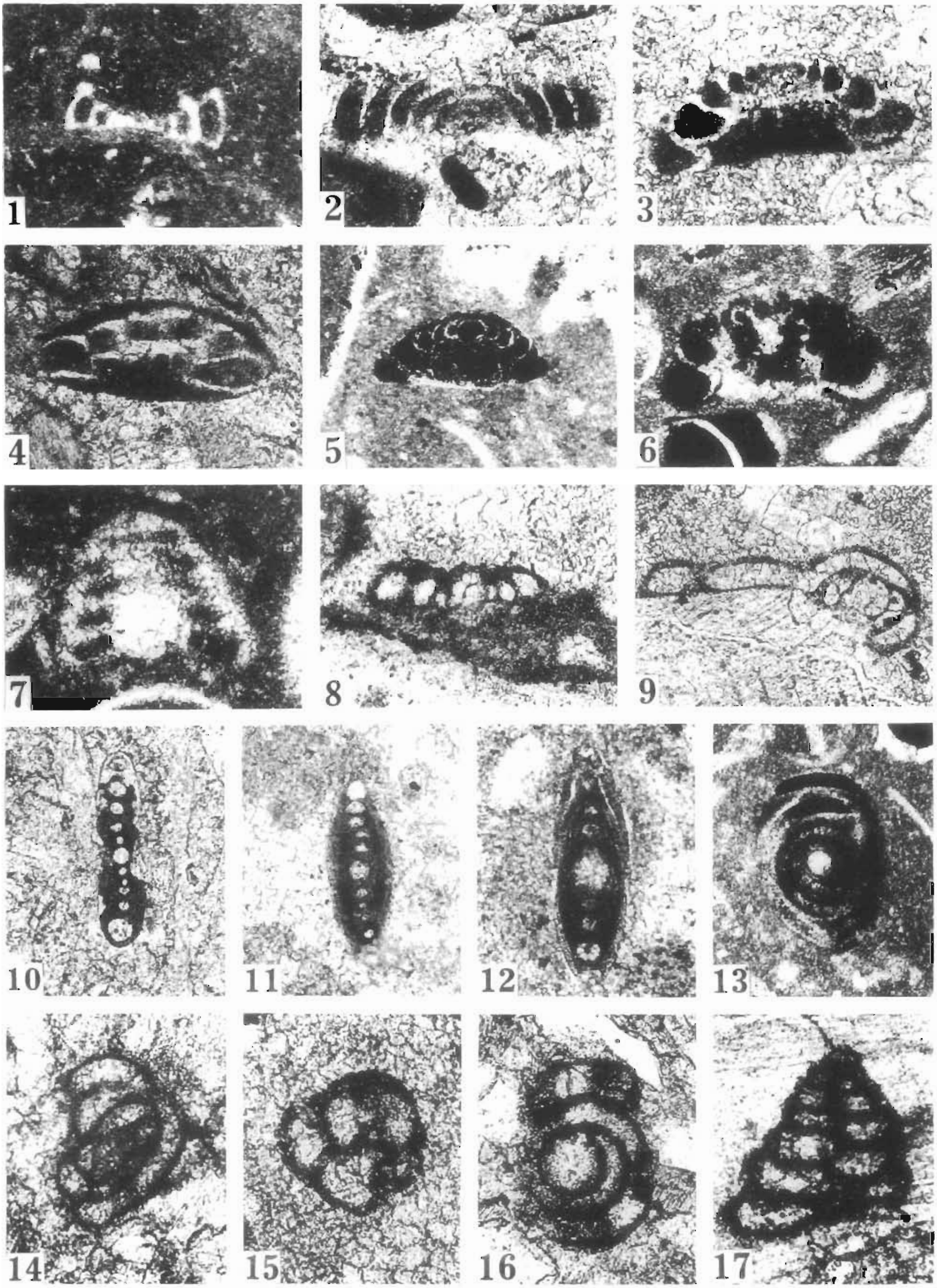
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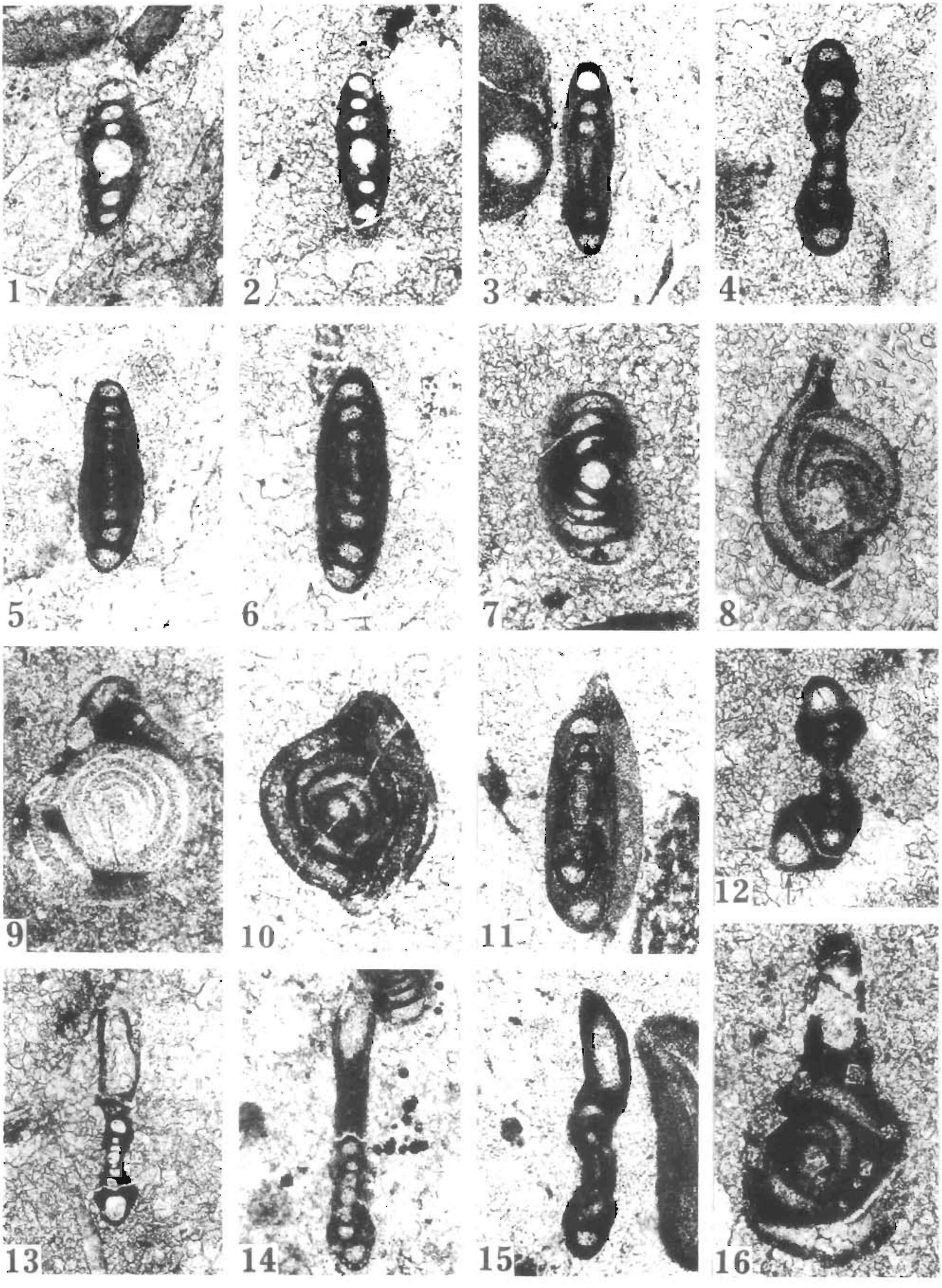
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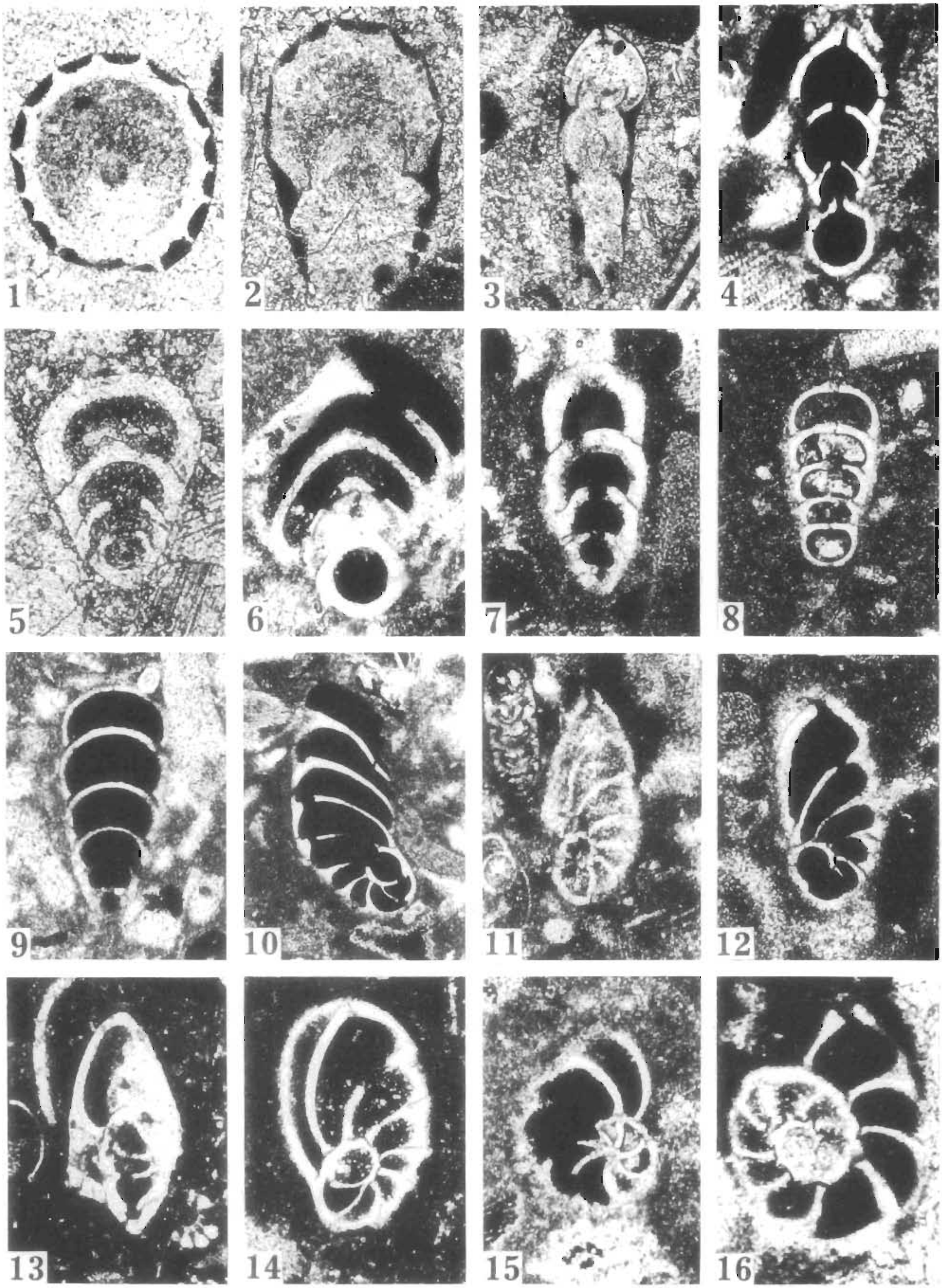
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Instead of Table 5 after p. 14:

Table 5

Correlation of the Middle to Upper Devonian deposits in Western Pomerania with Central Poland and other regions of Europe

SYSTEM	SERIES	STAGE	AMMONOID ZONES	CONODONT ZONES HOUSE and ZIEGLER 1977	OSTRACOD ZONES RABIEN 1954, 1960	ARDENNES BECKER and BLESS 1974 *a*, *b*	RHENISH MASSIF BECKER and BLESS 1974*b*, GROOS 1969	POLAND: Holy Cross Mts.: ŁYSOGÓRY Region ADAMCZAK 1976	POLAND: Holy Cross Mts.: KIELCE Region OLEMPSKA 1979	POLAND: WEST POMERANIA	EAST-EUROPEAN PLATFORM POLENOVA 1952, 1953 ROZHDESTVENSKAYA 1962
DEVONIAN	UPPER	FAMENNIAN	*CHEILOCERAS*	*triangularis*	*Entomozoe*	Fala	no data	no data	no data	Lower Famennian	no data
		FRASNIAN	*MANTICOCERAS*	*gigas*	*variostriata*	F3 Matagne	Tonschiefer			?U. Frasnian	
				Anc. triangularis	*cicatricosa*	F2 Frasnes	Refrath			M. Frasnian	
				assymetricus	*cicatricosa-torleyi*	F1 Fromelennes	Ob. Plattenkalk			L. Frasnian	Kynov
				hermanni cristatus	*torleyi*						
	MIDDLE	GIVETIAN	*MAENIOCERAS*	*varcus*	ostracode zones not established	Givet	Bolsdorf Kerpen Rodert	-?-?-?-?-?-? Skały	Stringocephalus Beds	Upper Givetian	Starooskol