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# FORAMINIFERA ASSEMBLAGES OF THE BACKBULGE DEPOZONE FROM THE MOLDAVIAN PLATFORM - THE BASARABIAN -

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**Abstract.** The Moldavian Platform supported a foreland type basin evolution during the Sarmatian, as the last phase within the transformation of the Carpathian geosynclinal area. There have been found characteristic depozones (wedge top, foredeep, forebulge and backbulge) that due to some particular facial conditions allowed the evolution of some specific faunal assemblages. Within all non-biotic factors, the water salinity evolved towards a freshwater one, representing along with the sedimentary process, the main cause that had a great influence on the foraminifers associations. The backbulge depozone consisted in a distant area with pelits accumulations with mild land influences. Under the conditions, the foraminifers assemblages have a series of characteristic features. On the lower part of the accumulated deposits one can notice the prevalence of *Articulina*, while on the upper part predominant are *Miliolidae, Nonionidae* and *Elphididae* suggesting the Basarabian age.

**Keywords:** Foraminifera, Sarmatian depozones, Miocene, Moldavian Platform

## INTRODUCTION

The intra-Volhynian tectogenesis and possibly some effects of the intra-badenian one had a great impact over the Paratethys during Sarmatian. There had been a rearrangement of depozones within the Carpathian foreland. The phenomenon was due to the migration of the Carpathian Orogene towards east, over the Moldavian Platform, and took place within the interval Buglovian-Late Basarabian. The west-east migration of depositional conditions can be noticed on the calcareous and oolithic sandstones packages' distribution between the Valea Siretului and Izvoarele Bahluiului during the Early Basarabian (Fig. 1).

The sedimentation during the Volhynian–Late Basarabian was a process that took place under the control of the subsidence phenomenon orientated on a west-east direction by the orogene that emitted the last echoes of the moldavidic movements. The beginning of the morphogenesis process during the Late Basarabian, determined the sedimentation to be under the control of the subsidence from the Curvature Carpathians zone on a north-south direction.

Under these circumstances, an important quantity of pelites (clays, siltits, argillaceous sands etc.) specific to the backbulge depozone had been accumulated over a wide area of the Moldavian Platform.

The process activated over an important stratigraphical interval, from Buglovian, Volhynian (Dărăbani-Mitoc clays) and up to the beginning of the Late Basarabian (the *Cryptomactra* clays).

## GEOLOGICAL SETTING

The backbulge depozone functioned on the Moldavian Platform "behind" the zone correspondent to the carbonatic platforms, over an area delimited by the Siret and Prut rivers (Fig.1). The sedimentation, of a pelitic type, started in Buglovian and continued all the way to the Late Basarabian. First, the Darabani-Mitoc clays were accumulated during Buglovian and Volhynian, followed by the clays with *Cryptomactra*, as soon as the Basarabian began. For the last ones the name is due to the presence within the macrofauna assemblage of *Cryptomactra pesanseris* (MAYER-EYMAR 1857). The backbulge depozone represents the area that became the neritic-pelitic lithofacies according to the Moldavian Platform specialists.

## MATERIAL AND METHODS

The fossil material had been collected from several sites – Şipote, Bivolari, Comarna, Vlădiceni – covering the entire area of the backbulge depozone, within the Early Basarabian and the first part of the Late Basarabian. From the stratigraphical point of view, these sites have a succesive localisation: the Şipote samples are from the lower part of the clays with *Cryptomactra*, the Bivolari samples are placed above those from Şipote, the Comarna samples are from the median zone, while the clays with *Cryptomactra*, the Bivolari samples are placed above those from Şipote, the Comarna samples are from the median zone, while the Vlădiceni samples had been taken from the upper part (Fig. 2).

The samples from Şipote, Bivolari, Comarna, have been obtained from the drillings performed by SC Geomold SA Câmpulung Moldovenesc, while at Vlădiceni, the samples have been obtained from the industrial quarry of SC Ceramica SA Iasi, where the clays with *Cryptomactra* are exposed over 60m in thickness. The samples have been collected from the rocks drilled by equal distance of a 0.5m, except for the Vlădiceni quarry, where the distance between samples was of 10m.

The sampled material had been marked by standard methods: immersion in water and sieving. The disaggregated sediment was sieved on a 63 μm mesh. Fauna identifications had been done from the material of a >63 μm fraction. The photos had been

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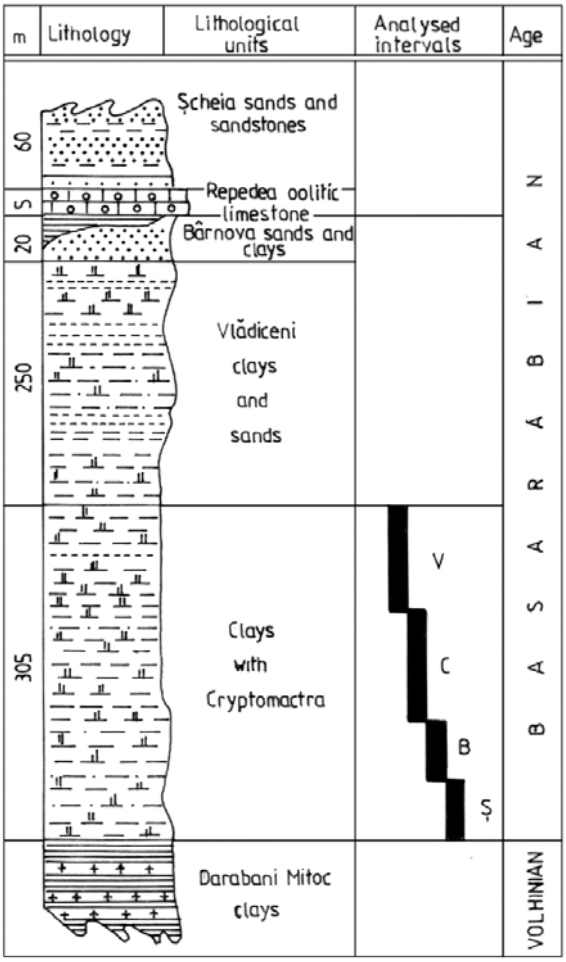
taken using a SEM microscope.

**Figure 1**
Lithological sketch for Volhynian-Basarabian



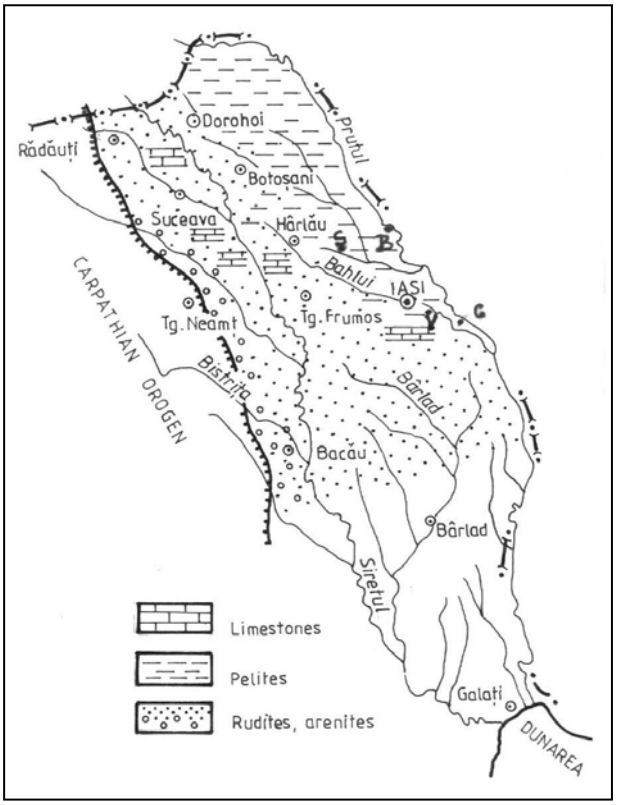




**Figure 2** – Basarabian lithological log with analysed intervals from the Backbulge depozone
V: Vlădiceni; C: Comarna; B: Bivolari; Ş: Şipote

**FORAMINIFERA ASSEMBLAGE**

The analysis of the samples begun with the lower part of the clays with *Cryptomactra* and ended with the material from the upper part.

At the Şipote drilling the samples interval is sited beneath the limit of underneath volhynian deposits– the Dărăbani-Mitoc clays–at 100-110m depth (0 to -10m absolute altitude). The microfauna is dominated by small sized *Articulina*: *Articulina problema* BOGDANOWICZ 1952, *Articulina articulinoides* GERKE & ISSAEVA 1952, *Articulina sarmatica* (KARRER 1877), followed by Miliolidae, of a lower frequency: *Quinqueloculina voloshinovae voloshinovae* BOGDANOWICZ 1947, *Quinqueloculina gracilis* KARRER 1867, *Quinqueloculina angustioris* BOGDANOWICZ 1952. The Elphides just as the Nonionids can be found extremly rare.

The analysis on the Bivolari samples considered the interval sited aprox. 30-50m above the limit with Volhynian deposits. Within the microfauna assemblage the following taxa can be frequently found: *Porosononion subgranosus hyalinum* BOGDANOWICZ 1960, *Elphidium aculeatum* d'ORBIGNY 1846, *Elphidium fichtelianum* d'ORBIGNY 1846, *Elphidium macellum macellum* FICHTEL & MOLL 1803, also maintained at a high frequency are the following taxa: *Articulina problema*, *Articulina sarmatica*, *Dogielina sarmatica* BOGDANOWICZ & DIDKOWSKI 1951 then *Quinqueloculina voloshinovae voloshinovae*, *Quinqueloculina circularis* BORNEMAN 1855, *Quinqueloculina reussi* BOGDANOWICZ 1947, *Quinqueloculina akneriana* d'ORBIGNY 1848, *Nonion bogdanowiczi* VOLOSHINOVA 1950. The tests are very well preserved, although they are of a small size. One can also notice the presence of reworked foraminifera (*Globigerina* sp., *Cibicides* sp.) with slight transport marks.

In the Comarna borehole, the samples have been

taked from 100-150m in depth respectively -65m to -115m absolute altitude. The sampled zone was considered as part of the middle sector of clays with *Cryptomactra*. Within the foraminifera assemblage the following taxa can be found at a high frequency: *Elphidium macellum macellum*, *Elphidium macellum tumidocamerale* BOGDANOWICZ 1932, *Elphidium crispum* (LINNÉ 1758), *Elphidium rugosum* (d'ORBIGNY) 1846, *Elphidium listeri* (d'ORBIGNY 1846), *Elphidium angulatum* (EGGER 1857), *Porosononion subgranosus subgranosus* (EGGER 1857), *Porosononion subgranosus hyalinum* BOGDANOWICZ 1960, *Porosononion martkobi* (BOGDANOWICZ 1947), *Nonion bogdanowiczi*, *Quinqueloculina consobrina consobrina* (d'ORBIGNY 1946), *Quinqueloculina consobrina nitens* (REUSS 1850), beside the low frequency and extremly rare taxa: A*mmonia beccarii* LINNÉ 1758, *Articulina problema*, *Dogielina sarmatica* etc. (Table 1). The majority of the foraminifera have a well-developed test, of a larger size from those from the lower part of the clays with *Cryptomactra*. By fossilisation all the characteristics had been very well preserved.

In the Vlădiceni quarry, the sampling was taken from the upper part of the clays with *Cryptomactra* at a 60-80m altitude. There have been found a rich foraminifera assemblage, with high frequency of the following taxa: *Porosononion subgranosus monogranulata* GERKE 1960*, Porosononion subgranosus umboelata* GERKE 1960, *Porosononion subgranosus hyalinum*, *Porosononion bessarabiensis* POPESCU 1995, then with medium frequency: *Elphidium listeri*, *Elphidium rugosum*, *Quinqueloculina angustioris*, *Quinqueloculina consobrina sarmatica* GERKE 1952, *Ammonia beccarii* etc.

**DISCUSSIONS AND CONCLUSIONS**

The Paratethys Sarmatian basin which functioned within the backbulge depozone during the Early Basarabian and the first part of the Late Basarabian had some complex paleomidal features. This situation was due to the fact that within this interval a platformic land had began to shape in the northern part of the Moldavian Platform. Also, an incipient hydrographic network appeared. In the western part of the platform the Carpathic Orogene continued its uplifting. All these processes echoed mainly in the sedimentology. The wedge top and foredeep depozones over accumulated, so that a great load of detritic material from the Orogene was driven over the backbulge depozone. This widespread material was of a fine, pelitic granulometry. Also the detritic material deriving from the erosion of the northern uplifted land was mainly of a pelitcal origin.

Within these conditions a few genera from the foraminifera assemblage developed in some areas by high frequency: *Articulina, Quinqueloculina, Elphidium, Porosononion, Nonion,* etc.

At the lower part of the clays with *Cryptomactra* (Şipote and Bivolari) one may notice the abundance, first, of the *Articulines*, then of the *Miliolids*, which are of a moderate frquency towards the median and upper part.

In the median and upper part of the clays with *Cryptomactra*, the following taxa have a high frequency: *Porosononion, Elphidium* and *Quinqueloculina* unlike *Articulines.*

The tests preserved by fossilisation prove a progressive decrease in size towards the upper part, much well evolved and very well preserved in the sediments. A certain britellness can be observed at some Miliolids' tests.

The analysis of the foraminifera assemblage shows the presence of some taxa characteristic for the Middle Sarmatian (Basarabian)– *Quinqueloculina voloshinovae voloshinovae*, *Quinqueloculina consobrina consobrina*, *Articulina problema, Dogielina sarmatica*, *Nonion bogdanowiczi*, *Porosononion bessarabiensis*, *Porosononion subgranosus subgranosus*, *Elphidium macellum macellum*. It has to be mentioned that the *Porosononion subgranosus hyalinum*, *Porosononion subgranosus umboelata*, *Porosononion subgranosus monogranulata* taxa had been found from Volhynian, but with an important development at the upper part of the clays with *Cryptomactra*.

The taxa: *Amonia beccarii*, *Articulina sarmatica*, Ar*ticulina problema*, *Nonion bogdanowiczi*, *Elphidium crispum*, *Elphidium rugosum* had been found in Volhynian, even Buglovian, but they are abundant in Basarabian. This situation is due only to some biotic factors, because an increase in the size of the individuals can be noticed.

Similar assemblages had been also found in other areas of the Moldavian Platform (Ionesi 1968, Paghida-Trelea 1969, Brânzilă 1998), but in slightly different biofacial conditions, just the same as it was recorded on the east side of Prut (Bobrinskaia 1981).

The analysis of the foraminifera assemblage within the clays with *Cryptomactra*, accumulated in the backbulge depozone of Carpathic foreland suggests the possibility of integrating it with the biozone with *Dogielina sarmatica* and *Sarmatiella moldaviensis* for the Early Basarabian and the first part of the Late Basarabian.

**Tabel 1** – The foraminifera distribution in the sampled sites

| Species | Şipote | Bivolari | Comarna | Vlădiceni |
|---|---|---|---|---|
| *Quinqueloculina consobrina consobrina* d'ORBIGNY | ■ | ■ | ■ | |
| *Quinqueloculina consobrina nitens* REUSS | ■ | ■ | | |
| *Quinqueloculina consobrina sarmatica*GERKE | ■ | ■ | ■ | ■ |
| *Quinqueloculina voloshinovae voloshinovae* BOGDANOWICZ | ■ | ■ | ■ | ■ |
| *Quinqueloculina voloshinovae ukrainica* DIDKOWSKI | | ■ | ■ | |
| *Quinqueloculina gracilis* KARRER | ■ | ■ | | |
| *Quinqueloculina angustioris* BOGDANOWICZ | ■ | ■ | | |
| *Quinqueloculina circularis* BORNEMAN | ■ | | | |
| *Quinqueloculina reussi* BOGDANOWICZ | ■ | | | |
| *Quinqueloculina aknerianad*'ORBIGNY | ■ | | | |
| *Articulina problema* BOGDANOWICZ | ■ | ■ | | |
| *Articulina sarmatica*KARRER | ■ | ■ | | |
| *Articulina articulinoides* GERKE et ISSAEVA | ■ | ■ | | |
| *Meandroloculina litoralis* BOGDANOWICZ | ■ | ■ | ■ | |
| *Dogielina sarmatica* BOGDANOWICZ & VOLOSHINOVA | ■ | ■ | | |
| *Nonion bogdanowiczi* VOLOSHINOVA | ■ | ■ | | |
| *Amonia beccarii* LINNÉ | ■ | ■ | ■ | ■ |
| *Porosononion subgranosus subgranosus* EGGER | | ■ | ■ | ■ |
| *Porosononion subgranosus hyalinum* BOGDANOWICZ | | | ■ | ■ |
| *Porosononion subgranosus monogranulata* GERKE | | | | ■ |
| *Porosononion subgranosus umboelata* GERKE | | | | ■ |
| *Porosononion martkobi* BOGDANOWICZ | ■ | ■ | | |
| *Porosononion bessarabiensis* POPESCU | | | ■ | ■ |
| *Elphidium macellum macellum* FICHTEL & MOLL | | ■ | ■ | |
| *Elphidium macellum tumidocamerale* BOGDANOWICZ | | | ■ | ■ |
| *Elphidium crispum* LINNÉ | | ■ | ■ | |
| *Elphidium multacamerum* KRASHENINIKOV | | | ■ | ■ |
| *Elphidium angulatum* EGGER | | ■ | ■ | ■ |
| *Elphidium laloviensis* VENGLINSKI | | | ■ | ■ |
| *Elphidium salebrosum* SEROVA | | | ■ | ■ |
| *Elphidium rugosum* d'ORBIGNY | | | ■ | ■ |
| *Elphidium subumbilicatum* d'ORBIGNY | | | ■ | ■ |
| *Elphidium poyeanum* d'ORBIGNY | | | ■ | ■ |
| *Elphidium fichtelianum* d'ORBIGNY | | | ■ | ■ |
| *Elphidium listeri* d'ORBIGNY | | ■ | ■ | |
| *Elphidium aculeatum* d'ORBIGNY | ■ | ■ | ■ | |

**REFERENCES**


Bobrinskaia, O.G. 1981, Kompleksi formaninifer v otlojenii sarmat Moldavii. *Biostratigrafia antropoghena i neoghena iugozapadna*, *SSSR, Akademia Nauk MSSR,* Izdatelstvo Stiinta, Chisinău.

Brânzilă, M. 1997, Contributions to the establishment of the age of „*Cryptomactra* clays" of the Moldavian Platform. *Acta Paleontologica Romaniae 1*, p.134-137, Bucureşti.

Brânzilă, M. 2002, Litofacial evolutions within the Moldavian Platform during Sarmatian and their influences on macrofauna associations. *Acta Paleontologica Romaniae 3*, p.33-40, Iaşi.

Ionesi, B. 1968, Stratigrafia depozitelor miocene de platformă dintre valea Siretului şi valea Moldovei. Editura Academiei Române, 391pag. 41Pl , Bucureşti.

Ionesi, B. 1998, Microfaune des argiles d'Ungheni (Col. Th. Văscăuţanu, 1929). *Analele Universităţii „Al. I. Cuza" Iaşi Geologie* T. XLIV, Iaşi

Grasu C., Brânzilă M., Miclăuş Crina & Bobos I., 2002, Sarmaţianul din sistemul bazinelor de foreland ale Carpaţilor Orientali. 407 pag., Editura Tehnică Bucureşti.

Paghida-Trelea N. 1969, Microfauna Miocenului dintre Siret şi Prut. 350pag., Editura Academiei Române, Bucureşti.

## PLATES

### PLATE I

Fig 1. *Quinqueloculina voloshinovae voloshinovae* BOGDANOWICZ, x250
Fig 2,3. *Quinqueloculina voloshinovae ukrainica* DIDKOWSKI, x240, x340
Fig 4. *Quinqueloculina consobrina consobrina* d'ORBIGNY, x240
Fig 5. *Quinqueloculina consobrina nitens* REUSS, x300
Fig 6. *Quinqueloculina consobrina sarmatica* GERKE, x125
Fig 7. *Articulina sarmatica* (KARRER), x166
Fig 8. *Articulina bidentata costata* DIDKOWSKI, x150
Fig 9. *Meandroloculina litoralis* BOGDANOWICZ, x166
Fig 10.*Dogielina sarmatica* BOGDANOWICZ et VOLOSHINOVA, x147

### PLATE II

Fig 1-4. *Nonion bogdanowiczi* VOLOSHINOVA, x280, x220, x280
Fig 5. *Ammonia beccarii* (LINEÉ), x280
Fig 6. *Porosononion subgranosus subgranosus* (EGGER), x220
Fig 7-9. *Porosononion subgranosus monogranulata* GERKE, x280,x270,x230

### PLATE III

Fig 1,2. *Porosononion subgranosus monogranulata* GERKE, x190, x230
Fig 3,4. *Porosononion subgranosus umboelata* GERKE, x230, x190
Fig 5. *Porosononion subgranosus hyalinum* BOGDANOWICZ, x190
Fig 6. *Porosononion martkobi* BOGDANOWICZ, x280
Fig 7. *Porosononion bessarabiensis* POPESCU, x210

### PLATE IV

Fig 1,2. *Elphidium macellum macellum* FICHTEL et MOLL, x170,x170
Fig 3. *Elphidium multacamerum* KRASHENINIKOV, x260
Fig 4. *Elphidium poyeanum* (d'ORBIGNY), x320
Fig 5. *Elphidium aculeatum* (d'ORBIGNY), x150
Fig 6. *Elphidium listeri* (d'ORBIGNY), x240
Fig 7. *Elphidium laloviensis* VENGLINSKI, x340
Fig 8. *Elphidium salebrosum* SEROVA, x370
Fig 9. *Elphidium subumbilicatum* (CZJZEK), x350
Fig 10. *Elphidium angulatum* (EGGER), x240
Fig 11. *Elphidium crispum* (LINEÉ), x120
Fig 12. *Elphidium macellum tumidocamerale* BOGDANOWICZ, x150

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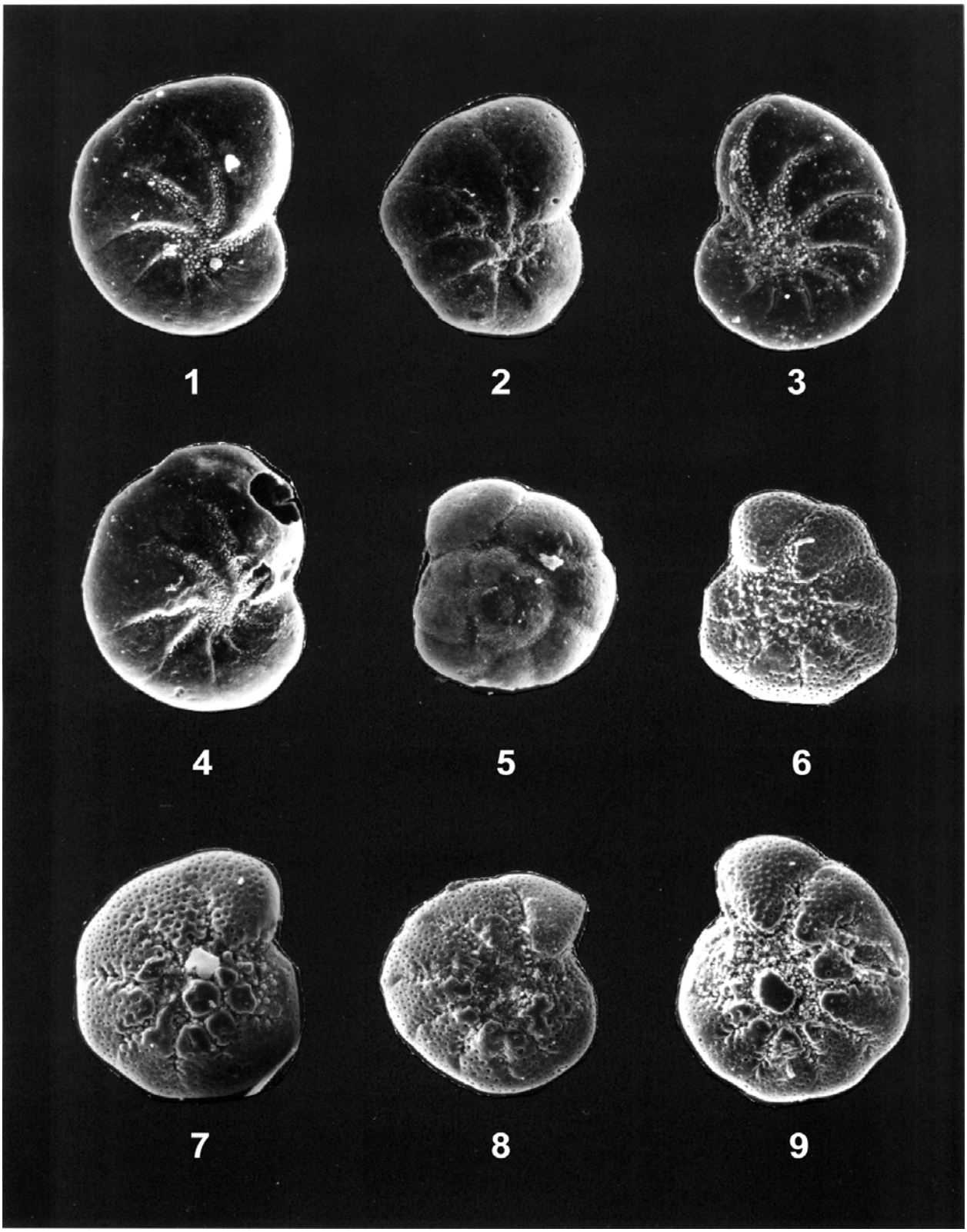
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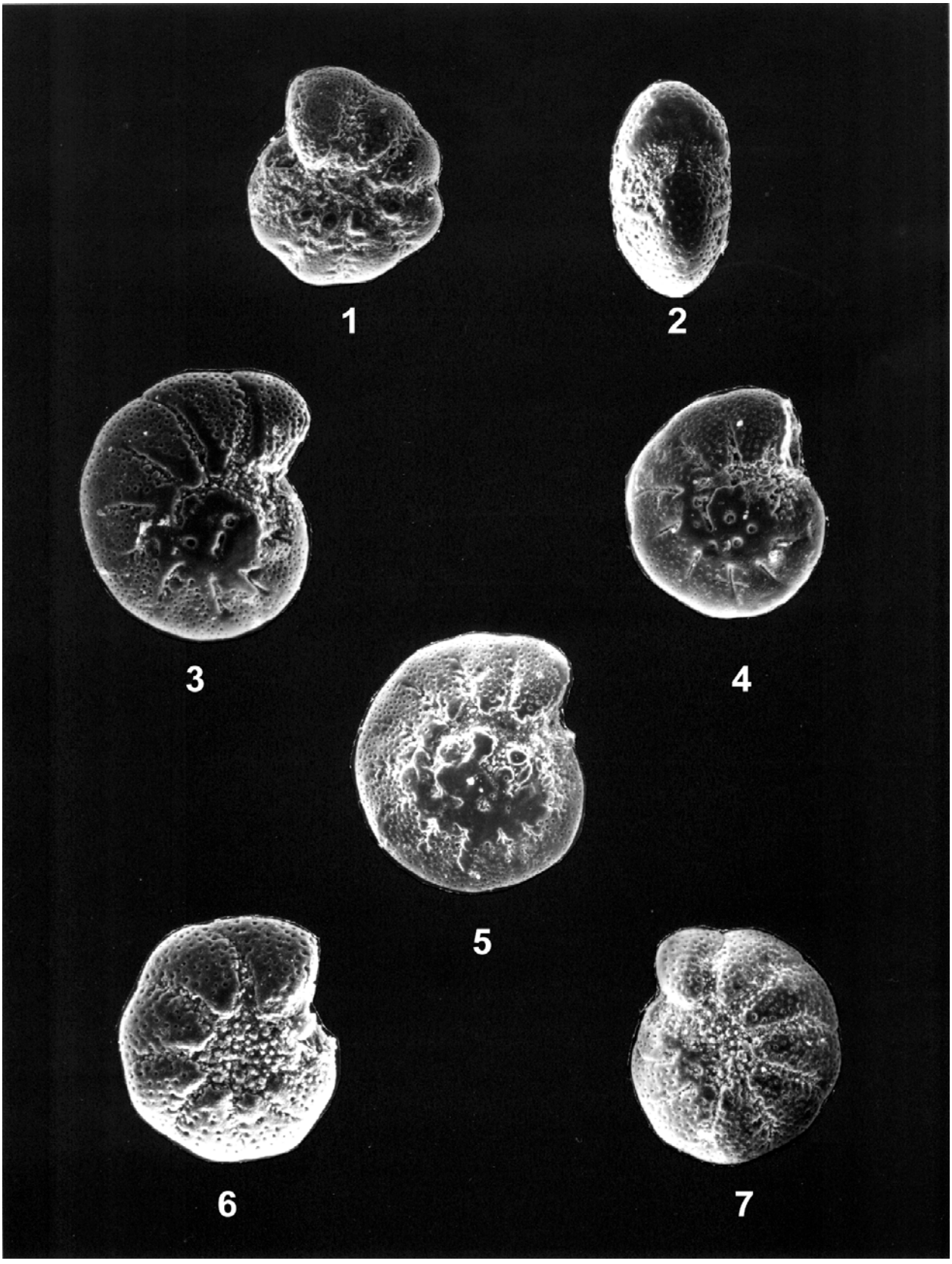
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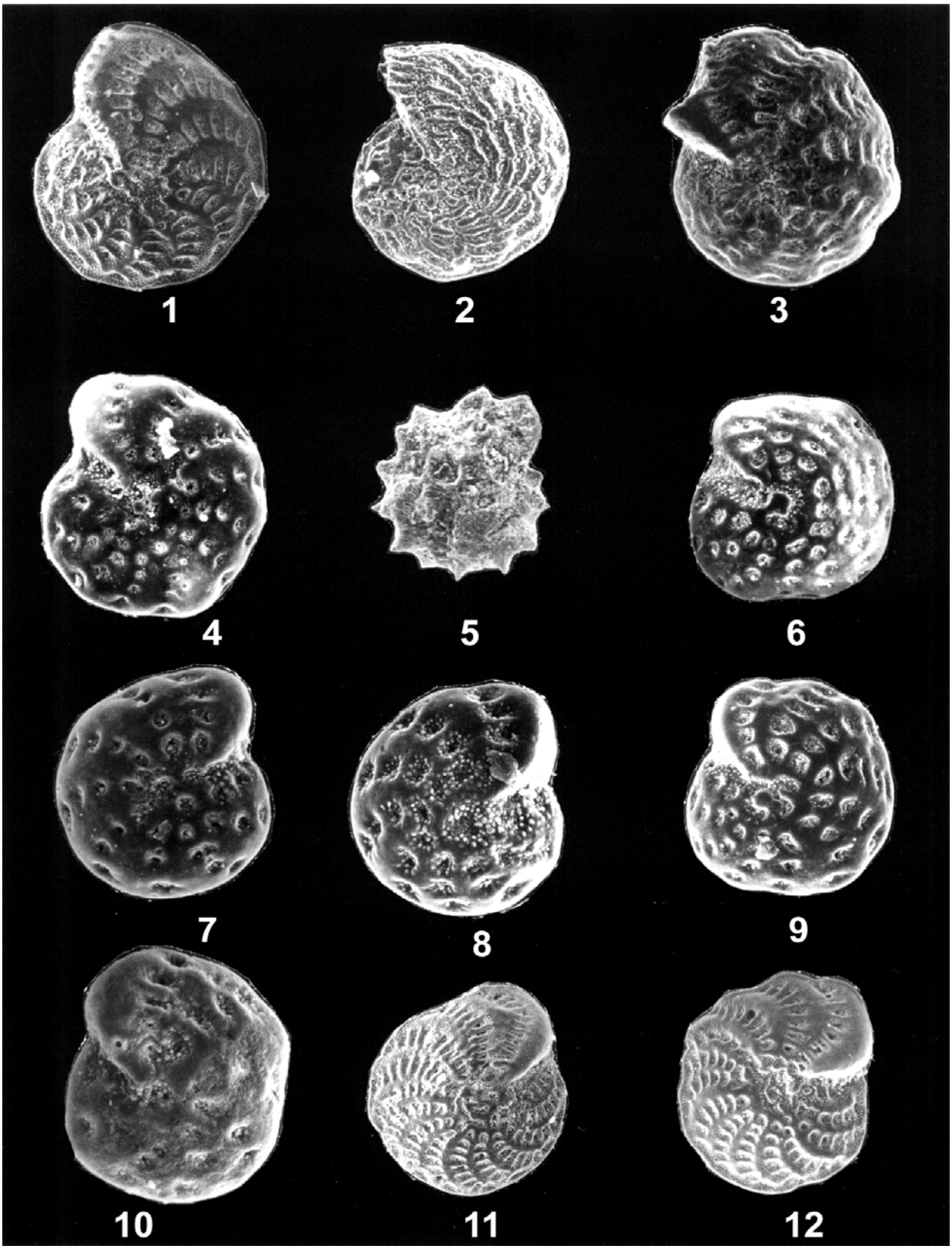
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