

Janina LISZKOWA, Joanna Janina MORGIEL

## Contribution to the knowledge of the foraminifers of the Frydek type facies in the Polish Outer Carpathians

Microfauna occurring in the marls of Frydek type (grey marls in the Subsilesian, Silesian units and Baculites Marls in the Skole unit) in the Polish Outer Carpathians are discussed. The Campanian and Maestrichtian assemblages have been found in the Subsilesian as well as the Maestrichtian ones in the Silesian and Skole units. The Frydek Marls have been formed in the final stage the submarine slumps at the boundary of the shelf and bathyal zones. They have more outer position than the variegated facies.

### INTRODUCTION

Microfauna of the Frydek Formation from Czechoslovakia have been worked out by E. Hanzlikova (1969, 1972), E. Hanzlikova et al. (1982). In the monographic paper, dealing with microfauna from the type locality at Frydek Mistek, E. Hanzlikova (1969) distinguished the biostratigraphic zones and in the paper by E. Hanzlikova et al. (1982) she refers to Longoria zones (J. F. Longoria, 1977). The similarity between microfauna from the grey marls of the Subsilesian unit and from the Frydek Marls has been pointed out in the papers by J. Liszkowa (1959) and J. Liszkowa, W. Nowak (1960, 1963). Microfauna of the grey marls from the Silesian unit are described in: J. Liszkowa, W. Nowak (1964), J. Liszkowa (*vide* S. Geroch et al., 1967), F. Szymakowska, J. Morgiel (1964). Microfauna of the Baculites Marls from the Skole unit have been investigated by J. Rychlicki (1912), S. Geroch (*vide* S. Bukowy, S. Geroch, 1957; S. Geroch et al., 1979), J. Morgiel (*vide* S. Gucik, 1962; S. Gucik, J. Morgiel, 1965; S. Wdowiarz et al., 1974). Number of findings of the Upper Senonian macrofauna coming from the Baculites Marls were described in: T. Wiśniowski (1905, 1909, 1918/1919), W. Rogala (1909, 1937), J. Nowak (1909), J. Kotlarczyk et al. (1972), J. Kotlarczyk (1979).

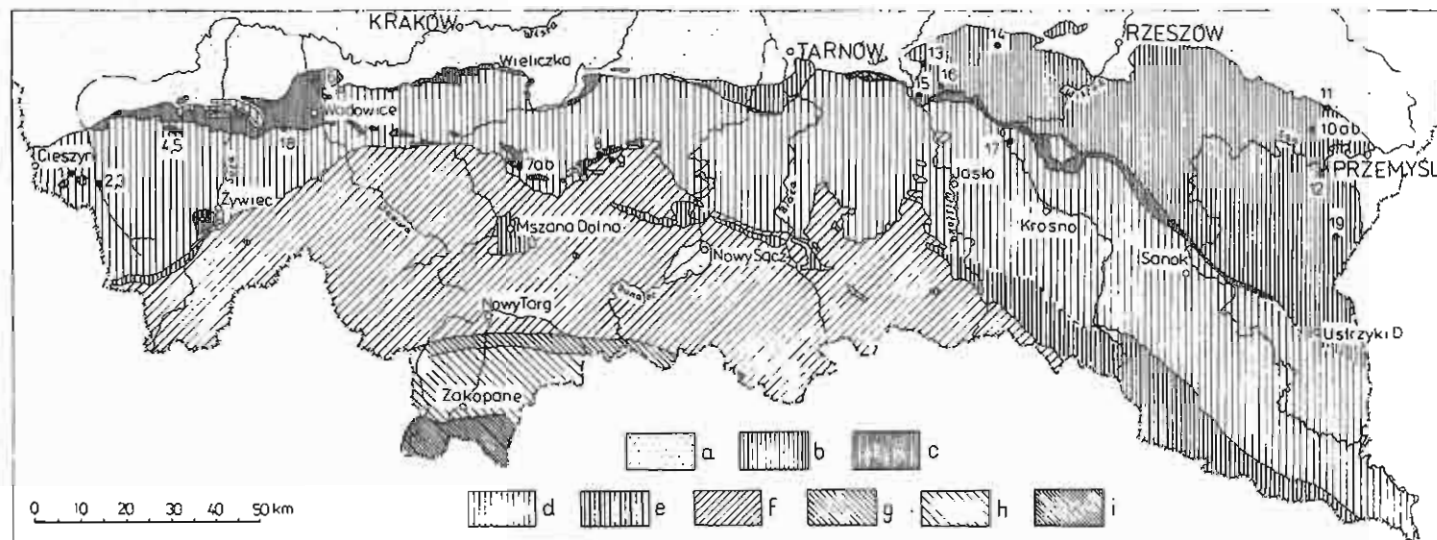


Fig. 1. Map of the localities

Mapa rozmieszczeń profili

a - Miocene, b - Skole unit, c - Subsilesian unit, d - Silesian unit, e - pre-Magura thrust, f - Magura unit, g - Pienny Klippen Belt, h - Podhale Pysch, i - High Tatic and Sub-Tatic units: 1 - Dziągciłów, 2 - Ustron 2, 3, 4 - Lunckorona Pisarżowicka, 5 - Zagroda, 6 - Zygodowice, 7a - Wisniowa, 7b - Przenosza, 8 - Żegocina, 9 - Rajbrot, 10a - Węgierka, 10b - Węgierka-quarry, 11 - Tuligłowy, 12 - Krasice, 13 - Podgródzie, 14 - Kamiénica Dolna, 15 - Gorzejowa, 16 - Chechły, 17 - Kobyle, 18 - Czaniec, 19 - Makowa

a - miocen, b - jednostka skoleńska, c - jednostka podśląska, d - jednostka śląska, e - łuska przedmagurska, f - jednostka magurska, g - pieniński pas skalkowy, h - flisz podhalański, i - jednostka wierehowa i regłowa; 1-14 objaśnione wyżej

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## THE CHARACTERISTICS OF MICROFAUNA IN THE PARTICULAR UNITS

Our study showed that the microfauna of Frydek type occur both in the Sub-silesian, and in the Silesian and Skole units. Only some of the planktonic zones distinguished in the Frydek Marls by E. Hanzlikova (1969) are represented in the Polish Outer Carpathians i.e. *Praeglobotruncana (Globotruncana) havanensis*, *Abathomphalus mayaroensis* and *Rugoglobigerina macrocephala* zones.

In the Polish Outer Carpathians the Campanian, Maestrichtian and Danian assemblages have been found in the Subsilesian unit while in the Silesian and Skole units only Maestrichtian ones occur (Fig. 1, 2). The most complete profiles occur

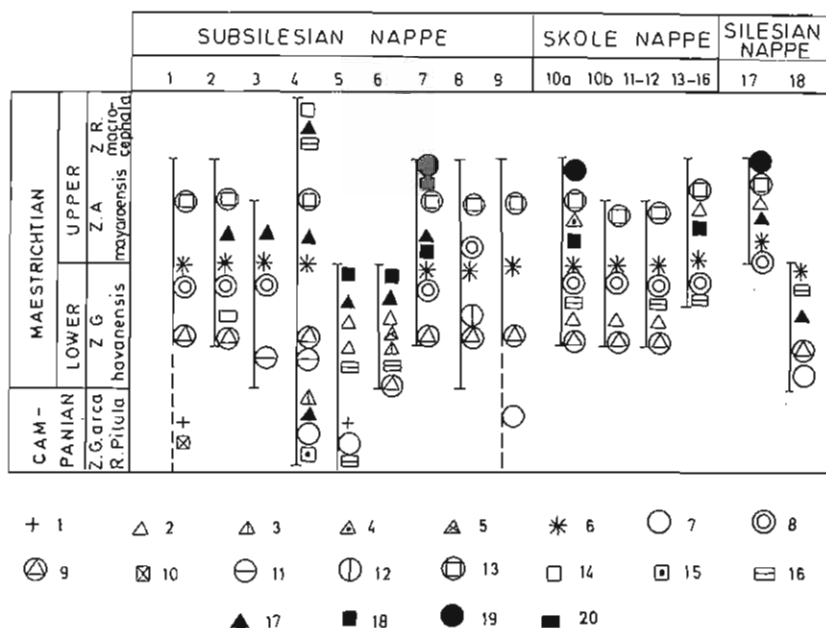


Fig. 2. Ranges of microfaunal assemblages with the typical foraminifera in Frydek type deposits of Polish Outer Carpathians

Zasięg zespołów mikrofauny z charakterystycznymi gatunkami otwornic w utworach typu frydeckiego polskich Karpat Zewnętrznych

1 - *Russella szajnochae* (Grzybowski), 2 - *Bolivinooides decoratus* (Jones), 3 - *B. delicatulus* Cushman, 4 - *B. draco* (Marsson), 5 - *B. miliaris* Hiltermann, 6 - *Racemiguembelina varians* (Rzehak), 7 - *Globotruncana areu* (Cushman), 8 - *G. contusa* (Cushman), 9 - *Globotruncanella havanensis* (Voorwijk), 10 - *Hedbergella monmouthensis* (Olsson), 11 - *Globotruncana ex gr. stuarti* (de Lapparent), 12 - *G. coliciformis* (de Lapparent), 13 - *Abathomphalus mayaroensis* (Bolli), 14 - *Rugoglobigerina macrocephala* Bronnimann, 15 - *R. pitula* Belford, 16 - *R. pennys* Bronnimann + *R. rugosa* (Plummer), 17 - *Daviesina minuscula* (Hofker), 18 - *Cymbalopora radiata* Hagenow, 19 - *Siderolites calcitrapoides* Lamarck, 20 - *Orbitoides media* d'Archiac; explanation of profile numbers as given in Fig. 1

Objaśnienia numerów profili jak na fig. 1

Table 1

Stratigraphical range the foraminifera of the Frydek type in Outer Carpathians, Poland

Foraminiferal species	Senonian				
	lower		upper		
	Coniacian	Santonian	Campanian	Maestrichtian	Paleocene
I	2	3	4	5	6
<i>Nodelum velascoense</i> (Cushman)					
<i>Rhabdammina cylindrica</i> Glaessner					
<i>Rhabdammina linearis</i> Brady					
<i>Rhabdammina abyssorum</i> Sars					
<i>Bathysiphon vitta</i> Naus					
<i>Dendrophrya robusta</i> Grzybowski					
<i>Dendrophrya excelsa</i> Grzybowski					
<i>Ammolagena clavata</i> (Jones et Parker)					
<i>Rzehakina apigona</i> (Rzehak)					
<i>Rzehakina inclusa</i> (Grzybowski)					
<i>Hormosina excelsa</i> (Dyłażanka)					
<i>Hormosina ovulum</i> (Grzybowski)					
<i>Spiroplectammina cretosa</i> Cushman					
<i>Spiroplectammina dentata</i> (Alth)					
<i>Spiroplectammina lanceolata</i> Huss					
<i>Spiroplectammina semicomplanata</i> (Carsey)					
<i>Dorothia crassa</i> (Marsson)					
<i>Dorothia oxycona</i> (Reuss)					
<i>Dorothia retusa</i> Cushman					
<i>Plectina lenis</i> (Grzybowski)					
<i>Matanzia varians</i> (Glaessner)					
<i>Nodosaria aspera</i> Reuss					
<i>Frondicularia biformis</i> Marsson					
<i>Frondicularia simplex</i> Reuss					
<i>Lugena hexagona</i> Williamson					
<i>Lagena izabella</i> (d'Orbigny)					
<i>Lagena paucicostata</i> Franke					
<i>Lagena sulcatiformis</i> Pożaryska et Urbanek					
<i>Lenticulina acuta</i> (Rauss)					
<i>Lenticulina valascoensis</i> White					
<i>Marginulina bullata</i> Reuss					
<i>Globulina lacrima</i> Reuss					
<i>Globulina prisca</i> Reuss					
<i>Guttulina adherens</i> (Olszewski)					
<i>Guttulina trigonula</i> (d'Orbigny)					
<i>Ramulina kitti</i> Rzehak					

1	2	3	4	5	6
<i>Praeulimina arcadelphiana</i> (Cushman et Parker)					----
<i>Praeulimina carseyae</i> (Plummer)					-----
<i>Praeulimina petroleana</i> (Cushman et Hedberg)					-----
<i>Praeulimina spinata</i> (Cushman et Campbell)					-----
<i>Bolivina decurrens</i> (Ehrenberg)					-----
<i>Bolivina gigantea</i> Wicher					-----
<i>Bolivina incrassata</i> Reuss					-----
<i>Bolivinoidea decoratus</i> (Jones)					-----
<i>Bolivinoidea delicatulus</i> Cushman					-----
<i>Bolivinoidea draco</i> (Marsson)					-----
<i>Bolivinoidea militaris</i> Hiltermann					-----
<i>Bolivinoidea regularis</i> Reiss					-----
<i>Praeulimina quadrata</i> (Plummer)					-----
<i>Reussella cimbrica</i> (Brotzen)					-----
<i>Reussella minuta</i> (Marsson)					-----
<i>Reussella szajnochae</i> (Grzybowski)					-----
<i>Pseudovigierina cristata</i> (Marsson)					-----
<i>Gavelinopsis bembix</i> (Marsson)					-----
<i>Nuttallinella florealis</i> (White)					-----
<i>Daviensina minuscula</i> (Hofker)					-----
<i>Siderolites calcitrapoides</i> Lamarck					-----
<i>Guembelirina cretacea</i> Cushman					-----
<i>Heterohelix globulosa</i> (Ehrenberg)	←				-----
<i>Heterohelix pulchra</i> (Brotzen)					-----
<i>Heterohelix striata</i> (Brotzen)					-----
<i>Planoglobulina acervulinoides</i> (Egger)					-----
<i>Pseudoguembelina costata</i> (Cushman)					-----
<i>Pseudoguembelina excolata</i> (Cushman)					-----
<i>Pseudotextularia carseyae</i> (Plummer)					-----
<i>Pseudotextularia elegans</i> (Rzehak)					-----
<i>Racemiguembelina textulariformis</i> (White)					-----
<i>Racemiguembelina varians</i> (Rzehak)					-----
<i>Ventilabrella eggeri</i> Cushman					-----
<i>Globigerinelloidea multispina</i> (Lalicker)					-----
<i>Hedbergella monmouthensis</i> (Olsson)					-----
<i>Globotruncana arca</i> (Cushman)					-----
<i>Globotruncana caliciformis</i> (de Lapparent)					-----
<i>Globotruncana conica</i> White					-----
<i>Globotruncana contusa</i> (Cushman)					-----
<i>Globotruncana elevata</i> (Brotzen)					-----
<i>Globotruncana fornicata</i> Plumeer					-----
<i>Globotruncana linneiana</i> (d'Orbigny)	←				-----
<i>Globotruncana stuarti</i> (de Lapparent)					-----
<i>Globotruncana stuartiformis</i> Dalbiez					-----
<i>Globotruncana tricarinata</i> (Querau)	←				-----
<i>Globotruncanella havanensis</i> (Voorwijk)					-----
<i>Abathomphalus mayaroensis</i> (Bolli)					-----
<i>Rugoglobigerina macrocephala</i> Bronnimann					-----

I	2	3	4	5	6
<i>Rugoglobigerina milomensis</i> Smith et Pessagno				---	
<i>Rugoglobigerina pennyi</i> Bronnimann				---	
<i>Rugoglobigerina pilula</i> Belford			---		
<i>Rugoglobigerina rugosa</i> (Plummer)			---		
<i>Rugoglobigerina rotundata</i> Bronnimann			---		
<i>Eponides subcandidulus</i> (Grzybowski)			---		
<i>Cibicides excavatus</i> Brotzen	←				
<i>Cibicides harperi</i> (Sandidge)				---	
<i>Cymbalopora radiata</i> Hagenow				---	
<i>Orbitoides media</i> d'Archiac				---	
<i>Pleurostomella wadowicensis</i> Grzybowski				---	
<i>Elipsopolymorphina velascoensis</i> (Cushman)			---		
<i>Nodosarella gracillima</i> Cushman	←				
<i>Nodosarella spinulosa</i> (Montagu)				---	
<i>Aragonia ouezzanensis</i> (Rey)				---	
<i>Chilostomella cf. ovaidea</i> (Reuss)				---	
<i>Chilostomella primitiva</i> Cushman et Todd				---	
<i>Chilostomella trinitatensis</i> Cushman et Todd				---	
<i>Allomorphina cretacea</i> Reuss	←				
<i>Quadriformina allomorphinoides</i> (Reuss)				---	
<i>Quadriformina minuta</i> (Cushman)				---	
<i>Florilus troastae</i> (Wisser)				---	
<i>Nonionella austinana</i> Cushman				---	
<i>Nonionella cretacea</i> Cushman				---	
<i>Nonionella robusta</i> Plummer				---	
<i>Pullenia cretacea</i> Cushman				---	
<i>Alabamina obtusa</i> (Burrow et Holand)				---	
<i>Osangularia cordieriana</i> (d'Orbigny)				---	
<i>Gyroidinoides nitidus</i> (Reuss)	←				
<i>Gavelinella rubiginosa</i> (Cushman)				---	→
<i>Stensioeina panimerana</i> Brotzen				---	

———— stratigraphic range of foraminifera after the literature;

- - - - stratigraphic range of foraminifera in Frydek type sediments in Outer Carpathians, Poland

in the Subsilesian unit and for that reason the authors began the microfaunal characteristic from this unit. The profiles from other units have been referred to the mentioned ones.

In the Subsilesian unit the Upper Senonian assemblage have been studied from the profiles in the area of: Golezów, Lanckorona Bielska, Zagrody, Zygodowice, Wiśniowa, Przenosza, Żegocina, Rajbrot and from the drillings: Dziegielów 1, 2, Ustron 1, 2. The Campanian assemblages were distinguished in the lower part of the profiles from the area of Lanckorona Pisarzowicka (Lanckorona, Zagroda profiles). In these assemblages there were found: *Bolivinoidea delicatulus* Jones et Cushman, *Gavelinopsis bembix* (Marsson), *Nuttallinella florealis* (White), *Daviesina minuscula* (Hofker), *Cibicides excavatus* Brotzen, *Chilostomella ovoidea* Reuss, *Ch. trinitatensis* Cushman et Todd, *Quadriformina allomorphinoides*

(Reuss), *Nonionella austinana* Cushman and further more great number of tiny planktonics: *Heterohelix* div. sp., *Globigerinelloides* div. sp. and in smaller amount *Hedbergella monmouthensis* (Olsson) and *Globotruncana arca* (Cushman), *G. tricarinata* (Querau), *Rugoglobigerina rugosa* Plummer, *R. pitula* Belford. The Maestrichtian assemblages are present in all mentioned above profiles of the Frydek Marls. A characteristic feature there is a frequent occurrence of the planktonic foraminifers (about 80%) represented by the genera: *Heterohelix*, *Pseudotextularia*, *Racemiguembelina*, *Globigerinelloides*, *Globotruncana*, *Rugoglobigerina*.

In the Lower Maestrichtian (the area of Lanckorona Bielska, Zygodowice, Żegocina) *Globotruncanella havanensis* (Voorwijk) is very abundant while *Bolivinoidea decoratus* (Jones) is sporadic. *Racemiguembelina varians* (Rzehak) and *Abathomphalus mayaroensis* (Bolli) are found in the Upper Maestrichtian. The assemblages with both Lower and Upper Maestrichtian elements have been also noted.

In the uppermost Maestrichtian the species *Rugoglobigerina macrocephala* Bronnimann occurs (Lanckorona Bielska profile).

*Daviesina minuscula* (Hofker) — very typical species for the Frydek Marls occurs in all Maestrichtian assemblages except those ones from Bochnia area. The benthic species are present as well: *Lagenidae*, *Guttulina trigonula* (Reuss), *Praebulimina arcadelpiana* (Cushman et Parker), *Bolivina* div. sp., *Reussella cimbrica* (Brotzen), *Gevelinopsis bembix* (Marsson), *Siderolites calcitrapoides* (Lamarck), *Cymbalopora radiata* Hagenov, *Orbitoides media* (d'Archiac), *Cibicides excavatus* Brotzen, *Chilostomella* div. sp., *Quadrimorphina allomorphinoides* (Reuss), *Florilus troostae* (Visser), *Nonionella* div. sp. In all samples from the Frydek Marls beside foraminifers there are also present ostracodes and fragments of macrofauna (sponges, echinoides, bryozoans, Inoceramus). The grey marly shales containing the Frydek type microfauna occur in the Silesian unit among the Istebna Beds. In the western, marginal part of the Silesian unit at Czaniec place (Andrychów area) J. Liszkowa, W. Nowak (1964) as well as in the eastern part at Kobyle (Fryszak area) — F. Szymakowska (1962 — unpublished materials), F. Szymakowska, J. Morgiel (1964) the foraminiferal fauna with characteristic species *Daviesina minuscula* have been found. These microfauna correspond with Maestrichtian assemblages from the Subsilesian unit. The assemblage from Czaniec, representing Lower Maestrichtian, could be correlated with *Globotruncana havanensis* zone of E. Hanzlikova (1969) whereas the assemblage from Kobyle corresponds to the Upper Maestrichtian — *Abathomphalus mayaroensis* zone.

The deposits comprising the Maestrichtian microfauna resembling the assemblages from the Frydek Marls of the Subsilesian unit occur in the Skole unit within the Inoceramian Beds. These deposits are present in the north-eastern part and are known as the Węgiełka or Baculites Marls and also partly deposits considered as the Babice clays from the western part of discussed unit.

From the surface profile of the Baculites Marls in the region of Węgiełka two Lower Maestrichtian assemblages have been distinguished. They correspond with coeval microfauna from the Subsilesian unit and differ only in a bigger amount of benthonics. The assemblage similar to the mentioned one from the Subsilesian unit with Lower and Upper Maestrichtian microfauna occurs in the following profiles: Tuligów, Krasice, Węgiełka (quarry). At Krasice the Upper Maestrichtian assemblage is also present. Rich Upper Maestrichtian microfauna were found in the western part of the Skole unit in the following profiles: Podgrodzie, Chechty, Kamienica Dolna, Gorzejowa. Smaller foraminifera are accompanied by larger ones i.e.: *Cymbalopora radiata* Hagenov, *Siderolites calcitrapoides* (Lamarck) as well as by ostracodes and numerous macrofauna's fragments, whereas species

*Daviesina minuscula* (Hofker) typical for the Frydek Marls of the Silesian and Sub-silesian units (except the most eastern part of this last one – Żegocina, Rajbrot profiles) is absent.

Full list of the foraminifers species is presented in the Table I of biostratigraphic ranges as well as in the paper of J. Liszkowa, J. Morgiel (1981).

## CONCLUSIONS

The foraminiferal assemblages distinguished in the marls of the Frydek type differ from the Upper Cretaceous ones of the other facies in the Subsilesian, Silesian and Skole units. The assemblages with the significant predominance of planktonic foraminifers of the genus: *Heterohelix*, *Pseudotextularia*, *Racemiguembelina*, *Globigerinelloides* in smaller amount *Globotruncana*, *Globotruncanella*, *Abathomphalus*, *Rugoglobigerina* and few *Hedbergella* occur in the marly facies (of the Frydek type). Scanty arenaceous benthic foraminifers of the family *Astrorhizidae* and of the genus: *Ammodiscus*, *Hormosina*, *Rzehakina*, *Dorothia*, *Spiroplectamina*, *Matanzia* and more abundant calcareous benthic of the family: *Nodosaridae*, *Polymorphinidae* (*Guttulina*), *Turilinidae* (*Praebulimina*), *Bolivinitidae* (*Bolivina*, *Bolivinooides*), *Epistomariidae* (*Nuttallinella*), *Rotaliidae* (*Daviesina*), *Cibicidae* (*Cibicides*), *Pleurostomelliidae* (*Epistopolymorphina*, *Elispoglandulina*), *Nonionidae* (*Chilostomella*, *Elipsoglandulina*, *Quadriformina*, *Florilus*, *Nonionella*, *Pullenia*), *Alabaminidae* (*Alabamina*), *Osangularidae* (*Gyroidina*, *Osangularia*), *Anomalinidae* (*Gavelinella*, *Stensioina*) are accompanying the planktonics. Larger foraminifers i.e. *Siderolites*, *Orbitoides* and also ostracodes and a number of macrofauna fragments are present as well. Species *Daviesina minuscula* (Hofker) is present in the Subsilesian unit (except its eastern part – Bochnia region) as well as in the Silesian while in the Skole unit of this species is absent.

The Campanian and Maestrichtian assemblages have been distinguished in the profiles of the Subsilesian unit. The Campanian microfauna occurs in the lower parts of the profile of Lanckorona Bielska region. The Maestrichtian assemblages are present in all mentioned units. Lower Maestrichtian is represented in the Subsilesian unit, in the area of Lanckorona Bielska, Zygodowice, Żegocina and in the Skole unit in the area of Krasice where it is the assemblage with abundant *Globotruncanella havanensis* (Voorwijk) that corresponds with *Praeglobotruncana havanensis* zone of E. Hanzlikova (1969).

The assemblages with numerous *Abathomphalus mayaroensis* (Bolli) occur in the Upper Maestrichtian deposits in the Subsilesian unit region of Lanckorona Bielska, Wiśniowa, Przenosza, Rajbrot, Silesian unit – region of Kobyle, Skole unit – region of Węgiarka, Pruchnik, Sopotnik Makowa, Chechły, Podgrodzie, Gorzejowa, Kamienica Dolna. They could be correlated with *Abathomphalus mayaroensis* zone of E. Hanzlikova (1969). The assemblages with both Lower and Upper Maestrichtian elements have been also found for example in the Subsilesian unit in the profiles of Dziegielów, Ustroń 2, Przenosza, Wiśniowa, in the Silesian unit – Czaniec and in the Skole unit – Węgiarka, Krasiczyn, Tuligłowy. Furthermore in the Lanckorona Bielska profile of the Subsilesian unit, the Upper Maestrichtian assemblage with *Rugoglobigerina macrocephala* has been distinguished which is placed by E. Hanzlikova (1969) above *Abathomphalus mayaroensis* zone. Together with an appearance of more clayey facies a number of arenaceous foraminifers increases. It is more visible in the eastern part of the Subsilesian unit. These



type of microfauna could already correspond with Danian.

Due to the incomplete profiles in the Polish Outer Carpathians only some of the assemblages could be correlated with zones distinguished by E. Hanzlikova (1969).

Microfaunal assemblages of the eastern part of the Subsilesian unit (Bochnia area) show a great similarity with those ones from the western part of the Skole unit (Pilzno area).

The Frydek type assemblages consist of three different ecological elements: 1 – autochthonous benthics of deeper water (*Chilostomellidae*), 2 – numerous planktonics could occur at the boundary of shelf and continental slope (B. Olszewska, oral information) and 3 – neritic fauna – shell's fragments of echinoids, bryozoans, sponges. Inoceramus, ammonites and molluscs and foraminifers: *Cymbalopora radiata* (Hagenow), *Orbitoides media* (d'Archiac), *Siderolites calcitrapoides* Lamarck, *Cibicides excavatus* Brotzen and in some cases *Daviesina minuscula* (Hofker). The exotics are also present in the Frydek type deposits.

Joint occurrence of the elements mentioned above, indicates the existence of submarine slumps at the boundary of continental shelf and slope, what was already noted by the other authors: M. Książkiewicz (*vide* S. Geroch et al., 1967), S. Gucik (1982), S. Gucik, J. Morgiel (1965), F. Szymakowska, J. Morgiel (1964), J. Kotlarczyk (1978), W. Burzewski (1966), S. Geroch et al. (1979).

These data indicate more shallow position of the Frydek type facies as it was earlier presented in M. Książkiewicz (1975). W. Nowak (*vide* J. Liszkowa, W. Nowak, 1960) considers that the Frydek facies in the Subsilesian unit had more northern situation than variegated one.

The afore-said fauna of the boreal and Tethys provinces are also noted by A. Mc Guban (1982). According to E. Hanzlikova (1969, 1972) the Frydek Marls are deposits of the outer shelf.

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Oddział Karpacki  
Instytutu Geologicznego  
Kraków, Skrzatów 1  
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Янина ЛИШКОВА, Иоанна Янина МОРГЕЛЬ

### К ВОПРОСУ О ИЗУЧЕННОСТИ ФОРАМИНИФЕР В ФАЦИЯХ ФРИДЕЦКОГО ТИПА ВО ВНЕШНИХ КАРПАТАХ ПОЛЬШИ

#### Резюме

В статье рассмотрена микрофауна, заключенная в мергелях фридецкого типа (серые в суб-силезском и силезском локовых, бакулитовые — в скольском покрове) Внешних польских Карпат. Выделены ассоциации фораминифер кампана и маастрихта в субсилезском покрове и маастрихта в силезском и скольском покровах. В них установлено наличие разных экологических элементов: автохтонная бентонная фауна глубоко моря, обильная планктонная фауна и неритовая фауна. Совместное залегание этих фаун свидетельствует о подводном оползне на пограничье шельфа и батимальной зоны, а также о более внешней позиции фации фридецкого типа по отношению к пестрой фации субсилезского покрова.

Janina LISZKOWA, Joanna Janina MORGIEL

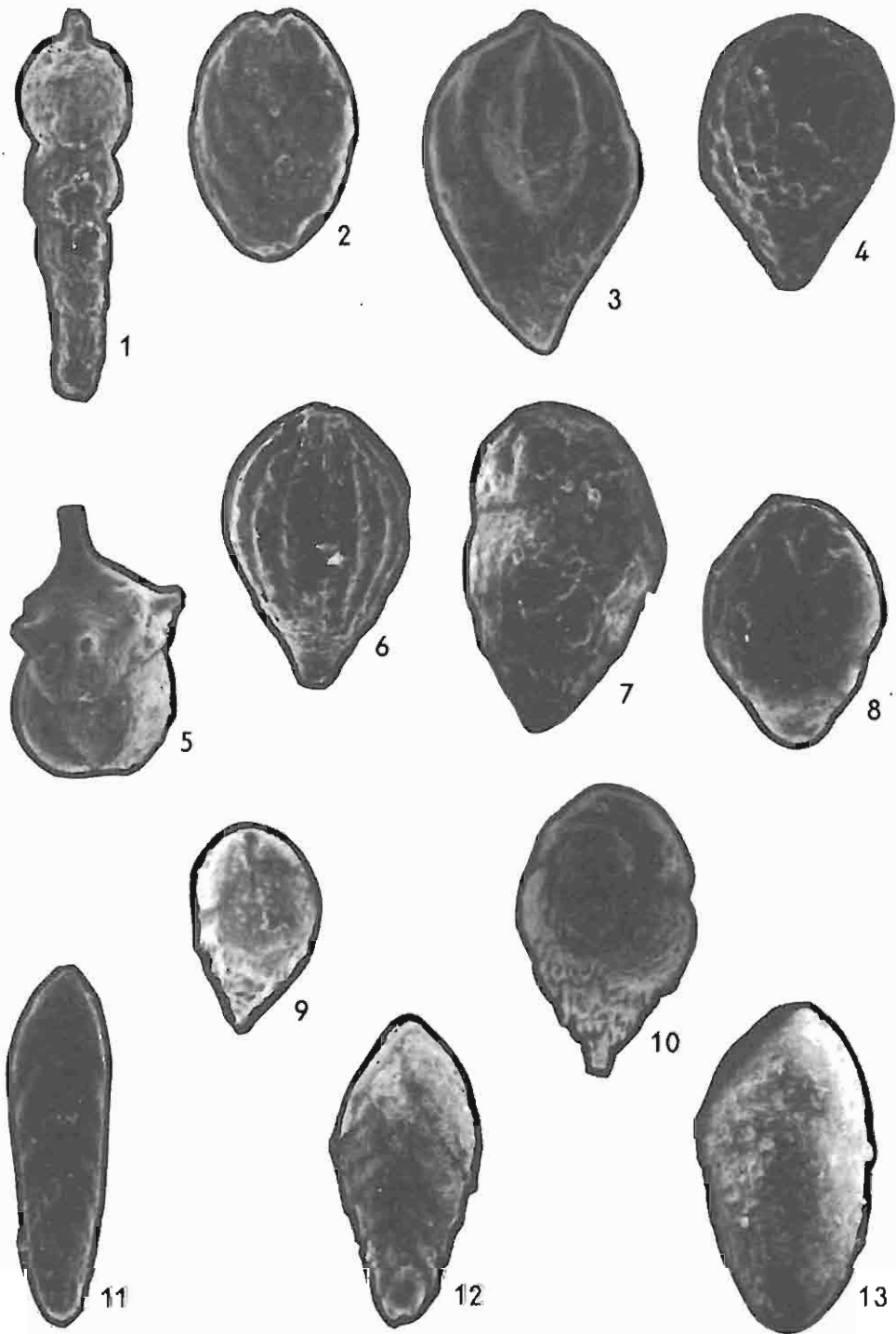
### PRZYCZYNEK DO ZNAJOMOŚCI OTWORNIC Z FACJI TYPU FRYDECKIEGO POLSKICH KARPAT ZEWNĘTRZNYCH

#### Streszczenie

Omówiono mikrofaunę występującą w marglach typu frydeckiego (szare w jednostkach podśląskiej, śląskiej i bakulitowe w jednostce skolskiej) polskich Karpat Zewnętrznych. Wydzielono zespoły otwornicowe kampanu i mastrychtu w jednostce podśląskiej i mastrychtu w jednostkach śląskiej i skolskiej. Stwierdzono w nich trzy różne elementy ekologiczne: autochtoniczną faunę bentoniczną głębszego morza, liczną faunę planktoniczną oraz faunę nerytyczną. Wspólne występowanie wymienionych elementów wskazuje na podmorski zsuw pogranicza szelfu i strefy batimalnej oraz potwierdza bardziej zewnętrzne położenie facji typu frydeckiego w stosunku do facji pstryj jednostki podśląskiej.

TABLE 1

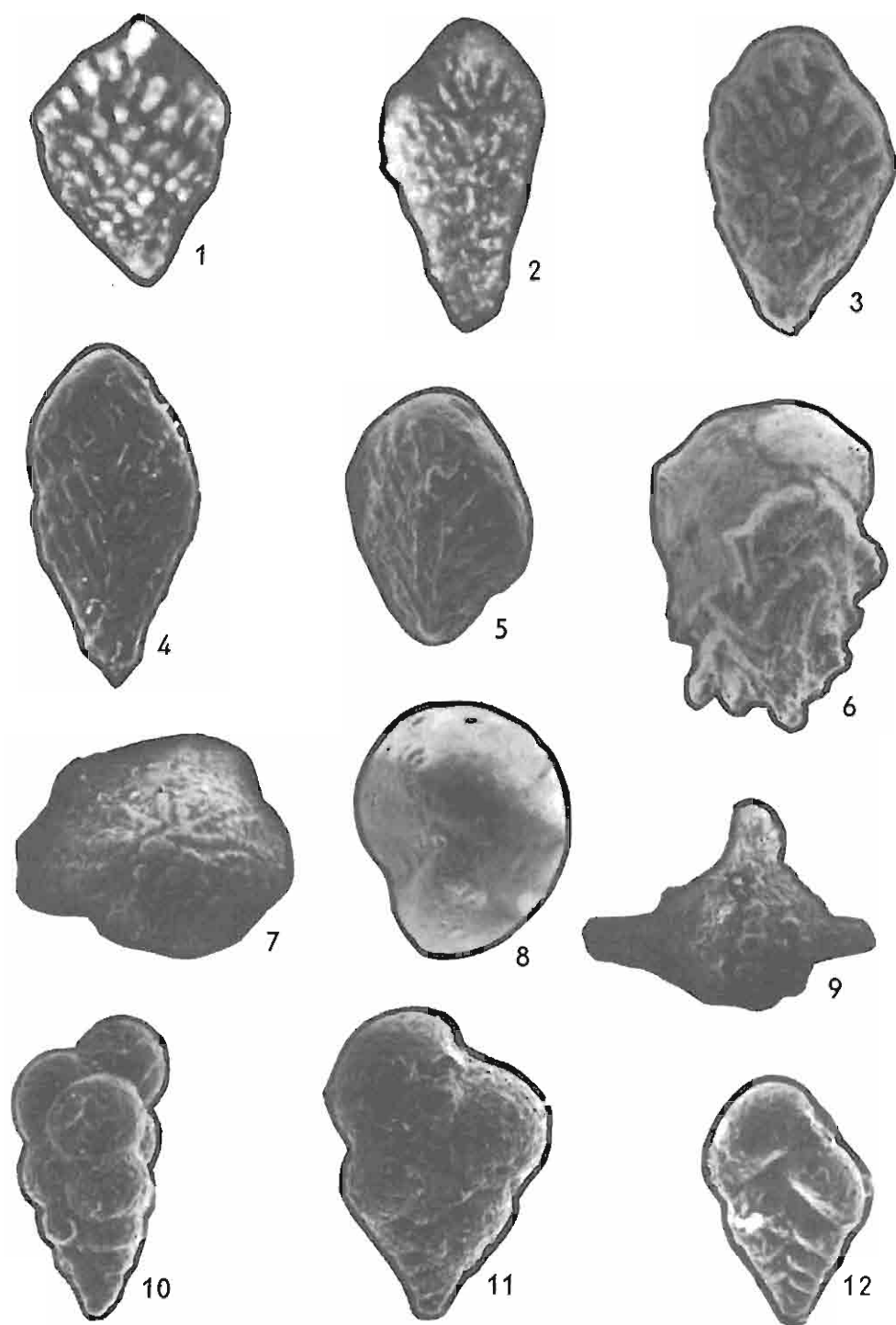
- Fig. 1. *Nodosaria aspera* Reuss; × 120  
Fig. 2. *Fronicularia bifformis* Marsson; × 80  
Fig. 3. *Fronicularia simplex* Reuss; × 120  
Fig. 4. *Lagena hexagona* Williamson; × 95  
Fig. 5. *Lagena izabella* (d'Orbigny); × 100  
Fig. 6. *Guttulina trigonula* (d'Orbigny); × 60  
Fig. 7. *Praebulimina arcadelphiana* (Cushman et Parker); × 60  
Fig. 8. *Praebulimina carseyae* (Plummer); × 60  
Fig. 9. *Praebulimina petroleana* (Cushman et Hedberg)  
Fig. 10. *Praebulimina spinata* (Cushman et Campbell)  
Fig. 11. *Bolivina inocrassata* Reuss; × 50  
Fig. 12. *Bolivina decurrens* (Ehrenberg); × 90  
Fig. 13. *Bolivina gigantea* Wicher; × 100



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TABLE II

- Fig. 1. *Bolivinooides decoratus* (Jones);  $\times 60$   
Fig. 2. *Bolivinooides delicatulus* Cushman;  $\times 60$   
Fig. 3. *Bolivinooides miliaris* Hiltermann;  $\times 90$   
Fig. 4. *Bolivinooides regularis* Reiss;  $\times 132$   
Fig. 5. *Bolivinooides draco* (Marsson);  $\times 60$   
Fig. 6. *Reussella szajnochae* (Grzybowski);  $\times 66$   
Fig. 7. *Daviesina minuscula* (Hofker); ventral view (strona brzuszna);  $\times 60$   
Fig. 8. *Gavelinopsis bembix* (Marsson); ventral view (strona brzuszna);  $\times 96$   
Fig. 9. *Siderolites culcitrapoides* Lamarck;  $\times 40$   
Fig. 10. *Guembelitria cretacea* Cushman;  $\times 180$   
Fig. 11. *Heterohelix globulosa* (Ehrenberg);  $\times 120$   
Fig. 12. *Heterohelix pulchra* (Brotzen);  $\times 100$

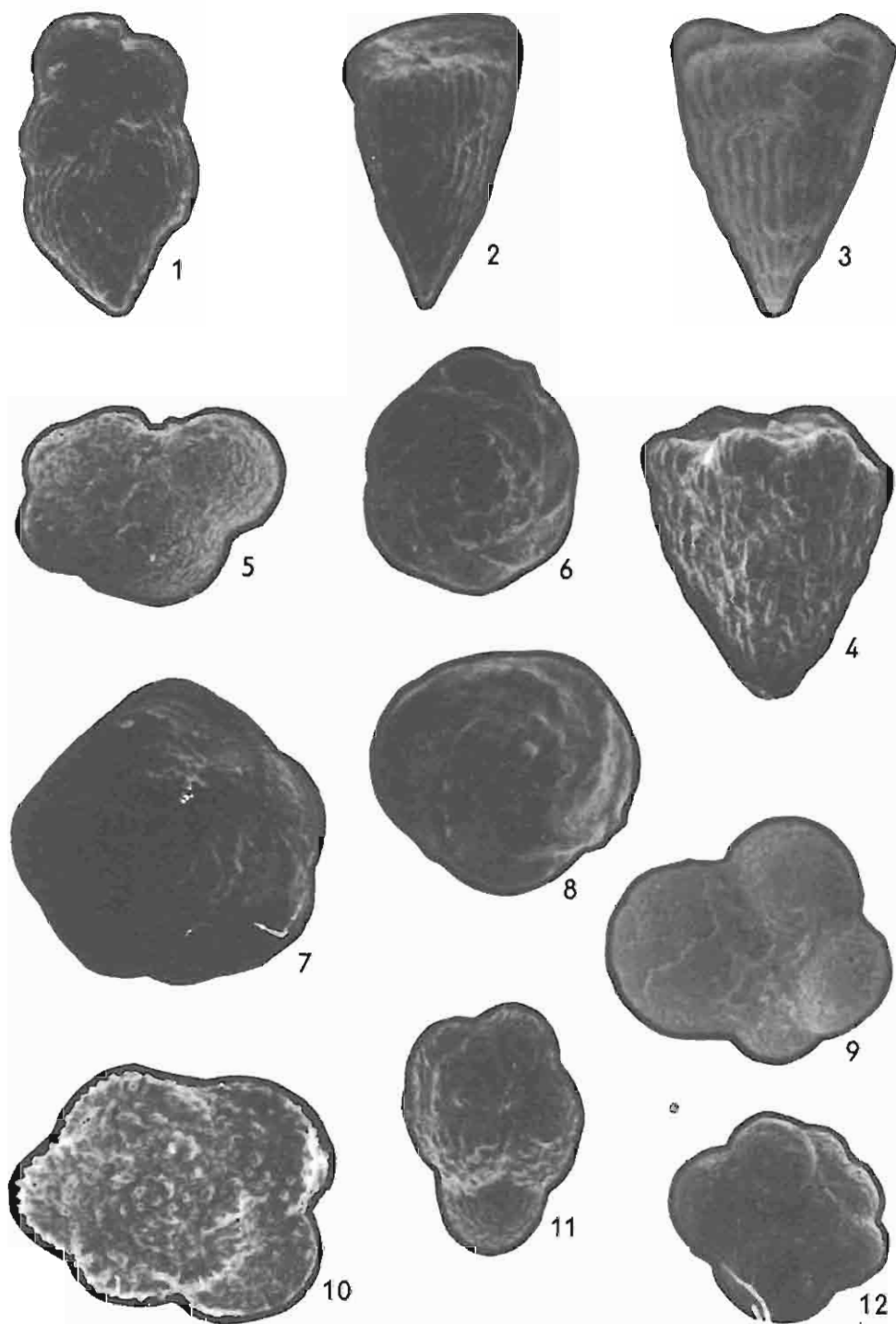


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TABLE III

- Fig. 1. *Pseudoguembelina costata* (Cushman);  $\times 72$   
Fig. 2. *Pseudotextularia elegans* (Rzehak);  $\times 96$   
Fig. 3. *Racemiguembellina textulariformis* (White);  $\times 96$   
Fig. 4. *Racemiguembellina varians* (Rzehak);  $\times 60$   
Fig. 5. *Globigerinelloides multispina* (Lolcker);  $\times 96$   
Fig. 6. *Globotruncana arco* (Cushman), dorsal view (strona grzbietowa);  $\times 72$   
Fig. 7. *Globotruncana contusa* (Cushman); dorsal view (strona grzbietowa);  $\times 108$   
Fig. 8. *Globotruncana formicata* Plummer; dorsal view (strona grzbietowa);  $\times 90$   
Fig. 9. *Globotruncanella havanensis* (Voorwijk); ventral view (strona brzuszna);  $\times 130$   
Fig. 10. *Abathomphalus mayaroensis* (Bolli); ventral view (strona brzuszna);  $\times 90$   
Fig. 11. *Rugoglobigerina macrocephala* Bronnimann; dorsal view (strona grzbietowa);  $\times 60$   
Fig. 12. *Rugoglobigerina milamensis* Smith et Pessagno, ventral view (strona brzuszna);  $\times 96$

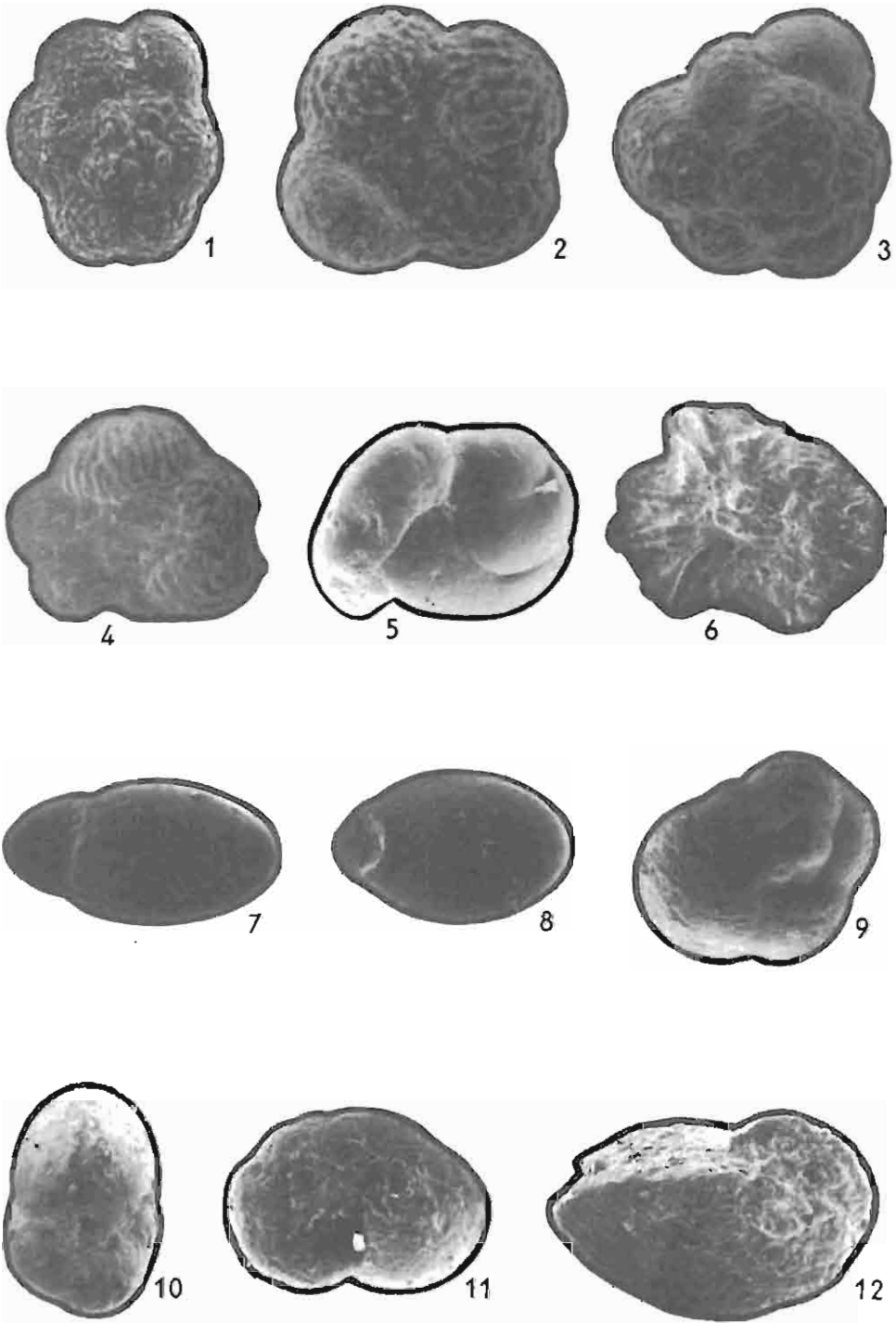




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TABLE IV

- Fig. 1. *Rugoglobigerina pennyi* Bronnimann; dorsal view (strona grzbietowa);  $\times 60$   
Fig. 2. *Rugoglobigerina pilula* Belford; ventral view (strona brzuszna);  $\times 132$   
Fig. 3. *Rugoglobigerina rotundata* Bronnimann; dorsal view (strona grzbietowa);  $\times 96$   
Fig. 4. *Rugoglobigerina rugosa* (Plummer); ventral view (strona brzuszna);  $\times 96$   
Fig. 5. *Cibicides excavatus* Brotzen; dorsal view (strona grzbietowa);  $\times 78$   
Fig. 6. *Cymbalopora radiata* Hagenov; ventral view (strona brzuszna);  $\times 40$   
Fig. 7. *Chilostomella primitiva* Cushman et Todd;  $\times 60$   
Fig. 8. *Chilostomella* cf. *ovoides* (Reuss);  $\times 60$   
Fig. 9. *Quadrimorphina allomorphinoides* (Reuss); dorsal view (strona grzbietowa);  $\times 60$   
Fig. 10. *Quadrimorphina minuta* (Cushman); dorsal view (strona grzbietowa);  $\times 60$   
Fig. 11. *Nonionella austinana* Cushman;  $\times 72$   
Fig. 12. *Florilus troostae* (Wisser);  $\times 90$



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