STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOLOGIA, XLV, 2, 2000

THE PRESENCE OF LOWER MIOCENE (EGGENBURGIAN) IN BOREHOLE 575 CETEA (EAST OF BOROD BASIN, NWrn ROMANIA)

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ABSTRACT. The microfloral record evidenced in borehole 575 Cetea is very rich, consisting of 114 taxa, some of them being new species for the Tertiary of Romania. At the same time, it includes species of Eggenburgian age of the host rocks. The whole microflora assemblage suggests a forest-type vegetation developed in a warm, subtropical climate, characteristic for the Eggenburgian age of the Early Miocene. The Eggenburgian of Romania shows the same microfloral features as the Eggenburgian of Central Paratethys.

Keywords: microflora, Early Miocene (Eggenburgian), Borod Basin, NWrn Romania

Introduction

Borod Basin, located in the western part of the Apuseni Mountains, between the Plopiş Mountains (to the north) and the Pădurea Craiului Mountains (to the south) had a particular evolution during the Neogene, as compared to the basins in the neighborhood (Şimleu and Beiuş). The specific features are evidenced by the biostratigraphic aspects, which are not yet completely understood. The studies performed in the last half of the 20th century lead to controversies concerning the age of the oldest Neogene deposits in this basin.

Givulescu (1957) has admited that this area could function as a sedimentation basin during Badenian. Still, the author considered that the Badenian deposits are missing, being eroded; thus the oldest sediments in the area are of a Sarmatian age. The fauna collected from the Lupului Brook (a tributary of Băița Valley) containing *Ostrea digitalina* DUB., *O. cochlear* POLLI (=*Neopycnodonte navicularis* (BROCCHI)),*Crassostrea cf. crassissima* LAM., *Natica helicina* LAM., can be considered as reworked in the basal part of the Sarmatian deposits. Paucă et al., (1968) and Istocescu & Istocescu (1974) considered that the oldest sediments in the basin belong to the Badenian. As support for this opinion, the authors mentioned the small outcrop of white marls in the right slope of Mîşca Valley as well as the mollusks mentioned by Givulescu (considered as reworked in the base of the Sarmatian).

In 1973 Şuraru & Şuraru described macro- and microfauna from the outcrops located between the Cetea and Băița Valleys. The assemblage is

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considered by the authors to be almost identical with those described in the Eggenburgian faciostratotypes from Central Paratethys; thus, they considered this fact as an unequivocal argument for the presence of Eggenburgian. Moreover, the authors extended the chronostratigraphic interval to Eggenburgian-Lower Ottnangian. This is due to the presence of some taxa that are common to the fauna in the basal part of the Hida Formation that were attributed by Şuraru (in Şuraru & Gheorghian, 1971) to the Ottnangian.

The presence of Eggenburgian in the Borod Basin was documented by using macrofauna by Nicorici et al., 1977, Moisescu (in Marinescu et al., 1980 and Papaianopol et al., 1984; 1990), Popa (in Popa et al., 1997 and Popa & Chira, 1999).

Biostratigraphy of deposits from Cetea – Borozel

Borehole 575 is located on Cetea Valley (Fig. 1) and it crossed deposits belonging to the Borod Formation in the interval 290,00-75,00 m. These sediments mainly consist of grey-blackish silty, fossiliferous marls, green to blackish clays interbedded with sand, sandstone, microconglomerate, and coal. In the interval 75,00-15,00 m the sediments of Cornițel Formation (Popa, 2000), consisting of greenish sandstone and microconglomerate, compact grey fossiliferous marls with intercalations of carbonate laminas in the upper part were intercepted (Fig. 2).

The ***macrofauna*** collected from the Borod Formation is rich and well preserved. Popa (in Popa & Chira, 1999) separated three assemblages: *Pirenella-Theodoxus-Tympanotonos, Turritella-Anadara,* and *Alvania-Ringicula-Pyramidella* (Fig. 2).

Only gastropod opercula were identified in the interval 290-219 m. In the interval 190-182 m the *Pirenella-Theodoxus-Tympanotonos* assemblage is present and mainly contains gastropods as *Pirenella plicata* div. ssp. and *Tympanotonos margaritaceus grateloupi* d'ORBIGNY. In the Central Paratethys these taxa are known only from deposits which are not younger than the Eggenburgian. The assemblage is typical for shallow, well oxygenate brackish environments.

The *Turritella-Anadara* assemblage separated between 174-172 m, contains gastropods from the *Pyramidellidae* family. Beside it represents a normal marine salinity assemblage.

A fauna containing small sized bivalves and gastropods separated as the *Alvania-Ringicula-Pyramidella* assemblage characterizes a wide interval between 148 and 94 m. The following identified taxa within this assemblage are known in Central Paratethys only from Badenian deposits: *Obsoletiforma kokkupica* (ANDR.), *Alvania venus danubiensis* COSSM. & PEY., *A. montagui ampulla* (EICHW.), *Turritella* cf. *partschi* ROLLE, *Cerithiopsis tubercularis astensis* COSSM., *Odostomia dispar* BOETT., *O. perrara* BOETT., *O. subintermedia* (COSSM. & PEY.), *Eulimella nitidissima* (MONT.), *Chrysallida interstincta* (MONT.), *C. sacyi* (COSSM. & PEY.), *Turbonilla scala* (EICHW.), and *Ringicula costata* (EICHW.).

Based on the stratigraphic distribution of the studied macrofauna, Popa (in Popa & Chira, 1999) attributed the deposits of the Borod Formation to the Eggenburgian-Badenian interval.

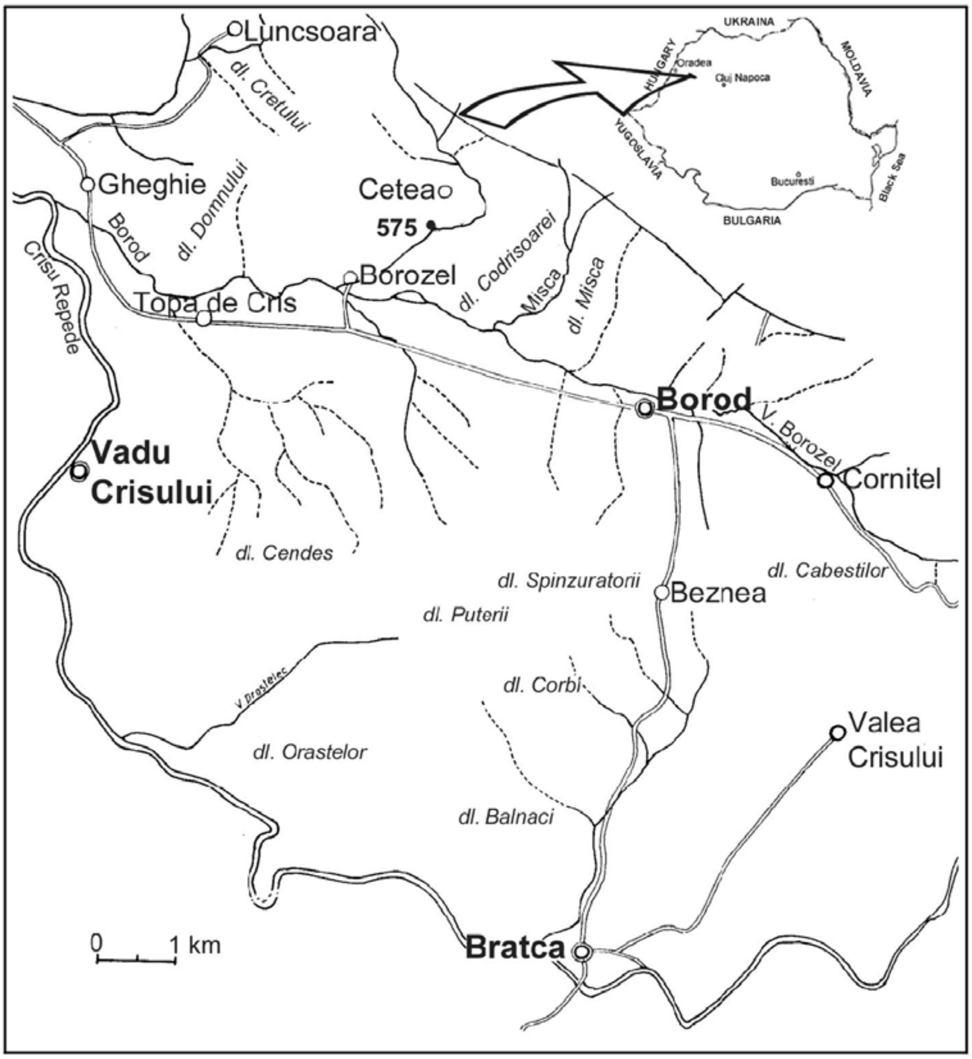

Fig. 1 Location of the 575 borehole

The ***nannoplankton*** assemblage are relatively scarce (Chira in Popa & Chira, 1999). This interval with gastropod opercula is practically depleted. The samples collected from the interval with *Pirenella-Theodoxus-Tympanotonos* assemblage contained only two species, *Cyclicargolithus* cf. *floridanus* (Roth & Hay 1967) and *Sphaenolithus* cf.*abies* Deflandre. The richest assemblage was identified in the interval with *Turritella-Anadara* and it contains *Helicosphaera ampliaperta* Bramlette & Wilcoxon 1967, the index species for NN4 biozone (Martini, 1971). The same species is present also in the interval corresponding to the *Alvania-Ringicula-Pyramidella* assemblage. In the above mentioned two intervals, the species *Calcidiscus leptoporus* (Murray & Blackman 1898) Loeblich & Tappan 1978, considered by Mărunțeanu

(1992) as the index species for subzone NN4b, and *Geminilithella rotula* (Kampner, 1956), species considered by Mărunţeanu (1999) as an index for subzone NN5a, were also noticed. However, the latter species is not accompanied by *Sphaenolithus heteromorphus* Deflandre*,* the index species for NN5 zone (Martini, 1971), thus the presence of Badenian cannot be documented with confidence.

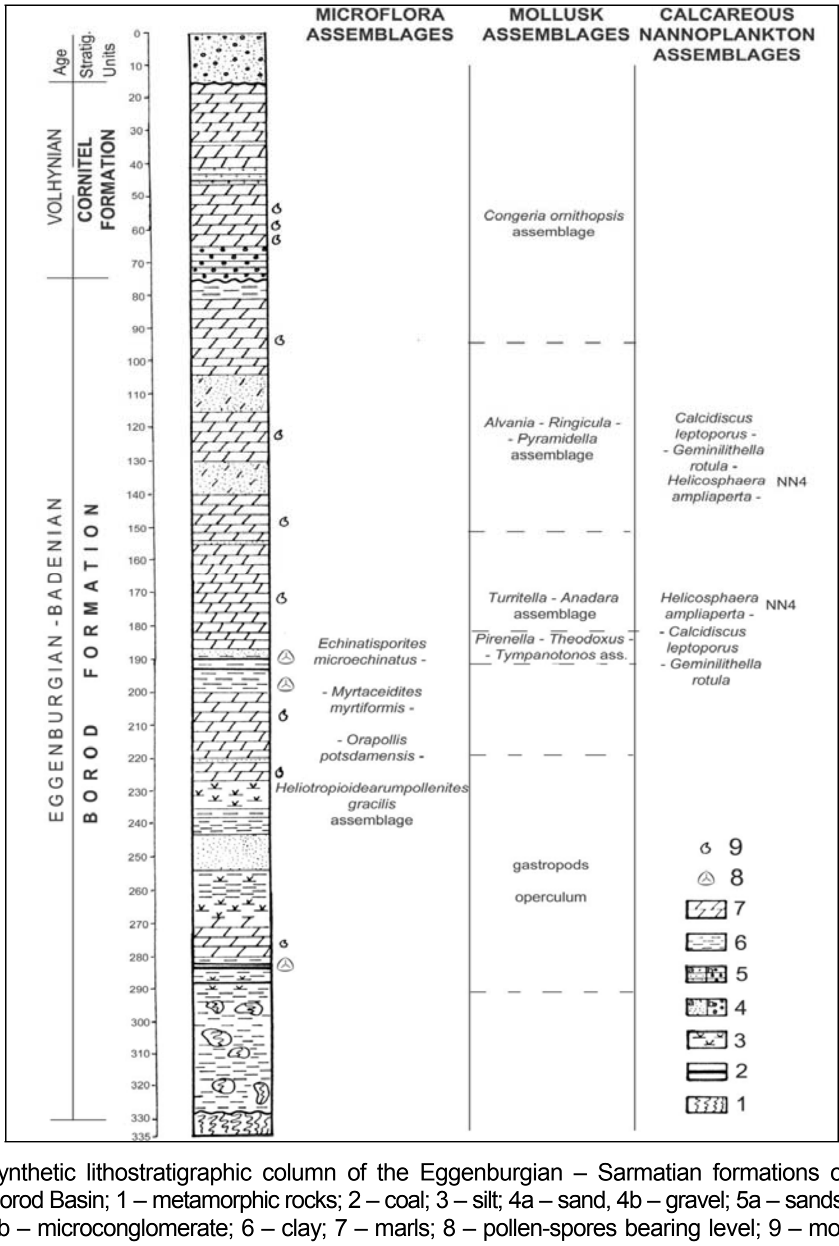

Fig. 2 Synthetic lithostratigraphic column of the Eggenburgian – Sarmatian formations of the Borod Basin; 1 – metamorphic rocks; 2 – coal; 3 – silt; 4a – sand, 4b – gravel; 5a – sandstone, 5b – microconglomerate; 6 – clay; 7 – marls; 8 – pollen-spores bearing level; 9 – mollusc-bearing level.

Based on the nannoplankton assemblages, the age of the Borod Formation is Ottnangian, probably Lower Badenian (Chira in Popa & Chira, 1999).

In the neighborhood of Cetea and Borozel localities, the ***microfloral assemblages*** in five boreholes were studied (Petrescu & Nicorici, 1977). This study evidenced rich spore-pollen assemblages in the Eggenburgian-Badenian deposits, dominated by juglandaceeans, sapotaceeans, and nyssaceeans. Among the most frequent taxa are: *Triatripollenites coryphaeus microcoryphaeus, T. c. punctatus, Tetracolporopollenites* div. sp*., Inaperturopollenites hiatus, Tricolporopollenites kruschi, T. cingulum, T. microhenrici, T. megaexactus, Triatripollenites myricoides.* A significant amount (20–35%) of reworked Cretaceous grains was noticed, in a similar way as in the calcareous nannoplankton assemblages.

Palynological study

Recently (Petrescu et al., 1999) we described few palynological rarities from Lower Miocene (Eggenburgian) from Cetea–Borod.

25 samples (clays in general) were collected and correspondingly prepared for extracting microflora from the Lower Miocene sequence – attributed to this age based on previous macrofauna and nannoplankton data. Unfortunately, a significant part of the core samples did not preserve a convincing microflora. A satisfactory palynological record was preserved in the samples from 281.5 m; 194.5 m and 187.5m. Only sample at m. 185.9 preserved a rich microflora – and most of the following data are based on the study of this sample.

Table 1 presents the record of the identified microflora.

Tab.1

TAXA	FREQUENCY
CHLOROPHYTA	
1. *Botryococcus* sp.	●
PTERIDOPHYTA.	
1. *Leiotriletes maxoides maxoides* W. Kr. 1962	○
2. *Leiotriletes maxoides minoris* W. Kr. 1962	○
3. *Leiotriletes* asp. *microsinuosoides* W. Kr. 1962	○
4. *Leiotriletes triangulus* (Murr.-Pf. 1952 ex.Kr. 1953) W. Kr. 1962	○
5. *Neogenisporis* sp.	○
6. *Undulatisporites* sp.	○
7. *Corrugatisporites corruvallatus* (W. Kr. 1967) Nagy 1985	●
8. *Corrugatisporites multivallatus* (W. Kr. 1959) Planderova 1990	●
9. *Corrugatisporites* sp.	●●
10. *Foveotriletes verrucatoides* W. Kr. 1962	●
11. *Foveotriletes* sp.	○
12. *Favoisporis trifavus* W. Kr. 1959	○
13. *Baculatisporites* gr. *primarius* (Wolff 1934) Th. et Pf. 1953	○
14. *Lusatisporis punctatus* W. Kr. 1963	○
15. *Echinatisporites cycloides* W. Kr. 1963	○
16. *Echinatisporites microechinatus* W. Kr. 1963	○
17. *Echinatisporites miocaenicus* W. Kr. 1963	○
18. *Laevigatisporites gracilis* Wilson et Webster 1946	○
19. *Laevigatisporites haardti* (Pot. et Ven. 1934) Th. et Pf. 1953	●●
20. *Laevigatisporites pseudodiscordatus* W. Kr. 1959	○
21. *Extrapunctatosporis alveolatus* (Couper 1960) W. Kr. 1967	○
22. *Extrapunctatosporis megapunctos* W. Kr. 1959	○
23. *Perinomoletes spicatus* Nagy 1973	●

TAXA	FREQUENCY
24. *Echinatisporites* sp.	●
25. *Verrucatosporites alienus* (Pot. 1931) Th. et Pf. 1953	○
26. *Verrucatosporites clatriformis* (Murr.- Pf. 1952) W. Kr. 1967	○
27. *Verrucatosporites favus* (Pot. 1931) Th. et Pf. 1953	●●
28. Verrucatosporites megabalticus W. Kr. 1967 *megabalticus* n. sfsp.	○
29. Verrucatosporites cf. potoniei (Nagy 1969) n.c.	○
30. *Polypodiaceoisporites corrutoratus* Nagy 1985	●
31. *Polypodiaceoisporites cyclocingulatus* W. Kr. 1967	●
32. *Polypodiaceoisporites gracillimus* Nagy 1963	●
33. *Polypodiaceoisporites hidasensis* Nagy 1969	○
34. *Polypodiaceoisporites lusaticus* W. Kr. 1967	●
35. *Polypodiaceoisporites mecsekensis* Nagy 1969	○
36. *Polypodiaceoisporites pauciornatus* Nagy 1985	○
37. *Polypodiaceoisporites saxonicus* W. Kr. 1967	○
38. *Polypodiaceoisporites verrucosus* Nagy 1969 *megaverrucosus* n. sfsp.	○
39. *Undulozonosporites* sp.	○
GYMNOSPERMATOPHYTA. CHLAMIDOSPERMATOPSIDA	
1. *Ephedripites* (D.) cf. *claricristatus* (Shakmundes 1965) W. Kr. 1970	○
GYMNOSPERMATOPHYTA. CONIFEROPSIDA	
1. *Sequoiapollenites gracilis* W. Kr. 1971	○
2. *Sequoiapollenites megaligulus* W. Kr. 1971	○
3. *Sequoiapollenites polyformosus* Thg. 1937	○
4. *Inaperturopollenites concedipites* (Wodeh. 1933) W. Kr. 1971	○
5. *Inaperturopollenites verrupapillatus* Trevisan 1967	○
6. *Cupressacites bockwitzensis* W. Kr. 1971	●
7. *Podocarpidites libellus* (Pot. 1931) W. Kr.1971	○
8. *Abiespollenites cedroides* (Thomson 1953) W. Kr. 1971	○
9. *Abiespollenites* sp.	○
10. *Cedripites crassiundulicristatus* (Trevisan 1967) W. Kr. 1971	●
11. *Cedripites cf. miocaenicus* W. Kr. 1971	●
12. *Pityosporites microalatus* (Pot. 1931) Th. et Pf. 1953	●●
13. *Pityosporites labdacus* (Pot. 1931) Th. et Pf. 1953	○
14. *Pityosporites latisaccatus medius* Trevisan 1967	○
15. *Pityosporites longus* (Nagy 1985) n.c.	○
16. *Pityosporites pristinipollinius* (Trav. 1955) W. Kr. 1971	○
17. *Pityosporites scopulipites* (Wdh. 1933) W. Kr. 1971	○
18. *Piceapollenites neogenicus* (Nagy 1969)	○
ANGIOSPERMATOPHYTA. MONOCOTYLEDONATAE	
1. *Sparganiaceaepollenites polygonalis* Thg. 1937	●
2. *Sparganiaceaepollenites sparganioides* (Meyer 1956) W. Kr. 1970	○
3. *Monocolpopollenites tranquillus* (Pot 1934) Th. et Pf. 1953	●
4. *Monocolpopollenites arcuatus* n. sp.	○
5. *Arecipites parareolatus* (W. Kr. 1958) W. Kr. 1970	○
6. *Arecipites* gr. *pseudoconvexus* W. Kr. 1970	○
7. *Arecipites* sp.	○
8. Dicolpopollis kockeli Pflanzl 1956	○
ANGIOSPERMATOPHYTA. DICOTYLEDONATAE	
1. *Magnolipollis neogenicus major* W. Kr. 1970	○
2. *Gothanipollis gothani crucis* W. Kr. 1959	○
3. *Myrtaceidites myrtiformis* Simoncsics 1964	●
4. *Triatriopollenites myricoides* (Kremp 1950) Th. et Pf. 1953	●
5. *Triatriopollenites bituitus* (Pot. 1931) Th. et Pf. 1953	○

TAXA	FREQUENCY
6. *Triatriopollenites rurensis* Th. et Pf. 1953	○
7. *Engelhardtioidites microcoryphaeus* (Pot. 1931) Thomson et Thg. ex Pot. 1960	●●
8. *Momipites punctatus* (Pot. 1931) Nagy 1969	●
9. *Platycaryapollenites miocaenicus* Nagy 1969	○
10. *Plicatopollis plicatus* (Pot. 1934) W. Kr. 1962	○
11. *Caryapollenites simplex* (Pot. 1931) W. Kr. 1960	●●
12. *Pterocaryapollnites stellatus* (Pot. 1931) Thg. 1937	○
13. *Ulmipollenites undulosus* Wolff 1934	○
14. *Zelkovaepollenites thiergarti* Nagy 1969	○
15. *Trivestibulopollenites betuloides* Pflug 1953	○
16. *Alnipollenites verus* (Pot. 1931) Pot. 1934	●
17. *Salixpollenites densibaculatus* Nagy 1969	○
18. *Intratriporopollenites instructus* (Pot. 1931) Th. et Pf. 1953	○
19. *Intratriporopollenites insculptus* Mai 1961	○
20. *Reevesiapollis triangulus* (Mamczar 1960) W. Kr. 1970	○
21. *Olaxipollis mathesi* W. Kr. 1962	○
22. *Porocolpopollenites vestibulum* (Pot. 1931) Th. et Pf. 1953	○
23. *Buxapollis buxoides* W. Kr. 1966	○
24. *Punctioratipollis ludwigi* W. Kr. 1966	○
25. *Heliotropioidearumpollenites gracilis* Nagy 1969	○
26. *Chenopodipollis multiplex* (Weyl. et Pf. 1957) W. Kr. 1966	○
27. *Tricolpopollenites liblarensis* (Th. 1950) Th. et Pf. 1953	○
28. *Tricolporopollenites cingulum* (Pot. 1931) Th. et Pf. 1953	○
29. *Tricolporopollenites pseudocingulum* (Pot. 1931) Th. et Pf. 1953	○
30. *Tricolporopollenites villensis* (Th. 1950) Th. et Pf. 1953	○
31. *Tricolporopollenites henrici* (Pot. 1931) W. Kr. 1960	●
32. *Tricolporopollenites microhenrici* (Pot. 1930) W. Kr. 1960	●
33. *Tricolporopollenites spinus* W. Kr. 1962	○
34. *Tricolporopollenites marcodurensis* Pf. et Th. 1953	●
35. *Araliaceoipollenites edmundi* (Pot. 1931) Pot. 1951	●
36. *Faguspollenites verus* Raatz 1937	○
37. *Cystacearumpollenites rotundus* Nagy 1969	○
38. *Nyssapollenites kruschi* (Pot. 1931) Nagy 1969	●
39. *Cyrillaceaepollenites exactus* (Pot. 1931) Pot. 1960	●
40. *Cyrillaceaepollenites megaexactus* (Pot. 1931) R. Pot. 1960	○
41. *Ilexpollenites margaritatus* (Pot. 1931) Thg. 1937	○
42. *Ilexpollenites iliacus* (Pot. 1931) Thg. 1937	○
43. *Caprifoliipites gracilis* Nagy 1969	●
44. *Tetracolporopollenites sapotoides* Pf. et Th. 1953	●
45. *Tetracolporopollenites microrhombus* Pf. 1953	○
46. *Tetracolporopollenites manifestus* (Pot. 1931) Th. et Pf. 1953 *contractus* Pf. 1953	●
47. *Ericipites callidus* (Pot. 1931) W. Kr. 1970	○

Frequency:
●● - frequent (10 - 20 grains).
● - rare (3 - 9 grains);
○ - very rare (1 - 2 grains);

Green algae are represented by colonies of *Botryoccocus*, which are abundant in the interval. 281.5 m – 280 m. It is possible that the decrease of the salinity in the proximal area of the sedimentation basin lead to the significant development of these algae.

The spores of ***Pteridophyta*** show a great variety (39 morphological types) but a small number of forms are frequent: *Corrugatisporites*, *Laevigatisporites* and *Verrucatosporites*.

Quantitatively, the pteridophyte spores represent 12 – 18 %.

The pollen of ***Coniferopsida*** is attributed to 18 types, among which the most frequent are the grains of *Pityosporites microalatus*, *Cedripites* and Taxodiaceae.

Quantitatively, this type of pollen represents 8 – 15%. The pollen of *Pityosporites* is more frequent in the upper part of the profile (attributed to the Lower Miocene).

Monocotyledonous angiosperms show low frequencies (1 – 3 %). Relatively diversified are the palms (*Monocolpopollenites*, *Arecipites*, *Dicolpopollis*), besides which the monopore pollen of *Sparganiaceaepollenites* was also identified.

Dicotyledonous angiosperms are dominant in all the analyzed samples (70 – 75 %). The list contains 47 types.

The most frequent pollen belongs to *Engelhardtioidites*, *Caryapollenites*, *Araliaceoipollenites, Cyrillaceaepollenites, Triatriopollenites, Tetracolporopollenites.* Relatively rare are the forms of *Myrtaceidites, Momipites, Ulmipollenites, Porocolpopollenites, Tricolporopollenites cingulum, T. microhenrici, T. marcodurensis, Nyssapollenites*, etc.

Some dicotyledonous types were identified for the first time in the palynological record of Romania (*Punctioratipollis ludwigi*, *Heliotropioidearumpollenites gracilis*, *Salixpollenites densibaculatus*). Other forms are mentioned for the first time in Lower Miocene deposits in our country: *Gothanipollis gothani*, *Olaxipollis mathesi*, *Buxapollis buxoides, Tricolporopollenites spinus* etc.

The paleoclimatic significance of the identified microflora can be drawn according to the following indices:

- the great diversity of the spores of Pteridophytes, as well as their significant amount (in some samples up to 18%) plead for a humid. The frequency of the spores of *Corrugatisporites*, *Verrucatosporites favus* or the frequency of the spores of *Leiotriletes maxoides* etc. prove a warm, subtropical continental environment;
- the same type of climate is indicated by the presence of palm pollen;
- a significant amount of the identified dicotyledonous angiosperms consists of forms characterizing a macrotherm climate: *Myrtaceidites*, *Engelhardtioidites*, *Platycaryapollenites*, *Reevesiapollis*, *Buxapollis*, *Araliaceoipollenites*, *Cyrillaceaepollenites*, *Tetracolporopollenites;*
- the temperate climate is represented by a small number of forms, proving a vertical zonation of the trees that generated the pollen. It is the case of some coniferals belonging to *Pinus* sg. *diploxylon*, *Abies* or of some dicotyledonous angiospermes such as *Ulmipollenites*, *Faguspollenites*, etc.

Generally, the studied microflora was generated by a forest vegetation that was developed during a warm interval of the Early Miocene (Eggenburgian).

The biostratigraphic importance of the studied microflora can be judged only by taking into account the vertical zonation of the identified taxa, as well as their frequency. *Echinatisporites microechinatus*, *Myrtaceidites myrtiformis*, *Punctioratipollis ludwigi, Heliotropioidearupollenites gracilis* etc. are the main forms of pollen-spores proving the Eggenburgian age of the deposits where they originated.

The correlation between the studied microflora and other similar assemblages

The Eggenburgian age is palynologically documented in boreholes from the Borod Basin (Petrescu & Nicorici, 1977), and the Þebea Basin respectively (Petrescu & Fazecas, 1989). At Coasta Mare (Cluj-Napoca) the Chechiş Clays (Upper Eggenburgian) preserved an interesting palynological record (Nicorici et al. 1979). In boreholes F 68 Sobolciu and F 48 Þețchea (Petrescu, Nicorici, 1987) the Lower Miocene deposits host a well preserved microflora, having at least an Eggenburgian age.

Planderova (1990) analyzed an Eggenburgian microflora from Slovakia formed in a warm, subtropical climate. The microfloral record contained: *Leiotriletes maxoides, Tricolporopollenites cingulum, Tricolporopollenites henrici, T. microhenrici, Triatriopollenites myricoides, T. bituitus, Cyrillaceaepollenites* etc.

Based on microflora, Nagy (1992) separated the Eggenburgian PN3 zone, i.e. the zone with "*Verrucingulatisporites grandis* and *Foveotriletes pessinensis*". Among the numerous forms specific for this zone, *Echinatisporites microechinatus*, *Laevigatisporites pseudodiscordatus, Heliotropioidearupollenites gracilis* etc. were mentioned. The list of the Eggenburgian forms identified in Hungary is very long; some of the forms were not identified in the Eggenburgian deposits which we investigated. Finally, there are some forms which are specific only for the Eggenburgian deposits in Romania.

Generally, the Eggenburgian deposits in Romania are similar to deposits of the same age in the Central Paratethys, concerning the microflora (Planderova, 1971).

Acknowledgements

Thanks to Dr. Sorin Filipescu for the review of the manuscript and to Dr. Dana Pop for the English translation.

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Plate I (1000x)
Fig. 1. *Leiotriletes maxoides minoris* Krutzsch, 1962
Fig. 2. *Lusatisporis punctatus* Krutzsch, 1963
Fig. 3. *Verrucatosporites clatriformis* (Murriger-Pflug, 1952) Krutzsch, 1967
Fig. 4. *Leiotriletes* asp. *microsinuosoides* Krutzsch, 1962
Fig. 5. *Laevigatisporites pseudodiscordatus* Krutzsch, 1959 (800x)
Fig. 6. *Corrugatisporites corruvallatus* (Krutzsch, 1967) Nagy, 1985

Plate II (1000x)
Fig. 1. *Corrugatisporites multivallatus* (Krutzsch, 1959) Planderova, 1990
Fig. 2. *Perinomoletes spicatus* Nagy, 1973
Fig. 3. *Verrucatosporites alienus* (Potonie, 1931) Thomson et Pflug, 1953
Fig. 4. *Extrapunctatisporites miocaenicus* Krutzsch, 1967
Fig. 5. *Polypodiaceoisporites cyclocingulatus* Krutzsch, 1967
Fig. 6. *Polypodiaceoisporites gracillimus* Nagy, 1963

Plate III (1000x)
Fig. 1. *Verrucingulatisporites* cf. *miocaenicus* Nagy, 1969
Fig. 2. *Podocarpidites libellus* (Potonie, 1931) Krutzsch, 1971
Fig. 3. *Sequoiapollenites megaligulus* Krutzsch, 1971
Fig. 4. *Cedripites crassiundulicristatus* (Trevisan, 1967) Krutzsch, 1971
Fig. 5. *Inaperturopollenites concedipites* (Wodeh., 1933) Krutzsch, 1971
Fig. 6. *Sequoiapollenites polyformosus* Thiergart, 1937
Fig. 7. *Sequoiapollenites gracilis* Krutzsch, 1971

Plate IV (1000x)
Fig. 1. *Pityosporites microalatus* (Potonie, 1931) Thomson et Pflug, 1953
Fig. 2. *Pityosporites latisaccatus medius* Trevisan, 1967
Fig. 3. *Magnolipollis neogenicus major* Krutzsch, 1970
Fig. 4., 5. *Monocolpopollenites arcuatus* n.sp.
Fig. 6., 7. *Dicolpopollis kockeli* Pflanzl 1956
Fig. 8., 9. *Myrtaceidites myrtiformis* Simoncsics, 1964
Fig. 10. *Gothanipollis gothani* Krutzsch, 1959
Fig. 11. *Arecipites* gr. *pseudoconvexus* Krutzsch, 1970

Plate V (1000x)
Fig. 1. *Pityosporites pristinipollinius* (Traverse, 1955) Krutzsch, 1971
Fig. 2. *Arecipites* gr. *parareolatus* (Krutzsch, 1958) Krutzsch, 1970
Fig. 3. *Momipites punctatus* (Potonie, 1931) Nagy, 1969
Fig. 4. *Engelhardtioidites microcoryphaeus* (Potonie, 1931) Thomson et Thiergart ex. Potonie, 1960.
Fig. 5. *Heliotropioidearumpollenites gracilis* Nagy, 1969
Fig. 6. *Cyrillaceaepollenites exactus* (Potonie, 1931) Potonie, 1960
Fig. 7. *Salixpollenites densibaculatus* Nagy, 1969
Fig. 8. *Tetracolporopollenites sapotoides* Pflug et Thomson, 1953
Fig. 9. *Punctioratipollis ludwigi* Krutzsch, 1966
Fig. 10. *Triatriopollenites myricoides* (Kremp 1950) Th. et Pf. 1953
Fig. 11. *Pterocaryapollenites stellatus* (Potonie, 1931) Thiergart, 1937
Fig. 12. *Faguspollenites verus* Raatz, 1937
Fig. 13. *Cystacearumpollenites rotundus* Nagy, 1969

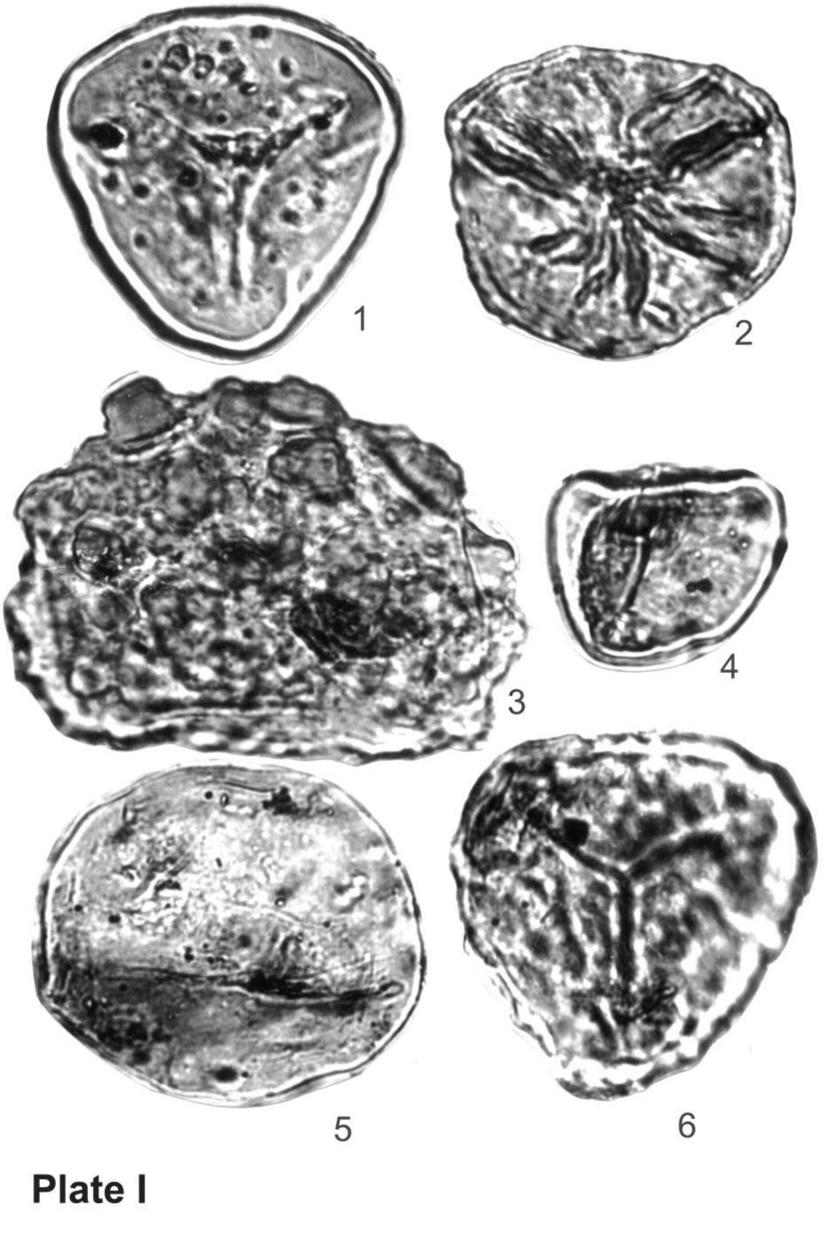

Plate I

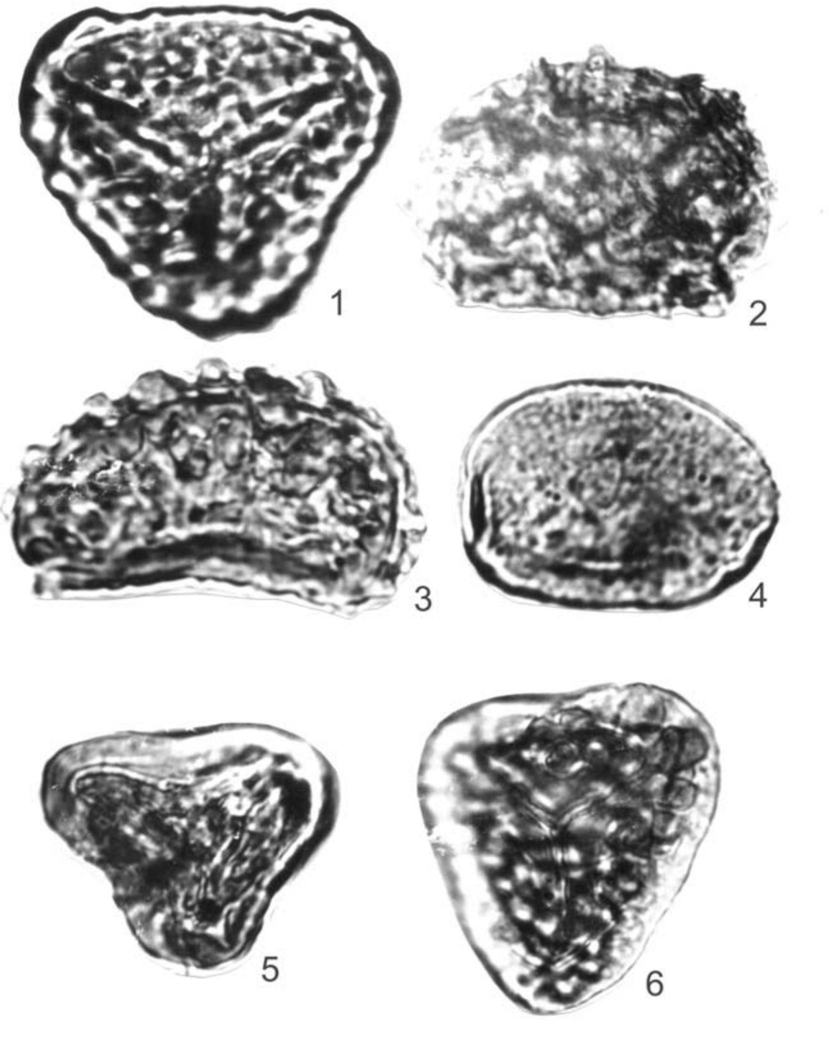

Plate II

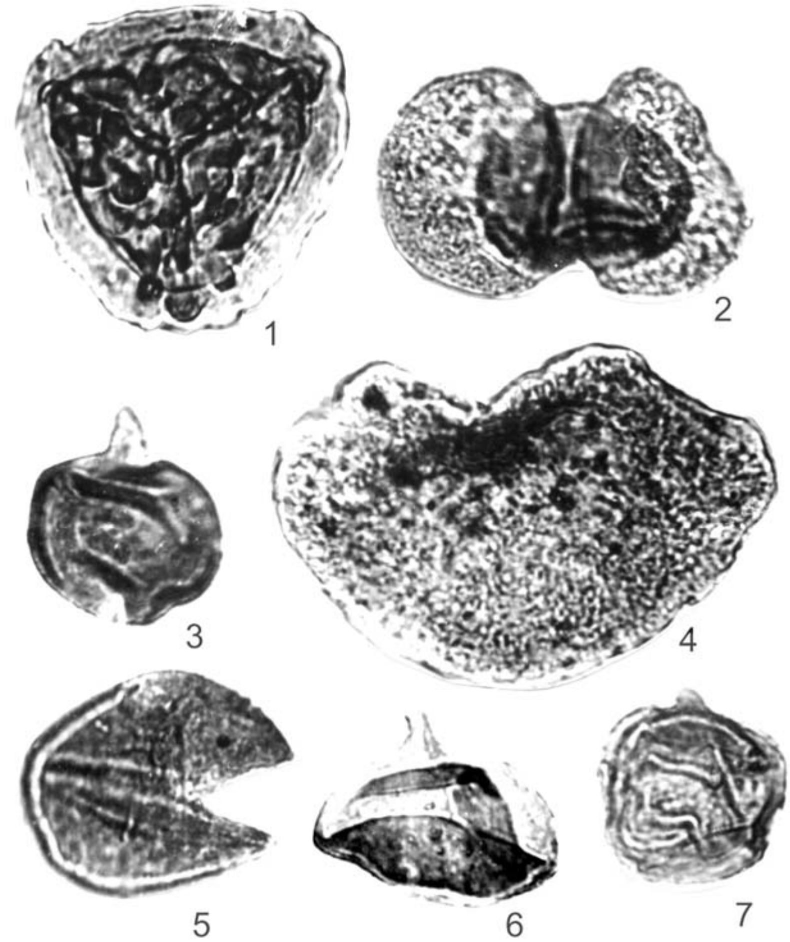

Plate III

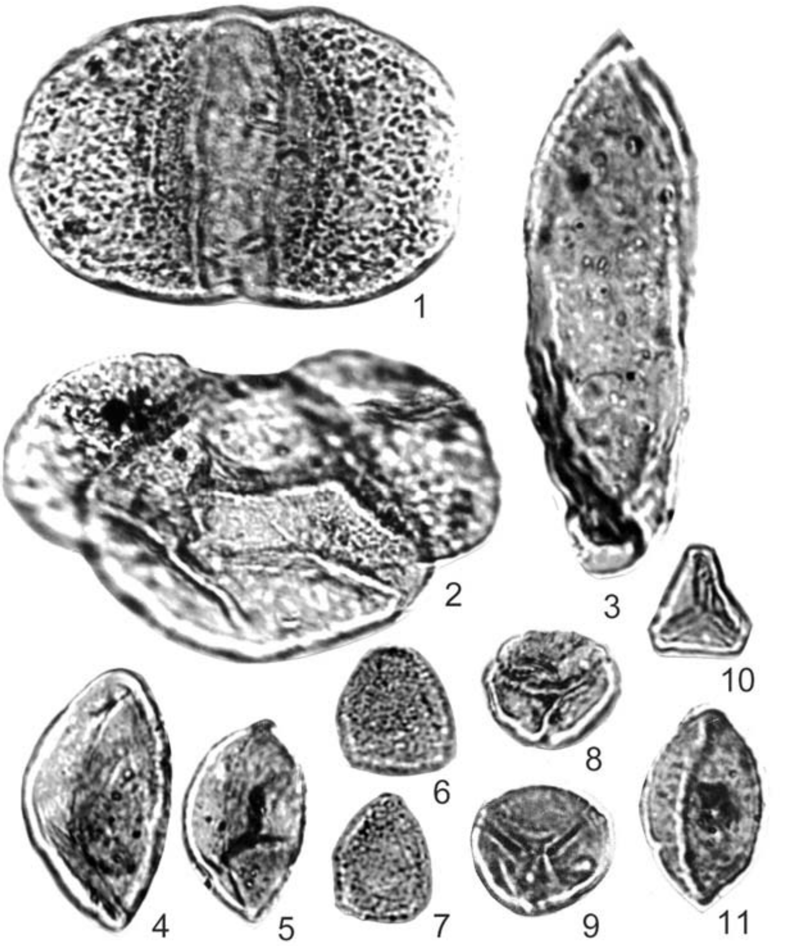

Plate IV

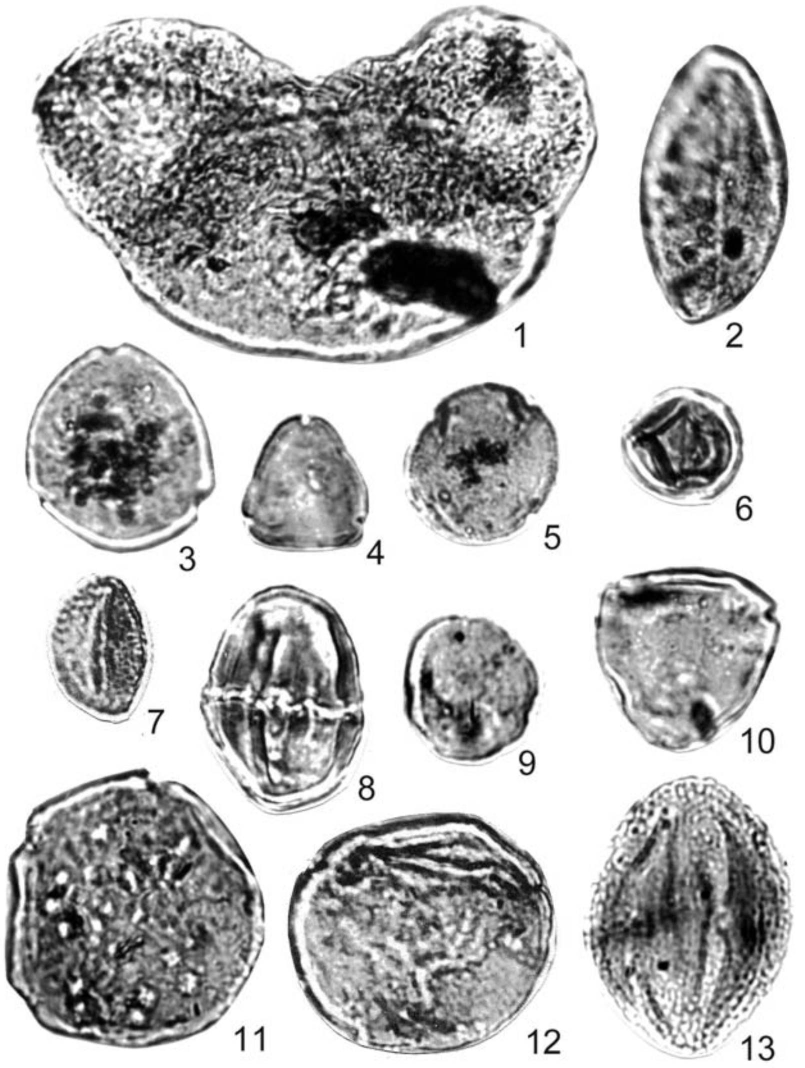

Plate V