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UNIVERSITATIS SCIENTIARUM BUDAPESTINENSIS DE ROLANDO EÖTVÖS NOMINATAE

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Bathonian Fossils from the Mecsek Mountains (Hungary)

GALÁCZ, A. (editor)

Contents

Annales Univ. Sci. Budapest., Sect. Geol. 30, p. 5 (1995)
GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Editorial preface

This volume of the *Annales* is dedicated to the description of the biostratigraphy and the fossil groups from the Bathonian red nodular limestone of the Mecsek Mountains. This formation has been known as a richly fossiliferous Jurassic rock, but detailed works were missing since the monograph of János BÖCKH in 1880–1881. His description, which was published in two parts (a stratigraphical and a palaeontological), is a pioneering work in many respects. This was the first Hungarian ammonite monograph, which was published well before the most important Bathonian papers, such as DE GROSSOUVRE's "Études sur l'étages Bathonien" (1888), SCHLIPPE's "Die Fauna des Bathonien im oberrheinischen Tieflanden" (1888), or QUENSTEDT's "Ammoniten des schwäbischen Jura" (1886-87). This was the first dissertation presented for membership in the Hungarian Academy of Sciences on the topic of Mesozoic biostratigraphy and fauna. Unfortunately, this connection to the Academy caused that the work was never published in foreign languages, thus remained almost completely unknown for the wider scientific audience.

In this volume the biostratigraphic revision is outlined on the basis of the ammonites, but a proper palaeontological revision of BÖCKH's monograph, including the refiguring of his original specimens and types, will be presented later. Among the most important groups the microfossils (foraminifers, radiolarians and ostracods), the brachiopods and the bivalves, and a special bryozoan are treated. Works on other groups (sponges, belemnites, nautiloids, echinoids) will be published in the near future.

The work was carried out in the framework of the No. 2294 Grant from the National Scientific Research Fund (OTKA). The whole staff of the Palaeontological Department of the Eötvös L. Univerity helped the research. Other friends from the Palaeontological Department of the Hungarian Natural History Museum and from other institutions gave also valuable help. Many helps came from my students – these are especially acknowledged. I am also indebted to Professors Mrs. VÉGH, B. GÉCZY and T. BÁLDI, editors of the *Annales*, who generously offered to devote a complete band of the series to present our results. I do hope that their kindness will be responded by the standard of the papers in the volume.

Budapest, 30th December, 1994.

András GALÁCZ

Annales Univ. Sci. Budapest., Sect. Geol. 30, 7–82 & 209–218 (1995)
GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Bathonian foraminifera from the Mecsek Mountains (South Hungary)

Ágnes GÖRÖG[1]

(7 figures and 10 plates on pp. 209–218)

Abstract

Well-preserved and rich Bathonian foraminifera fauna were set free by concentrated acetic acid from hard "Ammonitico Rosso" marl of Mecsek Mts (S Hungary). Three sections, well defined by ammonites, were studied. Throughout the Bathonian *Spirillina* spp. and *Lenticulina muensteri* (ROEMER) are dominant, Textulariina and Rotaliina are subordinate in the fauna. Most species are cosmopolitan in character and have wide stratigraphical distribution. The foramifera assemblage resembles more the southern Portugese and Sicilian faunas, than the epicontinental European faunas in rate of characteristic taxon. Detailed systematic description and stratigraphic distribution of 82 benthic species, involving 1 new genus and 6 new species are given.

Key words: Foraminifera, Bathonian, systematic descriptions, Mecsek Mts, Hungary

Contents

[1]Department of Palaeontology, Eötvös University, H–1083 Budapest, Ludovika tér 2, Hungary

Introduction

In the rich literature of Jurassic foraminifers relatively few papers can be found on Bathonian forms. During the last 100 years most of the studies dealt with faunas of epicontinantal European areas, from England by COLEMAN (1981, 1982) from Germany by BARTENSTEIN & BRAND (1937), FRENTZEN (1941), MUNK (1978) and BRAND (1990), from Poland by TERQUEM (1886), PAZDROWA (1967), BIELECKA & STYK (1969, 1981) and BIELECKA et al. (1988), from Ukraine by KAPTARENKO-CHERNOUSOVA (1960), KAPTARENKO-CHERNOUSOVA et al. (1963) and Pjatkova & PERMJAKOVA (1978). Only a few publications: BARBIERI (1960) from Sicily, RUGET (1973) and STAM (1986) from Portugal work on Tethyan assemblages.

The main reason was that on the first area washable rocks, mainly clay or clayey formations predominate. Meanwhile in the Mediterranean regions the indurated Ammonitico Rosso type rocks are dominant, from which it was impossible to free the microfossils by standard processing methods.

The macrofauna of "Ammonitico Rosso" is studied in detail all over this area. The situation is similar in the Hungarian literature. In contrast to the relatively large number of macrofaunal studies, the microfauna is hardly known from the Hungarian Bathonian.

The first mention of Bathonian foraminifera of Hungary was from marly layers of Óbánya by BÖCKH in 1880 (p. 29). VADÁSZ (1935) gave a short lithostratigraphical description of the Mecsek Mountains. In this paper the author mentioned, that "smaller foraminifera can be found in the washable part of the section" in the Hidas and the Óbánya Valleys (p. 58). SIDÓ is the only Hungarian micropalaeontologist who dealt with Jurassic foraminifers of Hungary in detail. She summarized the results in 1966 and in 1983. In the first work the author studied the Zengővárkony II section of the Eastern

Mecsek, which is very close to the area investigated in this paper (Fig. 1.). The micropalaeontological study was based mostly on thin sections and partly on washing residue. She gave only a faunal list, containing 37 taxa (27 species and 10 forms on generic level) from the Bathonian. The plates, showing the faunal assemblages, are of very poor quality. As the correct comparison with my material was impossible, I made only some comment in the later part of this paper. SIDÓ in the other paper gave a summary on the Lower and the Middle Jurassic and foraminifera fauna of the Mecsek Mts without description and figures. According to the author dominate forms in Bathonian are the "agglutinated as *Textularia, Marssonella* and *Ammobaculites,* moreover *Trocholina, Spirillina, Turrispirillina, Eoguttulina* species". NAGY et al. (1978) studied Bathonian microfacies of the Mecsek Mts and noticed that foraminifera are rare (p. 39). PATAKY et al. (1982) investigated a Bathonian sequence in the Ófalu, Kohltal (12 km west from the studied area of this paper). These authors mentioned (p. 388) and figured (pl. II, fig. 2) foraminifera in *"Posidonia-Protoglobigerina"* microfacies, in thin section. FŐZY et al. (1985) from Zobákpuszta (it is south of the Csengő Hill and the Hidas Valley) mentioned *"Protoglobigerina"* sp. in thin-section of Bathonian layers. VELLEDITS et al. (1986) determined a few genera of radiolarians and ostracods, and noticed the presence of foraminifera in thin-sections (p. 173). TÖRÖK et al. (1987) described from the Bathonian of the Hidas Valley: "the whole profile is uniform *Bositra*-wackestone. In the lower part there are some echinoderm fragments together with a few foraminifers".

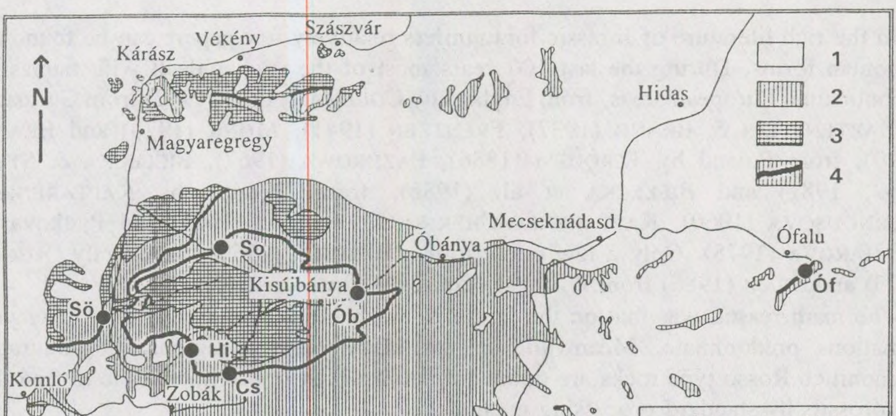

Fig. 1. Sketch map of the locality of studied sections in the Eastern Mecsek Mountains, South-Hungary. Legend: **Ób** - Óbánya Valley; **Hi** - Hidas Valley; **Cs** - Csengő Hill; **Z** - Zengővárkony. **1** Cenozoic sediments; **2** Mesozoic sediments; **3** Mesozoic volcanics; **4** outcrops of the Bathonian–Callovian beds.

This paper is part of a complex palaeontological study of three Bathonian sections in the Eastern Mecsek. The use of a new processing method allowed the study of free microfauna from hard Ammonitico Rosso type rocks. The aim was to give a detailed systematic description and evaluation of the foraminifera fauna, moreover to compare it with other European Bathonian assemblages.

Material and methods

The studied Bathonian foraminifera faunas were collected from three sequences of the Eastern Mecsek Mountains, South Hungary (Fig. 1). The sequences are as follows: the Hidas Valley, the Óbánya Valley and the Csengő Hill (Figs 2–4).

In the Mecsek Mts the Bathonian sequences are relatively thin, 10–15 m, containing the complete stage. They belong to the Óbánya Limestone Formation, which is of varied lithology, "Ammonitico Rosso"-type, red and green marl with hard limestone nodules, alternating clayey and calcareous strata. In the fauna the pelagic forms dominate. Layers are rich in macrofossils, especially in ammonites, but only molds can be found. The stratigraphical subdivision is based on ammonites (GALÁCZ 1984, 1993 and in this volume). Moreover the macrofauna contains brachiopods, bivalves (mostly *Bositra*), sponges, echinoids, aptychi and belemnites. The microfauna consists of radiolarians, ostracods and foraminifers. See details in BÖCKH (1880–81), VADÁSZ (1935), KOVÁCS (1953), SIDÓ (1966, 1983), NAGY et al. (1978), PATAKY at al. (1982), GALÁCZ (1984, 1993), FŐZY et al. (1985) and VELLEDITS et al. (1986).

The studied sections are well-known long ago. The layers in the Csengő Hill section represent the Upper Bathonian, the sequences of the Óbánya Valley and of the Hidas Valley show the whole Bathonian. Many papers have worked on the lithology, microfacies and macrofauna of these sections, but nobody has been dealt with microfauna in detail at earlier time. Data can be found about the Óbánya Valley in BÖCKH (1880–81), VADÁSZ (1935), NAGY et al. (1978) and VELLEDITS et al. (1986), and about the Hidas Valley in BÖCKH (1880–81) VADÁSZ (1935) KOVÁCS, (1953), NAGY et al. (1978), TÖRÖK et al. (1987) and GALÁCZ (1993).

23 fossiliferous samples were collected from indurated marl and clayey layers in the Hidas Valley (11 samples), in the Óbánya Valley (11 samples) and on the Csengő Hill (1 sample) (Figs 2–4). Each samples weighted about half kilogram. (We used the same samples, with MONOSTORI for the study of ostracoda (this volume). From the few washable layers microfauna was get free by standard processing methods. The hard rocks were dissolved in concentrated acetic acid. A total of more than 20,000 specimens were extracted, distributed among 82 species including 6 new ones. Synonym lists, stratigraphical ranges and palaeogeographical distributions of species are based only on publications which contain descriptions and/or figures of given forms. Abundance was studied both as percentage of the total foraminifera assemblage and as the number of their specimens in the samples.

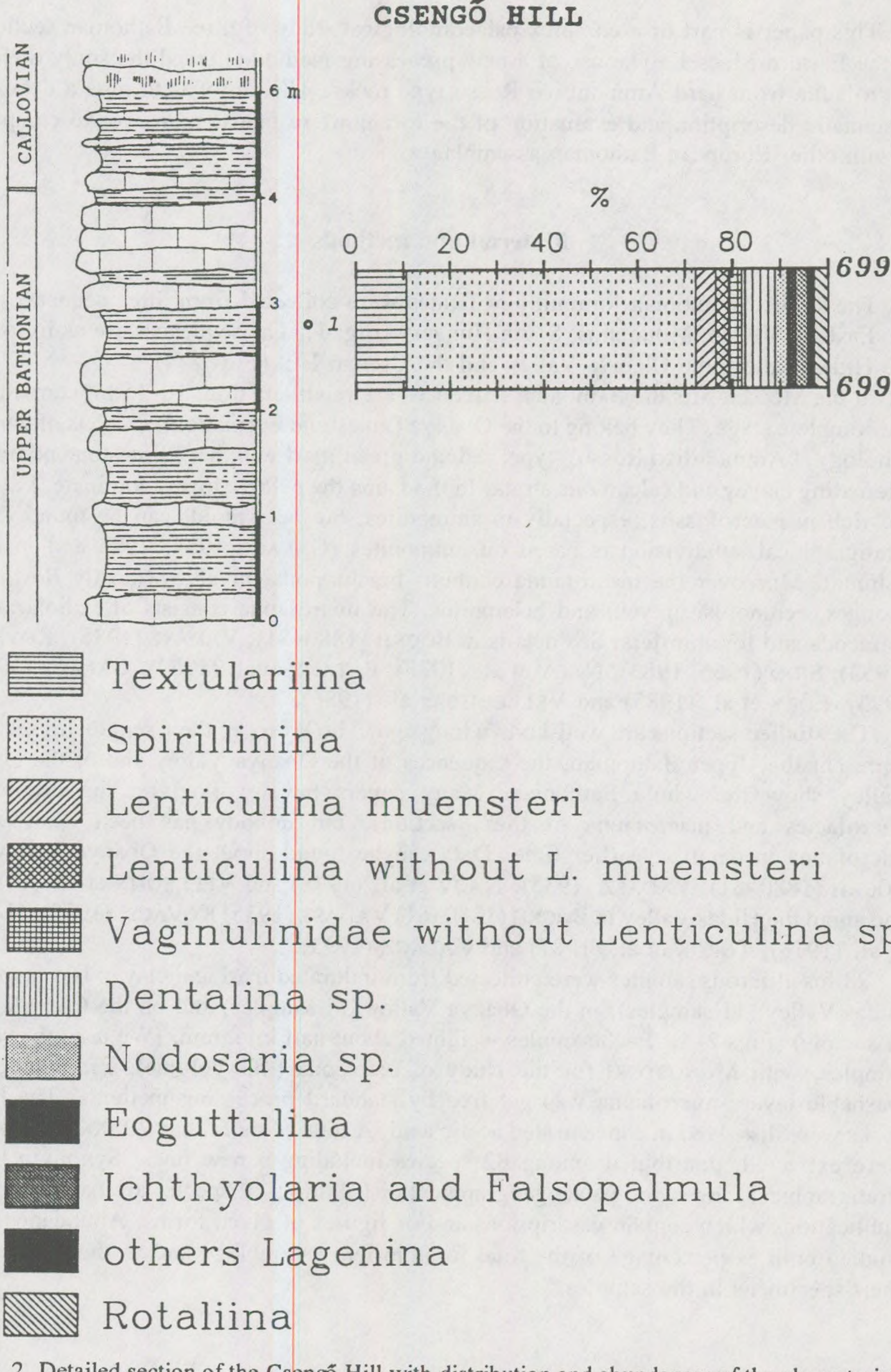

Fig. 2. Detailed section of the Csengő Hill with distribution and abundances of the characteristic taxa. Abundance is given in % of the total foraminiferal assemblage. Legend: *italics* figures number of specimens in given sample.

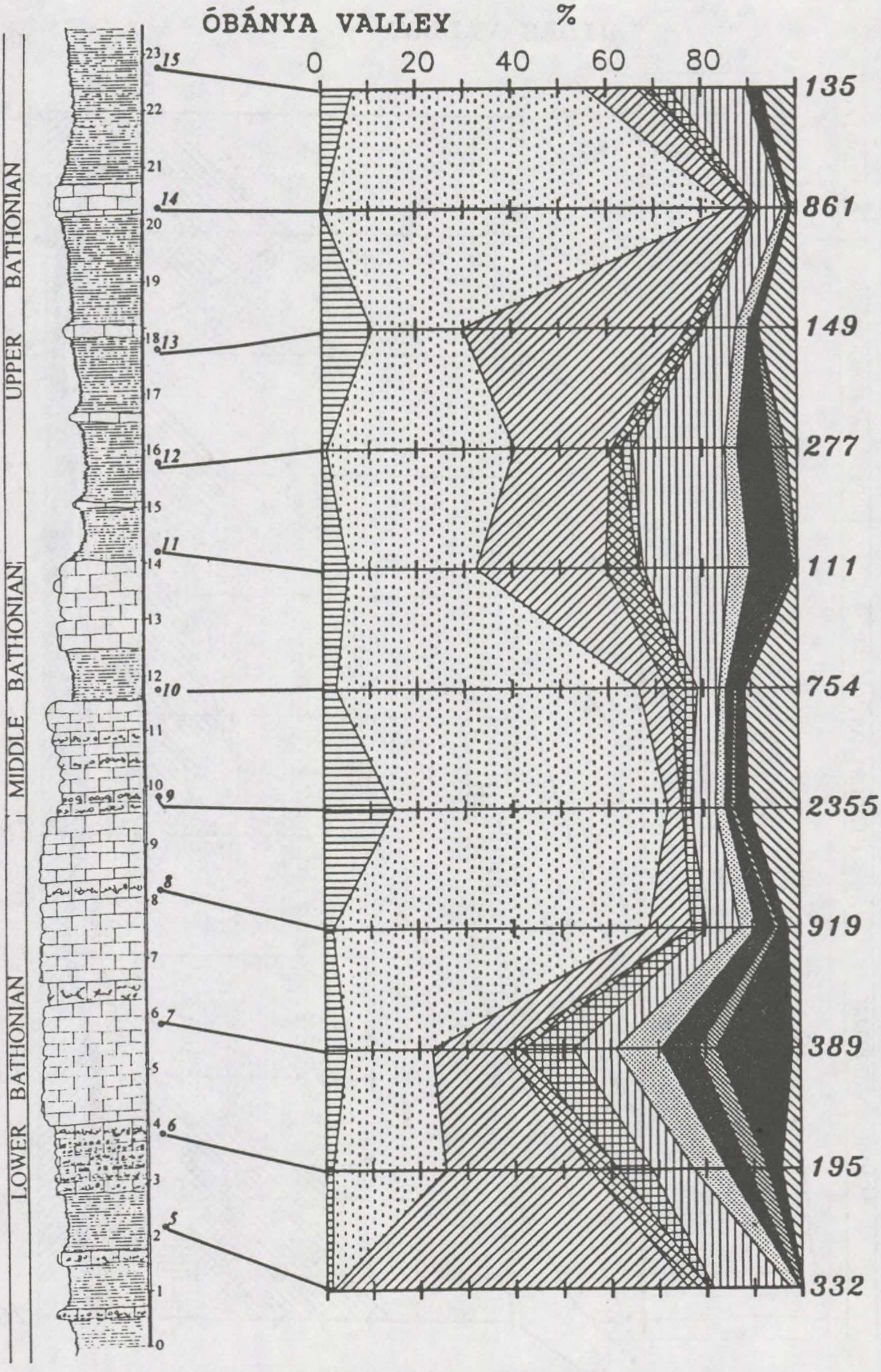

Fig. 3. Detailed section of the Óbánya Valley with distribution and abundances of the characteristic taxa. Abundance is given in % of the total foraminiferal assemblage. Legend see at Fig. 2.

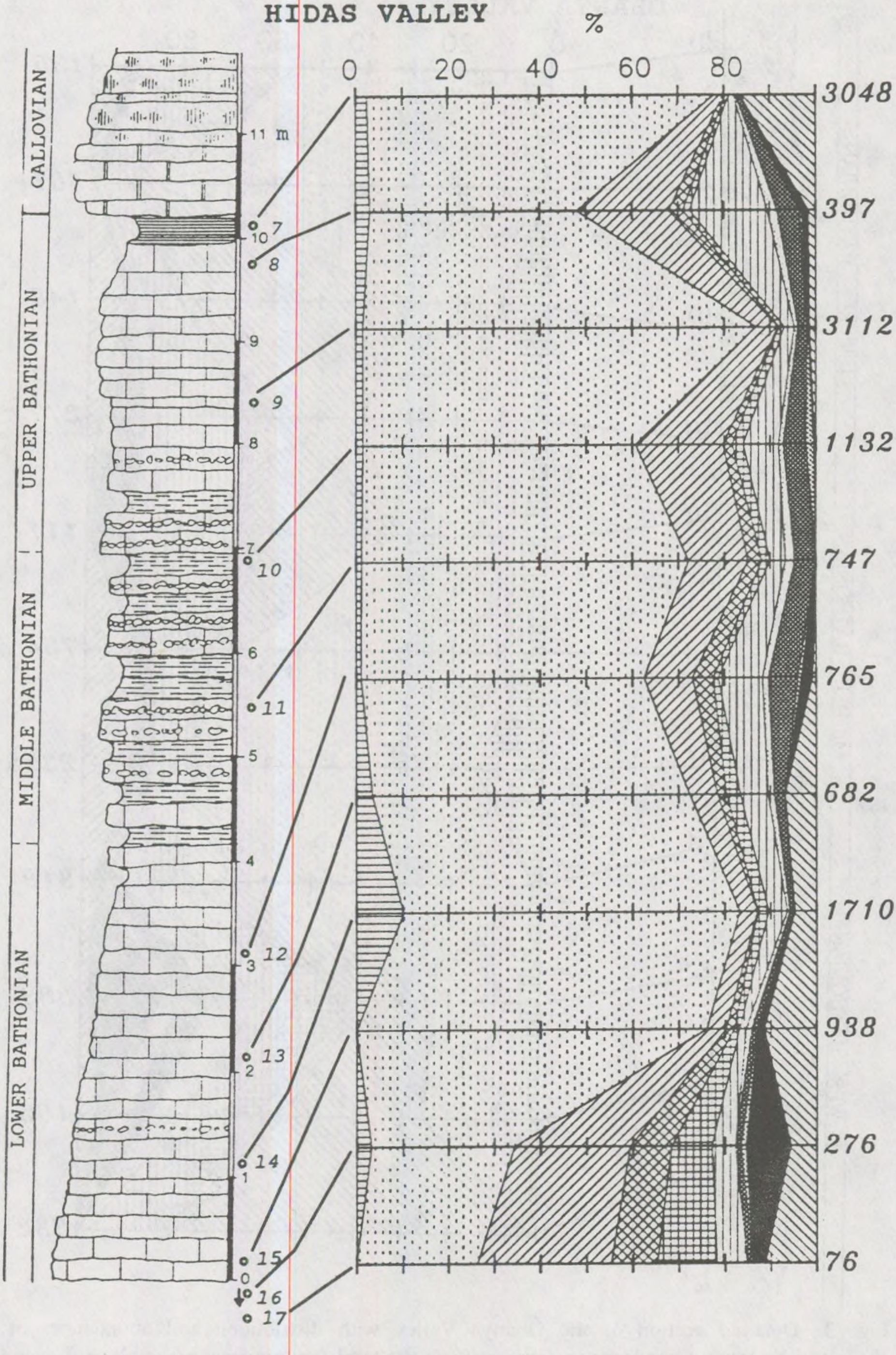

Fig. 4. Detailed section of the Hidas Valley with distribution and abundances of the characteristic taxa. Abundance is given in % of the total foraminiferal assemblage. Legend see at Fig. 2.

Bathonian foraminifera fauna of the Eastern Mecsek Mts

The studied Bathonian sections of the Mecsek Mts were rich in benthic foraminifera. Planktonic forms have not been found yet. In the Hidas Valley the preservation was far better than in the Óbánya Valley. The number of specimens is strongly varied from sample to sample. It ranged in the Óbánya Valley between 111 (sample 11) and 2355 (sample 9), the average value is nearly 600 specimens. In the Hidas Valley the average is about two times bigger than in the Óbánya Valley and the specimen number varied from 76 (sample 17) to 3112 (sample 9) (Figs 2–4). The small assemblages were caused by bad preservation.

The species number in the Hidas Valley samples varies from 10 to 35, in the Óbánya Valley from 11 to 43 and on the Csengő Hill it is 28 (Fig. 5). In the first section the average value is 23–24 in all substages. In the Óbánya Valley the fauna is the most diversified in the Middle Bathonian – 33 species per sample on the average –, in the Lower Bathonian this value is 28, while in the Upper Bathonian it is only 14. It was probably caused by the lithology, because marly layers of the studied sections contain less diversified fauna than the limestone beds. On the Csengő Hill the preservation and the specimen number (699) are average. There is no close connection between the species number and the diversity of the fauna. For example the biggest species number (43) could be found in the sample (Óbánya Valley sample 7) of relatively small specimen number (389).

Usually there was no significant difference between the foraminifera assemblages from washable and indurated parts of the given bed. Only in a single case, in Sample 10 of Hidas Valley were the faunas different from the calcareous and the marly parts of the same bed, with enrichment of *Eoguttulina* in the more calcareous parts.

The identified 82 species belong into 4 suborders: Textulariina, Spirillinina, Lagenina and Rotaliina.

Species of Spirillinina and Lagenina are the most abundant in the samples, while the two other suborder are subordinate.

Suborder Spirillinina is represented by one genus and three species only, but nearly 70 % of the studied specimens belong to these forms. The dominant species, about 75 % of spirillinids is *S. infima* (STRICKLAND). *S. elongata* BIELECZKA & POZARYSKI is also frequent, the rarest is *S. tenuissima* GÜMBEL. Spirillinids are predominant nearly throughout the Hidas Valley and the Csengő Hill sections. In the Óbánya Valley the percentage of *Spirillina* fluctuates between 0 and 86 %, showing a nearly increasing tendency upwards (Fig. 3). The percentage of spirillinid species is about 10 % on the average in each sections (Fig. 5).

In suborder Lagenina 19 genera and 62 species were identified, so this is the most diversified group. In the Hidas Valley Lagenina stands on second place in abundance, except in the lowermost beds (Samples 16 and 17) and in one sample (8) of the Upper Bathonian, where it is of first place. Species number percentage of this group varies between 50 and 79.5 % of the total fauna. The average value is nearly 70 % throughout the Bathonian. On the Csengő Hill the amount of Lagenina is 24.2 %, representation of Lagenina species is 71.4 %. In the Óbánya Valley specimens of this taxa are dominant in the Lower Bathonian and the lower part of the Upper Bathonian. The

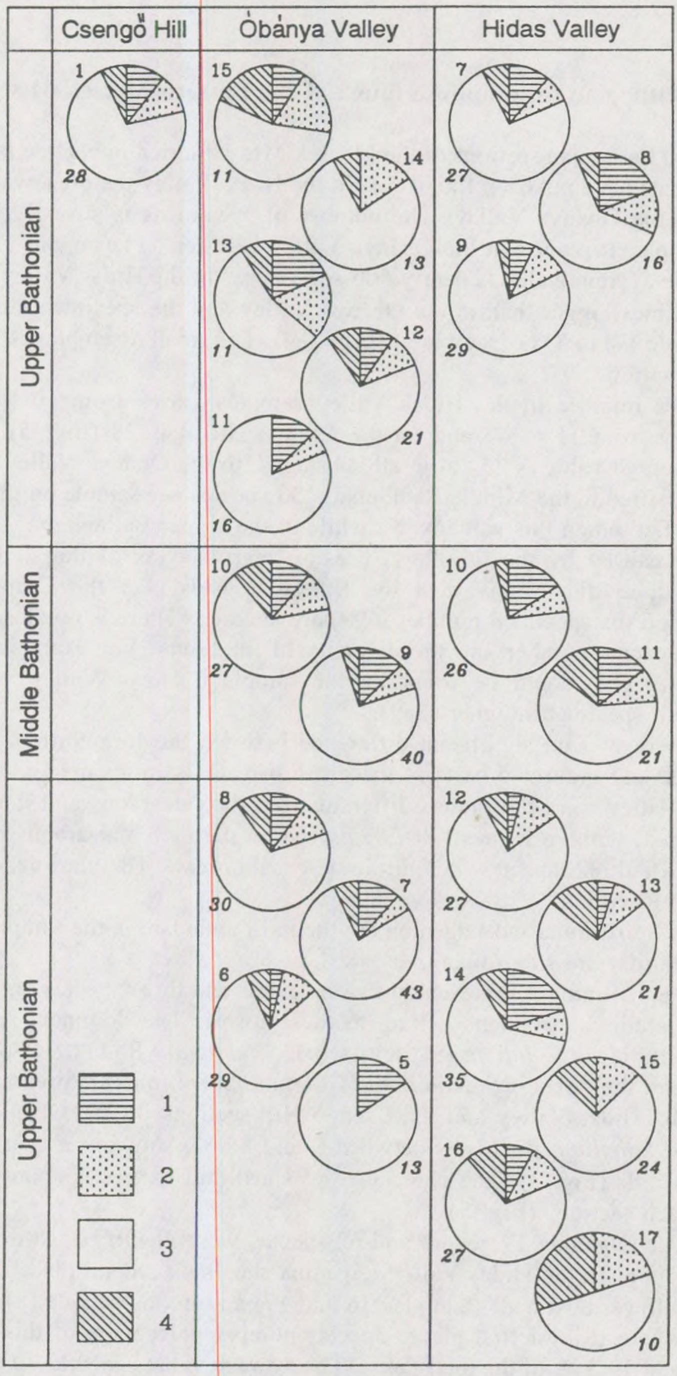

Fig. 5. Distribution of species number by suborders. Legend: **1** - Textulariina; **2** - Spirillinina; **3** - Lagenina; **4** - Rotaliina. Roman figures - number of samples. *italics* figures - number of species in given sample.

species number varies between 54.5 (in the Upper Bathonian) to 84.6 % of the total fauna. The average value is about 70 % too, but the diversity is the biggest in the Lower Bathonian and decreases upwards. Genus *Lenticulina* is the most frequent within this group, strongly fluctuating between 2.5 and 39 % of the total fauna in the Hidas Valley, and between 3 and 79 % in the Óbánya Valley. Specimens of *Lenticulina* are more abundant in the Óbánya than in the Hidas Valley. The *Lenticulina*/Lagenina ratio is 45 % in the Óbánya Valley and 48.8 % in the Hidas Valley on the average.

Seven *Lenticulina* species could be distinguished, as follows: *L. biexcavata* (MJATLIUK), *L. cultrata* (MONTFORT), *L. dorbigny* (ROEMER), *L. muensteri* (ROEMER), *L. parmula* GOFMAN, *L. quenstedti* (GÜMBEL) and *L. subalata* (REUSS). The smooth-walled forms are predominant. Especially abundant species is *L. muensteri* (ROEMER), which represents nearly 80 % of *Lenticulina* in the Hidas Valley and more than 85 % in the Óbánya Valley. Amount of *L. muensteri* is up to 75 % of the total assemblage in the Óbánya Valley. Among the ornamented species *L. quenstedti* (GÜMBEL) – which is a characteristic Middlevalle Jurassic form – is relatively frequent. From the genera of family Vaginulinidae (without *Lenticulina*) the lenticulinids, *Marginulinopsis, Astacolus* and *Planularia* are somewhat more frequent than *Marginulina, Citharina, Citharinella* and *Vaginulina.* These genera amount up to about 10 % of Lagenina. They are slightly frequent in the Hidas Valley and in the Lower Bathonian part of both sections. Another important Lagenina family is Nodosaridae. In the Óbánya Valley the specimen number is up to 22 % of the total fauna, and the average is nearly 14 %. In the Hidas Valley this family is less frequent, it is about 7 % on average. Within Nodosaridae the seven *Dentalina* species are dominant, especially *D. pseudocommunis* FRANKE and *D. oolithica* (TERQUEM). Moreover eleven *Nodosaria* species, with predominance of *N. fontinensis* TERQUEM and *N. mutabilis* TERQUEM, together with three *Pseudonodosaria* species could be determined. *Eoguttulina* species play second role in fauna, they are about 3 % of the total. They are most abundant (9 %) in the Óbánya, in the lower part of the Upper Bathonian. Genus *Ichthyolaria* is not too frequent (up to 2.8 %), but contains some characteristic Bathonian species, namely *I. nympha* KOPIK and *I. spatula* (TERQUEM), moreover two new species: *I. serraticostata* n. sp. and *I. hidasi* n. sp. All other species of order Lagenina in these samples do not comprise 1 % of the total assemblage.

Suborder Rotaliina is represented by one genus, *Paalzowella* and three species. In the Óbánya Valley, in the Lower Bathonian the percentage of *Paalzowella* varies between 3.5 and 9.7 %, except the lowermost beds where this genus is missing. In this section the Middle Bathonian beds are the richest in *Paalzowella* (11–12 %). Above, the percentage of these forms is not more than 2.2 %. Paalzowellids are most frequent in the Lower Bathonian beds of the Hidas Valley, with 4.9–12 %. This value is about 1 % from the highest bed of the Lower Bathonian to the uppermost layer of the Upper Bathonian, where the rate of these forms reaches 16.4 %. In the Upper Bathonian bed of the Csengő Hill the abundance of paalzowellids is 3.6 %. *Paalzowella feifeli feifeli* (PAALZOW) is predominant, *P. feifeli elavata* (PAALZOW) and *P. turbinella* (GÜMBEL) are less frequent. The average ratio of paalzowellid species is 11 % in the Hidas Valley and about 7 % in the Óbánya Valley and on the Csengő Hill (Fig. 5). Generally speaking, Rotaliina is most frequent in the lower part of the Bathonian.

In the studied fauna 12 genera and 13 species belong to suborder Textulariina. The species are as follows: *Thurammina papillata* BRADY, *Jaculella* sp., *Glomospira*

Species	L	M	U
Thurammina papillata Brady	...		...
Jaculella sp.	... - - -	... - - -	- - -
Glomospira variabilis (Kubler and Zwingli)	... - - -	... - - -	... - - -
Reophax dentaliniformis Brady	- - -		—
Ammobaculites agglutinans (d'Orbigny)	- - -	- - -	... - - -
Triplasia bartensteini Loeblich and Tappan	...		
Haplophragmium coprolithiforme Schwager	... - - -		—
Tritaxis lobata Seibold, E. and I.	...	- - -	...
Trochammina globigeriniformis (Parker and Jones)	...		
Verneuilinoides mauritii (Terquem)	...		...
Verneuilinoides tryphera Loeblich and Tappan	- - -	- - -	
Pseudomarssonella dumortieri (Schwager)	... - - -	... - - -	— ... - - -
Textularia jurassica Gumbel			— ... - - -
Spirillina elongata Bielecka and Pozaryski	... - - -	... - - -	— ... - - -
Spirillina infima (Strickland)	... - - -	... - - -	... - - -
Spirillina tenuissima Gumbel	... - - -	... - - -	— ... - - -
Palaeomiliolina? sp.	- - -		
Caputifera sulcata n. sp.		- - -	—
Ichtyolaria nodosaria (Terquem)			... - - -
Ichtyolaria nympha Kopik	... - - -	...	...
Ichtyolaria spatula (Terquem)		- - -	—
Ichtyolaria serraticostata n. sp.			- - -
Ichtyolaria hidasi n. sp.	... - - -		
Falsopalmula deslongchampsi (Terquem)	... - - -		- - -
Falsopalmula jurensis (Franke)	- - -	... - - -	— ...
Falsopalmula rugosa (d'Orbigny)		...	
Dentalina apiculata nom. nov.	- - -		
Dentalina bicornis Terquem			- - -
Dentalina buccinea n. sp.	- - -		
Prodentalina goldfussana (Gumbel)	... - - -	...	
Dentalina jurensis (Gumbel)	...		—
Dentalina oolithica (Terquem)	... - - -	... - - -	— ... - - -
Dentalina pseudocommunis Franke	... - - -	... - - -	— ... - - -
Nodosaria costata Bornemann	...		- - -
Nodosaria? cf. cuneiformis (Terquem)	- - -		
Nodosaria fontinensis Terquem	... - - -	... - - -	— ... - - -
Nodosaria lagenoides Wisniowski	...		- - -
Nodosaria mutabilis Terquem	... - - -	... - - -	— ... - - -
Nodosaria oculina (Terquem et Berthelin)	...		
Nodosaria plicatilis Wisniowski			—
Nodosaria raphanistriformis (Gumbel)	... - - -	...	

Fig. 6a–b. Stratigraphic distribution of species in the studied sections. Legend: L - Lower Bathonian; M - Middle Bathonian; U - Upper Bathonian; ——— Csengő Hill; ... - Óbánya Valley; - - - Hidas Valley

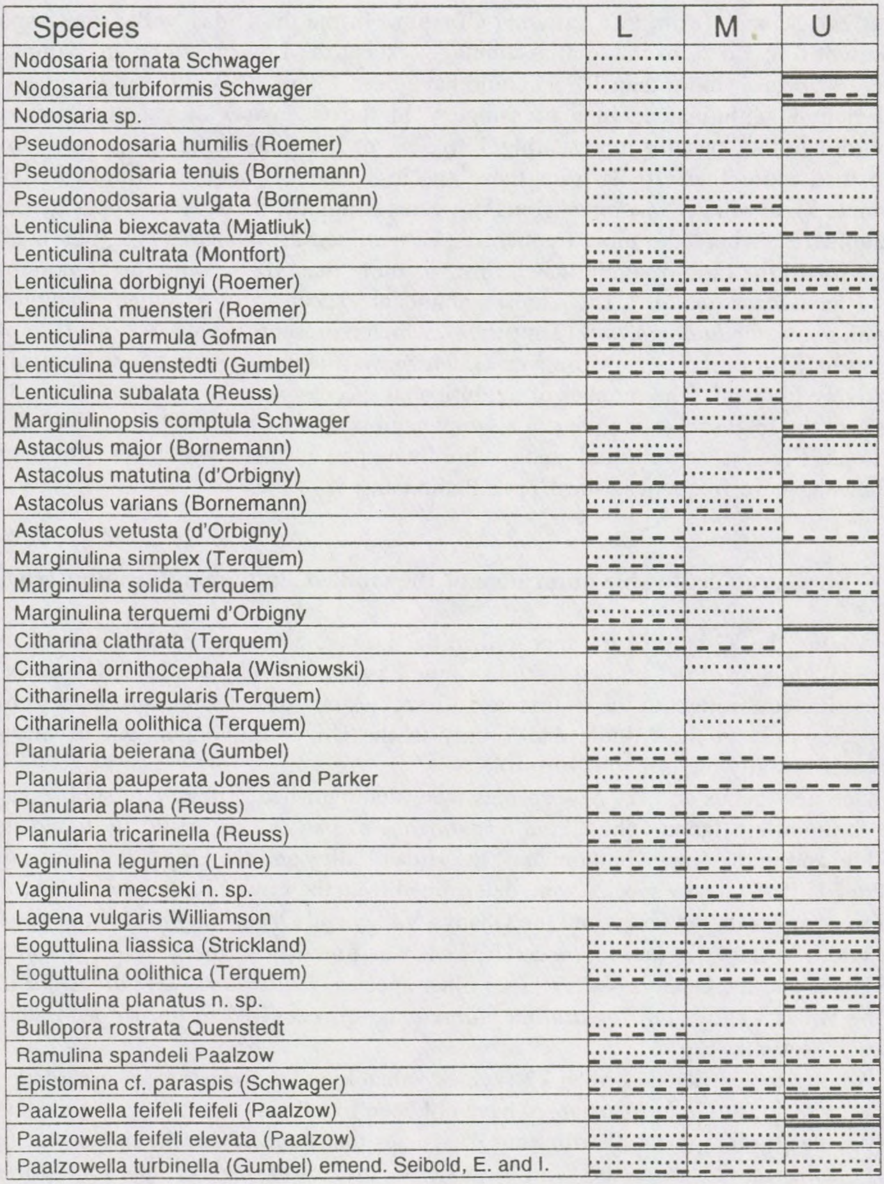
Species
L
M
U
Nodosaria tornata Schwager
Nodosaria turbiformis Schwager
Nodosaria sp.
Pseudonodosaria humilis (Roemer)
Pseudonodosaria tenuis (Bornemann)
Pseudonodosaria vulgata (Bornemann)
Lenticulina biexcavata (Mjatliuk)
Lenticulina cultrata (Montfort)
Lenticulina dorbignyi (Roemer)
Lenticulina muensteri (Roemer)
Lenticulina parmula Gofman
Lenticulina quenstedti (Gumbel)
Lenticulina subalata (Reuss)
Marginulinopsis comptula Schwager
Astacolus major (Bornemann)
Astacolus matutina (d'Orbigny)
Astacolus varians (Bornemann)
Astacolus vetusta (d'Orbigny)
Marginulina simplex (Terquem)
Marginulina solida Terquem
Marginulina terquemi d'Orbigny
Citharina clathrata (Terquem)
Citharina ornithocephala (Wisniowski)
Citharinella irregularis (Terquem)
Citharinella oolithica (Terquem)
Planularia beierana (Gumbel)
Planularia pauperata Jones and Parker
Planularia plana (Reuss)
Planularia tricarinella (Reuss)
Vaginulina legumen (Linne)
Vaginulina mecseki n. sp.
Lagena vulgaris Williamson
Eoguttulina liassica (Strickland)
Eoguttulina oolithica (Terquem)
Eoguttulina planatus n. sp.
Bullopora rostrata Quenstedt
Ramulina spandeli Paalzow
Epistomina cf. paraspis (Schwager)
Paalzowella feifeli feifeli (Paalzow)
Paalzowella feifeli elevata (Paalzow)
Paalzowella turbinella (Gumbel) emend. Seibold, E. and I.

Fig. 6b

variabilis (KÜBLER & ZWINGLI), *Reophax dentaliniformis* BRADY, *Ammobaculites agglutinans* (D'ORBIGNY), *Triplasia bartensteini* LOEBLICH & TAPPAN, *Haplophragmium coprolithiforme* SCHWAGER, *Tritaxis lobata* (SEIBOLD, E. & I.), *Trochammina globigeriniformis* (PARKER & JONES), *Verneuilinoides mauritii* (TERQUEM), *Verneuilinoides tryphera* LOEBLICH & TAPPAN, *Pseudomarssonella dumortieri* (SCHWAGER) and *Textularia jurassica* GÜMBEL. In the the Hidas Valley these species represent 0 to 3.6 % of the total assemblage, except the Lower Bathonian, Sample 14, where 7 species (more than 10 %) could have been found. This is the most diversified and richest agglutinated fauna of samples. In the Óbánya Valley textulariinids are subordinate too, usually representing 1 to 3 % of the total fauna. Only two samples contained more than 10 % from these species. One of them is Middle Bathonian (Sample 9), in which *Pseudomarssonella* species dominate, the other is Upper Bathonian (Sample 13), where the most frequent is *Verneulinoides mauritii* (TERQUEM). In the Csengő Hill the ratio of agglutinated forms is more than 10 %, with the predominance of *Pseudomarssonella.* The most abundant species of studied samples is *Pseudomarssonella dumortieri* (TERQUEM), which represents usually 80 to 100 % of the agglutinated foraminifera. Moreover *Glomospira variabilis* (KÜBLER & ZWINGLI) is relatively frequent. The number of agglutinated species varies from 0 to 7, it is 3.4 to 20 % of the total species number in a sample and is about 10 % on the average, in each sections (Fig. 5). Textularinids took subordinate part in the assemblages, but they are somewhat more frequent in the Upper Bathonian.

Stratigraphical value and range of the studied Bathonian foraminifera

Among the 82 species 68 appeared in the Lower, 51 in the Middle and 57 in the Upper Bathonian of the studied sections of the Eastern Mecsek Mts. Lots of species (36) is distributed throughout the Bathonian. 12 species could be found only in the Lower, 5 species only in the Middle and 7 only in the Upper Bathonian, but usually they appeared in only one section (Fig. 6).

One new genus and six new species were distinguished. They were subordinate in the foraminifera fauna. The *Caputifera sulcata* n. gen. n. sp. could be found in the Middle and in the Upper Bathonian of the Hidas Valley and the Upper Bathonian of the Csengő Hill. Two new species were determined from the Lower Bathonian, *Ichthyolaria hidasi* n. sp. from the Hidas and the Óbánya Valley and *Dentalina buccinea* n. sp. from the Hidas Valley. *Vaginulina mecseki* n. sp. was found from the Middle Bathonian of the Hidas and the Óbánya Valley. Two other species, *Ichthyolaria serraticostata* n. sp. in the Hidas Valley and *Eoguttulina planatus* n. sp. occurred in the Upper Bathonian of each sections (Fig. 6).

Among the earlier described 73 species valuable index forms, as *Reinholdella* sp., *Garantella* sp. or *Globuligerina* sp. have not been found yet. Greater part of the species have wide stratigraphical distribution. 25 species distributed from the upper part of the Early Jurassic, 23 from the Mid Jurassic to the lower part of the Late Jurassic, moreover 5 from the Mid Jurassic to Early Createceous. Previously 2 species were known only from the upper part of the Early Jurassic and 5 only from the lower part of the Late Jurassic. The number of Mid Jurassic species is 13. Eleven species of the latter group were described from the Late Bajocian to Callovian interval. They are as follows: *Triplasia bartensteini* LOEBLICH & TAPPAN, *Tritaxis lobata* (SEIBOLD, E. & I.), *Verneuilinoides tryphera* LOEBLICH & TAPPAN, *Ichthyolaria nympha* KOPIK, *I. spatula* (TERQUEM), *Dentalina apiculata* nom. nov., *D. oolithica* (TERQUEM), *Lenticulina biexcavata* (MJATLIUK), *L.* parmula GOFMAN, *Citharinella irregularis* (TERQUEM) and *Paalzowella turbinella* (GÜMBEL) emend. SEIBOLD, E. & I. Only *Ichthyolaria nympha* KOPIK is regarded as index fossil of the Late Bajocian to Early Bathonian of Poland. According to COLEMAN (1981) there is no difference between the Upper Bajocian and the Bathonian foraminifera faunas. All species, except the new ones, which appeared in only one substages of the studied sections have wider stratigraphical distribution. Accordingly the Bathonian fauna is characterized rather by predominance of some forms e.g. of *Spirillina* spp. and *Lenticulina muensteri* and relative abundance of other species e.g. of *Planularia beierana* and *Lenticulina quenstedti*, than the presence or absence of given species. The Bathonian substages are not distinct on the basis of foraminifera.

Detailed stratigraphical range and geographical distribution of each species are given in the systematic part.

Conclusion

The main features of the foraminifera are the same in the three studied Eastern Mecsek sections. Throughout the Bathonian spirillinids prevail with *Lenticulina muensteri* (ROEMER), the most diversified group is subordo Lagenina, among Nodosariidae *Dentalina* spp. predominate, and the agglutinated forms and the rotaliids are subordinate. In the two latter groups *Pseudomarssonella dumortieri* (SCHWAGER), *Paalzowella feifeli feifeli* (PAALZOW), respectively, are the dominant species. In spite of the repeatedly mentioned *"Protoglobigerina"* from thin-section (PATAKY et al. 1982; FŐZY et al. 1985) planktonic forms have not been found yet. The majority of the species have wide palaeogeographical and stratigraphical distribution. Distinguishing of the Bathonian substages was impossible on the basis of the foraminifera faunas. Qualitative and quantitative differences were bigger between the sections than between the Lower and Upper Bathonian of a given profile. Differences appeared rather in the ratio of characteristic groups, and not in presence or absence of certain species. The lithological characters of the sections being nearly the same, these differences were probably caused by dissimilar ecological conditions. In the ecological interpretation, the high degree of condensation of the Bathonian layers and fauna have to be taken into consideration. In the Hidas Valley the number of species is two times larger, the preservation is better, but the diversity is lower, than those in the Óbánya Valley. In Middle Jurassic foraminifera assemblages the amount of *Lenticulina muensteri* together with *Spirillina* spp. is up to the 80 % of the total fauna in bathyal regions, and is 90 % in shallow shelf areas (STAM 1986). This value ranges between 40 and 90 %, but it is usually 70–80 % in the Mecsek Mts. Spirillinids, which prefer the relatively shallower water are more abundant in the Hidas Valley, while *Lenticulina muensteri*, Nodosaridae and *Eoguttulina* species, which prefer deeper water, are more frequent in the Óbánya Valley. Summarizing, this faunal association is characteristic of epicontinental shelf regio with relatively deep water (about 200–250 m). On the basis of the foraminifera assemblages from the two complete Bathonian sections, the Hidas Valley looks somewhat shallower than the Óbánya Valley. The fauna of the Csengő Hill most resembles the upper part of the Middle Bathonian to lower part of the Upper Bathonian layers (Samples 9 and 10) of the Hidas Valley. Presumably this was caused by the shorter geographical distance between the two localities, so the ecological circumstances were more similar (Fig. 1).

The sections studied in this paper show some differences in comparison with the other section of the Eastern Mecsek. According to SIDÓ (1966 and 1983) in the Zengővárkony section (see Fig. 1) *"Spirillina, Trocholina, Ammodiscus* species and family Lagenidae" are predominant. She mentioned that "genus *Trocholina* is characteristic, mostly *T. conica* (SCHLUMBERGER)". The characteristic forms are the same as those the in present material – it is to be noted that instead of family Lagenidae the subordo Lagenina is evaluated here – except genus *Trocholina.* The assemblages studied in this paper did not contain any *Trocholina* species, but forms with very similar test-shape such as *Pseudomarssonella* sp. and *Paalzowella* spp. are frequent. *Trocholina* sp. is very characteristic in stable European faunas, as of Germany and Poland, and prefer the shallow, warm and agitated water (BRAND 1990). This facies is very different from the one indicated by the here studied fauna. Besides these facts, Sidó mentioned that "in the middle part of the Bathonian profile, *Lenticulina quenstedti* is dominant". This form is subordinate to the smooth-walled *Lenticulina* species throughout each studied sections. SIDÓ in 1966 distinguished planktonic foraminifers, "Pseudoglobigerinids" from Bathonian thin sections. These specimens belong to *Trochammina globigeriniformis* (PARKER & JONES) as verified by SIDÓ in 1983. Among the 27 species determined by *Sidó* only 12 are represented in the here studied material. These differences between several profiles within small area raises the need of detailed revision of the Zengővárkony section.

The comparison with other Bathonian foraminiferal assemblages of different parts of Tethys is rendered more difficult by the fact that most of the papers give only descriptions of species, without quantitative data. Moreover, mostly the faunas of the epicontinental regions were studied in detail. The localities of the most important studied Bathonian foraminiferal assemblages are figured in Fig. 7.

The comparisons are based mostly on the ratio of characteristic taxa, namely Textulariina, Miliolinacea, Spirillinidae, Nodosariacea, Polymorphinidea, Ceratobuliminidae and Rotaliina (*Paalzowella* sp. and *Trocholina* sp.), and partly on the common species. In the studied Mecsek Mts fauna 13 species belong to Textulariina, only 1 uncertain (*Paleomiliolina* ?) to Miliolinacea, 3 to Spirillinidae, 48 to Nodosariacea, 3 to Polymorphinidea, only 1 (*Epistomina* cf. *paraspis* (SCHWAGER)) with a few specimens to Ceratobuliminidae and 3 to Rotaliina. The ratio of these groups can be seen in Figures 2 to 4 and 6.

In southern England COLEMAN (1981, 1982) distinguished nearly 100 foraminifera species from the Bathonian shallow marine clays and calcareous sediment. The Nodosariacea species (70 % of the total) were predominant, with high abundance of *Lenticulina muensteri* (ROEMER). In contrast to the Mecsek fauna, the agglutinated forms (14 species), Miliolinacea (6 species) and Ceratobuliminidae (6 species) were more frequent and characteristic in the assemblages. The number of common species is 20.

Many detailed studies dealt with the rich foraminiferal fauna from clayey and calcareous shallow marine sediments of the Hildesheim area in NW-Germany

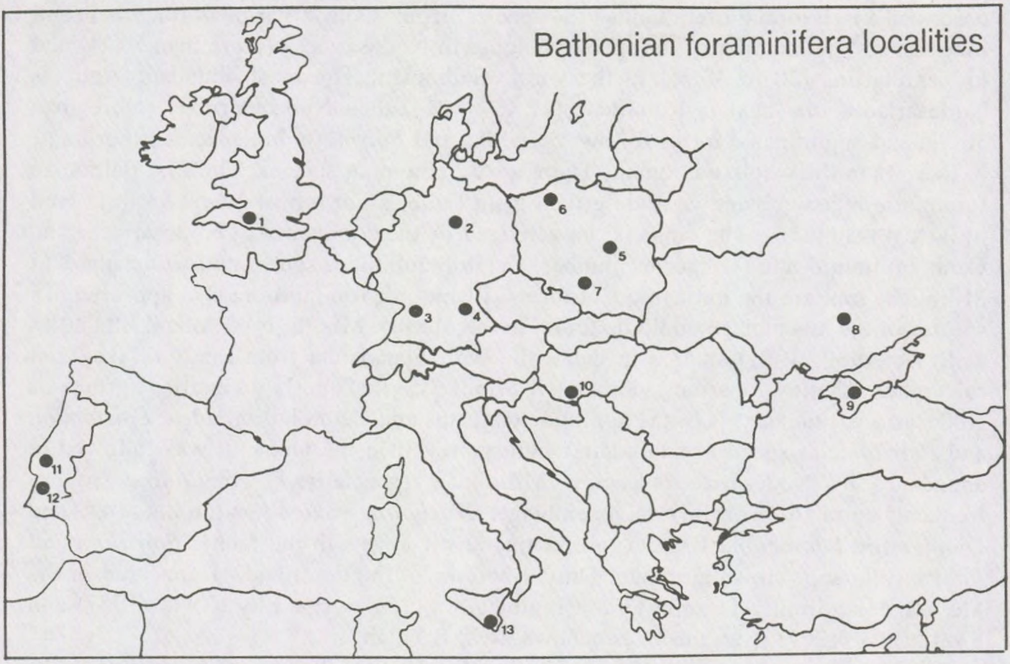

Fig. 7. Localities of previously studied sections in Europe. **1** – South-England, COLEMAN (1982); **2** – Hildesheim area, Germany, BARTENSTEIN & BRAND (1937), LUTZE (1967), BRAND (1990); **3** – Karlsruhe, Germany, FRENTZEN (1941); **4** – Franconia, Germany, MUNK (1978); **5** – Warsawa region, Poland, TERQUEM (1886); **6** – NW-Poland, BIELECKA & STYK (1969, 1981); **7** – Czestochowa area, Poland, KOPIK (1967) and PAZDROWA (1967); **8** – Dneper–Donec Basin, Ukraine, KAPTARENKO-CHERNOUSOVA (1960) and KAPTARENKO-CHERNOUSOVA et al. (1963) and PJATKOVA & PERMJAKOVA (1978); **9** – Crimea, Ukraine, PJATKOVA & PERMJAKOVA (1978); **10** – Eastern Mecsek, Mts., Hungary, SIDÓ (1966, 1983); **11** – Brenha section, Murtinhiera, Central Portugal, STAM (1986); **12** – Algarve Basin, S Portugal, RUGET (1973) and STAM (1986); **13** – Ragusa, Sicily, BARBIERI (1960).

(BARTENSTEIN & BRAND 1937; LUTZE 1967 and BRAND 1990). In the Lower Bathonian lenticulinids, mostly *L.* quenstedti (GÜMBEL), *Planularia tricarinella* (REUSS) and *Lenticulina muensteri* (ROEMER) predominate. The Upper Bathonian is rich in agglutinated forms (49 species), *Epistomina* spp. (7 species), *Trocholina* spp. appeared also and relatively less is *Lenticulina.* Most diversified are Nodosariacea, giving more than 60 % of the total assemblage. There are 38 common species. FRENTZEN (1941) gave a detailed quantitative and qualitative study of Bathonian foraminifera from Karlsruhe. The most diversified group is Nodosariacea (53 species, it is 50 % of the total), then Textulariina (36 species). The most frequent genus is *Lenticulina,* especially abundant *L. muensteri* throughout the Bathonian. Its ratio is up to nearly 40 % of the total assemblages in the Middle and the Upper Bathonian. Additionally in the Lower Bathonian *L. muensteri, L. quenstedti* and *L. subalata* (REUSS) are frequent. The Upper Bathonian is rich in *Trochammina globigeriniformis* (PARKER & JONES), rating to 24 % of the total assemblages. The percentage of spirillinids is only about 2 % in the whole Bathonian. 30 species are common. From Franconia (S Germany) MUNK (1978) described a rich foraminifera fauna (134 species) from shallow marine oolitic marls and limestones. The majority of the species belongs to Nodosariacea (more than 50 %) and to Textulariina (20 to 40 %) in the whole Bathonian. The most abundant group is Nodosariacea, the next is Rotaliidae (12 to 53 %), then Nubeculariidae (more than 30 %) and agglutinated forms follow. *Spirillina* and *Polymorphina* species subordinate (0 to 3 %) in the whole Bathonian. There are 32 commom species. The first Bathonian foraminiferal assemblage were described from Fuller's Earth near Warsawa in Poland by TERQUEM (1886). The fauna is characterized by the dominance of Nodosariacea and Ceratobuliminidea in the species number. Ceratobuliminidea spp., *Lenticulina* spp. and Miliolidae spp. are the most frequent forms. Planktonic foraminifera also appeared. 15 species of the assemblage could be found in the Mecsek Mts. In NW Poland BIELECKA & STYK (1969, 1981) studied in detail the Bathonian fauna from sandy, clayey and calcareous shallow marine sediments. Similarly, the most diversified group is Nodosariacea, the next is of the agglutinated forms and Ceratobuliminidea. *Epistomina* and *Reinholdella* species of this latter family prevail in the fauna. It was followed in abundance by Nodosariacea species. Miliolidae, especially *Paleomiliolina* sp. are frequent, up to 16 % of the total assemblage. *Trocholina conica* (SCHLUMBERGER) and *Globigerina bathoniana* PAZDRO are characteristic forms in the fauna. *Spirillina* and *Paalzowella* spp. are subordinate. Only 7 species of the described 41 appeared in the Mecsek Mts. Similar foraminiferal assemblages were described by KOPIK (1967) and PAZDROWA (1967) from the Czestochowa area, S Poland.

In Ukraine, except the Crimea, only the Lower Bathonian is marine. The foraminifera fauna is usually poor (24 species) and not very well-preserved (KAPTARENKO-CHERNOUSOVA 1960; KAPTARENKO-CHERNOUSOVA et al. 1963 and PJATKOVA & PERMJAKOVA 1978). The majority of species belong to Nodosariacea (about 60 %), the next, is Textulariina (26 %) in diversity. There are only one *Spirillina* and Miliolidae species each. The authors did not give quantitative data. The number of the common species is 4.

In Central Portugal (Brenha section, Murtinhiera) similarly as in the Eastern Mecsek *Spirillina* spp. and *Lenticulina muensteri* predominate in the Upper Bathonian (STAM 1986). Additionally, *Nodosaria, Dentalina* and *Eoguttulina* species are abundant. The lithofacies is oolitic, pisoolitic limestone. RUGET (1973) and STAM (1986) described the Middle Bathonian foraminifera fauna of the Algarve Basin, S Portugal. They studied faunas from different lithofacies, RUGET from marls, STAM from ammonite-rich reefal limestones, so they got different ratios for the characteristic taxa. According to RUGET *Lenticulina muensteri* is dominant, up to more than 50 % of the total assemblage in the marls, while this species is represented only with 5 % in the carbonates (STAM 1986). STAM found that the most abundant genus is *Spirillina,* and also the three species *S. tenuissima* GÜMBEL, *S. infima* (STRICKLAND) and *S. elongata* BIELECKA & POZARYSKI appeared together, just as here, in the studied Mecsek Mts fauna. Moreover, the ratio of these species is similar too, but the amount is less, 30 to 40 %, of the total. The fauna from S Portugal differs from the S Hungarian one in the higher percentage of agglutinated forms (up to 40 %), in less number of Nodosariacea specimens, and in occurrence of planktonic foraminifers. Among the 62 species of the Algarve Basin 21 could be found in the Mecsek Mts, while is the greatest similarity in ratio among the all previously mentioned faunas.

The only assemblage coming from Ammonitico Rosso marl was described by BARBIERI (1960) from Sicily. Unfortunately the age is uncertain, and the fauna is very badly preserved. There were only 4 genera determined. *Spirillina* and *Lenticulina* species are dominant in the fauna.

Summarising, the Bathonian fauna of Europe is characterized by Nodosariinacea and Textulariina as the most diversified taxa.

Frequently *Lenticulina muensteri* is the most abundant species. The predominance of *Spirillina* spp. and big specimen number of *Lenticulina muensteri,* as in the fauna of the Eastern Mecsek Mts, could be observed in S Portugal and Sicily. The greatest number of common species with the assemblages of the Mecsek could be found in Germany, while the smallest number of it is in Ukraine. This is partly in connection with the diversity of the fauna, as the ratio of the common species and the total species number of the given fauna is about the same, 15 to 20 % in each localities, except Portugal, where it is up to 33 %. On the basis of the ratio of characteristic taxa and common species the foraminifera assemblages resembles those of S Portugal and Sicily more, than the faunas of the shallow-marine, epicontinental areas.

Acknowledgements

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Systematic descriptions

After LOEBLICH and TAPPAN (1988).

Phylum Protista
Subphylum Sarcodina SCHMARDA, 1871
Classis Rhizopodea VON SIEBOLD, 1845
Subclassis Lobosia CARPENTER, 1861
Ordo Foraminiferida EICHWALD, 1830
Subordo Textulariina DELAGE and HÉROUARD, 1894
Superfamily Astrorhizacea BRADY, 1881
Family Saccamminidae BRADY, 1884
Subfamily Thuramminae A. D. MIKLUKHO-MAKLAY, 1963
Genus *Thurammina* BRADY, 1879

Thurammina papillata BRADY, 1879
Pl. I, Fig. 1.

1879. *Thurammina papillata* n. sp.; BRADY, H. B.. Notes on some of the reticularean Rhizopoda of the "Challenger" Expedition. Quart. Jour. Micr. Sci. London, vol. 19, p. 45, pl. 5, fig. 4–8. fide Catalogue ELLIS et MESSINA.

pars 1890. *Thurammina papillata,* BRADY; HAEUSLER, pl. 6, fig. 1-8, 12-19, 21; non pl. 6, fig. 20, 22-23, 25-26; pl. 8, fig. 1-2.
1928. *Thyrammina albicans* BRADY; PAALZOW, p. 8, pl. 1, fig. 1-2.
1941. *Thurammina papillata* BRADY; FRENTZEN, p. 301, pl.1, fig. 5.
1968. *Thurammina papillata* BRADY, 1879; OESTERLE, p. 707, fig. 6c-h. cum. syn.

Material. 11 chambers.

Description. Test lemon-shaped with conical protuberances; wall agglutinated; aperture small round at the end of each protuberance.

Remarks. Shape of specimens figured by HAEUSLER (1890) on plate 6, figures 20, 22-23, 25-26 and on plate 8, figures 1-2 strongly different from the type specimen of BRADY.

Dimensions. Diameter: 0.12-0.23 mm.

Distribution. S Germany: Upper Bajocian, Oxfordian; Switzerland: Middle Jurassic to Oxfordian. Hungary, Mecsek Mts: Óbánya Valley: Lower and Upper Bathonian.

Superfamily Hippocrepinacea RHUMBLER, 1895
Family Hippocrepinidae RHUMBLER, 1895
Subfamily Hippocrepininae RHUMBLER, 1895
Genus *Jaculella* BRADY, 1879

Jaculella sp.
Pl. I, Fig. 2.

Material. 20 specimens.

Description. Test long and slender tube, with tapered inicial portion; wall fine-grained agglutinated; aperture round, at somewhat constricted open end of tube.

Dimensions. Height: 0.56-1.33 mm; diameter: 0.06-0.09 mm;

Distribution. Hungary, Mecsek Mts, Hidas Valley: Bathonian; Óbánya Valley: Lower and Middle Bathonian.

Superfamily Ammodiscacea REUSS, 1862
Family Ammodiscidae REUSS, 1862
Subfamily Ammovertellininae SAIDOVA, 1981
Genus *Glomospira* RZEHAK, 1885

Glomospira variabilis (KÜBLER and ZWINGLI, 1870)
Pl. I, Fig. 3.

1870. *Cornuspira variabilis;* KÜBLER and ZWINGLI, p. 33, pl. 4, Oxfordien, fig. 4a-b.
1941. *Glomospira gordialis* (JONES et PARKER); FRENTZEN, p. 307. pl. 1, fig. 15-17.
1960. *Glomospira variabilis* (KÜBLER and ZWINGLI 1870); SEIBOLD, E. and I., p. 324, text-fig. 2q-s.
1968. *Glomospira variabilis* (KÜBLER and ZWINGLI); OESTERLE, p. 711, fig. 8-9, 10a-d. cum. syn.

1978. *Glomospira gordialis* (PARKER et JONES); PJATKOVA and PERMJAKOVA, p. 15, pl. 1, fig. 15.

1989. *Glomospira variabilis* (KÜBLER & ZWINGLI); RIEGRAF and LUTERBACHER, p. 1019, pl. 1, fig. 9–10.

Material. 53 specimens.

Description. Test small, variable shape; consists of an irregularly coiled (usually 4 to 5 whorls) tubular chamber, winding about the proloculus in various planes; wall finely agglutinated; aperture at the end of the tube; surface smooth and bright.

Remarks. OESTERLE (1868) dealt with variability of this species in detail.

Dimensions. The largest diameter: 0.26–0.38 mm.

Distribution. NW Germany: Bathonian; S Germany: upper part of the Lower Jurassic to lower part of the Upper Jurassic; Switzerland: Oxfordian; Russia: Aalenian, Upper Bajocian, Callovian; DSDP North Atlantic: Kimmeridgian to Upper Tithonian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Superfamily Hormosinacea HAECKEL, 1894
Family Telamminidae LOEBLICH and TAPPAN, 1985
Subfamily Reophacinae CUSHMAN, 1910
Genus *Reophax* DE MONTFORT, 1808

Reophax dentaliniformis BRADY, 1881
Pl. I, Fig. 4

1886. *Nodosaria agglutinans,* TERQUEM; TERQUEM, p. 10, pl. 1, fig. 20.

1936. *Reophax dentaliniformis* BRADY; FRANKE, p. 19, pl. 1, fig. 20.

1937. *Reophax dentaliniformis* H. B. BRADY, 1881; BARTENSTEIN and BRAND, p. 133, pl. 1A, fig. 4; pl. 1B, fig. 4–13; pl. 14A, fig. 1a–b; pl. 14B, fig. 1.

1941. *Reophax dentaliniformis* BRADY; FRENTZEN, p. 308, pl. 1, fig. 22–23.

1978. *Reophax dentaliniformis* BRADY; PJATKOVA and PERMJAKOVA, p. 13, pl. 1, fig. 7.

Material. 12 specimens.

Description. Test elongated; consists of 3 to 4 chambers, which nearly circular in cross-section; first chambers nearly globular, later ones pyriform; sutures strongly depressed; wall coarsely agglutineted; aperture round and terminal; surface rough.

Dimensions. Height: 0.58–0.72 mm; the largest diameter of chambers: 0.18–0.27 mm.

Distribution. NW Germany: Lower Jurassic, Bathonian; S Germany: lower part of the Lower Jurassic to lower part of the Upper Jurassic; Russia: Upper Bajocian; Ukraine: Upper Jurassic; S Poland: Bathonian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Lower Bathonian.

Superfamily Lituolacea DE BLAINVILLE, 1827
Family Lituolidae DE BLAINVILLE, 1827
Subfamily Ammomarginulininae PODOBINA, 1978
Genus *Ammobaculites* CUSHMAN, 1910

Ammobaculites agglutinans (D'ORBIGNY, 1846)
Pl. I, Fig. 5.

1846. *Spirolina agglutinans*, D'ORBIGNY; D'ORBIGNY, p. 127, pl. 7, fig. 10–12.
1860. *Lituola agglutinans,* D'OR.; JONES and PARKER, p. 455, pl. 20, fig. 47.
? 1890. *Haplophragmium agglutinans,* D'ORBIGNY; HAEUSLER, p. 32, pl. 3, fig. 32–36; pl. 4, fig. 5–6, 18.
1936. *Ammobaculites agglutinans* (D'ORB.); FRANKE, p. 127, pl. 12, fig. 25.
1937. *Ammobaculites agglutinans* (D'ORBIGNY, 1846); BARTENSTEIN and BRAND, p. 186, pl. 4, fig. 14; pl. 5, fig. 78; pl. 6, fig. 40; pl. 8, fig. 38a–c; pl. 10, fig. 45a–b; pl. 11A, fig. 19a–b; pl. 11B, fig. 28a–b; pl. 12A, fig. 22; pl. 13, fig. 23; pl. 14B, fig. 19.
1941. *Ammobaculites agglutinans* (D'ORBIGNY); FRENTZEN, p. 364, pl. 7, fig. 1–3.
1954. *Ammobaculites agglutinans* (D'ORB.); BIELECKA and POZARYSKI, p. 158, pl. 2, fig. 3a–c.
1978. *Ammobaculites agglutinans* (D'ORBIGNY, 1846); PJATKOVA and PERMJAKOVA, p. 20, pl. 3, fig. 8.
1981. *Ammobaculites agglutinans* (D'ORBIGNY), 1846; BARNARD et al., p. 388, pl. 1, fig. 2.
1981. *Ammobaculites agglutinans* (D'ORBIGNY); COLEMAN, p. 112, pl. 6.2.1, fig. 1.

Material. 19 specimens.

Description. Test elongated; early portion planispiral, close-coiled, consists of 4 chambers with depressed umbilicus; later portion uncoiled and rectilinear, consists of 5 to 6 broader than high chambers, which remain fairly constant in breadth; circular in cross-section; sutures depressed; wall finely agglutinated; aperture round, simple, terminal; surface rough.

Remarks. Loose-coiled specimens, similar to that which was figured in HAEUSLER (1890) are not in my material and in the other publications.

Dimensions. Height: 0.38–0.78 mm; diameter of coiled part: 0.16–0.19 mm; diameter of rectilinear part: 0.10–0.14 mm.

Distribution: Austria: Miocene; England: Jurassic to Cretaceous; NW Germany: Pliensbachian to upper part of the Middle Jurassic (Frequent in Middle Jurassic); S Germany: Lower Aalenian to Oxfordian; Central Poland: Malm; Switzerland: Lower Jurassic to Oxfordian; England: Middle Bathonian to Lower Kimmeridgian; Ukraine: Late Toarcian to Aalenian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Upper Bathonian.

Subfamily Flabellammininae PODOBINA, 1978
Genus *Triplasia* REUSS, 1854

Triplasia bartensteini LOEBLICH and TAPPAN, 1952
Pl. I, Fig. 6.

1937. *Triplasia variabilis* (BRADY); BARTENSTEIN and BRAND, p. 185, pl. 14A, fig. 6.
1941. *Triplasia variabilis* (BRADY); FRENTZEN, p. 363, pl. 6, fig. 24–25.
1952. *Triplasia bartensteini* nov. syn.; LOEBLICH, A. R. and TAPPAN, H.: The Foraminiferal genus *Triplasia* REUSS, 1854. Smithsonian Institute Miscell. Coll., vol. 117, p. 8, pl. 1, fig. 9. *fide* Catalogue ELLIS et MESSINA.
1960. *Triplasia* cf. *emslandensis* BARTENSTEIN and BRAND; LUTZE, p. 441, pl. 27, fig. 13.
1967. *Triplasia bartensteini* LOEBLICH and TAPPAN; GORDON, p. 450, pl. 1, fig. 19–20.
1971. *Triplasia bartensteini* LOEBLICH and TAPPAN, 1952; WERNLI, p. 313, pl. 2, fig. 19.

Material. 1 specimen.
Description. Test elongated, slightly curved; periphery angular; quadrate in cross-section; sutures depressed and arched; wall coarsely agglutinated; aperture terminal, oval; surface rough.
Remarks. LOEBLICH and TAPPAN (1952) renamed *Triplasia variabilis* (BRADY) described by BARTENSTEIN and BRAND (1937).
Dimensions. Height: 0.68 mm; the largest thickness: 0.28 mm.
Distribution. England: Bathonian; Scotland: Callovian; E France: Upper Bajocian to Bathonian; NW Germany: Bathonian; S Germany: Upper Bathonian. Hungary, Mecsek Mts: Óbánya Valley: Lower Bathonian.

Superfamily Haplophragmiacea, EIMER and FICKERT, 1899
Family Haplophragmiidae, EIMER and FICKERT, 1899
Genus *Haplophragmium* REUSS, 1860

Haplophragmium coprolithiforme SCHWAGER, 1867
Pl. I, Fig. 7.

1867. *Haplophragmium coprolithiforme* n. sp.; SCHWAGER, C.: Über die Zone des *Ammonites Sowerbyi*. *in* WAAGEN, W.: Geogn.-Paläont. Beitrage von Bennnecke, Bd. 1, Heft 3, p. 654, pl. 34, fig. 3, *fide* Catalogue ELLIS et MESSINA.
1890. *Haplophragmium coprolithiforme,* SCHWAGER; HAEUSLER, p. 33, pl. 4, fig. 7, 20.
1928. *Haplophragmium coprolithiforme* SCHWAGER; PAALZOW, p. 31, pl. 4, fig. 3.
1932. *Ammobaculites coprolithiformis* SCHWAGER; PAALZOW, p. 94, pl. 4, fig. 19.
1954. *Ammobaculites coprolithiformis* (SCHWAG.); BIELECKA and POZARYSKI, p. 160, pl. 3, fig. 6a–b.
1967. *Ammobaculites coprolithiformis* (SCHWAGER); GORDON, p. 449, pl. 1, fig. 4.
1971. *Ammobaculites coprolithiformis* (SCHWAGER), 1867; WERNLI, p. 310, pl. 1, fig. 16; pl. 2, fig. 6–8.

1978. *Ammobaculites* ex. gr. *coprolithiforme* (SCHWAGER, 1867); PJATKOVA and PERMJAKOVA, p. 20, pl. 4, fig. 1.
1981. *Ammobaculites coprolithiformis* (SCHWAGER); COLEMAN, p. 112, pl. 6.2.1, fig. 2.
1982. *Ammobaculites coprolithiformis* (SCHWAGER); COLEMAN, pl. 1, fig. 26.

Material. 11 specimens.

Description: Test large, early portion planispirally coiled, composed of 5 to 9 chambers; later ones uncoiled and rectilinear consisting of 2 to 4 chambers; circular to oval in cross-section; each chamber enveloping the previous one; sutures usually indistinct and depressed; wall coarsely agglutinated; aperture simple, terminal and produced on a short neck; surface rough.

Dimensions. Height: 0.53–1.45 mm; diameter of coiled part: 0.26–0.86 mm; diameter of rectilinear part: 0.16–0.51 mm.

Distribution. England: Lower Bathonian to Upper Callovian (Kimmeridgian); E France: Lower Bajocian to Lower Oxfordian; S Germany: Upper Bajocian, Lower Oxfordian; Central Poland: Oxfordian to Kimmeridgian; Scotland: Callovian; Ukraine: Lower Callovian to Lower Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Lower Bathonian; Óbánya Valley: Lower Bathonian.

Superfamily Trochamminacea SCHWAGER, 1877
Family Trochamminidae SCHWAGER, 1877
Subfamily Trochammininae SCHWAGER, 1877
Genus *Tritaxis* SCHUBERT, 1921

Tritaxis lobata (SEIBOLD, E. and I., 1960)
Pl. I, Figs 8–9.

1960. *Valvuline ? fusca* (WILLIAMSON 1858); LUTZE, p. 447, pl. 28, fig. 4.
1960. *Valvulina lobata* n. sp.; SEIBOLD, E. and I., p. 336, fig. 4f, g, pl. 8, fig. 11.
1971. *"Paalzowella"* sp. A; WERNLI, p. 341, pl. 8, fig. 13.

Material. 4 specimens.

Description. Test low trochospiral; periphery rounded; 3 to 5 whorls with only 3 chambers per whorl; chambers crescent-shaped, lobate and gradually increasing in size as added; sutures strongly depressed and oblique on the spiral side; on umbilical side flat or slightly depressed in the centre, with radial sutures; two and half chambers visible on the umbilical side; wall finely agglutinated; aperture interiomarginal arch.

Remarks. This species differs from *T. fusca* (WILLIAMSON, 1858) in lobate periphery of chambers.

Dimensions. Diameter: 0.43–0.47 mm; height: 0.20–0.23 mm.

Distribution. NW Germany: Middle to Upper Callovian; S Germany: lower part of the Upper Jurassic; E France: Middle Jurassic. Hungary, Mecsek Mts: Hidas Valley: Middle Bathonian; Óbánya Valley: Lower and Upper Bathonian.

Genus *Trochammina* PARKER and JONES, 1865

Trochammina globigeriniformis (PARKER and JONES, 1865)
Pl. II, Fig. 1.

pars 1890. *Haplophragmium globigeriniforme,* PARKER and JONES; HAEUSLER, p. 36, pl. 4, fig. 17, 17a; non pl. 4, fig. 13, 16.
1937. *Trochammina globigeriniformis* (PARKER and JONES, 1865); BARTENSTEIN and BRAND, p. 189, pl. 1A, fig. 21; pl. 4, fig. 13; pl. 5 fig. 76.
1971. *Trochammina globigeriniformis* (PARKER et JONES), 1865; WERNLI, p. 315, pl. 8, fig. 4, 9.
1978. *Trochammina globigeriniformis* (PARKER and JONES, 1865); PJATKOVA and PERMJAKOVA, p. 27, pl. 8, fig. 1.
1981. *Trochammina globigeriniformis* (PARKER & JONES), 1865; BARNARD et al., p. 393, pl. 1, fig. 12, text-fig. 6C.
pars 1981. *Trochammina globigeriniformis* (PARKER and JONES); COLEMAN, p. 114, pl. 6.2.1., fig. 11, non 10.
1982. *Trochammina globigeriniformis* (PARKER and JONES); COLEMAN, pl. 1, fig. 19.

Material. 4 specimens.
Description: Test small, trochoid; periphery rounded, lobulate; chambers arranged in 2 to 3 whorls; chamber gradually increasing in size as added; 3 to 4 more or less globular chambers on the final whorl; sutures depressed; wall agglutinated; aperture loop-shaped at the base of last chamber; surface rough and bright.
Remarks. Some planispirally coiled specimens were figured by QHAEUSLER (1890), which not belong to this species. Specimen figured by COLEMAN on pl. 6.2.1. fig. 10. is *Cyclogyra liasina* (TERQUEM).
Dimensions. Diameter: 0.15–0.24 mm.
Distribution. England: Lower Bathonian to Upper Callovian (Sinemurian to Kimmeridgian); E France: Upper Aalenian to Lower Oxfordian; Germany: Aalenian to Lower Bathonian to lower part of the Upper Jurassic; Switzerland: Oxfordian; Ukraine: Middle Callovian. Hungary, Mecsek Mts: Óbánya Valley: Lower Bathonian.

Superfamily Verneuilinacea CUSHMAN, 1911
Family Verneuilinidae CUSHMAN, 1911
Subfamily Verneuilinoidinae SULEYMANOV, 1973
Genus *Verneuilinoides* LOEBLICH and TAPPAN, 1949

Verneuilinoides mauritii (TERQUEM, 1866)
Pl. 2, Fig. 3.

1866. *Verneuilina Mauritii* TERQ., TERQUEM, p. 448, pl. 18, fig. 18a–b.
1936. *Verneuilina mauritii* TERQ.; FRANKE, p 126, pl. 12, fig. 22–23.
1937. *Verneuilina mauritii* TERQUEM, 1866; BARTENSTEIN and BRAND, p. 183, pl. 1A, fig. 22.

1971. *Verneuilinoides mauritii* (TERQUEM), 1866; WERNLI, p. 315, pl. 1, fig. 9–11.
1988. *Verneuilinoides mauritii* (TERQUEM, 1866); BIELECKA et al. p. 98, pl. 25, fig. 3.

Material. 15 specimens.
Description. Test high cone, triserial; nearly circular in cross-section; umbilical side somewhat depressed; sutures depressed; wall finely agglutinated; aperture simple arch, interiomarginal; surface rough.
Dimensions. Height: 0.25–0.38 mm; the largest diameter: 0.12–0.15 mm.
Distribution. E France: Lower Bajocian to Middle Oxfordian; S France: Lower Jurassic; Germany: Lower Jurassic; Poland (Extra-Carpathian): Aalenian to Lower Bathonian. Hungary, Mecsek Mts: Óbánya Valley: Lower and Upper Bathonian.

Verneuilinoides tryphera LOEBLICH and TAPPAN, 1950
Pl. II, Fig. 2.

1950. *Verneuilinoides tryphera* LOEBLICH and TAPPAN n. sp.; LOEBLICH and TAPPAN, p. 42, pl. 11, fig. 16a-b.
1981. *Verneuilinoides tryphera* LOEBLICH and TAPPAN, 1950; COLEMAN, p. 114, pl. 6.2.1, fig. 17.

Material. 6 specimens.
Description: Test elongated cone, triserial; periphery lobulate; subtriangular in cross-section; chambers subglobular, increasing very gradually in size as added; sutures distinct and depressed; wall finely agglutinated; aperture crescent-shaped at the base of last chamber; surface slightly rough.
Dimensions. Height: 0.35–0.41 mm; the largest diameter: 0.11–0.13 mm.
Distribution. North America: Oxfordian; S England: Bathonian to Callovian.
Hungary, Mecsek Mts: Hidas Valley: Lower to Middle Bathonian.

Superfamily Textulariacea EHRENBERG, 1838
Family Eggerellidae CUSHMAN, 1937
Subfamily Dorothiinae BALAKHMATOVA, 1972
Genus *Pseudomarssonella* REDMOND, 1965

Pseudomarssonella dumortieri (SCHWAGER, 1866)
Pl. II, Figs 5–7.

1866. *Textularia dumortieri* m.; SCHWAGER, C.: *in* WAAGEN, W.: Über die Zone des Ammonites transversarius von Dr. Albert OPPEL. Geogn.-Paläont. Beiträge von Bennnecke, Bd. 1, Heft 2, p. 309, fig. 14. *fide* Catalogue ELLIS et MESSINA.
1890. *Textularia conica,* D'ORBIGNY; HAEUSLER, p. 72, pl. 11, fig. 40–42, 45–46.
1989. *Pseudomarssonella dumortieri* (SCHWAGER); RIEGRAF and LUTERBACHER, p. 1023, pl. 2, fig. 1–8.

Material. 745 specimens.

Description. Test high conical; trochospirally coiled; periphery subacute; 5 to 7 whorls with 3 to 5 chambers per whorl; sutures between whorls slightly depressed, within the whorl indistinct; umbilicus depressed; aperture cribrate, consisting of numerous pores on a termatophore plate that cover the umbilical region; surface somewhat rough.

Dimensions. Height: 0.35–0.49 mm; the largest diameter: 0.41–0.51 mm.

Distribution. S Germany: Bathonian to Lower Oxfordian; Switzerland: Lower Oxfordian; DSDP Sites, Nordatlantic: Upper Jurassic. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Family Textulariidae EHRENBERG, 1838
Subfamily Textulariinae EHRENBERG, 1838
Genus Textularia Defrance, 1824

Textularia jurassica GÜMBEL, 1862
Pl. II, Fig. 4.

1862. *Textularia jurassica* n. sp.; GÜMBEL, p. 228, pl. 4, fig. 17a–b.
1865. *Plecanium depravatum* m.; SCHWAGER, p. 93, pl. 2, fig. 3.
1886. *Textularia inversa,* TERQUEM; TERQUEM, p. 60, pl. 7, fig. 6.
pars 1890. *Textularia agglutinans,* D'ORBIGNY; HAEUSLER, p. 71, pl. 11, fig. 1–9, 11–16, 47, 50, 52. non?: 10, 48–49.
1928. *Textularia jurassica* GÜMBEL; PAALZOW, p. 14, pl. 1, fig. 21–22.
1932. *Textularia jurassica* GÜMBEL; PAALZOW, p. 94, pl. 4, fig. 21–23.
1937. *Textularia agglutinans* D'ORBIGNY, 1839; BARTENSTEIN and BRAND, p. 182, pl. 14A, fig. 5a–b; pl. 14C, fig. 16; pl. 15A, fig. 40a–c; pl. 15B, fig. 3a–c pl. 15C, fig. 21a–b.
1941. *Textularia agglutinans* D'ORBIGNY; FRENTZEN, p. 360, pl. 6, fig. 13–14.
1955. *Textularia jurassica* GÜMBEL 1862; SEIBOLD E. and I., p. 98, text-fig. 2a–b; pl. 13, fig. 1.
1967. *Textularia jurassica* (GÜMBEL); GORDON, p. 450, pl. 1, fig. 11.
1971. *Textularia agglutinans* D'ORBIGNY, 1839; WERNLI, p. 314, pl. 1, fig. 13–15.
1978. *Textularia jurassica* GÜMBEL 1862; PJATKOVA and PERMJAKOVA, p. 27, pl. 7, fig. 8.
1988. *Textularia jurassica* GÜMBEL, 1862; BIELECKA et al. p. 97, pl. 24, fig. 8.

Material. 9 specimens.

Description. Test relatively long and narrow, biserial, flattened; oval in cross-section; periphery rounded; 6 to 10 wider than high chambers, which gradually increase in size; sutures depressed, nearly perpendicular to the longer axis of the test; wall agglutinated; aperture interiomarginal, low semicircular.

Remarks. Specimens figured by HAEUSLER (1890) on plate 11, fig. 10, 48–49 have a strange initial part.

Dimensions. Height: 0.67–0.82 mm; the largest diameter: 0.21–0.24 mm.

Distribution: E France: Upper Bajocian to Middle Oxfordian; NW Germany: Bajocian-Oxfordian; S Germany: Upper Bajocian to Lower Bathonian, Oxfordian; Poland (Extra Carpathian): Bathonian, Callovian to lower part of Upper Oxfordian;

Scothland: Callovian; Switzerland: lower part of the Lower Jurassic to Oxfordian; Russia: Upper Bajocian, Callovian to Oxfordian; Ukraine: Oxfordian. Hungary, Mecsek Mts Csengő Hill: Upper Bathonian; Hidas Valley: Upper Bathonian; Óbánya Valley: Upper Bathonian.

Subordo Spirillinina HOHENEGGER and PILLER, 1975
Family Spirillinidae REUSS and FRITSCH, 1861
Genus *Spirillina* EHRENBERG, 1843

Spirillina elongata BIELECKA and POZARYSKI, 1954
Pl. II, Fig. 8.

1937. *Ammodiscus tenuissimus* (GUEMBEL, 1862); BARTENSTEIN and BRAND, p. 130, pl. 10, fig. 5e–d.
1954. *Spirillina elongata* n. sp.; BIELECKA and POZARYSKI, p. 196, pl. 10, fig. 53a–b.
1971. *"Spirillina" elongata* (BIELECKA and POZARYSKI), 1954; WERNLI, p. 343, pl. 8, fig. 18–20.
1986. *Spirillina elongata* BIELECKA and POZARYSKI, 1954; STAM, p. 125, pl. 6, fig. 11.
1988. *Spirillina elongata* BIELECKA and POZARYSKI, 1954; BIELECKA, p. 235, pl. 87, fig. 5.

Material. More than 3500 specimens.

Description. Test planispirally coiled, flat; outline more or less elongated oval, with nearly parallel sides; periphery rounded; proloculus small and spherical; deuteroloculus tubular and surrounds the proloculus by 4 to 6 whorls, nearly planispirally; later perpendicular to the plan of the initial whorls tube coiled in 3 to 4 whorls; sutures depressed; wall hyaline with pores; aperture round at the open end of the tube; surface smooth and bright.

Dimensions. The largest diameter: 0.26–0.36 mm; thickness: 0.04–0.06 mm.

Distribution. NW Germany: upper part of the Lower Jurassic to lower part of the Upper Jurassic; Poland: Lower Kimmeridgian; Portugal: Middle Jurassic; E France: Upper Aalenian to Lower Oxfordian; Central Poland: Lower Kimmeridgian. Hungary, Mecsek Mts Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Spirillina infima (STRICKLAND, 1846)
Pl. II, Figs 9–10.

1846. *Orbis infimus* m.; STRICKLAND, H. F.: On two species of microscopic shells found in the Lias. Quart. Jour. Geol. Soc. vol. 2, p. 31, fig. a. *fide* Catalogue ELLIS et MESSINA.
1936. *Ammodiscus infimus* (STRICKLAND); FRANKE, p. 15, fig. 14a–b.
1978. *Ammodiscus infimus* (STRICKLAND, 1846); PJATKOVA and PERMJAKOVA, p. 16, pl. 2, fig. 6.

1982. *Spirillina infima* (STRICKLAND), 1846, emend. BARNARD, 1952; BARNARD, p. 427, pl. 4, fig. 1–2.
1982. *Spirillina infima* (STRICKLAND); COLEMAN, pl. 2, fig. 2.
1986. *Spirillina infima* (STRICKLAND, 1846) emend. BARNARD, 1952; STAM, p. 125, pl. 6, fig 10.

Material. About 10000 specimens.
Description. Test disc-shaped, planispirally enrolled; periphery rounded; proloculus small and globular; tubular chamber relative broad and involute, which envelops the proloculus by 3 to 4 closely coiled whorls, later perpendicular to the plan of initial whorls tube enrolled in 4 to 5 whorls; umbilicus of agamonta induviduals slightly depressed on both side, gamont induviduals have a central conical protuberance on one side of the test; sutures distinct and slightly depressed; wall hyaline with pores; aperture round at the end of the tube; surface smooth and bright.
Remarks. The deuteroconch of S. infima is much thicker, robust and more involute than specimens of S. tenuissima.
Dimensions. Diameter: 0.23–0.52 mm; thickness: 0.045–0.068 mm.
Distribution. England: Bathonian to Lower Oxfordian; Germany: Lower Jurassic; Portugal: Middle Jurassic; Russia: Lower and Middle Jurassic; Ukraine: Lower and Middle Jurassic. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian. Very frequent.

Spirillina tenuissima GÜMBEL, 1862
Pl. II, Fig. 11.

1862. *Spirillina tenuissima* n. sp.; GÜMBEL, p. 214, pl. 4, fig. 12a–b.
1932. *Ammodiscus tenuissimus* GÜMBEL, PAALZOW, p. 92, pl. 4, fig. 12–15.
pars 1937 *Ammodiscus tenuissimus* (GUEMBEL, 1862); BARTENSTEIN and BRAND, p. 130, pl. 8, fig. 6a–c; pl. 11A, fig. 4a–c; pl. 13, fig. 2a–b. non pl. 10, fig. 5a–c;
1955. *Spirillina tenuissima* GÜMBEL 1862; SEIBOLD, E. and I., p. 125, text-fig. 5n.
1982. *Spirillina tenuissima* GUEMBEL, 1862; BARNARD, p. 428, pl. 4, fig. 4, 8.
1986. *Spirillina tenuissima* GUEMBEL, 1862; STAM, p. 126, pl. 6, fig. 9.
1988. *Spirillina tenuissima* GUEMBEL, 1862; BIELECKA, p. 235, pl. 87, pl. 7

Material. 163 specimens.
Description. Test planispirally enrolled, strongly flattened; periphery rounded; proloculus small and globular, which is surrounded by the relatively thin and evolute second chamber; initial coiling consists of 3 to 4 closely enrolled whorls; following by 5 to 7 involute whorls, which are perpendicular to the plane6 of initial whorls; the last whorl may be involute; umbilicus nearly flush; sutures distinct; aperture circular at the end of the tube; surface smooth.
Remarks. Specimens figured by Bartenstein and Brand on pl. 10, fig. 5a–c have too wide tube.
Dimensions. Diameter: 0.26–0.38 mm; thickness: 0.035–0.053 mm.
Distribution. England: Upper Callovian to Lower Oxfordian; NW Germany: Aalenian to Bathonian; S Germany: Lower Oxfordian; Newfoundland: Middle Jurassic;

Poland: Upper Callovian to Oxfordian; Portugal: Middle Jurassic. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Lower to Middle Bathonian.

Superfamily Miliolacea EHRENBERG, 1839
Family Spiroloculinidae WEISNER, 1920
Genus *Palaeomiliolina* ANTONOVA, 1959

Palaeomiliolina ? sp.
Pl. III, Fig. 1.

Material. 2 specimens.
Description. Test elongated oval, flattened; periphery rounded; 3 elongated chambers visible from outside; sutures distinct and slightly depressed; wall porcellaneous, imperforate; aperture simple, round, produced on a neck; surface smooth.
Dimensions. Lenght: 0.72–0.75 mm; breadth: 0.27–0.29 mm; thickness: 0.12–0.13 mm;
Distribution. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian.

Subordo Lagenina DELAGE and HÉROUARD, 1896
Family Ichthyolariidae LOEBLICH and TAPPAN, 1986
Genus *Caputifera* n. gen.

Derivatio nominis: caputifera (Latin) caput = head, fera = bearing.
Diagnosis. Test consists of an ichtyolaroid uniserial part and large inflated final chamber extending one third part of the test. Aperture radial at the apex of the final chamber.

Caputifera sulcata n. sp.
Pl. III, Figs 2–5.

Derivatio nominis: sulcata (latin) to stria
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Middle Bathonian.
Holotype: Plate III, Figure 2.
Paratypes: Plate III, Figures 3–5.
Material. 18 specimens.
Description. Test uniserial and elongated; periphery rounded; the initial part ichthyolaroid, elongated, tapering at both ends, strongly flattened and slightly curved or straight; consists of 7 to 9 chevron-shaped chambers; on both sides of this part there is a stria along the longest axis of the test; sutures slightly depressed; the last chamber is inflated and large, up to one third of the test; wall calcareuos; aperture radial at the apex of the final chamber; surface smooth.
Remarks. The ichthyolaroid part of this species is close to that of *Frondicularia nuda* TERQUEM, 1886, but never shows the large inflated final chamber at the latter form.

Dimensions. Lenght: 0.71–1.56 mm; breadth of ichthyolaroid part of the test: 0.21–0.32 mm; thickness of ichthyolaroid part of the test: 0.06–0.08 mm; diameter of the last chamber: 0.35–0.46 mm.

Distribution. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Upper Middle to Upper Bathonian.

Genus *Ichthyolaria* WEDEKIND, 1937

Ichthyolaria nodosaria (TERQUEM, 1870)

pars 1870. *Frondicularia nodosaria,* TERQ.; TERQUEM, p. 217, pl. 22, fig. 25. non 26–30.
1886. *Frondicularia spatula,* TERQUEM; TERQUEM, p. 42, pl. 4, fig. 32.
1937. *Frondicularia nodosaria* TERQUEM, 1870; BARTENSTEIN and BRAND, p. 155, pl. 12A, fig. 6; pl. 13, fig. 14; pl. 15A, fig. 21.
pars 1941. *Frondicularia nodosaria* TERQUEM; FRENTZEN, p. 332, pl. 3, fig. 15, 16 non 17.
1960. *Frondicularia nodosaria* TERQUEM, 1870; KAPTARENKO-CHERNOUSOVA, p. 87, pl. 8, fig. 11.
1960. *Frondicularia nodosaria* TERQUEM 1870; LUTZE, p. 468, pl. 32, fig. 13.
pars 1971. *Lingulina nodosaria* (TERQUEM), 1870; WERNLI, p. 326, pl. 6, fig. 2, 4–8; non 1, 3.
1978. *Frondicularia nodosaria* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 49, pl. 13, fig. 29.
1981. *Lingulina nodosaria* (TERQUEM), 1870; BARNARD et al., p. 411, pl. 3, fig. 3, text-fig. 17.
1981. *Geinitzinita nodosaria* (TERQUEM, 1870); BIELECKA and STYK, p. 27, pl. 2, fig. 9.
1981. *Lingulina longiscata,* (TERQUEM); COLEMAN, p. 120, pl. 6.2.4, fig. 1.
1988. *Lingulina nodosaria* (TERQUEM, 1870); BIELECKA et al., p. 106, pl. 28, fig. 11.

Material. 5 specimens.

Description: Test uniserial, lanceolate, flattened; periphery rounded; oval proloculus followed by up to 10 chambers; chevron-shaped chambers gradually increase in size; sutures depressed, arched towards the aperture; aperture elongate-oval, terminal and produced on a short neck ; surface ornamented with dense, fine longitudinal striae, which do not continue from one chamber to the next.

Remarks. Specimens of TERQUEM on pl. 22. figs. 26–30 are Nodosaria-like forms. The figure of FRENTZEN (pl. 3, fig. 17) has too wide and low chambers. Specimens figured by WERNLI (1971) on plate 6, figures 1 and 3 have too wide chambers and smooth surface.

Dimensions. Height: 0.69–0.82 mm; largest diameter: 0.17–0.22 mm; thickness: 0.05–0.07 mm;

Distribution: Austria: upper part of the Lower Jurassic to Middle Jurassic; France: Upper Aalenian to Lower Oxfordian; Germany: Middle Jurassic; Poland: Upper Bajocian –Lower Callovian; S Poland: Bathonian; Ukraine: Upper Bajocian. Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian; Óbánya Valley: Upper Bathonian.

Ichthyolaria nympha KOPIK, 1969
Pl. III, Fig. 6.

1969. *Frondicularia (Ichthyolaria) nympha* sp. n.; KOPIK, p. 556, pl. 103, fig. 1–13, text-fig. 3a–c, 4a–d.
1978. *Frondicularia nympha* KOPIK, 1969; MUNK, p. 41, pl. 5, fig. 3; fig. 15.
1981. *Frondicularia nympha* KOPIK, 1969; COLEMAN, p. 118, pl. 6.2.3, fig. 4.
1982. *Frondicularia nympha* KOPIK; COLEMAN, pl. 2, fig. 13.
1988. *Frondicularia (Ichthyolaria) nympha* KOPIK, 1969; BIELECKA at al., p. 103, pl. 26, fig. 18.

Material. 28 specimens.
Description: Test uniserial, compressed; outline varies from elongated to oval; periphery rounded or sometimes keeled; oval in cross-section; 3 to 8 chevron-shaped chambers slowly increase in width; sutures thick and raised; aperture round, radiate, central, terminal and elevated on short neck; surface smooth.
Dimensions. Height: 0.25–0.52 mm; largest diameter: 0.16–0.19 mm; thickness: 0.05–0.065 mm.
Distribution. England: Upper Bajocian to Lower Bathonian; S Germany: Upper Bajocian to Lower Bathonian; Poland: Middle and Upper Kuiavian (Upper Bajocian- Lower Bathonian index fossil). Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower to lower part of the Upper Bathonian.

Ichthyolaria spatula (TERQUEM, 1886)
Pl. III, Fig. 7.

pars 1886. *Frondicularia spatula*, TERQUEM; TERQUEM, p. 42, pl. 4, fig. 31. non 32.

Material. 8 specimens.
Description. Test elongated and flattened; periphery rounded; oval in cross-section; proloculus globular; number of chevron-shaped chambers up to 10, which gradually increase in width; sutures distinct and depressed; aperture elongated oval and terminal; surface smooth.
Remarks. Specimen figured by TERQUEM (1886) on plate 4, figure 32 corresponds to *Ichthyolaria nodosaria* (TERQUEM, 1870).
Dimensions. Height: 0.48–0.63 mm; the largest breadth: 0.165–0.176 mm; thickness: 0.78–0.89 mm.
Distribution. S Poland: Bathonian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: upper part of Middle Bathonian.

Ichthyolaria serraticostata n. sp.
Pl. III, Fig. 8.

Derivatio nominis: serrati (Latin) to notched; costata (Latin) to ribbed.
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Upper Bathonian.

Holotype: Plate III, Figure 8.
Material. 2 specimens.
Diagnosis. Test elongated, flattened and consists of 6 to 8 chevron-shaped chambers. Surface ornamented by longitudinal serrated costae.
Description. Test elongated and flattened; periphery rounded; oval in cross-section; proloculus relatively small and globular; 6 to 8 chevron-shaped chambers, which first rapidly increase in size, later the size nearly uniform; sutures depressed; aperture an elongated-oval opening at the rounded end of the final chamber; surface covered by 18 to 20 longitudinal serrated costae.
Remarks. The test shape of this species is very close to that of *Ichthyolaria spatula* (TERQUEM, 1886), but differs in surface ornamentation.
Dimensions. Height: 0.45–0.48 mm; the largest breadth: 0.158–0.165 mm; thickness: 0.088--0.094 mm.
Distribution: Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian.

Ichthyolaria hidasi n. sp.
Pl. III, fig. 9.

Derivatio nominis: After Hidas, the type locality.
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Lower Bathonian.
Holotype: Plate III, Figure 9.
Material. 5 specimens.
Diagnosis. Test is pear-shaped, slightly flattened and consists of 6 to 8 chevron-shaped chambers, aperture produced on a neck, surface rugged.
Description. Test pear-shaped to ovoid; periphery rounded; broad oval in cross-section; proloculus globular; 6 to 8 chevron-shaped chambers, gradually increasing in size; sutures depressed and marked with irregular ribs; aperture small, oval and produced on a neck; surface rugged.
Remarks. The most characteristic feature of this species the pear-shaped test and the rugged surface.
Dimensions. Height: 0.48–0.57 mm; the largest breadth: 0.28–0.33 mm; thickness: 0.18--0.24 mm.
Distribution: Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower Bathonian.

Family Robuloididae REISS, 1963
Genus *Falsopalmula* BARTENSTEIN, 1948

Falsopalmula deslongchampsi (TERQUEM, 1863)
Pl. IV, Figs 8–9.

1863. *Flabellina Deslongchampsi* TERQ., TERQUEM, p. 216, pl. 10, fig. 13.
1870. *Flabellina liassica;* KÜBLER-ZWINGLI, p. 11, pl. 1, fig. Oberer Lias 10.
1928. *Flabellina deslongchampsi* TERQUEM; PAALZOW, p. 20, pl. 2, fig. 13–15.

1932. *Flabellina deslongchampsi* TERQUEM; PAALZOW, p. 132, pl. 9, fig. 26.
1936. *Flabellina deslongchampsi* TERQ.; FRANKE, p. 92, pl. 9, fig. 12.
1937. *Flabellina deslongchampsi* TERQUEM, 1964; BARTENSTEIN and BRAND, p. 168, pl. 6, fig. 28a–d; pl. 8, fig. 33a–b; pl. 10, fig. 29; pl. 11A, fig. 9; 11B, fig. 14; 12A, fig. 9.
1948. *Falsopalmula deslongchampsi* (TERQUEM, 1864); BARTENSTEIN, p. 130, pl. 1, fig. 6–7, pl. 2, fig. 10.
1960. *Falsopalmula deslongchampsi* (TERQUEM 1864); LUTZE, p. 464, pl. 32, fig. 5.
1971. *Falsopalmula deslongchampsi* (TERQUEM), 1864; WERNLI, p. 318, pl. 4, fig. 9, 13.
non 1978. *Citharinella deslongchampsi* (TERQUEM, 1863); PJATKOVA and PERMJAKOVA, p. 100, pl. 33, fig. 2.
1981. *Falsopalmula deslongchampsi* TERQUEM, 1863; COLEMAN, p. 118, pl. 6.2.3, fig. 1.
1982. *Falsopalmula deslongchampsi* (TERQUEM); COLEMAN, pl. 2, fig. 25.

Material. 23 specimens.

Description. Test large, elongate to quadrate leaf-shaped, strongly flattened; more or less depressed along the long axis of the test; periphery acute; initial planispiral portion consists of 4 to 7 chambers enveloped by later equitant, low, chevron-shaped chambers, which are 4 to 6 in number; sometimes the last chamber slightly inflated and bright; sutures distinct, often marked by low ribs; aperture oval and terminal; surface smooth.

Remarks. The apertural end of the specimen figured by PJATKOVA and PERMJAKOVA strongly differs from that of *F. deslongchampsi* (TERQUEM).

Dimensions. Height: 0.68–1.23 mm; breadth: 0.38–0.57 mm; thickness: 0.03–0.05-mm.

Distribution. England: upper part of the Lower Jurassic -- Bajocian; E France: Aalenian to Lower Oxfordian; NW Germany: upper part of the Lower Jurassic - to Lower Malm; S Germany: Bajocian to Callovian, Lower Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Lower and Upper Bathonian; Óbánya Valley: Lower Bathonian.

Falsopalmula jurensis (FRANKE, 1936)

Pl. IV, Fig. 10.

1936. *Flabellina jurensis* n. sp.; FRANKE, p. 92, pl. 9, fig. 13.

Material. 18 specimens.

Description. Test elongated rhomboid to oval in shape; strongly flattened; periphery acute; planispirally coiled initial part consists 4 to 5 chambers; the uncoiled portion consists of 6 to 9 low chevron-shaped chambers, which strongly sharpened towards the aperture; sutures depressed; aperture small and broad-oval; surface smooth.

Dimensions. Height: 0.65–1.13 mm; breadth: 0.21–0.42 mm; thickness: 0.032–0.049 mm.

Distribution. Germany: upper part of the Lower Jurassic. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Lower to Middle Bathonian; Óbánya Valley: Middle to Upper Bathonian.

Falsopalmula rugosa (D'ORBIGNY, 1840)
Pl. V, Fig. 1.

1840. *Flabellina rugosa* n. sp.; D'ORBIGNY, A.: Mémoire sur les foraminiféres de la craie blanche du bassin de Paris. Mém. Soc. Geol. France, Paris, tom. 4, no 1, p. 23. *fide* Catalogue ELLIS et MESSINA.
1860. *Flabellina rugosa,* D'O.; JONES and PARKER, p. 453, pl. 19, fig. 20–21.
1941. *Flabellina rugosa* D'ORBIGNY; FRENTZEN, p. 344, pl. 4, fig. 26–29.
1948. *Falsopalmula tenuistriata* (FRANKE, 1936); BARTENSTEIN, p. 125, pl. 1, figs 1–5.

Material. 1 specimen.
Description. Test elongated oval; flattened; periphery subrounded; initial part consists of 4 planispirally coiled chambers ; the uncoiled portion consists of 5 chevron-shaped chambers, which strongly sharpened towards the aperture; sutures depressed; aperture small and broad-oval at the end of the extention of the final chamber; surface rugose.
Remarks. This species differs from *F. tenuistriata* (FRANKE, 1936) in ornamentation of test-surface, which consists of longitudinal striae at the latter species.
Dimensions. Height: 0.71 mm; breadth: 0.30 mm; thickness: 0.036 mm.
Distribution. England: Jurassic?–Cretaceous?; France: Cretaceous; Germany: Middle Jurassic to lower part of the Upper Jurassic; Hungary, Mecsek Mts: Óbánya Valley: Middle Bathonian.

Superfamily Nodosariacea EHRENBERG, 1838
Family Nodosariidae EHRENBERG, 1838
Subfamily Nodosariinae EHRENBERG, 1838
Genus *Dentalina* RISSO, 1826

Dentalina apiculata nom. nov.
Pl. IV, Fig. 6.

non 1862. *Vaginulina jurensis* n. sp.; GÜMBEL, p. 220, pl. 3, fig. 14a–c.
jun. syn. 1870. *Dentalina jurensis,* TERQ.: TERQUEM, p. 260, pl. 27, fig. 6.
non 1870. *Dentalina jurensis,* TERQ.: TERQUEM, p. 260, pl. 27, fig. 7–15.
1886. *Dentalina oolithica,* TERQUEM; TERQUEM, p. 14 , pl. 1, fig. 39–40.
non 1955. *Dentalina jurensis* (GÜMBEL 1862); SEIBOLD, E. and I., p. 112, text-fig. 2; pl. 13, fig. 9.
non 1956. *Dentalina jurensis* (GÜMBEL 1862); SEIBOLD, E. and I., p. 131, text-fig. 5a–c. cum. syn.

Dervatio nominis: apiculata (Latin) = spine, after sharpened proloculus.
Material. 5 specimens.
Description. Test elongated and slender; round in cross-section; usually the first chamber is the largest, which elongated and strongly sharpened at the end; next 2 or 3 chambers elongated and nearly uniform in size; sutures depressed and slightly

oblique; aperture radial and peripheral at the tapered end of the final chamber; surface smooth.

Remarks. TERQUEM (1870) figured one specimens of this species together with other specimens (on pl. 27, fig. 7–15) which correspond to *D. goldfussana* (GÜMBEL, 1862).

Dimensions. Height: 0.44–0.55 mm; the largest diameter: 0.085–0.105 mm.

Distribution: S France: Middle Jurassic (Upper Bajocian). Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian.

Dentalina bicornis TERQUEM, 1870
Pl. III, Fig. 10.

pars 1870. *Dentalina bicornis,* TERQ.; TERQUEM, p. 268, pl. 29, fig. 13–15; non 16–17.
1937. *Dentalina bicornis* TERQUEM, 1870; BARTENSTEIN and BRAND, p. 138, pl. 10, fig. 17a–c; pl. 15A, fig. 8.
1973. *Dentalina bicornis* TERQUEM, 1870; RUGET, p. 533, pl. 7, fig. 6–7.
1978. *Dentalina bicornis* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 90, pl. 30, fig. 9.

Material. 3 specimens.

Description. Test elongated, straight or sickle-shaped; periphery rounded; oval in cross-section; test consists of 4 to 6 chambers, nearly uniform in wide; first and final chambers elongated and sharpened; sutures oblique and flush, except the suture of the last chamber; aperture terminal and radiate; surface smooth.

Remarks. Specimens figured by TERQUEM (1870) on pl. 29, figs. 16–17 have strongly different shape from that of the other forms (figs 13–15).

Dimensions. Height: 0.79–0.93 mm; diameter: 0.18–0.24 mm.

Distribution. S France: Middle Jurassic; NW Germany: Middle Jurassic- lower part of the Upper Jurassic; Portugal: Middle Bathonian; Ukraine: Lower Aalenian. Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian.

Dentalina buccinea n. sp.
Pl. IV, Figs 2–3.

Derivatio nominis: buccinea (Latin) to inflated.
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Lower Bathonian.
Holotype: Plate IV, Figure 2.
Paratype: Plate IV, Figure 3.
Material. 5 specimens.

Diagnosis. Test ovoid, 4 to 6 low and broad chambers, sutures indistinct, aperture radial and protruding, surface smooth.

Description. Test oviform; round to slightly oval in cross-section; periphery rounded; 4 to 6 chambers broad and low, except the final chamber which hemisperical; sutures indistinct, nearly horizontal; aperture radial and protruding on a short neck and somewhat peripheral; surface smooth.

Remarks. The distinctive feature of this species is the ovoid test shape.
Dimensions. Height: 0.58–0.67 mm; the largest diameter: 0.35–0.39 mm. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian.

Dentalina goldfussana (GÜMBEL, 1862)
Pl. IV, Fig. 4.

1862. *Dentalina Goldfussana* n. sp.; GÜMBEL, p. 218, pl. 3, fig. 11a–b.
1955. *Dentalina goldfussana* (GÜMBEL 1862); SEIBOLD, E. and I., p. 111, text-fig. 2m; pl. 13, fig. 16–17.
1973. *Dentalina goldfussana* (GUMBEL 1862); RUGET, p. 534, pl. 7, fig. 10.

Material. 7 specimens.
Description. Test elongated, usually curved; round in cross-section; periphery rounded; proloculus spherical; 4 to 6 chambers gradually increasing in size and nearly spherical except the last chamber, which is elongated; sutures depressed and more or less horizontal; aperture radial and terminal; wall smooth.
Dimensions. Height: 0.36–0.45 mm; the largest diameter: 0.11–0.14 mm.
Distribution. NW Germany: lower part of the Upper Jurassic; Portugal: Middle Bathonian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower to lower part of the Middle Bathonian.

Dentalina jurensis (GÜMBEL, 1862)
Pl. IV, Fig. 5.

1862. *Vaginulina jurensis* n. sp.; GÜMBEL, p. 220, pl. 3, fig. 14a–c.
1865. *Dentalina Gümbeli* m.; SCHWAGER, p. 101, pl. 2, fig. 20.
non 1870. *Dentalina jurensis,* TERQ.: TERQUEM, p. 260, pl. 27, fig. 6–15
1955. *Dentalina jurensis* (GÜMBEL 1862); SEIBOLD, E. and I., p. 112, text-fig. 2; pl. 13, fig. 9.
1956. *Dentalina jurensis* (GÜMBEL 1862); SEIBOLD, E. and I., p. 131, text-fig. 5a–c. cum. syn.
1966. *Dentalina guembeli* (SCHWAGER); GORDON, p. 327, pl. 2, fig. 1–4.
1967. *Dentalina guembeli* (SCHWAGER); GORDON, p. 453, pl. 4, fig. 1–2.

Material. 22 specimens.
Description. Test is uniserial, curved or straight, slender; periphery rounded; 8 to 10 chambers slightly inflated or flush; chambers first gradually increase in size, later nearly uniform in diameter; the first 3 to 5 chambers are nodosarine in shape, being round in cross-section with transverse sutures; later sutures are usually diagonal; sutures slightly depressed; aperture radial and peripheral; surface smooth.
Remarks. *Dentalina jurensis* TERQUEM corresponds to *Dentalina apiculata* nom. nov. (see above).
Dimensions. Height: 0.86–1.25 mm; the largest diameter: 0.132–0.165 mm.
Distribution. England: Oxfordian; NW Germany: lower part of the Upper Jurassic; Scotland: Callovian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Óbánya Valley: Lower Bathonian.

Dentalina oolithica (TERQUEM, 1870)

Pl. IV, Fig. 7.

1870. *Dentalina oolithica*, TERQ.; TERQUEM, p. 264 , pl. 28, fig. 5–15.

pars 1886. *Dentalina oolithica*, TERQUEM; TERQUEM, p. 14 , pl. 1, fig. 38; non 39–40.

1960. *Dentalina oolithica* TERQUEM, 1870; KAPTARENKO-CHERNOUSOVA, p. 48, pl. 3, fig. 10.

1978. *Dentalina oolithica* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 93, pl. 31, fig. 3.

1973. *Dentalina oolithica* TERQUEM, 1870; RUGET, p. 535, pl. 8, fig. 4.

Material. More than 50 specimens.

Description. Test relatively large, elongated; dorsal side lobulate, ventral side more or less plane; nearly circular in cross-section; 4 to 6 elongated chambers rapidly increase in size; sutures oblique and depressed; aperture radial and peripheral; surface smooth.

Remarks. Specimens figured by TERQUEM on pl. 1, figs. 39–40 have straight sutures.

Dimensions. Height: 0.87–1.55 mm; the largest diameter: 0.28–0.34 mm.

Distribution. S France: Middle Jurassic; Portugal: Middle Bathonian; Ukraine: Middle Callovian.

Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Dentalina pseudocommunis FRANKE, 1936

Pl. IV, Fig. 1.

1890. *Dentalina communis*, D'ORBIGNY; HAEUSLER, p. 99, pl. 13, fig. 97, 100, 108; pl. 14, fig. 24.

1890. *Dentalina communis* D'ORBIGNY; WISNIOWSKI, p. 201, pl. 1, fig. 35–36.

1928. *Dentalina communis* D'ORB.; PAALZOW, p. 17, pl. 2, fig. 8.

1932. *Dentalina communis* D'ORBIGNY; PAALZOW, p. 116, pl. 8, fig. 7.

1936. *Dentalina pseudocommunis* n. sp.; FRANKE, p. 30, pl. 2, fig. 20a–b.

1937. *Dentalina communis* D'ORBIGNY, 1826; BARTENSTEIN and BRAND, p. 136, pl. 1A, fig. 6; pl. 1B, fig. 14, 15; pl. 2A, fig. 5; pl. 2B, fig. 9, 10; pl. 3, fig. 8; pl. 4, fig. 23a–b; pl. 5, fig. 13; pl. 6, fig. 10.

1954. *Dentalina communis* (D'ORB.); BIELECKA and POZARYSKI, p. 188, pl. 9, fig. 42a–b.

1960. *Dentalina communis* D'ORBIGNY, 1826; KAPTARENKO-CHERNOUSOVA, p. 52, pl. 4, fig. 3–4.

1978. *Dentalina communis* (D'ORBIGNY, 1826); MUNK, p. 40, pl. 2, fig. 4, 6.

1978. *Dentalina pseudocommunis* FRANKE, 1936; PJATKOVA and PERMJAKOVA, p. 91, pl. 31, fig. 7.

1981. *Dentalina pseudocommunis* FRANKE, 1936; BARNARD et al., p. 406, pl. 2, fig. 2.

1981. *Dentalina communis* D'ORBIGNY, 1826; COLEMAN, p. 116, pl. 6.2.2, fig. 5.

Material. More than 450 specimens.

Description: Test uniserial, elongated; circular to slightly oval in cross section; proloculus ovate; 7 to 8 chambers gradually increasing in size, giving slender, gently flaried outline; the height of chambers are usually larger than the wide; end of the last chamber narrowed; suture slightly oblique, usually indistinct at first, later depressed; aperture radial and terminal; surface smooth.

Dimensions. Height: 0.51–0.92 mm; the largest diameter: 0.19–0.27 mm.

Distribution. England: Hettangian to Kimmeridgian; NW Germany: Lower Jurassic to lower part of the Upper Jurassic; S Germany: Upper Bajocian, Lower Oxfordian; Poland: Lower Jurassic; Central Poland: Kimmeridgian; Switzerland: Oxfordian; Ukraine: Aalenian –Bajocian, Callovian.

Common in Bajocian to Bathonian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Genus *Nodosaria* LAMARCK, 1812

Nodosaria cf. *costata* (BORNEMANN, 1854)
Pl. V, Fig. 2.

1936. *Nodosaria* cf. *costata* (BORN.); FRANKE, p. 50, pl. 4, fig. 24a–b.

Material. 4 specimens.

Description. Test uniserial, consists of 3 chambers; proloculus conical in shape; later chambers nearly globular; suture between the proloculus and the next chamber indistinct, the later sutures distinct and depressed; aperture small, round and produced on a neck; surface ornamented by 6 longitudinal costae.

Remarks. The holotype specimen of BORNEMANN (1854) differs from our material in larger number of chambers (5), in indistinct sutures, in absence of protruding neck and in more (7 to 9) longitudinal costae.

Dimensions. Height: 0.28–0.35 mm; the largest diameter: 0.12–0.14 mm.

Distribution. Germany: upper part of the Lower Jurassic. Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian; Óbánya Valley: Lower Bathonian.

Nodosaria ? cf. *cuneiformis* (TERQUEM, 1870)
Pl. V, Fig. 3.

1870. *Dentalina cuneiformis*, TERQ.; TERQUEM, p. 257, pl. 26, fig. 24–25; p. 259, pl. 27, fig. 4.

non 1875. *Dentalina cuneiformis*, TERQ. et BERTH.; TERQUEM et BERTHELIN, p. 27, pl. 2, fig. 6a–c.

Material. 2 none complete specimens.

Description. Test incomplete, consists of one large chamber, which is elongated and tapering at both end; round in cross-section; aperture unknown; surface covered by numerous longitudinal striae.

Remarks. Specimens figured in TERQUEM & BERTHELIN (1875) differ from *D. cuneiformis* in having smmoth surface and numerous chambers.

Dimensions. Height: 0.488–0.525 mm; the largest diameter: 0.149–0.166 mm.

Distribution. S France: Upper Bajocian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian.

Nodosaria fontinensis TERQUEM, 1870
Pl. V, Fig. 4.

pars 1870. *Nodosaria fontinensis,* TERQ.; TERQUEM, p. 251, pl. 26, fig. 1–4. non 5.
1886. *Nodosaria fontinensis,* TERQUEM; TERQUEM, p. 11, pl. 1, fig. 22–24.
1928. *Nodosaria fontinensis* TERQUEM; PAALZOW, p. 16, pl. 2, fig. 3.
1936. *Nodosaria fontinensis* TERQ.; FRANKE, p. 50, pl. 5, fig. 1.
1937. *Nodosaria fontinensis* TERQUEM, 1870; BARTENSTEIN and BRAND, p. 148, pl. 6, fig. 24, pl. 8, fig. 16a–c; pl. 10, fig. 19a–b; pl. 11B, fig. 6a–b; pl. 12A, fig. 4; pl. 12B, fig. 5; pl. 13, fig. 9a–c; pl. 14B, fig. 3; pl. 14C, fig. 5; pl. 15A, fig. 12a–c; pl. 15C, fig. 4.
1960. *Nodosaria fontinensis* TERQUEM, 1870; KAPTARENKO-CHERNOUSOVA, p. 33, pl. 2, fig. 2–5.
non 1978. *Nodosaria fontinensis* TERQUEM, 1870; MUNK, p. 39, pl. 1, fig. 5.
1978. *Nodosaria fontinensis* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 37, pl. 11, fig. 3.

Material. More than 60, partly incomplete specimens.

Description. Test uniserial, elongated; round in cross-section;

proloculus large and spherical; 4 to 6 globular chambers nearly uniform in size; sutures more or less depressed and distinct; aperture small and round; surface ornamented by 8 to 9 longitudinal costae.

Remarks. Specimen figured by Terquem (1870) on pl. 26, fig. 5 differs from *N. fontinensis* in deeper sutures. Specimen in MUNK (1978) corresponds to *N. mutabilis* TERQUEM.

Dimensions. Height of chambers: 0.16–0.18 mm; diameter of chambers: 0.18–0.20-mm.

Distribution. France: Middle Jurassic; Germany: Lower Jurassic to Oxfordian; Russia: Toarcian; Ukraine: Bajocian, Callovian to Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Nodosaria lagenoides WISNIOWSKI, 1890
Pl. V, Fig. 5.

1890. *Nodosaria lagenoides* mihi; WISNIOWSKI, p. 194, pl. 1, fig. 25.
1928. *Nodosaria mutabilis* TERQUEM; PAALZOW, p. 16, pl. 2, fig. 1.
1932. *Lagena nodosaroides* nov. spec; PAALZOW, p. 133, pl. 9, fig. 29.
1932. *Lagena polygona* nov. spec; PAALZOW, p. 133, pl. 9, fig. 27.
1941. *Lagena nodosaroides,* PAALZOW; FRENTZEN, p. 342, pl. 4, fig. 10–13.
1960. *Lagena nodosaroides* PAALZOW 1932; SEIBOLD, E. and I., p. 369, text–fig. 7b.

1978. *Nodosaria lagenoides* WISNIOWSKI, 1890; MUNK, p. 39, pl. 1, fig. 7.
1978. *Nodosaria fontinensis* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 37, pl. 11, fig. 6.
1988. *Nodosaria lagenoides* WISNIOWSKI, 1890; BIELECKA, p. 226, pl. 83, fig. 9, 16.

Material. 7 specimens.

Description. Test consists of 3 chambers; the first chamber appears as a low ring, which is significantly narrower than the next one; second chamber large and slightly elongated ovoid or nearly globular; third chamber low cone, narrowing upwards; the last chamber small and tubular; sutures distinct and depressed; aperture small and circular; surface ornamented by 16 to 20 longitudinal striae, only a part of which follows to the younger chambers.

Remarks. According to MUNK (1978) the ring is the first chamber.

Dimensions. Height: 0.29–0.38 mm; the largest diameter of globular chamber: 0.22–0.25 mm.

Distribution. S Germany: Upper Bajocian, Callovian, Lower Oxfordian; Poland: Lower to Middle Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian; Óbánya Valley: Lower Bathonian.

Nodosaria mutabilis TERQUEM, 1870
Pl. V, Fig. 6.

pars 1870. *Nodosaria mutabilis* TERQUEM; TERQUEM, p. 251 pl. 26, fig. 6–8. non 9–12.
1876. *Nodosaria mutabilis* TERQUEM; TERQUEM, p. 481 pl. 15, fig. 3.
1886. *Nodosaria mutabilis* TERQUEM; TERQUEM, p. 11 pl. 1, fig. 21.
pars 1928. *Nodosaria mutabilis* TERQUEM; PAALZOW, p. 16, pl. 2, fig. 2.; non pl. 2, fig. 1.
1932. *Nodosaria mutabilis* TERQUEM; PAALZOW, p. 123, pl. 9, fig. 3.
1936. *Nodosaria mutabilis* TERQ.; FRANKE, p. 51, pl. 5, fig. 2a–b.
1937. *Nodosaria mutabilis* TERQUEM; BARTENSTEIN and BRAND, p. 148, pl. 2B, fig. 16, pl. 3, fig. 20; pl. 5, fig. 23; pl. 11B, fig. 7a–b; pl. 14A, fig. 2a–b; pl. 15A, fig. 13a–c; pl. 15C, fig. 5.
1960. *Nodosaria mutabilis* TERQUEM, 1870; KAPTARENKO-CHERNOUSOVA, p. 35, pl. 2, fig. 10–12.
1960. *Nodosaria mutabilis* TERQUEM 1870; LUTZE, p. 475, pl. 28, fig. 21–22.
1967. *Nodosaria mutabilis* TERQUEM; GORDON, p. 543, pl. 4, fig. 5.
1978. *Nodosaria fontinensis* TERQUEM, 1870; MUNK, p. 39, pl. 1, fig. 5.
pars 1978. *Nodosaria fontinensis* TERQUEM, 1870; PJATKOVA and PERMJAKOVA, p. 37, pl. 11, fig. 5, non. 6.
1981. *Nodosaria mutabilis* TERQUEM, 1870; BIELECKA and STYK, p. 24, pl. 1, fig. 26.

Material. 23 specimens.

Description: Test elongated, consists of 3 to 5 chambers; the first chamber globular and large, usually the largest chamber; second chamber smaller than the previous one; later chambers uniform or slowly enlarging in size; sutures strongly depressed; aperture small and round; surface covered by longitudinal 8 costae.

Remarks. Specimens figured by TERQUEM (1870) on pl. 26, figs. 9–12, by PAALZOW (1928) on pl. 2, fig. 1, and PJATKOVA and PERMJAKOVA (1978) on pl. 11, fig. 6 have only two or three chambers, which strongly differ in size.

Dimensions. Height of 4 chambers specimens: 0.41–0.66 mm; the largest diameter: 0.12–0.19 mm.

Distribution. S France: Upper Bajocian, Bathonian; German Basin: Upper Bajocian to Lower Oxfordian. NW Germany: Late Aalenian–Upper Callovian; S Poland: Bathonian; Central Poland: Upper Bajocian to Callovian; Russia: Toarcian; Scotland: Callovian; Ukraine: Middle and Upper Callovian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Nodosaria oculina (TERQUEM et BERTHELIN, 1875)
Pl. V, Fig. 7.

1875. *Dentalina oculina,* TERQ. et BERTH.; TERQUEM and BERTHELIN, p. 31, pl. 2, fig. 20a–c.

1936. *Nodosaria oculina* (TERQ. et BERTH.); FRANKE, p. 49, pl. 4, fig. 21.

Material. 2 specimens.

Description. Test elongated, straight; round in cross-section; 3 to 4 chambers, which are wider than high; initial and final chambers conical; sutures horizontal and indistinct; aperture small, round on a short protuberance; surface covered by 8 longitudinal parallel costae.

Dimensions. Height: 0.56–0.59 mm; the largest diameter: 0.155–0.165 mm.

Distribution. S France: Upper Bajocian; Germany: Lower Jurassic. Hungary, Mecsek Mts: Óbánya Valley: Lower Bathonian.

Nodosaria plicatilis WISNIOWSKI, 1890
Pl. V, Fig. 8.

1890. *Nodosaria plicatilis* mihi; WISNIOWSKI, p. 194, pl. 1, fig. 16.

1928. *Nodosaria plicatilis* WISNIOWSKY; PAALZOW, p. 16, pl. 2, fig. 4.

1937. *Nodosaria plicatilis* WISNIOWSKI, 1890; BARTENSTEIN and BRAND, p. 149, pl. 15A, fig. 14.

1978. *Nodosaria plicatilis* WISNIOWSKI, 1890; MUNK, p. 39, pl. 1, fig. 6.

1981. *Nodosaria plicatilis* WISNIOWSKI, 1890; BIELECKA and STYK, p. 24, pl. 1, fig. 27.

1988. *Nodosaria plicatilis* WISNIOWSKI, 1890; BIELECKA et al. p. 100, Pl. 26, fig. 1, 2.

Material. 2 specimens.

Description. Test elongated, slim; consists of 5 to 7 strongly elongated-oval chambers; proloculus globular; low and relatively broad constrictions are between the chambers; aperture round; surface ornamented by 9 to 11 longitudinal costae.

Dimensions. Height: 0.91–0.96 mm; the largest diameter: 0.175–0.180 mm.

Distribution. England: Bathonian; NW Germany: Callovian; S Germany: Late Bajocian to Lower Oxfordian; Poland: Bathonian to Middle Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian.

Nodosaria raphanistriformis (GÜMBEL, 1862)
Pl. V, Fig. 9.

1862. *Dentalina raphinistriformis* n. sp.; GÜMBEL, p. 219, pl. 3, 12a–b.
1955. *Nodosaria raphanistriformis* (GÜMBEL 1862); SEIBOLD, E. and I., p. 117, text-fig. 5a; pl. 12, fig. 18.
1960. *Nodosaria raphanistriformis* (GÜMBEL 1862); LUTZE, p. 474, pl. 28, fig. 18.
1973. *Nodosaria corallina* GUMBEL, 1812; RUGET, p. 536, pl. 8, fig. 3.
1989. *Nodosaria raphanistriformis* (GÜMBEL); RIEGRAF and LUTERBACHER, p. 1028, pl. 3, fig. 3.

Material. 7 specimens.
Description. Test uniserial, straight or slightly curved; round in cross-section; 4 to 6 low and broad chambers slowly increasing in size; sutures depressed; aperture terminal, small and round; surface covered by 20 to 22 longitudinal costae.
Dimensions. Height of specimens, containing 4 chambers: 0.69–0.73 mm; the largest diameter: 0.255–0.280 mm.
Distribution. NW Germany: Upper Callovian, Oxfordian; Portugal: Bathonian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower and Middle Bathonian.

Nodosaria tornata SCHWAGER, 1865
Pl. VI, Fig. 1.

1865. *Nodosaria tornata* m.; SCHWAGER, p. 96, pl. 2, fig. 9.
1956. *Nodosaria tornata* SCHWAGER 1865; SEIBOLD, E. and I., p. 147, text-fig. 6h.

Material. 7 specimens.
Description. Test consists of 3 chambers; circular in cross-section; the first chamber relatively large and elongated, the next chambers somewhat smaller and nearly globular; the last chamber is the largest and strongly elongated; sutures distinct and depressed; aperture small, round; surface smooth.
Dimensions. Height: 0.57–0.61 mm; the largest diameter: 0.15–0.17 mm.
Distribution. S Germany: Lower Oxfordian. Hungary, Mecsek Mts: Óbánya Valley: Lower Bathonian.

Nodosaria turbiformis SCHWAGER, 1865
Pl. VI, Figs 2–3.

1865. *Nodosaria turbiformis* m.; SCHWAGER, p. 98, pl. 2, fig. 13.
1956. *Nodosaria turbiformis* SCHWAGER 1865; SEIBOLD, E. and I., p. 136, text-fig. 3f.
1960. *Nodosaria turbiformis* SCHWAGER 1865; LUTZE, p. 475, pl. 28, fig. 19.
1978. *Nodosaria turbiformis* SCHWAGER, 1865; MUNK, p. 40, pl. 9a–b.

Material. 5 specimens.

Description. Test consists of 4 chambers, uniserial; circular in cross-section; the first chamber appeared as a low ring, which is significantly narrower than the next one; the later two essentially larger broad-oval chambers gradually increasing in size; the final chamber small and sharpened; sutures distinct and strongly depressed; aperture small and circular; surface covered by 8 to 9 longitudinal costae.

Remarks. SCHWAGER (1865) described and figured specimens with 18 to 24 striae. In my material and in SEIBOLD's (1956) only 8 to 9 costae appeared on these forms. According to MUNK (1978) the ring is the first chamber.

Dimensions. Height: 0.47–0.51 mm; the largest diameter: 0.17–0.21 mm.

Distribution. S Germany: Upper Bajocian -- Lower Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Upper Bathonian; Óbánya Valley: Lower Bathonian.

Nodosaria sp.
Pl. VI, Fig. 4.

Material. 9 specimens, all incomplete.

Description. Test elongated and straight; round in cross-section; initial chamber unknown; 3 to 4 broad-oval chambers gradually increasing in size; sutures depressed; aperture unknown; surface smooth.

Dimensions. Height: 0.46–0.51 mm; the largest diameter: 0.11–0.14 mm.

Distribution. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Óbánya Valley: Lower Bathonian.

Genus *Pseudonodosaria* BOOMGAART, 1949

Pseudonodosaria humilis (ROEMER, 1841)
Pl. VI, Fig. 5.

1841. *Nodosaria humilis* n. sp.; ROEMER, F. A.: Die Versteinerungen des norddeutschen Kreidegebirges. Hannover, p. 95, pl. 15, fig. 6. *fide* Catalogue ELLIS et MESSINA.

1860. *Nodosaria humilis,* ROEM.; JONES and PARKER, p. 453, pl. 19, fig. 6.

1876. *Glandulina bajociana,* TERQUEM; TERQUEM, p. 482, pl. 15, fig. 4, 8.

1937. *Pseudoglandulina vulgata* (ROEMER, 1841); BARTENSTEIN and BRAND, p. 150. pl. 8, fig. 18.

1960. *Rectoglandulina humilis* (ROEMER 1841); LUTZE, p. 481, pl. 29, fig. 8–9, text-fig. 16.

Material. More than 90 specimens.

Description. Test spindle-shaped; round in cross-section; 4 to 6 broad chambers gradually increasing in size; the final chamber cone-shaped; sutures indistinct and flush; aperture small, round at the tapering end of the final chamber; surface smooth.

Dimensions. Height: 0.54–0.85 mm; the largest diameter: 0.21–0.36 mm.

Remarks. *Glandulina bajociana* TERQUEM (1876) is similar to *P. humilis* (ROEMER).

Distribution. England: Jurassic; S France: Upper Bajocian; NW Germany: Lower Jurassic to Cretaceous.

Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Lower to lower part of Upper Bathonian.

Pseudonodosaria tenuis (BORNEMANN, 1854)
Pl. VI, Fig. 6.

1854. *Glandulina tenuis* m.; BORNEMANN, p. 31, pl. 2, fig. 3a–b.
1865. *Glandulina immutabilis* m.; SCHWAGER, p. 57, pl. 4, fig. 13–14.
1886. *Glandulina obtusa* TERQUEM; TERQUEM, p. 10, pl. 1, fig. 18.
1936. *Glandulina tenuis* BORN.; FRANKE, p. 55, pl. 5, fig. 13a–b.
1937. *Pseudoglandulina tenuis* (BORNEMANN, 1854); BARTENSTEIN and BRAND, p. 150. pl. 4, fig. 41, pl. 6, fig. 16; pl. 8, fig. 19; pl. 15A, fig. 15.
1954. *Pseudoglandulina tenuis* (BORN.); BIELECKA and POZARYSKI, p. 191, pl. 9, fig. 46a–b.
1960. *Rectoglandulina* cf. *tenuis* (BORNEMANN 1854); LUTZE, p. 481, pl. 29, fig. 3, text-fig. 16.
1978. *Pseudonodosaria tenuis* (BORNEMANN, 1854); MUNK, p. 50, pl. 1, fig. 1.
1978. *Pseudonodosaria tenuis* (BORNEMANN, 1854); PJATKOVA and PERMJAKOVA, p. 43, pl. 13, fig. 5.

Material. 5 specimens.

Description. Test elongated, skittle-shaped; round to broad-oval in cross-section; proloculus elongated and narrow, following by 4 to 6 chambers, slowly increasing in size; before the last chamber often appeared a smaller one; the last chamber conical; sutures distinct, horizontal and depressed; aperture round and terminal; surface smooth.

Dimensions. Height: 0.56–0.68 mm; the largest diameter: 0.18–0.22 mm.

Distribution. NW Germany: Lower Jurassic to Oxfordian; S Germany: upper part of the Lower Jurassic to Middle Jurassic; Central Poland: Lower Tithonian; S Poland: Bathonian; S Poland: Bathonian; Ukraine: Callovian. Hungary, Mecsek Mts: Óbánya Valley: Lower Bathonian.

Pseudonodosaria vulgata (BORNEMANN, 1854)
Pl. VI, Fig. 7.

1854. *Glandulina rotundata* m. corrected in Errata to *G. vulgata;* BORNEMANN, p. 31, pl 2, fig. 1a–b, 2.
1890. *Glandulina laevigata* D'ORBIGNY; HAEUSLER, p. 91, pl. 13, fig. 61–64, 66–67; pl. 14, fig. 2.
1936. *Glandulina vulgata* BORN.; FRANKE, p. 54, pl. 5, fig. 9a–b.
1956. *Pseudonodosaria vulgata* (BORNEMANN 1854); SEIBOLD, E. and I., p. 139, text-fig. 6m-n, r–t.
1960. *Rectoglandulina vulgata* (BORNEMANN 1854); LUTZE, p. 480, pl. 29, fig. 4–7, text-fig. 16.
1967. *Pseudonodosaria vulgata* (BORNEMANN); GORDON, p. 454, pl. 4, figs 7–8.

1978. *Pseudonodosaria vulgata* (BORNEMANN, 1854); PJATKOVA and PERMJAKOVA, p. 44, pl. 13, fig. 8.
1981. *Pseudonodosaria vulgata* (BORNEMANN, 1854); BIELECKA and STYK, p. 32, pl. 3, fig. 13.
1981. *Pseudonodosaria vulgata* (BORNEMANN), 1854; BARNARD et al., p. 410, pl. 3, fig. 9, 11.

Material. 15 specimens.
Description. Test large, pupa-shaped to skittle-shaped; round in cross-section; the first 3 chambers gradually increasing in size, the next 1 to 3 chambers nearly uniform in wide; last chamber onion-shaped; sutures depressed; aperture small, round and terminal; surface smooth.
Dimensions. Height: 0.56–1.22 mm; the largest diameter: 0.21–0.27 mm.
Distribution. England: Middle Callovian to Lower Oxfordian; France: Kimmeridgian; Germany: Lower Jurassic to Lower Oxfordian; Poland: Bathonian to Lower Oxfordian; Scotland: Callovian; Switzerland: Callovian to Lower Oxfordian; Ukraine: Callovian. Hungary, Mecsek Mts: Hidas Valley: Middle Bathonian; Óbánya Valley: Bathonian.

Family Vaginulinidae REUSS, 1860
Subfamily Lenticulininae CHAPMAN, PARR and COLLINS, 1934
Genus *Lenticulina* LAMARCK, 1804

Lenticulina biexcavata (MJATLIUK, 1939)
Pl. VI, Figs 8–9.

1939. *Cristellaria biexcavata* n. sp.; MJATLIUK, E. V.: Foraminifera from the Upper Jurasssic and Lower Cretaceous deposits of the Middle Volga region and Oschchyi Syst. Neftainyi geologo-razvedochnyi Institut, Trudy Ser. A. fasc. 120, p. 72, pl. 4, figs 41–42. *fide* Catalogue ELLIS et MESSINA.
1978. *Lenticulina biexcavata* (MJATLIUK, 1939); PJATKOVA and PERMJAKOVA, p. 52, pl. 14, fig. 11.

Material. 27 specimens.
Description. Test planispirally coiled; slightly flattened; periphery acute; 8 to 10 chambers on the last whorl, which slowly increases in size; sutures straight, radial and depressed; umbilicus depressed; aperture small, slit-like, peripheral and slightly produced; surface smooth.
Dimensions. Diameter: 0.39–0.56 mm; thickness: 0.12–0.14 mm.
Distribution. Ukraine: Upper Bajocian. Hungary, Mecsek Mts: Hidas Valley: Upper Bathonian; Óbánya Valley: Lower to Middle Bathonian.

Lenticulina cultrata (MONTFORT, 1808)
Pl. VII, Figs 1–2.

1890. *Cristellaria cultrata,* MONTFORT; HAEUSLER, p. 114, pl. 15, fig. 4–5, 11.

1937. *Cristellaria (Lenticulina) cultrata* (MONTFORT, 1808); BARTENSTEIN and BRAND, p. 175, pl. 9, fig. 51; pl. 11B, fig. 20a–b; pl. 12A, fig. 17a–c; pl. 13, fig. 37; pl. 14B, fig. 15.

Material. 16 specimens.

Description. Test planispirally coiled; lenticular in shape; periphery keeled; 8 to 10 chambers on the last whorl, which slowly enlarges in size; sometimes the last 1 or 2 chambers uncoiled; sutures slightly curved, radial and somewhat depressed; umbilicus elevated; aperture small, radial and peripheral; surface smooth.

Dimensions. Diameter: 0.43–0.51 mm; thickness: 0.19–0.22 mm.

Distribution. NW Germany: Middle Jurassic; S Germany: Lower Jurassic-Malm; Switzerland: Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower Bathonian.

Lenticulina muensteri (ROEMER, 1839)
Pl. VII, Fig. 6.

1863. *Cristellaria Münsteri* RÖM. sp.; REUSS, p. 77, pl. 9, fig. 3–4.

1886. *Cristellaria mamillaris* TERQUEM; TERQUEM, p. 37, pl. 4, fig. 1–3.

1928. *Lenticulina münsteri* RÖMER; PAALZOW, p. 29, pl. 3, fig. 16.

1932. *Lenticulina münsteri* RÖMER; PAALZOW, p. 101, pl. 5, fig. 23–24; pl. 6, fig. 1–2.

pars 1937. *Cristellaria (Lenticulina) münsteri* (ROEMER, 1839); BARTENSTEIN and BRAND, p. 174, pl. 6, fig. 34a–b; pl. 9, fig. 49a–e; pl. 10, fig. 38a–b; pl. 11A, fig. 13a–d; pl. 11B, fig. 19a–d; pl. 12A, fig. 16a–b; pl. 12B, fig. 15a–e; pl. 13, fig. 36; pl. 14B, fig. 14a–c; pl. 14C, fig. 13a–b. pl. 15A, fig. 34a–c. pl. 15C, fig. 19a–c. non pl. 3, fig. 30a–b; pl. 4, fig. 69a–b to *Lenticulina gottingensis* (BORNEMANN, 1854).

1954. *Lenticulina münsteri* (ROEM.); BIELECKA and POZARYSKI, p. 165, pl. 4, fig. 12a–b.

1955. *Lenticulina (Lenticulina) münsteri* (ROEMER 1839); SEIBOLD, E. and I., p. 104, text-fig. 4a–c.

1956. *Lenticulina (Lenticulina) münsteri* (ROEMER 1839); SEIBOLD, E. and I., p. 109, text-fig. 4a–b, 5q–r. cum. syn.

1966. *Lenticulina muensteri* (ROEMER); GORDON, p. 326, pl. 1, fig. 6–13.

1967. *Lenticulina muensteri* (ROEMER); GORDON, p. 451, pl. 4, fig. 4, 12–14.

1971. *Lenticulina münsteri* (ROEMER), 1839; WERNLI, p. 321, pl. 4, fig. 29.

1973. *Lenticulina munsteri* (ROEMER, 1839); RUGET, p. 517, pl. 1, fig. 5.

1975. *Lenticulina muensteri* (ROEMER, 1839); JENDRYKA-FUGLEWICZ, p. 149, pl. 8–10; pl. 11, fig. 1–6; pl. 19; pl. 20, fig. 1–2.

1978. *Lenticulina muensteri* (ROEMER, 1839); MUNK, p. 42, pl. 2, fig. 4; fig. 19.

1978. *Lenticulina muensteri* (ROEMER, 1839); PJATKOVA and PERMJAKOVA, p. 58, pl. 19, fig. 1.

1981. *Lenticulina muensteri* (ROEMER); BARNARD, p. 413, pl. 2, fig. 20–21.

1986. *Lenticulina muensteri* (ROEMER, 1839); STAM, p. 122, pl. 5, fig. 7–8.

Material. More than 1800 specimens.

Description. Test planispirally coiled, lenticular in shape; periphery more or less subacute; numerous chambers arrange in involute planispiral, 2 to 3 whorls; 8 to 12 chambers can be seen on the last whorl; chambers broad, low and slowly increasing in size; the last chambers may be uncoiled; sutures flush and radial, sometimes the last sutures slightly depressed; in the umbilicus may be an umbilical boss or plug; aperture radial and peripheral; surface smooth.

Variability. Degree of the inflations of the chambers varies. Umbilical plug or boss may be present or absent.

Remarks. JENDRYKA-FUGLEWICZ (1975) dealt with this species in detail.

Dimensions. Diameter: 0.48–1.12 mm; thickness: 0.20–0.42 mm.

Distribution. England: Middle and Upper Jurassic; E France: Aalenian to Lower Oxfordian; NW Germany: Upper Sinemurian to lower part of the Upper Jurassic; S Germany: Bajocian to Callovian, Lower Oxfordian; Newfoundland: Middle Jurassic; S Poland: Bathonian, Malm; Portugal: Middle Jurassic (very frequent in Middle Bathonian); Scotland: Callovian; Ukraine: Oxfordian: Russia: Callovian to Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian. Very frequent.

Lenticulina dorbignyi (ROEMER, 1839)
Pl. VII, Fig. 3.

1839. *Peneroplis d'orbigny* n. sp.; ROEMER, F. A.: Die Versteinerungen des norddeutschen Oolithen Gebirges. Ein Nachtrag, Hannover, p. 47, pl. 20, fig. 31. *fide* Catalogue ELLIS et MESSINA.

1936. *Cristellaria (Lenticulina) d'orbignyi* ROEM.; FRANKE, p. 118, pl. 12, fig. 4.

1937. *Cristellaria (Lenticulina) d'orbignyi* ROEMER, 1839; BARTENSTEIN and BRAND, p. 178, pl. 6, fig. 37a–c; pl. 9, fig. 56a–d.

1971. *Lenticulina dorbignyi* (ROEMER), 1839; WERNLI, p. 320, pl. 3, fig. 4, 9; pl. 10, fig. 2.

1982. *Lenticulina d'orbignyi* (ROEMER); COLEMAN, pl. 2, fig. 27.

1986. *Lenticulina d'orbignyi* (ROEMER, 1839); STAM, p. 123, pl. 6, fig. 1–2.

Material. 13 specimens.

Description. Test planispirally coiled; slightly flattened; periphery subacute; 9 to 11 chambers on the last whorl, which gradually enlarges in size; sutures slightly arcuate and radial; umbilicus nearly flat; aperture small, radial and peripheral; surface reticulated.

Dimensions. Diameter: 0.38–0.46 mm; thickness: 0.18–0.22 mm.

Distribution. England: upper part of the Lower Jurassic; E France: Middle Jurassic; Grand Banks: Aalenian; NW Germany: upper part of the Lower Jurassic to lower part of the Middle Jurassic; Portugal: Middle Jurassic. Hungary, Mecsek Mts: Hidas Valley: Lower to Middle Bathonian; Óbánya Valley: Lower to lower Upper Bathonian.

Lenticulina parmula GOFMAN, 1961
Pl. VII, Figs 4–5.

1978. *Lenticulina parmula* GOFMAN, 1961; PJATKOVA and PERMJAKOVA, p. 60, pl. 19, fig. 11.

Material. 23 specimens.

Description. Test planispirally coiled; lenticular in shape; periphery acute; 8 to 11 chambers on the last whorl, which slowly enlarges in size; sutures arcaute; umbilicus nearly flat; aperture small, radial and peripheral; along the sutures surface ornamented by 2 to 5 verrucae; in the umbilicus a few verrucae may be link to an arch.

Dimensions. Diameter: 0.48–0.84 mm; thickness: 0.28–0.42 mm.

Distribution. Russia: Callovian; Ukraine: Bathonian to Lower Callovian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower and Upper Bathonian.

Lenticulina quenstedti (GÜMBEL, 1862)
Pl. VII, Fig. 7.

1862. *Cristellaria Quenstedti* n. sp.; GÜMBEL, p. 226, pl. 4, fig. 2a–b.
1928. *Lenticulina quenstedti* GÜMBEL; PAALZOW, p. 30, pl. 3, fig. 20–22.
1932. *Lenticulina quenstedti* GÜMBEL; PAALZOW, p. 102, pl. 6, fig. 3–5.
pars 1937. *Cristellaria (Lenticulina) quenstedti* GÜMBEL, 1862; BARTENSTEIN and BRAND, p. 177, pl. 11A, fig. 16a–c; pl. 11B, fig. 23a–c; pl. 12A, fig. 19a–d; pl. 12B, fig. 17a–c; pl. 14B, fig. 17a–c; pl. 15A, fig. 36a–c, pl. 15C, fig. 20a–c. non. pl. 13, fig. 39a–c; to *Astacolus argonauta* KOPIK, 1969.
1955. *Lenticulina (Lenticulina) quenstedti* (GÜMBEL 1862); SEIBOLD, E. and I., p. 105, text-fig. 3f–g; pl. 13, fig. 3.
1967. *Lenticulina quenstedti* (GÜMBEL); GORDON, p. 451, pl. 2, fig. 6–10.
1971. *Lenticulina quenstedti* (GÜMBEL), 1862; WERNLI, p. 322, pl. 4, fig. 14, 21, 23, 25, 27–28; pl. 10, fig. 1.
1973. *Lenticulina quenstedti* (GUMBEL, 1862); RUGET, p. 518, pl. 1, fig. 4, 7–9.
1978. *Lenticulina quenstedti* (GUEMBEL); GRADSTEIN, pl. 1, fig. 3.
? 1978. *Lenticulina (Lenticulina) quenstedti* (GÜMBEL, 1862); MUNK, p. 43, pl. 3, fig. 1.
1978. *Lenticulina quenstedti* (GÜMBEL, 1862); PJATKOVA and PERMJAKOVA, p. 62, pl. 3.
1978. *Lenticulina (Astacolus) volubilis* DAIN, 1958; MUNK, p. 45, pl. 3, fig. 1
1981. *Lenticulina quenstedti* (GÜMBEL), 1862; BARNARD et al., p. 414, pl. 2, fig. 32, text-fig. 21–22.
1981. *Lenticulina quenstedti* (GÜMBEL); COLEMAN, p. 120, pl. 6.2.3, fig. 12.
1982. *Lenticulina quenstedti* (GÜMBEL); COLEMAN, pl. 1, fig. 18.
1986. *Lenticulina quenstedti* (GUEMBEL, 1862); STAM, p. 123, pl. 5, fig. 9–11.
1989. *Lenticulina quenstedti* (GÜMBEL); RIEGRAF and LUTERBACHER, p. 1032, pl. 3, fig. 29–35.

Material. More than 100 specimens.

Description: Test involute planispiral, usually lenticular in shape; periphery keeled; 8 to 12 chambers slowly increasing in size; sutures arcuate and marked by distinct sharp ribs, which usually converge to form a circular umbilical rib; aperture radiate and peripheral.

Variability. Uncoiling specimens sometimes appear. The outline of the test may be nearly round or elongated oval. The ornamentation varies, as umbilical ring does not always appear.

Dimensions. Diameter: 0.47–0.71 mm; thickness: 0.20–0.28 mm.

Distribution. England: Toarcian to Oxfordian; E France: Middle Jurassic to lower part of the Upper Jurassic; NW Germany: Lower Bajocian to Oxfordian; S Germany: Upper Bajocian to Callovian, Lower Oxfordian; Newfoundland, Grand Banks: Upper Bajocian to Upper Kimmeridgian; Portugal: Aalenian to Kimmeridgian (frequent in Bathonian); Russia: Upper Callovian to Lower Oxfordian; Scotland: Callovian; Ukraine: Upper Callovian -Lower Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Lenticulina subalata (REUSS, 1854)

1854. *Cristellaria subalata* n. sp.; REUSS, A. E.: Beiträge zur Characteristic der Kreideschichten in den Ostalpen, besondes im Gosauhale und am Wolfgangsee. K. Akad. Wiss. Wien Math.-Naturw. Cl. Denkschr, Wien, Bd. 7, p. 68, pl. 25, fig. 13a–b. *fide* Catalogue ELLIS et MESSINA.

1863. *Cristellaria subalata* m.; REUSS, p. 34, pl. 8, fig. 10; pl. 9, fig, 1.

1869. *C. helios* TERQ.; TERQUEM, p. 183, pl. 16, fig. 19–21.

1936. *Cristellaria (Lenticulina) subalata* RSS.; FRANKE, p. 115, pl. 11, fig. 19.

1937. *Cristellaria (Lenticulina) subalata* REUSS, 1854; BARTENSTEIN and BRAND, p. 176, pl. 6, fig. 35–a–b; pl. 9, fig. 54a–c, pl. 10, fig. 41a–b; pl. 11A, fig. 15a–b; pl. 11B, fig. 22a–b; pl. 12A, fig. 18a–c; pl. 12B, fig. 16; pl. 13, fig. 38a–c; pl. 14B, fig. 16a–b; pl. 15A, fig. 35a–b.

1954. *Lenticulina subalata* (REUSS); BIELECKA and POZARYSKI, p. 166, pl. 4, fig. 14a–b.

1971. *Lenticulina subalata* (REUSS, 1854); WERNLI, p. 323, pl. 4, fig. 24.

1973. *Lenticulina subalata* (REUSS, 1854); RUGET, p. 519, pl. 2, fig. 1-2.

1978. *Lenticulina (Lenticulina)* sp. 3.; MUNK, p. 44, pl. 3, fig.4a–c; fig. 20.

1981. *Lenticulina subalata* (REUSS), 1854; BARNARD et al., p. 416, pl. 2 fig. 33.

1981. *Lenticulina subalata* (REUSS); COLEMAN, p. 120, pl. 6.2.3, fig. 13.

Material. 8 specimens.

Description: Test planispirally coiled and involute; lenticular in shape; outline nearly circular; periphery acute or keeled; sutures arcuate and marked by rounded ribs, which converge to form a shiny umbilical boss and dissappear towards the periphery; aperture radiate, terminal and peripheral; surface smooth.

Dimensions. Diameter: 0.54–0.76 mm; thickness: 0.33–0.45 mm.

Distribution. England: Toarcian to Upper Callovian; E France: upper part of the Lower Jurassic to Middle Jurassic; S France: Upper Bajocian; NW Germany: upper part of the Lower Jurassic to Oxfordian; S Germany: Lower and Middle Callovian, Middle Cretaceous; Central Poland: Kimmeridgian; Portugal: Middle Jurassic (Middle Bathonian). Hungary, Mecsek Mts: Hidas Valley: Middle Bathonian; Óbánya Valley: Middle Bathonian.

Genus *Marginulinopsis* A. SILVESTRI, 1904

Marginulinopsis comptula SCHWAGER, 1865
Pl. VIII, Fig. 1.

1865. *Cristellaria comptula* m.; SCHWAGER, p. 133, pl. 6, fig. 19.
1932. *Lenticulina comptula* SCHWAGER; PAALZOW, p. 103, pl. 6, fig. 6.
1956. *Lenticulina (Astacolus) comptula* (SCHWAGER 1865); SEIBOLD, E. and I., p. 115, text-fig. 3q, r; pl. 7, fig. 10.
1960. *Lenticulina (Astacolus) comptula* (SCHWAGER 1865); LUTZE, p. 453, pl. 28, fig. 6.
1978. *Astacolus comptulus* (SCHWAGER, 1865): PJATKOVA and PERMJAKOVA, p. 71, pl. 24, fig. 11.

Material. 19 specimens.
Description. Initial portion closely coiled, later portion uncoiled, straight or slightly curved; oval to subtriangular in cross-section; periphery keeled; sutures indistinct; aperture small, round and situated on a short neck; surface covered by 6 to 7 longitudinal parallel costae, which only slightly curved at the coiled part, and often end before the last chamber.
Dimensions. Height: 0.54–0.68 mm; breadth: 0.29–0.35 mm; thickness: 0.13–0.16 mm.
Distribution. Germany: Lower Oxfordian; Russia: Upper Oxfordian to Lower Kimmeridgian; Ukraine: Kimmeridgian. Hungary, Mecsek Mts: Hidas Valley: Lower and Upper Bathonian; Óbánya Valley: Middle Bathonian.

Subfamily Marginulininae WEDEKIND, 1937
Genus Astacolus DE MONTFORT, 1808

Astacolus major (BORNEMANN, 1854)
Pl. VIII, Fig. 2.

1854. *Cristellaria major* m.; BORNEMANN, p. 40, pl. 4, fig. 31a–b.
1936. *Cristellaria (Astacolus) major* BORN.; FRANKE, p. 101, pl. 9, fig. 36.
1960. *Lenticulina (Astacolus) major* (BORNEMANN 1854) Form A; LUTZE, p. 454, pl. 28, fig. 5, text-fig. 12d–g.
1978. *Lenticulina (Astacolus) major* (BORNEMANN 1854); MUNK, p. 45, fig. 21.
1981. *Astacolus major* (BORNEMANN) 1854; BARNARD et al., p. 412, pl. 2, fig. 17–18. text-fig. 19.
1981. *Lenticulina major* (BORNEMANN); COLEMAN, p. 120, pl. 6.2.3, fig. 11.

Material. 70 specimens.
Description: Test robust, ovate in outline; slightly compressed; oval in cross-section; initial planispiral coil of 3 to 5 chambers followed by rectilinear portion of up to 7 chambers; chambers are boarder than high, very slowly increasing in size, giving a parallel-sided outline; sutures distinct, marked by thick ribs; aperture peripheral and radiate.

Dimensions. Height: 0.64–1.18 mm; breadth: 0.28–0.44 mm; thickness: 0.14–0.17 mm.

Distribution. England: Lower Jurassic, Middle Callovian to Lower Oxfordian; NW Germany: upper part of the Lower Jurassic, Callovian to Oxfordian; S Germany: Callovian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Lower Bathonian; Óbánya Valley: Lower and Upper Bathonian.

Astacolus matutina (D'ORBIGNY, 1849)
Pl. VIII, Fig. 3.

1849. *Cristellaria matutina* D'ORB., 1849; D'ORBIGNY, p. 242.
1886. *Cristellaria hybrida,* TERQUEM; TERQUEM, p. 34, pl. 3, fig. 44, 49.
1936. *Cristellaria (Astacolus) matutina* D'ORB.; FRANKE, pl. 10, fig. 11–12.
1937. *Cristellaria (Astacolus) matutina* D'ORBIGNY, 1849; BARTENSTEINY and BRAND, p. 172, pl. 2B, fig. 33; pl. 3, fig. 45; pl. 4 fig. 79; pl. 5, fig. 53; pl. 6, fig. 33.
1954. *Marginulina matutina* (D'ORB.); BIELECKA and POZARYSKI, p. 182, pl. 8, fig. 35a–b.
1955. *Lenticulina (Astacolus) matutina* (D'ORBIGNY) 1849; SEIBOLD, E. and I., p. 108, text-fig. 4k–l.
1956. *Lenticulina (Astacolus) matutina* (D'ORBIGNY 1849); SEIBOLD, E. and I., p. 118, text-fig. 4m–n. cum.syn.
1978. *Astacolus matutinus* (ORBIGNY, 1849); PJATKOVA and PERMJAKOVA, p. 74, pl. 25, fig. 5.

Material. 36 specimens.

Description. Test large, early portion coiled, later uncoiled and rectilinear; periphery broadly rounded; broad-oval in cross-section; 4 to 7 coiled chambers rapidly increasing in size as added, the 1 to 3 uniserial ones nearly uniform in size; sutures distinct, nearly straight and somewhat oblique, flush to slightly depressed on the younger portion of the test; aperture radiate, at the dorsal angle; surface smooth.

Dimensions. Height: 0.58–0.87 mm; breadth of uncoiled portion: 0.26–0.36 mm; thickness: 0.13–0.16 mm.

Distribution. France: Lower Jurassic; NW Germany: Lower Jurassic to lower part of the Upper Jurassic; S Germany: lower part of the Upper Jurassic; Central Poland: Kimmeridgian; S Poland: Bathonian; Russia: Toarcian; Ukraine: Lower Aalenian. Hungary, Mecsek Mts: Hidas Valley: Lower and Upper Bathonian; Óbánya Valley: Middle Bathonian.

Astacolus varians (BORNEMANN, 1854)
Pl. VIII, Fig. 4.

1854. *Cristellaria varians* m.; BORNEMANN, p. 41, pl. 4, fig. 32–34a–c.
1936. *Cristellaria (Lenticulina) varians* BORN.; FRANKE, p. 112, pl. 11, fig. 9–13.
1937. *Cristellaria (Lenticulina) varians* BORNEMANN; BARTENSTEIN and BRAND, p. 176, pl. 1, fig. 18; pl. 2A, fig. 16, 20; pl. 3, fig. 31; pl. 5, fig. 60, pl. 9, fig. 53a–b.

1937. *Cristellaria (Lenticulina) varians* BORNEMANN, 1854 Form A; BARTENSTEIN and BRAND, p. 176, pl. 10, fig. 40a–d; pl. 11A, fig. 14a–d; pl. 11B, fig. 21a–b.
1954. *Lenticulina varians* (BORN.); BIELECKA and POZARYSKI, p. 164, pl. 4, fig. 11a–b.
1960. *Lenticulina (Lenticulina) varians* (BORNEMANN 1854) Form B; LUTZE, p. 450, pl. 28, fig. 10.
1975. *Lenticulina varians* (BORNEMANN, 1854); JENDRYKA-FUGLEWICZ, p. 137, pl. 2, fig. 1–2.
1978. *Lenticulina varians* (BORNEMANN, 1854); PJATKOVA and PERMJAKOVA, p. 67, pl. 23, fig. 7.
1981. *Lenticulina varians* (BORNEMANN), 1854 Form B LUTZE, 1960; BARNARD, p. 417, pl. 2, fig. 25, text-fig. 19.

Material. 25 specimens.
Description. Test planispiral, oval in outline, somewhat biconvex; periphery acute, sometimes keeled on the spiral part of the test; initial portion planispirally coiled, the final 1 or 2 chambers elongated and uncoiled; 7 to 10 chambers are on the last whorl; sutures distinct, flush, arcuate on the spiral portion, nearly straight on the uncoiled portion; aperture radiate, terminal and peripheral; surface smooth.
Dimensions. The largest diameter: 0.58–1.12 mm; thickness: 0.12–0.16 mm.
Distribution. England: Middle Callovian to Lower Oxfordian; NW Germany: upper part of the Lower Jurassic to Oxfordian; Poland: Lower Jurassic, Malm; Russia: Upper Bajocian; Ukraine: Upper Bajocian to Lower Bathonian, Lower Callovian; Hungary, Mecsek Mts: Hidas Valley: Lower and lower Middle Bathonian; Óbánya Valley: Lower and lower Middle Bathonian.

Astacolus vetusta (D'ORBIGNY, 1849)
Pl. VIII, Fig. 5.

1849. *Cristellaria vetusta* D'ORB., 1849; D'ORBIGNY, p. 242.
1886. *Cristellaria hybrida,* TERQUEM; TERQUEM, p. 34, pl. 3, fig. 45.
1936. *Cristellaria (Astacolus) vetusta* D'ORB.; FRANKE, p. 105, pl. 10, fig. 13.
1937. *Cristellaria (Astacolus) vetusta* D'ORBIGNY, 1849; BARTENSTEIN and BRAND, p. 172, pl. 3, fig. 43a–b; pl. 6 fig. 31a; pl. 10, fig. 35; pl. 11B, fig. 17a–b; pl. 12A, fig. 14a–b; pl. 13, fig. 32a–b.
1941. *Cristellaria (Astacolus) vetusta* D'ORBIGNY; FRENTZEN, p. 353, pl. 5, fig. 21–22.
1954. *Marginulina vetusta* (D'ORB.); BIELECKA and POZARYSKI, p. 181, pl. 7, fig. 33a–b.

Material. 35 specimens.
Description. Test elongated; early portion coiled later uncoiled and rectilinear; periphery rounded; oval in cross-section; 4 to 6 coiled chambers rapidly increasing in size as added, the 3 to 7 uniserial ones nearly uniform in size; sometimes the last chamber essentially smaller than the previous one; sutures distinct, oblique and arcaute; sutures slightly depressed on the coiled portion and depressed on the younger portion of the test; aperture radiate, at the dorsal angle; surface smooth.
Dimensions. Height: 0.57–0.89 mm; breadth of uncoiled portion: 0.22–0.26 mm; thickness: 0.11–0.13 mm.

Distribution. France: Lower Jurassic; NW Germany: Lower Jurassic to Middle Jurassic; S Germany: Lower Jurassic to lower part of the Upper Jurassic; Central Poland: Kimmeridgian; S Poland: Bathonian. Hungary, Mecsek Mts: Hidas Valley: Lower and Upper Bathonian; Óbánya Valley: Middle Bathonian.

Genus *Marginulina* D'ORBIGNY, 1826

Marginulina simplex (TERQUEM, 1863)
Pl. VIII, Fig. 6.

1863. *Vaginulina simplex* TERQ.; TERQUEM, p. 184, pl. 8, fig. 1a–b.
1936. *Marginulina simplex* (TERQ.); FRANKE, p. 75, pl. 7, fig. 22a–b, 23, 24a–b.
1937. *Marginulina simplex* (TERQUEM, 1864); BARTENSTEIN and BRAND, p. 159, pl. 1A, fig. 14; pl. 3, fig. 37; pl. 4, fig. 57; pl. 5, fig. 42; pl. 10, fig. 23; pl. 11B, fig. 10a–b; 12A, fig. 7; pl. 13, fig. 15a–b; pl. 14B, fig. 4a–b.
1960. *Vaginulina simplex* TERQUEM, 1863; KAPTARENKO-CHERNOUSOVA, p. 57, pl. 3, fig. 13.
1978. *Vaginulina simplex* TERQUEM, 1863; PJATKOVA and PERMJAKOVA, p. 96, pl. 31, fig. 20.

Material. 5 specimens.
Description. Test elongated; early portion slightly curved, later uncoiled and rectilinear; periphery rounded; oval in cross-section; 4 to 6 coiled chambers rapidly increasing in size as added, the 3 to 7 uniserial ones nearly uniform in size; sometimes the last chamber essentially smaller than the previous one; sutures distinct, oblique and arcaute; sutures slightly depressed on the coiled portion and depressed on the younger portion of the test; aperture radiate, at the dorsal angle; surface smooth.
Dimensions. Height: 0.61–0.72 mm; breadth: 0.19–0.22 mm; thickness: 0.10–0.13 mm.
Distribution. NW Germany: middle part of the Lower Jurassic to Middle Jurassic; Ukraine: Upper Bajocian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower Bathonian.

Marginulina solida TERQUEM, 1867
Pl. VIII, Fig. 7.

pars 1867. *Marginulina solida* TERQ., TERQUEM, p. 122, pl. 8, fig. 1–11. non 12.
1876. *Marginulina solida* TERQUEM; TERQUEM, p. 488, pl. 16, fig. 8–9.
1886. *Marginulina solida* TERQUEM; TERQUEM, p. 24, pl. 2, fig. 34–43.
1932. *Marginulina solida* TERQUEM; PAALZOW, p. 108, pl. 7, fig. 6.
? 1941. *Marginulina solida* TERQUEM; FRENTZEN, p. 337, pl. 4, fig. 1.

Material. More than 60 specimens.
Description. Test elongated; early portion slightly curved later rectilinear; periphery rounded; oval in cross-section; chambers low and wide, except the last, which is 2 to 3 times higher than the previous ones, 3 to 9 uniserial chambers nearly uniform

in size; sutures distinct, strongly oblique and straight; sutures depressed, stonger on the ventral side than the dorsal side, giving a nearly straight dorsal side and lobulate ventral side; aperture radiate, at the dorsal angle; surface smooth.

Remarks. Shape of the test highly variable. Specimen figured by TERQUEM (1867) on pl. 8, fig. 12 has high chambers.

Dimensions. Height: 0.51–1.45 mm; breadth: 0.26–0.38 mm; thickness: 0.17–0.23 mm.

Distribution. S France: Upper Bajocian; S Germany: lower part of the Upper Jurassic; S Poland: Bathonian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Marginulina terquemi D'ORBIGNY, 1849
Pl. VIII, Fig. 8.

1849. *Marginulina Terquemi* D'ORB., 1849; D'ORBIGNY, p. 242.
1928. *Marginulina terquemi* D'ORB.; PAALZOW, p. 21, pl. 2, fig. 16–17.
1936. *Marginulina terquemi* D'ORB.; FRANKE, p. 73, pl. 7, fig. 16.

Material. 24 specimens.

Description. Test relatively short; slightly curved; nearly round in cross-section; proloculus spherical; 4 to 6 somewhat inflated chambers gradually increasing in size; chambers slightly wider than higher, except the final chamber; sutures depressed, distinct and oblique; aperture small and radiate, on the narrowed end of the final chamber; surface smooth.

Dimensions. Height: 0.45–0.59 mm; the largest breadth: 0.15–0.19 mm; thickness: 0.14–0.18 mm.

Distribution. France: Lower Jurassic; S Germany: upper part of the Lower Jurassic, Upper Bajocian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower to Middle Bathonian.

Subfamily Vaginulininae REUSS, 1860
Genus *Citharina* D'ORBIGNY, 1839

Citharina clathrata (TERQUEM, 1863)
Pl. VIII, Figs 9–10.

1863. *Flabellina clathrata,* TERQ.; TERQUEM, p. 219, pl. 10, fig. 18a–b.
1971. *Vaginulina clathrata* (TERQUEM), 1863; WERNLI, p. 334, pl. 4, fig. 3–5.
1973. *Vaginulina* aff. *clathrata* (TERQUEM, 1863); RUGET, p. 528, pl. 6, fig. 5–10, 12.
1981 *Citharina clathrata* (TERQUEM, 1864); BIELECKA and STYK, p. 26, pl. 2, fig. 1.
1981. *Vaginulina clathrata* (TERQUEM) *eypensa* CIFELLI; COLEMAN, p. 123, pl. 6.2.4, fig. 18.
1982. *Vaginulina clathrata* TERQUEM; COLEMAN, pl. 2, fig. 1.
1988. *Citharina clathrata* (TERQUEM, 1864); BIELECKA et al. p. 102, pl. 26, fig. 13.

Material. 8 specimens.

Description: Test large, uniserial, flattened; periphery acute; proloculus oval, followed by 7 to 10 chambers rapidly increasing in breadth, giving triangular outline; sides sometimes nearly parallel; sutures oblique; aperture radial, terminal, peripheral; surface ornamented with 4 to 6 sharp, longitudinal costae, which are continuous over the test and increasing in numbers as the test widens.

Variability. The test shape varies from narrow U-shaped, with a few parallel costae to broad V-shaped, with increasing number of costae.

Dimensions. Height: 0.45–0.59 mm; the largest breadth: 0.15–0.19 mm; thickness: 0.14–0.18 mm.

Distribution. England: upper part of the Lower Jurassic to Lower Bathonian; E France: Upper Aalenian to Lower Oxfordian; S France: Lower Jurassic; Poland: Bathonian; Portugal: Middle Bathonian; Switzerland: upper part of the Lower Jurassic to Aalenian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Lower to Middle Bathonian; Óbánya Valley: Lower Bathonian.

Citharina ornithocephala (Wisniowski, 1890)
Pl. IX, Fig. 1.

1890. *Vaginulina ornithocephala* mihi; Wisniowski, p. 210, pl. 2, fig. 1.
1928. *Vaginulina ornithocephala* Wisniowski; Paalzow, p. 23, pl. 2, fig. 23a–b.
1978. *Vaginulina ornithocephala* Wisniowski, 1890; Munk, pl. 2, fig. 5, 11; pl. 5, fig. 2.
1981. *Citharina ornithocephala* (Wisniowski), 1890; Barnard et al. p. 425, pl. 2, fig. 8.
1988. *Vaginulina ornithocephala* Wisniowski, 1890; Bielecka et al. p. 106, pl. 28, fig. 9, 10.

Material. 2 specimens.

Description: Test nearly triangular, strongly flattened; periphery keeled; proloculus relatively large and spherical; the next 4 to 5 low and broad chambers gradually increasing in width; sutures indistinct and strongly oblique; aperture round at the dorsal side; surface ornamented by 7 longitudinal costae.

Dimensions. Height: 0.57–0.59 mm; the largest breadth: 0.18–0.19 mm; thickness: 0.19–0.21 mm.

Distribution. England: Lower Oxfordian; S Germany: Upper Bajocian to Bathonian; Poland: Middle Jurassic. Hungary, Mecsek Mts: Óbánya Valley: Middle Bathonian.

Genus *Citharinella* Marie, 1938

Citharinella irregularis (Terquem, 1870)
Pl. IX, Fig. 2.

1870. *Frondicularia irregularis,* Terq.; Terquem, p. 216, pl. 22, fig. 21–22.
1886. *Frondicularia irregularis* Terquem; Terquem, p. 43, pl. 4, fig. 33.

Material. 2 specimens.

Description: Test uniserial, romboidal and compressed; periphery subacute; proloculus small and spherical; the next 2 to 3 chambers narrow; later 8 to 10 slightly inflated, chevron-shaped chambers rapidly increasing in width; sutures subacute, distinct and depressed; aperture oval, on the rounded apertural end; surface smooth.

Dimensions. Height: 0.41–0.43 mm; the largest breadth: 0.28–0.29 mm; thickness: 0.20–0.21 mm.

Distribution. S France: Upper Bajocian to Bathonian; Poland: Middle Jurassic. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian.

Citharinella oolithica (TERQUEM, 1870)
Pl. IX, Fig. 3.

pars 1870. *Frondicularia oolithica,* TERQ.; TERQUEM, p. 213, pl. 22, fig. 1–6, 9; non 7–8.
1937. *Frondicularia oolithica* TERQUEM, 1870; BARTENSTEIN and BRAND, p. 153, pl. 11B, fig. 9; pl. 13, fig. 12; pl. 15A, fig. 18; pl. 15C, fig. 7.
1960. *Frondicularia oolithica* TERQUEM, 1870; KAPTARENKO-CHERNOUSOVA, p. 82, pl. 7, fig. 18–20a,b; pl. 8, fig. 6a–b, 7.
? 1978. *Citharinella oolithica* (TERQUEM, 1870); PJATKOVA and PERMJAKOVA, p. 101, pl. 33, fig. 6.
1981 *Frondicularia oolithica* TERQUEM, 1870; COLEMAN, p. 118, pl. 6.2.3, fig. 5.

Material. 2 specimens.

Description: Test uniserial, elongated deltoid, flattened; periphery angular; proloculus spherical, followed by 7 to 9 chevron-shaped chambers; sutures distinct, wide and depressed, marked by low and rounded ribs; aperture oval, terminal, central; surface smooth.

Remarks. Specimens in TERQUEM (1870) on plate 22, figures 7–8 striated and very narrow, without wide sutures.

Dimensions. Height: 0.41–0.43 mm; the largest breadth: 0.28–0.29 mm; thickness: 0.20–0.21 mm.

Distribution. England: Bajocian to Bathonian; S France: Upper Bajocian to Bathonian; NW Germany: Bajocian to Bathonian; Russia: Upper Bajocian; Ukraine: Upper Aelenian to Upper Bajocian. Hungary, Mecsek Mts: Óbánya Valley: Middle Bathonian.

Genus *Planularia* DEFRANCE, 1826

Planularia beierana (GÜMBEL, 1862)
Pl. IX, Fig. 4.

1862. *Marginulina Beierana* n. sp.; GÜMBEL, p. 221, pl. 3, fig. 20a–b.
1865. *Cristellaria spicula* m.; SCHWAGER, p. 122, pl. 5, fig. 9.
1865. *Cristellaria laminosa* m.; SCHWAGER, p. 124, pl. 5, fig. 13.

1955. *Lenticulina (Planularia) beierana* (GÜMBEL 1862); SEIBOLD, E. and I., p. 106, text-fig. 4e–f; pl. 13, fig. 7.
1956. *Lenticulina (Planularia) beierana* (GÜMBEL 1862); SEIBOLD, E. and I., p. 112, text-fig. 5e–h, o, p, u.
1978. *Lenticulina (Planularia) beierana* (GÜMBEL 1862); MUNK, p. 47, pl. 5, fig. 4.
1981. *Planularia beierana* (GÜMBEL), 1862; BARNARD et al., p. 419, pl. 2, fig. 28, text-fig. 24.
1982. *Planularia beierana* (GÜMBEL); COLEMAN, p. 122, pl. 6.2.4, fig. 10.
1982. *Planularia beierana* (GÜMBEL); COLEMAN, pl. 1, fig. 24.

Material. 19 specimens.

Description: Test elongated, lower part rounded and tapering towards the aperture; highly compressed; periphery keeled or acute; 3 to 7 chambers arranged in loose planispiral; later chambers uncoiled may or may not touch the spiral part; sutures slightly depressed or flush; aperture radiate, terminal and peripheral; surface smooth.

Dimensions. Height: 0.39–0.47 mm; the largest breadth: 0.14–0.18 mm; thickness: 0.08–0.10 mm.

Distribution. England: Lower Bathonian to Lower Oxfordian; NW Germany: Oxfordian; S Germany: Upper Bajocian to Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Lower and Middle Bathonian; Óbánya Valley: Lower Bathonian.

Planularia pauperata (JONES and PARKER, 1860)
Pl. IX, Fig. 5.

1860. *Planularia pauperata*, J. et P. (n. sp.); JONES and PARKER, p. 454, pl. 20, fig. 39.
1865. *Cristellaria pauperata* JONES and PARKER sp.; SCHWAGER, p. 131, pl. 6, fig. 15.
1928. *Cristellaria pauperata* PARKER et JONES; PAALZOW, p. 25, pl. 2, fig. 30–32; pl. 3, fig. 1, 3–4.
1982. *Planularia pauperata* (JONES and PARKER); COLEMAN, pl. 2, fig. 12.

Material. 36 specimens.

Description: Test large, broadly oval, somewhat tapering towards the aperture; flattened; periphery acute; chambers low, broad and highest dorsally; the first 3 to 5 chambers arranged in loose planispiral; later chambers uncoiled may or may not touch the spiral part; sutures flush; aperture radiate, terminal and peripheral; surface smooth.

Dimensions. Height: 0.49–0.85 mm; the largest breadth: 0.29–0.34 mm; thickness: 0.16–0.19 mm.

Distribution. England: Lower Bathonian; S Germany: Lower Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Lower Bathonian.

Planularia plana (REUSS, 1863)
Pl. IX, Fig. 6.

1863. *Cristellaria plana* m.; REUSS, p. 72, pl. 8, fig. 3.
1917. *Cristellaria plana* (REUSS, 1863); PAALZOW, p. 239, pl. 46, fig. 1–2, 4.

Material. 3 specimens.
Description: Test large, elongated oval; highly flattened; periphery subacute; chambers low, broad; the first 3 to 5 chambers arranged in loose planispiral; the next 2 to 3 chambers uncoiling; the final chamber is sometimes smaller than the previous one; sutures distinct, oblique and slightly depressed; aperture radiate, terminal and dorsal; surface smooth.
Dimensions. Height: 0.60–0.93 mm; the largest breadth: 0.29–0.34 mm; thickness: 0.09–0.10 mm.
Distribution. Germany: Oxfordian, Lower Cretaceous. Hungary, Mecsek Mts: Óbánya Valley: Lower to lower part of the Middle Bathonian.

Planularia tricarinella (REUSS, 1863)
Pl. VII, Figs 8–9.

1863. *Cristellaria tricarinella* m.; REUSS, p. 68, pl. 7, fig. 9; pl. 12, fig. 2–4.
1869. *Cristellaria polymorpha* TERQUEM; p. 192. pl. 19, fig. 1–30; pl. 20, fig. 1–30; pl. 21, fig. 1–30.
1928. *Cristellaria tricarinella* REUSS; PAALZOW, p. 25, pl. 3, fig. 5.
1937. *Cristellaria (Astacolus) tricarinella* REUSS, 1863; BARTENSTEIN and BRAND, p. 173, pl. 13, fig. 35a–b;, pl. 14B, fig. 13a–b; pl. 15A, fig. 33a–b; pl. 15C, fig. 18.
1941. *Cristellaria (Astacolus) tricarinella* REUSS; FRENTZEN, p. 353, pl. 5, fig. 13–14.
1954. *Planularia tricarinella* (REUSS); BIELECKA and POZARYSKI, p. 171, pl. 5, fig. 20a–b.
1960. *Lenticulina (Planularia) tricarinella* (REUSS 1863); LUTZE, p. 456, pl. 29, fig. 12–13.
1960. *Lenticulina (Planularia) tricarinella* (REUSS 1863); SEIBOLD, E. and I., p. 350, text-fig. 6a–d.
1966. *Lenticulina tricarinella* (REUSS); GORDON, p. 326, pl. 2, fig. 5–19.
1971. *Planularia tricarinella* (REUSS), 1863; WERNLI, p. 323, pl. 5, fig. 1–5, 8, 11–12; pl. 10, fig. 3.
1978. *Planularia tricarinella* (REUSS, 1863); PJATKOVA and PERMJAKOVA, p. 83, pl. 28, fig. 9.
1981. *Lenticulina tricarinella* (REUSS), 1863; BARNARD et al. p. 422, pl. 2, fig. 23–24, text-fig. 25C, 1–4.
1982. *Planularia tricarinella* (REUSS); COLEMAN, p. 120, pl. 6.2.3, fig. 14–15.
1982. *Planularia tricarinella* (REUSS); COLEMAN, pl. 2, fig. 18.

Material. 12 specimens.
Description: Test loose, planispirally coiled; compressed, forming parallel sides; periphery keeled; two lateral keels or discontinuous oblique costae are along the

margin of the test; 8 to 10 low and broad chambers on the final whorl; sutures arcuate, distinct and marked by sharp ribs; aperture radiate, terminal, peripheral.

Variability. Degree of coiling and ornamentation are variable.

Dimensions. The largest diameter: 0.64–0.88 mm; thickness: 0.31–0.39 mm.

Distribution. England: Bajocian to Oxfordian; E France: Middle Jurassic; S France: Upper Bajocian; NW Germany: Upper Bajocian to Oxfordian; S Germany: Upper Bajocian to Bathonian, lower part of the Upper Jurassic, Lower Cretaceous; Central Poland: Lower Kimmeridgian; Russia: Upper Bajocian, Callovian to Kimmeridgian; Ukraine: Upper Bajocian, Callovian to Kimmeridgian. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Bathonian.

Genus *Vaginulina* D'ORBIGNY, 1826

Vaginulina legumen (LINNÉ, 1758)
Pl. IX, Fig. 7.

? 1860. *Vaginulina Legumen,* LINN.; JONES and PARKER, p. 453, pl. 19, fig. 27–28.
1890. *Vaginulina legumen,* LINNÉ, 1758; HAEUSLER, p. 107, pl. 14, fig. 49.
1937. *Vaginulina legumen* (LINNÉ, 1758); BARTENSTEIN and BRAND, p. 162, pl. 15A, fig. 22; pl. 15C, fig. 10a–c.
1981. *Vaginulina legumen* (LINNÉ); COLEMAN, p. 123, pl. 6.2.4, fig. 20.
1982. *Vaginulina legumen* (LINNÉ); COLEMAN, pl. 1, fig. 7

Material. 50 specimens.

Description: Test uniserial, elongated, slightly curved or straight; slightly depressed; periphery subrounded; 5 to 7 chambers very gradually increasing in size; sutures oblique and slightly depressed or flush; aperture radiate, terminal and peripheral; surface smooth.

Dimensions. Height: 0.44–0.63 mm; the largest breadth: 0.11–0.15 mm; thickness: 0.08–0.10 mm.

Distribution. England: Bathonian; Germany: Bathonian to Oxfordian; Switzerland: Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Lower and Middle Bathonian.

Vaginulina mecseki n. sp.
Pl. IX, Figs 8–9.

Derivatio nominis: After Mecsek Mts.
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Middle Bathonian.
Holotype: Plate IX, Figure 9.
Paratypes: Plate IX, Figure 8.
Material. 14 specimens.

Diagnosis. Test is large, uniserial, elongated and tapering at both ends, aperture is radiate, surface is smooth.

Description. Test uniserial, large, elongated and flattened; axis of the test more or less curved; periphery subrounded; proloculus oval; 5 to 8 chambers gradually increasing in size; sutures depressed or flush and oblique; aperture radiate and terminal; surface smooth.

Remarks. The most distinctive feature of this species is the flattened and curved test.

Dimensions. Height: 1.24–1.83 mm; the largest breadth: 0.37–0.46 mm; thickness: 0.14–0.18 mm. Hungary, Mecsek Mts: Hidas Valley: Middle Bathonian; Óbánya Valley: Middle Bathonian.

Family Lagenidae REUSS, 1862

Genus *Lagena* WALKER and JAKOB, 1798

Lagena vulgaris WILLIAMSON, 1858

Pl. IX, Fig. 10.

1858. *Lagena vulgaris, typica* (n. sp.); WILLIAMSON, p. 4, pl. 1, fig. 5, 5a.
1870. *Lagena vulgaris,* WILL.; TERQUEM, p. 247, pl. 25, fig. 21–22.
1875. *Lagena vulgaris,* WILLIAMSON; TERQUEM et BERTHELIN, p. 13, pl. 1, fig. 6a–b.
1886. *Lagena vulgaris* WILL.; TERQUEM, p. 6, pl. 1, fig. 4.
1936. *Lagena vulgaris* WILL.; FRANKE, p. 89, pl. 9, fig. 1.

Material. 25 specimens.

Description. Test consists of a nearly globular chamber; round to oval in cross-section; aperture small round and protruding on short conical neck; surface smooth or sometimes slightly rough.

Dimensions. Diameter: 0.33–0.88 mm.

Distribution. England: S France: Lower Jurassic to Middle Jurassic; Germany: upper part of the Lower Jurassic; S Poland: Bathonian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Middle Bathonian.

Family Polymorphinidea D'ORBIGNY, 1839

Subfamily Polymorphininae D'ORBIGNY, 1839

Genus *Eoguttulina* CUSHMAN and OZAWA, 1930

Eoguttulina liassica (STRICKLAND, 1846)

Pl. X, Fig. 1.

1846. *Polymorphina liassica,* n. sp.; STRICKLAND, H. F.: On two species of microscopic shells found in the Lias. Quart. Jour. Geol. Soc. vol. 2, p. 31, pl. p. 30, fig. b. *fide* Catalogue ELLIS et MESSINA.
1875. *Guttulina similis,* TERQ. et BERTH.; TERQUEM and BERTHELIN, p. 71, pl. 6, fig. 6a–b.
1875. *Polymorphina metensis,* TERQ.; TERQUEM and BERTHELIN, p. 68, pl. 4, fig. 1a–j.
1932. *Eoguttulina liassica* STRICKLAND; PAALZOW, p. 134, pl. 11, fig. 1.
1936. *Polymorphina liasica* STRICKL.; FRANKE, p. 120, pl. 12, fig. 8–10.

1937. *Eoguttulina liassica* (STRICKLAND, 1846); BARTENSTEIN and BRAND, p. 178, pl. 1A, fig. 24a–b; pl. 2A, fig. 23; pl. 2B, fig. 35; pl. 3, fig. 49; pl. 4, fig. 74a–b; pl. 5, fig. 69a–b.

1954. *Eoguttulina liassica* (STRICKL.); BIELECKA and POZARYSKI, p. 193, pl. 10, fig. 49a–b.

1967. *Eoguttulina liassica* (STRICKLAND); GORDON, p. 456, pl. 4, fig. 26.

1981. *Eoguttulina liassica* (STRICKLAND), 1846; BARNARD, p. 426, pl. 3, fig. 20, text-fig. 29a.

1981. *Eoguttulina liassica* (STRICKLAND, 1846); BIELECKA and STYK, p. 33, pl. 3, fig. 18.

Material. More than 250 specimens.

Description. Test spindle-shaped; lower part rounded, apertural end tapered; oval in cross-section; three or four chambers are visible; sutures more or less depressed and longitudinal except the suture of the final chamber, which is oblique and cut the previous sutures; aperture radial; surface smooth and bright.

Dimensions. Height: 0.67–0.92 mm; diameter: 0.18–0.26 mm.

Distribution. England: Lower Jurassic to Middle Portlandian; France: Lower Jurassic, Oxfordian; Germany: Lower Jurassic to Oxfordian; Poland: Kuiavian to Middle Portlandian, Upper Malm; Scotland: Callovian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Eoguttulina oolithica (TERQUEM, 1874)
Pl. X, Fig. 2.

1874. *Polymorphina oolithica* TERQ.; TERQUEM, p. 299, pl. 32, fig. 1–10.

1886. *Polymorphina oolithica,* TERQUEM; TERQUEM, p. 62, pl. 7, fig. 11–14.

1890. *Polymorphina oolithica* TERQ.; WISNIOWSKI, p. 232, pl. 3, fig. 27.

1928. *Polymorphina oolithica* TERQUEM; PAALZOW, p. 31, pl. 4, fig. 2.

1937. *Eoguttulina oolithica* (TERQUEM, 1874); BARTENSTEIN and BRAND, p. 179, pl. 8, fig. 34a–b; pl. 10, fig. 43a–b; pl. 11A, fig. 18a–c; 11B, fig. 24a–b; pl. 12B, fig. 18; pl. 15A, fig. 37a–b.

1941. *Eoguttulina oolithica* (TERQUEM); FRENTZEN, p. 357, pl. 5, fig. 29–30.

1982. *Eoguttulina oolithica* (TERQUEM, 1874); BIELECKA and STYK, p. 33, pl. 3, fig. 19.

1986. *Eoguttulina?* cf. *oolithica* (TERQUEM, 1874); STAM, p. 118, pl. 5, fig. 2–3.

Material. More than 170 specimens.

Description. Test oval in outline, with somewhat tapered ends, flattened; oval in cross-section; periphery rounded; three chambers can be seen on both sides; sutures smooth or slightly depressed; aperture radiate and terminal; surface smooth and bright.

Dimensions. Height: 0.42–0.58 mm; diameter: 0.19–0.26 mm.

Distribution. England: Lower Oxfordian to Middle Portlandian; France: Middle Jurassic to Kimmeridgian; Germany: Bajocian to Oxfordian; Poland: Bajocian-Oxfordian; Portugal: Middle Jurassic. Hungary, Mecsek Mts: Hidas Valley: Lower to lower part of the Upper Bathonian; Óbánya Valley: Bathonian.

Eoguttulina planatus n. sp.
Pl. X, Figs 3–4.

Derivatio nominis: planatus (Latin) to flattened.
Locus typicus: Hidas Valley, Mecsek Mts, Hungary.
Stratum typicum: Upper Bathonian.
Holotype: Plate X, Figure 3.
Paratype: Plate X, Figure 4.
Material. 26 specimens.
Diagnosis. Test is large, oval, highly compressed, with 3 or 4 visible chambers. Aperture is radiate.
Description. Test large, oval in outline; strongly flattened with nearly parallels side in cross-section; periphery subrounded; 3 to 4 elongated chambers can be seen from the outside; sutures depressed and longitudinal; aperture radiate and terminal; surface smooth.
Remarks. The most distinctive features of this species are the broad-oval outline and the strongly flattened test.
Dimensions. Height: 0.82–1.28 mm; breadth: 0.35–0.43 mm; wide: 0.07–0.10 mm.
Distribution. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Upper Bathonian; Óbánya Valley: Upper Bathonian.

Subfamily Webbinellinae RHUMBLER, 1904
Genus *Bullopora* QUENSTEDT, 1856

Bullopora rostrata QUENSTEDT, 1858
Pl. X, Fig. 5.

1858. *Bullopora rostrata* QUENSTEDT, p. 580, pl. 73, fig. 28.
1932. *Bullopora rostrata* QUENSTEDT; PAALZOW, p. 137, pl. 10, fig. 1–4.
1936. *Bullopora rostrata* QUENSTEDT; FRANKE, p. 121, pl. 12, fig. 11.
1937. *Bullopora rostrata* QUENSTEDT, 1858; BARTENSTEIN and BRAND, p. 180, pl. 6, fig. 39; pl. 12A, fig. 20a–b; pl. 15A, fig. 38.
1960. *Bullopora rostrata* QUENSTEDT 1858; LUTZE, p. 494, pl. 33, fig. 13.
1960. *Bullopora rostrata* QUENSTEDT 1858; SEIBOLD, E. and I., p. 372, text-fig. 7k, pl. 7, fig. 14.
1978. *Bullopora rostrata* QUENSTEDT, 1858; PJATKOVA and PERMJAKOVA, p. 106, pl. 34, fig. 19.
1989. *Bullopora rostrata* QUENSTEDT, 1857; RIEGRAF and LUTERBACHER, p. 1036, pl. 4, fig. 13.

Material. 52 chambers.
Description. The test consists of some chambers, but in my material there are only isolated chambers; chambers ovoid to nearly spherical with two tubular extentions at the opposite sides of the chamber; aperture small, on an extention of the final chamber; surface smooth.

Dimensions. The largest diameter of the chambers: 0.34–0.43 mm; thickness of extentions: 0.07–0.09 mm.

Distribution. NW Germany: Lower Jurassic to Middle Jurassic; S Germany: Lower Oxfordian; Ukraine: Lower Oxfordian; DSDP, North-Atlantic: Upper Jurassic. This species frequent in the lower part of the Lower Jurassic and rare in whole Middle Jurassic. Hungary, Mecsek Mts: Hidas Valley: Lower Bathonian; Óbánya Valley: Lower to Middle Bathonian.

Subfamily Ramulininae BRADY, 1884

Genus *Ramulina* T. R. JONES, 1875

Ramulina spandeli PAALZOW, 1917

Pl. X, Fig. 6.

1917. *Ramulina spandeli* n. sp.; PAALZOW, p. 46, pl. 47, fig. 15.
1932. *Ramulina spandeli* PAALZOW; PAALZOW, p. 135, pl. 9, fig. 30.
1937. *Ramulina spandeli* PAALZOW, 1917; BARTENSTEIN and BRAND, p. 180, pl. 11B, fig. 25a–b.
1960. *Ramulina spandeli* PAALZOW 1917; SEIBOLD, E. and I., p. 372, text-fig. 7l.
1967. *Nodosaria apheilolocula* TAPPAN; GORDON, p. 453, pl. 4, fig. 31.
1978. *Ramulina spandeli* PAALZOW, 1917; PJATKOVA and PERMJAKOVA, p. 106, pl. 34, fig. 18.
1989. *Ramulina spandeli* PAALZOW; RIEGRAF and LUTERBACHER, p. 1036, pl. 4, fig. 15–21.

Material. 18 chambers.

Description. The test consists of some chambers, but in my material there are only isolated chambers; chambers bottle-shaped; aperture small, on an extention of the final chamber; surface pustulated.

Dimensions. Length of the chambers: 0.38–0.43 mm; the largest diameter of the chambers: 0.24–0.32 mm.

Distribution. NW Germany: Lower Bajocian to Bathonian; S Germany: Lower Oxfordian; Scotland: Callovian; Ukraine: Upper Bajocian, Oxfordian; North-Atlantic: Oxfordian to Barremian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Superfamily Ceratobuliminacea CUSHMAN, 1927

Family Epistominidae WEDEKIND, 1937

Subfamily Epistomininae WEDEKIND, 1937

Genus *Epistomina* TERQUEM, 1883

Epistomina cf. *paraspis* (SCHWAGER, 1866)

Pl. X, Fig. 7.

1937. *Epistomina paraspis* (SCHWAGER, 1866); BARTENSTEIN and BRAND, p. 193, pl. 5, fig. 77.

1960. *Conorboides ? paraspis* (SCHWAGER 1866); SEIBOLD, E. and I., p. 382, text-fig. 7s, t.
? 1968. *Discorbis ? paraspis* (SCHWAGER, 1866); OESTERLE, p. 774, fig. 49.
1971. *Discorbis paraspis* (SCHWAGER), 1866; WERNLI, p. 337, pl. 7, fig. 1–10.
1986. *Discorbis paraspis* (SCHWAGER, 1866); STAM, p. 117, pl. 5, fig. 5–6.

Material. 12 specimens, partly probably moulds.

Description. Test oval in outline, trochospirally coiled in 1,5–2 whorls; spiral side convex, umbilical side concave; periphery rounded; 11 to 14 chambers gradually increasing in size; the last 6 to 8 chambers visible; umbilicus relative by wide and slightly depressed; sutures depressed; aperture at the end of the final chamber; surface smooth.

Remarks. The sutures of the figured specimen are wide and deep probably because this is mould.

Dimensions. The largest diameter: 0.30–0.31 mm; thickness: 0.12–13 mm.

Distribution. E France: Upper Bajocian to Upper Bathonian; NW Germany: Lower Jurassic; S Germany: lower part of the Upper Jurassic; Portugal: Lower Bathonian, Lower Callovian, Middle Oxfordian to Kimmeridgian; Switzerland: Oxfordian. Hungary, Mecsek Mts: Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Subordo Rotaliina DELAGE and HÉROUARD, 1896
Superfamily Discorbacea EHRENBERG, 1838
Family Placentulinidae G.K. KASIMOVA, POROSHINA and GEODAKCHAN, 1980
Subfamily Ashbrookiinae LOEBLICH and TAPPAN, 1984
Genus *Paalzowella* CUSHMAN, 1933

Paalzowella feifeli feifeli (PAALZOW, 1932)
Pl. X, Fig. 8.

1932. *Trocholina feifeli* nov spec.; PAALZOW, p. 140, pl. 11, fig. 6–7.
1960. *Paalzowella feifeli feifeli* (PAALZOW 1932); SEIBOLD, E. and I., p. 378, text-fig. 8h, l, p, q; pl. 7, fig. 2.
1971 *"Paalzowella"* sp. A; WERNLI, p. 341, pl. 8, fig. 5–8, 1–11,
1981. *Paalzowella feifeli* (PAALZOW), 1932; BARNARD et al., pl. 4, fig. 9, 12–13.
1981. *Paalzowella feifeli* (PAALZOW); COLEMAN, p. 114, pl. 6.2.1, fig. 6.
1982. *Paalzowella feifeli* (PAALZOW); COLEMAN, pl. 2, fig. 1

Material. About 1000 specimens.

Description: Test small, trochospirally coiled; low conical, height somewhat smaller than the diameter; numerous chambers arranged in 4 to 7 whorls visible on the spiral side; periphery of the chambers ornamented by carinae, showing a spiral line on the dorsal side, giving step-like appearance; spiral line cut the sutures; sutures indistinct; umbilical side flat or concave; 3 chambers on the final whorl; aperture interiomarginal, slit, extending nearly from the periphery to the umbilicus.

Dimensions. Diameter: 0.19–0.26 mm; height: 0.15–0.21 mm.

Distribution. S Germany: lower part of the Upper Jurassic; England: Bajocian to Lower Oxfordian; E France: Upper Aalenian to Lower Oxfordian. Hungary, Mecsek Mts: Csengő Hill: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Paalzowella feifeli elevata (PAALZOW, 1932)
Pl. X, Fig. 9.

1932. *Trocholina elavata* nov. spec.; PAALZOW, p. 140, pl. 11, fig. 4
1960. *Paalzowella* aff. *feifeli elevata* (PAALZOW 1932); LUTZE, p. 487, pl. 33, fig. 11.
1960. *Paalzowella feifeli elevata* (PAALZOW 1932); SEIBOLD, E. and I., p. 379, text-fig. 8u; pl. 7, fig. 3.
1988. *Paalzowella feifeli elevata* (PAALZOW, 1932); BIELECKA, p. 236, pl. 87, fig. 9.

Material. About 300 specimens.

Description: Test small, trochospirally coiled; high conical, height larger than the diameter; numerous chambers arranged in 4 to 7 whorls visible on the spiral side; periphery of the chambers sometimes ornamented by weak carinae, showing a spiral line on the dorsal side, giving fine step-like appearance; spiral line cut the sutures; sutures indistinct; umbilical side flat or concave; 3 chambers on the final whorl; aperture interiomarginal, slit, extending nearly from the periphery to the umbilicus.

Dimensions. Diameter: 0.19–0.27 mm; height: 0.25–0.34 mm.

Distribution. NW Germany: Oxfordian; Poland: Middle to lower part of Upper Oxfordian. Hungary, Mecsek Mts: Csengő Valley: Upper Bathonian; Hidas Valley: Bathonian; Óbánya Valley: Bathonian.

Paalzowella turbinella (GÜMBEL, 1862) emend. SEIBOLD E. and I., 1955
Pl. X, Figs 10–11.

? 1862. *Rotalina turbinella* n. sp.; GÜMBEL, p. 230, pl. 4, fig. 10a–b.
1955. *Paalzowella turbinella* (GÜMBEL, 1862); SEIBOLD, E. and I., p. 126, text-fig. 5i–m; pl. 13, fig. 12.
1986. *Paalzowella feifeli* (PAALZOW, 1932); STAM, p. 124, pl. 6, fig. 7–8.
1988. *Paalzowella turbinella* (GÜMBEL, 1862); BIELECKA, p. 236, pl. 87, fig. 11.
1989. *Paalzowella turbinella* (GÜMBEL); RIEGRAF and LUTERBACHER, p. 1026, pl. 2, fig. 21.

Material. About 200 specimens.

Description. Test trochospirally coiled; dorsal side low conical; umbilical side concave; periphery sharp. Dorsal side: 5 to 7 whorls, the inner 4 to 5 whorls narrow, the last 2 whorls occupy half of the diameter; sharp spiral line run along the chambers, giving a distinct step-like appearence in side view; sutures indistinct. Ventral side: the last 4 chambers visible; umbilicus depressed; sutures slightly depressed; in half part of each chambers a narrow, deep stria appears, start out umbilicus and up to 3/4 part of radius; aperture on the end of the last chamber, extending above an older chamber.

Remarks. Description and figuration of *Rotalia turbinella* in GÜMBEL (1862) differ from the neotypus of this species in SEIBOLD, E. and I. (1955) in rounded periphery and in absence of the characteristic spiral line.

Dimensions. Diameter: 0.26–0.35 mm; height: 0.18–0.22 mm;

Distribution. Germany: Upper Jurassic; Grand Banks: Middle Callovian to Kimmeridgian; S Poland: Upper Oxfordian; North Atlantic: Oxfordian, Lower Kimmeridgian. Hungary, Mecsek Mts: Hidas Valley: Lower to Middle Bathonian; Óbánya Valley: Bathonian.

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Plate explanations

Plates on pp. 209–218

PLATE I.

Fig. 1. *Thurammina papillata* BRADY. Upper Bathonian, Óbánya Valley 13. sample; Side view. N: 240x

Fig. 2. *Jaculella* sp.. Lower Bathonian, Hidas Valley 14. sample; Side view. N: 90x

Fig. 3. *Glomospira variabilis* (KÜBLER & ZWINGLI). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 130x

Fig. 4. *Reophax dentaliniformis* BRADY. Upper Bathonian, Csengő Hill; Side view. N: 105x

Fig. 5. *Ammobaculites agglutinans* (D'ORBIGNY). Upper Bathonian, Hidas Valley 7. sample; Side view. N: 155x

Fig. 6. *Triplasia bartensteini* LOEBLICH & TAPPAN. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 95x

Fig. 7. *Haplophragmium coprolithiforme* SCHWAGER. Lower Bathonian, Óbánya Valley 9. sample; Side view. N: 50x

Fig. 8. *Tritaxis lobata* (SEIBOLD, E. & I.) Lower Bathonian, Óbánya Valley 7. sample; Dorsal side. N: 100x

Fig. 9. *Tritaxis lobata* (SEIBOLD, E. & I.) Lower Bathonian, Óbánya Valley 7. sample; Ventral side. N: 90x

PLATE II.

Fig. 1. *Trochammina globigeriniformis* (PARKER & JONES). Lower Bathonian, Óbánya Valley 7. sample; Ventral side. N: 210x

Fig. 2. *Verneuilinoides tryphera* LOEBLICH & TAPPAN. Lower Bathonian, Hidas Valley 14. sample; Side view. N: 170x

Fig. 3. *Verneuilinoides mauritii* (TERQUEM). Lower Bathonian, Óbánya Valley 13. sample; Side view. N: 190x

Fig. 4. *Textularia jurassica* GÜMBEL. Lower Bathonian, Hidas Valley 9. sample; Side view. N: 230x

Fig. 5. *Pseudomarssonella dumortieri* (SCHWAGER). Middle Bathonian, Óbánya Valley 9. sample; Dorsal side. N: 90x

Fig. 6. *Pseudomarssonella dumortieri* (SCHWAGER). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 80x

Fig. 7. *Pseudomarssonella dumortieri* (SCHWAGER). Middle Bathonian, Óbánya Valley 9. sample; Ventral side. N: 50x

Fig. 8. *Spirillina elongata* BIELECKA & POZARYSKI. Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 80x

Fig. 9. *Spirillina infima* (STRICKLAND). Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 150x

Fig. 10. *Spirillina infima* (STRICKLAND). Middle Bathonian, Óbánya Valley 9. sample; Side view of a gamont specimen. N: 95x

Fig. 11. *Spirillina tenuissima* GÜMBEL. Lower Bathonian, Hidas Valley, 12. sample; Side view. N: 130x

PLATE III

Fig. 1. *Palaeomiliolina* ? sp. Lower Bathonian, Hidas Valley, 14. sample; Side view. N: 85x

Fig. 2. *Caputifera sulcata* n. sp. Holotype. Middle Bathonian, Hidas Valley, 10. sample; Side view. N: 50x

Fig. 3. *Caputifera sulcata* n. sp. Paratype. Upper Bathonian, Csengő Hill. Side view. N: 60x

Fig. 4. *Caputifera sulcata* n. sp. Paratype. Upper Bathonian, Csengő Hill. Side view. N: 70x

Fig. 5. *Caputifera sulcata* n. sp. Paratype. Middle Bathonian, Hidas Valley, 10. sample; Side view of a specimen without final chamber. N: 80x

Fig. 6. *Ichthyolaria nympha* KOPIK. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 150x

Fig. 7. *Ichthyolaria spatula* (TERQUEM). Upper Bathonian, Csengő Hill; Side view. N: 120x

Fig. 8. *Ichthyolaria serraticostata* n. sp. Holotype. Upper Bathonian, Hidas Valley 7. sample; Side view. N: 145x

Fig. 9. *Ichthyolaria hidasi* n. sp. Holotype. Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 110x

Fig. 10. *Dentalina bicornis* TERQUEM. Upper Bathonian, Hidas Valley 7. sample; Side view. N: 80x

PLATE IV

Fig. 1. *Dentalina pseudocommunis* FRANKE. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 65x

Fig. 2. *Dentalina buccinea* n.sp. Holotype. Lower Bathonian, Hidas Valley 16. sample; Side view. N: 90x

Fig. 3. *Dentalina buccinea* n.sp. Paratype. Lower Bathonian, Hidas Valley 16. sample; Apertural view. N: 110x

Fig. 4. *Dentalina goldfussana* (GÜMBEL). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 150x

Fig. 5. *Dentalina jurensis* (GÜMBEL). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 60x

Fig. 6. *Dentalina apiculata* nom. nov.. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 160x

Fig. 7. *Dentalina oolithica* (TERQUEM). Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 60x

Fig. 8. *Falsopalmula deslongchampsi* (TERQUEM). Lower Bathonian, Óbánya Valley 8. sample; Side view. N: 65x

Fig. 9. *Falsopalmula deslongchampsi* (TERQUEM). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 90x

Fig. 10. *Falsopalmula jurensis* (FRANKE). Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 100x

PLATE V

Fig. 1. *Falsopalmula rugosa* (D'ORBIGNY). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 100x

Fig. 2. *Nodosaria* cf. *costata* (BORNEMANN). Upper Bathonian, Hidas Valley 7. sample; Side view. N: 220x

Fig. 3. *Nodosaria* ? cf. *cuneiformis* (TERQUEM). Lower Bathonian, Hidas Valley 14. sample; Side view. N: 120x

Fig. 4. *Nodosaria fontinensis* TERQUEM. Lower Bathonian, Hidas Valley 14. sample; Side view. N: 100x

Fig. 5. *Nodosaria lagenoides* WISNIOWSKI. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 150x

Fig. 6. *Nodosaria mutabilis* TERQUEM. Middle Bathonian, Hidas Valley 11. sample; Side view. N: 165x

Fig. 7. *Nodosaria oculina* (TERQUEM et BERTHELIN). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 115x

Fig. 8. *Nodosaria plicatilis* WISNIOWSKI. Upper Bathonian, Csengő Hill; Side view. N: 75x

Fig. 9. *Nodosaria raphanistriformis* (GÜMBEL). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 80x

PLATE VI

Fig. 1. *Nodosaria tornata* SCHWAGER. Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 125x

Fig. 2. *Nodosaria turbiformis* SCHWAGER. Upper Bathonian, Hidas Valley 7. sample; Side view. N: 145x

Fig. 3. *Nodosaria turbiformis* SCHWAGER. Upper Bathonian, Hidas Valley 7. sample; Apertural view. N: 225x

Fig. 4. *Nodosaria* sp. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 120x

Fig. 5. *Pseudonodosaria humilis* (ROEMER). Lower Bathonian, Óbánya Valley 8. sample; Side view. N: 120x

Fig. 6. *Pseudonodosaria tenuis* (BORNEMANN). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 95x

Fig. 7. *Pseudonodosaria vulgata* (BORNEMANN). Lower Bathonian, Óbánya Valley 8. sample; Side view. N: 90x

Fig. 8. *Lenticulina biexcavata* (MJATLIUK). Middle Bathonian, Óbánya Valley 9. sample; Oblique apertural view. N: 130x
Fig. 9. *Lenticulina biexcavata* (MJATLIUK). Middle Bathonian, Hidas Valley 11. sample; Side view. N: 75x

PLATE VII

Fig. 1. *Lenticulina cultrata* (MONTFORT). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 115x
Fig. 2. *Lenticulina cultrata* (MONTFORT). Lower Bathonian, Hidas Valley 16. sample; Apertural view. N: 130x
Fig. 3. *Lenticulina dorbignyi* (ROEMER). Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 140x
Fig. 4. *Lenticulina parmula* GOFMAN. Lower Bathonian, Hidas Valley 16. sample; Apertural view. N: 80x
Fig. 5. *Lenticulina parmula* GOFMAN. Lower Bathonian, Hidas Valley 16. sample; Side view. N: 100x
Fig. 6. *Lenticulina muensteri* (ROEMER). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 70x
Fig. 7. *Lenticulina quenstedti* (GÜMBEL). Middle Bathonian, Óbánya Valley 10. sample; Side view. N: 80x
Fig. 8. *Planularia tricarinella* (REUSS). Lower Bathonian, Hidas Valley 16. sample; Apertural view. N: 65x
Fig. 9. *Planularia tricarinella* (REUSS). Lower Bathonian, Hidas Valley 14. sample; Side view. N: 85x

PLATE VIII

Fig. 1. *Marginulinopsis comptula* SCHWAGER. Lower Bathonian, Hidas Valley 14. sample; Side view. N: 90x
Fig. 2. *Astacolus major* (BORNEMANN). Lower Bathonian, Hidas Valley 16. sample; Side view. N: 60x
Fig. 3. *Astacolus matutina* (D'ORBIGNY). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 80x
Fig. 4. *Astacolus varians* (BORNEMANN). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 100x
Fig. 5. *Astacolus vetusta* (D'ORBIGNY). Lower Bathonian, Óbánya Valley 8. sample; Side view. N: 80x
Fig. 6. *Marginulina simplex* (TERQUEM). Lower Bathonian, Hidas Valley 12. sample; Side view. N: 95x
Fig. 7. *Marginulina solida* TERQUEM. Lower Bathonian, Óbánya Valley 8. sample; Side view. N: 50x
Fig. 8. *Marginulina terquemi* D'ORBIGNY. Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 120x
Fig. 9. *Citharina clathrata* (TERQUEM). Lower Bathonian, Hidas Valley 14. sample; Side view. N: 60x

Fig. 10. *Citharina clathrata* (TERQUEM). Lower Bathonian, Hidas Valley 14. sample; Side view. N: 60x

PLATE IX

Fig. 1. *Citharina ornithocephala* (WISNIOWSKI). Upper Bathonian, Hidas Valley 9. sample; Side view. N: 110x
Fig. 2. *Citharinella irregularis* TERQUEM. Upper Bathonian, Csengő Hill; Side view. N: 130x
Fig. 3. *Citharinella oolithica* (TERQUEM). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 180x
Fig. 4. *Planularia beierana* (GÜMBEL). Lower Bathonian, Hidas Valley 14. sample; Side view. N: 150x
Fig. 5. *Planularia pauperata* JONES & PARKER. Lower Bathonian, Hidas Valley 14. sample; Side view. N: 100x
Fig. 6. *Planularia plana* (REUSS). Middle Bathonian, Óbánya Valley 9. sample; Side view. N: 70x
Fig. 7. *Vaginulina legumen* (LINNÉ). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 140x
Fig. 8. *Vaginulina mecseki* n. sp.. Paratype. Middle Bathonian, Hidas Valley 10. sample; Side view. N: 40x
Fig. 9. *Vaginulina mecseki* n. sp. Holotype. Middle Bathonian, Hidas Valley 10. sample; Frontal view. N: 55x
Fig. 10. *Lagena vulgaris* WILLIAMSON. Upper Bathonian, Hidas Valley 9. sample; Apertural view. N: 140x

PLATE X

Fig. 1. *Eoguttulina liassica* (STRICKLAND). Lower Bathonian, Hidas Valley 13. sample; Side view. N: 70x
Fig. 2. *Eoguttulina oolithica* (TERQUEM). Lower Bathonian, Óbánya Valley 7. sample; Side view. N: 100x
Fig. 3. *Eoguttulina planatus* n. sp. Holotype. Upper Bathonian, Hidas Valley 9. sample; Side view. N: 70x
Fig. 4. *Eoguttulina planatus* n. sp. Paratype. Upper Bathonian, Hidas Valley 9. sample; Side view. N: 65x
Fig. 5. *Bullopora rostrata* QUENSTEDT. Upper Bathonian, Hidas Valley 7. sample; Side view. N: 110x
Fig. 6. *Ramulina spandeli* PAALZOW. Upper Bathonian, Hidas Valley 7. sample; Side view. N: 110x
Fig. 7. *Epistomina* cf. *paraspis* (SCHWAGER). Upper Bathonian, Hidas Valley 8. sample; Dorsal side. N: 160x
Fig. 8. *Paalzowella feifeli feifeli* (PAALZOW). Lower Bathonian, Óbánya Valley 6. sample; Dorsal side. N: 180x
Fig. 9. *Paalzowella feifeli elevata* (PAALZOW). Lower Bathonian, Óbánya Valley 6. sample; Side view. N: 160x

Fig. 10. *Paalzowella turbinella* (GÜMBEL) emend. SEIBOLD, E. & I. Lower Bathonian, Óbánya Valley 6. sample; Dorsal side. N: 150x

Fig. 11. *Paalzowella turbinella* (GÜMBEL) emend. SEIBOLD, E. & I. Lower Bathonian, Óbánya Valley 6. sample; Umbilical side. N: 160x

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GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Bathonian Radiolaria from the Mecsek Mts (South Hungary)

András BARABÁS[1]

(2 plates on pp. 219-220)

Abstract

Samples were collected and studied for radiolarians from the Óbánya Limestone Formation of Bathonian age from the Mecsek Mts. Unfortunately, the preservation of radiolarians was poor, because of the selective dissolution of tests in the calcareous, thus chemically alkaline sediments. However, the radiolarians can verify the ancient pelagic, bathyal environment and do not exclude the Bathonian age of the samples, but don't make possible to restrict their age only this stage, and the review of taxa can help future studies.

Key words: Radiolaria, Jurassic, bathonian, Mecsek Mts, Hungary, stratigraphy

Introduction

The Bathonian radiolarian fauna of the Tethyan region is rather unknown, because the widespread formation of radiolarite and cherty limestone have started generally only in the Callovian. In the case of the Bathonian radiolarians of the Mecsek, almost all tests were dissolved or replaced by calcite after the burial in the calcareous, thus alkaline sedimentary environment. The dissolving and replacing process was selective. The spinous, branching forms were dissolved mainly, so the fossil fauna differs considerably from the ancient association. This phenomenon, and the poor preservation cause that neither adequate paleoecological-taxonomical, nor appropriate stratigraphical evaluation about the radiolarian fauna can be given. However, the review of the taxa and the photoplates can help future studies, or examination of the fauna of other areas.

The radiolaria content from the Upper Jurassic - Lower Cretaceous limestone - cherty limestone series of the eastern Mecsek is well known. The best and most detailed evaluation of the quantitative distribution of radiolarians was made by NAGY (1964, 1966) within the framework of his microfacies studies. However, the only study of radiolarian taxonomy and stratigraphy is the author's still unpublished university diploma work.

[1]Pécs, Hajnóczy u. 1, H-7633 Hungary

The Bathonian Óbánya Limestone Formation was not examined for radiolarians before. The radiolarian content of the rocks increases uniformly from the early Middle Jurassic to the Upper Jurassic, with the increasing water depth. The mainly red, nodular, marly limestone of the Óbánya Formation is a very characteristic, easily recognizable part of this deepening facies series. It contains relatively great amount of macrofossils, so no attention was paid previously to the radiolarians.

The studied material came from two localities of the Óbánya Limestone (Fig. 1). One localitity is the Hidas valley, where a complete Bathonian section was studied for different faunal elements. Samples which were prepared for ostracod and foraminiferal studies gave some radiolarians, too (see below). The samples came from different levels of the Bathonian (Fig. 2). The other locality is the Bathonian profile in the Óbánya valley. Here the same sampling procedure was followed. The samples refer also to different levels within the Bathonian (Fig. 3).

Preservation of the radiolarians and the extraction method

The poor preservation of the Bathonian radiolarians makes the studies difficult. In most cases the test material is calcified, more or less corroded, in some cases entirely dissolved. Internal casts are frequent.

The author's previous attempts to extract radiolarians from the Bathonian sediments proved unsuccessful, because of the use of traditional HCl-dissolving method. In the recent study all samples were dissolved in concentrated acetic acid, and the remnants were separated by a screen. The acetic acid is indulgent for the tests, but even by using this special and time consuming method, a few samples were productive only (Fig. 4).

Taxonomical, paleoecological and paleoenvironmental evaluation

There are only a few publication on Bathonian (and older Middle Jurassic) radiolarians, especially from the Tethyan region. Comprehensive summaries on Tethyan radiolarites are given by BAUMGARTNER (1984, 1987). His zonation starts somewhere in the Bajocian, but the exact starting point is undefined, and the first zone includes an uncertain part of the Bajocian and the whole Bathonian. This fact shows clearly the problems of Bathonian radiolarian studies. Deposition of radiolarites became common in the Callovian; these sediments and the Upper Jurassic–Lower Createceous pelagic, deep-water siliceous limestones generally contain great amount of well-preserved radiolarians.

In the case of the samples from the Mecsek Mts, 17 taxa were identified, but in most cases only on generic level. Because of the poor preservation, further refining was impossible. 9 genera belong to suborder Nassellariina, and only 2 to suborder Spumellariina. On species level and in specimen number the dominance of Nassellariina is even greater. Normally the ratio of the two suborders is near to 1:1. On the other hand, genus *Praeconocaryomma* is interestingly represented by very variable forms (at least two, but possibly four species). There are only 4 or 5 species reported worldwide from the whole Middle Jurassic–Lower Cretaceous. It is also remarkable, that both in

Nassellariina and Spumellariina the more or less spherical forms predominate, almost all spines and other protruding sculptural elements being absent.

The question arises: whether the composition of this fossil fauna corresponds to the ancient faunal association or not? Answering this question is very important for making sound paleoecological evaluation. The answer is definitely not. The main reason of the difference is the post-burial dissolution of radiolarian tests, which is extremely strong in calcareous deposits, because the alkaline environment being favourable for dissolving siliceous material. Unfortunately the course of the dissolution process is incompletely known, just like the closely related formation of chert nodules.

The dissolving and calcite replacing process is apparently selective. Spherical, isometric tests are more resistant to dissolution than branching, spine-bearing forms, which provide more points of attack for the dissolving agents. Probably there is an other selecting factor for the resistance against dissolution and calcite replacing, because the microstructural (crystalline) composition of the tests correlates with the taxonomical position of the specimens.

STEIGER (1992) has made a paleoecological and paleoenvironmental analysis of the Upper Jurassic radiolarians of the Northern Calcareous Alps, but this method cannot be applied for the Bathonian of the Mecsek Mts, because of the presence of poorly preserved radiolarians here. General principles of radiolarian ecology, e.g. that species of small, spherical, massive body live in deep water, cannot be followed in this case, because just these forms are resistant to post-burial dissolution, while the fragile, spine-bearing species are absent from the fossil assemblages.

The selective dissolving and replacing processes explain the uncommon ratio between the suborders Nassellariina and Spumellariina, but do not give a reason for the high variability and number of species of genus *Praeconocaryomma.* In the Upper Jurassic–Lower Cretaceous of the Mecsek there is only a single *Praeconocaryomma* species in the rich radiolarian fauna (90 taxa!). On the other hand the Bathonian radiolarian fauna contained originally at least 2, but more probably 4 (or even more) *Praeconocaryomma* species. It is a very interesting fact, but difficult to explain, because *Praeconocaryomma* is an extinct genus, therefore its ecological features are still unknown.

As a summary, it can be stated that the recent composition of the poorly preserved Bathonian radiolarian fauna is a result of the selective post-burial dissolving and calcite replacing process. The presence of deep-water forms suggests pelagic, bathyal environment, but the vertical distribution of radiolarian species is still unreconstructable.

Stratigraphy and palaeobiogeography

Unfortunately the Bathonian radiolarians of the Mecsek Mts are unsuitable for stratigraphy. Most specimens were identified only on generic level, and some of them are probably new species. The range of the identified two species [*Mirifusus mediodilatatus* s.l. (RÜST 1885) and *Triactoma jonesi* (PESSAGNO 1977)] and their subordinate occurrence in the samples make the stratigraphical evaluation impossible. The radiolarians do not exclude the Bathonian age of the samples, but do not make possible to restrict their age only to this stage. The only result is the extension of the range of *M. mediodilatatus* s.l. down to the lower part of the Bathonian. The previous range was determined by BAUMGARTNER (1984) as Callovian to Tithonian. The ranges of the radiolarian taxa identified in the samples are shown in Figure 4.

Palaeobiogeographical evaluation has the same problems as stratigraphy, i.e. the poor preservation of the radiolarians. The Mecsek Mts is generally considered as having been belonged to the borderland of the Mediterranean and "European" provinces during most of the Mesozoic times, with a site on the southern margin of stable Europe. PESSAGNO & BLOME (1986) have defined the criteria of the Tethyan and Boreal realms for radiolarians. Their work was revised by BAUMGARTNER (1987), who established that these realms were primarily controlled by palaeoceanographical rather than palaeolatitudinal factors ("Tethyan": high fertility - stirred ocean; "Boreal": low fertility - stratified ocean). However, keeping the two realms is useful for radiolarian palaeobiogeography. The Bathonian radiolarian fauna of the Mecsek Mts is too poor to identify the realm, but previous works (BARABÁS, unpublished) on the Upper Jurassic and Lower Cretaceous show rather the Tethyan connections (e.g. abundance and high diversity of Pantanellids). This result could be corroborated by the more complete comparison of the entire Jurassic radiolarian fauna of the Mecsek Mts with other (Tethyan or Boreal) faunas.

Systematic part

Subordo Spumellariina EHRENBERG 1875
Familia Stylosphaeridae HAECKEL 1882, emend. KOZUR & MOSTLER 1979
Genus *Triactoma* RÜST 1885

Type species: *Triactoma tithonianum* RÜST 1885.

Triactoma jonesi (PESSAGNO 1977)
Plate 2, Figs 9–10.

1977a *Tripocyclia jonesi* PESSAGNO, p.80, pl.7, figs 1–5.
1978 *Triactoma jonesi* (PESSAGNO) - FOREMAN, p.743, pl.1, figs 13–14.
1984 *Triactoma jonesi* (PESSAGNO) - BAUMGARTNER, p.790, pl.10, fig.4.
1986 *Triactoma jonesi* (PESSAGNO) - DE WEVER, pl.6, fig.16.
1990 *Tripocyclia jonesi* PESSAGNO - YANG & WANG, pl.2, fig. 9.
1992 *Triactoma jonesi* (PESSAGNO) - STEIGER, pl.3, figs 9–13.

Remarks: The only form which was sufficient to determine on species level.

Familia Praeconocaryommidae PESSAGNO 1976
Genus Praeconocaryomma PESSAGNO 1976

Type species: *Praeconocaryomma universa* PESSAGNO 1976

Praeconocaryomma sp. A
Plate 2, Fig. 8.

Description: Smaller form, moderately tuberculated. Tubercules are medium-sized, blunt. Pore frame is probably rounded or irregular. The medullary shell is unknown.

Praeconocaryomma sp. B
Plate 2, Fig. 7.

Description: Relatively big, densely tuberculated form. Tubercules are small, slightly pointed. Pore frame is probably rounded or irregular. The medullary shell is unknown.

Remarks: Bigger form with more tubercules than in *Praeconocaryomma* sp. A. There are two further, very poorly preserved *Praeconocaryomma*s called here as *P.* sp. C and *P.* sp. D, but their identification is uncertain. *Paraconocaryomma* sp. C is a big form (1.5–2 times bigger than *P.* sp. B), its tuberculated structure is similar to that of *P.* sp. B. *Praeconocaryomma* sp. D is a very small form with great, circularly arranged, blunt tubercules.

Subordo Nassellariina EHRENBERG 1875
Familia Hsuidae PESSAGNO & WHALEN 1982
Genus *Hsuum* PESSAGNO 1977

Type species: *Hsuum cuestaensis* PESSAGNO 1977.

Hsuum sp.
Plate 2, Fig. 4.

Remarks: Several poorly preserved specimens. Pore structure is unrecognizable.

Familia Stichocapsidae HAECKEL 1882
Genus *Tricolocapsa* HAECKEL 1881

Type species: *Tricolocapsa theophrasti* HAECKEL 1887.

Tricolocapsa sp.
Plate 2, Fig. 5.

Description: Spherical, pear-shaped form with small, irregular pores. Proximal part is small, rounded.

Familia Syringocapsidae FOREMAN 1973
Genus *Mirifusus* PESSAGNO 1977

Type species: *Mirifusus guadalupensis* PESSAGNO 1997.

Mirifusus mediodilatatus s.l. (RÜST 1885)
Plate 2, Fig. 2.

1885 *Lithocampe mediodilatata* RÜST, p.316, pl.40, fig. 9.

Remarks: Internal casts; ranging into subspecies is impossible.

Genus *Podocapsa* RÜST 1885

Type species: *Podocapsa guembeli* RÜST 1885.

Podocapsa sp.
Plate 2, Fig. 1.

Description: Test is divided into three equal parts. Proximal part is conical, pointed, pore structure is unrecognizable. Middle part is sphaerical with penta- and hexagonal pore frame. Distal part and wings are cylindrical, slightly conical with the same pore structure as in the middle part.
Remarks: The spherical middle part is uncharacteristic for other *Podocapsa* species.

Genus *Sethocapsa* HAECKEL 1881

Type species: *Sethocapsa cometa* (PANTANELLI) in RÜST 1885.

Sethocapsa sp. A
Plate 1, Fig. 6.

Description: Proximal part is conical, pointed, pore structure is unrecognizable. Distal part spherical with penta- and hexagonal pore frame.

Sethocapsa sp. B
Plate 1, Fig. 5.

Description: Proximal part is hemispherical, pore structure is unrecognizable. Distal part is spherical, densely tuberculated.

Familia Eucyrtidiidae EHRENBERG 1847
Genus *Podobursa* WISNIOWSKI 1889

Type species: *Podobursa dunikowskii* WISNOWSKI 1889

Podobursa sp. A
Plate 1, Fig. 3.

Remarks: Shape and habit is similar to those of *P. spinosa* (OŽVOLDOVÁ 1975), but the radial extensions and branching spines are missing (may be broken off or dissolved).

Podobursa sp. B
Plate 1, Figs 1–2.

Description: Proximal part is conical, elongated, with irregular pores. Middle part is spherical with penta- and hexagonal pore frame, and without spines. Distal part is cylindrical, slightly conical.

Podobursa sp. C
Plate 1, Fig. 4.

Description: Big test, middle part is regular, spherical, with big penta- and hexagonal pores and without spines. Proximal and distal parts are short, conical with irregular pores.
Remarks: The most abundant form, in several samples.

Familia Parvicingulidae PESSAGNO 1977

Genus *Parvicingula* PESSAGNO 1977

Type species: *Parvicingula santabarbarensis* PESSAGNO 1977.

Parvicingula sp.
Plate 2, Fig. 3.

Description: Conical form, but the last two segments are narrower than the middle ones. Cephalis, thorax and abdomen are all smooth, conical. The following eight postabdominal segments have three rows of pores and are separated by circumferential ridges.

Familia Theoperidae HAECKEL 1882, emend. RIEDEL 1967
Genus *Protunuma* ICHIKAWA & YAO 1976

Type species: *Protunuma fusiformis* ICHIKAWA & YAO 1976

Remarks: All here studied *Protunuma* specimens are internal casts. The species are frequent as compared to the total number of the radiolarians.

Protunuma sp. A
Plate 1, Fig. 7.

Description: Slightly pear-shaped form. Test has 5 longitudinal costae per half circumference. Pore structure is unrecognizable.
Remarks: The shape is similar to that of *Protunuma* (?) sp. B in STEIGER 1992.

Protunuma sp. B
Plate 1, Fig. 9.

Description: Big, spherical melon-shaped form without apical horn. Test has 6 longitudinal costae per half circumference, and a little collar on the distal part. Pore structure is unrecognizable.

Protunuma sp. C
Plate 1, Fig. 8.

Description: Small, acorn-shaped form without apical horn. Test has 4–5 longitudinal costae per half circumference, and a collar on the distal part. Pore structure is unrecognizable.

Familia Williriedellidae DUMITRICĂ 1970

Williriedellidae gen. and sp. indet.
Plate 2, Fig. 6.

Remarks: A frequent group of radiolarians in all samples.

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Plate 1

Fig. 1: *Podobursa* sp. B, Sample H–10.
Fig. 2: *Podobursa* sp. B, Sample H–10.
Fig. 3: *Podobursa* sp. A, Sample H–11.
Fig. 4: *Podobursa* sp. C, Sample H–8.
Fig. 5: *Sethocapsa* sp. B, Sample H–10.
Fig. 6: *Sethocapsa* sp. A, Sample H–8.
Fig. 7: *Protunuma* sp. A, Sample H–11.
Fig. 8: *Protunuma* sp. C, Sample H–10.
Fig. 9: *Protunuma* sp. B, Sample H–16.

(H = Hidas valley)
scale bars = 100 μm

Plate 2

Fig. 1: *Podocapsa* sp., Sample H–10.
Fig. 2: *Mirifusus mediodilatatus* s.l., Sample H–10.
Fig. 3: *Parvicingula* sp., Sample H–10.
Fig. 4: *Hsuum* sp., Sample H–10.
Fig. 5: *Tricolocapsa* sp., Sample Óv–13.
Fig. 6: Williriedelidae gen. et sp. indet., Sample H–10.
Fig. 7: *Praeconocaryomma* sp. B, Sample H–10.
Fig. 8: *Praeconocaryomma* sp. A, Sample H–8.
Fig. 9: *Triactoma jonesi* (PESSAGNO), Sample H–10.
Fig.10: *Triactoma jonesi* (PESSSAGNO), Sample H–10.

(H = Hidas valley; Óv = Óbánya valley)
scale bars = 100 μm

Annales Univ. Sci. Budapest., Sect. Geol. 30, 93–109 & 221–224 (1995)
GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Bivalvia from the Bathonian (Middle Jurassic) of the Mecsek Mts, Hungary

István SZENTE[1]

(2 figures and 4 plates on pp. 221–224)

Abstract

Marine bivalves from the Bathonian red, nodular marl of the Mecsek Mts (Southern Transdanubia, Hungary) are briefly described and figured. Twenty taxa are identified, among them a new species, *Limea (Pseudolimea) galaczi* n. sp., is designated. Three bivalve associations could be recognized. *Inoceramus oosteri* FAVRE 1870 occurs in dense clusters. *Bositra buchii* (ROEMER 1836) usually concentrates in pavements on bedding planes of marl beds. Scattered occurrence of *Anisocardia*? sp. cf. *A. (A.) tenera* (SOWERBY 1821), limids and some rarer forms characterizes the bivalve assemblage of the nodular limestone facies. The bivalve fauna proves that the Bathonian sequence has been deposited in a deeper-water environment.

Key words: Bivalvia, Jurassic, Bathonian, Mecsek Mts, Hungary, stratigraphy, palaeoecology

Introduction

The red, nodular marl sequence of the Bathonian represents one of the most fossil-rich stages of the Jurassic in the Mecsek Mts. During the last one and a half decade, several thousands of fossils were collected from these beds by students of the Eötvös Loránd University and by staffs of the Department of Palaeontology of the Eötvös Loránd University and of the Geological and Palaeontological Department of the Hungarian Museum of Natural History. This material, which contains more than 120 bivalve specimens, served as the base of the palaeontological re-study of the Bathonian of the Mecsek Mts.

Some 20 bivalve species, belonging to 15 genera have been identified. Therefore the Mecsek Mts yielded one of the most diverse Bathonian bivalve faunas of the Alpine-Carpathian belt. Moreover, because bivalves are generaly not frequent in the ammonite-rich, nodular marl facies, and are often confined to some "paper pectens", the Mecsek fauna seems to be worth documenting here.

[1]Eötvös University, Department of Palaeontology, H-1083 Budapest, Ludovika tér 2, Hungary.

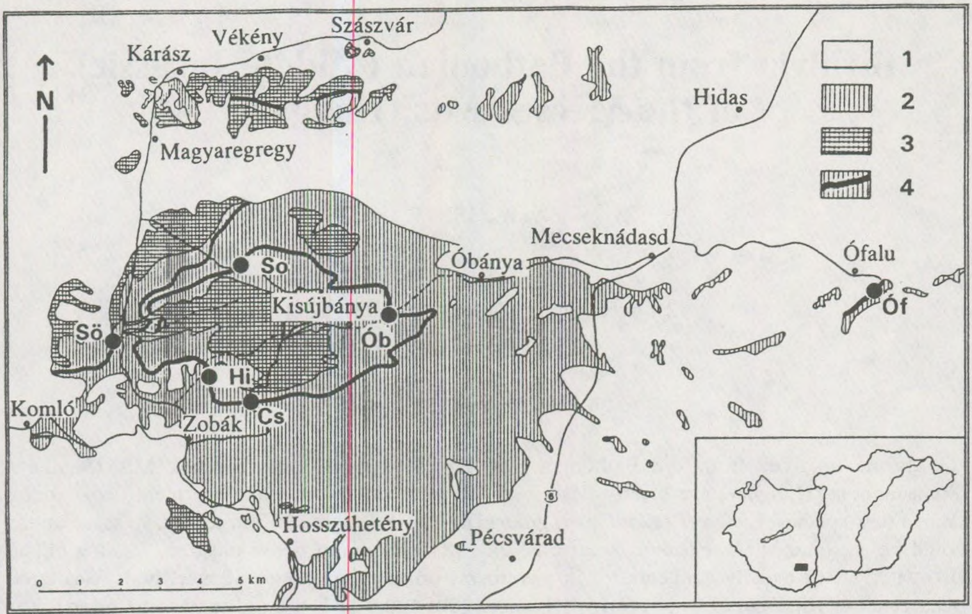


Fig. 1. Sketch map of the locality of studied sections in the Eastern Mecsek Mountains, South-Hungary. Legend: Ób - Óbánya Valley; **Hi** - Hidas Valley; **Cs** - Csengő Hill; **Z** - Zengővárkony. **1** Cenozoic sediments; **2** Mesozoic sediments; **3** Mesozoic volcanics; **4** outcrops of the Bathonian–Callovian beds.

Previous studies

Bathonian bivalves of the Mecsek Mountains, just as most Hungarian Jurassic bivalve faunas, did not receive much attention in the past. The eminent Hungarian geologist János BÖCKH, in his pioneering work on the Middle Jurassic of the Mecsek Mts (BÖCKH 1881) described four bivalve species: "*Inoceramus petalotus* n. sp." and "*Posidonomya alpina* GRAS" from the "*dubium* and *rectelobatum* beds", and "*Ostrea costata* SOW." and "*Ostrea rhysa* n. sp." from the "*rectelobatum*" and "*subfurcatum*" beds, respectively. The first and last mentioned species, described as new ones by BÖCKH, were figured as well. Later VADÁSZ (1935), in his monograph of the Mecsek Mountains, gave extended lists of fossils from the area. He added "*Anomia* sp.", "*Entolium* cfr. *renevieri* OPP.", "*E. demissum* PHILL." and "*Isocardia* sp." to the species recorded by BÖCKH, and listed all of them as Bathonian. Since the publication of VADÁSZ's work only a very few has been added to the knowledge of the Bathonian bivalves of the Mecsek Mts: KOVÁCS (1953) recorded *Goniomya* sp. from the Hidas valley.

Ammonites are by far the most frequent macrofossils in the Bathonian of the Mecsek Mountains. They were treated several times since the pioneering publication of BÖCKH (1881), in which, beside them, some belemnites and brachiopods were described as well. Many ammonite species were figured by GALÁCZ (1984, 1995) and TÖRÖK et al.

(1987). Sponges, other conspicuous elements of the fauna, were described by POČTA (1886). Forams and ostracods were studied by GÖRÖG (1995) and MONOSTORI (1995), respectively. BARABÁS (1995) investigated radiolarians. A surprisingly rich brachiopod fauna was described by VÖRÖS (1995). NAGY (1958) documented the co-occurrence of a belemnite and a rhyncholite.

Geological setting and localities

The red, nodular marl beds of the Bathonian rest on Bajocian grey marls and limestones which represent the youngest formation of a 1,000–2,000 m thick Upper Sinemurian–Bajocian "Fleckenmergel" sequence. Due to their distinctive colour and easily recognizable lithology even in the loose, Bathonian beds serve as an important stratigraphic marker horizon in the tectonically complicated eastern Mecsek Mts. The Bathonian is overlain by a sequence of compact greenish grey, well-bedded cherty limestones ranged into the Callovian. The lithological changes seem to coincide with the stage boundaries, however, the basal beds of the overlying limestone sequence may still belong to the Bathonian, and the lowermost red, nodular beds may represent the uppermost Bajocian.

Two lithofacies dominate the Bathonian rocks of the Mecsek Mts: seams of dark red to green, more or less laminated marl and lighter-coloured, more calcareous layers alternate. Thicknesses of the latter beds usually do not exceed 10 cm. The ratio of clayey and calcareous beds proved to be highly variable in the studied sections, and does not seem to show any tendencies. The microfacies is uniform "*Bositra*-wackestone" throughout the sequence (TÖRÖK et al. 1987).

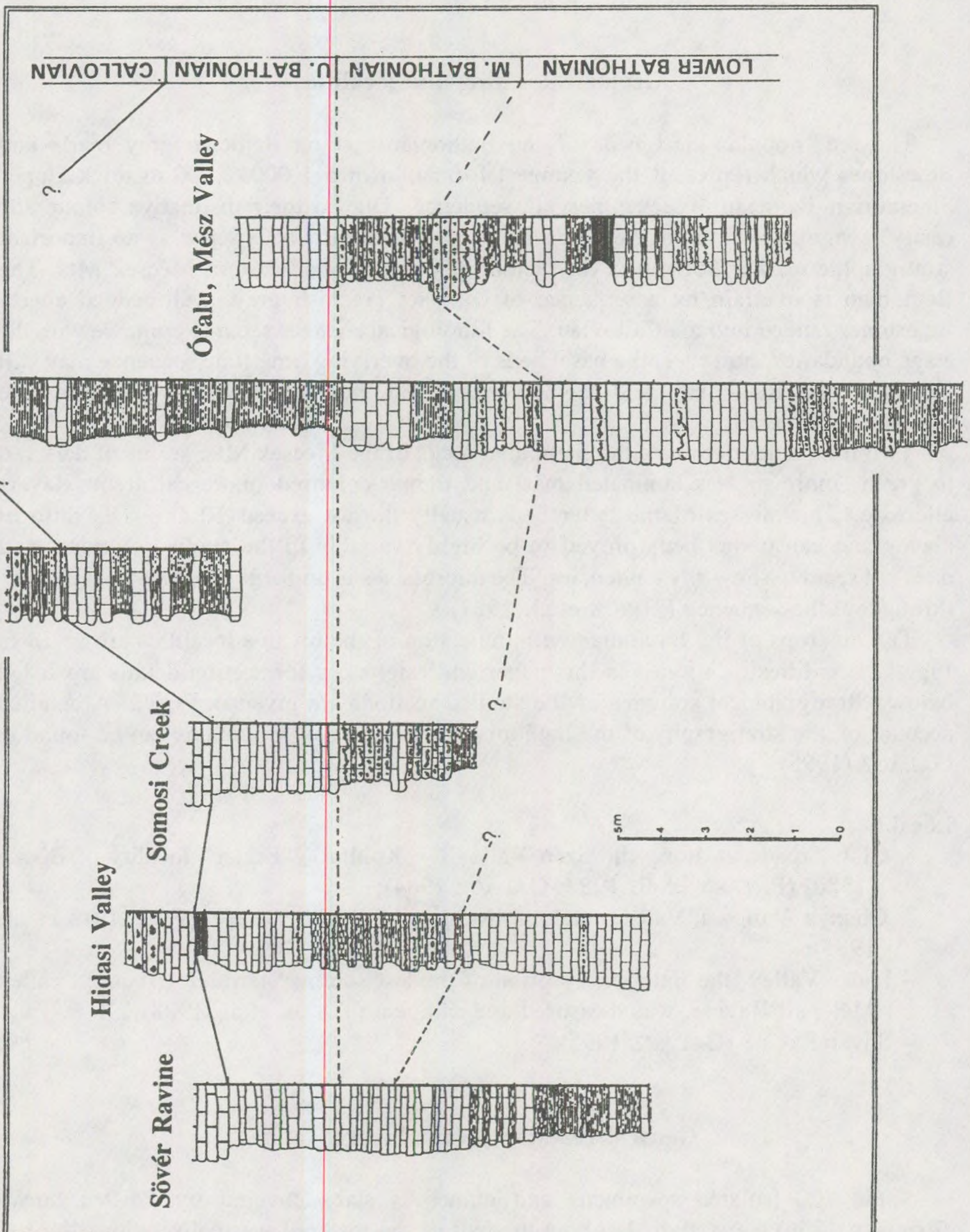
The outcrops of the Bathonian with indication of the bivalve localities are given in Fig. 1. Localities mentioned in this paper and references for section details are listed below. Stratigraphical columns of the studied sections are given in Fig. 2. A detailed account on the stratigraphy of the Bathonian of the Mecsek Mountains can be found in GALÁCZ (1995).

Localities:

- Ófalu, road cut along the Szén Valley (= Kohltal) ("Eszter" locality of Böckh (1880) (PATAKY et al. 1982; GALÁCZ 1984);
- Óbánya Valley ("Vadász malom" locality of Böckh (1880) (VELLEDITS et al. 1985);
- Hidas Valley (the Bathonian section of the last southwestern left tributary, called Mátépart Ravine, was measured and sampled (TÖRÖK et al. 1988);
- Sövér Ravine (GALÁCZ 1995).

General remarks on the bivalve fauna

Some 120 isolated specimens and numerous slabs covered by *Bositra buchii* (ROEMER,1836) were studied. About the half of the material was collected bed-by-bed from measured sections, so stratigraphic position of these specimens could be established at least at substage level. The other half of the material were found in the


LOWER BATHONIAN
M. BATHONIAN
U. BATHONIAN
CALLOVIAN
Óbánya Valley
Ófalu, Mész Valley
Csengő Hill
Somosi Creek
Hidasi Valley
Sövér Ravine
5m
4
3
2
1
0
?

loose of the sections and can be assigned only as Bathonian in age. About 100 specimens were identified at least at generic level.

The preservation of bivalves is rather poor. Pteriomorphs (*Pinna,* limids, pectinids, *Inoceramus, Placunopsis* and *Bositra*) are preserved with shell, while others as internal moulds. Internal features of the valves could be studied only exceptionally.

The stratigraphic distribution of bivalves in the Bathonian of the Mecsek Mts cannot be given precisely because the vast majority of the specimens of known stratigraphic position was collected from a single section, i. e. from the Hidas Valley. Due to the poor outcrop conditions, however, even this sections was rather unevenly sampled: the Upper Bathonian is well represented in the material, while the fauna of the Lower and especially of the Middle Bathonian is much less known.

"*Ostrea rhysa* BÖCKH" and "*Ostrea costata* SOW." recorded by BÖCKH (1881), the former now considered as Bajocian, were not found and are not treated here.

An annotated list of Bathonian bivalves

In the following, bivalves collected during this study from the Bathonian beds of the Mecsek Mts are listed, as a kind of "inventory". Complete systematic descriptions will be published elsewhere, only the number of specimens identified and some remarks are given here.

Malletia? sp.
Pl. 1, fig. 1.

Material: six specimens from the Upper Bathonian of the Hidas Valley.

Remarks: All of the available specimens are internal moulds, with impressions of ctenodont teeth. The wide posterior end strongly resembles that of species of *Malletia* DES MOULINS 1832. Due to their poor preservation, however, the generic assignment of the specimens is doubtful.

Pinna sp.
Pl. 1, fig. 4.

Material: One fragmentary internal mould, with remains of shell, was found in the loose of the Hidas Valley. A more complete but corroded specimen, probably attributable to the same species, was collected from the lowermost greenish grey limestone bed (Upper Bathonian or Lower Callovian) of the same locality.

Fig. 2. Stratigraphical columns of the most important Bathonian sections of the Mecsek Mts (after GALÁCZ 1995).

Modiolus (Modiolus) anatinus (SMITH 1817)
Pl. 1, fig. 5.

Material: An incomplete internal mould of a left valve, from the lowermost greenish grey limestone bed (uppermost Bathonian or lowermost Callovian) of the Hidas Valley.

Remarks: COX (1965) and VÖRÖS (1971) discussed the differences between *M.* (*M.*) *anatinus* and the closely related species *M.* (*M.*) *imbricatus* SOWERBY 1818. The marked inflation and well-developed anterior lobe of the Mecsek specimen strongly resembles features shown by *M. (M.) anatinus* as figured in the literature.

Modiolus (*Modiolus*) *imbricatus* SOWERBY 1818.
Pl. 1, fig. 2.

Material: four internal moulds from the Bathonian of the Hidas Valley, one of them from the *Retrocostatum* Zone.

Remarks: As FÜRSICH & WERNER (1988) and YIN & FÜRSICH (1991) pointed out, a plethora of names is available for Jurassic *Modiolus,* most probably due to the compactional distorsion of the unornamented valves. The Mecsek specimens are preserved in calcareous marl and are less deformed than those found in siliciclastic sediments. They seem to be within the range of variation of *M. (M.) imbricatus* as given by the fore-mentioned authors and others.

Inoceramus oosteri FAVRE 1870.
Pl. 1, figs 3, 6; Pl. 2, fig. 1.

Material: 34 specimens from the Bathonian, 8 from the uppermost Bathonian or lowermost Callovian from the Hidas Valley.

Remarks: The name *oosteri* has been used by several authors (PRINCIPI 1912; TRAUTH 1920; KUNZ 1967; VÖRÖS 1971) for a distinct group of inoceramids widely distributed in the Bathonian and Callovian of the peri-Mediterranean region. *I. oosteri* differs from *I. (Mytiloides?) fuscus* QUENSTEDT 1858, a widespread Aalenian-Bajocian species, in its less oblique and less elongated form. As CRAME (1982) pointed out, generic classification of European Jurassic inoceramids is much less clear than that of Cretaceous forms. Similarly to the case of most inoceramid species described from and restricted to the Middle Jurassic of this continent, internal characteristics of *I. oosteri* are not known, so it should be assigned to *Inoceramus* J. SOWERBY 1814 sensu lato. HAYAMI (1960) regarded *I. oosteri* as belonging to the "group of *Inoceramus fuscus* or *I. neocomiensis*". Nowadays, however, both groups are known to be rather heterogenous in nature, consisting of species which obviously represent different genera (CRAME 1982).

Some questions can arise about the conspecific nature of the syntypes of *I. oosteri*. OOSTER (1869, p. 38, Pl. 13, figs 7-14.) described and figured a series of inoceramid specimens under the name *I. brunneri* OOSTER from the Swiss Alps, and assigned them to the Middle Jurassic. Later, considering *"I. brunneri"* as a Late Cretaceous species, FAVRE introduced the name *"oosteri"* to replace *"brunneri"*, and re-figured the best preserved specimen of OOSTER (1869, pl. 13, fig. 7.) (FAVRE 1876, p. 64, Pl. 6, fig. 2.) among Oxfordian fossils from the Swiss Alps. According to FAVRE (1876), the remaining of OOSTER's specimens from the Middle Jurassic "Klausschichten" of the Stockhorn Range are too poorly preserved to answer the question whether they represent *I. oosteri* or not.

"Inoceramus petalotus n. sp." of BÖCKH (1881, p. 91, pl. 5, fig. 8.), as the study of its holotype now housed in the Hungarian Geological Museum suggests, can be regarded as a synonim of *I. oosteri.*

Entolium (*E.*) *corneolum* (YOUNG & BIRD 1828).
Pl. 2, fig. 2.

Material: Two specimens from the Mész Valley at Ófalu, eight specimens from the Mátépart Ravine, Hidas Valley.

Remarks: All the available specimens are incomplete. Their measurements are within the range of *E.* (*E.*) *corneolum,* as given by JOHNSON (1984).

Eopecten spondyloides (ROEMER 1836).
Pl. 2, fig. 3.

Material: one fragmentary internal mould of a left valve, with remains of shell, from the loose of the Bathonian of the Hidas Valley.

Remarks: The shell is densely covered by costae. Among them the intercalary ones rapidly gain the same heigh as original ones and all of them bear small imbricate lamellae. As JOHNSON (1984) pointed out, these are distinguishing characteristics of *E. spondyloides*.

A small bryozoan, the first one known from the Hungarian Jurassic, encrusts this specimen (ZÁGORŠEK 1995).

Radulopecten? sp.
Pl. 2, fig. 4.

Material: A single, small specimen, most probably a juvenile one, from the Lower Bathonian of the Óbánya Valley.

Remarks: The specimen is ornamented by 10 main plicae. Between them, in each observable sulci, a much narrower and lower plica can be seen. All plicae bear comarginal lamellae. Although the shell of the umbonal region is lacking, the plicae seem to be present even early in ontogeny. This type of ornamentation is strongly resembling to that of *Radulopecten* ROLLIER 1911, however, similar plicae can be shown by the "coarse phenotypes" of *Chlamys (Ch.) textoria* (SCHLOTHEIM 1820) as well (JOHNSON 1984), therefore generic assignement of the specimen is, due to its small size and incompleteness, uncertain.

Limea (Pseudolimea) galaczi n. sp.
Pl. 2, figs 9, 10; Pl. 3, figs 1–6, 8.

Holotypus: A right valve (M. 95. 1 in the collection of the Hungarian Museum of Natural History, Dept. of Geology and Palaeontology, Budapest, Pl. 3, figs. 1, 8.)
Derivatio nominis: After Dr. András GALÁCZ, who iniciated the palaeontological re-study of the Bathonian of the Mecsek Mts
Stratum typicum: Lower Bathonian
Locus typicus: Mátépart Ravine (= westernmost left tributary of the Hidas Valley (Mecsek Mts, Hungary).
Material: 16 specimens from the Bathonian, 4 specimens from the uppermost Bathonian or lowermost Callovian.

Measurements:

Length	20.5	18.8	22.8	18.2	22.7	19.6
Height	20.5	18.2	22.1	17.8	22.0	22.5
Number of plicae	20	22	23	24	20	20

Diagnosis: Medium-sized *Limea* (*Pseudolimea*) species ornamented by 20-24 radial, subangular plicae. The plicae may bear 1-7 longitudinal rows of curved scales or tubercles.

Description: Equivalve, moderately inflated, inequilateral, usually slightly longer than high. Outline subtrapezoidal to subelliptical. Umbones placed at two-third of the lenght of the valves. Radial plicae are present on the whole surface of the valves. 20-24 plicae can be observed on the lateral region of the valves, and some much weaker ones on the antero-dorsal and postero-dorsal parts. Plicae may bear 1-7 rows of thorn-like spines or tubercles. No threads can be observed between plicae. Hinge margin could be studied only in one specimen (Pl. 3, fig. 2.), bearing a series of oblique teeth on either side of the ligament pit. Teeth converge to a point below the beaks.

Remarks: Three *Limea* (*Pseudolimea*) species, hitherto described from the Jurassic, were found to bear plicae similarly ornamented to those of *L.* (*P.*) *galaczi* n. sp.. *Limea koninckana* CHAPUIS & DEWALQUE 1853, from the Hettangian of Western Europe has, however, about 15 main plicae (COX 1944), and its valves are only slightly inaequilateral in outline. *Limea cristata* DUMORTIER 1869 from the Pliensbachian of Western Europe, has nearly equilateral valves, and a much smaller number (10-11) of plicae (COX 1944). "*Lima*" *dornasensis* FAVRE 1876, based on a single specimen from the Oxfordian of the Fribourg Alps, seems to be the species closest to *L.* (*P.*) *galaczi* n. sp., however, the former bears only 18 plicae ornamented by irregularly spaced spines (FAVRE 1876, p. 66, Pl. 7, fig. 4c).

Range and occurrence: *Limea* (*Pseudolimea*) *galaczi* n. sp. is known from the Bathonian and probably from the Lower Callovian of the Mecsek Mts, Hungary.

Plagiostoma subcardiiformis (GREPPIN 1867)
Pl. 3, figs 9-11.

Material: 15 specimens from the Bathonian of the Hidas Valley.

Remarks: Outline and ornamentation of the Mecsek specimens, although most of them are rather poorly preserved, agree well with *P. subcardiiformis* as first figured by SCHLIPPE (1888, pl. 2, fig. 7.). The cross-section of plicae seems to be a rather variable feature in *P. subcardiiformis*. According to COX & ARKELL (1948), valves from the Great Oolite are ornamented by rounded plicae. From the Bathonian of the Villány Mts (Hungary), VÖRÖS (1971, p. 186, pl. 3, fig. 5.) described specimens bearing flat-topped plicae, trapezoidal in cross-section. The Mecsek specimens bear subangular plicae, well corresponding to the description of *P. subcardiiformis* as given by DESCHASEAUX (1936).

Plagiostoma cf. *rupicola* (UHLIG 1881)
Pl. 3, fig. 7.

Material: Internal moulds of two right valves from the loose of the Bathonian of the Hidas Valley.

Remarks: The Mecsek specimens have subelliptical outline, short lunule and they bear numerous plicae. These features are similar to those of *P. rupicola* as described and figured by UHLIG (1881, p. 410, Pl. 9, fig. 4a-d) from the Callovian of the Pieniny Klippen Belt, Poland. Details of ornamentation of the plicae, however, could not be observed on the specimens available.

Placunopsis semistriata (BEAN 1839).
Pl. 2, fig. 6.

Material: Several very poorly preserved specimens were collected from the Upper Bathonian of the Hidas Valley.

Remarks: The rounded oblong-shaped form and the distinctive ornamentation, i. e. radial striation restricted to the middle part of the shell, are well visible. The holotype of *P. semistriata* was described by BEAN (1839) from the Cornbrash, which represents the Upper Bathonian – Lower Callovian (TORRENS 1980). Further records of this characteristic species, as listed by HÖLDER (1991) indicate that *P. semistriata* is confined to the Upper Bathonian – Lower Callovian.

Bositra buchii (ROEMER 1836).
Pl. 2, figs 5, 7, 8.

Material: several tens of valves from various localities, concentrating in pavements on bedding planes, and some isolated, articulated specimens.

Remarks: Some authors (e. g. DAMBORENEA 1987, ABERHAN 1994b) regarded *B. ornati* (QUENSTEDT 1851) as a valid name for *Bositra* specimens less elongated than the holotype of *B. buchii* as described and figured by ROEMER (1836, p. 81, pl. 4, fig. 8). The Mecsek material does not account for this distinction. Some of the specimens agree well with that of ROEMER (Pl. 2, fig. 7) while others resemble to *"B. ornati"* (Pl. 2, fig. 5), and a continuous morphological transition can be observed between these two extremes. A wide range of intraspecific variations, similar to that is displayed by the Mecsek specimens, was already documented by CONTI & MONARI (1992). Therefore the view of COX (1965), DUFF (1978) and CONTI & MONARI (1992) is shared here, considering *B. ornati* as a junior synonim of *B. buchii*.

Praeconia ? sp.
Pl. 4, fig. 1

Material: One specimen from the Sövér Ravine, three specimens from the Hidas Valley, all from the Bathonian.

Remarks: The subtrapezoidal shape as well as the subterminal umbones are strongly reminiscent of *Praeconia* STOLICZKA 1871. Due to their poor preservation, however, the generic assignement of the specimens is uncertain.

Anisocardia ? sp. cf. *A.* (*A.*) *tenera* (SOWERBY 1821).
Pl. 4, figs. 2-6.

Material: 27 specimens from the Bathonian of various localities, 4 specimens from the uppermost Bathonian or lowermost Callovian of the Hidas Valley.

Remarks: Differences between *A. (A.) tenera* and *Rollierella minima* (SOWERBY 1821), a species similar to and often confused with the former one, were broadly discussed by DUFF (1978). According to him (DUFF 1978), rostrate posterior margin, as well as moderately enrolled umbones are characteristics of *A. (A.) tenera*. The Mecsek specimens clearly show these features. Their inflation (about 80 % of the length) is, however, markedly larger than that of *A. (A.) tenera* from the Lower Oxford Clay (about 60 %), and falls in the range of *R. minima* as given by DUFF (1978). Well inflated specimens similar to those found in the Mecsek Mts were described and figured as *A. (A.) tenera* by RADULOVIĆ & JOVANOVIĆ (1988) from the condensed Upper Bajocian-Lower Callovian ironstone of eastern Serbia.

Pholadomya (*Pholadomya*) *escheri* AGASSIZ 1845.
Pl. 4, fig. 10.

Material: a fragmentary internal mould of a right valve, from the uppermost Bathonian or lowermost Callovian of the Hidas Valley.

Remarks: About ten irregularly-spaced, narrow and sharp radial riblets, fading toward the venral margin, can be observed on the umbonal region of the specimen. The outline and ornamentation agree well with those displayed by *P. (P.) escheri* as described and figured by MOESCH (1874, p. 50, pl. 20, fig. 12; pl. 21, figs 2-7.)

Pholadomya (*Pholadomya*) sp. A.
Pl. 4, fig. 7.

Material: an internal mould of a right valve, from Ófalu.

Remarks: Only the umbonal region of the specimen is preserved, showing regularly and closely spaced, rounded radial riblets, which apparently reach the ventral margin.

Pholadomya (Pholadomya) sp. B.
Pl. 4, fig. 11.

Material: a well preserved composite internal mould from the Bathonian of the Mész Valley at Ófalu.

Remarks: The well marked escutcheon bordered by sharp ridges, as well as the ornamentation consisting of comarginal plicae and a few weak radial riblets confined to the umbonal region, are characteristics of *Pholadomya* SOWERBY 1823 s. str. The marked constriction of the ventral region can be interpreted most likely as a theratologic feature.

Pholadomya? sp.
Pl. 4, fig. 8.

Material: A fragmentary composite internal mould from the Bathonian of the Mátépart Ravine of the Hidasi Valley.

Remarks: Strong, regular comarginal plicae are the only ornamentation of the specimen. Radial elements are lacking. The shape and ornamentation are reminiscent of *Pleuromya* AGASSIZ 1843, but the presence of escutcheon bordered by sharp ridges excludes the assignement to the latter genus. Possibility of the existence of a distinct group of pholadomyid species with no radial ornamentation was already suggested by CONTI & MONARI (1991).

Goniomya literata (J. SOWERBY 1819).
Pl. 4, figs 9, 12.

Material: Two composite internal moulds from the Hidas Valley.
Remarks: The Mecsek specimens, both rather poorly preserved, differ from each other in strength, width and frequency of the V-shaped plicae. According to ARKELL (1935, p. 344) *G. literata* is a rather variable species, widespread in the Bathonian and in the higher Jurassic up to the Kimmeridgian. Shape and ornamentation of the Mecsek specimens seem to agree with those of *G. literata* described and figured in the literature.

Remarks on the palaeoecology

Bivalves are only subordinate elements in the Bathonian fauna of the Mecsek Mts The scarcity of bivalves and of other benthic organisms does not make a formal quantitative palaeoecological analysis possible. Some palaeoecological and palaeoenvironmental consequences can be drawn, however, from the composition of the bivalve fauna as a whole, and from observations made in the field and in the laboratory.

The benthic fauna is strongly dominated by the terebratulid brachiopod *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ 1984, represented by more than 350 specimens in the recently made collections (VÖRÖS 1995). Sponges and gastropods occur sporadically. Suspension filters are the predominant feeding group among the benthos, except *Malletia?* sp. and, probably, some gastropods.

As numbers of the identified specimens show, the bivalve fauna consists of a few relatively frequent and several much rarer forms, the latter ones usually represented by only one or a few specimens.

The most common species, *Inoceramus oosteri* was found to occur in clusters, thus may be regarded as the trophic nucleus of a monospecific "community". About three-fourth of the specimens available were collected from such a cluster, found in a marl bed of the Upper Bathonian of the Hidas Valley. The same mode of occurrence of inoceramids was reported, for examplé, by GÉCZY (1961) from the Aalenian "ammonitico rosso" limestone of the Bakony Mts, Hungary, and by DUFF (1978) from the English Lower Oxford Clay.

The mode of life of inoceramids occurring in faunas poor in, or devoid of definitely benthic organisms has been debated for a long time (see e. g. MACLEOD & HOPPE, 1992). Some smooth, thin-shelled forms are supposed to represent a pseudoplanktonic mode of life (e. g. SEILACHER 1982, OSCHMANN 1994b). Taphonomic features shown by the Mecsek specimens do not contradict to this assumption. Nearly all the specimens found in the cluster are crushed and articulated ones, indicating that opening of the valves after death of the animal was hindered most likely by the pressure of other specimens and that of the object, probably a drift-wood, to which they had been attached before the latter subsided to the sea-floor. No signs of rapid burial with sediments were observed. The lack of traces of such floating objects can be due to the unsuitability of red, nodular limestone facies for plant preservation.

Bositra buchii (ROEMER 1836) is a very frequent species in the Aalenian to Bathonian of the Mecsek Mts, usually occurring in pavements on bedding planes of marl seams. Among the Bathonian sections, *B. buchii* was found to be especially frequent in the Óbánya Valley. In some cases *Placunopsis semistriata* associates to it. Better preserved "three-dimensional" *B. buchii* specimens were found, rarely, in nodular limestone beds. Washing residues of most samples from the Bathonian of the Mecsek Mts contain frequent small (≤ 1 mm), smooth larval shells presumably belonging to *B. buchii*.

Skeletal concentrations characterized by the overwhelming abundance of *Bositra buchii (B. buchii* association as defined by HEINZE 1991) are widespread in the Middle Jurassic (see e. g. STURANI 1971). Controversal ideas concerning the life habit of *B. buchii* and related forms were discussed by CONTI & MONARI (1992) and more recently by OSCHMANN (1994a), the latter author interpreting this species as a probably progenetic, holo-pelagic bivalve. On the other hand, ABERHAN (1994b) regarded *Bositra* as adapted to a floating mode of life, on soft bottoms. The study of the Mecsek specimens could not contribute to the knowledge of functional morphology and mode of life of this widespread species. Considering the equality of its valves, however, a floating, pleurothetic recliner mode of life seems to be less probable.

Based on observations made during the collecting work and on the limited quantitative data available, the present author takes the courage to suggest the presence of a third, surely benthic association in the Bathonian of the Mecsek Mts *Anisocardia?* sp. cf. *A. (A.) tenera*, the most common bivalve after the fore-mentioned two forms, was found to occur together with the brachiopod *Karadagella zorae*. These two species seem to constitute the trophic nucleus of a distinct benthic association, which can be named *Karadagella zorae/Anisocardia?* sp. association. *Limea (Pseudolimea) galaczi* n. sp. and *Plagiostoma subcardiiformis* are the most important associated faunal elements.

The subordinate role of some taxa in the benthic fauna, as well as the rarity of traces of encrusting organisms are supposed to bear some palaeoenvironmental significance. Recent species of *Pinna* are "mud stickers" in coarse-grained sediments at litoral to shallow sublitoral depths (e. g. STANLEY 1970). *Eopecten spondyloides* preferred high energy conditions (JOHNSON 1984). Pholadomyids are common elements in Mesozoic shallow-shelf associations (ABERHAN 1994a). The rarity of the fore-mentioned forms as well as the lack of definitely shallow-marine groups such as trigoniids and oysters suggest that the Bathonian rocks of the Mecsek Mts were deposited in a deeper-water, most probably deep sublitoral environment.

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Plate 1

(Specimens were coated with ammonium chloride. Photographs taken by the author.)

1. *Malletia* ? sp. Hidas Valley, Upper Bathonian, 1.2X
2. *Modiolus (M.) imbricatus* SOWERBY 1818. Hidas Valley, Retrocostatum Zone, 1.1X
3. *Inoceramus oosteri* FAVRE 1870. Hidas Valley, Upper Bathonian or Lower Callovian, 1.1X
4. *Pinna* sp. Hidas Valley, Bathonian, 1.1X
5. *Modiolus (M.) anatinus* SMITH 1817.Hidas Valley, uppermost Bathonian or lowermost Callovian, 1X
6. *Inoceramus oosteri* FAVRE 1870. Hidas Valley, Bathonian, 1.2X

Plate 2

1. *Inoceramus oosteri* FAVRE 1870. Hidas Valley, Upper Bathonian, 1.2X
2. *Entolium (E.) corneolum* (YOUNG & BIRD 1828). Hidas Valley, Upper Bathonian, 1.2X

3. *Eopecten spondyloides* (ROEMER 1836). Hidas Valley, Bathonian, 1.1X
4. *Radulopecten?* sp. Szén Valley at Ófalu, Lower Bathonian, 2X
5. *Bositra buchii* (ROEMER 1836). Hidas Valley, Lower Bathonian 3X
6. *Placunopsis semistriata* (BEAN, 1839). Hidas Valley, Upper Bathonian, 1.5X
7. *Bositra buchii* (ROEMER 1836). Hidas Valley, Lower Bathonian 2X
8. *Bositra buchii* (ROEMER 1836). Óbánya Valley, Bathonian, 1X
9. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1.2X
10. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1.8X

Plate 3

1. *Limea (Pseudolimea) galaczi* n. sp. Holotype. Hidas Valley, Lower Bathonian, 5X
2. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1.7X
3. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1.1X
4. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 5X
5. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1X
6. *Limea (Pseudolimea) galaczi* n. sp. Hidas Valley, Bathonian, 1X.
7. *Plagiostoma* cf. *rupicola* (UHLIG 1881). Hidas Valley, Bathonian, 1.1X
8. *Limea (Pseudolimea) galaczi* n. sp. Holotype. Hidas Valley, Lower Bathonian, 1.6X

9-10. *Plagiostoma subcardiiformis* (GREPPIN 1867). Hidas Valley, Upper Bathonian, 1X

11. *Plagiostoma subcardiiformis* (GREPPIN 1867). Hidas Valley, Bathonian, 1X

Plate 4

1. *Praeconia*? sp. Sövér Ravine, Bathonian, 1.2X

2-5. *Anisocardia* ? sp. cf. *A. (A.) tenera* (J. SOWERBY 1821). Hidas Valley, Bathonian, 2-3, 5: 1X, 4: 1.2X

6. *Anisocardia* ? sp. cf. *A. (A.) tenera* (J. SOWERBY 1821). Hidas Valley, Upper Bathonian, 1X.
7. *Pholadomya (P.)* sp. A. Mész Valley at Ófalu, Bathonian, 2X
8. *Pholadomya?* sp. Hidas Valley, Bathonian, 1.2X

9, 12. *Goniomya literata* (J. SOWERBY 1819). Hidas Valley, Bathonian, 1.2X

10. *Pholadomya (P.) escheri* AGASSIZ 1845. Hidas Valley, uppermost Bathonian or lowermost Callovian, 1.1X
11. *Pholadomya* (P.) sp. B. Mész Valley at Ófalu, Bathonian, 1.1X

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GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Ammonite stratigraphy of the Bathonian red limestone of the Mecsek Mts, south Hungary

András GALÁCZ[1]

(8 figures, 1 table, and 6 plates on pp. 225–230)

Abstract

In a recent project on the Bathonian of the eastern Mecsek Mts the most important localities were revisited. The studies on the ammonites collected from measured sections resulted in the clearing up the stratigraphy of the Óbánya Limestone Formation, i.e. the Bathonian red marly limestone. Accordingly, the lower boundary of the Bathonian coincides with or is near to the lithological change of the greyish-greenish marls to red nodular marls and limestone. Within the red marly limestone the substages, the zones, and probably the subzones can be identified, except the uppermost Bathonian Clydoniceras discus Zone, which is difficult to trace in lack of its zonal index. The overlying siliceous limestone is ranged into the Lower Callovian. Characteristic, important or interesting ammonites are figured and most of them discussed in a separate chapter. Some genera (e.g. *Ebrayiceras, Parapatoceras, Epistrenoceras*) are firstly recorded or figured from Hungary.

Key words: Ammonoidea, Jurassic, Bathonian, Mecsek Mts, Hungary, stratigraphy

Introduction

In the early 1980's the Eötvös L. University selected the Mecsek as one of the places of summer exercises for geology students. The activity of the students and their supervisors resulted in a great amount of new data, which initiated numerous research programmes. One of the projects outgrown from these field studies is that on the Bathonian of the eastern Mecsek Mts. Profiles were investigated in the area, and the most important sections were studied in detail.

The Bathonian marly limestone is rich in fossils. Most common are ammonites, but belemnites, brachiopods, bivalves, sponges and echinoids appear also frequently. In this paper the stratigraphically most important results of the ammonite studies are presented.

[1]Department of Palaeontology, Eötvös L. University, H-1083 Budapest, Ludovika tér 2, Hungary

A complete revision of the Bathonian ammonite fauna of the Mecsek will be based on these preliminary studies.

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This paper is based on field work carried out together with friends and colleagues from the Department of Palaeontology, Eötvös L. University, and from the Palaeontological Department of the Hungarian Natural History Museum. University students also helped in the collecting of fossils from the sections. All these contributions are acknowledged. I am especially indebted to L. SÖVÉR, T. BERTALAN and Z. ORBÁN, private collectors in Bonyhád, who kindly helped our work in the field, and placed important specimens of their collections at my disposal.

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Bathonian formations in the Mecsek Mts

The first data on fossiliferous Middle Jurassic rocks in the Mecsek Mts were published by PETERS (1862, p.37), who recorded Aalenian near Óbánya. In the 1870's HOFMANN and BÖCKH started detailed mapping in the Mecsek (HAUER 1876). They recognized a red nodular, calcareous marl as a "constantly occurring bank" above the grey marls which were dated by PETERS as Upper Lias and deeper Middle Jurassic. Later BÖCKH (1880, 1881) made a comprehensive study on the stratigraphy and palaeontology of the red nodular limestone and the rocks immediately below and above. He established the age of the red carbonate as Bathonian, and gave a biostratigraphic subdivisioning for the whole fossiliferous succession (see below). As of the distribution, BÖCKH (1880, pp. 46-50) pointed out that the red marly limestone crops out in several localities of the eastern Mecsek Mountains, from Komló in the west to Ófalu in the east. He also described the most important localities.

The next description of the Bathonian rocks was given by VADÁSZ (1935), who has made mapping in the Mecsek in the early 1910's. His monograph on the geology of the Mecsek treats the red nodular limestone and marl as a formation developing continuously from the underlying grey, yellowish-grey claymarls. VADÁSZ was the first to recognize the general distribution of this rock, mentioning it as a "marker horizon" within the thick Jurassic sequence of the Mecsek Mts. This marker character of the rock comes from the easily recognizable lithology (i.e. red colour, nodular texture), and the constant thickness which was given by VADÁSZ as 15 to 20 m. He described also that the red carbonates change into yellowish-brown, siliceous, *Posidonomya-* (i.e. *Bositra-*) marls in several places. Higher up the formation grades into hardly distinguishable red, siliceous marl or massive, yellowish-brown limestone of Early Callovian age. VADÁSZ suggested a slightly different stratigraphic interpretation of the red limestone (see below).

In the 1950's and 1960's the Hungarian Geological Institute conducted a project of detailed geological mapping in the Mecsek Mountains, under the direction of R. HETÉNYI. The results were the publication of the 1:10,000 geological map and explanation series, other maps of different scales, guide books, etc. (see FORGÓ et al.

1966). In these works it was established that the Bathonian is represented by red, nodular calcareous marl, which replaces the Bajocian greenish-grey, soft marls. This is a thin, maximum 31 m sequence, which can be subdivided into three parts. This subdivisioning was the same what VADÁSZ suggested before (1935), but now slightly different lithologies and thicknesses were attributed to the basically biostratigraphic units.

In the 1970's a tendency in Hungary to apply lithostratigraphic classification resulted in the introduction of formation names for most of the rocks previously recognized as mappable units. Thus the red Bathonian carbonate of the Mecsek Mts got a lithostratigraphic name: the Óbánya Limestone Formation. Unfortunately, this name appeared only in a summary of the Hungarian lithostratigraphic classification (HAAS & CSÁSZÁR 1983), without any formal definition and designaton of type section. However, the name suggests that the type section is that in the Óbánya Valley, known from the fundamental work of BÖCKH (1880).

No significant works have been done on the Middle Jurassic of the Mecsek since the 1950's, until 1980, when geology students started field practicals in the area. The revision of the old localities, the measuring of the available sections, and the new collection of fossils resulted in a wealth of new data and arising interest. On the basis of the previous investigations and the recently made field studies, the main characteristics of the Bathonian Óbánya Formation can be summarized.

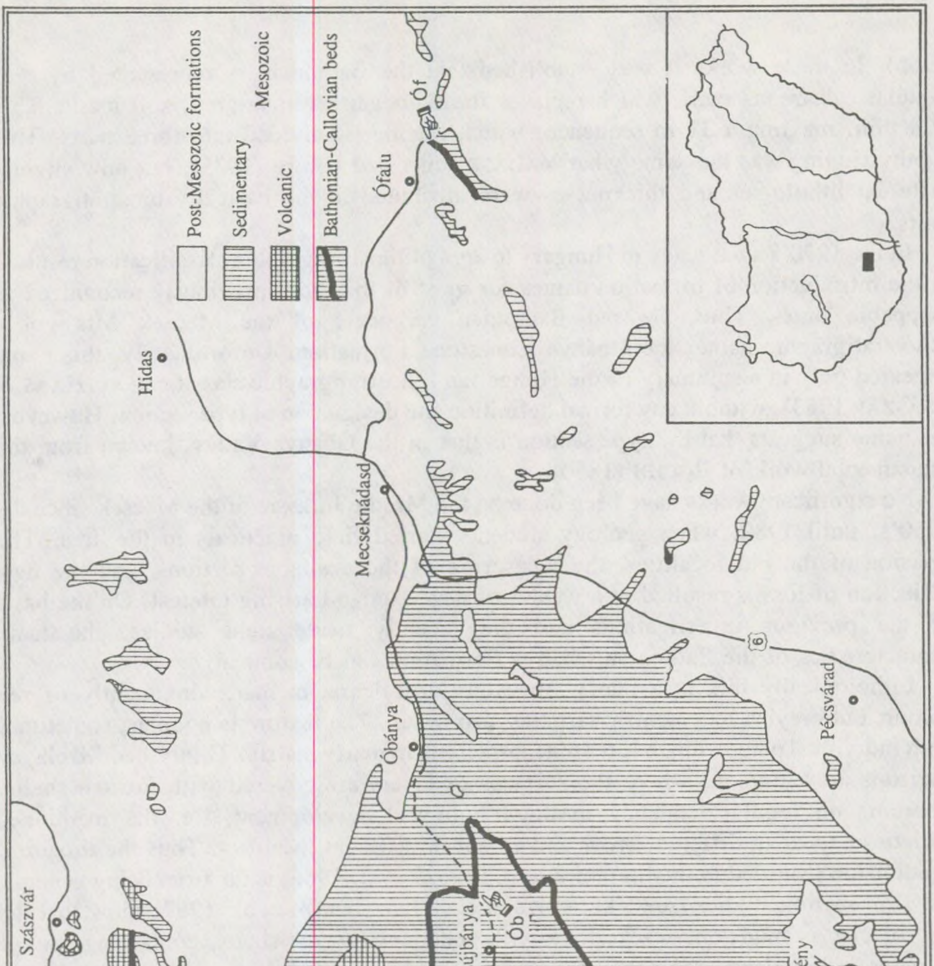
Lithologically this is a marly limestone or calcareous marl, dominantly of red colour, but greyish or greenish varieties also occur. The texture is nodular, sometimes with individual pale, whitish limestone intraclasts in marly matrix. Thinly-bedded clayey horizons are common, where the surfaces of layers are covered with *Bositra* shells. There is no regular tendency in the lithological development, i.e. the mentioned varieties appear in different order and extent in different localities. Thus the threefold subdivision recorded in the literature (e.g. FORGÓ et al. 1966) is far from being general.

Thin-section studies (see VELLEDITS et al. 1985, TÖRÖK et al. 1987) show that the microfacies is mudstone-wackestone with abundant *Bositra* shells, containing sponge spicules, echinoderm fragments, foraminifers and radiolaria.

One of the most characteristic features of the formation is its richness in fossils. Ammonites are very common, belemnites, brachiopods are frequent too, but other megafossil groups (e.g. echinoids, sponges, bivalves, nautiloids) are also well represented. As rare elements, gastropods also occur.

The red nodular marly limestone generally develops from the underlying grey claymarls and/or greenish-grey nodular marls. The upper boundary and the immediate cover of the Óbánya Formation is rather variable. In some places (e.g. Csengő Hill) the red colour changes into grey, the nodularity disappears, and the rock becomes siliceous in the Callovian, then a thick succession of cherty radiolarite follows. In other places (e.g. Óbánya Valley) thinly-bedded *Bositra*-marls become dominant upwards, which are more and more siliceous, but proper radiolarite does not appear. In most places the red nodular limestone is topped by a bank of grey, greenish, or yellowish, siliceous limestone, which is ranged here in the Callovian.

The thickness of the Óbánya Formation is variable, but generally 12-15 m. The greatest thickness is shown in the Óbánya Valley section, where it is about 23 m. The


Post-Mesozoic formations
Sedimentary
Volcanic
Mesozoic
Bathonian-Callovian beds
Hidas
Ófalu
Óf
Mecseknádasd
6
Pécsvárad
Obánya
Szászvár
Kisújbánya
Ób
Hosszúhetény
Vékény
Magyaregregy
Mc
Sc
Csh
Hic
Mv
Si
Hi
Zobák
Kárász
Sö
Komló
N
0 1 2 3 4 5 km

30 m thickness mentioned in the literature (e.g. FÖLDI et el. 1977, p.34) seems to be a slight exaggeration.

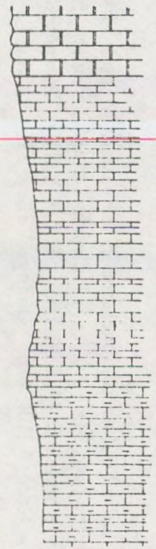
The areal distribution (Fig. 1) is quite wide. The best occurrences are in the Kisújbánya syncline, where the Bathonian red limestone appears everywhere on top of the thick Aalenian-Bajocian marl sequence (see WEIN 1968). Local tectonism may cause closely situated repeated occurrences in folded structures. In the tectonically independent northern part of the eastern Mecsek ("Northern trust sheet" - not studied in this recent project) the red Bathonian limestone is heavily tectonised, and the fossils are very poorly preserved. From the Lower Bathonian a red or grey crinoidal limestone with big brachiopods is mentioned (WEIN 1965). Southeast to the main mass of the Mecsek the Bathonian crops out in two isolated localities. One is near to Zengővárkony, at the quarries worked in the past for Upper Jurassic limestone. Here an old trench exposes the 10 to 12 m thick red, nodular marl (HETÉNYI et al. 1968, p.24). In the tectonically separated Ófalu inlier a Jurassic sequence of reduced thickness is known (HETÉNYI et al. 1976). Here, in the so-called Kohlthal of Eszter, a classic Middle Jurassic succession was first described by BÖCKH (1880), then revised by PATAKY et al. (1983) and GALÁCZ (1984). Between the two occurrences, near to Pusztakisfalu, there was an other locality with a rich fauna from the Upper Bajocian, Bathonian and Lower Callovian, one of the main localities of BÖCKH (1880). Unfortunately, the valley was filled up and the outcropping beds covered in the beginning of this century (see VADÁSZ 1935).

The stratigraphical subdivisioning of the Bathonian rocks of the Mecsek Mountains

The first stratigraphical subdivisioning of the Middle Jurassic formations of the Mecsek was given by BÖCKH (1880), who ranged his studied formations into five "beds" or horizons. These are, in descending order:

Stephanoceras macrocephalum and bullatum beds
Stephanoceras Eszterense beds
Stephanoceras rectelobatum beds
Cosmoceras dubium beds
Cosmoceras subfurcatum beds.

Fig. 1. Distribution of the red Bathonian limestone in the eastern Mecsek Mts, with locations of the sections discussed in the text. **Mv** - Márévár Hill; **Mc** - Márévár Valley; **Sc** - Somosi Creek; **Sö** - Sövér Ravine; **Si** - Singödör Valley; **Hic** - Hidas Valley, Csurgó; **Hi** - Hidas Valley, Mátépart Ravine; **Csh** - Csengő Hill; **Ób** - Óbánya Valley; **Óf** - Ófalu, Kohlthal



Lithostratigraphy	BÖCKH 1880		LÓCZY 1915		VADÁSZ 1935		Current standard zones		
Dorogó Calcareous Marl Formation							CALLOVIAN		
Óbánya Limestone Formation	Callovian	*Stephanoceras macrocephalum and bullatum beds*	Callovien	*Zone des Macrocephalites macrocephalus*	Callovian	*Macrocephalites macrocephalus horizon*	BATHONIAN	Upper	*Clydoniceras discus Zone* *Oxycerites orbis Zone* *Procerites hodsoni Zone*
	Bathonian	*Stephanoceras Eszterense beds*	Bradfordien	*Zone des Oppelia aspidoides*	Bradfordian	*Oppelia aspidoides horizon*		Middle	*Morrisiceras morrisi Zone* *Tulites subcontractus Zone* *Gracilisphinctes progracilis Zone*
		Stephanoceras rectelobatum beds		*Zone des Parkinsonia Parkinsoni*	Bathonian	*Parkinsonia ferruginea horizon*		Lower	*Asphinctites tenuiplicatus Zone* *Zigzagiceras zigzag Zone*
Komló Calcareous Marl Formation	Parkinsoni Zone	*Cosmoceras dubium beds*	Bathien	*Zone des Parkinsonia ferruginea*		*Cosmoceras dubium horizon*	BAJOCIAN		
		Cosmoceras subfurcatum beds	Bajocien	*Zone des Stephanoceras Humphriesianum*	Bajocian	*Cosmoceras subfurcatum horizon*			

Table I. The stratigraphic subdivisions of the red Bathonian limestone of the Mecsek Mts.

He suggested that the whole sequence can be correlated with QUENSTEDT's topmost δ to topmost ϵ of the Braun Jura of Swabia, which corresponds to the Parkinsoni Zone, the whole Bathonian and the Macrocephalum Zone of OPPEL.

LÓCZY (1915, pp.213-215) agreed with BÖCKH's classification, and made only some corrections in the nomenclature, applying stage and zonal names for the represented interval (Table I).

VADÁSZ (1935, pp.57-60) suggested a threefold, basically biostratigraphic subdivisioning for the red limestone and marl, using stage names (Bathonian, Bradfordian, Callovian) for the three parts, and horizon names for the distinguished faunal assemblages (Table I).

As a summary of the detailed mapping of the 1950's and 1960's, there was an attempt to distinguish lithologically the three stratigraphic units which were separated previously by VADÁSZ within the red marly limestone (see FORGÓ et al. 1966, p.60). On the basis of the recent field studies, this threefold lithological subdivison cannot be applied for all occurrences, because the nodularity, the marl/limestone ratio, and the interbedded clayey layers appear in different order and different thicknesses in the profiles.

In the time of the Geological Institute's mapping activity, KOVÁCS (1952) started a study on the Bathonian ammonites. Unfortunately he based his studies on poor material consisting of unhorizonted specimens from a few localities. He concluded that the fauna suggests the Bathonian, Bradfordian and Lower Callovian. This conclusion was apparently misunderstood later, because the following publications (e.g. HETÉNYI et al. 1976, BILIK et al. 1978) regarded the formation as one where the stratigraphic horizons are unimportant or impossible to distinguish.

In the 1980's the renewed studies justified the results of BÖCKH's pioneering work. Careful bed-by-bed collecting does make possible to distinguish and identify the different stages, zones and even subzones of the Bathonian. The red nodular marl or limestone belongs into the Bathonian. The Bajocian/Bathonian boundary is near to the greenish to reddish colour change within the lower, more marly part of the sequence. The red limestone - pale siliceous limestone lithological change on top of the marly carbonate sequence is regarded here as the Bathonian/Callovian stage boundary.

In this work the basic lithostratigaphic arrangement (CSÁSZÁR & HAAS 1983) is followed, where the Upper Bajocian greenish, greyish nodular marl belongs to the top of the Komló Marl Formation, the red marly limestone ranges into the undivided Óbánya Limestone Formation, and its overlying rock, the siliceous pale limestone into the basal part of the Dorogó Calcareous Marl Formation. In the zonal subdivisioning of the stages this work follows (Table I) the current Bathonian and Lower Callovian ammonite zonation (see e.g. WESTERMANN & CALLOMON 1988; CALLOMON et al. 1988).

Description of the sections

The Bathonian red limestone of the Mecsek is known in several smaller exposures, mainly in the side valleys running down to the Kisújbánya syncline. Most of these shows only a part, or only the weathered debris of the Bathonian limestone sequence.

In this chapter only the most important localities and profiles are described. The locations of the sections are indicated in Fig. 1.

Márévár Valley

This is one of the best-known localities of the Bathonian red limestone of the Mecsek (see e.g. NAGY et al. 1978). Because of easy access, most geological excursions visit the place (e.g. CSÁSZÁR & HAAS 1984). The exposure is a steep slope on the northern side of the forestry road running in the valley, about 600 m southeast from the end of the public road (Mc in Fig. 1).

The first to collect Bathonian ammonites from the Márévár Valley was HOFMANN, whose material from two localities were determined and published by BÖCKH (1880, p.48). The first locality was a single piece of rock, yielding the following forms (BÖCKH's determinations):

"*Lytoceras tripartitum* RASP. sp.
L. n. sp.
L. polyanchomenum GEMM.
Phylloceras Ó-Bányaense n. sp.
P. flabellatum NEUM.
P. disputabile ZITT.
P. mediterraneum NEUM.
Haploceras sp. indet. (cfr. *oolithicum* D'ORB. sp.)
Perisphinctes subtiliplicatus n.sp.
P. sp. indet."

BÖCKH concluded that this fauna indicates his Rectelobatum horizon, i.e. the Lower Bathonian. The other locality gave poorly preserved specimens:

"*Phylloceras disputabile* ZITT.
Oppelia aspidoides vel *fusca* (two little fragments)
Stephanoceras sp. indet. (ex gr. *Steph. Ymir*)
Perisphinctes cfr. *procerus* SEEB. sp."

BÖCKH was undecided, but inclined to suggest the Eszterense horizon, i.e. the Middle Bathonian for the level of this fauna.

Later VADÁSZ (1935) listed the Márévár Valley as a place where the Bathonian is well exposed, and fossils can be collected.

KOVÁCS (1953, p.90) described shortly the locality identifiable with the one visible today, and gave the following list of ammonites:

"*Heterophylloceras óbányaense* BÖCKH
Calliphylloceras demidoffi ROUSS.
Holcophylloceras zignodianum D'ORB.
Ptychophylloceras flabellatum NEUM.
Ptychophylloceras cfr. *flabellatum* NEUM.
Lytoceras sp. ex aff. *Phyllipsi* SOW.
Lytoceras pygmaeum D'ORB.

Lytoceras adeloides KUD.
Perisphinctes cfr. *lytoceratoides* LÓCZY
Oppelia sp. indet."

On the basis of these determinations he identified the Bathonian, and from the presence of *Lytoceras adeloides* (!) he concluded that the Callovian is also represented.

Recently the exposure is in bad state, being almost completely overgrown and covered by slope debris. Neither the lower nor the upper boundary of the formation can be seen. Some removed blocks stand out, giving possibilities for collecting fossils, of which stratigraphic positions are unclear. Ammonites are frequent and suggest the presence of the Middle and Upper Bathonian. Most common forms are Phylloceratids and Perisphinctids (*Procerites* spp. and *Wagnericeras* spp.), and some *Bullatimorphites* and *Cadomites* were also found.

Márévár Hill

This locality is a poor outcrop of the red marly limestone, near the foundations of the ruined Márévár castle, on the southern side of the Márévár Valley (Mv in Fig. 1). The Middle Jurassic sequence is in strongly tectonised position, the beds standing nearly vertically.

Only the uppermost 2 to 3 metres of the Bathonian is visible. The red marly beds are overlain by a bank of greenish-grey, siliceous limestone, which yielded large Perisphinctids and a *Macrocephalites* sp., thus ranged into the Lower Callovian.

Bathonian fossils having been collected from the loose debris are as follows:

Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Paroecotraustes sp.
Cadomites (Polyplectites) sp.
Rugiferites (Sphaeroptychius) sp.
Procerites sp. indet.

These are ammonites suggesting the late Middle Bathonian or early Upper Bathonian.

Somosi Creek

Somosi Creek runs down in a northern side valley of the Márévár Valley. In its lower, southwestern part it cuts the Upper Liassic - Middle Jurassic sequence, up to the Oxfordian cherty limestone. This latter was described by HARANGI (1989). The Middle Jurassic part of the succession consists of grey *Zoophycos*-marls (Bajocian), red, nodular marly limestone (Bathonian) and a bank of grey siliceous limestone. The place is listed as a locality of the fossiliferous Bathonian red carbonates (NAGY et al. 1978, p.37).

The Bathonian beds are poorly exposed in the slope above the stream. They form a steeply dipping, 6 metres thick sequence (Fig. 2) of which contact with the underlying grey marls is unexposed. The lower part of the visible sequence is formed by claymarls, then there is a succession of nodular, marly limestone, and the upper part is harder, well-bedded limestone.

Fossils are rare and poorly preserved. Most specimens are distorted by tectonic deformation or cut by sheets of white calcite crack-fills. Three fossiliferous horizons were found, which yielded ammonites.

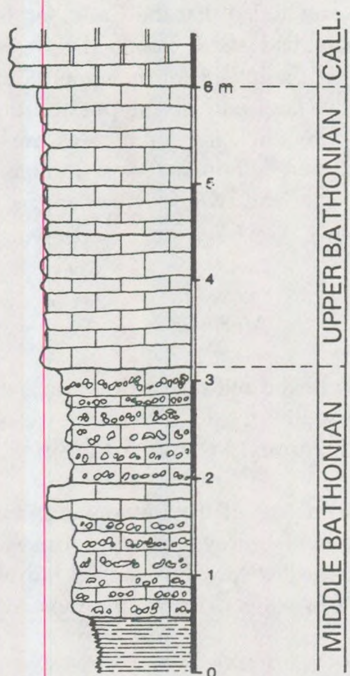


Fig. 2. The stratigraphy of the Bathonian section in the Somosi Creek

Horizon 3; ca. 1.80 m above the clay/claymarl contact in the lower part of the visible section. The following ammonites were collected:

Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Nannolytoceras tripartitum (RASPAIL)
Oxycerites sp.
Cadomites (Polyplectites) sp.
Bullatimorphites sp. indet.

This is an undiagnostic fauna; the *Nannolytoceras* and *Bullatimorphites* appearing together may suggest the base of the Middle Bathonian.

Horizon 2; just above Horizon 3, in the clayey limestone. The ammonites from this level are:

Phylloceras kudernatschi (NEUMAYR)
Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)

Horizon 1; 1.20 m below the overlying grey, siliceous limestone. Ammonites from this level are as follows:

Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Cadomites (Polyplectites) sp.
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)
Procerites sp. indet.
Choffatia (Subgrossouvria) sp.

These fossils may indicate the Upper Bathonian, but the exact age is very uncertain in lack of forms suggesting any zones definitely.

The poorly preserved, few faunal elements are insufficient to give a detailed subdivisioning of this Bathonian profile. New road-cuts in the eastern slope of the valley (Németdöglés) may give new opportunities to collect more fossils and give more details about the local stratigraphy.

Singödör

Singödör is one of the valleys running down easterly from the hills bordering the Kisújbánya syncline. This is an east-west valley, where Upper Jurassic then Bajocian beds are exposed in the western end. As one follows the folded sequence, outcrops become poorer toward the clayey marls of the Upper Bajocian. Then the reddish calcareous marls and limestones appear in the low cuts of the stream. The Bathonian outcrop (Si in Fig. 1) is poor, showing only some beds in a slightly domed structure.

The locality was mentioned by KOVÁCS (1953, p.91), who gave a short list of ammonites from here:

"*Calliphylloceras demidoffi* ROUSS.
Perisphinctes lytoceratoides LÓCZY
Perisphinctes sp. indet.
Sphaeroceras bullatum D'ORB.
Oppelia sp. ind."

In the explanations to the 1:10,000 geological map (BILIK et al. 1978) Singödör is listed as one of the best exposures of the Bathonian beds, but only a collective list of fossils from several outcrops in the covered area is given.

In recent times the Singödör outcrops are poor, overgrown, and while the characteristic rock is easy to identify, detailed, bed-by-bed collecting is impossible.

Fossils appear as loose specimens. The repeated visits have resulted in a usual list of ammonites:

Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lissoceras ferrifex (ZITTEL) (Pl.6, fig.4)
Cadomites (Cadomites) cf. *rectelobatus* (HAUER)
Bullatimorphites (Bullatimorphites) sp.
Siemiradzkia sp. indet.

This faunula suggests the lower part of the Middle Bathonian, but the succession probably represents a wider interval of the Bathonian. Excavations may reveal further fossiliferous beds, thus more detailed informations could be obtained for the locality.

Sövér Ravine

This locality (Sö in Fig. 1) is in a small, narrow valley running down east, on the western side of the Zobákpuszta-Magyaregregy road. The locality is probably new, found by collectors in recent years. However, former lists of Bathonian outcrops (NAGY et al. 1978) mention unspecified occurrences in valleys in the neighbourhood.

The valley exposes the grey *Zoophycos*-marls, then the red Bathonian nodular limestone. The transitional part with the greenish clayey-marly uppermost Bajocian is covered and gave no fossils. The visible section (Fig. 3) consists of a reddish marl - nodular limestone sequence of 5.5 m thickness, which is overlain by yellowish-grey, slightly siliceous, thick-bedded limestone. Fossils are rare, but several horizons can be distinguished.

In the lower part of the succession some levels gave the following ammonites:

Phylloceras kudernatschi (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Nannolytoceras tripartitum (RASPAIL) (Pl.6, fig.3)
Oxycerites sp.
Cadomites (Cadomites) rectelobatus (HAUER)
Morphoceras multiforme ARKELL
Ebrayiceras sulcatum (ZIETEN)
Parkinsonia (Gonolkites) sp.
Procerites sp.
Siemiradzkia sp.

This Lower Bathonian fauna came from two fossiliferous levels. One is at 3 to 3.2 m and gave only Phylloceratids and Lytoceratids. The other level is four beds from 5.20 to 5.70 m, and this yielded the Morphoceratids.

The next faunal interval extends from 5.70 to 6.95 m, and yielded Middle Bathonian ammonites:

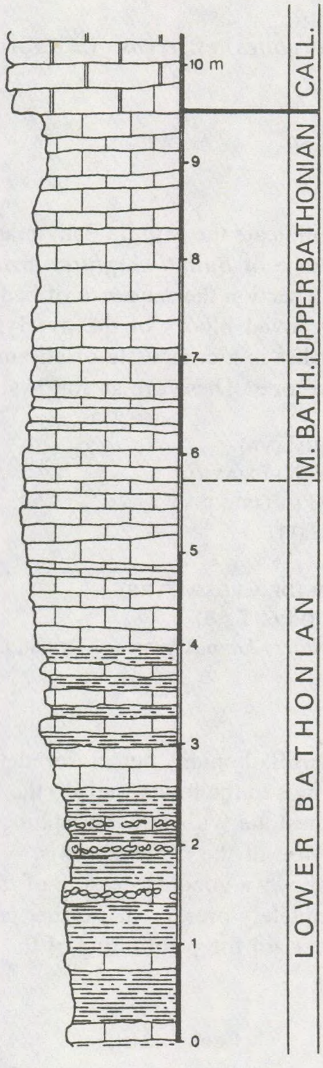


Fig. 3. The stratigraphy of the Bathonian section in the Sövér Ravine

Phylloceras kudernatschi (NEUMAYR)
Adabofoloceras subobtusum (KUDERNATSCH) (Pl.1, fig.4)
Ptychophylloceras flabellatum (NEUMAYR)
Calliphylloceras disputabile (ZITTEL)
Lissoceras sp. indet.
Oxycerites sp. indet.
Paroecotraustes serrigerus WAAGEN (Pl.1, fig.3)
Cadomites (Cadomites) rectelobatus (HAUER)

Cadomites (Cadomites) sp.
Cadomites (Polyplectites) sp.
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)
Procerites sp. indet.
Siemiradzkia sp. indet.
Choffatia (Subgrossouvria) sp.
Homoeoplanulites sp. indet.

These poorly preserved forms indicate the Middle Bathonian, of which lower boundary is drawn here with the appearance of *Bullatimorphites eszterense.*

In the uppermost part of the section the sequence of beds is hard to follow, because the layers are disturbed by removed blocks of the overlying hard, massive siliceous limestone. Thus the following list is a composite of all ammonites collected from the top 2.5 m of red, nodular limestone. These are as follows:

Phylloceras kudernatschi (NEUMAYR)
Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Paroecotraustes sp.
Prohecticoceras retrocostatum (DE GROSSOUVRE)
Cadomites (Polyplectites) sp. (Pl.6, fig.2)
Bullatimorphites (Bullatimorphites) hannoveranus (J.ROEMER)
Choffatia (Subgrossouvria) sp.
Wagnericeras sp.

This fauna indicates the Upper Bathonian, but closer determination of the zones is difficult. Most probably it belongs to the lower part, to the Hodsoni or the Orbis Zone.

The overlying siliceous limestone with rare Perisphinctids is ranged here into the Callovian, similarly as in the case of the other sections.

The Sövér Ravine section shows a good succession of faunas, though fossils are not too common and mostly incompletely preserved. Further collecting is needed to obtain more diagnostic forms and ascertain the positioning of the zonal boundaries.

Csengő Hill

This locality (Csh in Fig. 1) is in the cut of the road which goes from Zobákpuszta to the village Kisújbánya, and was re-made in the early 1980's. A substantial part of the Middle Jurassic is exposed, from the grey *Zoophycos*-marls of the Bajocian to the Upper Jurassic radiolarite, then red limestone. The topmost Bajocian - Bathonian marl-limestone sequence seems to be incomplete, because near the top of the Bajocian marls a Humphriesianum Zone fauna was collected, while the red Bathonian sequence above is about 6 to 8 metres altogether. The uppermost Bajocian and lowermost Bathonian greenish-grey and red claymarls are missing, probably by tectonic causes. Unfortunately the problematic part of the succession is covered by slope debris and soil. The section drawn by I.NAGY (in CSÁSZÁR & HAAS 1984) showing the Middle Jurassic formations as a continuous sequence is apparently constructed from general lithological data.

BÖCKH (1880) did not discussed the locality which was probably not exposed in those times, however he referred to some specimens (*"Phylloceras disputabile* ZITT." and *"Lytoceras* cfr. *Adeloides* KUD.") as coming from "Csengőárok" (Csengő ravine), which may correspond to the recent exposure.

The Csengő Hill exposure was studied some years ago by FŐZY et al. (1985), when the section was in better state. Then a 4 m thick portion of the red marls and limestones was visible (Fig. 4). Fossils were rare and came mostly from the loose debris. The following list is a composite of the material of FŐZY et al. and specimens collected in the following years.

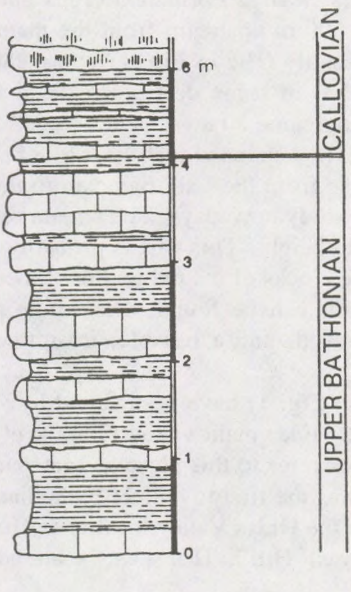


Fig. 4. The stratigraphy of the Bathonian section on the Csengő Hill

Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras sp. indet.
Lissoceras sp.
"Cadomites (Polyplectites)" compressus DE GROSSOUVRE
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)
Bullatimorphites ("Bomburites") suevicus (J.ROEMER)
Procerites sp. indet.
Siemiradzkia sp. indet (= *"Asphynctites?"* sp. in FŐZY et al., pl.I, fig.2)
Choffatia (Subgrossouvria) acuticosta (J.ROEMER) (Pl.3, fig.9)

These ammonites suggest the Upper Bathonian, but are insufficient to make zonal arrangement. The occurrence of *"Polyplectites" compressus* may indicate a correlation with the characteristic horizon from Bed 10 of the Hidas Valley, i.e. with the Orbis Zone (see below).

The lithology changes in the section from the red nodular limestone to grey siliceous marls, then siliceous limestone. Some limestone beds are intercalated in the basal part, and one of these yielded a *Macrocephalites* sp. Thus the lower boundary of the Callovian was drawn here (4.15 m in the measured section).

Hidas Valley

This valley provides the best locality of the Bathonian red marls and limestones in the Mecsek Mts. In the valley the Óbánya Formation crops out in two bigger exposures. The better-known one is ca. 500 m upstream from the main road, opposite to the so-called Csurgó spring. This locality (Hic in Fig. 1) was mentioned in VADÁSZ (1935), and studied by KOVÁCS (1953) in some detail. He listed many ammonites from an unhorizonted collection, giving some strange names (e.g. "*Stephanoceras* sp. ind. ex aff. *coronatum* SCHLOTH."). He concluded that the 6 to 8 m thick nodular limestone in the profile corresponds to ages from the Late Bajocian to the Callovian.

The locality is difficult to study nowadays. The stream excavates only the greenish-reddish marls in a wall of 3 m height. This part is probably of Late Bajocian age. The steep slope above shows some blocks of the red nodular limestone, and loose specimens of ammonites and other fossils can be found. The whole picture suggests that most blocks are more or less removed, and a reliable, in-situ collecting would need hard excavation work.

A far better locality (Hi in Fig. 1) have been found by students some years ago in a ravine running down to the Hidas main valley (TÖRÖK et al. 1987). This was a rediscovery, because earlier data refer to this place as Mátépart Ravine (see FÖLDI et al. 1977). Probably HOFMANN was the first to collect Bathonian ammonites here, because BÖCKH (1880, p.47) refers to the Hidas Valley locality as HOFMANN's place "southeast to the Baglás (today: Baglyas) Hill". HOFMANN's ammonites are (with BÖCKH's determinations):

"*Litoceras tripartitum* RASP. sp. (*sic!*)
L. cfr. *Adeloides* KUD. sp.
L. polyanchomenum GEMM.
Phylloceras Ó-Bányanese ? n.sp.
P. disputabile ZITT.
P. Mediterraneaum NEUM.
Oppelia Mecsekiensis n. sp.
Stephanoceras rectelobatum HAU. sp."

BÖCKH regarded this fauna as one from his Rectelobatum horizon, which corresponds to the Lower Bathonian.

TÖRÖK et al. (1987) when revisiting the locality, measured the Bathonian profile, and collected a limited fauna from the lower part of the succession. They recorded the most important ammonites which were determined only on generic level. Some of these were figured:

Lissoceras sp. (pl.I, fig.1 = *Lissoceras ferrifex* (ZITTEL)
Procerites sp. (pl.I, fig.2)
Oxycerites sp. (pl.I, figs 3-4 = *Oxycerites yeovilensis* ROLLIER, refigured here in Pl.1, fig.7)
Morphoceras sp. (pl.I, fig.5 = *Morphoceras multiforme* ARKELL, refigured here in Pl.3, fig.1)
Bullatimorphites sp. (pl.II, fig.1).

The narrow Mátépart Ravine is a SE-NW valley joining the Hidas Valley at 250 m from its end at the main road. A small stream cuts into the grey, Bajocian *Zoophycos*-marls, which are thus exposed in about 32 m thickness. Just below the lithofacies change into nodular, greenish-greyish marls, some beds are richly fossiliferous, giving ammonites of Niortense Zone age.

The green, grey, sometimes reddish marl sequence above is poorly exposed, only some portions of the clayey beds are visible. In a few levels these gave fossils suggesting the Garantiana and Parkinsoni Zones. This part of the sequence is ca. 27 m thick. From its uppermost part, from a ca. 5 m interval, lowermost Bathonian ammonites were collected:

Phylloceras kudernatschi (NEUMAYR)
Ptychophylloceras flabellatum (NEUMAYR)
Calliphylloceras disputabile (ZITTEL)
Adabofoloceras sp.
Lytoceras polyanchomenum (GEMMELLARO)
Nannolytoceras tripartitum (RASPAIL)
Lissoceras psilodiscus (SCHLOENBACH)
Lissoceras cf. *monachum* (GEMMELLARO)
Oxycerites yeovilensis ROLLIER (Pl.1, fig.7)
Oxycerites sp.
Morphoceras multiforme ARKELL (Pl.3, fig.1)
Zigzagiceras cf. *plenum* ARKELL (Pl.3, fig.5).

The typical red, nodular, calcareous sequence (Fig. 5) starts with a harder limestone of 4 m thickness, which forms a steep wall in the ravine. Higher up marly limestone follows in 4 m thickness, where the limestone beds alternate with marl, sometimes claymarl layers. The limestone beds show nodular texture, and the intervening clayey layers are full with *Bositra* shells. The upper part of the red, calcareous sequence is a massive nodular limestone of 2 m thickness.

The red limestone succession is topped by a green-grey clay bed (15-20 cm), then a 80 cm thick bank of white, greenish, siliceous limestone. This limestone bank is covered by a ferrugineous hard-ground and is overlain by white-pink limestone with chert nodules.

The whole sequence is 11 m in total thickness, and was measured from the top of the hard limestone bank. It was subdivided into 55 beds, where "bed" refers to individual strata or 35 cm thick units in massive members without well-distinguishable partings.

Most beds are fossiliferous. The top limestone bank (Beds 1 to 4) gave a rich fauna with Macrocephalitids, and thus ranged into the Callovian. The clay bed immediately

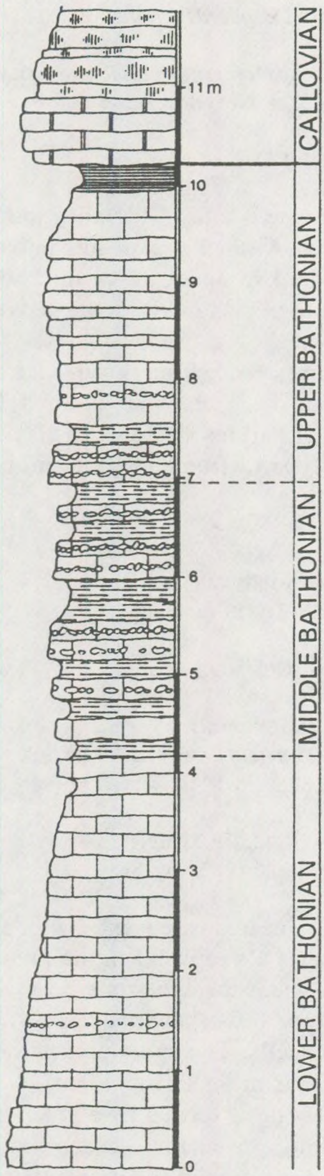


Fig. 5. The stratigraphy of the Bathonian section in the Mátépart Ravine, Hidas Valley

below (Bed 5) is unfossiliferous. The 10 m thick red nodular marl and limestone is Bathonian, and its upper third is favourable for bed-by-bed collecting. Other levels sporadically yielded material. The most important ammonites are listed below, in ascending order, by substages.

Lower Bathonian, Beds 55 to 35, 0 to 4.05 m.

Phylloceras kudernatschi (NEUMAYR)
Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Adabofoloceras sp.
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Nannolytoceras tripartitum (RASPAIL)
Lissoceras psilodiscus (SCHLOENBACH) (Pl.1, fig.5)
Oxycerites sp.
Paroecotraustes sp.
Cadomites (Cadomites) sp.
?*Parkinsonia* sp. indet.
Morphoceras multiforme ARKELL
Morphoceras macrescens (BUCKMAN) (Pl.2, fig.6)
Ebrayiceras sulcatum (ZIETEN) (Pl.3, fig.4)
Procerites sp.
Siemiradzkia sp.

This is a good Lower Bathonian fauna, but insufficient to distinguish the subzones of the Zigzag Zone. *Morphoceras* and *Ebrayiceras* are common in Beds 54 - 52, which forms a fossiliferous horizon at the base of the lower massive limestone. Fossils are rarer and undiagnostic above. However, the occurrence of Morphoceratids in a distinct horizon may indicate the Macrescens Subzone, while the beds above may represent the Yeovilensis and Tenuiplicatus Subzones.

Middle Bathonian, Beds 34 to 21, 4.05 to 6.98 m

From this interval the following ammonites were collected:

Ptychophylloceras flabellatum (NEUMAYR) (Pl.1, fig.1)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Lissoceras ferrifex (ZITTEL)
Paroecotraustes sp.
Cadomites (Cadomites) orbignyi DE GROSSOUVRE
Cadomites (Cadomites) sp.
Cadomites (Polyplectites) sp.
Bullatimorphites (Bullatimorphites) ymir (OPPEL)
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)
Rugiferites (Sphaeroptychius) marginatus (ARKELL)
Procerites sp.
Gracilisphinctes sp.
Siemiradzkia sp.
Wagnericeras fortecostatum (DE GROSSOUVRE)
Homoeoplanulites (Parachoffatia) sp.

This is a fauna of mainly undiagnostic forms, which was ranged into the Middle Bathonian, because Bed 34 yielded the first ammonites suggesting the Progracilis Zone. These are *Wagnericeras fortecostatum* and *Cadomites (C.) orbignyi*. Higher up, in Bed 25 other Middle Bathonian species (e.g. *Bullatimorphites ymir*) occur. A loose specimen of *Tulites subcontractus* (Pl.5, fig.3) came probably also from this part of the sequence. Ammonites indicating the higher Middle Bathonian (Morrisi Zone) have not been found so far.

Upper Bathonian, Beds 20 to 6, 6.98 to 9.90 m

This is the most fossiliferous part of the succession, which was collected intensively. In its lower part the limestone and claymarl layers alternate, the higher part is a development of well-bedded then massive red nodular limestone. Fossils abound in the lower and middle parts (Beds 20 to 8). The following ammonites were found:

Phylloceras kudernatschi (NEUMAYR)
Ptychophylloceras flabellatum (NEUMAYR)
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Oxycerites orbis (GIEBEL) (Pl.1, fig.6)
Paroecotraustes sp.
Prohecticoceras blanazense ELMI
Prohecticoceras tenuistriatum (DE GROSSOUVRE)
Prohecticoceras retrocostatum (DE GROSSOUVRE)
Cadomites (Cadomites) sp.
Cadomites (Polyplectites) sp.
"Cadomites (Polyplectites)" compressus DE GROSSOUVRE
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH) (Pl.5, fig.1)
Bullatimorphites (Bullatimorphites) hannoveranus (J.ROEMER)
Bullatimorphites ("Bomburites") suevicus (J.ROEMER) (Pl.5, fig.2)
Epistrenoceras histricoides ROLLIER (Pl.4, fig.3)
Epistrenoceras haugi (DOUVILLÉ) (Pl.4, fig.2)
Parapatoceras tenue (BAUGIER & SAUZÉ) (Pl.3, fig.7)
Parapatoceras distans (BAUGIER & SAUZÉ)
Procerites hodsoni ARKELL
Siemiradzkia galla STEPHANOV (Pl.2, fig.4)
Homoeoplanulites (Parachoffatia) arisphinctoides ARKELL
Homoeoplanulites (Homoeoplanulites) balinensis (NEUMAYR) (Pl.4, fig.5)
Wagnericeras arbustigerum (D'ORBIGNY)
Wagnericeras cf. *bathonicum* ARKELL (Pl.4, fig.4)
Choffatia (Subgrossouvria) cerealis (ARKELL) (Pl.4, fig.1)

This faunal list could have been longer, because only forms hitherto identified are listed.

The lower boundary of the Upper Bathonian was tentatively drawn at the appearance of narrow-whorled *Prohecticoceras* (e.g. *P. tenuistritatum)* in Bed 20. Higher up the similar *P. blanazense* occurs, then (from Bed 15) the typical *P. retrocostatum* becomes common. Other lineage is of *Bullatimorphites*, with *B. eszterense* enduring into the lower, and *B. hannoveranus* appearing in the upper beds. Microconch *Bullatimorphites* are very common and more variable than the macroconchs.

Zonal subdivisioning of the Upper Bathonian is difficult to make here in the sequence. The Procerites hodsoni Zone is indicated clearly by Perisphinctids and *Prohecticoceras* spp. in an assemblage similar to that described recently from NW Germany (HAHN et al. 1990).

Oxycerites orbis appears in Bed 12, thus the lower boundary of the Orbis Zone may be drawn here. Bed 12 is the lower part of a horizon (extending up here to Bed 9) with a very particular fauna, characterized by *"Cadomites (Polyplectites)" compressus* DE GROSSOUVRE. This is a curious ammonite, certainly not a Cadomitid (see TORRENS 1967, p.592, 1971, p.143), which was recorded previously from the Morrisi Zone by MANGOLD (1970b, p.301). In the Hidas Valley it seems to appear together with *Epistrenoceras histricoides* in Bed 10, thus ranges up here in the Upper Bathonian. The loose specimen of *Epistrenoceras haugi* (Pl.4, fig.2) came probably also from this level.

The uppermost part of the red limestone sequence gave only a few ammonites. Only a single diagnostic form, *Parapatoceras tenue* came from here (Bed 6, 40 cm below the top of the red limestone). A loose specimen of *Parapatoceras distans* might be also derived here.

All these records suggest that the whole Orbis Zone is represented in the upper part of the red limestone, but the uppermost Bathonian Discus Zone seems to be missing. Interesting enough that the recently described "Hochstetteri Horizon" of the Discus Zone in SW Germany (DIETL 1994) yielded many ammonites which are represented here, too (see the faunal list above, e.g. *Bullatimorphites hannoveranus, B. ("Bomburites") suevicus, Homoeoplanulites balinensis).* However, in lack of *Clydoniceras,* the only reliable index of the uppermost Bathonian zone, one cannot range the corresponding beds into the Discus Zone.

The red nodular limestone is covered here with a layer of greyish-greenish clay without ammonites, then a hard, siliceous limestone bank follows. In the upper two layers of this pale limestone (Beds 1 and 2) a rich fauna with *Macrocephalites, Bullatimorphites, Parachoffatia,* etc. occurs, which was regarded as Lower Callovian.

The Mátépart Ravine of the Hidas Valley is the best and most fossiliferous Bathonian section known from the Mecsek Mts (GALÁCZ 1993). Especially rich are the faunas in the Lower Bathonian and in the deeper part of the Upper Bathonian. Further collecting from the zonal and subzonal boundary levels, and more precise determination of the ammonites may give a more detailed picture on the stratigraphy, and will make the profile a reference section for the whole area.

Óbánya Valley

This valley runs northeast to southwest from Óbánya up to Kisújbánya, and exposes an extended Middle Jurassic to Lower Cretaceous sequence (VELLEDITS et al. 1986). In the lower part of the valley, from Óbánya village upstream, the small river cuts into the grey Upper Aalenian - Bajocian *Zoophycos*-marls. If one follows the stream from village Kisújbánya, about 250 m from the last houses, on the righthand side of the valley, the red Bathonian limestone is exposed in a good outcorp in the steep slope (Ób in Fig. 1).

This locality is well-known from the literature. The first to collect ammonites here was HOFMANN, then BÖCKH gave a detailed description on the sequence (1880, p.27). He called the place as Vadász-malom (Hunter's Mill), after a building which has been ruined and removed completely since then.

In BÖCKH's times the basal part of the sequence was better exposed, because on the left bank of the stream he found some greyish-greenish beds with an extensive fauna of the Upper Bajocian Garantiana and Parkinsoni Zones. These beds are unexposed now. In the overlying red limestone beds he collected a rich fauna, of which ammonites were as follows:

"*Lytoceras tripartitum* RASP. sp.
Phylloceras Ó-Bányaense n.sp.
P. flabellatum NEUM.
P. disputabile ZITT.
P. mediterraneum NEUM.
P. subobtusum KUD. sp.
P af. *tortisulcato* D'ORB. sp.
Oppelia sp. indet.
Stephanoceras rectelobatum HAU. sp.
Stephanoceras molarum n.sp.
Cosmoceras sp. indet. (aff. *ferrugineum* OPP.)
Perisphinctes subtiliplicatus n.sp.
P. aurigerus OPP. sp.
P. sp. indet. (fragment)
P. sp. indet. (ex gr *procerus)*
P. banaticus ZITT. sp."

This fauna was ranged by BÖCKH into his Stephanoceras rectelobatum horizon, and correlated with the Klaus-Schichten what he regarded as of Lower Bathonian. This age determination seems to be correct (on the basis of the recorded *Parkinsonia* and *Procerites* species). "*Perisphinctes subtiliplicatus* n.sp." is most probably an *Asphinctites,* which suggests, together with *Procerites banaticum,* the uppermost part of the Lower Bathonian.

According to BÖCKH, the sequence of the red marly limestone becomes poor in fossils upwards. He mentioned a single, poorly preserved *Bullatimorphites* some metres above the Rectelobatum horizon, what he regarded as the indication of his Eszterense horizon (i.e. Middle Bathonian).

Higher up the red colour changes into grey, and the lithology is thinly-bedded, calcareous *Bositra*-marl. The succession is covered by yellowish siliceous limestone.

Recently in a detailed study on the Jurassic of the Óbánya Valley (VELLEDITS et al. 1986), a revision was made on the Bathonian sequence. This was a good time for the investigation, because the Hungarian Geological Survey cleaned the exposure for the type section of the previously designated Óbánya Limestone Formation, i.e. the lithostratigraphic unit corresponding to the red nodular Bathonian limestone of the Mecsek Mts. This revision was supervised by the author, thus the results and subsequent investigations and collecting works can be summarized together.

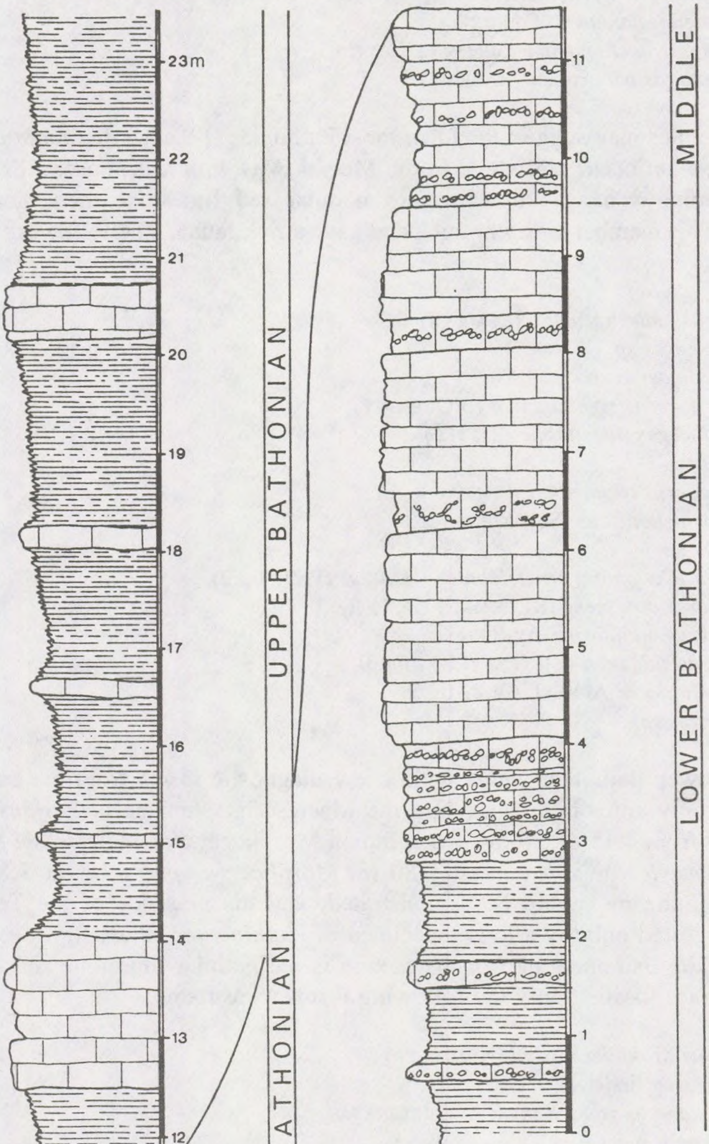


Fig. 6. The stratigraphy of the Bathonian section in the Óbánya Valley

The section (Fig. 6) starts with a grey-green clayey marl with intercalated nodular limestone beds. This part was exposed in 3 m thickness formerly, today only the upper 1 - 1.5 m is visible. Fossils are rare and undiagnostic:

Phylloceras kudernatschi (NEUMAYR)
Adabofoloceras subobtusum (KUDERNATSCH)
Calliphylloceras disputabile (ZITTEL)
Lytoceras eudesianum (D'ORBIGNY)
Lytoceras polyanchomenum GEMMELLARO (Pl.1, fig.2)
Nannolytoceras tripartitum (RASPAIL)

These ammonites may suggest the lowermost Bathonian, because *A. subobtusum* and *L. polyanchomenum* occur elsewhere in the Mecsek Mts with Morphoceratids.

The lithology changes upward into nodular red limestone then more massive limestone. This member is 5.5 m thick and gave a rich fauna. The following ammonites were found:

Phylloceras kudernatschi (NEUMAYR)
Adabofoloceras sp.
Ptychophylloceras sp.
Holcophylloceras zignodianum (D'ORBIGNY)
Calliphylloceras disputabile (ZITTEL)
Lytoceras sp.
Nannolytoceras tripartitum (RASPAIL)
Lissoceras psilodiscus (SCHLOENBACH)
Oxycerites sp.
Cadomites (Cadomites) rectelobatus (HAUER) (Pl.2, fig.2)
Morphoceras patescens (BUCKMAN) (Pl.2, fig.5)
Morphoceras multiforme ARKELL
Ebrayiceras sulcatum (ZIETEN) (Pl.3, fig.3)
Parkinsonia dorni ARKELL (Pl.2, fig.3)
Siemiradzkia sp.

This is a Lower Bathonian fauna with a few diagnostic forms from the basal Zigzag Zone. The only ammonite suggesting the Macrescens Subzone is *Parkinsonia dorni* which came from 4.15 m. Above the common Morphoceratids indicate the Macrescens Subzone (*Ebrayiceras sulcatum* at 5.80 m, *Morphoceras patescens* at 7.80 m). The Yeovilensis Subzone cannot be demonstrated, and the presence of the Tenuiplicatus Zone is suggested only by a loose specimen of *Asphinctites* (Pl.3, fig.2).

The Middle Bathonian part of the section is red nodular limestone and subordinate marls with rare fossils. Only the following forms were found:

Phylloceras cf. *kudernatschi* (NEUMAYR)
Phylloceras sp. indet.
Holcophylloceras zignodianum (D'ORBIGNY)
Oxycerites sp. indet.
Eohecticoceras sp. (Pl.2, fig.1)
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)
Rugiferites (Sphaeroptychius) sp. indet.
Siemiradzkia sp.
Choffatia (Subgrossouvria) sp.

The first *Bullatimorphites eszterense* specimen came from 9.6 m, and this was used to draw the lower boundary of the Middle Bathonian. The *Eohecticoceras* specimen (from

11.15 m) is an early form transitional to typical *Prohecticoceras* in the higher Middle Bathonian (see below).

From 14.1 m the lithology changes to dominant marls and claymarls, with a few limestone interbeds. Fossils are very rare and poorly preserved, usually crushed. In the basal beds of the claymarls the following ammonites were collected:

Ptychophylloceras flabellatum (NEUMAYR)
Oxycerites sp. indet.
Prohecticoceras blanazense ELMI
Bullatimorphites (Bullatimorphites) eszterense (BÖCKH)

Appearance of *P. blanazense* indicates the basal Upper Bathonian, but the fauna is too poor to range into any zone definitely.

Immediately above, at 14.5 m some examples of a characteristic assemblage were found:

Cadomites (Cadomites) sp.
Cadomites (Polyplectites) claromontanus KOPIK (Pl.3, fig.5)
Bullatimorphites (Bullatimorphites) sp.
Parapatoceras distans (BAUGIER & SAUZÉ) (Pl.3, fig.6)

These ammonites probably belong to the same level as that in Bed 10 of the Hidas Valley, and indicate the upper part of the Orbis Zone (Julii or Histricoides horizon).

The marl sequence continues upwards, but except some crushed Phylloceratids and Perisphinctids, gave no ammonites.

The Óbánya section is a good reference for the Bathonian of the Mecsek Mts. Especially the Lower Bathonian part is important, because this portion is more fossiliferous than in the other profiles. Further collecting may reveal a better subdivisioning within the Zigzag Zone, and more details for the Middle and Upper Bathonian.

Ófalu

The classic locality of the red nodular Bathonian limestone (Óf in Fig. 1) near the village of Ófalu has been recently studied (PATAKY et al. 1982; GALÁCZ 1984). Since the revision only occasional smaller collections have been made. Unfortunately the exposure became overgrown in the last years, thus the succession is hardly visible now. Road maintenance stopped the erosion of the road cut, so collecting is more complicated recently. Most probably the exposure will be completely covered in the near future, thus it is necessary to record the detailed, measured section (Fig. 7).

The collections made in the last years yielded the usual ammonites: mainly Phylloceratids all along the section, *Nannolytoceras* in the Lower Bathonian, *Bullatimorphites* and Perisphinctids in the Middle and Upper Bathonian. A fine specimen of *Rugiferites davaiacensis* (LISSAJOUS) (Pl.6, fig.1) came from the Middle Bathonian.

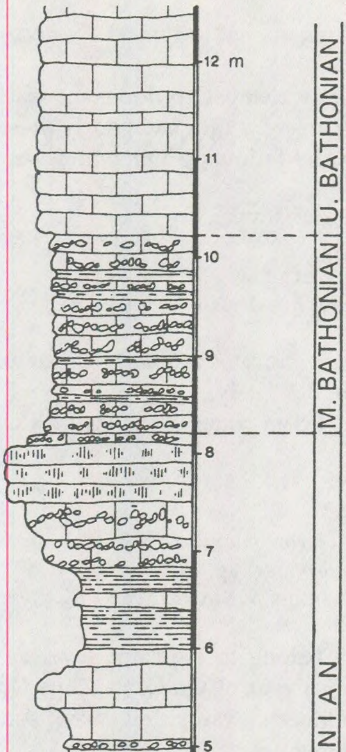


Fig. 7. The stratigraphy of the Bathonian section in the Kohlthal, Eszterpuszta, Ófalu

Stratigraphic conclusions and correlation of the sections

1. In the Mecsek Mountains the red, marly nodular limestone (i.e. the Óbánya Limestone Formation) represents the Bathonian. In contrast to previous opinions, the Bajocian below and the Callovian above can be easily distinguished, even on the basis of lithological features, and especially on faunistic grounds.

2. The profiles of the Óbánya Limestone Formation represent most of the Bathonian (Fig. 8), though single section with representation equally good for the whole stage cannot be selected.

3. The Lower Bathonian is best represented in the Óbánya Valley section, but here the Bajocian/Bathonian boundary beds are not exposed. The best Middle Bathonian section is that in the Kohlthal of Ófalu, while the Hidas Valley section is the most favourable to study the Upper Bathonian.

These observations are close to the results of BÖCKH (1880), who regarded the Óbánya section as the typical development of his "Rectelobatumn beds" (= Lower Bathonian), and the Kohlthal of Ófalu as the best representation of his "Eszterense beds" (i.e. Middle Bathonian).

4. The Bathonian/Callovian boundary is difficult to draw, because diagnostic Discus Zone (i.e. topmost Bathonian) elements are missing in the uppermost part of the red limestone.

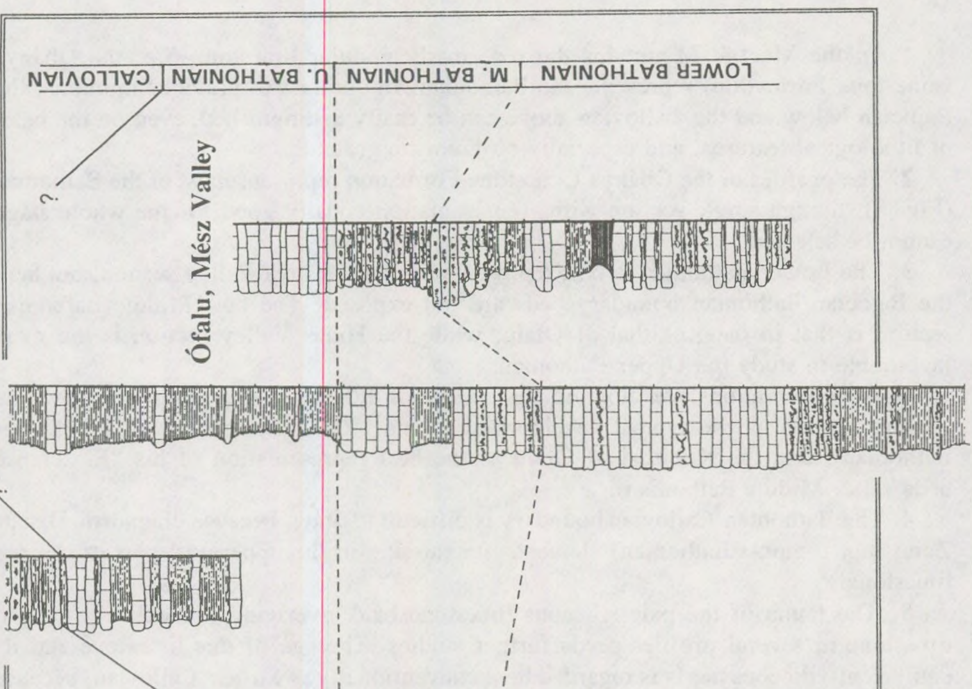
5. The fauna of the pale siliceous limestone bank overlying immediately the red limestone in several profiles needs further studies. The age of this limestone and its equivalent siliceous marls is regarded here conventionally as earliest Callovian, because these yielded Macrocephalitids. However, on the basis of recent studies in classic Bathonian-Callovian localities and faunas (e.g. Swabia, see CALLOMON et al. 1989), there is a possibility to place these beds justly into the topmost Bathonian.

6. The Bathonian limestone and its fauna show close similarities to rocks and faunas in the Klippen Belt of the Northern Calcareous Alps (JÜSSEN 1891, TRAUTH 1922, KRYSTYN 1972), and of the West Carpathians (BIRKENMAJER 1977, RAKÚS 1992). The palaeo(bio)geographic significance of this similarity was predicted in recent works on reconstruction of the Carpathian-Pannonian area (see KOVÁCS et al. 1990, GALÁCZ 1990).

Comments on some important ammonites

Adabofoloceras subobtusum (KUDERNATSCH, 1852)
(Pl.1, fig.4)

A common Bathonian Phylloceatid, which seems to be represented in most Mecsek localities, in the Lower and in the deeper part of the Middle Bathonian. BÖCKH (1881, p.29) recorded the species from Óbánya, and subsequent works also mention it from


LOWER BATHONIAN
M. BATHONIAN
U. BATHONIAN
CALLOVIAN
Ófalu, Mész Valley
Óbánya Valley
Csengő Hill
Somosi Creek
Hidasi Valley
Sövér Ravine
5m
4
3
2
1
0

other localities. The here figured specimen came from the Middle Bathonian of the Sövér Ravine.

Ptychophylloceras flabellatum (NEUMAYR, 1871)
(Pl.1, fig.1)

This is one of the most common ammonite species in the Mecsek Bathonian, being represented in almost all sections, in several levels. The features shown in the specimens agree well with those discussed in detail on the material from the Bakony Mts, also Hungary (GALÁCZ 1980), and on the type material from Swinitza, Rumania (GALÁCZ 1994). BÖCKH (1881, p.15) also recorded this species from Óbánya and the Márévár Valley, but his figured specimen (pl. 9, fig.7) is an example from Swinitza.

Ptychophylloceras flabellatum seems to range through the whole Bathonian, because in the Hidas Valley, which is the most complete sequence, it appears in the deepest beds of the Zigzag Zone and endures up to the uppermost fossiliferous Bathonian levels. The figured specimen came from the Middle Bathonian of the Hidas Valley.

Lytoceras polyanchomenum GEMMELLARO, 1872
(Pl.1, fig.2)

This rarely recorded ammonite seems to be quite common in the Mecsek. BÖCKH (1881, p.33, pl.9, fig.10a-c) recorded it from two localities, and his figured specimen came from the Hidas valley. The here figured form was yielded by the Lower Bathonian of the Óbánya Valley section.

The morphology (low whorls, compressed cross-section, radial constrictions on the internal mould, traces of ribs on the body chamber, etc.) is in agreement with that of the type (GEMMELLARO 1872, pl.4, figs 2-3), and that in the detailed description and figures of BÖCKH. The age of the recently collected material confirms BÖCKH's opinion that the species is of longer range, because all Mecsek specimens came from the Lower Bathonian.

Nannolytoceras tripartitum (RASPAIL, 1831)
(Pl.6, fig.3.)

This is a very common ammonite in the uppermost Bajocian and especially in the Lower Bathonian beds, giving a good help to identify the Zigzag Zone in lack of other diagnostic forms.

Most specimens are fragments, but some entire examples attain large size. The figured specimen is one of the biggest ones, with 80 mm diameter. This is the same size what PUGIN (1964, p.52) mentioned as maximum. A part of the body chamber is broken off, thus the maximal diameter might have been about 100 mm.

Fig. 8. Correlation of the Bathonian sections in the eastern Mecsek Mts

Lissoceras psilodiscus (SCHLOENBACH, 1865)
(Pl.1, fig.5)

This is a common Lower Bathonian ammonite, occurring frequently in the Mecsek Mts localities. A specimen from Ófalu was figured previously (GALÁCZ 1984, pl.2, fig.2). The here figured form came from the Lower Bathonian of the Hidas Valley section.

Lissoceras ferrifex (ZITTEL, 1868)
(Pl.6, fig.4)

Another common *Lissoceras* species, which occurs mainly in the Middle Bathonian, but is rarely represented also in the Lower Bathonian. The species is characterized by relatively big size, rounded whorl-section and well-rounded umbilical margin.

The species was previously recorded from the Mecsek (as *Lissoceras* sp. in TÖRÖK et al. 1987, pl.1, fig.1), from the Hidas Valley section. The here figured specimen came from the Singödör Valley, from the debris of the probably Middle Bathonian beds.

Eohecticoceras sp.
(Pl.2, fig.1)

This is an early Hecticoceratid with high whorl-section, narrow venter and small umbilicus. The ribbing is characteristic: the inner ribs are relatively weak, the secondaries are long and irregular in strength. Similar form is what KRYSTYN figured (1972, pl.5, fig.6) as *Prohecticoceras angulicostatum* LÓCZY. However this latter species (LÓCZY 1915, p.64, holotype: pl.5, fig.4; pl.6, fig.1) is more densely and regularly ribbed, with shorter secondaries. Also similar is *Hecticoceras (Prohecticoceras) mondegoense lazregi* of ELMI (1971, p.254, pl.19, figs 1, 6-7), what was described from the Middle Bathonian.

The figured specimen, which was mentioned previously as *Prohecticoceras* sp. aff. *tenuistriatus* (in VELLEDITS et al. 1986, text-fig.3) came also from the Middle Bathonian, from the Óbánya Valley section.

Prohecticoceras retrocostatum (DE GROSSOUVRE, 1888)
(Pl.1, fig.8)

The figured specimen came from the Upper Bathonian of the Hidas Valley section. The species is quite common here and in other Mecsek localities. The strong ribbing and the depressed, wide venter is very characteristic.

Because of wide vertical range, the species lost its formerly accepted index value in the Upper Bathonian (see TORRENS 1980). However, its occurrence is useful in identifying deeper Upper Bathonian levels.

Cadomites (Cadomites) rectelobatus (HAUER, 1857)
(Pl.2, fig.2)

This species is very common in the Mecsek Bathonian. The figured specimen is a wholly septate fragment which shows the characteristic features well: the depressed, wide whorl section, the dense and short primary ribs, etc. These features are very close to those on the type material from Swintiza (see GALÁCZ 1980, p.72).

C. (C.) rectelobatus specimens are yielded from almost all Bathonian sections of the Mecsek Mts. The species is most common in the Lower Bathonian, this is why BÖCKH (1880) introduced the "Rectelobatum horizon" for the interval corresponding to the Lower Bathonian. However, *C. (C.) rectelobatus* specimens were collected in the Middle and Upper Bathonian beds, too.

The figured specimen came from the Zigzag Zone of the Óbánya Valley profile, which was the type section of BÖCKH's Rectelobatum horizon.

Cadomites (Polyplectites) cf. *claromontanus* KOPIK, 1974
(Pl.3, fig.5)

A characteristic microconch which is quite common in the Upper Bathonian of the Mecsek Mts. The most similar form in the literature is what KOPIK described (1974, p.39, pl.9, fig.2) as *C. (P.) claromontanus* from the Upper Bathonian of Częstochova. The only difference is in the whorl section, which is slightly rectangular in the holotype but rounded in the Mecsek specimens.

The figured specimen came from the Óbánya Valley section, form the Orbis Zone (Upper Bathonian).

Cadomites (Polyplectites) sp.
(Pl.6, fig.2)

This is a microconch form occurring in the Upper Bathonian of the Sövér Ravine and the Hidas Valley. The characteristic features are the robust form and the strong, sharp ribs. The only comparable form in the literature is what recorded from the Polish Upper Bathonian as *C. (P.)* cf. *linguiferus* (D'ORB.) (KOPIK 1974, pl.9, fig.1). The figured specimen came from the Upper Bathonian of the Sövér Ravine.

Bullatimorphites (Bullatimorphites) eszterense (BÖCKH, 1881)
(Pl.5, fig.1)

This species is the most common Tulitid in the Mecsek, and is a good guide to identify the Middle Bathonian, though specimens were collected also from the Upper Bathonian. In its long vertical range the species shows some morphological variations, but the only tendency is in size, i.e. the forms become bigger towards the Upper Bathonian.

The figured form is near to the upper limit of the size range, and it comes from the Orbis Zone (Bed 8) of the Hidas Valley section. Other speciemens came from Ófalu (type locality, see GALÁCZ 1984), and practically from all localities.

Bullatimorphites ("Bomburites") suevicus (J.ROEMER, l911)
(Pl.5, fig.2)

This microconch Tulitid is usually associated with *B. (B.) eszterense,* and shows the same variations in size and sculpture. The figured specimen is from Bed 8 (Orbis Zone) of the Hidas Valley, and represents average morphology.

The systematics and nomenclature of microconch *Bullatimorphites* needs a thorough revision. Here the general practice followed in naming all unlappeted microconch *Bullatimorphites* as *"Bomburites"* (see WESTERMANN & CALLOMON 1988, p.80). However, these Bathonian microconchs certainly need a name, because *Bomburites* s. str. is a mainly Callovian form, matching *Kheraiceras,* which is again a genus on its own with enough morphological differences to be distinguished from *Bullatimorphites* (see GALÁCZ 1980, pp.79-80).

Tulites subcontractus (MORRIS & LYCETT, 1851)
(Pl.5, fig.3)

This is a loose specimen found in the debris of the Middle Bathonian beds in the Hidas Valley section. It resembles remarkably the incomplete specimen figured by ARKELL (1951-59, pl.12, fig.2). An important find, even without exact stratigraphy, because as an index species, it unequivocally indicates the middle part of the Middle Bathonian.

Rugiferites davaiacensis (LISSAJOUS, 1923)
(Pl.6, fig.1)

This Tulitid is a characteristic but rarely recorded ammonite in Middle Bathonian faunas. The distinguishing feature is the rectiradiate ribbing which results chevron-like outer ribs on the venter. This ribbing is associated with parabolic nodes in the inner whorls. Most of the figured specimens in the literature are incomplete or middle whorls (see LISSAJOUS 1923, pl.21, fig.2; KRYSTYN 1972, pl.21, fig.2), but the complete specimen of SANDOVAL (1983, pl.67, fig.4) shows that the characteristic ribbing endures up to the body chamber - just as in the form from the Mecsek.

The figured specimen came from the Middle Bathonian of the Ófalu - Kohlthal section.

Asphinctites sp.
(Pl.3, fig.2)

This is an incomplete and worn specimen from the debris of the Lower Bathonian of the Óbánya Valley section. Despite the poor preservation, the very wide umbilicus, the compressed whorls and the feeble ribbing suggest *Asphinctites*. Species cannot be identified.

Asphinctites was indirectly indicated from the Mecsek, because BÖCKH (1881, p.79) compared his *"Perisphinctes subtiliplicatus* n. sp." to *"Perisphinctes" tenuiplicatus* BRAUNS. Unfortunately BÖCKH did not figure his specimens, but his description is precise enough. The specimens mentioned in the description came from the Rectelobatum horizon (Lower Bathonian) of the same locality (Óbánya Valley) and from the Márévár Valley material of HOFMANN.

Ebrayiceras sulcatum (ZIETEN)
(Pl.3, figs 3 and 4)

This is the form what generally is named as *E. pseudoanceps* (EBRAY), but convincingly showed by MANGOLD (1970a, p.90) that its valid name is *sulcatum*. The two specimens figured here are within the range of the variation of the species.

Ebrayiceras is regarded as microconch of *Morphoceras*, and in fact the two groups occur and range together in the Lower Bathonian. The Mecsek specimens came also from thre Zigzag Zone: that in Pl.3, fig.3 from the Óbánya Valley section, that in Pl.3, fig.4 from the Hidas Valley profile.

Epistrenoceras histricoides ROLLIER, 1911
(Pl.4, fig.3)

This diagnostic specimen came from the upper part (Bed 10) of the Hidas Valley profile. It indicates the presence of the upper, E. histricoides faunal horizon of the Orbis Zone (see WESTERMANN & CALLOMON 1988, pp.11-12).

The incomplete specimen shows the body chamber, which is usually missing in examples figured in the literature. This part of the shell is wide, rectangular in cross-section, and shows rectiradiate outer ribs which cross the venter without interruption.

Epistrenoceras haugi (DOUVILLÉ, 1915)
(Pl.4, fig.2)

This specimen came from the loose material of the Hidas Valley section, but its stratigraphic position is undoubtedly close to the congeneric form discussed above.

The incomplete, otherwise well-preserved specimen shows irregular ribbing and compressed body chamber, thus differs from the more common *E. histricoides. E. haugi* is known from France (SAYN & ROMAN 1928, pl.5, fig.9; DE BRUN 1935, pl.2, fig.6). The specimen described by JÜSSEN (1891, pl.2, fig.3) from the Klippen Belt of the Northern Calcareous Alps (Austria) belongs also here.

Parapatoceras distans (BAUGIER & SAUZÉ, 1843)
(Pl.3, fig.6)

This small fragment was found in 1984 (see VELLEDITS et al. 1986) in the Upper Bathonian of the Óbánya Valley section. Even such a small portion is enough to identify the species of which features are the distant ribs of different strength and the high tubercules on the ventral side (see DIETL 1978).

P. distans is a characteristic ammonite in the Upper Bathonian, and seems to be restricted to the upper part of the Orbis Zone (see ELMI 1967, p.454).

Parapatoceras tenue (BAUGIER & SAUZÉ, 1843)
(Pl.3, fig.7)

This ammonite was the only diagnostic form found in the highest part of the red limestone in the Hidas Valley section. This is a rare species, which is clearly distinguished from *P. distans*, but is very close to *Parapatoceras tuberculatum* (BAUGIER & SAUZÉ), a Lower Callovian heteromorph. The here figured specimen is similar to *P. tuberculatum* but seems to be closer to the form recently figured from the Discus Zone of southwest Germany (*P.* cf. *tenue* in DIETL 1994, pl.2, fig.2).

Zigzagiceras cf. *plenum* ARKELL
(Pl.3, fig.5)

The figured only specimen is a fragmentary, incomplete example of which remarkable feature is that it is wholly septate at 62 mm, the biggest preserved diameter. It is closely compared here with *Zigzagiceras plenum* ARKELL, on the basis of its long coronate stage ("zigzag stage" of STURANI 1967).

The specimen was collected from the Lower Bathonian of the Hidas Valley section.

Siemiradzkia galla STEPHANOV, 1972
(Pl.2, fig.4)

This *Siemiradzkia* species is characterized by high, compressed whorl-section in the body chamber (see SANDOVAL 1983, text-figs 128 and 131), and distant, low ribs. The species was designated by STEPHANOV (1972, p.51), and based on *Perisphinctes (Grossouvria) matisconensis* in LISSAJOUS 1923, pl.6, fig.1 (only).

The single specimen of the Mecsek came from Bed 16, i.e. from the Upper Bathonian of the Hidas Valley section. This age is slightly younger than the previous datings which indicate Middle Bathonian levels for the species.

Wagnericeras cf. *bathonicum* ARKELL, 1958
(Pl.4, fig.4)

This is an incomplete phragmocone from Bed 8 of the Hidas Valley section. All features suggest *Wagnericeras:* strong, rounded ribs with slightly irregular bifurcation, relatively simple suture-line, etc. The narrow, but rounded whorl-section indicates the *Wagnericeras* s.str. group, and the ribbing, which is dominantly radial, is near to that in *W. bathonicum* ARKELL. However, the holotype of this species shows only the outer whorls, thus identification of such small specimens remains doubtful.

ARKELL's specimen came from the Fuller's Earth, according to TORRENS (1967, p.591) from the Retrocostatum Zone. Similar forms in France (MANGOLD et al. 1967, pp.112, 125) came from the middle part of the Upper Bathonian, i.e. from the Orbis Zone.

Homoeoplanulites (Homoeoplanulites) balinensis (NEUMAYR, 1871)
(Pl.4, fig.5)

This medium-sized Perisphinctid from the Upper Bathonian of the Hidas Valley matches well the form described from the famous Balin oolite near Cracow, South Poland. There were serious uncertainties about the horizon of the species, but revisions recently cleared its Late Bathonian age, which is supported now with data from southwestern Germany (DIETL 1994).

The Mecsek form shows a single difference from the type (NEUMAYR 1871, pl.15, fig.2): it has constrictions in the middle whorls. The here figured specimen (which is an individual damaged in the body chamber) came from Bed 11 (Orbis Zone) of the Hidas Valley.

Choffatia (Subgrossouvria) acuticosta (J.ROEMER, 1911)
(Pl.3, fig.9)

An incompletely preserved ammonite which is septate up to about 85 mm diameter. All visible features (coiling, ribbing, constrictions) suggest *C. acuticosta,* a species which was suspected previously from the Mecsek by a closely allied form (GALÁCZ 1984, pl.4, fig.3).

C. acuticosta is an Upper Bathonian ammonite (see HAHN 1969, MANGOLD 1970c). The figured specimen came from the Csengő Hill section.

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Explanations of plates

Plate 1

Fig. 1. *Ptychophylloceras flabellatum* (NEUMAYR). Hidas Valley, Middle Bathonian.

Fig. 2. *Lytoceras polyanchomenum* GEMMELLARO. Óbánya Valley, Lower Bathonian.

Fig. 3. *Paroecotraustes serrigerus* WAAGEN. Sövér Ravine, Middle Bathonian.

Fig. 4. *Adabófoloceras subobtusum* (KUDERNATSCH). Sövér Ravine, Middle Bathonian.

Fig. 5. *Lissoceras psilodiscus* (SCHLOENBACH). Hidas Valley, Lower Bathonian.

Fig. 6. *Oxycerites orbis* (GIEBEL). Hidas Valley, Upper Bathonian.

Fig. 7. *Oxycerites yeovilensis* ROLLIER. Hidas Valley, Lower Bathonian (= *Oxycerites* sp. in TÖRÖK et al. 1987, pl.I, fig.7).

Fig. 8. *Prohecticoceras retrocostatum* (DE GROSSOUVRE). Hidas Valley, Upper Bathonian.

(All figures natural size)

Plate 2

Fig. 1. *Eohecticoceras* sp. Óbánya Valley, Middle Bathonian.

Fig. 2. *Cadomites (Cadomites) rectelobatus* (HAUER). Óbánya Valley, Lower Bathonian.

Fig. 3. *Parkinsonia dorni* ARKELL. Óbánya Valley, Lower Bathonian.

Fig. 4. *Siemiradzkia galla* STEPHANOV. Hidas Valley, Upper Bathonian.

Fig. 5. *Morphoceras patescens* (BUCKMAN). Óbánya Valley, Lower Bathonian.

Fig. 6. *Morphoceras macrescens* (BUCKMAN). Hidas Valley, Lower Bathonian.

(All figures natural size)

Plate 3

Fig. 1. *Morphoceras multiforme* ARKELL. Hidas Valley, Lower Bathonian (= *Morphoceras* sp. in TÖRÖK et al. 1987, pl.I, fig.5).

Fig. 2. *Asphinctites* sp. A loose specimen from the Óbánya Valley section, Lower Bathonian.

Fig. 3. *Ebrayiceras sulcatum* (ZIETEN). Óbánya Valley, Lower Bathonian.

Fig. 4. *Ebrayiceras sulcatum* (ZIETEN). Hidas Valley, Lower Bathonian.

Fig. 5. *Cadomites (Polyplectites)* cf. *claromontanus* KOPIK. Óbánya Valley section, Upper Bathonian (Orbis Zone).

Fig. 6. *Parapatoceras distans* (BAUGIER & SAUZÉ). Óbánya Valley, Upper Bathonian (2 x).

Fig. 7. *Parapatoceras tenue* (BAUGIER & SAUZÉ). Hidas Valley, Upper Bathonian.

Fig. 8. *Zigzagiceras* cf. *plenum* ARKELL. Hidas Valley, Lower Bathonian.

Fig. 9. *Choffatia (Subgrossouvria) acuticosta* (J. ROEMER). Csengő Hill, Upper Bathonian.

(All figures natural size except otherwise stated)

Plate 4

Fig. 1. *Choffatia (Subgrossouvria) cerealis* ARKELL. Hidas Valley, Upper Bathonian.

Fig. 2. *Epistrenoceras haugi* (DOUVILLÉ). Loose specimen from the debris of the Hidas Valley section.

Fig. 3. *Epistrenoceras histricoides* (ROLLIER). Hidas Valley, Upper Bathonian.

Fig. 4. *Wagnericeras* cf. *bathonicum* ARKELL. Hidas Valley, Upper Bathonian.

Fig. 5. *Homoeoplanulites (Homoeoplanulites) balinensis* (NEUMAYR). Hidas Valley, Upper Bathonian.

(All figures natural size)

Plate 5

Fig. 1. *Bullatimorphites (Bullatimorphites) eszterense* (BÖCKH). Hidas Valley, Bed 8, Upper Bathonian.

Fig. 2. *Bullatimorphites ("Bomburites") suevicus* (J.ROEMER). Hidas Valley, Bed 8, Upper Bathonian.

Fig. 3. *Tulites subcontractus* (MORRIS & LYCETT). A loose specimen from the debris of the Middle Jurassic in the Hidas Valley.

(All figures natural size)

Plate 6

Fig. 1. *Rugiferites davaiacensis* (LISSAJOUS). Ófalu, Kohlthal, Middle Bathonian.

Fig. 2. *Cadomites (Polyplectites)* sp. Sövér Ravine, Upper Bathonian.

Fig. 3. *Nannolytoceras tripartitum* (RASPAIL). Sövér Ravine, Lower Bathonian.

Fig. 4. *Lissoceras ferrifex* (ZITTEL). Loose specimen from the Singödör, probably Middle Bathonian.

(All figures natural size)

Annales Univ. Sci. Budapest., Sect. Geol. 30, 151–176 & 231–234 (1995)
GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

Bathonian ostracods from the Mecsek Mts (South Hungary)

Miklós MONOSTORI[1]

(13 figures and 4 plates on pp. 231–234)

Abstract

Thirteen taxa of the ostracod fauna collected from the Bathonian of the Mecsek Mts (S. Hungary) are determinable on species level: *Cytherella limpidaforma* n. sp., *Cytherella perennis* BŁASZYK, 1967, *Cytherella compacta* n. sp., *Cytherella* cf. *irgisensis* LIUBIMOVA, 1955, *Cardobairdia mecsekensis* n. sp., *Cardobairdia inflata spinosa* n. ssp., *Bairdia caudifera* n. sp., *Bairdia hilda* JONES, 1884, *Anisobairdia ? magna* n. sp., *Pontocyprella izjumicaformis* n. sp., *Pontocyprella cavataformis* n. sp., *Paracypris obanyensis* n. sp., and *Paracypris lata* n. sp. The deep sublittoral shallow bathyal origin of the Bathonian sequences has been verified by the quantitative analysis of the genera. The species known from other areas indicate a marine area between the Jurassic epicontinental sea and the Tethys.

Key words: Ostracoda, Jurassic, bathonian, Mecsek Mts, Hungary, stratigraphy

Introduction

Several well described ostracod faunas are known from the Jurassic of Europe. Particularly high number of them is known from the Bathonian pelites. However, there is only a single notice in a stratigraphical work about Hungarian Bathonian ostracods until now (VELLEDITS et al. 1986). Moreover, there is no scientific work about the Hungarian Jurassic ostracods. The reason is the hard carbonates unsuitable for traditional washing for microfauna. We know only from slides, which have been made in large numbers for the stratigraphical description of the sequences, that ostracods are frequently present in these carbonates. Taxonomical descriptions of ostracods are impossible from slides.

A new preparation technique, by concentrated acetic acid, is very productive for the carbonate rocks (LETHIERS & CRASQUIN-SOLEAU 1988). It fortunately combines the slight chemical effect with a mechanical one. We have obtained excellent microfauna from marls, clayey limestones, limestones containing iron and manganese precipitations

[1]Department of Palaeontology, Eötvös University, H–1083 Budapest, Ludovika tér 2, Hungary

and incrustations. It is a problem for ostracod studies that the result is mainly carapaces without possibility of studying inner features. Sometimes (e.g. Cypridae) that makes much difficult to determine the genera correctly.

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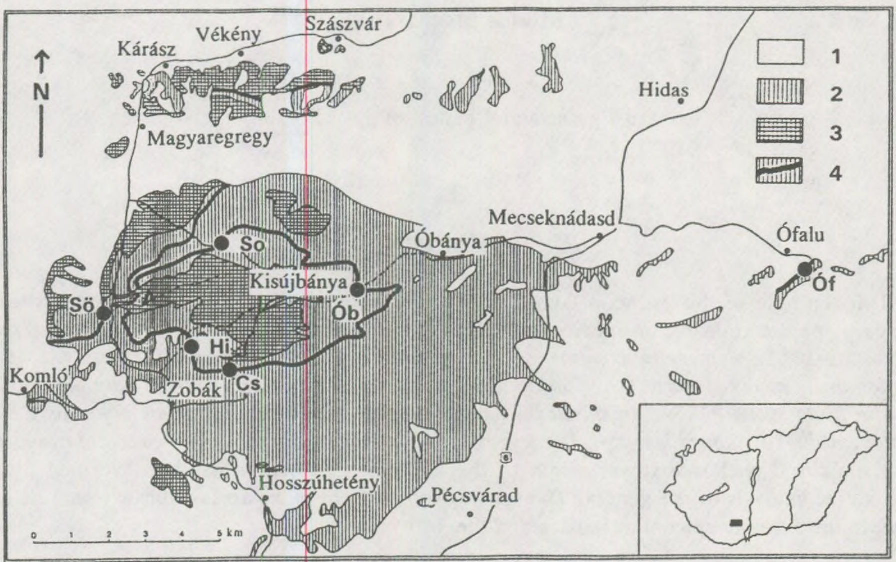

Fig. 1. Locations of the studied Bathonian sections in the Mecsek Mts. **Ob** = Óbánya Valley; **Hi** = Hidas Valley; **So** = Somos-Csörge Creek Valley; **Cs** = Csengő Hill; **1** = Cenozoic; **2** = Mesozoic sediments; **3** = Mesozoic volcanics; **4** = outcrops of the Bathonian-Callovian beds.

Sequences and sampling

The Bathonian sequences of the Mecsek Mts (S Hungary) are very thin (maximum 25 m) as compared to the whole thickness of the Jurassic sediments (4000 m in some localities). The ammonite stratigraphy and lithology of some sections are published in detail (PATAKY et al. 1982, VELLEDITS et al. 1986, TÖRÖK et al. 1987, GALÁCZ 1984a, 1984b, 1990, 1993).

The material investigated here came from the eastern part of the Mecsek Mts (Fig. 1).

There are 10 samples from the Hidas Valley (Fig. 2), 11 samples from the Óbánya Valley (Fig. 3) (complete Bathonian sequences), 5 samples from the Somosi Creek (Fig. 4) and 1 sample from the Csengő Hill (Fig. 5) (incomplete sequences with Upper Bathonian layers). The rocks are mainly red nodular marls and limestones, locally with abundant macrofauna (mainly ammonites). Sometimes loose, washable marls occur, with harder nodules. The microfauna was prepared partly by washing, but mainly by concentrated acetic acid. All micropaleontological investigations were made from the same samples.

The starting material of each samples was 500 g of sediment, the whole microfauna was picked for quantitative evaluation.

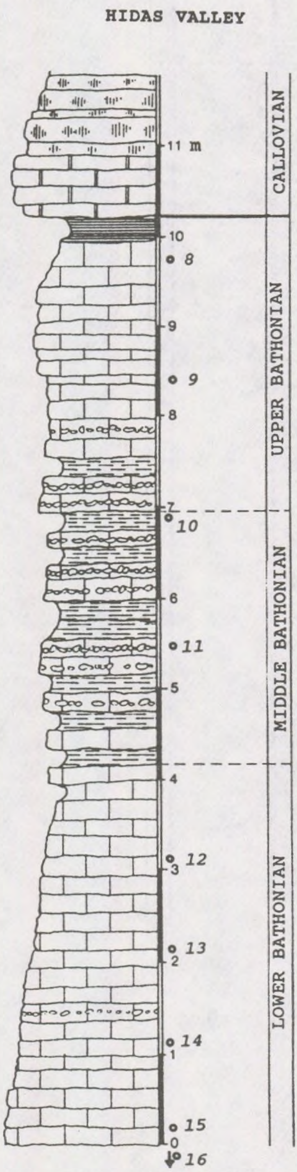

Fig. 2. Sampling of ostracods from the Hidas Valley section. Samples are numbered in italics.

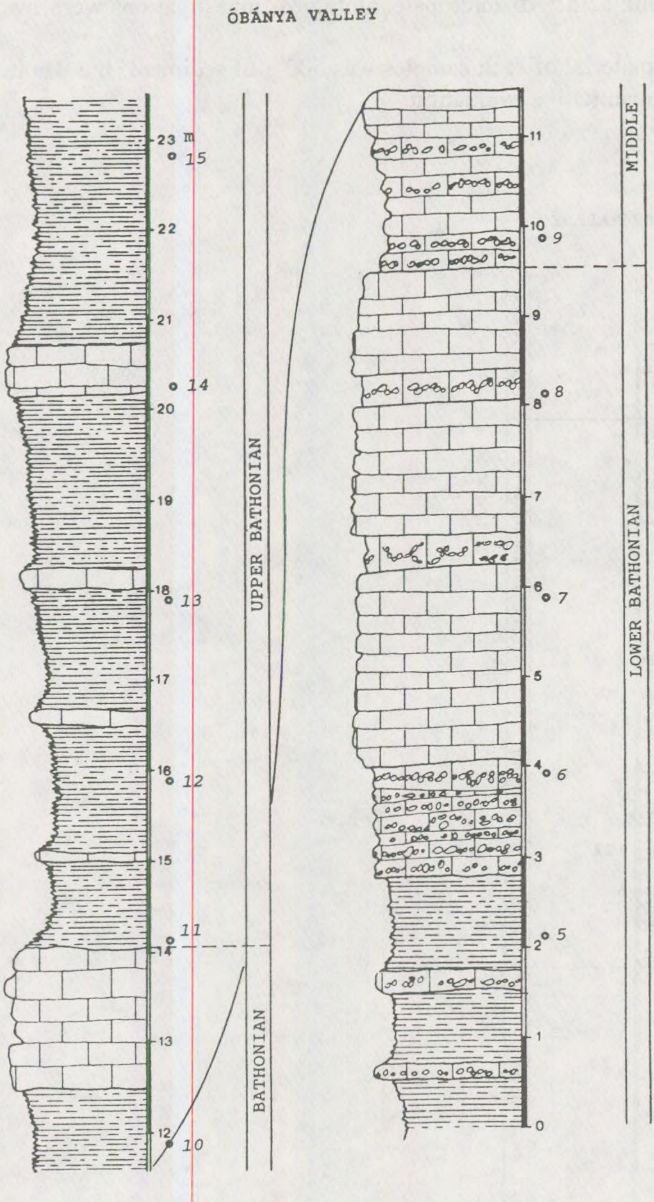

Fig. 3. Sampling of ostracods from the Óbánya Valley.

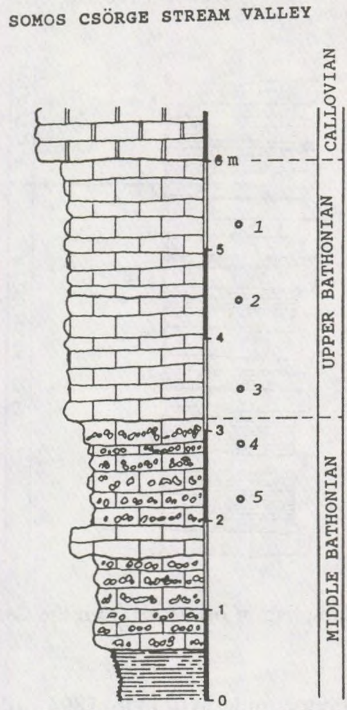

Fig. 4. Sampling of ostracods from the Somos-Csörge Stream Valley

Systematic descriptions

Ostracoda LATREILLE, 1806 classis
Myodocopida SARS, 1866 ordo
Cladocopa SARS, 1866 subordo
Polycopidae SARS, 1866 familia
Polycope SARS, 1866

Polycope sp.
(Pl. 1, Fig. 1.)

Remarks: small specimens. There are no investigable sculptural elements on their surfaces (concerning the identification with *P. pelta* FISCHER, 1961 see the investigations made by HARLOFF 1993). These incompletely preserved smooth carapaces cannot be determined on species level.

Dimensions: L = 0.35–0.46 mm

Material: Óbánya Valley, samples 6, 7 and 9; Somosi Creek, sample 4. 5 specimens.

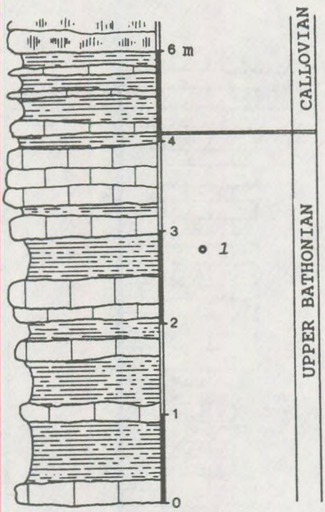

Fig. 5. Sampling of ostracods from the Csengő Hill.

Podocopida MÜLLER, 1894 ordo
Platycopa SARS, 1866 subordo
Cytherellidae SARS, 1866 familia
Cytherella JONES, 1849

Cytherella limpidaforma n. sp.
(Pl. 1, Figs 2–4.)

Derivatio nominis: it is similar to *C. limpida* BŁASZYK, 1967.
Locus typicus: Óbánya Valley, Mecsek Mts.
Stratum typicum: Lower Bathonian.
Diagnosis: the carapace of adults has symmetrical anterior and dorsal outline. The ventral outline is somewhat concave, the posterior slightly asymmetrical.
Description: the anterior outline of the adult right valve is asymmetrically rounded, it turns gradually into the nearly symmetrical, fairly arched dorsal outline. The posterior outline somewhat asymmetrical, the radius of its ventral part being larger than that of the dorsal part. The ventral outline is slightly concave.

The anterior outline of the adult left vave is somewhat asymmetrical, its ventral part has a larger radius, there is a break between its dorsal part and the straight dorsal outline. The dorsal outline turns into the asymmetrical posterior outline with increased inflexion after 0.5 length. The ventral outline is straight or slightly concave.

The instars are more stubby, their dorsal outline asymmetrical (in both valves). The adults and also the instars have characteristic depression along the anterior outline of the right valve, therefore the anterior rim looks like a protruding keel.

Dimensions: Adult carapace: L = 0.87 mm
H = 0.54 mm
Instars' carapace: L = 0.66–0.72 mm
H = 0.42–0.44 mm
Adult right valves: L = 0.77–0.80 mm
H = 0.44–0.46 mm

Comparison: the adult carapaces are far less asymmetrical compared to *C. limpida*. The juvenile carapaces have far less angular dorsal outline. Very close to this species is *C.* aff *index* OERTLI, 1959 of ROSENFELD & HONIGSTEIN (1991). The instars have similar outline as *C. notata* LJUBIMOVA, 1955.

Material: Óbánya Valley, samples 6–12, 14–15, Hidas Valley, samples 8–12, 14–6, Somosi Creek, samples 1, 3 and 5, Csengő Hill, sample 1. 131 specimens.

Cytherella perennis BŁASZYK, 1967
(Plate 1, Fig. 5.)

1967. *Cytherella perennis* n. sp. – BŁASZYK, pp. 15–18., Pl. II. f. 1–11, Pl. III., f. 6–7.
1978. *Cytherella perennis* BŁASZYK, 1967 – PIATKOVA & PERMIAKOVA, p. 122., Pl. 45., f. 1.
1988. *Cytherella perennis* BŁASZYK, 1967 – BIELECKA et al., p. 169., Pl. LXV. f. 3.

Remarks: The Hungarian specimens are similar to BŁASZYK's material with their parallel and nearly straight dorsal and ventral outlines, and with their nearly symmetrically arched anterior and posterior outlines.

Dimensions: Adult carapace: L = 0.81 mm, H = 0.47 mm

Material: Óbánya Valley, samples 7–8, 10, 14, Hidas Valley, samples 10–14. Csengő Hill, sample 4. 11 specimens

Cytherella compacta n. sp.
(Plate 1, Figs 6–7.)

Derivatio nominis: the name relates to its stubby shape.

Locus typicus: Óbánya Valley, Mecsek Mts.

Stratum typicum: Middle Bathonian.

Diagnosis: the shape is stubby, anterior and posterior outlines are symmetrically rounded. It has short and nearly parallel dorsal and ventral outlines.

Description: the anterior outline of the right valve is symmetrically rounded. It turns gradually into the short and nearly parallel dorsal and ventral outlines. The posterior outline is also symmetrically rounded. The ventral and dorsal outlines turn into the posterior outline somewhat more angularly than into the anterior outline.

Dimensions: Adult right valve: L = 0.86–0.90 mm
H = 0.54–0.55 mm

Comparison: The similar *C. irgisensis* LJUBIMOVA, 1955 differs from the new species in its convex ventral and dorsal outlines. The also similar *C. ukrainkaensis* LJUBIMOVA, 1955 has much longer, straight dorsal and ventral outlines.

Material: Óbánya Valley, samples 9–11, Hidas Valley, samples 8, 10–12, 14. 15 specimens.

Cytherella cf. *irgisensis* LIUBIMOVA, 1955
(Plate 1, Fig. 8.)

Remarks: the ventral outline is more fairly arched than that of the typical *irgisensis*.

Dimensions: Adult right valve: L = 0.76–0.83 mm
H = 0.47–0.55 mm

Material: Óbánya Valley, samples 6, 10, 14, Hidas Valley, samples 10, 16. 7 specimens.

Metacopa SYLVESTER-BRADLEY, 1967 subordo
Healdiacea HARLTON, 1933 superfamilia
Saipanettidae MCKENZIE, 1968 familia
Cardobairdia VAN DEN BOLD, 1960

Cardobairdia mecsekensis n. sp.
(Plate 2, Figs 1–3.)

Derivatio nominis: its name refers to the type area (Mecsek Mts).

Locus typicus: Óbánya Valley, Mecsek Mts.

Stratum typicum: Lower Bathonian.

Diagnosis: the shape is nearly rhomboid because of the strong break of the ventral and dorsal outlines and the narrow anterior and posterior outlines.

Description: the anterior outline of the left valve has an asymmetrical and narrow arch, its dorsal part has a larger radius and turns gradually into the dorsal outline. The dorsal outline has a break in midlength, its branches form an obtuse angle. The posterior outline nearly symmetrically rounded, with a narrow arch. The ventral outline has a similar construction as the dorsal one, its branches form more obtuse angle. The character of the dorsal and ventral outlines gives rhombic shape to the valve.

The anterior outline of the right valve is more asymmetrical, the break of the dorsal outline is before the midlength, the posterior part of the dorsal outline is much longer than the anterior one. The posterior outline is more pointed, the ventral outline is nearly straight. The left valve strongly overlaps the right ventrally and dorsally.

Dimensions: Adult carapace: L = 0.59–0.64 mm
H = 0.40–0.42 mm

Comparison: the rhombic shape is a strong difference between the new species and the somewhat similar *C. liassica* (DREXLER, 1958).

Material: Óbánya Valley, samples 6–10, Hidas Valley, samples 9–12, 14–16. 28 specimens.

Cardobairdia inflata spinosa n. ssp.
(Plate 2, Fig. 4.)

Derivatio nominis: the name refers to the caudal spine.
Locus typicus: Óbánya Valley, Mecsek Mts.
Stratum typicum: Lower Bathonian
Diagnosis: the right valve has a strong caudal spine.
Description: the shape corresponds to the more stubby specimens of *C. inflata* SZCZECHURA & BŁASZYK 1968, but there is a strong, spine-like extension on the posterior end of the right valve at the level of 1/3 height. The spine reaches beyond the left valve. The ventral overlap of the valves is weaker than in subspecies *inflata inflata*.
Dimensions: Adult carapace: L = 0.55 mm, H = 0.32 mm
Comparison: see in description.
Material: Óbánya Valley, samples 6, 8, Hidas Valley, sample 10. 5 specimens.

Podocopa SARS, 1866 subordo
Bairdiacea SARS, 1866 superfamilia
Bairdiidae SARS, 1888 familia
Bairdia MCCOY, 1844

Bairdia caudifera n. sp.
(Plate 2, Figs. 5–7.)

Derivatio nominis: it is named after the rostrum-like posterior end.
Locus typicus: Óbánya Valley, Mecsek Mts.
Stratum typicum: Lower Bathonian.
Diagnosis: the shape is stubby, with strongly arched dorsal outline, arched caudal process and densely pitted surface.
Description: The anterior outline of the left valve is asymmetrically rounded, its ventral part has much larger radius, a part of it is nearly straight. The anterior outline turns into the dorsal one with a break. The anterior part of the dorsal outline is slightly concave and steeply ascending, it turns into the steeply descending and slightly convex posterior part before half-length. The posterior outline is a slightly upward-curved caudal process, it comes to the 1/6 of the total length. The two branches of the ventral outline meet in 140–150° angles. The anterior part of the ventral outline turns gradually into the broadly arched ventral part of the anterior outline.

The anterior outline of the right valve is more asymmetrical, its ventral part nearly straight. The anterior part of the dorsal outline is more convex, there is a straight middle part characteristic to *Bairdia*, the posterior part is also straight, because here the caudal process is more curved upward and more pointed. The ventral outline is slightly concave at midlength. In dorsal view of the carapace the outline is slightly ascending to 1/10 length, then abruptly ascends to about 1/3 length. Here is a transition with small radius, then the outline slopes to the process.

Comparison: The most similar species is *B. ohmerti* KNITTER, 1984, but it has also different caudal process, ventral and anterior outlines.

Material: Óbánya Valley, samples 6–7, 9–11, Hidas Valley, samples 10–11, 15–(10U16, Somosi Creek, samples 1, 4–5, Csengő Hill, sample 1. 39 specimens.

Bairdia hilda JONES, 1884
(Plate 2, Fig. 8; Plate 3, Figs 1–2.)

1884. *Bairdia hilda* n. sp. – JONES, p. 771., Pl. 34. f. 20.
1888. *Bairdia fullonica* n. sp. – JONES & SHERBORN, p. 253., Pl. 5., f. 4a–c.
1963. *Bairdia hilda* JONES, 1884 – BATE, pp. 188–189., Pl. 2., f. 9–12., Pl. 3. f. 1–4.
1969. *Bairdia hilda* JONES, 1884 – BATE, p. 383., Pl. 1., f. 5–6.
1969. *Bairdia hilda* JONES, 1884 – BATE, pp. 397–398., Pl. 4., f. 5–6.
? 1978. *Bairdia hilda* JONES, 1884 – PIATKOVA, PERMIAKOVA, p. 124., Pl. 45., f. 6.
1983. *Bairdia hilda* JONES, 1884 – MORRIS, Pl. IV., f. 11–14.

Remarks: most specimens are strongly elongated, like *B. hilda* type, but there is a transitional line from the elongated forms to the more stubby ones.

Dimensions: Adult carapaces of the *hilda* form: L = 1.07–1.27 mm
H = 0.53–0.67 mm
L/H = 1.90–2.02

Adult and last instar (?) carapaces of the *"fullonica"* form: L = 0.77–0.97 mm
H = 0.49–0.57 mm
L/H = 1.57–1.70

Material: Óbánya Valley, samples 6–11, 14, Hidas Valley, samples 8, 11, 15–16, Somosi Creek, sample 3. 32 specimens.

Bairdia sp.

Remarks: 31 specimens belonging to the genus *Bairdia* are indeterminable because of their poor preservation.

Anisobairdia KOLLMANN, 1963

Anisobairdia ? *magna* n. sp.
(Plate 4, Figs 5–8.)

Derivatio nominis: it is named after its size.

Locus typicus: Hidas Valley, Mecsek Mts.

Stratum typicum: Upper Bathonian.

Diagnosis: the carapace is more or less asymmetrically oval, with a longitudinal depression in midheight of the larger valve.

Description: The anterior outline of the larger (left?) valve is broadly, somewhat asymmetrically rounded. The radius of the dorsal arch is larger, its anterior and posterior parts are less curved. The radius of the posterior arch is less than that of the anterior arch. The radius of the ventral arch is always much larger than that of the dorsal arch, its middle part is sometimes nearly straight. The smaller (right?) valve is completely overlapped by the greater one. Its ventral outline is concave, the dorsal arch is trapezoidal. The smaller valve is more flattened, anteriorly and posteriorly slightly depressive. There is a longitudinal depression at midheight of the larger valve.

Variability: The convexity of the ventral outline, and the length and strength of the depression in the larger valve are variable. The probable instars are more trapezoidal.

Comparison: similar forms are known in the Lower Jurassic (KOLLMANN 1963, HARLOFF & JÄGER 1994). The outline of the adults in the Mecsek material is different from these forms. Neither the muscle scars, nor the hinge are known, so the systematical position is uncertain.

Dimensions: Adult carapaces: L = 1.37–0.91 mm
H = 1.11–0.69 mm
Instar: L = 0.50 mm
H = 0.36 mm

Material: Óbánya Valley, samples 6–7, 10, 12, Hidas Valley, samples 8–12, 15–16, Somosi Creek, sample 3, Csengő Hill, sample 1. 142 specimens.

Cytheracea BAIRD, 1850 superfamilia
Cytheridae BAIRD, 1850 familia
Progonocytherinae SYLVESTER-BRADLEY, 1948 subfamilia
Progonocythere SYLVESTER-BRADLEY, 1948

Progonocythere ? sp.
(Plate 3, Figs. 3–4.)

Remarks: the dorsal outline of the carapace is strongly arched, the lateral surface is roughly reticulated and wrinkled. The ventrolateral extension reaches beyond the ventral margin. The posterior end is symmetrically pointed at about the midheight level. Because of the poor preservation the inner features are not visible, either the details of the ornamentation. Similar forms are known both in genus *Glyptocythere*, BRAND & MALZ, 1962 and *Micropneumatocythere* BATE, 1963.

Dimensions: Adult carapaces: L = 0.63–0.65 mm
H = 0.41–0.43 mm

Material: Óbánya Valley, sample 6, Hidas Valley, samples 11, 15, Somosi Creek, sample 3. 6 specimens.

Glyptocythere BRAND et MALZ, 1962
Glyptocythere? sp.
(Plate 3, Fig. 5.)

Remarks: The carapace has a straight dorsal outline, it turns to the dorsal straight branch of the pointed posterior outline with a strong break. The lateral surface is densely reticulated; the keel of the posteroventral swelling hardly reaches beyond the ventral margin. The posterior end is strongly depressed. There are strengthened ventral and anteroventral concentric costae. Many *Glyptocythere* have similar outline, mainly their larval forms.

Dimensions: Instar? carapaces: L = 0.52–0.54 mm
H = 0.30–0.33 mm

Material: Hidas Valley, samples 8, 10–11, 14–15, Csengő Hill. sample 1. 8 specimens

Nemoceratina GRÜNDEL et KOZUR, 1971

Nemoceratina? sp.

(Plate 3, Fig. 6.)

Remarks: The anterior outline of the carapace is symmetrically rounded, the dorsal outline is nearly straight, the posterior outline is asymmetric and pointed, its ventral part is concave in the posterior 1/4 length, the ventral outline is nearly straight. There are three knots in a row at about midheight and between 0.4–0.8 of length. The central one is the largest, the posterior one is the most projecting, spine-like. The lateral surface is finely reticulated, its anterior part is depressed.

Dimensions: Adult carapace: L = 0.65 mm
H = 0.26 mm

Material: Óbánya Valley, sample 9, Hidas Valley, sample 10. 2 specimens

Cypridacea BAIRD, 1845 superfamilia

Macrocyprididae MÜLLER, 1912 familia

Macrocypris BRADY, 1868.

Macrocypris? sp.

(Plate 3, Fig. 7.)

Remarks: The anterior outline of the carapace is narrowly and somewhat asymmetrically rounded, the dorsal outline has a large arch, its posterior quarter is straight. The posterior outline very narrowly arched and pointed at the level of ventral outline. The ventral outline is slightly concave. The inner features are not visible. The overlap cannot be determined precisely.

Dimensions: Adult carapace: L = 0.65 mm
H = 0.26 mm

Material: Óbánya Valley, sample 6, Hidas Valley, samples 10, 12. 3 specimens

Pontocyprididae MÜLLER, 1894
Pontocyprella LIUBIMOVA, 1955

Pontocyprella izjumicaformis n. sp.
(Plate 3, Fig. 8.)

Derivatio nominis: its name originates from the similarity to *P. izjumica* LIUBIMOVA, 1956.
Locus typicus: Óbánya Valley, Mecsek Mts.
Stratum typicum: Middle Bathonian
Diagnosis: the form is elongated, its posterior outline is asymmetrically and narrowly rounded near the midheight.
Description: The anterior outline of the left valve is somewhat asymmetrically rounded, it turns into the broadly arched dorsal outline with a distinct break. The posterior outline is asymmetric, its dorsal arch beginning at 0.8 length has larger, the ventral arch has smaller radius, there is a sharp break near midheight. The ventral outline is slightly concave and asymmetric. In the right valve the ventral sinus is deeper, the left valve overlaps the right dorsally.
Variability: there are more stubby forms with weaker ventral sinus.

Remarks: The posterior outline of the species is more sharpened than that of *P. iziumica* LIUBIMOVA, 1956.
Dimensions: Adult carapaces: L = 0.60–0.85 mm
H = 0.31–0.34 mm
Material: Óbánya Valley, samples 6–12, Hidas Valley, samples 10, 12, Somosi Creek, samples 1–4. 38 specimens.

Pontocyprella cavataformis n. sp.
(Plate 4, Fig. 1.)

Derivatio nominis: The species is very similar to *P. cavata* DONZE, 1967.
Locus typicus: Hidas Valley, Mecsek Mts.
Stratum typicum: Middle Bathonian
Diagnosis: The form is high, nearly triangular, hardly sharpened posteriorly.
Description: The anterior outline of the left valve is nearly symmetrically rounded. The more broadly rounded dorsal arch is slighly broken at midlength. The posterior outline slightly sharpened below the midheight. The middle part of the ventral outline is straight. The right valve is much lower, the anterior part of the dorsal outline is straight or hardly concave, its posterior part is straight, the dorsal part of the posterior outline is nearly straight after a break.
Variability: the roundness of the posterior end is somewhat variable, the L/H ratio too.
Comparison: as compared to *P. cavata* the anterior outline of this species is more symmetric, also more symmetric is the dorsal arch of the left valve, having a distinct break near midlength.
Dimensions: Adult carapaces: L = 0.66–0.72 mm
H = 0.41–0.44 mm

Material: Óbánya Valley, samples 7, 10–11, Hidas Valley, samples 10–12, 14, Somosi Creek, sample 3. 21 specimens.

Pontocyprella? sp.
(Plate 4, Fig. 2.)

Remarks: This form is very similar to *P. suprajurassica* OERTLI, 1959 in MORRIS 1983. But the species, figured by MORRIS is not the equivalent of the *suprajurassica*-type, and its systematic position is very uncertain.

Dimensions: Adult carapaces: L = 0.59–0.61 mm
H = 0.31–0.32 mm

Material: Óbánya Valley, samples 6–7, Hidas Valley, samples 10, 16. 4 specimens

Candonidae KAUFMANN, 1900. familia
Paracypridinae SARS, 1923. subfamilia
Paracypris SARS, 1866.

Paracypris obanyensis n. sp.
(Plate 4, Fig. 3.)

Derivatio nominis: after the village Óbánya.
Locus typicus: Óbánya Valley, Mecsek Mts.
Stratum typicum: Middle Bathonian.
Diagnosis: The shape is elongated, the posterior end somewhat upwardly directed.
Description: the anterior outline of the left valve is asymmetrically rounded, it turns into the dorsal outline with a break. The anterior third of the dorsal outline is nearly straight, the median arch is convex with large radius, the posterior third is nearly straight again. The posterior end is somewhat asymmetrically sharpened above the level of the ventral outline. The ventral outline is straight. The anterodorsal outline and the median part of the ventral outline are concave in the right valve.
Variability: the asymmetry of the anterior outline and the dorsal arch is somewhat variable.
Comparison: the shape of the dorsal outline and the character of the posterior end differ from those of any Jurassic species.
Dimensions: Adult carapaces: L = 0.74–1.00 mm
H = 0.36–0.48 mm
Material: Óbánya Valley, samples 6–7, 9, 12, 14, Hidas Valley, samples 10–12, 15, Somosi Creek, samples 1, 3. 22 specimens.

Paracypris lata n. sp.
(Plate 4, Fig. 4.)

Derivatio nominis: the name refers to the high carapace.
Locus typicus: Hidas Valley, Mecsek Mts.

Stratum typicum: Middle Bathonian.

Diagnosis: the form is stubby with a posterior end which is weakly pointed in the lower third of the height.

Description: the anterior outline of the left valve is asymmetrically rounded, the dorsal outline highly arched, its anterior third is straight. The posterior outline consists of a rather rounded point at about 1/3 height. The ventral outline is nearly straight. In the right valve the anterior third of the dorsal outline is somewhat concave, the posterior third nearly straight. The ventral outline is fairly concave near the midlength.

Variability: the height and the roundness of the posterior end is variable.

Comparison: *P. makridini* LIUBIMOVA, 1956 from the Russian Jurassic is similarly stubby, but its posterior pointing is in the level of the ventral outline, the dorsal outline turns into the posterior by a fairly concave part. Its height has a more anterior position.

Dimensions: Adult carapaces: L = 0.58–0.60 mm
H = 0.33–0.35 mm

Material: Óbánya Valley, samples 6, 12, Hidas Valley, samples 9, 11, 14. 6 specimens.

Cypridacea gen. et sp. indet.

9 different forms of Cypridacea are not determinable even on generic level.

Material: 51 carapaces

The distribution of the ostracods

From the 349 ostracod specimens of the Hidas Valley 274 specimens are determinable to genus or species level. 21 % of the fauna is indeterminable. The specimen number of the samples varies between 9 and 72.

In the Óbánya Valley section 257 specimens were found: 207 of them are determinable, 20 % indeterminable. The specimen number varies between 1 and 78.

The material of Somosi Creek is rather rare and poorly preserved. The total specimen number is 50, 32 of them are determinable and the indeterminable comes to 35 %. The single sample of Csegő Hill contains 72 ostracods, they are fairly well preserved; 45 % of them are indeterminable.

13 of the discovered forms were possible to describe on species level, further 7 on generic level. 2 of the species are comparable with known ones, a further one is a new subspecies of a known species:

Cytherella perennis BŁASZYK, 1967 – Upper Bajocian, Bathonian; Poland, Ukraina.

Cardobairdia inflata SZCZECHURA & BŁASZYK, 1967 *spinosa* n. ssp. – Nominate subspecies distribution: Upper Bajocian, Bathonian; Poland, Germany.

Bairdia hilda JONES, 1884 – Upper Bajocian, Bathonian, Gr. Britain, Ukraine.

None of the 13 species is restricted to a distinct Bathonian level, considering that all species have been found from Lower Bathonian to Upper Bathonian in every studied sections.

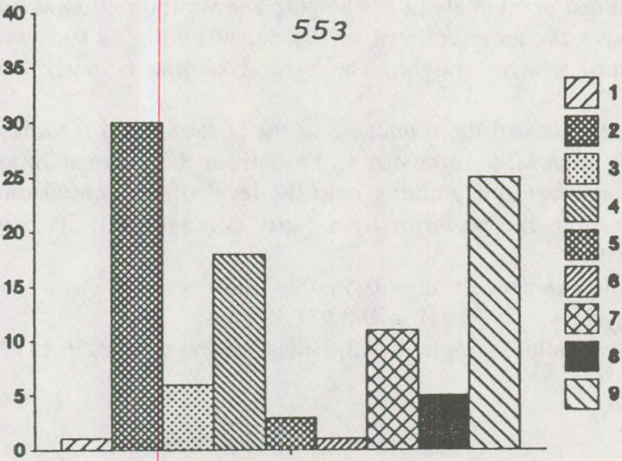

Fig. 6. Distribution (percentage) of ostracod taxa in the Bathonian of the Mecsek Mts. Legend: **1** = *Polycope;* **2** = *Cytherella;* **3** = *Cardobairdia;* **4** = *Bairdia;* **5** = Cytheracea; **6** = *Macrocypris;* **7** = *Pontocyprella;* **8** = *Paracypris;* **9** = *Anisobairdia* ? Total number of evaluable specimens is in italics.

Fauna and environment

There are 11 genera in the fauna and their quantity is characteristic to the paleoenvironment.

1. *Polycope*
2. *Cytherella*
3. *Cardobairdia*
4. *Bairdia*
5. *Anisobairdia* ?
6. Cytheracea (because of their rarity the 3 genera are summarized)
7. *Macrocypris*
8. *Pontocyprella*
9. *Paracypris*

The most characteristic feature of the discovered fauna as compared to the known faunas is the rarity of the Cytheracea, which represent only 3 % of the total specimen number (Fig. 6). The 3 dominant genera are *Cytherella* (30 % of the total specimen number), *Bairdia* (18 %) and *Anisobairdia* ? (25 %). Frequent genera are *Cardobairdia* (6 %), *Pontocyprella* (11 %) and *Paracypris* (5 %). Additional elements are *Polycope*

(1 %) and *Macrocypris* (1 %). Very similar faunal appearances of later ostracod faunas are known (e. g. from Paleogene, MONOSTORI 1993). Among the Bairdias the form with pointed caudal end *(B. caudifera* n. sp.) is very characteristic, *Cardobairdia* and *Pontocyprella* are frequent, *Cytherella* + *Bairdia* are always predominant; this faunal composition allows to conclude a deep sublittoral–upper bathyal marine environment.

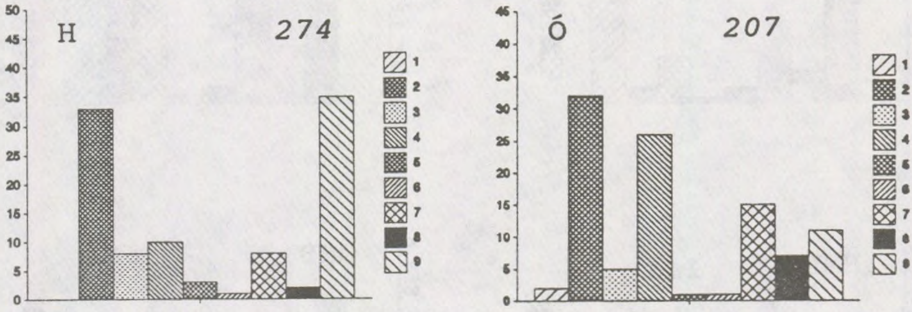

Fig. 7 Percentage of ostracod taxa in the Bathonian of Hidas Valley **(H)** and Óbánya Valley **(Ó)**. Legend: see on Fig. 6.

Independently investigating the two complete sections (Hidas and Óbánya Valleys), a series of significant differences appears in the local quantitative composition of the essentially similar faunas. In the Hidas Valley the *Anisobairdia* ? and *Cardobairdia* are more frequent, in the Óbánya Valley *Bairdia*, *Pontocyprella* and *Paracypris* are more numerous than in the other localities (Fig. 7).

The high *Cytherella* dominance is a characteristic feature of the Lower Bathonian of the Hidas Valley (Fig. 8). A distinct feature of the Hidas Valley's Middle Bathonian material is the mass appearance of *Anisobairdia* ?. Apart from *Anisobairdia* ?, the high amount of *Cardobairdia* is also characteristic in this material. The percentage of *Cytherella* surpasses that of *Bairdia* in both locality, in the Hidas Valley material by two.

In the Upper Bathonian material of the Hidas Valley the dominant appearance of *Anisobairdia* ? is significant. The analysis of the composition without *Anisobairdia* ? indicates a strong *Cytherella* dominance in the Hidas Valley over *Bairdia*, while there is a slight *Bairdia* dominance in the Óbánya Valley over *Cytherella*. *Pontocyprella* and *Paracypris* have a much greater part in the Upper Bathonian fauna of Óbánya Valley.

The section of Somosi Creek represents Middle and Upper Bathonian layers, and the Csengő Hill section consists of only Upper Bathonian layers (Fig. 9). The fauna of the Middle Bathonian is not suitable for interpretation. The Somosi Creek Upper Bathonian fauna is similar to the Upper Bathonian one of the Óbánya Valley. The fauna from the Csengő Hill is poorly preserved. The high dominance of *Anisobairdia* ? is similar to the Hidas Valley's material. The rare *Cytherella* and the lack of determinable *Pontocyprella* and *Paracypris* may be due to the poor preservation.

Analysing the two complete sections on sample level, there are higher differences in the faunal composition (Figs 10–13).

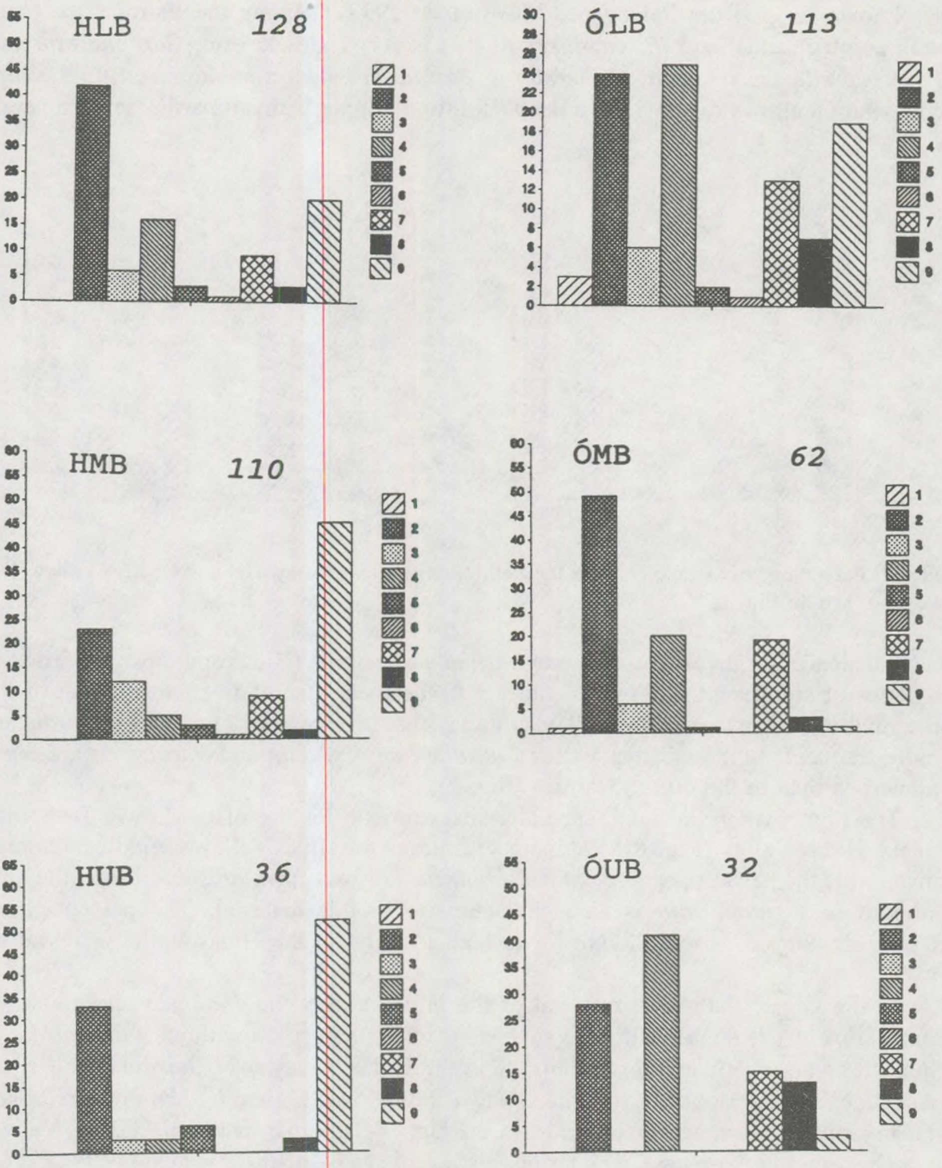

Fig. 8. Percentage of ostracod taxa in the Lower Bathonian of Hidas (**HLB**) and Óbánya (**ÓLB**) Valleys, in the Middle Bathonian of Hidas (**HMB**) and Óbánya (**ÓMB**) Valleys, in the Upper Bathonian of Hidas (**HUB**) and Óbánya (**ÓUB**) Valleys. Legend: see on Fig. 6.

The *Cytherella/Bairdia* ratio is significantly varied in the Lower Bathonian samples of the Hidas Valley, with permanent *Cytherella* dominance, except sample 13, which is doubtful owing to the low specimen number. The presence of Cytheridae is occasional.

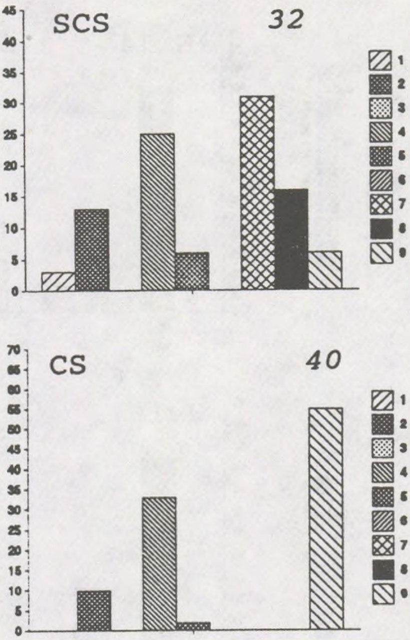

Fig. 9. Percentage of ostracod taxa in Bathonian of Somos-Csörge Stream Valley (SCS) and Csengő Hill (CS). Legend: see on Fig. 6.

In the Lower Bathonian samples of the Óbánya Valley the *Cytherella/Bairdia* ratio is also variable, but sometimes with *Bairdia* dominance. The amount of the *Anisobairdia* ? is gradually decreasing.

In the Middle Bathonian samples of the Hidas and Óbánya Valleys the role of *Cardobairdia* is variable; *Cytherella* predominates *Bairdia.* The presence of *Anisobairdia* ? and Cytheridae are episodic in the Óbánya Valley, *Anisobairdia* ? is dominant, and the presence of Cytheridae is significant in the Hidas Valley.

In the Upper Bathonian of the Hidas Valley there is a *Cytherella* predominance over *Bairdia*; the most common form is *Anisobairdia* ?. In most samples the Upper Bathonian of the Óbánya Valley there is a characteristic *Bairdia* predominance over *Cytherella* and the presence of *Anisobairdia* ? is episodic. Because of low specimen numbers, most of the Upper Bathonian samples cannot be evaluated in themselves.

Conclusions

The Bathonian ostracods of the Mecsek Mts are suitable for some paleoenvironmental conclusions. The sedimentation of the Bathonian marls and limestones in a deepest sublittoral-shallow bathyal environment is suggested by the subordinate role of the Cytheridae (3 %) in contrast to the richness of Cytheridae in well-known Bathonian shallow-water faunas. The specimen number is low (28 specimens in 500 g of sediments in average) in spite of the strong condensation

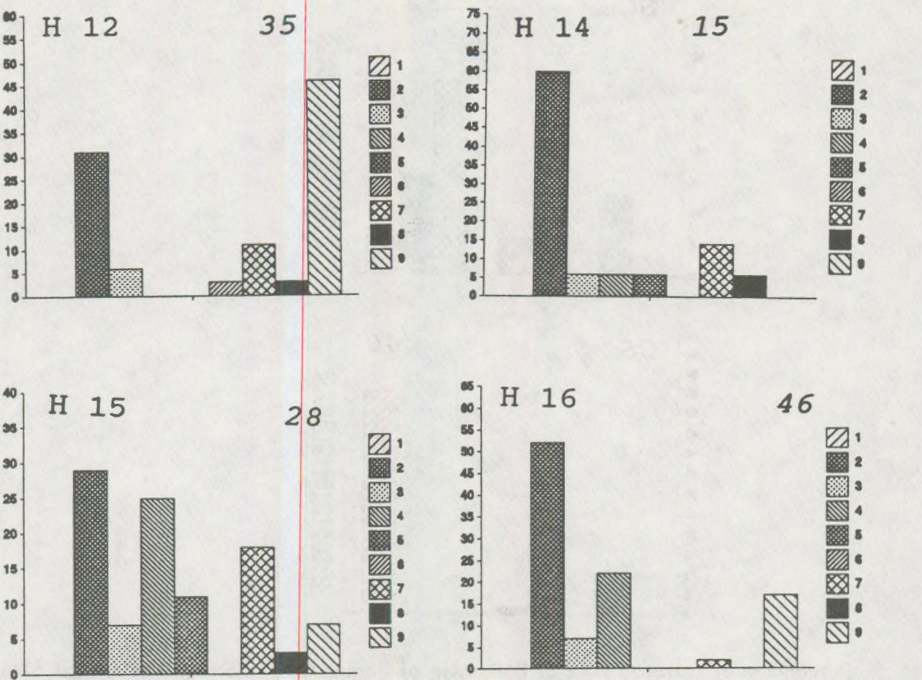

Fig. 10. Percentage of ostracod taxa in Lower Bathonian samples of Hidas Valley. Legend: see on Fig. 6.

(thin, complete sequences). *Cytherella* is a characteristic, dominant form in shelf-marginal and bathyal communities (BOLD 1981, DUCASSE 1973, 1974, PEYPOUQUET et al. 1982). The also dominating *Bairdia* is an ubiquist form, but often it is a dominant genus in deep-water associations. One of the characteristic *Bairdia* species in the Bathonian of the Mecsek is *B. caudifera* n. sp. with its pointed caudal process. Similar forms are typical for deep-water communities up to recent (DUCASSE 1973, 1974). *Cardobairdia* is a characteristic form of communities bellow the shelf (BOLD 1981, DUCASSE & PEYPOUQUET 1978, 1979, 1986). There are similar conclusions in these works for *Pontocyprella.*

Among the similar deep sublittoral-bathyal conditions it is obvious from the comparative investigation of the sections, that each part of bottom had different local environmental factors, and therefore the populations took part in the communities in different degree. Differences appear also in the sedimentation, and parallelly the evolution of the communities has locally different features.

On basis of epicontinental European relationships of the determinable species and of the ecological aspects, the Bathonian fauna of the Mecsek Mts perhaps have lived in a transitional region between epicontinental seas and the Tethys.

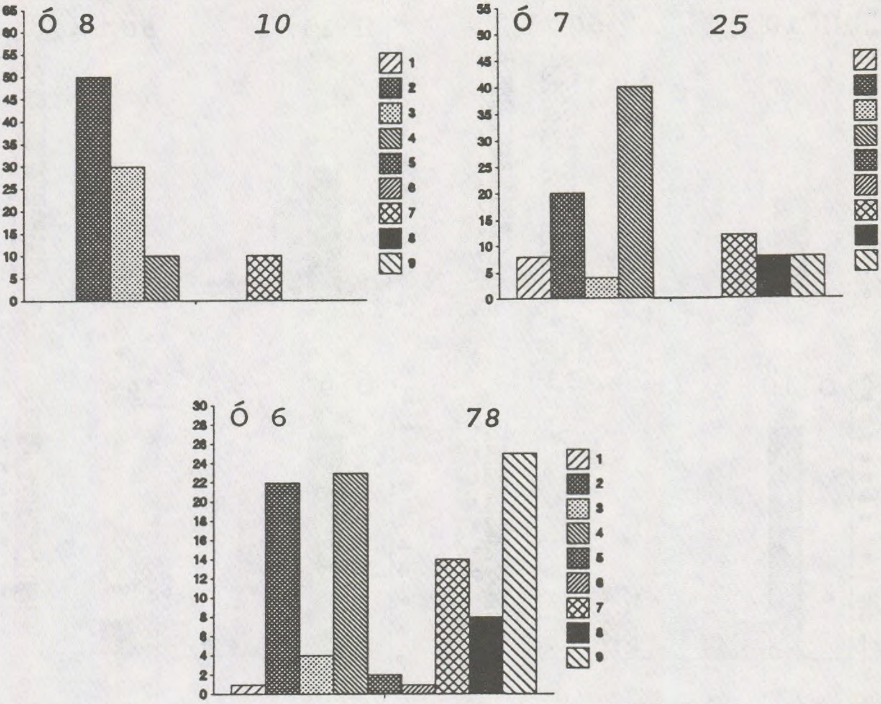

Fig. 11. Percentage of ostracod taxa in Lower Bathonian samples of Óbánya Valley. Legend: see on Fig. 6.

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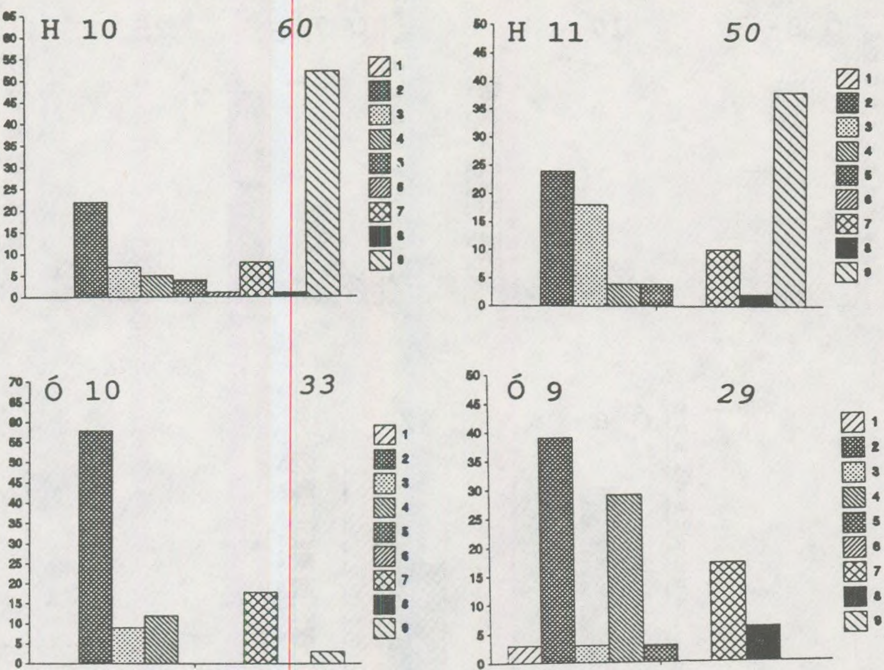

Fig. 12. Percentage of ostracod taxa in Middle Bathonian samples of Hidas **(H)** and Óbánya **(Ó)** Valleys. Legend: see on Fig. 6.

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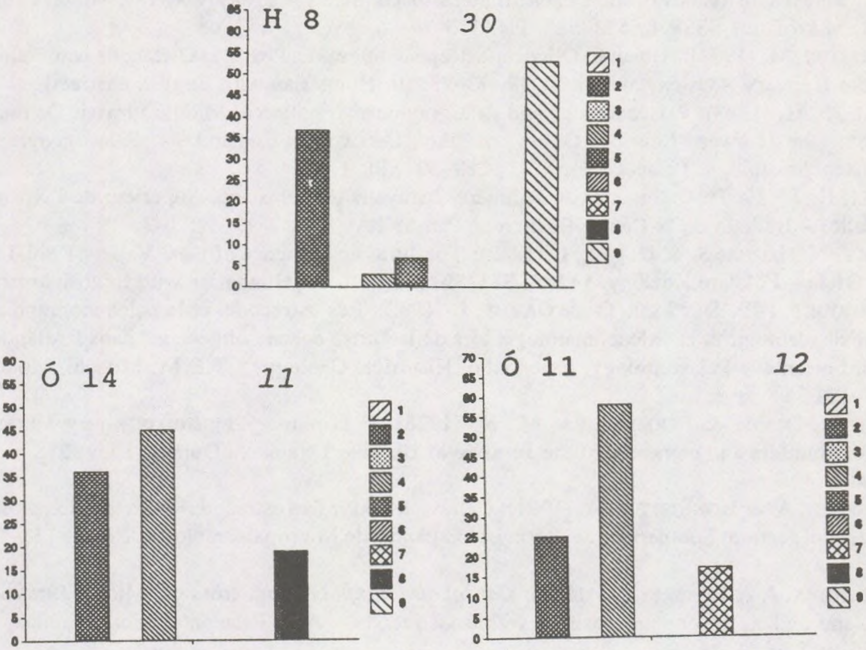

Fig. 13. Percentage of ostracod taxa in Upper Bathonian samples of Hidas (H) and Óbánya (Ó) Valleys. Legend: see on Fig. 6.

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Plate 1

Fig. 1. *Polycope* sp. Carapace Óbánya Valley, sample 6. Lower Bathonian. 108×

Figs 2-4. *Cytherella limpidaforma* n. sp.
2., 4. Carapaces from the left valve.
2. Óbánya Valley, sample 7. Lower Bathonian, 90×
4. Óbánya Valley, sample 9. Middle Bathonian. 80×
3. left valve. Óbánya Valley, sample 6. Lower Bathonian. 70×

Fig. 5. *Cytherella perennis* BŁASZYK, 1967. Carapace from the left valve. Hidas Valley, sample 12. Lower Bathonian. 75×

Figs 6-7. *Cytherella compacta* n. sp. Right valves. Óbánya Valley, samples 11, 10. Middle and Upper Bathonian. 65×, 60×

Fig. 8. *Cytherella* cf. *irgisensis* LIUBIMOVA 1955. Right valve. Óbánya Valley, sample 6. Lower Bathonian. 70×

Plate 2

Fig. 1. *Cytherella* cf. *irgisensis* LIUBIMOVA 1955. Right valve. Óbánya Valley, sample 6. Lower Bathonian. 50×

Figs 2–3. *Cardobairdia mecsekensis* n. sp. Left valves. Hidas Valley, samples 16, 11. Lower and Middle Bathonian. 100×

Fig. 4. *Cardobairdia inflata spinosa* n. ssp. Carapace from right valve. Óbánya Valley, sample 8. Lower Bathonian. 90×

Figs 5–7. *Bairdia caudifera* n. sp.
5–6. Carapaces from the right valve.
5. Hidas Valley, sample 16. Lower Bathonian. 50×
6. Óbánya Valley, sample 6. Lower Bathonian. 50×
7. Carapace from dorsal side. Óbánya Valley, sample 9. Middle Bathonian. 55×

Fig. 8. *Bairdia hilda* JONES, 1884 ("*hilda* form"). Carapace from right valve. Óbánya Valley, sample 6. Lower Bathonian. 60×

Plate 3

Figs 1–2. *Bairdia hilda* JONES, 1884. Carapaces from the right valve.
1. "*hilda*" form. Óbánya Valley, sample 7. Lower Bathonian. N = 50×
2. "*fullonica*" form. Óbánya Valley, sample 11. Upper Bathonian. N = 70×

Figs 3–4. *Progonocythere*? sp. Óbánya Valley, sample 6. Lower Bathonian.
3. Carapace from right valve. 90×
4. Carapace from left valve. 95×

Fig. 5. *Glyptocythere* ? sp. Carapace from right valve. Hidas Valley, sample 8. Upper Bathonian. N = 85×

Fig. 6. *Nemoceratina* ? sp. Carapace from left valve. Óbánya Valley, sample 9. Middle Bathonian. N = 85×

Fig. 7. *Macrocypris* ? sp. Carapace from right valve. Óbánya Valley, sample 6. Lower Bathonian. N = 100×

Fig. 8. *Pontocyprella izjumicaformis* n. sp. Carapace from right valve. Óbánya Valley, sample 9. Middle Bathonian. N = 60×

Plate 4

Fig. 1. *Pontocyprella cavataformis* n. sp. Carapace from right valve. Hidas Valley, sample 11. Middle Bathonian. 90×

Fig. 2. *Pontocyprella*? sp. Carapace from right valve. Hidas Valley, sample 10. Middle Bathonian. 105×

Fig. 3. *Paracypris obanyensis* n. sp. Carapace from right valve. Óbánya Valley, sample 9. Middle Bathonian. N = 65×

Fig. 4. *Paracypris lata* n. sp. Carapace from left valve. Hidas Valley, sample 11. Upper Bathonian. 95×

Figs 5–8. *Anisobairdia* ? *magna* n. sp.
5. Left valve. Hidas Valley, sample 10. Middle Bathonian. 35×
6–8. Carapaces from right valve.
6–7. Óbánya Valley, samples 6, 7. Lower Bathonian. 45×, 105×
8. Hidas Valley, sample 11. Middle Bathonian. 60×

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GALÁCZ, A. (ed.): Bathonian Fossils from the Mecsek Mountains (Hungary)

First find of Jurassic Bryozoa in Hungary

Kamil ZÁGORŠEK[1]

(2 plates on pp. 235–236)

Abstract

In the Bathonian (Middle Jurassic) of the Mecsek Mts (Hungary) a zoarium of a small bryozoan encrusting a bivalve shell has been found. It is described here in detail. Due to the small size of the zoarium with few morphological features, a precise determination is impossible and the bryozoan is referred informally to *"Berenicea"* sp.

Key words: Bryozoa, Cyclostomata, systematics, Jurassic, Mecsek Mts, Hungary.

Introduction

The Bryozoa suffered their largest crisis during the Late Permian and Triassic. Most of the ancient types (orders Trepostomata, Cryptostomata, Fenestrata and Cystoporata) became extinct. The Jurassic was a period of origination of the Cheilostomata and a time of cyclostome radiation (TAYLOR & LARWOOD 1990). Bryozoans occur quite rarely in Jurassic rocks, with some exceptions (e.g. Bathonian of Normandy, France) and new finds are important.

About 3 years ago, while collecting fossils in the Jurassic sequences of the Mecsek Mts, Mr. Zoltán ORBÁN (Bonyhád) found a well-preserved bivalve specimen. Later he donated it to Dr. SZENTE, who found on it a small encrusting bryozoan zoarium.

According to SZENTE (1994), the bivalve belongs to *Eopecten spondyloides* (ROEMER, 1836), and is Bathonian in age. The locality is situated northeast of the town Komló, in the westernmost left tributary of the Hidasi Valley. It is an outcrop of the Óbánya Limestone Formation.

This find is the first true bryozoan from the Hungarian Jurassic. SZABÓ (1992) described recently trace fossils in gastropod shells from the Bakony Mts, which he thought were bryozoans. According to P. D. TAYLOR (personal communication, 1994) these traces were probably not formed by bryozoans. He suggested two possibilities: the

[1]Department of Geology and Palaeontology, Comenius University, Mlynská dolina, SK-842 15 Bratislava, Slovakia

borings are pseudoborings similar ichnogenus *Rodocanalis* (hydroid?), or are borings belongs to the ichnogenus *Talpina* (phoronid).

Systematic part

Phylum Bryozoa EHRENBERG, 1831
Class Stenolaemata BORG, 1926
Order Cyclostomata BUSK, 1852
Suborder Tubuloporina MILNE-EDWARDS, 1838
Family incertae sedis
Genus *Berenicea* LAMOUROUX, 1821

"Berenicea" sp.
Pl. 1, Figs 1–4, Pl. 2, Figs 1–2

Material: One specimen encrusting a shell of *Eopecten spondyloides* (ROEMER, 1836) from Hidasi valley locality. Obánya Limestone Formation.

Description: Zoarium small, encrusting, multiserial, unilamellar, fan-shaped to oval. Thickness small, generally one zooecium, only visible ath the colony growing margin, sometimes two zooecia. Ancestrula not preserved. Autozooecia tube-like, very short. Budding from margin of zoarium predominantly towards the lateral margin of the encrusted bivalve shell. Frontal walls short, pseudoporous, strongly convex, merging into a low peristome. The pseudopores are small, rare. Younger, more marginal zooecia have frontal wall as long as wide, and the apertures square to rectangular in shape. Older zooecia in the centre of colony (upper ones) have frontal walls not more than two times longer than wide, and the apertures generally circular, occasionally oval.

In the middle part of zoarium there is the structure, which might be a gonozooecium. It is very badly preserved, small, and irregularly circular to oval in shape. It is not clear, if the structure covers one zooecium or if it is larger. The possible ooeciopore is located terminally, and is a little smaller than the apertures in autozooecia. The possible ooeciostome is little longer than peristomes of the autozooecia.

Dimensions (in micrometers):

diameter of all zoarium: 3214×1627
width of marginal zooecia: 285–310
diameter of aperture of marginal zooecia: 216–264
length of central zooecia: 216–504
wide of central zooecia: 192–216
diameter of aperture of central zooecia: 108–144
diameter of ovicell: 696–576
diameter of oeciopore: 68–96

Remarks: The studied specimen is not very well preserved and covers only very small part of the bivalve shell. The fan-shaped zoarium, which has not attained the discoidal form typical of larger colonies of *"Berenicea"*, the predominant direction of autozooecia, and the less well developed morphological features indicate a young specimen.

The structure, which might be a gonozooecium is very poorly visible. Its frontal wall is very similar to those of the autozooecia, only little more swollen. The peristome (ooeciostome) is only slightly longer in this "?gonozooecium" than in autozooecium. Therefore, it is doubtful that the structure is a true gonozooecium. As gonozooecia are necessary for generic identification of bryozoans of this type, the Hungarian speciemn can only be referred to the form-genus *"Berenicea"* (TAYLOR & SEQUEIROS 1982).

However, if we suppose, that the described structure could be a gonozooecium, the specimens might belong to the genus *"Mesonopora"*. Among the species of *Mesonopora, M. "concatenata"* (REUSS, 1867) would be the most probable determination.

Occurrence: the *"Berenicea"* is the most common type of encrusting zoarium during the Jurassic. *Mesonopora "concatenata"* (REUSS, 1867) occurs in the Kraków basin (Poland) in Upper Bathonian to Callovian deposits, and in southern England and Normandy (France) in the Bathonian.

Acknowledgements

I would like to express my sincere thanks to Dr. István SZENTE (Department of Palaeontology, Eötvös University, Budapest), who gave me the described specimen, and helped me to prepare the final version of this paper. My thanks go also to Dr. M. KÁZMÉR, and Dr. Paul D. TAYLOR (Natural History Museum - London), who helped me in the preparing of this paper, and to L. OSVALD an J. KRIŠTÍN who made the S.E.M. photos. The publication of this paper has been supported by OTKA grant No. 2294.

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Explanations to plates

Plate 1

Fig. 1. *"Berenicea"* sp. general view of the zoarium, 25x, SEM Jeol
Fig. 2. *"Berenicea"* sp. short autozooecia with circular aperture, 75x, SEM Jeol
Fig. 3. *"Berenicea"* sp. marginal zooecium with long frontal wall, 100x, SEM Jeol
Fig. 4. *"Berenicea"* sp. general view of colony shown position of gonozooecium (arrow), 40x, SEM Jeol

Plate 2

Fig. 1. *"Berenicea"* sp. gonozooecium with long oeciostome and small oeciopore, 80x, SEM Jeol
Fig. 2. *"Berenicea"* sp. frontal wall of gonozooecium with small pores, 200x, SEM Jeol

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Bathonian brachiopods of the Mecsek Mts (Hungary)

Attila VÖRÖS[1]

(11 figures and 2 plates on pp. 237–238)

Abstract

New collections from the red nodular Bathonian limestones of the Mecsek Mts have resulted in more than 400 brachiopod specimens. Systematic description of eight species is given; from among them *Dichotomosella galaczi* sp. n. and *Karadagithyris eduardi* sp. n. are new. A short revision of the museum's material kept in the Hungarian Geological Survey is added.

Key words: brachiopods, systematic descriptions, Bathonian, Mecsek Mts

Introduction

In the Mecsek Mts the Bathonian stage is represented by an around ten metres thick reddish, clayey nodular limestone sequence (Óbánya Limestone Formation). This facies, a variety of an "Ammonitico Rosso marl" is not favourable for the benthos which is, in fact, very subordinate in relation to the abundant ammonoids. Within the benthonic assemblage, however, brachiopods are predominant over the bivalves and sponges.

BÖCKH (1881) was the first to mention and describe brachiopods from the Bathonian beds; two species were figured also in his monograph devoted to the ammonoid fauna. After a long silence, VADÁSZ (1935) enlarged a little the knowledge of the Bathonian brachiopods of the Mecsek, repeating some of BÖCKH's determinations and listing a few other species. His faunal lists were not accompanied by detailed descriptions, but the original material was kept in the collection of the Hungarian Geological Survey (HGS) and was revised by the present author.

In the last decades the knowledge of the Bathonian faunas of the Mecsek was mainly contributed by the "explanatory notes" to the geological maps of the area published by the HGS. Unfortunately, no improvements can be found in them in relation to the brachiopods; they repeated the faunal lists of VADÁSZ (1935). (The only exception is a short list of brachiopod determinations by L. KOVÁCS (1953), including some strange species names. This material was not found in the collections of the HGS.)

[1]Department of Geology and Paleontology, Hungarian Natural History Museum, H–1088 Budapest, Múzeum körút 14–16, Hungary

The last contribution was given by TÖRÖK et al. (1987) who figured two specimens under the name *Cererithyris* sp., aff. *intermedia* (SOWERBY, 1812). In fact, this determination was made by the present author and it was a definitely wrong judgement, based on the apparent external similarity, but without the knowledge of the internal morphology. In the light of the new information presented herein, these specimens belong to the species *Karadagella zorae* TCHORZHEVSKY & RADULOVIĆ, 1984.

In 1990 a new project has started in order to gather accurate stratigraphical information from the Bathonian sections of the Mecsek Mts. The project has been supported by the National Scientific Research Fund and led by Dr. András GALÁCZ. During several summer campaigns, a great amount of fossils has been collected; the copious new material made a modern study of brachiopods possible. The detailed systematical description of the collected brachiopod fauna takes the main part of the present paper, but first a short taxonomical and nomenclatorial revision of the old material found in the collections of the Hungarian Geological Survey is given.

Revision of the Bathonian brachiopods of the Mecsek Mts kept in the collections of the HGS

The material was collected mainly by K. HOFMANN, J. BÖCKH (in the 1870s) and E. VADÁSZ (in the 1930s) from various localities of the Mecsek Mts, and amounts to a few dozens of specimens. Partly different species determinations were given by BÖCKH (1881) and VADÁSZ (1935). The two revised faunal lists will be given separately below.

BÖCKH (1881)

Rhynchonella cf. *spathica* LAM. sp. = ? = *Stolmorhynchia* sp., aff. *stolidota* BUCKMAN
Rhynchonella penninica UHLIG = *Apringia* ? *penninica* (UHLIG)
Terebratula cf. *perovalis* SOW. = ? = *Karadagella zorae* TCHORZHHEVSKY & RADULOVIĆ (the original specimens were not found.)
Waldheimia (Zeilleria) digona SOW. sp. = Terebratulida indet.

VADÁSZ (1935)

Rhynchonella cf. *voultensis* OPP. = *Caucasella voultensis* (OPPEL)
Rhynchonella spathica LAM. ? = *Stolmorhynchia* sp., aff. *stolidota* BUCKMAN
Rhynchonella penninica = *Apringia* ? *penninica* (UHLIG)
Acanthothyris sp. = *Capillirhynchia* cf. *brentoniaca* (OPPEL)
Terebratula dorsoplicata SUESS = *Karadagella zorae* TCHORZHEVSKY & RADULOVIĆ
Terebratula cf. *excavata* DESL. = *Linguithyris* cf. *nepos* (CANAVARI)
Zeilleria digona SOW. = Terebratulida indet.

In summary, the revised list of the old material is the following:

Caucasella voultensis (OPPEL)

? *Stolmorhynchia* sp., aff. *stolidota* BUCKMAN
Apringia ? *penninica* (UHLIG)
Capillirhynchia cf. *brentoniaca* (OPPEL)
Linguithyris cf. *nepos* (CANAVARI)
Karadagella zorae TCHORSZHEVSKY & RADULOVIĆ

One of these, *Apringia* ? *penninica* did not appear in the new collections which, on the other hand, contained further three species, previously unknown from the Bathonian of the Mecsek.

Bathonian brachiopods of the Mecsek: the new collections

The brachiopods, together with other fossils have been collected mainly by A. GALÁCZ, I. SZENTE, L SÖVÉR, T. BERTALAN, a few university students and the present author. The collected material amounts to 415 specimens with a strong predominance of *Karadagella zorae* (357 specimens). The most important localities are shown in Fig. 1. The distribution of the brachiopods according to localities is given below.

Locality	specimens
Hidas valley	324
Sövér ravine	42
Óbányai valley	7
Márévár valley (including Somosi Creek)	13
Síngödör	4
Csengő Hill	1
Ófalu	2
Zengővárkony	1
Mecsek (locality not specified)	21
Total	415

The fauna consists of the following species:

Caucasella voultensis (OPPEL, 1865)
Stolmorhynchia sp., aff. *stolidota* BUCKMAN, 1918
Dichotomosella galaczi sp. n.
Capillirhynchia brentoniaca (OPPEL, 1863)
Linguithyris nepos (CANAVARI, 1882)
Karadagella zorae TCHORSZHEVSKY & RADULOVIĆ, 1984
Karadagithyris eduardi sp. n.
Zittelina ? *beneckei* (PARONA, 1880)

The stratigraphical distribution of the brachiopods in the systematically collected sections is not really conclusive. They seem to reach the greatest density and diversity in the Upper Bathonian. Most species run through the Bathonian, some of them

(*Capillirhynchia brentoniaca*, *Zittelina* ? *beneckei*) seem to be restricted to the Upper Bathonian but this may be due to imperfect record as well.

The fauna shows a surprisingly strong Mediterranean affinity; only two species occurred in the NW-European province. The close similarity to the fauna of the Pieniny Klippen Belt of the Carpathians is very remarkable; almost all species (or their closely related forms) were found also there.

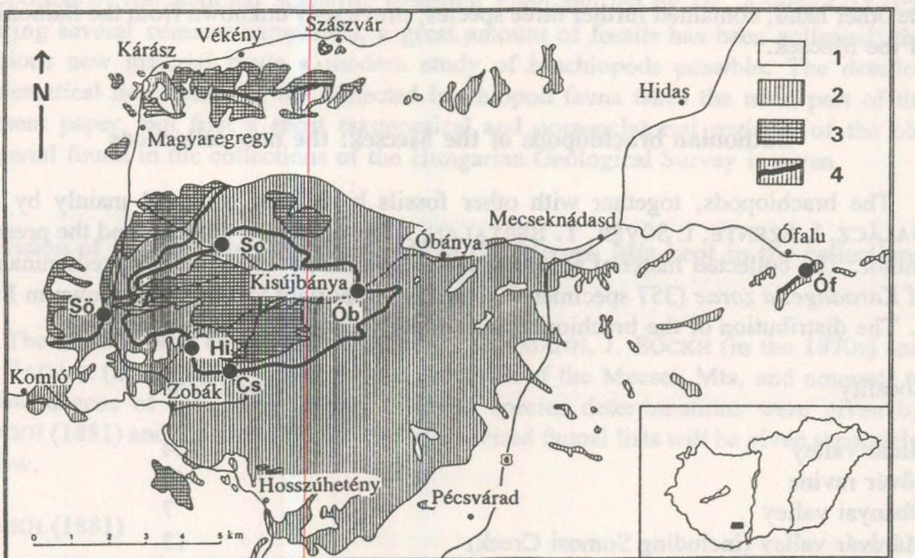


Fig. 1. Simplified geological map of the eastern Mecsek showing the most important Bathonian localities. **1.** Cretaceous and Tertiary. 2. Lower and Middle Jurassic. **4.** Upper Jurassic. **4.** Bathonian, red, calcareous marl. **So.** Somosi Creek. **Ób.** Óbánya valley. **Sö.** Sövér ravine. **Hi.** Hidas valley. **Cs.** Csengő Hill. **Óf.** Ófalu.

In the following descriptions the systematics of the "Treatise" (MOORE, 1965) is used except the subsequently created genera *Karadagella* and *Karadagithyris*, where the higher systematics of TCHORSZHEVSKY & RADULOVIĆ (1984) is applied.

The material is deposited in the Department of Geology and Palaeontology of the Hungarian Natural History Museum (HNHM) (Budapest). The figured specimens are under the inventory numbers M. 94.88. to M. 94.115.

Systematic descriptions

Order Rhynchonellida KUHN, 1949
Superfamily Rhynchonellacea GRAY, 1848
Family Dimerellidae BUCKMAN, 1918
Genus *Caucasella* MOISSEEV, 1934

Caucasella voultensis (OPPEL, 1865)
(Plate I: 1a–d, 2a–d, Fig. 2)

1859 *Rhynchonella trigona* (QUENST.) – DESLONGCHAMPS, La Voulte, p. 202, pl. 2, figs. 8, 8a.
1865 *Rhynchonella Voultensis* OPP. – OPPEL, Ardèche, p. 317 (footnote).
1886 *Rhynchonella Voultensis* OPPEL – ROTHPLETZ, Vilser Alpen, p. 153, pl. 11, figs 18, 25.
1916 *Rhynchonella voultensis* OPP. – JEKELIUS, Brassói hegyek, p. 245, pl. 4, figs. 1, 1a.
1925 *Rhynchonella voultensis* OPP. – JEKELIUS, Berge von Brassó, p. 50, pl. 1, figs. 1, 1a
v 1935 *Rhynchonella* cf. *voultensis* OPP. – VADÁSZ, Mecsekhegység, p. 59.

Material: 4, partly incomplete specimens.

Dimensions (mm):	L	W	T
M. 94.88.	9.8	10.8	6.8
M. 94.89.	13.6	12.5	8.4
M. 94.90.	11.0	12.5	7.1

Description:

External characters: Medium-sized *Caucasella* with subtrigonal outline. The lateral margins are divergent with an apical angle slightly below 90° and passes to the straight anterior margin through subrounded anterolateral extremities. The valves are equally convex, the maximum convexity lies in the posterior one-third. The beak is erect. The pedicle opening is rather large; the delthyrium cannot be seen. The beak ridges are poorly developed and short, reaching the half of the lateral margins. The planareas are shallow and poorly demarcated. The lateral commissures are nearly straight. The anterior commissure is rectimarginate, and shows sharp and uniform zig-zag deflections; their amplitude equals to their "wave-length". The surface of the shell is ornamented with radial ribs. Posteriorly they are ill-defined and low but become sharp and strong close to the anterior margin; their number varies between 8 and 11.

Internal characters (Fig. 2): *Pedicle valve*: The delthyrial cavity is subquadrate to semicircular in cross-section; the umbonal cavities are poorly preserved. The dental plates are slightly convergent ventrally. Pedicle collar has not been observed. The hinge teeth are rather massive with crenulated posterior end. *Brachial valve*: Cardinal process is not seen. The dorsally divergent crural plates are thin and short; they support septifer crura. The outer hinge plates are subhorizontal and connected to the ventral end of the crura.

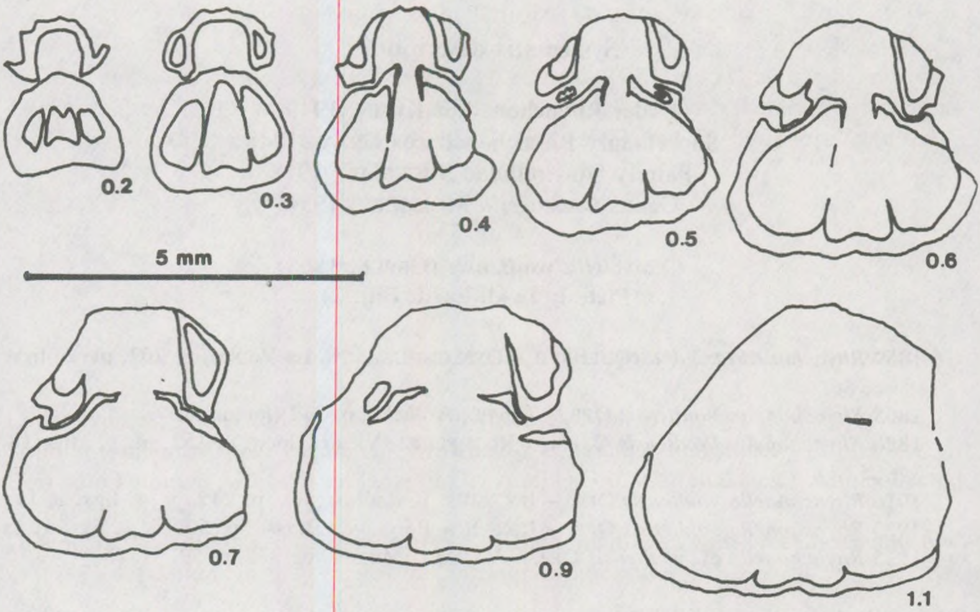


Fig. 2. *Caucasella voultensis* (OPPEL). A series of eight transverse sections through the posterior part of a specimen from Sövér ravine, Bed K-1, Upper Bathonian. HNHM, M. 94.90. Original length of the specimen 11.0 mm. The distal parts of the crura were missing. Distances from the posterior end of the shell in mm.

Remarks: OPPEL (1965) erected the species *voultensis* on a figure by DESLONGCHAMPS (1859, fig. 8) representing a variety of "*Rhynchonella trigona*" QUENSTEDT, 1851. ROTHPLETZ (1886) gave the first revision and discussion of these forms and stated that "*R.*" *trigona* has more numerous (10–14) ribs and wider triangular outline, whereas "*R.*" *voultensis* is a narrower form with less than 10 ribs. A further difference can be stressed here, namely that *C. trigona* has a well-developed planarea in contrast to *C. voultensis* where it is ill-demarcated. According to these principles, the specimens from the Mecsek belong to *C. voultensis*, though one of them (Plate I: 2a–d) has 11 ribs.

Distribution: Bathonian and Callovian of Southern France and the Southern Carpathians. The Mecsek specimens came from Zengővárkony, Márévár valley (Bathonian) and the Sövér ravine (Upper Bathonian).

Family Wellerellidae LIKHAREV, 1958
Subfamily Lacunosellinae SMIRNOVA, 1963
Genus *Stolmorhynchia* BUCKMAN, 1918

Stolmorhynchia sp., aff. *stolidota* BUCKMAN, 1918
(Plate I: 3a–d)

v ? 1881 *Rhynchonella* cf. *spathica* LAM. - BÖCKH, Mecsekhegység, p. 95, pl. 9, fig. 11.

Material: 3, one well-preserved and two incomplete specimens.

Dimensions (mm):	L	W	T
M. 94.91.	10.5	9.8	6.4

Description:

External characters: Medium-sized rhynchonellids with subpentagonal outline. The lateral margins are slightly concave; the anterior margin is subrounded. The valves are nearly equally convex; the maximum convexity lies at about the half of the length. The beak is suberect to erect. The pedicle opening and delthyrium cannot be seen. The beak ridges are blunt and short; planarea not developed. The lateral commissures are gently arched dorsally; the first zig-zag deflections appear at the lateral extremities. The anterior commissure is uniplicate and has sharp deflections which show growing amplitude toward the centre. Two or three deflections lie in the plica. The surface of the shell is covered with rather coarse radial ribs and regular growth lines. The number of the ribs varies between 8 and 10.

Internal characters: These were not studied in detail due to the lack of suitable material. Through the thin and transparent shell, two strong dental plates can be seen in the pedicle valve but no median septum is visible in the brachial valve.

Remarks: Due to the paucity of material (two fragmentary and an immature specimen) and inadequate knowledge of the internal features, the open nomenclature is applied in the determination of this species. The general habit and the apparent lack of the median septum supports the attribution of this species to the Lacunosellinae and to *Stolmorhynchia* which is the main representative of the subfamily in the Middle Jurassic. The Mecsek specimens show affinity to several species of *Stolmorhynchia*, e.g. *S. prava* (ROTHPLETZ, 1886), *S. stolidota* BUCKMAN, 1918 and some other nominal species described from the Caucasus by KAMYSHAN & BABANOVA (1973). From among them, *S. stolidota* is the best documented originally (BUCKMAN 1918, pl. 13, fig. 12) and recently (PROSSER 1993, pl 1, fig. 6), therefore this name is used to express the relationship of the specimens studied. The somewhat larger specimen described by BÖCKH (1881) from the Bathonian of the Mecsek may also belong to this species.

Distribution: The Mecsek specimens came from the Hidas valley (Lower Bathonian) and the Sövér ravine (Middle Bathonian).

Genus *Dichotomosella* TCHOUMATCHENCO, 1987

This genus was introduced by TCHOUMATCHENCO (1987, p. 51) as a subgenus of *Lacunosella* WISNIEWSKA, 1932 on the basis of antidichotomous pattern of ribbing as a diagnostic difference. Recently SHI & GRANT (1993) put *Dichotomosella* to the rank of genus.

Dichotomosella galaczi sp. n.
(Plate I: 4a–c, Fig. 3)

Holotype: Hungarian Natural History Museum (Budapest), inventory number: M. 94.92.
Locus typicus: Hidas valley, Bed No. 19. (Mecsek Mts, Hungary)
Stratum typicum: Upper Bathonian, brownish-red, nodular limestone.
Derivatio nominis: After the surname of Dr. András GALÁCZ (Budapest), who collected the holotype.
Diagnosis: Medium-sized *Dichotomosella* of Bathonian age, with erect beak and few (1–2) deflections in the plica of the anterior commissure.

Material: 2 specimens, partly worn.

Dimensions (mm):	L	W	T
Holotype (M. 94.92.)	16.8	18.4	11.0
Sectioned paratype (M. 94.93.)	13.3	11.5	7.7

Description:

External characters: This is a medium-sized *Dichotomosella* with rounded subpentagonal outline. The lateral margins are straight and divergent with an apical angle slightly above 90°. The anterior margin is subrounded. The valves are nearly equally convex; the maximum convexity lies at about the half-length. The beak is erect to slightly incurved. The pedicle opening and delthyrium cannot be seen. The beak ridges are blunt or not developed. The lateral commissures are straight; the first weak deflections appear at the lateral extremities. The anterior commissure is highly uniplicate and has a few, low deflections in its lateral flanks. The central uniplication has a sharp, inverted V-shape; it shows one asymmetric deflection at its top (holotype), otherwise it is smooth. The surface of the shell is covered with 8–12 rather strong ribs except the anterior part of the fold and sulcus, where the ribs disappear or become fused (five ribs into one or two in the holotype).

Internal characters (Fig. 3): *Pedicle valve*: The delthyrial cavity is subquadrate to subtrigonal; the umbonal cavities are rounded triangular in cross-section. A very weak pedicle collar is present. The dental plates are slightly convergent ventrally. The hinge teeth are massive, wide and smooth; denticula are present. *Brachial valve*: Cardinal process is not well-marked. Median septum is not developed, only a rudimentary trace can be seen in the umbo. Septalium is missing; the hinge plates are fused posteriorly.

The outer hinge plates are subhorizontal and raise from the upper end of the inner socket ridges. The outer socket ridges are strong. The crural bases emerge dorsally and give rise to crura of falcifer type which curve toward the ventral valve.

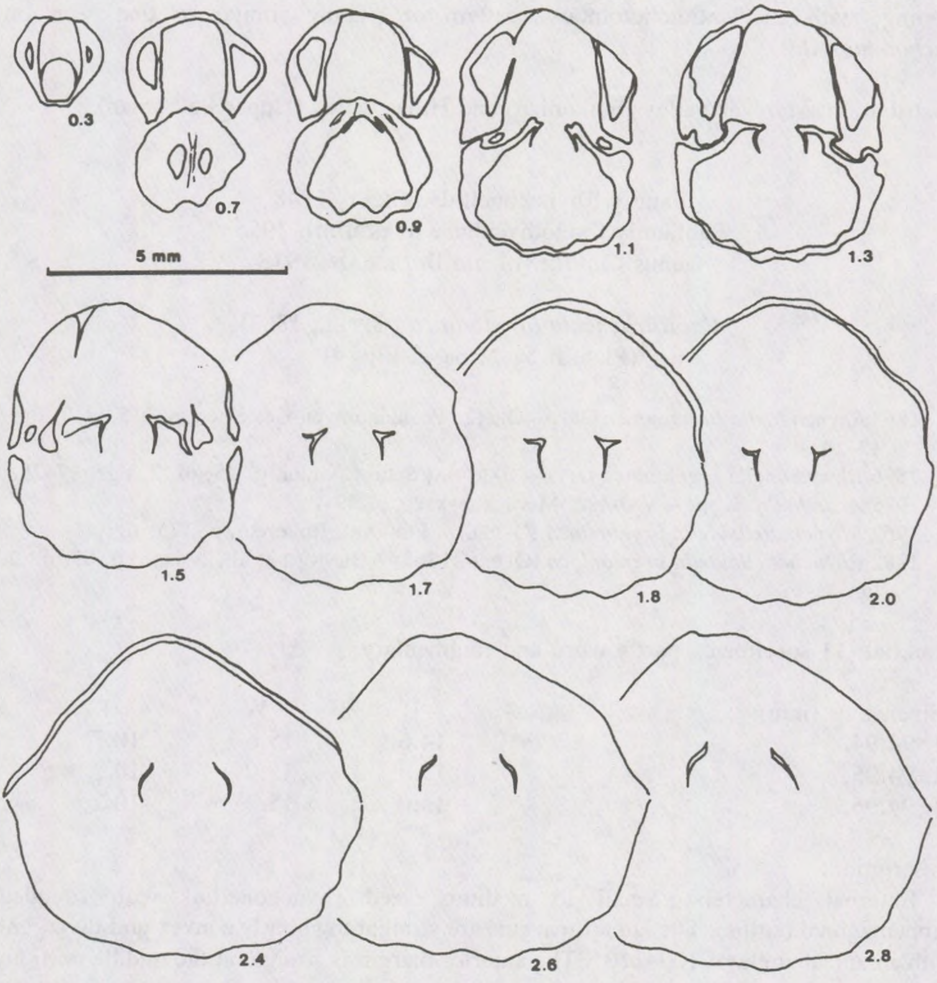


Fig. 3. *Dichotomosella galaczi* sp. n. A series of twelve transverse sections through the posterior part of the sectioned paratype from Márévári valley, Bathonian. HNHM, M. 94.93. Original length of the specimen 13.3 mm. The crura persisted to 3.0 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

Remarks: The more incurved (erect) beak, the fewer anterior ribs and the less expanded falcifer crura make *D. galaczi* different from *D. bourheddouensis* TCHOUMATCHENCO, 1987, the type species of *Dichotomosella*. Both the external and the internal features of *D. galaczi* suggest close relationship to *Lacunosella* and more precisely to *Dichotomosella*. Nevertheless, a strong morphological affinity to *Apringia* is seen as well, especially in the development of the anterior commissure. The well-known Middle Jurassic representatives of *Apringia*, e.g. *A. atla* (OPPEL), *A. alontina* (DI STEFANO), *A. penninica* (UHLIG), are entirely smooth even posteriorly but some of the Early Jurassic species, e.g. *A. stoppanii* (PARONA), *A. altesinuata* (BÖSE) show weak posterior ribbing, with an "antidichotomous" pattern of ribbing similar to that seen on *Dichotomosella*.

Distribution: Márévár valley (Bathonian) and Hidas valley (Upper Bathonian).

Family Rhynchonellidae GRAY, 1848
Subfamily Cyclothyridinae MAKRIDIN, 1955
Genus *Capillirhynchia* BUCKMAN, 1918

Capillirhynchia brentoniaca (OPPEL, 1863)
(Plate I: 5a–e, 6a–c, Fig. 4)

v 1863 *Rhynchonella Brentoniaca* OPP. – OPPEL, Posidonomyen-Gesteinen, p. 215, pl. 7, figs. 12–14.
1896 *Rhynchonella brentoniaca* OPP. – PARONA, Sette Comuni, p. 35, pl. 2, figs. 27–28.
v 1935 *Acanthothyris* sp. – VADÁSZ, Mecsekhegység, p. 59.
? 1962 *Rhynchonelloidella brentoniaca* (OPPEL) – FERRARI, Rovereto, p. 115, fig. 4.
1982 *Rhynchonelloidella brentoniaca* (OPPEL, 1863) – BENIGNI et al., Asiago, p. 63, pl. 2, fig. 4a–e.

Material: 11 specimens, partly worn and fragmentary.

Dimensions (mm):	L	W	T
M. 94.94.	14.6	15.6	10.7
M. 94.95.	13.5	15.0	10.2
M. 94.96.	14.0	15.2	10.2

Description:

External characters: Small to medium sized rhynchonellids with rounded subpentagonal outline. The lateral margins are straight to slightly convex and divergent with an apical angle of 100–110°. The anterior margin is straight at the middle portion. The valves are nearly equally convex; the maximum convexity lies at about the half-length. The beak is suberect. The pedicle opening is very small; the delthyrium can not be seen. The beak ridges are blunt; planarea is not developed. The lateral commissures are nearly straight; a few weak deflections can be seen at the lateral extremities. The anterior commissure is widely uniplicate. The middle portion of the uniplication is straight and shows 8–10 weak deflections. The surface of the shell is covered with faint, radial capillae. The strength of the capillae increases anteriorly; their number remains more or less constant, ramification rarely occurs. Near the anterior margin of the adult specimens, the capillae become fused to (or substituted by) coarser riblets. The ratio between the number of capillae and riblets is 1 to 4 in average.

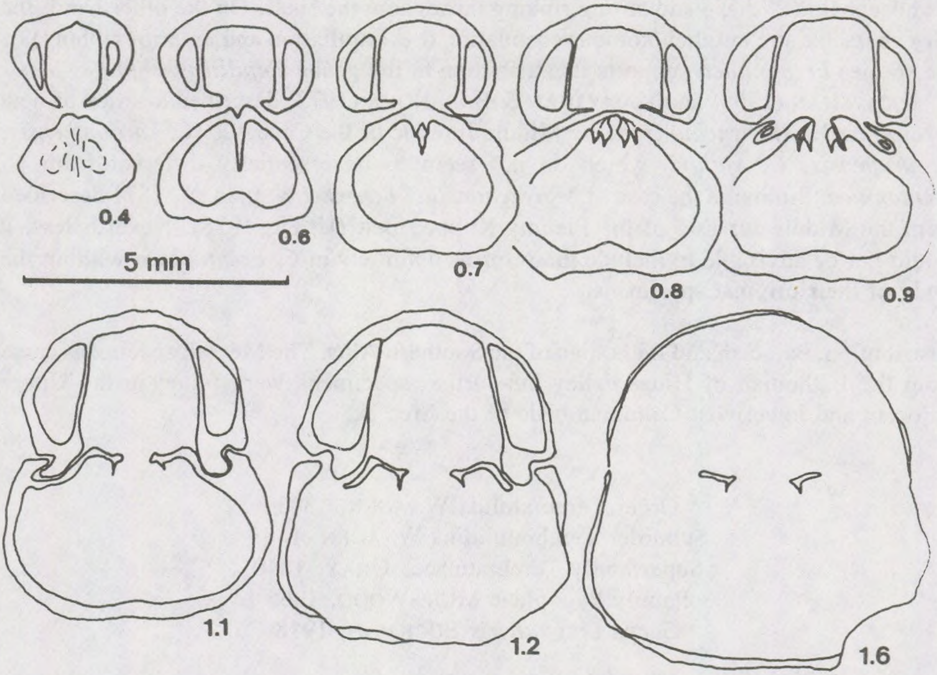


Fig. 4. *Capillirhynchia brentoniaca* (OPPEL). A series of eight transverse sections through the posterior part of a specimen from Hidas valley, Bed 17, Upper Bathonian. HNHM, M. 94.96. Original length of the specimen 14.0 mm. The crura persisted to 2.8 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

Internal characters (Fig. 4): *Pedicle valve*: The delthyrial cavity is subquadrate; the umbonal cavities are rounded subtrigonal in cross-section. The deltidial plates are thin. The dental plates are massive, subparallel, slightly convergent ventrally. The hinge teeth are massive, smooth, tapering laterally. Denticula are developed. *Brachial valve*: The cardinal process is dissected by a muscle trough. The median septum is rudimentary and appears only in the umbonal part. Septalium is not developed, instead the ventral part of the septum becomes bifurcate anteriorly and supports the crural bases. The outer hinge plates are subhorizontal and raise from the ventral end of the inner socket ridges. The outer socket ridges are well-developed. The crural bases emerge dorsally from the outer hinge plates and give rise to crura of prefalcifer type.

Remarks: This species was previously described and well illustrated by OPPEL (1863), PARONA (1896) and BENIGNI et al. (1982). All these descriptions and/or figures show clearly the most important external features, namely the capillation and the anterior ribbing, i.e. the antidichotomous costulation. Based on these, the Mecsek specimens can be attributed to *Capillirhynchia brentoniaca* with great certainty. FERRARI (1962) described this species with the illustration of serial sections which fit well with those presented herein. He, and subsequently BENIGNI et al. (1982) attributed this species to *Rhynchonelloidella* what can certainly not endorsed, since this genus has an almost "cynocephalous" shape and strong ribbing throughout the shell. On the other hand, the very characteristic antidichotomous costulation (i.e. capillation and anterior ribbing) of the species *brentoniaca* supports its attribution to the genus *Capillirhynchia*.

KAMYSHAN (1968) and KAMYSHAN & BABANOVA (1973) described a series of new species of *Capillirhynchia* from the Middle Jurassic of the Caucasus (*C. kardonikensis*, *C. urupensis*, *C. vjalovi*) which do not seem to be essentially different from *C. brentoniaca*. Similar is the case of "*Rhynchonella*" *beneckei* NEUMAYR, 1871 described from the Middle Jurassic of the Pieniny Klippen Belt (UHLIG 1878). Nevertheless, it would not be advisable to include these forms definitely in *C. brentoniaca* without the study of their original specimens.

Distribution: Bajocian and Bathonian of the Southern Alps. The Mecsek specimens came from the Bathonian of Hidas valley but further specimens were found in the Upper Bajocian and lowermost Callovian beds of the Mecsek.

Order Terebratulida WAAGEN, 1883
Suborder Terebratulidina WAAGEN, 1883
Superfamily Terebratulacea GRAY, 1840
Family Pygopidae MUIR-WOOD, 1965
Genus *Linguithyris* BUCKMAN, 1918

Linguithyris nepos (CANAVARI, 1882)
(Plate I: 7a–c, 8a–c, 9a–c, Fig. 5)

1882 *Terebratula nepos* n. f. – PARONA & CANAVARI, Brachiopodi oolitici, p. 342, pl. 10, figs 1–4.

1886 *Terebratula nepos* CANAVARI – ROTHPLETZ, Vilser Alpen, p. 116, pl. 5, figs. 20, 22, 24.

v 1935 *Terebratula* cf. *excavata* DESL. – VADÁSZ, Mecsekhegység, p. 60.

1937 *Pygope nepos* CANAV. – VINASSA DE REGNY, Fossili giuresi, p. 85, pl. 2, figs 29–33.

1962 *Glossothyris nepos* CANAVARI – JARRE, Révision du genre *Pygope*, p. 100, pl. J, fig. 2.

1962 *Linguithyris nepos* (CANAVARI) – FERRARI, Rovereto, p. 144, pl. 10, fig. 7.

1972 *Nucleata nepos* (CANAVARI, 1882) – FERRARI & MANARA, Monte Peller, p. 315, pl. 30, figs. 1–2.

1982 *Linguithyris nepos* (CANAVARI, 1882) – BENIGNI et al., Asiago, p. 66, pl. 2, figs. 13–14.

Material: 5 well preserved specimens.

Dimensions:	L	W	T
M. 94.97.	16.5	19.6	10.0
M. 94.98.	16.4	20.4	9.8
M. 94.99.	15.5	17.8	10.7
M. 94.100.	14.1	15.0	9.2

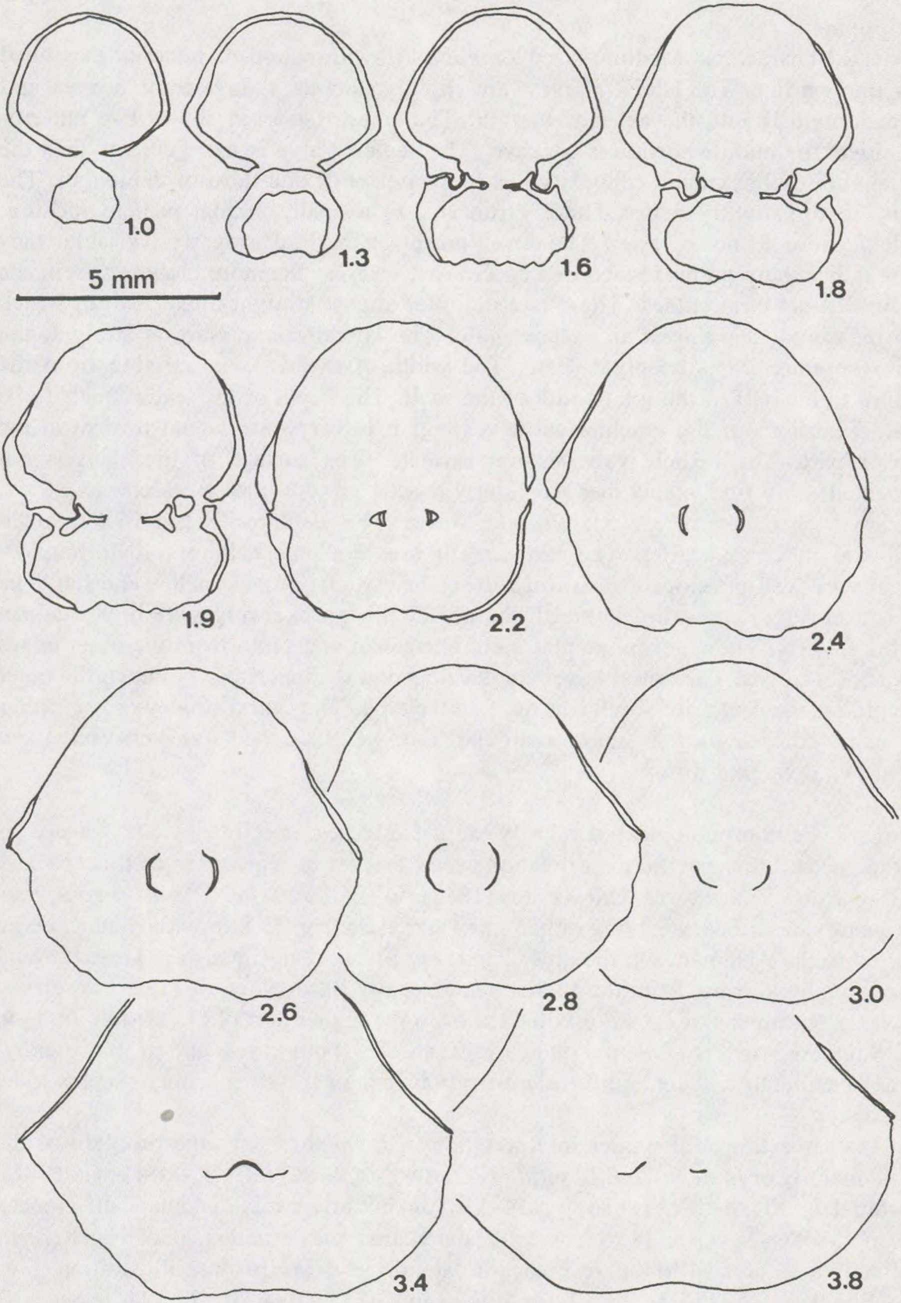


Fig. 5. *Linguithyris nepos* (CANAVARI). A series of twelve transverse sections through the posterior part of a specimen from Sövér ravine, A-beds, Upper Bathonian. HNHM, M. 94.100. Original length of the specimen 14.1 mm. The brachidium persisted to 3.9 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

Description:

External characters: Medium-sized *Linguithyris* with rounded, laterally expanded subtrigonal outline. The lateral margins are slightly sinuous, then become convex and arch continuously into the anterior margin. The anterior margin shows two anterior extremities; the middle portion is concave. The pedicle valve is more convex than the brachial one; the maximum convexity lies in the posterior one-third of the length. The beak is erect to slightly incurved and is truncated by a small, circular pedicle opening. The delthyrium cannot be seen. The development of the beak ridges is variable: they may be rather sharp on the less convex specimens, whereas the more globose specimens have no distinct beak ridges. There is a definite, almost straight hinge margin which meets the lateral margins at an obtuse angle. The lateral commissure is straight; the anterior commissure is deeply sulcate. The width of the sinus is variable from the one-third to the half of the total width of the shell. The depth of the sinus equals to its width. The sulcus of the brachial valve is long; it is very narrow but present at the posterior part. The pedicle valve is not carinate. The surface of the shell is not ornamented; only fine, sometimes irregularly spaced growth lines are seen.

Internal characters (Fig. 5): *Pedicle valve*: The delthyrial cavity is rounded subtrigonal in cross-section. The hinge teeth are moderately long, rather narrow. Denticula are well-developed. *Brachial valve*: The cardinal process is low and flat. The outer socket ridges are well-developed, sharp. The inner socket ridges are high and lean over the sockets. The outer hinge plates are horizontal and grow from the inner edges of the socket ridges. The crural bases are developed at the innermost points of the outer hinge plates; the crura are similar to the falcifer type. The crural processes are rather high, incurved. The loop is short, triangular, with gently arched transverse band and ends in two divergent tips.

Remarks: The morphological similarity of the Mecsek specimens to *L. nepos* is remarkable, still the specific identification needs a wider interpretation of this species. Namely, from PARONA & CANAVARI (1882) to FERRARI (1962), *L. nepos* was consequently described as having rather small size (less than 15 mm wide) and as being restricted to the Aalenian. On the other hand, the Mecsek specimens are large (around 20 mm wide) and came from the Bathonian. Recently BENIGNI et al. (1982) described a few large specimens of *L. nepos* collected from the higher part of the Middle Jurassic of the Southern Alps. By this, the range of this species (both in size and in stratigraphy) became considerably wider and the identification of the Mecsek specimens seems to be justified.

At the same time, this wider interpretation of *L. nepos* raises the problem of the specific identity of *L. nepos* and *L. bifida* (ROTHPLETZ, 1886) (cf. BENIGNI et al. 1982). Unfortunately, ROTHPLETZ (1886, p. 114–116) did not give really diagnostic differences between the two species. He laconically stated that they "unterscheiden sich recht auffallend" and referred to the difference in lateral view. The profuse illustration (l. c. pl. 5, figs 17–19, 21, 23, 25–27 for *bifida* and pl. 5, figs 20, 22, 24 for *nepos*) however does not at all supports his statements. All the figured specimens can be interpreted as representatives of a single, variable species, where the smaller individuals were called *nepos*. In spite of having this opinion, the present author was unwilling to list *L. bifida* in the synonymy of *L. nepos* for two reasons. One is that it would not be satisfactory without studying the original material; the other is that *L. bifida* is the type species of *Linguithyris* and its deletion (as the junior synonym of *nepos*) might lead to nomenclatorial confusion.

Distribution: Middle Jurassic (Aalenian and Bajocian) of the Southern Alps and the Northern Calcareous Alps. The Mecsek specimens came from the Bathonian of the Hidas valley and the Sövér ravine.

Superfamily Loboidothyridacea MAKRIDIN, 1964
Family Muirwoodellidae TCHORSZHEVSKY, 1974
Subfamily Karadagithyridinae TCHORSZHEVSKY, 1974
Genus *Karadagella* BABANOVA, 1965

Karadagella zorae TCHORSZHEVSKY & RADULOVIĆ, 1984
(Plate II: 1a–c, 2a–c, 3a–c, 4a–c, 5a–c, 6a–c, Fig. 6, 7)

v 1935 *Terebratula dorsoplicata* SUESS – VADÁSZ, Mecsekhegység, p. 58.
1984 *Karadagella zorae* n. sp. – TCHORSZHEVSKY & RADULOVIĆ, Carpathians and Carpatho-Balkanides, p. 151, pl. 3, figs. 9–12, fig. 14.
1987 *Cererithyris* sp. aff. *intermedia* (Sowerby, 1812) – TÖRÖK et al., Zobákpuszta, p. 192, pl. 2, figs 2, 3, 4.

Material: 357 specimens of variable state of preservation.

Dimensions:	L	W	T
M. 94.102.	23.4	19.1	12.0
M. 94.103.	25.4	20.0	12.9
M. 94.104.	28.0	24.3	14.2
M. 94.105.	29.0	22.2	14.6
M. 94.106.	31.4	24.5	15.5
M. 94.107.	30.2	25.8	14.5

The size-frequency distribution of 90 measured specimens is shown in Fig. 8.

Description:

External characters: Medium-sized to large terebratulids with variable outline from elongate oval to rounded subtrigonal. The lateral margins are gently convex and pass gradually into the rounded trapezoidal anterior margin. The pedicle valve is strongly and uniformly convex, whereas the brachial valve is almost flat, except the umbonal part. The beak is erect to slightly incurved and is truncated by a rather large, mostly subcircular pedicle opening. The delthyrium is concealed by the beak. The beak ridges are blunt or missing. The lateral commissure is arched ventrally with a point of inflection at the lateral extremities. The anterior commissure is widely uniplicate; the low trapezoidal uniplication is straight in the middle portion. The surface of the shell is not ornamented; only irregularly spaced growth lines and rugae can be seen.

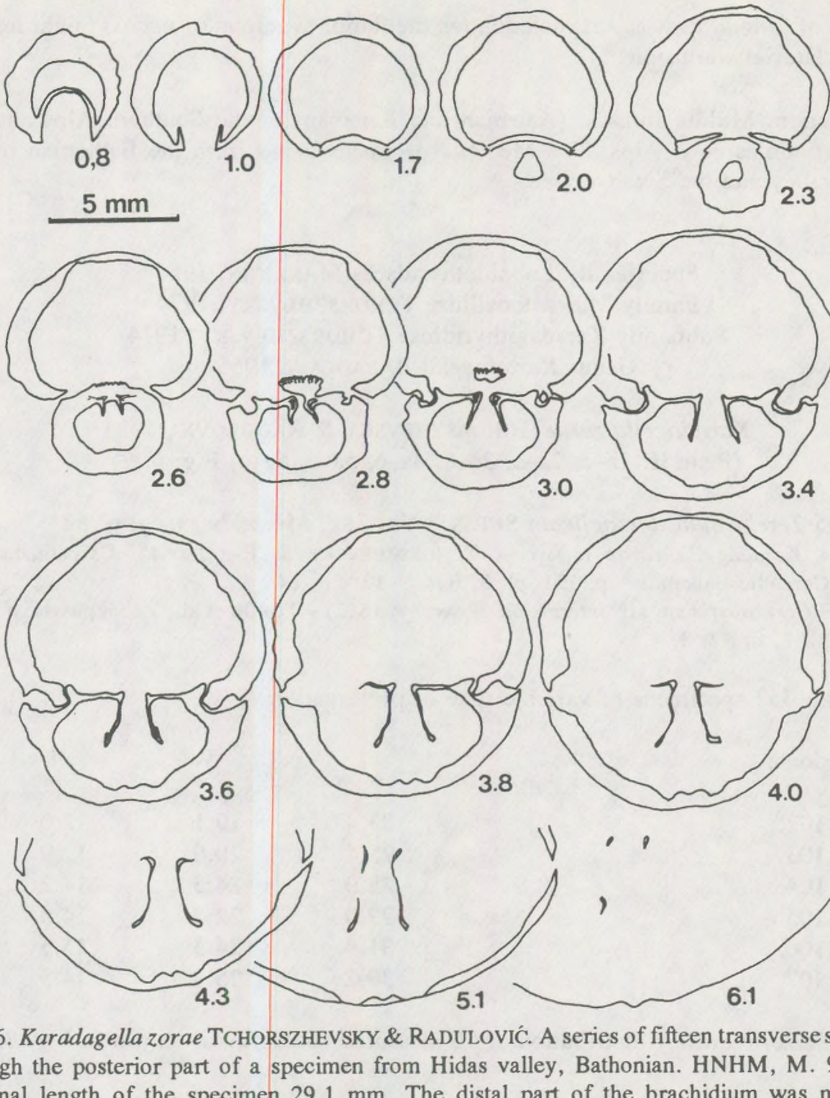


Fig. 6. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. A series of fifteen transverse sections through the posterior part of a specimen from Hidas valley, Bathonian. HNHM, M. 94.108. Original length of the specimen 29.1 mm. The distal part of the brachidium was missing. Distances from the posterior end of the shell in mm.

Internal characters (Figs 6, 7): *Pedicle valve*: The pedicle collar is well-developed. The deltidial plates form a symphytium posteriorly. The delthyrial cavity is subcircular in cross-section. The hinge teeth are massive, stout; denticula are developed. *Brachial valve*: The cardinal process is well-developed, crenulated, and projects in the delthyrial cavity. The outer socket ridges are strong. The inner socket ridges are high and lean a little over the sockets. The outer hinge plates are wide, horizontal and grow from the inner edges of the socket ridges. The crural bases emerge dorsally from the posterior part of the hinge plates; at the plane of articulation there is a tube-like hollow in the

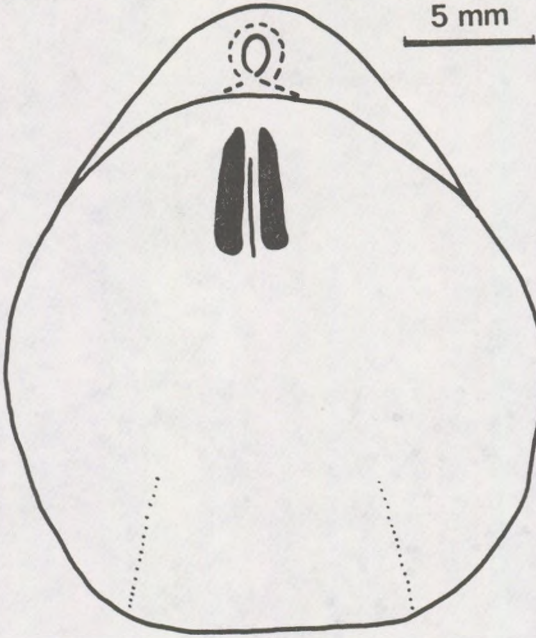
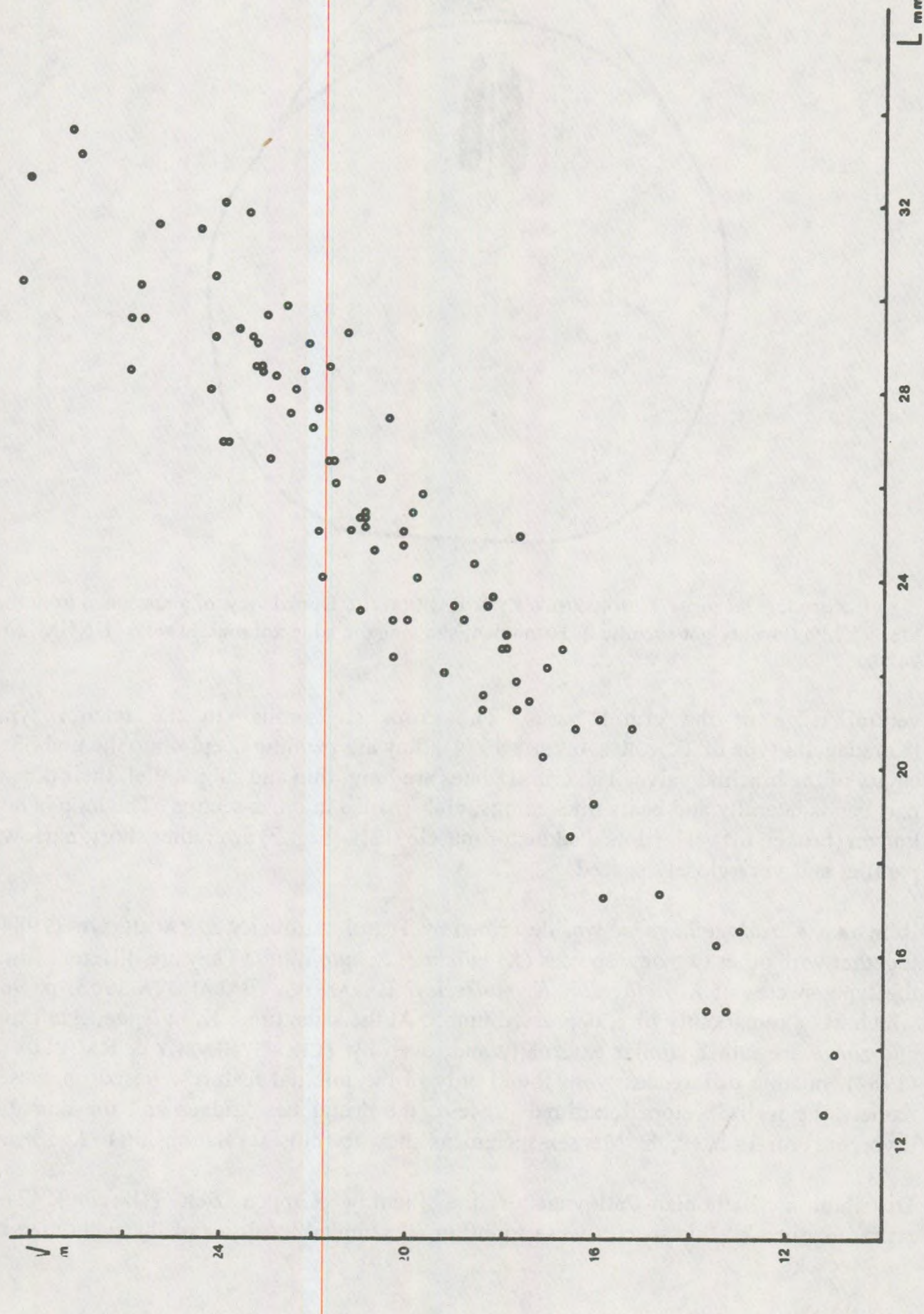


Fig. 7. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Dorsal view of a specimen from the Mecsek Mts (locality not specified), Bathonian, showing the adductor muscle scars. HNHM, M. 94.101.

ventral ridge of the crural bases. The crura are similar to the falcifer type (Karadagella-type of TCHORSZHEVSKY 1974), they are pending deeply into the umbonal cavity of the brachial valve. The crural plates are long, thin and subparallel, their dorsal part bends laterally and bears thickenings, club-shaped in cross-section. The loop is not known (broken off). The dorsal adductor muscle scars (Fig. 7) are rather short, narrow, parallel and very closely spaced.

Remarks: *Karadagella zorae* was described by TCHORSZHEVSKY & RADULOVIĆ (1984) together with other two new species (*K. milenae, K. annickae*). They are different from the type species of *Karadagella, K. moisseievi* BABANOVA (BABANOVA 1965, p. 96) which has a remarkably tiny, depressed umbo. At the same time, K. *milenae, annickae* and *zorae* are rather similar externally and, even by TCHORSZHEVSKY & RADULOVIĆ (1984), notable differences were found only in the internal features. Based on these, namely the well-developed cardinal process, the crural base ridges and the dorsally divergent crural plates, the Mecsek specimens show the closest relationship to *K. zorae*.

Distribution: Bathonian-Callovian of the Pieniny Klippen Belt (Ukraine). The representatives of this species were found in all sampled localities of the Bathonian of the Mecsek.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Genus *Karadagithyris* TCHORSZHEVSKY, 1974

Karadagithyris eduardi sp. n.
(Plate I: 10a–c, Fig. 9)

1984 *Karadagithyris gerda* (OPPEL, 1863) - TCHORSZHEVSKY & RADULOVIĆ, Carpathians and Carpatho-Balkanides, p. 152, pl. 3, figs. 13–16, 17–20, fig. 15.

Holotype: Hungarian Natural History Museum (Budapest), inventory number: M. 94.109.
Locus typicus: Hidas valley, Bed No. 45 (Mecsek Mts, Hungary).
Stratum typicum: Lower Bathonian, brownish-red, nodular limestone.
Derivatio nominis: after the name of Dr. Eduard Stanislavovich TCHORSZHEVSKY, famous brachiopod worker (Kharkov, Ukraine).
Diagnosis: Large *Karadagithyris* with massive, incurved beak, strongly convex pedicle valve and uniplicate anterior commissure.

Material: 5 specimens of variable state of preservation.

Dimensions:	L	W	T
Holotype (M. 94.109)	35.5	25.3	19.4
Sectioned paratype (M. 94.110.)	31.4	24.0	17.5

Description:

External characters: This is a large terebratulid with oval, elongate drop-shaped outline. The lateral margins are straight and pass into the anterior margin along a continuous curve. The anterior margin is rounded subtrapezoidal. The pedicle valve is strongly and uniformly convex, the brachial valve is gently convex. The beak is incurved and is truncated by a rather large, subcircular to elongate oval pedicle opening. The beak ridges are blunt; a planarea-like shallow depression is developed on the pedicle valve. The lateral commissure is gently sinuous; at first it is slightly arched dorsally then it is deflected ventrally at the lateral extremities. The anterior commissure is uniplicate; the low but well-demarcated, trapezoidal plica is straight in the middle portion. Except the fine growth lines, the surface of the shell is not ornamented. Two blunt radial ridges arise at the middle part of the brachial valve and run to the corners of the uniplication.

Fig. 8. The size-frequency distribution of 90 specimens of *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. L = length, W = width

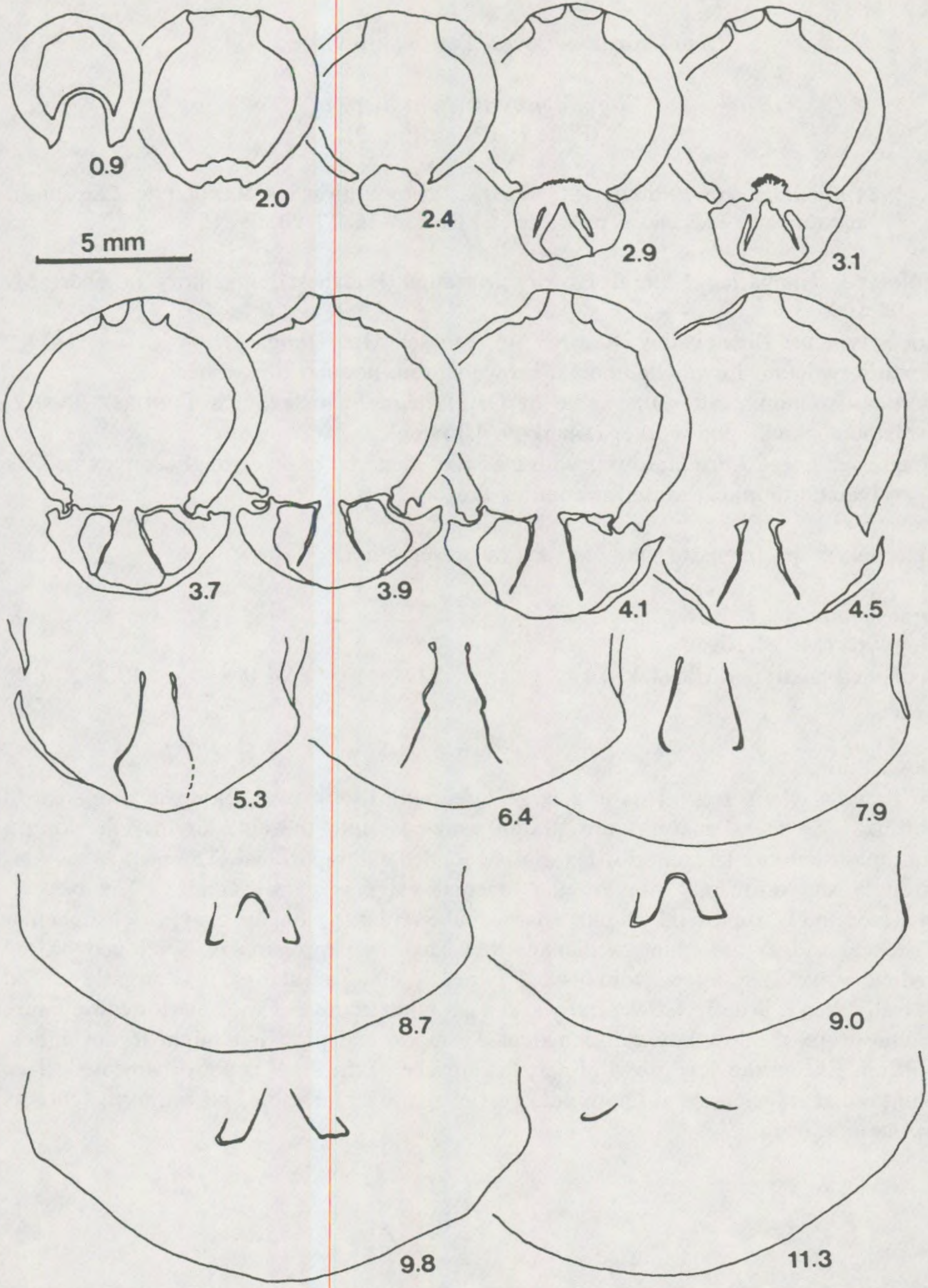

Fig. 9. *Karadagithyris eduardi* sp. n. A series of sixteen transverse sections through the posterior part of the sectioned paratype from Sövér ravine, Bed L-1, Lower Bathonian. HNHM, M. 94.110. Original length of the specimen 31.4 mm. The brachidium persisted to 13.1 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

Internal characters (Fig. 9): *Pedicle valve*: The pedicle collar is well-developed. The fused deltidial plates form a symphytium. The delthyrial cavity is subcircular in cross-section. On the ventral side very deep adductor muscle scars and grooves can be seen. The hinge teeth are stout, denticula are developed. *Brachial valve*: The cardinal process is well-developed, high and strongly crenulated. The outer socket ridges are wide and strong. The inner socket ridges are low and lean moderately over the sockets. The outer hinge plates grow from the top of the inner socket ridges, they are subhorizontal and rather thin. The crural bases appear in the umbonal cavity as dorsally divergent plates between the cardinal process and the dorsal valve floor. They are connected to the outer hinge plates forming ventral ridges. The crura are similar to the falcifer type and are supported by crural plates reaching the valve floor (Karadagithyris-type of TCHORSZHEVSKY 1974). The loop is rather wide subtrigonal, ending in long, divergent tips. The transverse band is highly arched and projects a little posteriorly.

Remarks: The Mecsek specimens described here as *Karadagithyris eduardi*, new species, show almost perfect identity, both externally and internally, with those presented by TCHORSZHEVSKY & RADULOVIĆ (1984) under the name *Karadagithyris gerda* (OPPEL). This new species is very markedly different from "*Terebratula*" *gerda* OPPEL, 1863 which has a short and wide, rounded subpentagonal outline, equiglobose shells and almost perfectly rectimarginate lateral and anterior commissures, in contrast to the elongate oval outline, the inequiglobose shells and uniplicate anterior margin of *K. eduardi*. The present author had the opportunity to study the type (figured) specimen of "*T.*" *gerda* in the Bayerische Staatssammlung (München) and is convinced that the figures given by OPPEL (1863, pl. 5, fig. 1a–c) are reliable.

It is worth mentioning that "*T.*" *gerda* was collected in great number from the Bajocian of the Bakony (Hungary). Recent studies on their internal morphology has revealed that they have relatively short crural plates, not reaching the floor of the dorsal valve, i.e. the "true" *gerda* may belong rather to *Karadagella* than to *Karadagithyris*.

The large size and the uniplicate anterior commissure seem to differentiate *K. eduardi* from all other known species of *Karadagithyris*.

Distribution: Undivided Bathonian-Callovian of the Pieniny Klippen Belt (Ukraine) and the Danubic unit of the Yugoslavian Carpatho-Balkanides. The Mecsek specimens came from the Bathonian of the Hidas valley and the Sövér ravine.

Suborder Terebratellidina MUIR-WOOD, 1955
Superfamily Terebratulacea KING, 1850
Family Dallinidae BEECHER, 1893
Subfamily Kingeninae ELLIOTT, 1948
Genus *Zittelina* ROLLIER, 1919

Zittelina ? *beneckei* (PARONA, 1880)
(Plate II: 7a–c, 8a–c, 9a–f, Figs. 10, 11)

1880 *Waldheimia Beneckei* n. sp. – PARONA, Strati a Posidonomya, p. 274, pl. 5, fig. 24a–c.
1886 *Terebratula* mut. *brica* DE GREG. – DE GREGORIO, Ghelpa, p. 18, pl. 2, fig. 46.

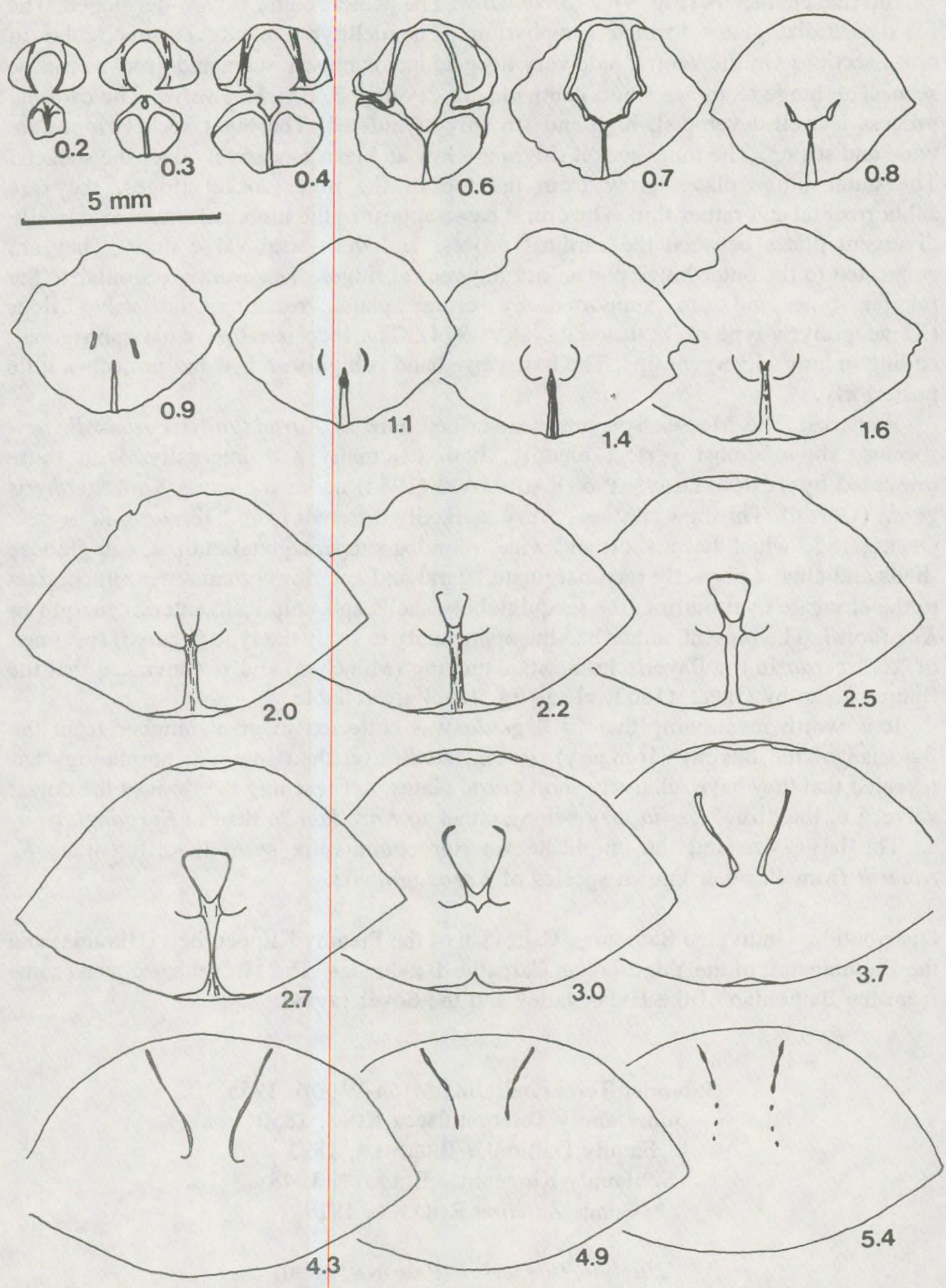

Fig. 10. *Zittelina* ? *beneckei* (PARONA). A series of nineteen transverse sections through a juvenile(?) specimen from Hidas valley, Bed 15, Upper Bathonian. HNHM, M. 94.114. Original length of the specimen 9.4 mm. The brachidium persisted to 5.7 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

1886 *Terebratula abrupta* DE GREG. – ibid., p. 18, pl. 2, fig. 47.
1886 *Terebratula abruturgida* DE GREG. – ibid. p. 18, pl. 3, fig. 1.
1886 *Terebratula* mut. *miopina* DE GREG. – ibid. p. 18, pl. 3, figs. 2, 3.
1886 *Terebratula elga* DE GREG. – ibid. p. 18, pl. 3, fig. 4.
1886 *Terebratula felina* DE GREG. – ibid. p. 18, pl. 3, fig. 5.
1886 *Terebratula mirilla* DE GREG. – ibid. p. 18, pl. 3, fig. 6.
1886 *Terebratula Renardi* DE GREG. – ibid. p. 18, pl. 3, fig. 7.
1886 *Terebratula cavendina* DE GREG. – ibid. p. 18, pl. 3, fig. 8.
1886 *Terebratula* mut. *propecavendina* DE GREG. – ibid. p. 19, pl. 3, fig. 9.
1886 *Terebratula* mut. *tricavendina* DE GREG. – ibid. p. 19, pl. 3, fig. 10.
1896 *Waldheimia Beneckei* PAR. – PARONA, Sette Comuni, p. 31, pl. 2, figs 19, 20.

Material: 27 specimens of variable state of preservation.

Dimensions:	L	W	T
M. 94.111.	8.2	8.1	5.5
M. 94.112.	10.5	10.3	8.0
M. 94.113.	9.8	10.4	7.4

Description:

External characters: this is a very small, globose terebratulid, with rounded subpentagonal outline. The lateral margins are nearly straight at first, then become convex and pass gradually into the rounded trapezoidal anterior margin. The valves are inequiglobose, the pedicle valve is very strongly convex. The maximum convexity lies at the posterior one-third of the length. The tiny, depressed beak is incurved and is truncated by a small, subcircular pedicle opening. The delthyrium is concealed by the beak. The lateral commissure is straight and bends a little ventrally. According to the degree of this bending, the anterior commissure can be described as uniplicate to parasulcate. The uniplication (or the middle plica of the parasulcation) is wide and low. The surface of the shell is covered by rather regularly spaced growth lines.

Internal characters (Figs 10, 11): *Pedicle valve*: The delthyrial cavity is subcircular to oval; the umbonal cavities are rounded subtrigonal in cross-section. The dental plates are strong and convergent ventrally. The hinge teeth are short and weak. In the mature (gerontic ?) specimen (Fig. 11) the inner part of the umbo is vastly thickened by secondary shell material (callus). *Brachial valve*: There is no cardinal process but a narrow, deep notch can be interpreted as a muscle trough. This continues in a deep, V-shaped septalium, formed by the fused inner hinge plates. The septalium is supported by a strong median septum. The septalium persists well beyond the plane of articulation, here the crural bases became free from the inner socket ridges but are still attached to the median septum by the septalium. The crura are free and similar to the falcifer type; the crural processes are incurved. Further anteriorly, the median septum remains high and very massive, it takes part in the development of the loop. Both the descending and the ascending branches are connected to the median septum (reinforced with callus). The hood is well-developed; it is circular (in the adult) or subtrigonal (in the juvenile) in cross-section. The frenuliniform to terebrataliiform loop bears lateral spines (in the adult specimen) and ends in numerous, long anterior spurs.

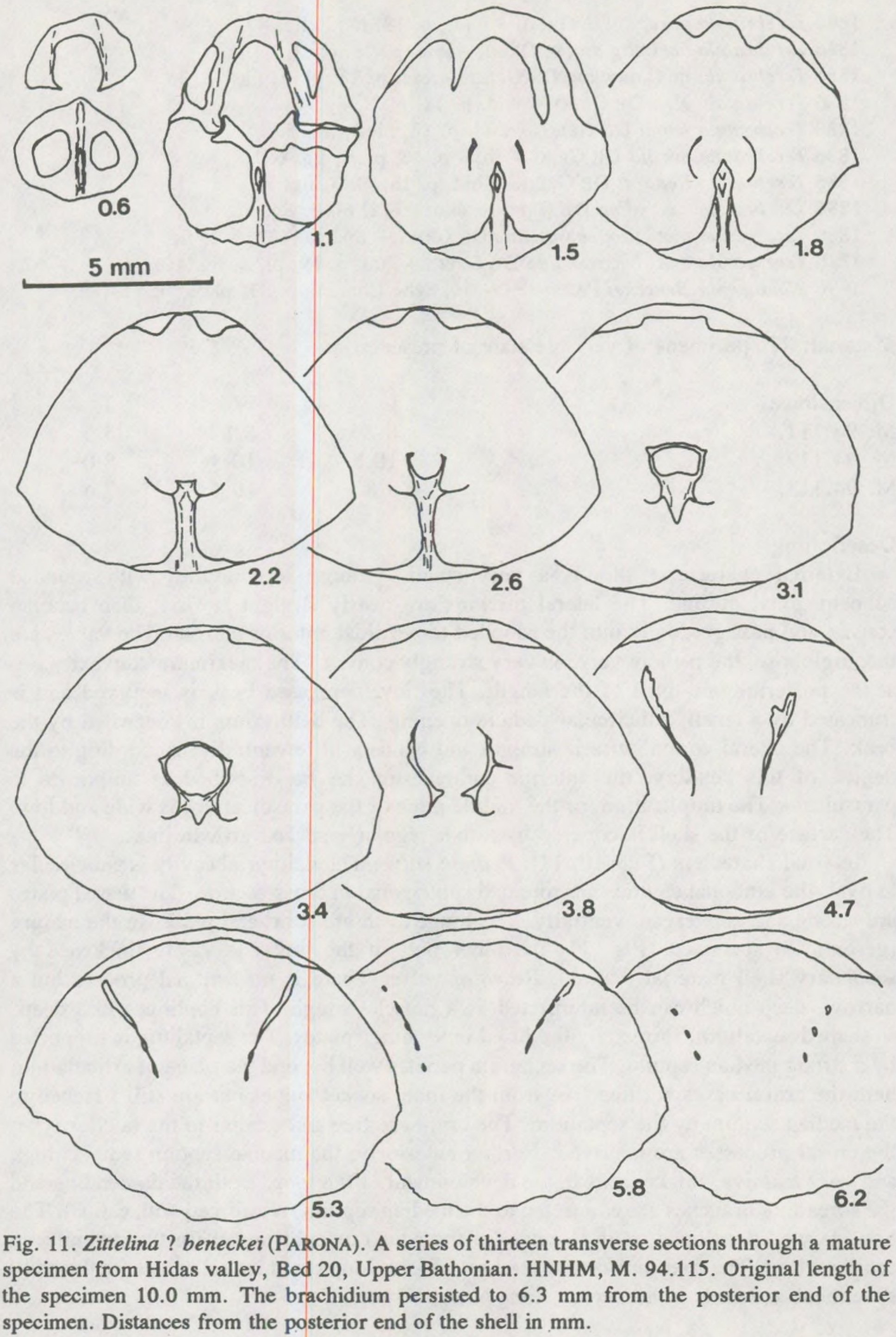

Fig. 11. *Zittelina* ? *beneckei* (PARONA). A series of thirteen transverse sections through a mature specimen from Hidas valley, Bed 20, Upper Bathonian. HNHM, M. 94.115. Original length of the specimen 10.0 mm. The brachidium persisted to 6.3 mm from the posterior end of the specimen. Distances from the posterior end of the shell in mm.

Remarks: The Mecsek specimens can well be identified with "*Waldheimia*" *beneckei* described by PARONA (1880) from the Bathonian of the Southern Alps. DE GREGORIO (1886) erected eleven new species and mutations, all belonging to the "group of *T. beneckei*". They are regarded as synonymous with "*W.*" *beneckei*, in accordance with the opinion of PARONA (1896).

"*Waldheimia beneckei*" HAAS & PETRI, 1882, from the Aalenian of Alsace-Lorraine, is a junior homonym of this species.

The attribution of "*W.*" *beneckei* to the genus *Zittelina* is tentative. There are no Middle Jurassic genera of Kingeninae (or other Dallinidae) with appropriate external and internal (loop) morphology. Probably a new genus should be created for this and some other, externally similar and possibly related forms ("*W.*" *boehmi* PARONA, 1896; "*W.*" *truncatella* ROTHPLETZ, 1886). The closest relationship has to be sought in the Late Jurassic, where, besides *Zittelina*, some recently described genera show similar features (e. g. *Tiaretithyris* TCHOUMATCHENCO, 1986 and *Oppeliella* TCHORSZHEVSKY, 1989). From among them, at the moment, *Zittelina* seemed to be the most suitable to embrace the species *beneckei*.

Distribution: Bathonian of the Southern Alps. The Mecsek specimens came from the Bathonian of the Hidas valley, Sövér ravine, Óbánya valley and Síngödör.

Acknowledgements

This work was supported by the grant No. 2294 of the National Scientific Research Fund (OTKA). The author is indebted to Dr András GALÁCZ, leader of the above project, who entrusted him with this task and encouraged him all the time. Thanks are due to Dr. László KORDOS (Museum of the Hungarian Geological Survey, Budapest) and to the late Dr. Reinhard FÖRSTER (Bayerische Staatssammlung, München) for their help in access to the collections in their charge.

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Explanation to plates

Plate I.

In each case **a** is the dorsal view, **b** is the anterior view (brachial valve upward), **c** is the lateral view, **d, e** or **f** are enlargements. The specimens are deposited in the Hungarian Natural History Museum. Photographs taken by the author.

1a-d. *Caucasella voultensis* (Oppel). Zengővárkony, Mészkemence, Bathonian. M. 94.89. (a-c: x 1, d: x 2.5)

2a-d. *Caucasella voultensis* (Oppel). Sövér ravine, Bed K-1, Upper Bathonian. M. 94.88. (a-c: x 1, d: x 2.5)

3a-d. *Stolmorhynchia* sp., aff. *stolidota* BUCKMAN. Hidas valley, Bed 50, Lower Bathonian. M. 94.91. (a-c: x 1, d: x 2.5)

4a-c. *Dichotomosella galaczi* sp. n., holotype. Hidas valley, Bed 19, Upper Bathonian. M. 94.92. (x 1)

5a-e. *Capillirhynchia brentoniaca* (OPPEL). Hidas valley, Bathonian. M. 94.94. (a-c: x 1, d-e: x 2.5)

6a-c. *Capillirhynchia brentoniaca* (OPPEL). Hidas valley, Bed 10-14, Upper Bathonian. M. 94.95. (x 1)

7a-c. *Linguithyris nepos* (CANAVARI). Hidas valley, Bathonian. M. 94.98. (x 1)

8a-c. *Linguithyris nepos* (CANAVARI). Hidas valley, Bed 10, Upper Bathonian. M. 94.97. (x 1)

9a-b. *Linguithyris nepos* (CANAVARI). Hidas valley, Bathonian. M. 94.99. (x 1)

10a-c. *Karadagithyris eduardi* sp. n., holotype. Hidas valley, Bed 45, Lower Bathonian. M. 94.109. (x 1)

Plate II.

In each case **a** is the dorsal view, **b** is the anterior view (brachial valve upward), **c** is the lateral view, **d, e** or **f** are enlargements. The specimens are deposited in the Hungarian Natural History Museum. Photographs taken by the author.

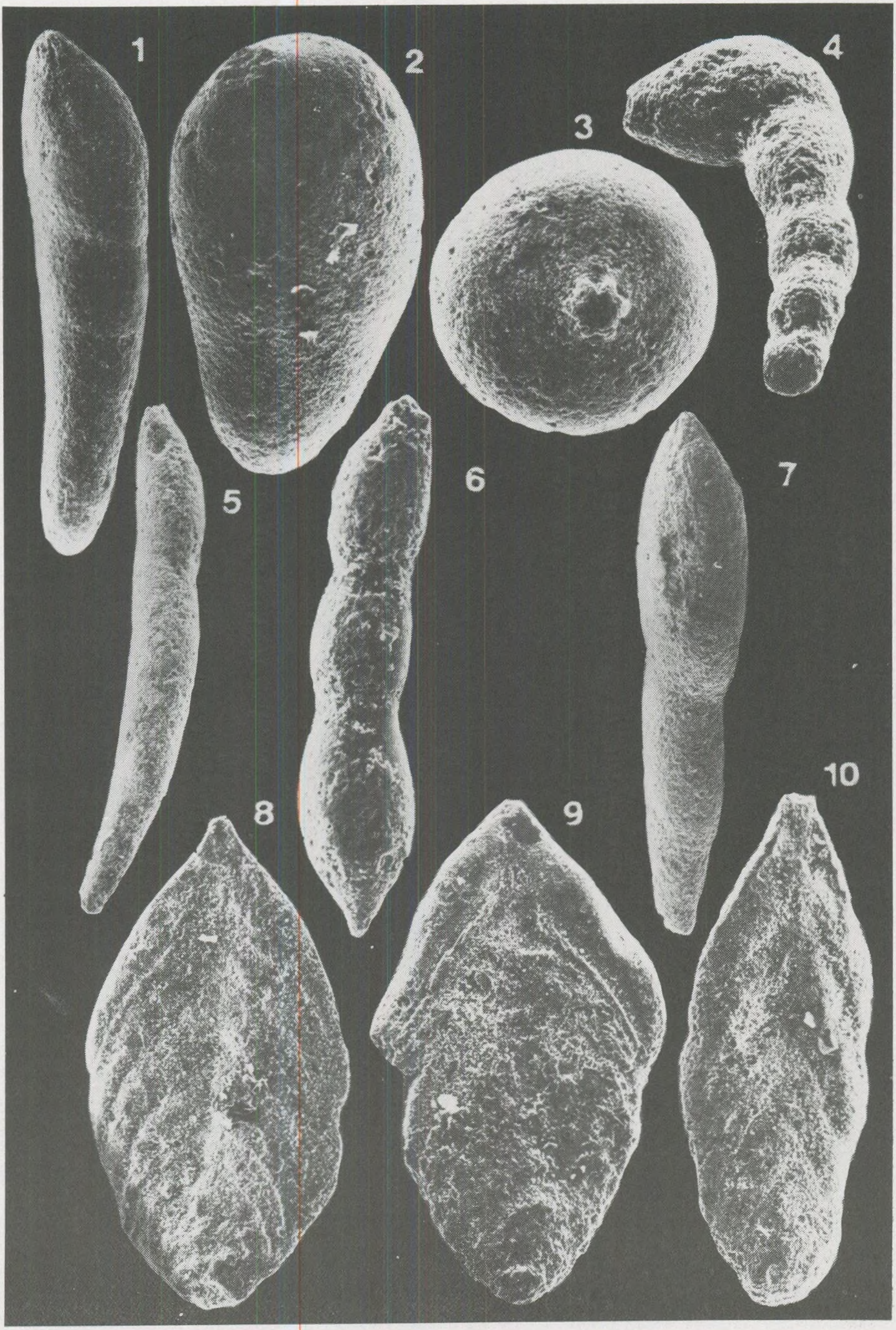
1a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Hidas valley, Bed 15, Upper Bathonian. M. 94.102. (x 1)
2a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Hidas valley, Bed 8, Upper Bathonian. M. 94.103. (x 1)
3a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Hidas valley, Bathonian. M. 94.104. (x 1)
4a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Hidas valley, Bed 8, Upper Bathonian. M. 94.105. (x 1)
5a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Hidas valley, Bed 20, Upper Bathonian. M. 94.106. (x 1)
6a–c. *Karadagella zorae* TCHORSZHEVSKY & RADULOVIĆ. Ófalu, "Kalktal", Bathonian. M. 94.107. (x 1)
7a–c. *Zittelina ? beneckei* (PARONA). Sövér ravine, Bed K–4, Middle Bathonian. M. 94.111. (x 1)
8a–c. *Zittelina ? beneckei* (PARONA). Hidas valley, Bed 20, Upper Bathonian. M. 94.112. (x 1)
9a–f. *Zittelina ? beneckei* (PARONA). Hidas valley, Bed 20, Upper Bathonian. M. 94.113. (a–c: x 1, d–f: x 2.5)

Plate I

Plate II

Plate III

Plate IV



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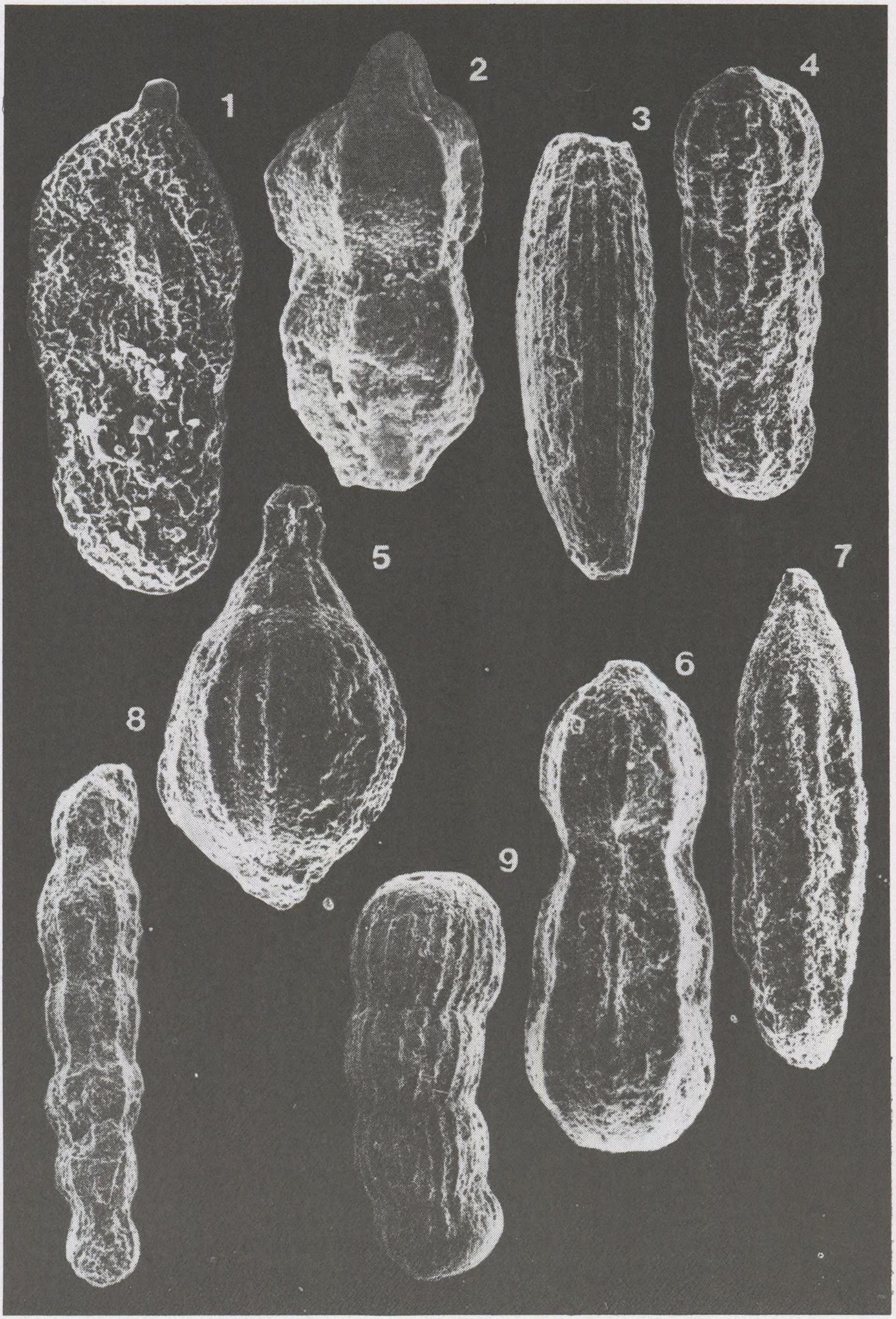

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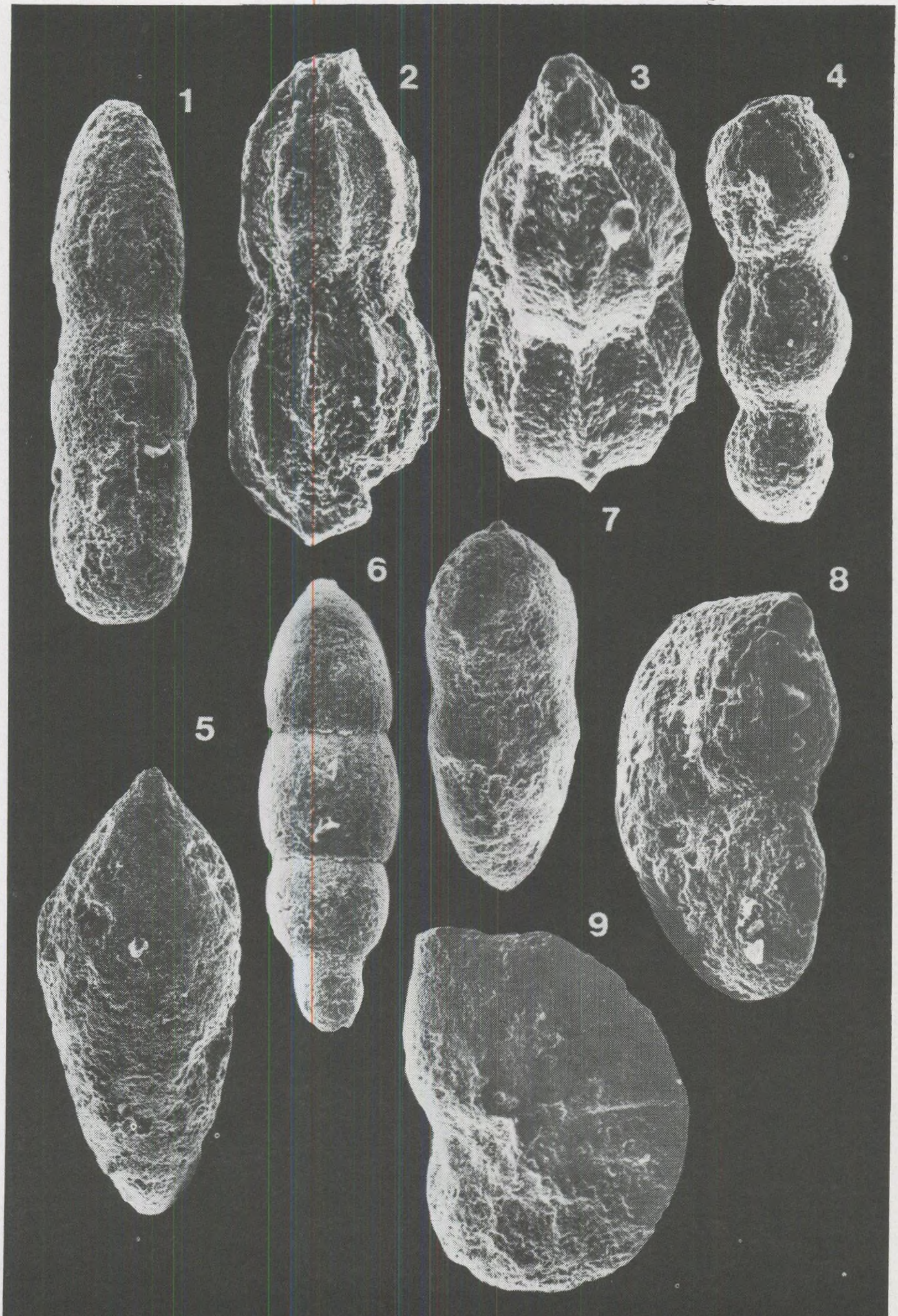

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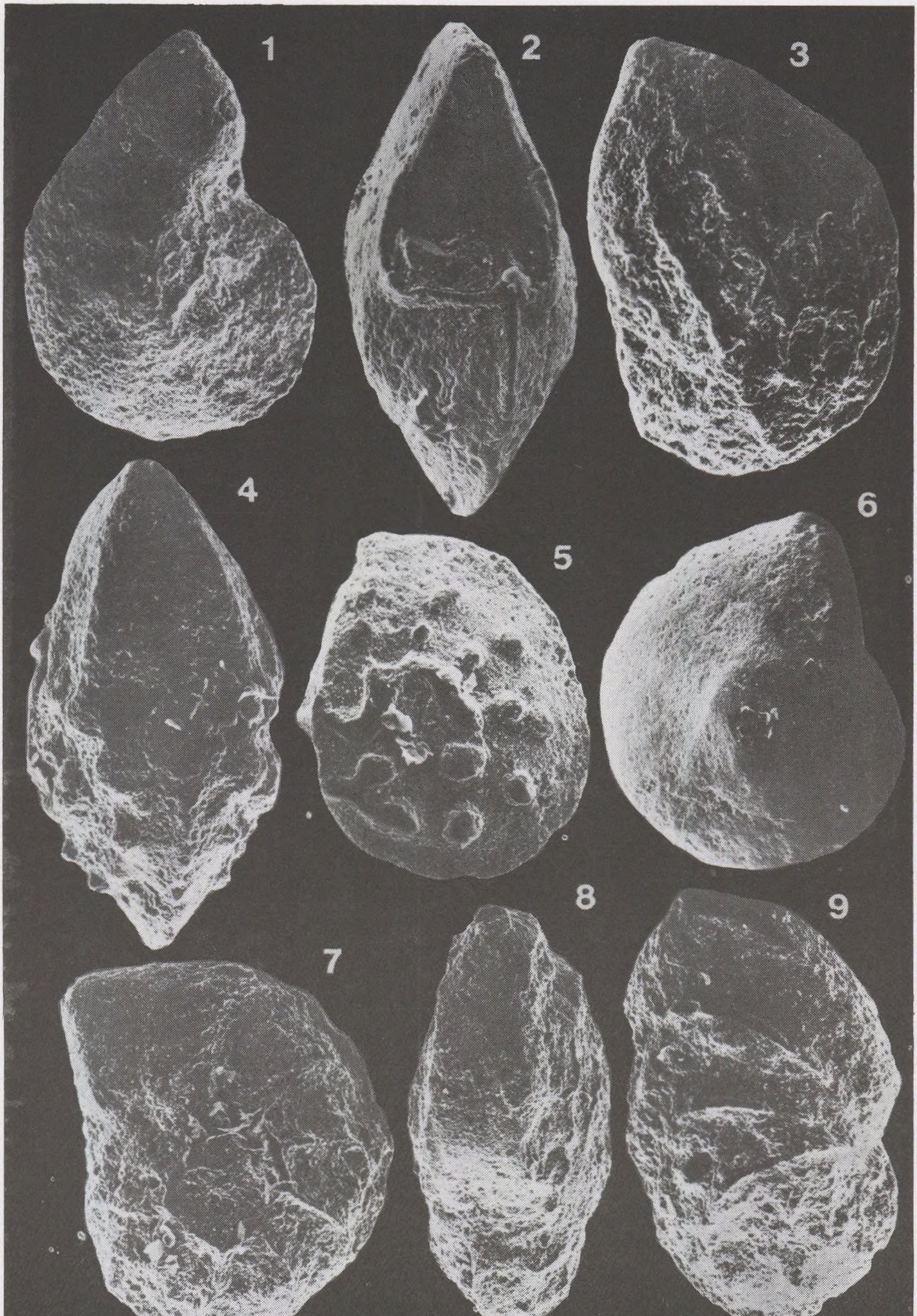

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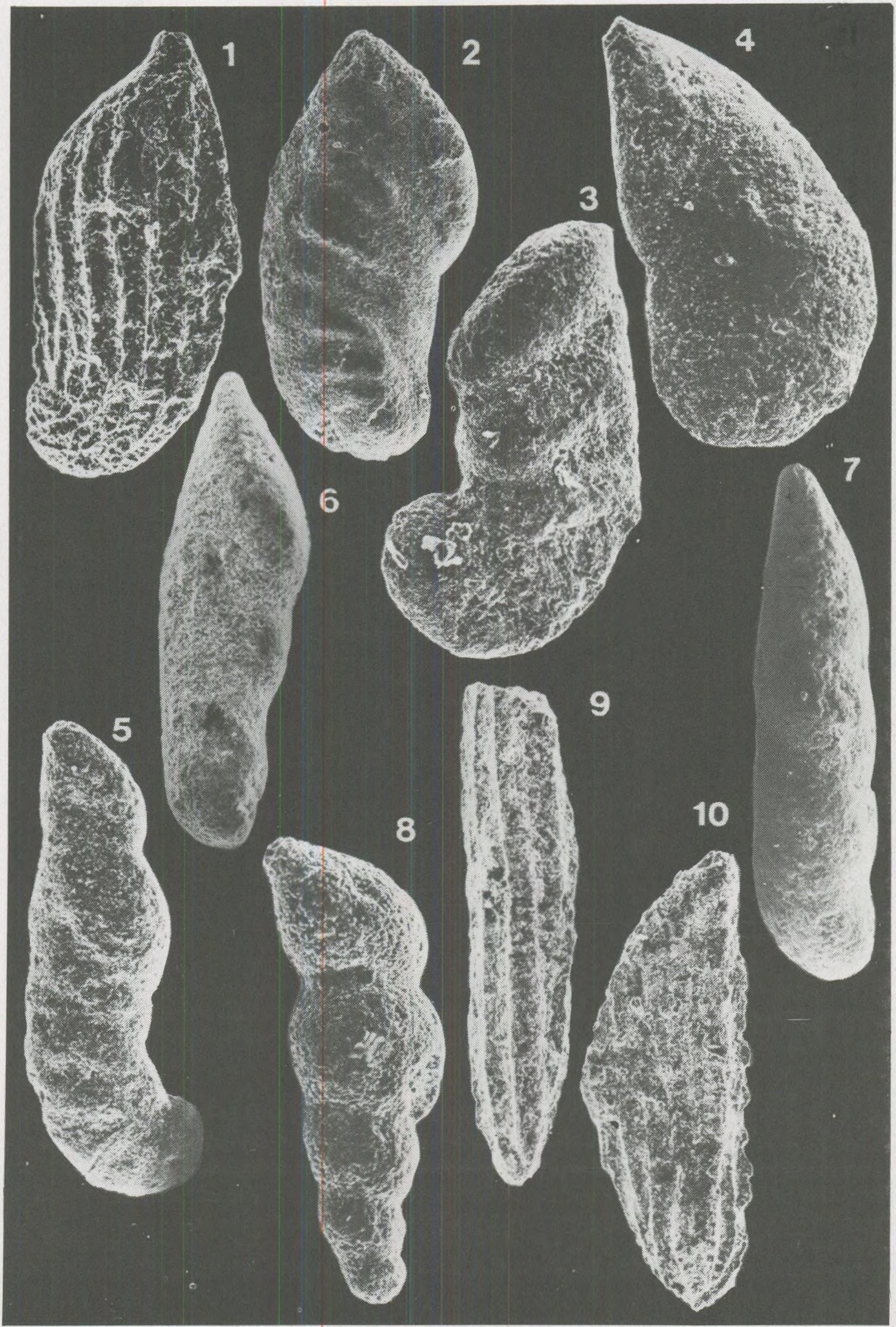

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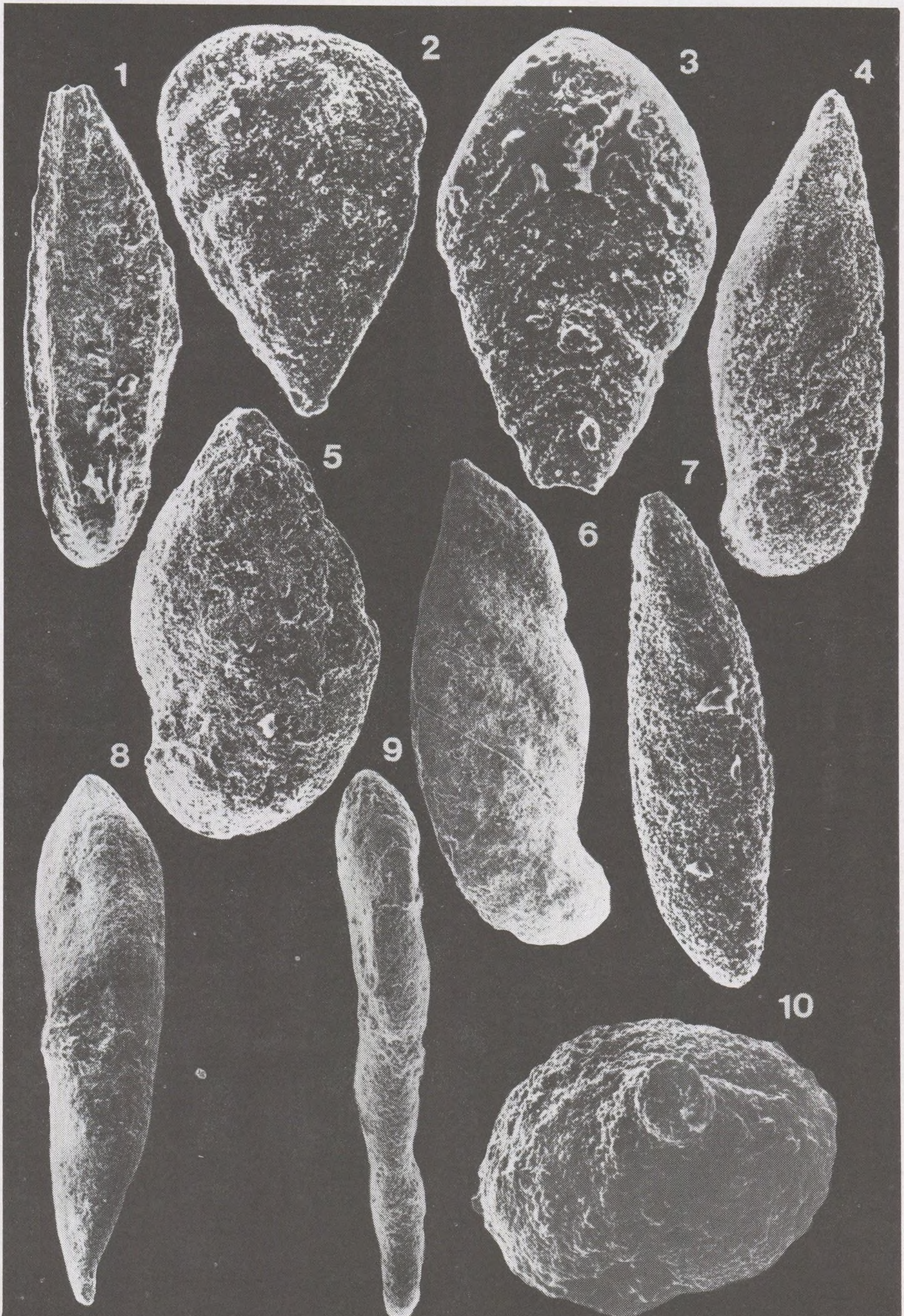

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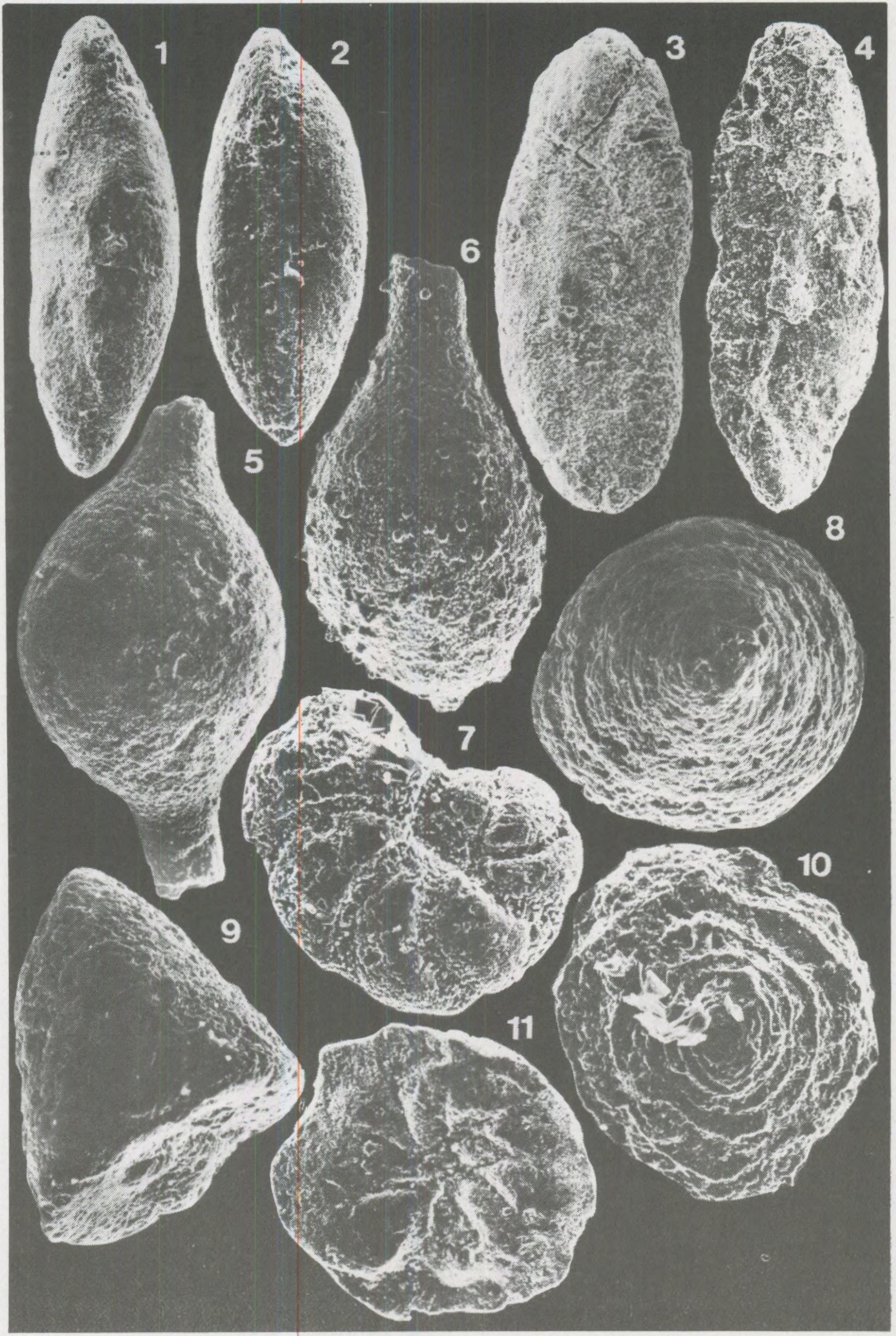
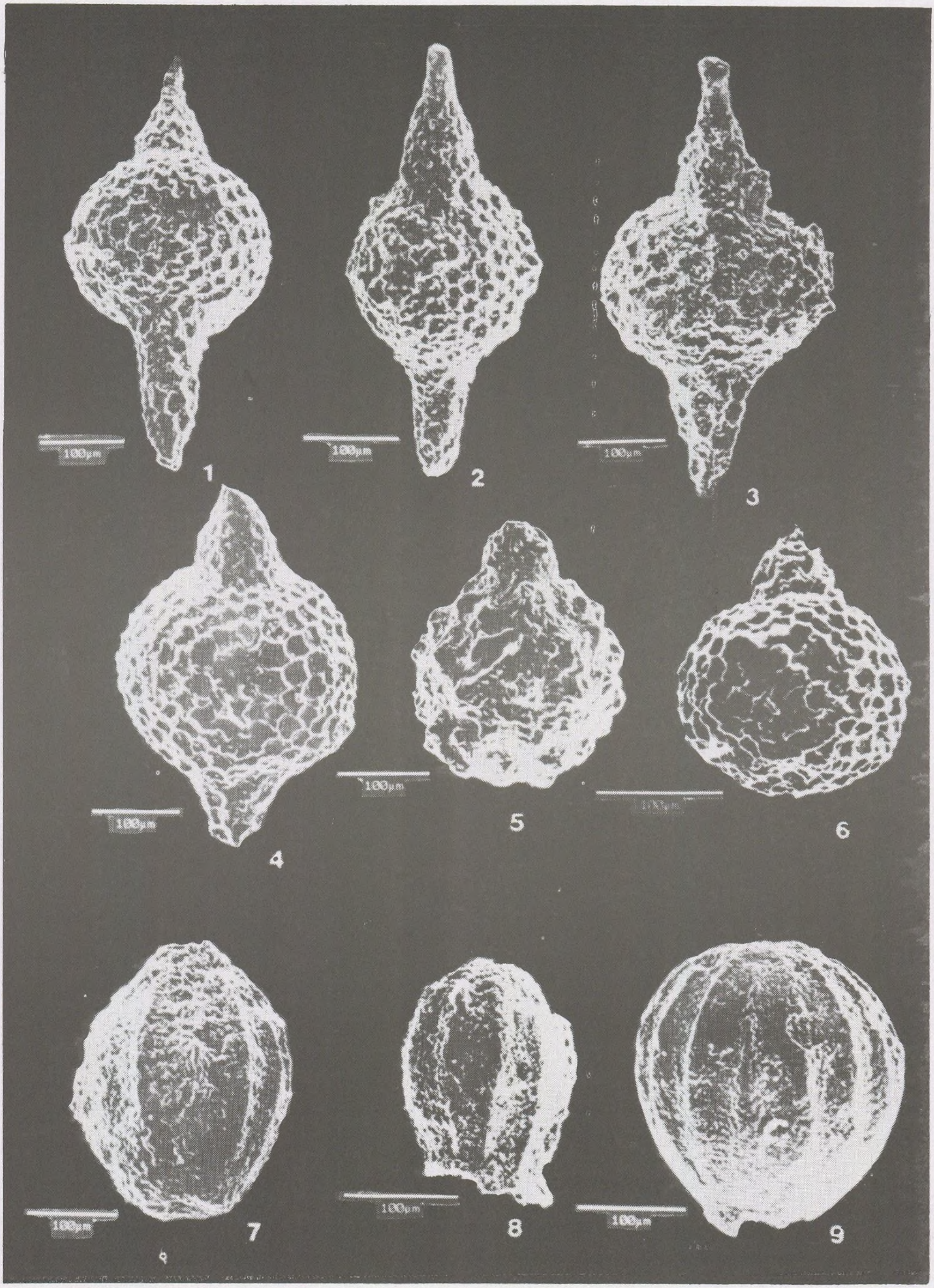


Plate 1



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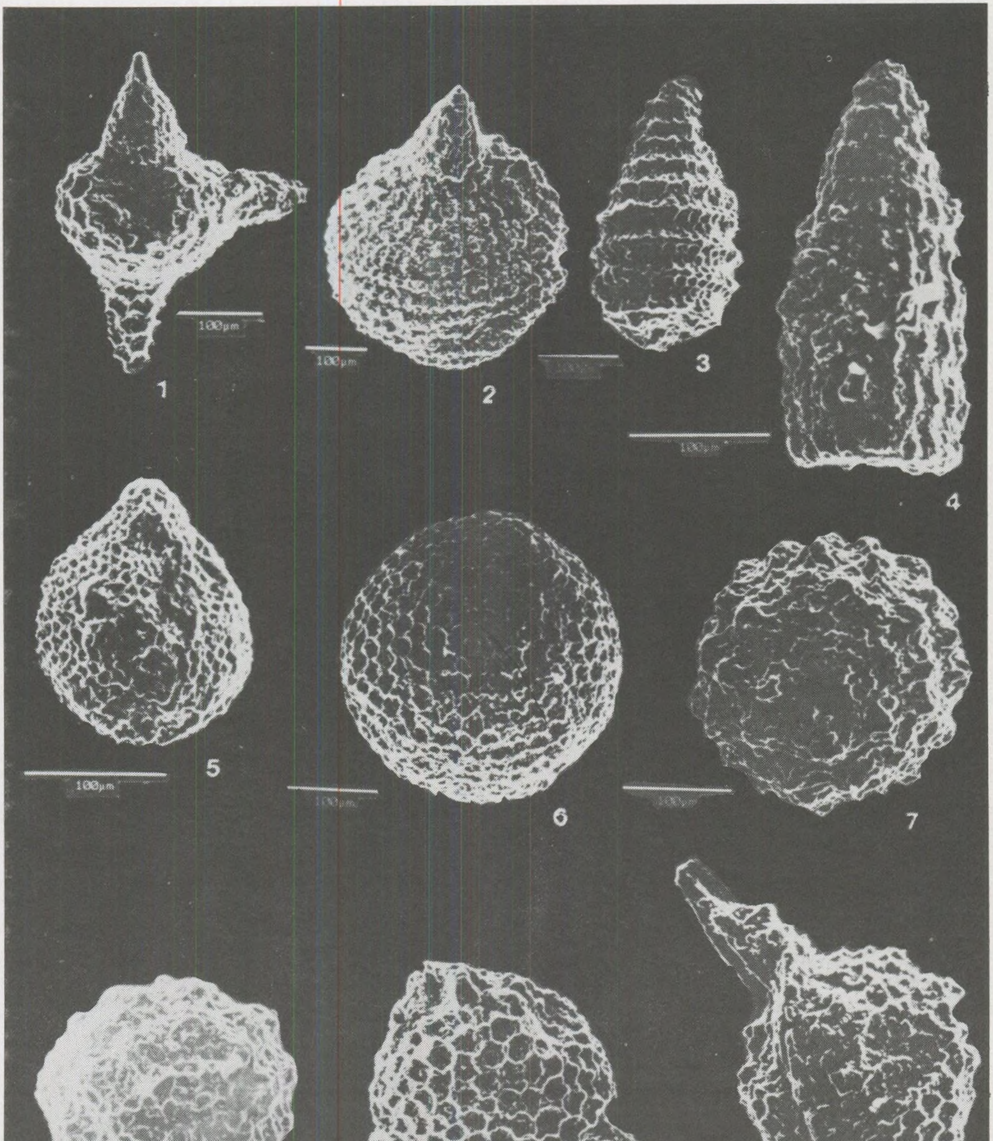
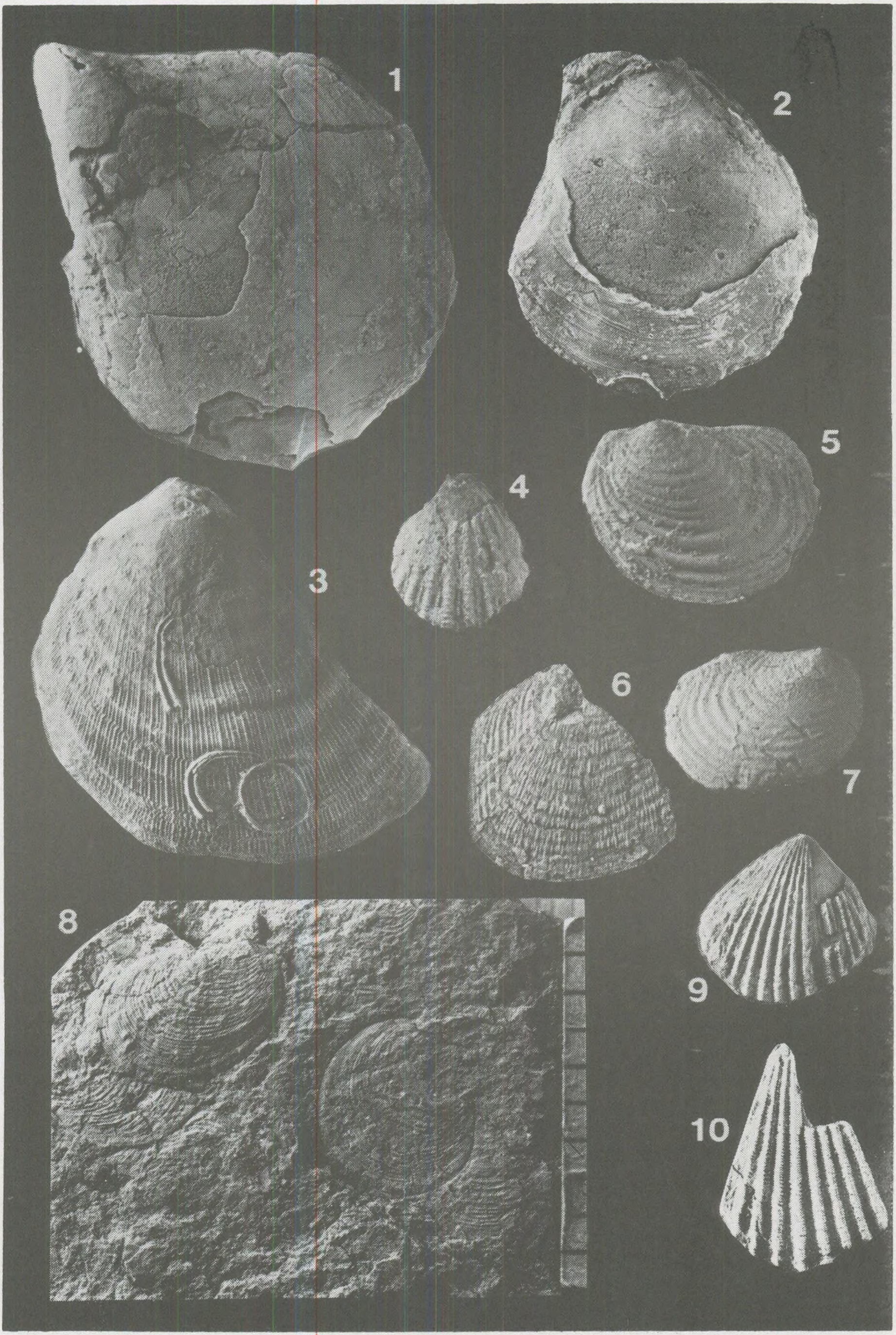


Plate 1

Plate 2



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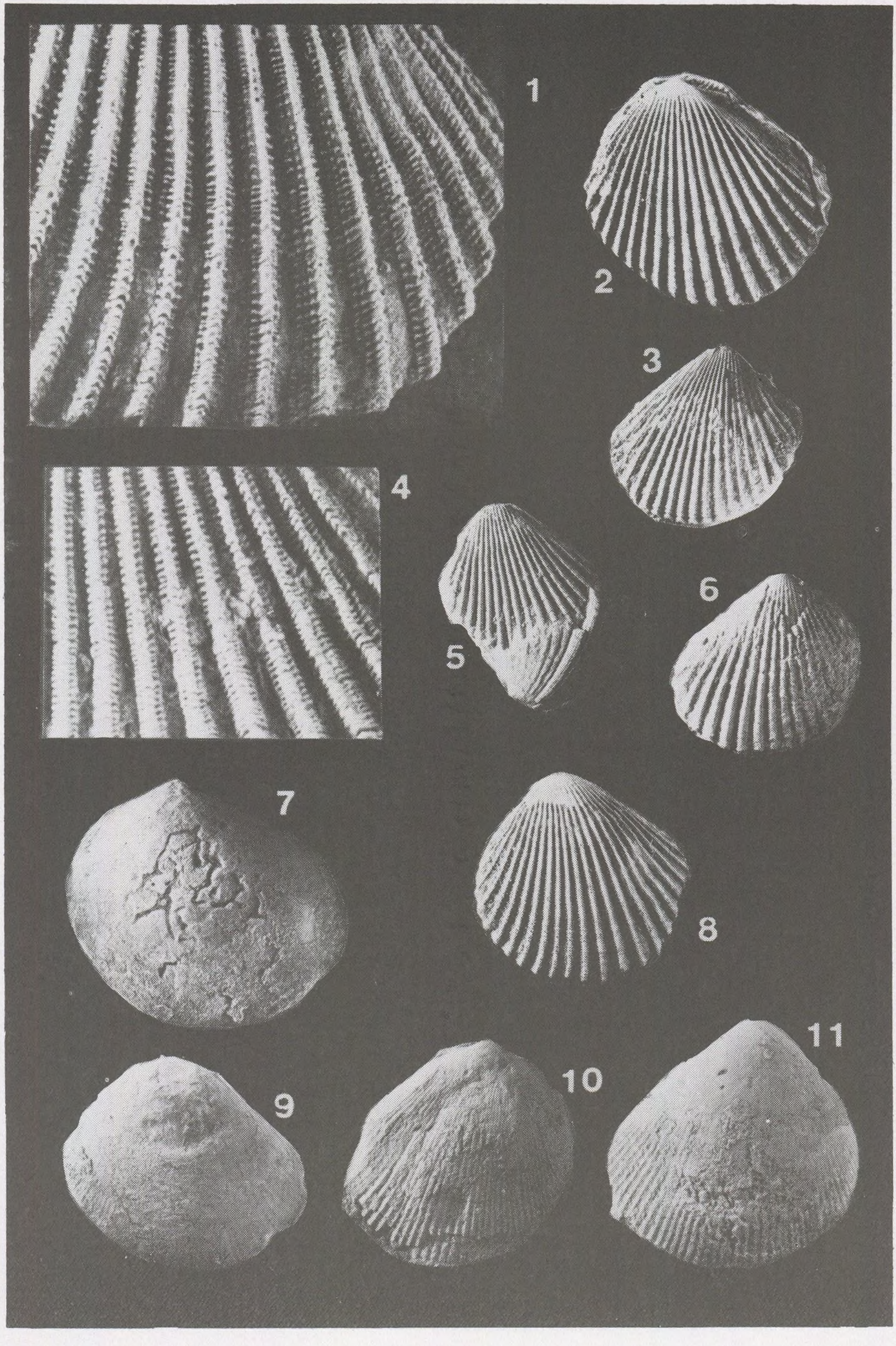

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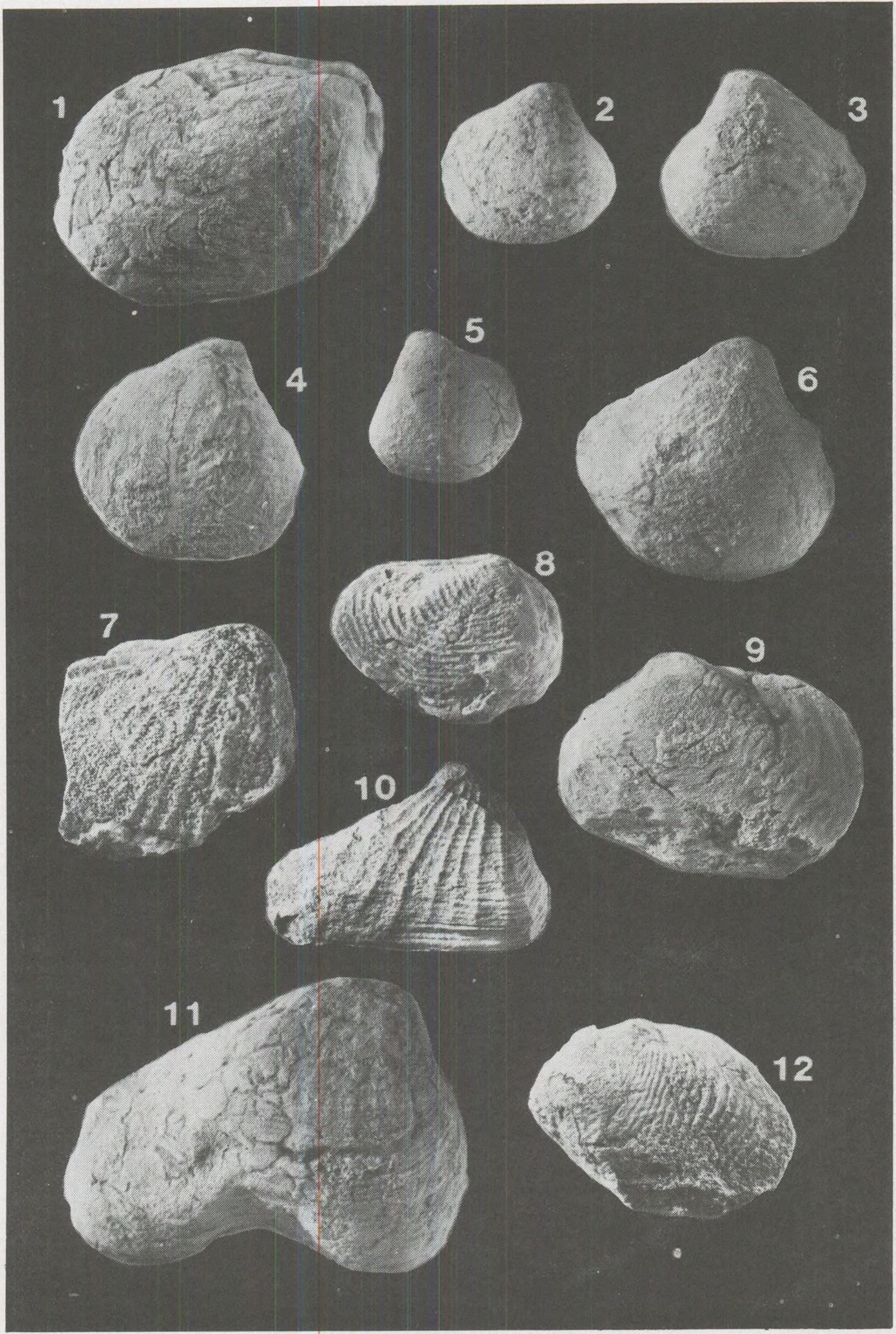
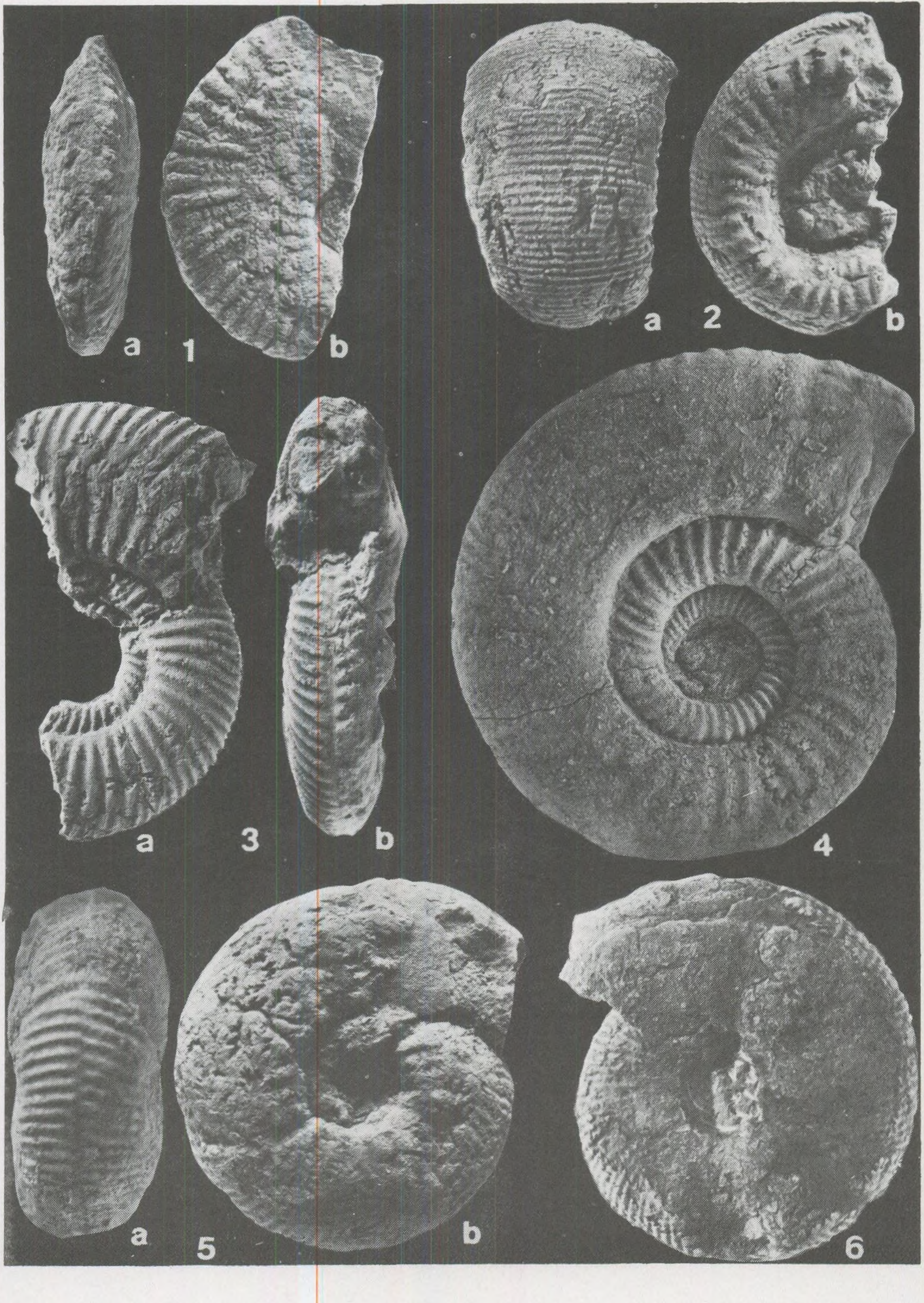


Plate 1

Plate 2



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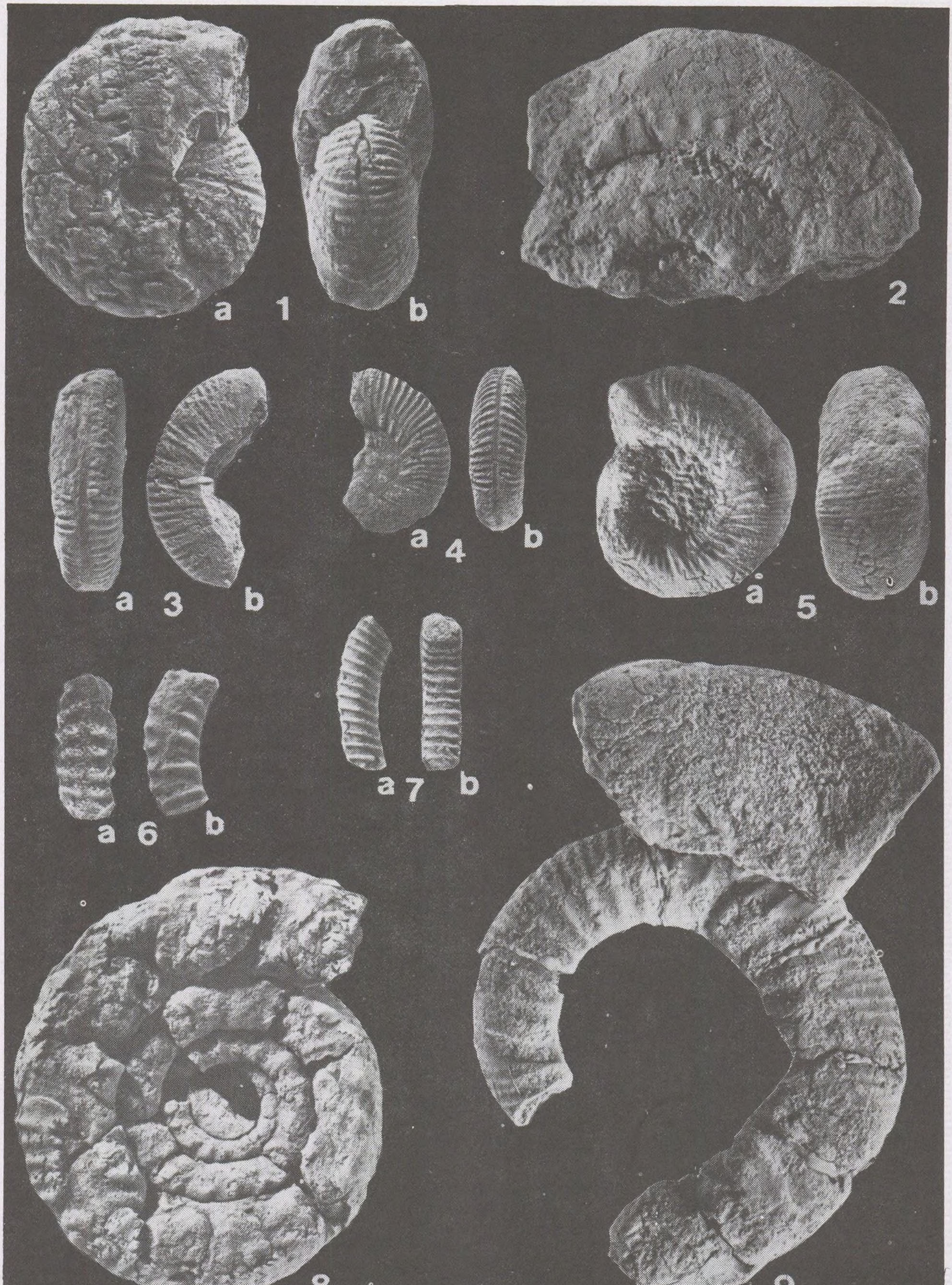

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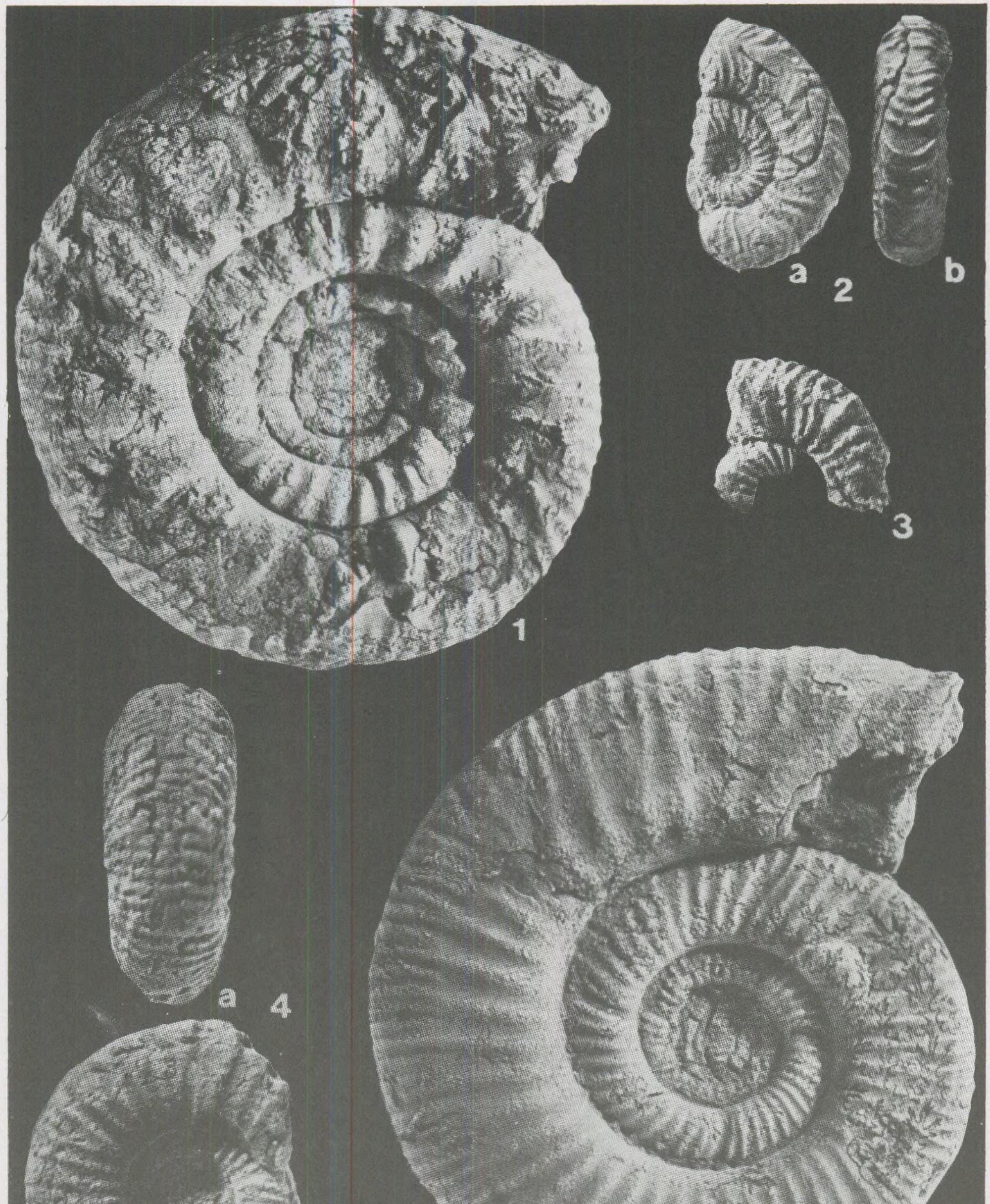
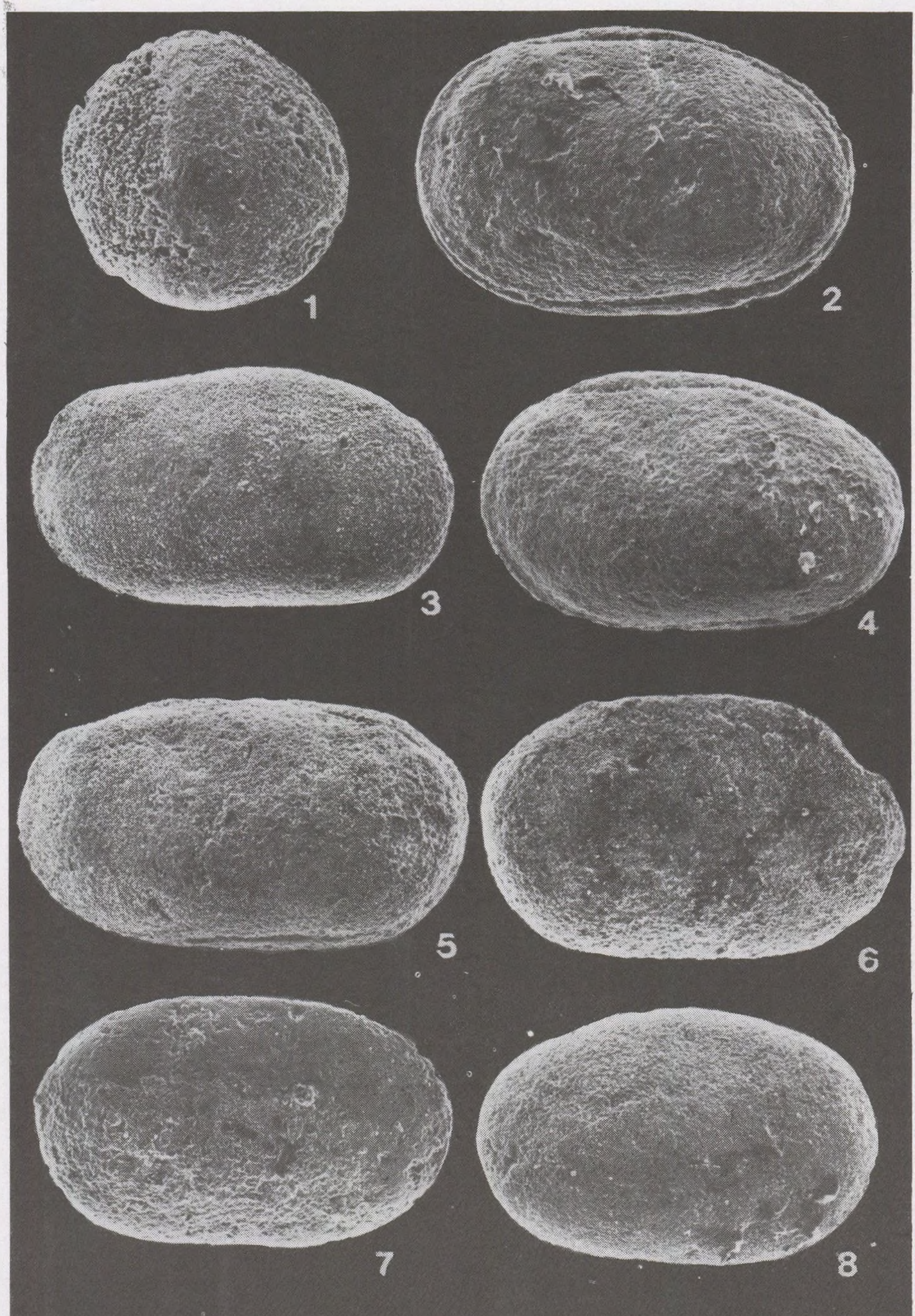


Plate 5

Plate 6

Plate 1



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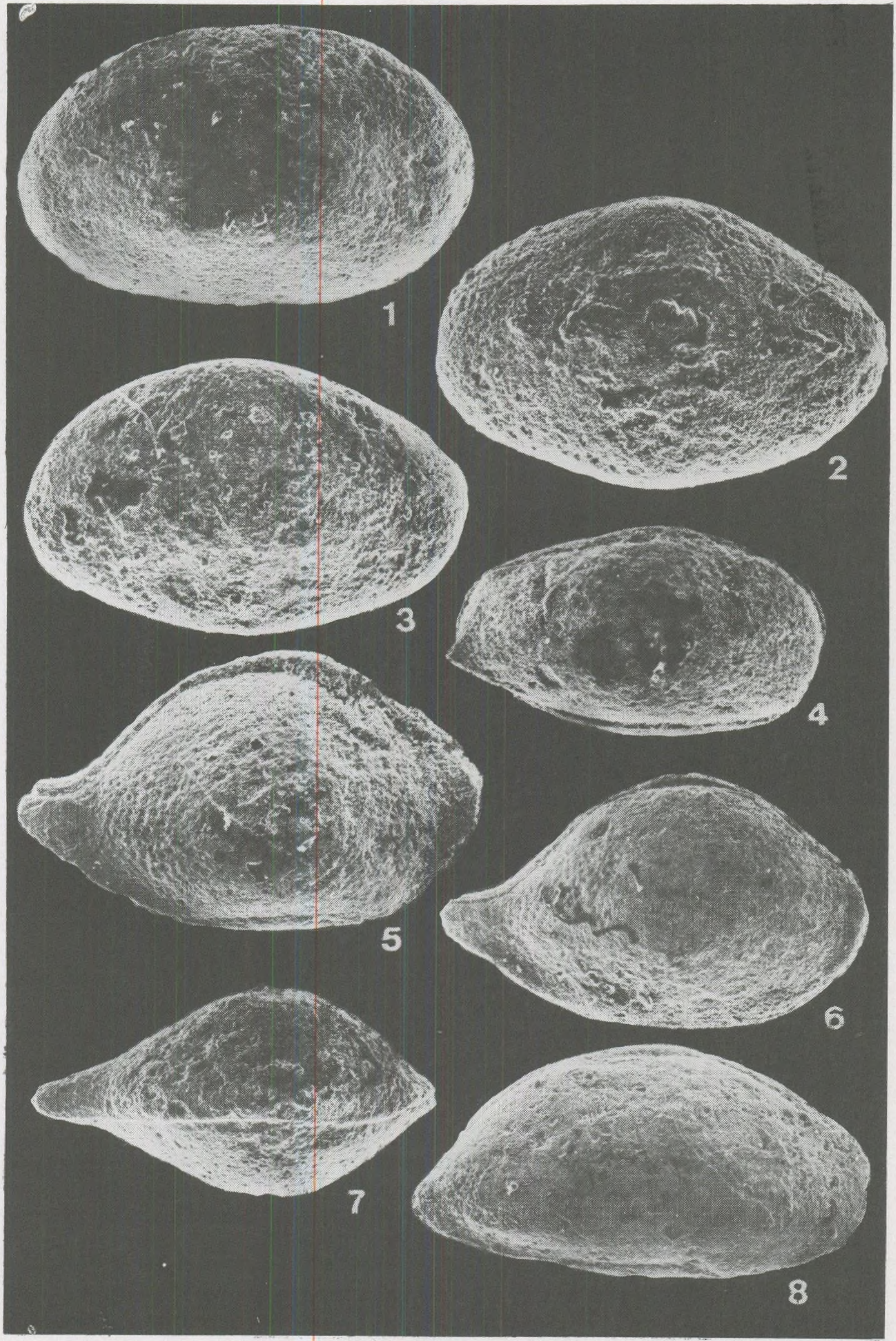
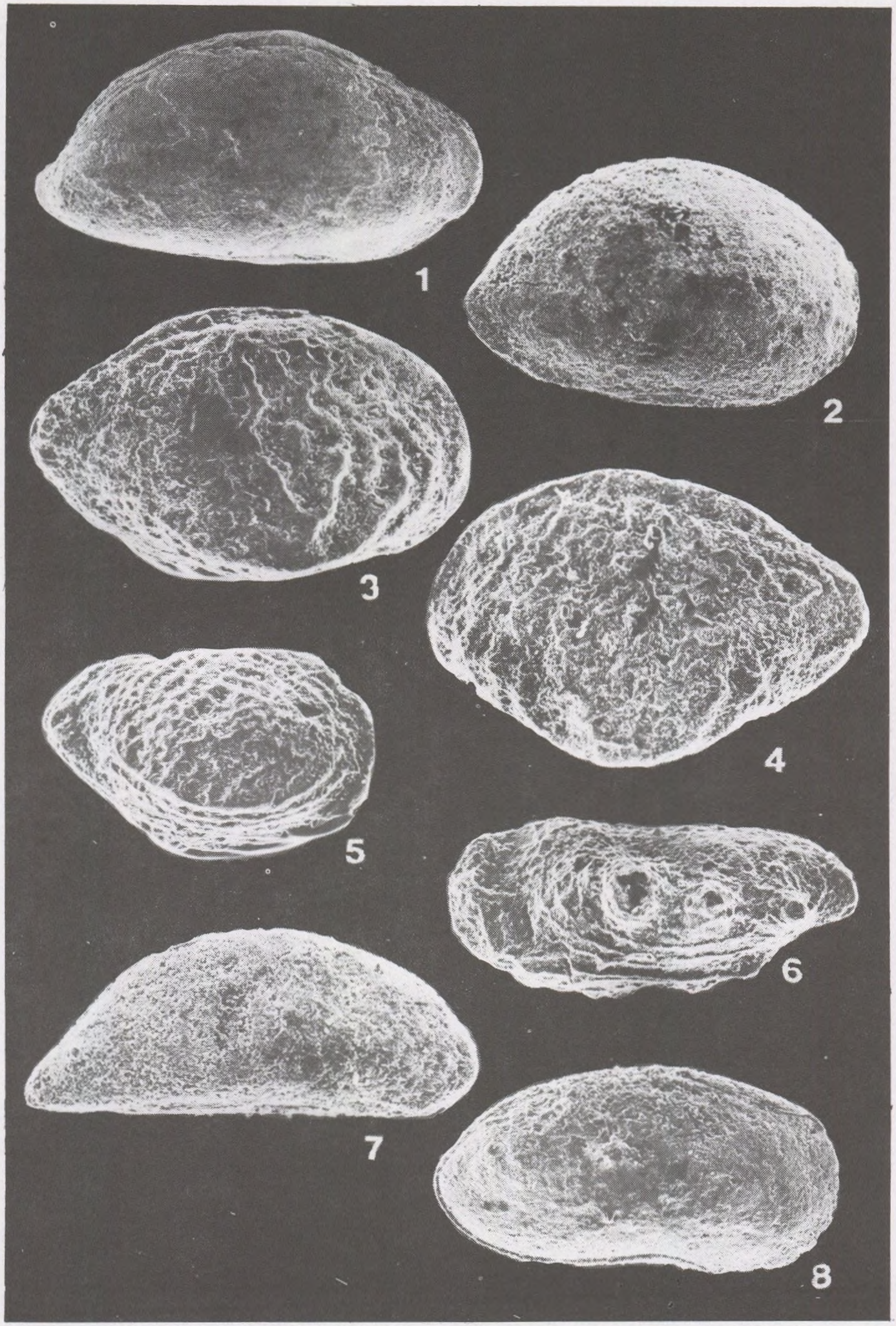


Plate 3



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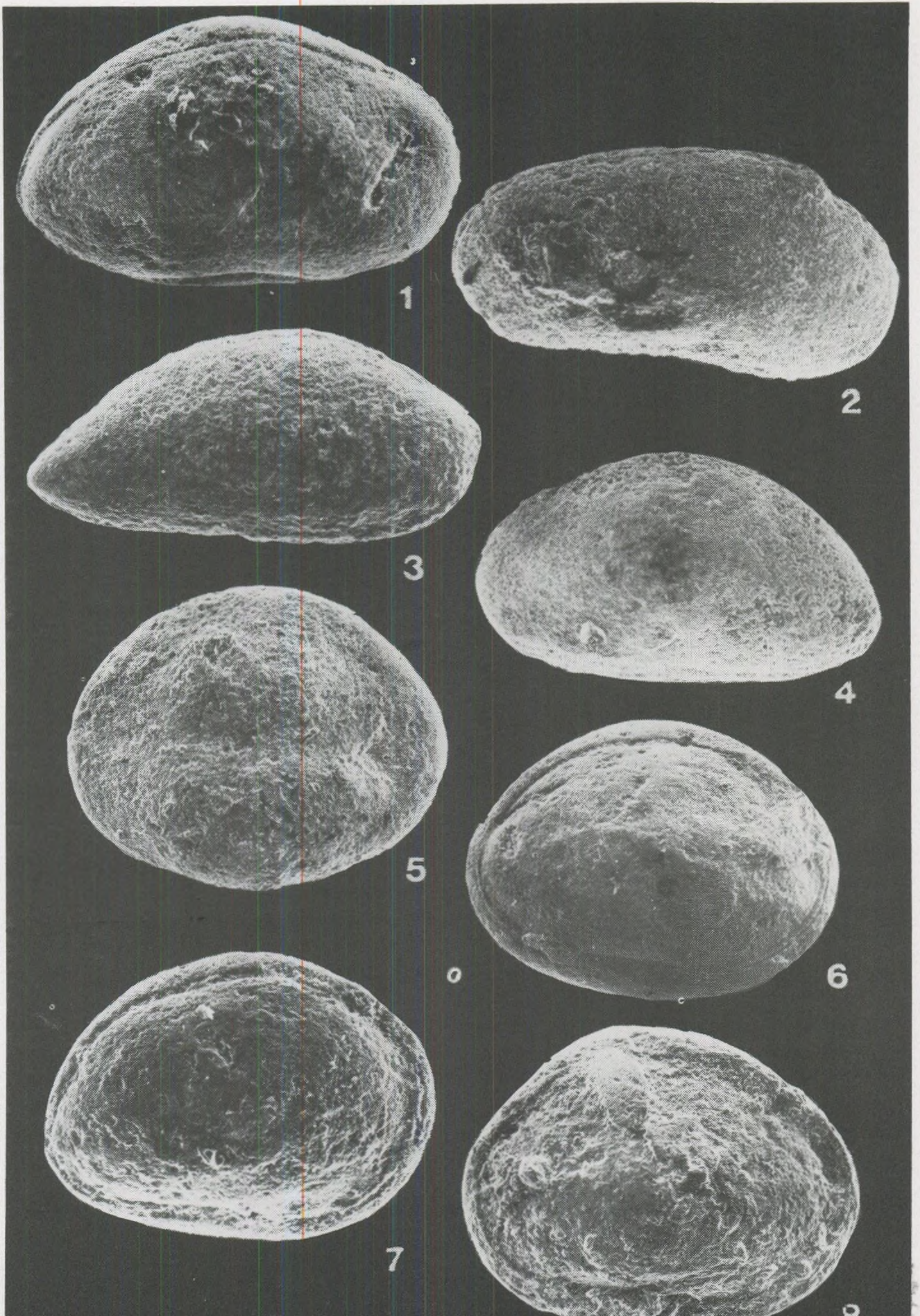
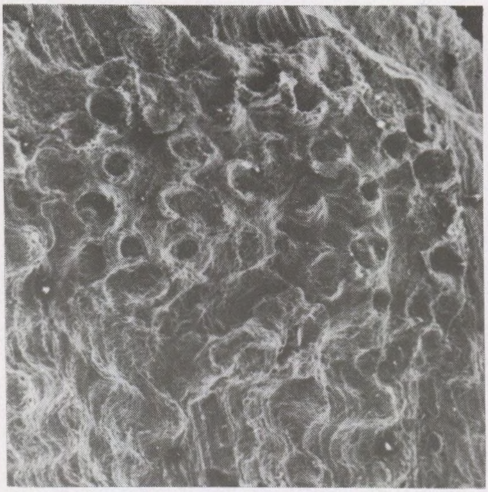


Plate 1



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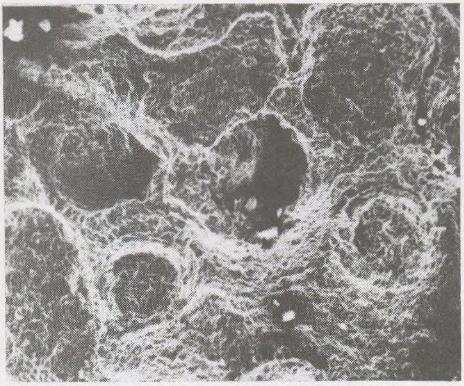

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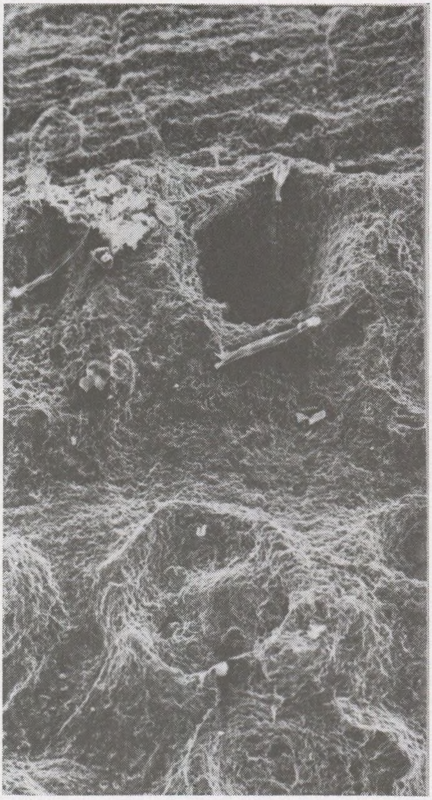

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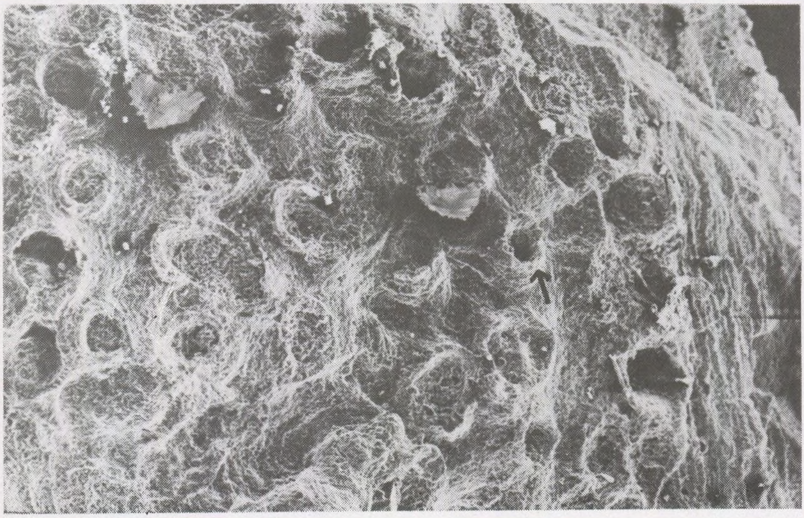

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Plate 2

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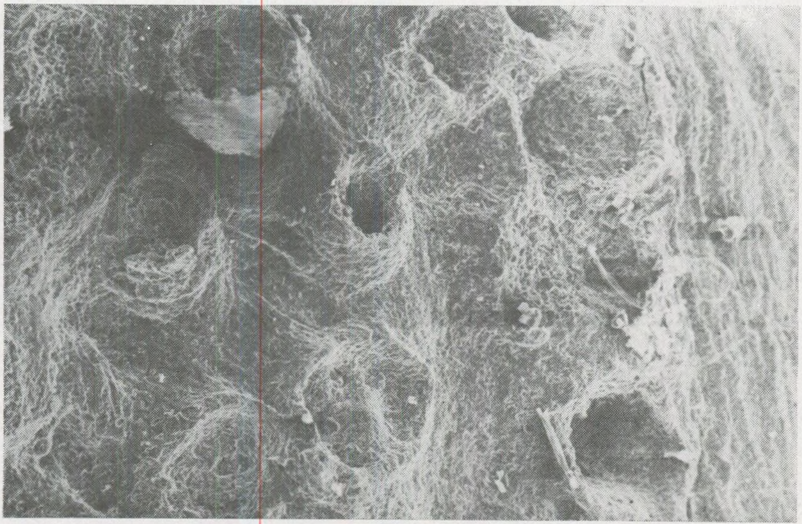

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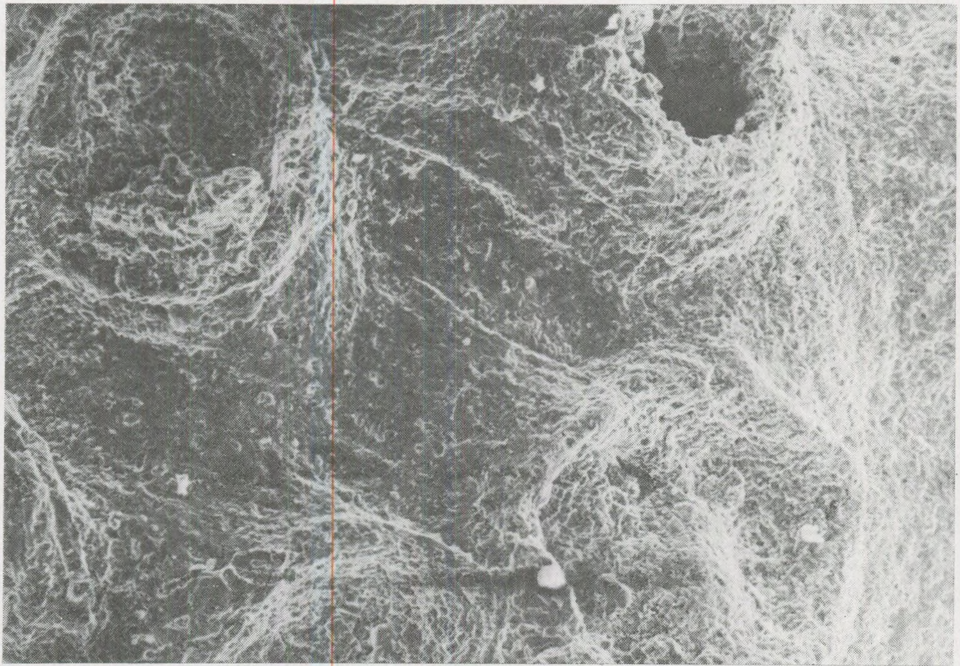
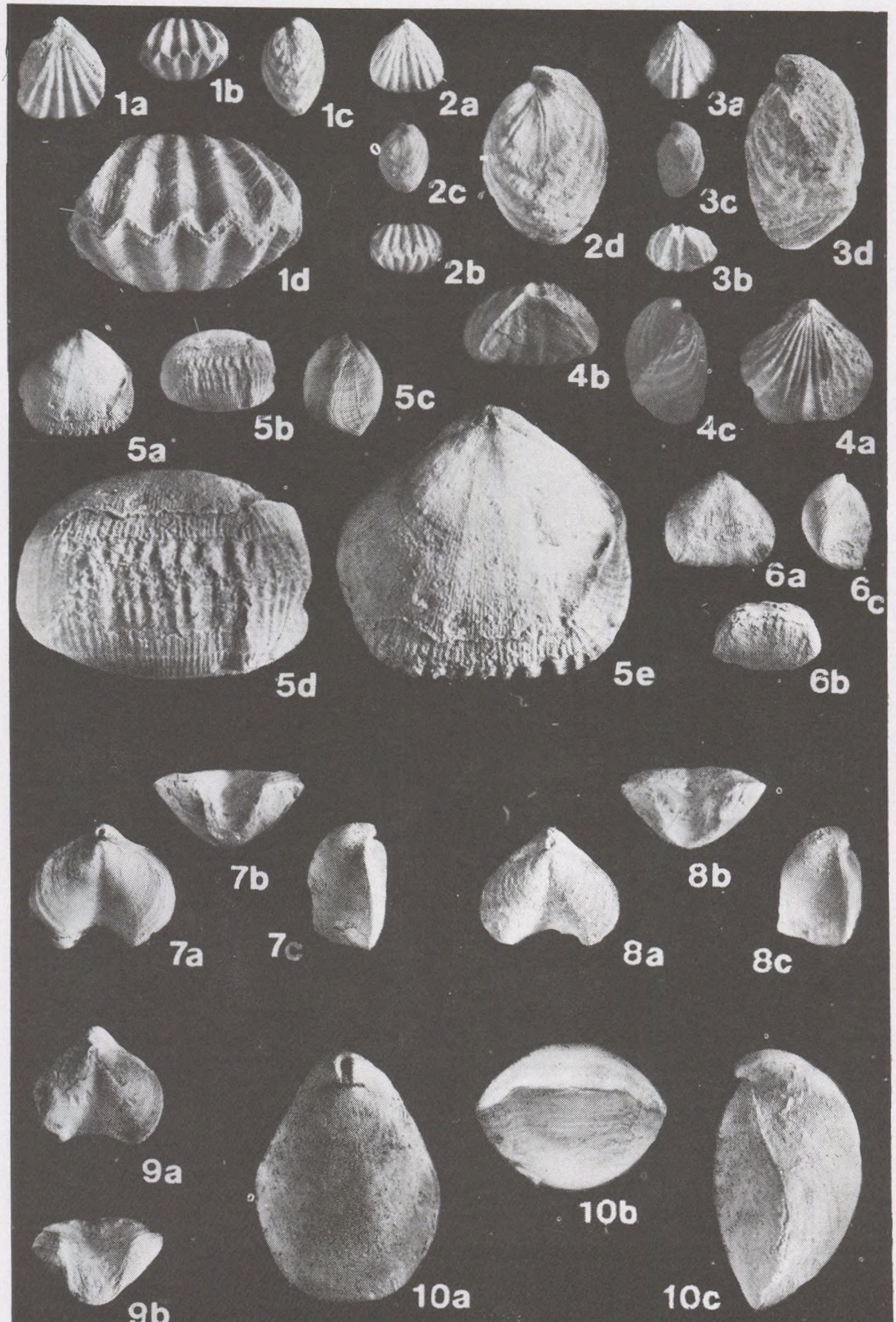


Plate 1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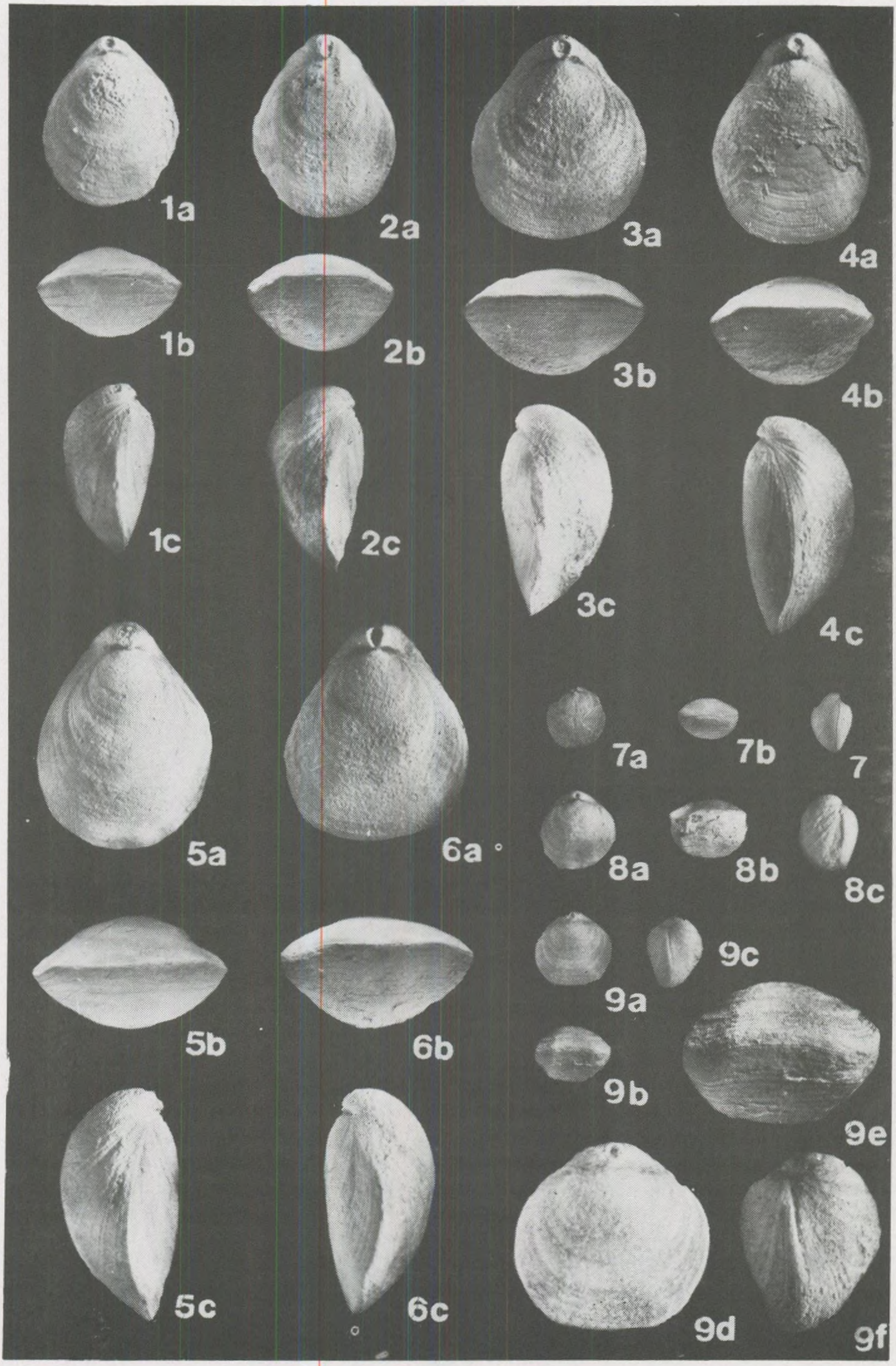
10c

Plate 2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9f

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