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THE SARMATIAN MACRO- AND MICROFLORA FROM STAN'S HILL – BOZIENI (MOLDAVIAN PLATFORM)

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Abstract

The association of macro- and microflora founded in the outcrop from Stan's Hill is of the Basarabian age. It consists of 12 taxa of macroflora and 66 palynological taxa. There was observed a domination of monocotyledonous angiosperms represented by *Typha* (among the macrofloristic taxa), the *Daphnogene* gender being for the first time mentioned in the Sarmatian of the Moldavian Platform. Among the palynomorphs there were identified taxa belonging to the *Pinaceae, Taxodiaceae, Fagaceae, Ulmaceae, Juglandaceae* families. Based on this paleoflora, we have assumed that there was little biocenosis and palaeoclimate during the sedimentation of the analyzed deposits. The palaeoclimate was assumed using the "Coexistence approach" method (Mosbrugger and Utescher, 1997).

Keywords: palaeoflora, palaeoclimate, Basarabian, Moldavian Platform, Dealul Mare Formation, Stan's Hill

Geological setting

The geological profile from Stan's Hill is located south of the Roman – Piatra Neamţ highway, in Bozieni (fig. 1).

Geologically, the sedimentary deposits from this area belong to the southwestern part of the Moldavian Platform.

The first mention of this outcrop from Stan's Hill – Bozieni was made by David (1932), who identified a faunistic association between *Plicatiforma fittoni, Potamides*

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disjunctus and *Mactra variabilis.* Based on these taxa, the author assigns the deposits to the Basarabian age.

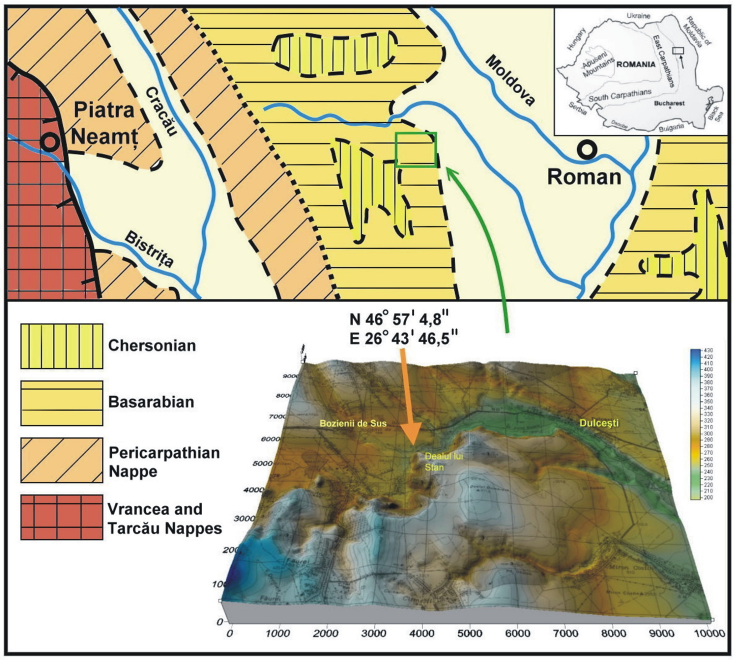

Fig. 1 The geological map and geographical position of the outcrop from Stan's Hill (geological map from Ionesi et al., 2005)

Further lithological and faunistic research in this area has been made by Martiniuc (1948), Macarovici (1954, 1964), Saraiman (1976), Ionesi et Ciobanu (1976, 1978). The most important association of mollusks (57 species) was cited by Ionesi et Ciobanu (1978) from the outcrops located in the northern part of Stan's Hill (fig. 2). The identified taxa *(Mactra (S.) pallasi, M. (S.) vitaliana*, *Plicatiforma plicatofittoni*, *Barbotella omaliusii*, *Obsoletiforma desperata* etc.) indicate, in the opinion of these authors, the Upper Basarabian age.

The lithological column presented (fig. 2) is enclosed between 305 – 350 m altitude, 3 lithological units being described:

- the Sandy-Clay Unit (25 m thick), made up mainly of clay and sands; in certain patches the sands are coarse-grained. Within the research made by us on this outcrop, we have found this lithological unit between 248 – 325 m altitude. The fossil leaves and the samples collected for palynological study belong to the clays rocks of this unit.

- the Conglomerate-Sandstone Unit (6 m thick), consisting from coarse-grained sandstones, friable sandstones with thin intercalations of clay, microconglomerates and conglomerates with pebbles from the Carpathian Flysch (limestone, menilite and bituminous marl). This lithological unit was defined by Ionesi et al. (2005) *The Level "Dealul lui Stan"*. The association of mollusks is more abundant than in the previous lithological unit, consisting of 42 taxa.

The absence of taxa as *Mactra* (S.) *fabreana* and *Plicatiforma fittoni* shows that the age of the deposits represents the beginning of the Upper Basarabian (Ionesi et al., 2005).

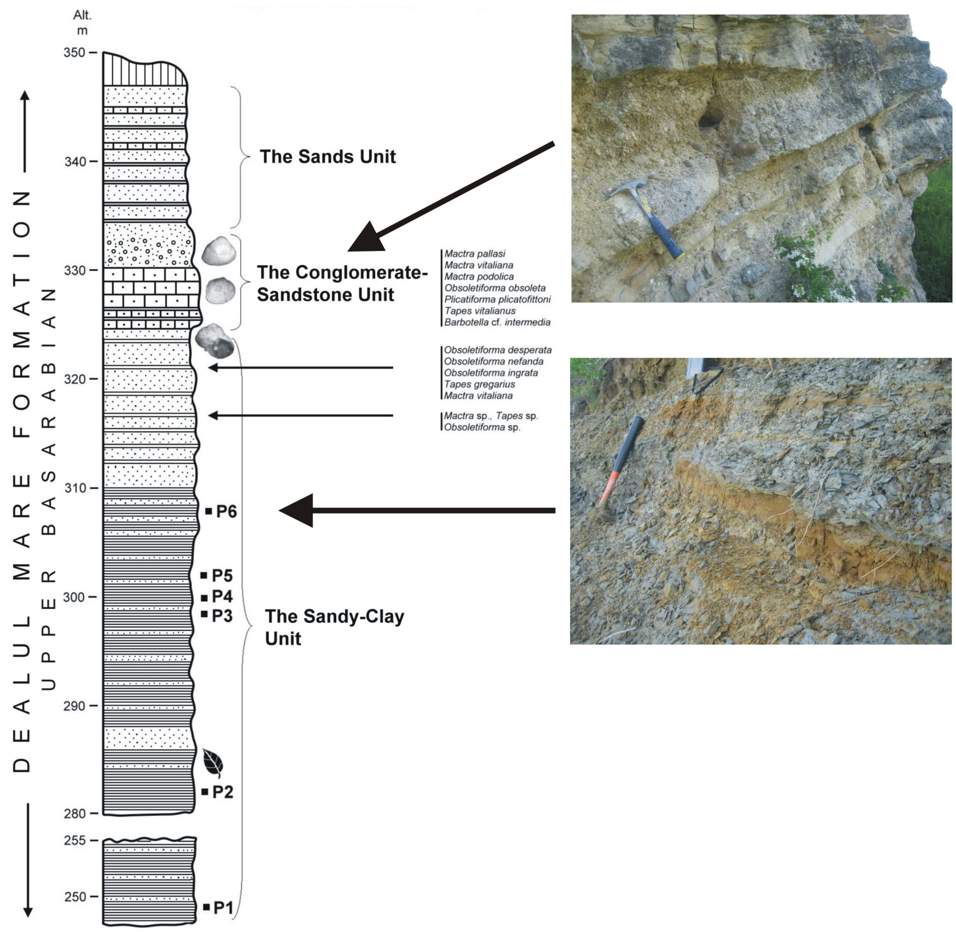

Fig. 2 The lithological column of the Upper Basarabian deposits from the Stan's Hill outcrop (after Ionesi et Ciobanu, 1978; with modifications). P1 - P6 are samples used for palynological analysis

- the Sands Unit, consisting of sands interbedded with thin layers of sandstones and clays.

Grasu et al. (2002) consider that the deposits from Stan's Hill belong to a sedimentologic stage with a polarity of the self source from north to south.

Ionesi et al. (2005) establish for the interval between the Lower Basarabian and the beginning of the Upper Basarabian of the Moldavian Platform a *Lower Marine-Brackish Biofacies* which is grouped from west to east in 4 lithofacies: Littoral Lithofacies, Neritic-Arenite Lithofacies, Neritic-Pelital Lithofacies and Reef Lithofacies. The sedimentary deposits from Stan's Hill are enclosed at Neritic-Arenite Lithofacies (Dealul Mare Formation), with a development on the left and right side of Siret River. The thickness of the Dealul Mare Formation from the right side of Siret River was estimated at approximately 300 m, the accumulation made in the neritic domain corresponding to a carbonate platform. The fauna of bivalves, gastropods and foraminifers reveals a low water depth (50 - 60 m) and an active dynamics of the water (Ionesi et al., 2005).

The Dealul Mare Formation consists of 5 levels of limy-sandstone rocks ± rudite, the succession being the following: *Lower Basarabian*, 1. Hărmăneşti-Manolea; 2. Criveşti-Miroslăveşti; 3. Gruiu; 4. Brăteşti; *Upper Basarabian*, 5. Dealul lui Stan (Ionesi et al., 2005). The presence of the levels of limy-sandstones from the Dealul Mare Formation reflects an oscillation of the marine level (water depth between 20 – 50 m).

As part of the research carried out in the Stan's Hill area we have identified the 3 lithological units separated by Ionesi et Ciobanu (1978). The Sandy-Clay Unit is open with few interruptions between 248 - 325 m of elevation (fig. 2), the first 60 m consisting mainly of sandy-clays interbedded with thin layers of sand. On top of these there is the Conglomerate-Sandstone Unit, with a thickness of 6 - 7 m, where we can identify a large number of shells of mollusks, immovable because of the friability. The lithological succession ends with the Sands Unit, from whence this Unit crop out sporadically until the top of the hill.

Materials and methods

The fossil leaves collected are well-preserved, and they appear as compression on sandy-clay rocks. These taxa are easy to use for detailed investigation, having a good conservation of the primary, secondary and tertiary ribs. In few cases the fossil leaves are entirely conserved, thus allowing us to establish the shape, size of lamina and the types of tooth.

The palynologic study was made using 6 samples of clay, collected from the interval between 248 - 308 m altitude. The quantity of sediments for analysis was approximately 50 g for each sample. Those have been treated with HCl (37%) to remove the carbonate and, afterwards, with HF (48%) to remove the silicate minerals. The separation of palynomorphs from the residue resulted from the chemical reaction described above was made with centrifugal action using as heavy liquid $ZnCl_2$ with a density of 2.00 g/cm^3. The organic fraction resulted was inserted in a mixture of glycerine and gelatine, 1 - 2 drops been mounted on the palynological shim. The visualisation of the palynomophs was accomplished with a Leica DM1000 microscope with transmitted light, using the amplification of X100, X400.

Floristic composition

The fossil macroflora identified in this profile consists of 11 taxa, the dominating ones being monocotyledonous angiosperms represented by *Typha.*

Tab. 1 Taxonomic list of macroflora found in Stan's Hill outcrop

Taxa	Family	Prefered habitat	Climatic distribution	No. of exemplars
Monocotyledonous Angiosperms (? *Typha*)		Fresh-water vegetation	cosmopolit	5
Dicotyledonate Angiosperms				
Laurophyllum sp.	Lauraceae	Riparian or mixed - mesophytic vegetation	Subtropical, mediteranean	2
Daphnogene sp.	Lauraceae	Riparian or mixed - mesophytic vegetation	Subtropical, mediteranean	1
Salix varians Goeppert 1855	Salicaceae	Riparian vegetation	temperate	1
Quercus sp.	Fagaceae	Mixed - mesophytic vegetation	Temperate-warm	2
Carpinus grandis Unger 1850	Betulaceae	Mixed - mesophytic vegetation	Temperate	1
Carpinus sp.	Betulaceae	Mixed - mesophytic vegetation	Temperate	2
Betula prisca Ettingshausen 1851	Betulaceae	Mixed - mesophytic vegetation	Temperate	1
Ulmus sp.	Ulmaceae	Mixed - mesophytic vegetation	Temperate	1
Cassiophyllum berenices (Unger 1850) Krausel 1938	Caesalpini-aceae		Subtropical - tropical	1
Liquidambar europaea Braun 1836	Hamameli-daceae	Riparian vegetation	Temperate-warm	1
Acer sp.	Aceraceae	Mixed - mesophytic vegetation	Temperate	1

From the *Lauraceae* we have found *Laurophyllum* sp. and *Daphnogene* sp. (tab. 1). The last taxon has never been mentioned in the Sarmatian of the Moldavian Platform. In exchange, a few taxa of *Laurus princeps* Heer has cited from the chersonian deposits from Şcheia (David, 1922) and Meotian from Hîrsova - Vaslui (David, 1916; Barbu, 1934). *Laurus* cf. *furstenbergi* Br. has been cited from the Păun - Iaşi Quarry (Balta - Păun Formation, Chersonian age) (Macarovici et Paghida, 1966). The *Betulaceae* family is represented by *Carpinus grandis* and *Betula prisca*, the *Carpinus* gender being often cited in the Sarmatian of the Moldavian Platform. Another taxa found rarely in the Moldavian Platform is *Cassiophyllum berenices*, cited until now only in volhinian deposits (Fălticeni - Boroaia Formation, Ţibuleac, 1998; Chirilă, 2008; Chirilă and Ţabără, 2008).

The microflora identified from those 6 analyzed samples brings an accomplishment to the fossil vegetation preserved in the area that was the subject of the study.

The phytoplancton found is represented by only one autochthonous gender: *Tytthodiscus* sp. From the Pteridophyte, in the analyzed deposits we have been able to find taxa such as *Schizaeceae* (*Leiotriletes triangulatoides, L. wolffi wolffi, L. neddenioides* etc.) and *Polypodiaceae* (*Laevigatosporites gracilis, L. haardti, Polypodiaceoisporites* sp.) (tab. 2). With sporadic appearance in the palynologic association we mention taxa such as *Hydrosporis azollaënsis, Neogenisporis neogenicus* and *Retitriletes* cf. *lusaticus*. From the systematic group of ferns we have found many reworked taxa that cannot be easily identified after the dark color of the exina.

Tab. 2 Palynological association identified in Stan's Hill outcrop

Taxa	P1 alt. 249,5 m	P2 alt. 282 m	P3 alt. 299 m	P4 alt. 300 m	P5 alt. 302 m	P6 alt. 308 m
Phytoplancton						
Tytthodiscus sp.	+			+	x	+
Areosphaeridium sp. (reworked)	x					
Deflandrea phosphoritica EISENACK 1938 (reworked)	x					
Pteridophyta						
Neogenisporis neogenicus KRUTZSCH 1962				x		
Neogenisporis sp.	x				x	x
Hydrosporis azollaënsis KRUTZSCH 1962	x					
Polypodiaceoisporites sp.	x					x
Toroisporis sp.	x					
Laevigatisporites haardti (POTONIÉ et VENITZ 1934) THOMSON et PFLUG 1953	x					x
Laevigatosporites gracilis WILSON - WEBSTER 1946						x
Leiotriletes microlepioidites KRUTZSCH 1962	x					x
Leiotriletes triangulatoides KRUTZSCH 1962	x					
Leiotriletes wolffi wolffi KRUTZSCH 1962	x			x		
Leiotriletes wolffi brevis KRUTZSCH 1962						x
Leiotriletes asp. *microsinuosoides* KRUTZSCH 1962						x
Leiotriletes neddenioides KRUTZSCH 1962	x					
Leiotriletes sp.	x					x

Retitriletes cf. *lusaticus* KRUTZSCH 1963						x
Verrucatosporites sp.	x					
Gleicheniidites sp. (reworked)	x					
Cicatricosisporites sp. (reworked)	x					
Reworked spores	+		x			+
Gymnospermatophyta						
Pityosporites sp.	••	x		x	x	+
Pityosporites minutus (ZAKLINSKAJA 1957) KRUTZSCH 1971	+					x
Pityosporites labdacus (POTONIÉ 1931) THOMSON et PFLUG 1953	+			x	x	x
Pityosporites insignis (NAUMOVA ex BOLCHOVITINA 1953) KRUTZSCH 1971	x					
Pityosporites scopulipites (WODEHOUSE 1933) KRUTZSCH 1971	x					
Pityosporites alatus (POTONIÉ 1931) THOMSON et PFLUG 1953	x					x
Pityosporites microalatus (POTONIÉ 1931) THOMSON et PFLUG 1953	+					x
Piceapollis tobolicus (PANOVA 1966) KRUTZSCH 1971	x					
Piceapollis praemarianus KRUTZSCH 1971	x	x				
Cedripites miocaenicus KRUTZSCH 1971	x					
Cedripites sp.	x					
Abiespollenites absolutus THIERGART 1937	x					
Abiespollenites latisaccatus (TREVISAN 1967) KRUTZSCH 1971	x	x				
Abiespollenites sp.	x					
Podocarpidites sp.	x					
Inaperturopollenites hiatus (POTONIÉ 1931) THOMSON et PFLUG 1953	x					x
Inaperturopollenites sp.	+					x
Sciadopityspollenites varius KRUTZSCH 1971	x					
Sciadopityspollenites serratus (POTONIE et VEN. 1934) THIERGART 1937	x					
Zonalapollenites verrucatus KRUTZSCH 1971						x
Ephedripites sp.				x		
Angiospermatophyta. Monocotyledonatae						
Monocolpopollenites tranquillus (POTONIÉ 1934) THOMSON et PFLUG 1953						x
Monocolpopollenites sp.	x	x			x	x
Sparganiaceaepollenites polygonalis THIERGART 1937	x					

Graminidites media (COOKSON 1947) POTONIÉ 1960						x
Angiospermatophyta. Dicotyledonatae						
Quercopollenites robur NAGY 1969	x					
Quercopollenites granulatus NAGY 1969	x					
Quercopollenites sp.	x					x
Momipites punctatus (POTONIÉ 1931) NAGY 1969	x					
Engelhardtioidites microcoryphaeus (POTONIÉ 1931) THOMSON et THIERGART ex POTONIÉ 1960	x					x
Caryapollenites simplex (POTONIÉ 1931) KRUTZSCH 1960	x		x			
Faguspollenites minor NAGY 1969	x					
Triatriopollenites rurensis PFLUG et THOMSON 1953	x					
Myricipites bituitus (POTONIE 1931) NAGY 1969	x					
Myricipites sp.	x					
Alnipollenites verus (POTONIÉ 1931) POTONIÉ 1934	x					
Zelkovaepollenites thiergarti NAGY 1969						x
Ulmipollenites undulosus WOLFF 1934	x					x
Tricolporopollenites marcodurensis PFLUG et THOMSON 1953	x					
Tricolporopollenites cingulum (POTONIE 1931) THOMSON et PFLUG 1953 subsp. *pusillus* (POTONIE 1934) THOMSON et PFLUG 1953	x			x		
Tricolporopollenites microhenrici (POTONIÉ 1930) KRUTZSCH 1960	x					x
Tricolporopollenites henrici (POTONIÉ 1931) KRUTZSCH 1960						x
Tricolporopollenites sp.	+					x
Tricolpopollenites liblarensis (THOMSON 1950) THOMSON et PFLUG 1953 subsp. *liblarensis*	x					
Sapotaceoidaepolleninites rotundus NAGY 1969	x					
Ilexpollenites sp.	x					
Liquidambarpollenites sp.				x		
Salixipollenites sp.						x
Nyssapollenites kruschi (POTONIÉ 1931) NAGY 1969						x
Frequency: x – very scarce (1–2 grains); + - scarce (3-9 grains); • – frequent (10-20 grains); •• - very frequent (> 21 grains).						

The conifers are the main element from the palynological spectra and are represented by the *Pinaceae* and *Taxodiaceae* families. *Pinus* is the most present taxa, being represented by species such as *Pityosporites labdacus, P. minutus, P. alatus* etc. From the *Pinaceae* family we have found other taxa such as *Abiespollenites latisaccatus, Piceapollis praemarianus, Cedripites miocaenicus, Zonalapollenites verrucatus* etc. From the *Taxodiaceae* family the most present taxon is *Inaperturopollenites* div. sp., followed by taxas such as *Sciadopityspollenites* div. sp.

The monocotyledonous angiosperms are rare and less diversified. We have found taxa of monocolpate pollen of palms (*Monocolpopollenites tranquillus*) and monoporate pollen such as *Sparganium* and *Gramineae*.

Dicotyledonous angiosperms are presents in the palynological association and they are represented by taxa of *Fagaceae* (*Quercopollenites* div. sp., *Faguspollenites minor, Tricolporopollenites microhenrici*), *Ulmaceae* (*Ulmipollenites undulosus, Zelkovaepollenites thiergarti*), and *Juglandaceae* (*Engelhardtioidites microcoryphaeus, Caryapollenites simplex*). Apart from that, there has been identified fossil pollen of *Myrica, Salix, Liquidambar, Nyssa, Sapotaceae* etc.

From the pollen spectrum, the *Chenopodiaceae* are missing. These taxa were found with a higher frequency at the upper part of the Cryptomactra Formation (Brânzilă and Ţabără, 2005; Ţabără, 2008), which is disposed in the eastern part of the researched area, the age of it being the Lower Basarabian – the beginning of the Upper Basarabian.

Palaeovegetation and palaeoclimate reconstruction

The fossil association of macroflora and microflora allows the reconstruction of the following biocenosis:

- swamp vegetation alongside the lacustrine basins with fresh water. In this category are taxa such as *Taxodium, Nyssa* or *Polypodiaceae.* In the same lacustrine basin *Typha* is also present, especially where the water depth is between 2 – 3 m.

- riparian vegetation of low land, disposed alongside the rivers, represented by *Lauraceae* (*Laurophyllum, Daphnogene*), *Alnus, Engelhardtia, Myrica, Liquidambar, Salix*.

- open area vegetation was identified in the palaeofloristic spectrum only by species such as *Ephedra,* with a low frequency.

- the mixed mesophytic forest is well represented by leaf impression and fossil pollen, such as *Carpinus, Quercus, Ulmus, Betula, Carya, Acer*.

- the high land forest is represented in the paleofloristic association based on pollen and is proven by the presence of taxa such as *Abies, Picea, Pinus* and *Tsuga* (*Zonalapollenites*).

Another palynological association identified based on the Upper Basarabian is cited from the Neritic-pelital Lithofacies (Cryptomactra Formation), which crop out in Vlădiceni-Iaşi Quarry (Ţabără, 2008). A comparison of those two associations (Stan's Hill area and Vlădiceni Quarry) shows that phytoplancton such as *Tytthodiscus,* found in the samples from Stan's Hill, was not found in the Cryptomactra Formation (Vlădiceni Quarry). In exchange, taxa such as *Pleurozonaria stellulata, Thalassiphora pelagica, Ovoidites* etc., have been found only in the Cryptomactra Formation.

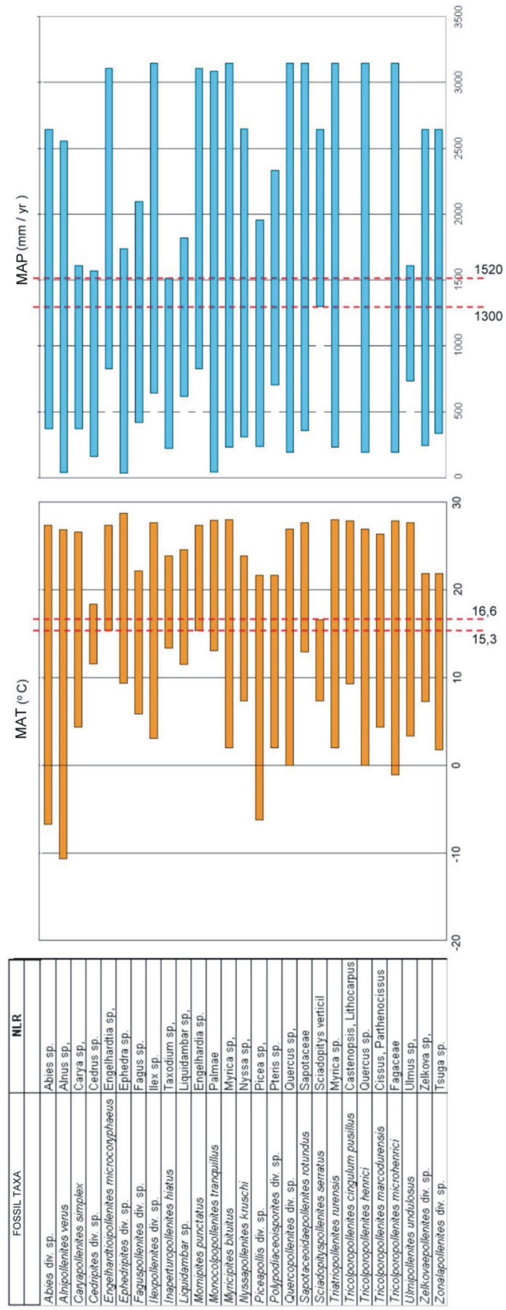

Fig. 3 Mean annual temperature (MAT) and mean annual precipitation (MAP) assumed using the "Coexistence approach" method (Mosbrugger and Utescher, 1997) for the Basarabian microflora from Stan's Hill

Among the pteridophyta taxa, in both palynological associations, we mention taxa such as *Leiotriletes triangulatoides, L. wolffi wolffi, Laevigatosporites gracilis, Polypodiaceoisporites* div. sp. etc. Taxa of gymnosperms are similar in both associations, with the small diference that those from the Cryptomactra Formation are more diversified. From the species found only in the Cryptomactra Formation we cite *Sequoiapollenites gracilis, Cupressacites bockwitzensis, Araucariacites, Ginkgo* etc.

The taxonomic similarity from both palynological associations was observed concerning monocotyledonous and dicotyledonous angiosperms. Species such as *Typha angustifolia, Tricolporopollenites hedwigae, Cyrillaceaepollenites exactus, Juglanspollenites maculosus, Nymphaeaepollenites minor* etc. have been cited only in the Cryptomactra Formation (Ţabără, 2008). A taxonomic difference observed between both associations was the presence in Vlădiceni Quarry of a high number of *Chenopodiaceae*, while in Stan's Hill this taxon is absent.

The fragments of fossil vegetation have been cited from Basarabian deposits from the Moldavian Platform by Ţicleanu and Micu (1978) at Corni (Neamţ County) and Ştefârţă (1997) at Bravicea, Ghidighici and Nisporeni (in the central area of the Moldavian Republic). In the Corni area there have been mentioned taxa of *Salix varians, Carpinus pyramidalis, Fagus attenuata, Quercus pseudocastanea* etc., taxa such as *Lauraceae* (identified in Stan's Hill) missing from this association. In the Republic of Moldova, Ştefârţă (1997) described 29 species, representative being the *Betulaceae* (*Alnus, Betula, Carpinus*), *Salicaceae* (*Populus, Salix*) and *Ulmaceae* (*Ulmus, Zelkova*) families. Taxa with subtropical affinity such as *Sapindus, Persea* and *Cassia* are present in small numbers, and thermophylous gymnosperms (*Sequoia, Taxodium, Cupressus)* are missing. Based on the actual correspondent of fossil taxa, the author established the following palaeoclimatic parameters: a mean annual temperature (MAT) of 11°C, the warmest mean monthly temperature at 23°C, the coldest mean monthly temperature at - 2°C and mean annual precipitation (MAP) at maximum 700 mm/yr.

The palaeoclimate was assumed based on the "Coexistence approach" method (Mosbrugger and Utescher, 1997). Estimations of MAT and MAP have been obtained on 27 palynological taxa identified in 6 samples analysed from Stan's Hill outcrop. MAT deduced based on the method mentioned above is between 15,3 - 16,6°C and MAP is between 1300 - 1520 mm/yr (fig. 3).

Conclusions

In the outcrop from Stan's Hill there have been identified macro- and microfragments of fossil vegetation. Based on this, there was estimated for the Upper Basarabian a climate with values for MAT between 15,3 - 16,6°C and MAP between 1300 - 1520 mm/yr. These values are higher than those presented by Ştefârţă (1997) for the Basarabian from the Republic of Moldova.

Basarabian paleovegetation indicates the presence of a swamp environment alongside the sedimentation basin. Also, we have assumed an area with knolls or hills with different altitudes and a mountainous zone with coniferous forest. The areas with open spaces are weakly argumented by the palynological association.

The palynological association identified at the upper part of the Dealul Mare Formation (Stan's Hill Level) is correlated with the Cryptomactra Formation (the Vlădiceni - Iaşi Quarry), most of the taxa being found in both formations.

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CAPTION OF PLATES

Plate I

1. *Laurophyllum* sp.
2. *Daphnogene* sp.
3. *Liquidambar europaea* BRAUN 1836
4. *Salix varians* GOEPPERT 1855
5. *Cassiophyllum berenices* (UNGER 1850) KRAUSEL 1938
6. *Quercus* sp.
7. *Betula prisca* ETTINGSHAUSEN 1851
8. Monocotyledonous angiosperms (? *Typha*)

Plate II

1, 2. *Tytthodiscus* sp.
3. *Leiotriletes neddenioides* KRUTZSCH 1962
4. *Leiotriletes wolffi brevis* KRUTZSCH 1962
5. *Leiotriletes* asp. *microsinuosoides* KRUTZSCH 1962
6. *Neogenisporis* sp.
7. *Retitriletes* cf. *lusaticus* KRUTZSCH 1963
8. *Laevigatisporites haardti* (POTONIÉ et VENITZ 1934) THOMSON et PFLUG 1953
9, 10. *Inaperturopollenites hiatus* (POTONIÉ 1931) THOMSON et PFLUG 1953
11, 12. *Sciadopityspollenites varius* KRUTZSCH 1971
13. *Leiotriletes triangulatoides* KRUTZSCH 1962
14. *Abiespollenites absolutus* THIERGART 1937
15. *Cedripites miocaenicus* KRUTZSCH 1971

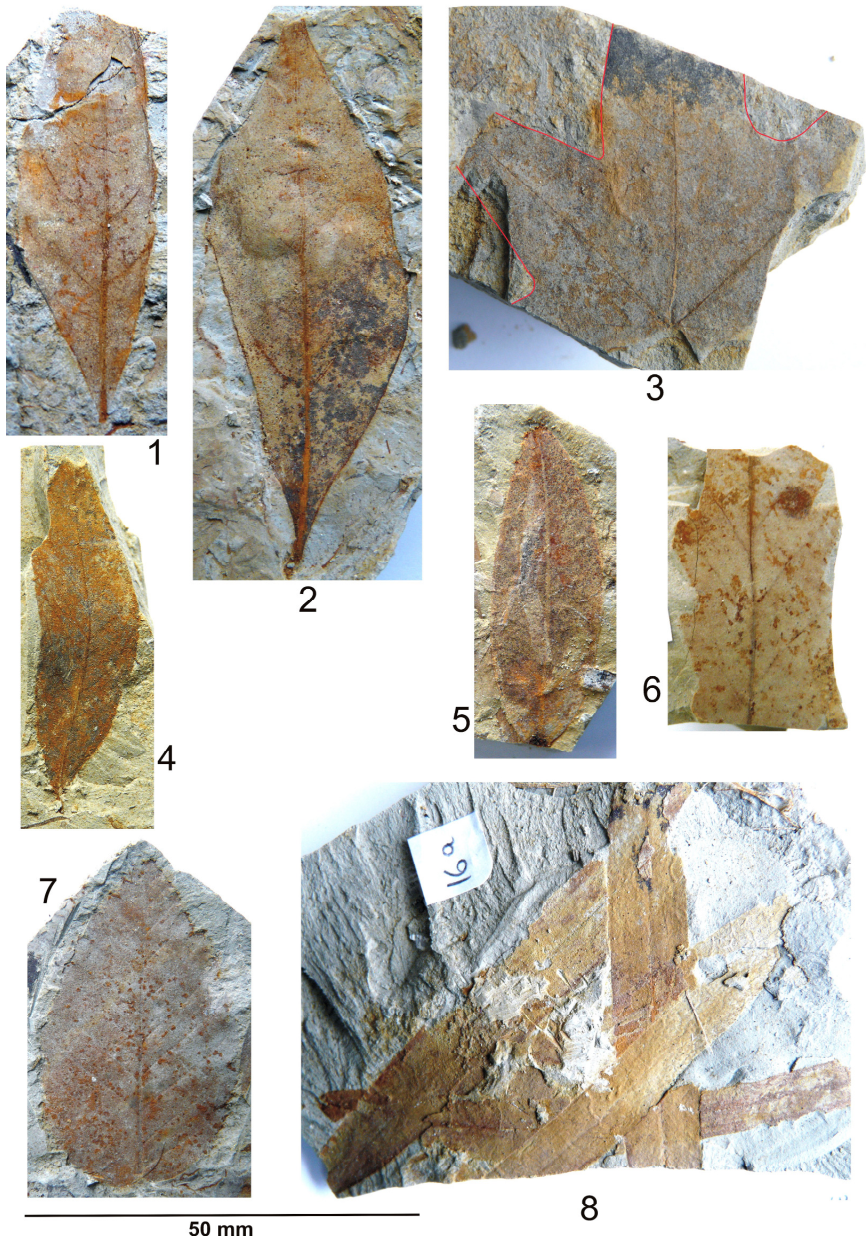
Plate III

1. *Abiespollenites* sp.
2. *Zonalapollenites verrucatus* KRUTZSCH 1971
3. *Pityosporites labdacus* (POTONIÉ 1931) THOMSON et PFLUG 1953
4. *Pityosporites microalatus* (POTONIÉ 1931) THOMSON et PFLUG 1953
5. *Pityosporites alatus* (POTONIÉ 1931) THOMSON et PFLUG 1953
6. *Piceapollis tobolicus* (PANOVA 1966) KRUTZSCH 1971
7. *Pityosporites scopulipites* (WODEHOUSE 1933) KRUTZSCH 1971

Plate IV

1, 2. *Faguspollenites minor* NAGY 1969
3. *Alnipollenites verus* (POTONIÉ 1931) POTONIÉ 1934
4. *Tricolpopollenites liblarensis* (THOMSON 1950) THOMSON et PFLUG 1953 subsp. *Liblarensis*
5. *Caryapollenites simplex* (POTONIÉ 1931) KRUTZSCH 1960

6. *Engelhardtioidites microcoryphaeus* (POTONIÉ 1931) THOMSON et THIERGART ex POTONIÉ 1960
7. *Myricipites bituitus* (POTONIE 1931) NAGY 1969
8. *Tricolporopollenites microhenrici* (POTONIÉ 1930) KRUTZSCH 1960
9. *Quercopollenites granulatus* NAGY 1969
10. *Tricolporopollenites cingulum* (POTONIE 1931) THOMSON et PFLUG 1953 subsp. *pusillus* (POTONIE 1934) THOMSON et PFLUG 1953
11. *Tricolporopollenites marcodurensis* PFLUG et THOMSON 1953
12. *Triatriopollenites rurensis* PFLUG et THOMSON 1953
13. *Momipites punctatus* (POTONIÉ 1931) NAGY 1969
14. *Zelkovaepollenites thiergarti* NAGY 1969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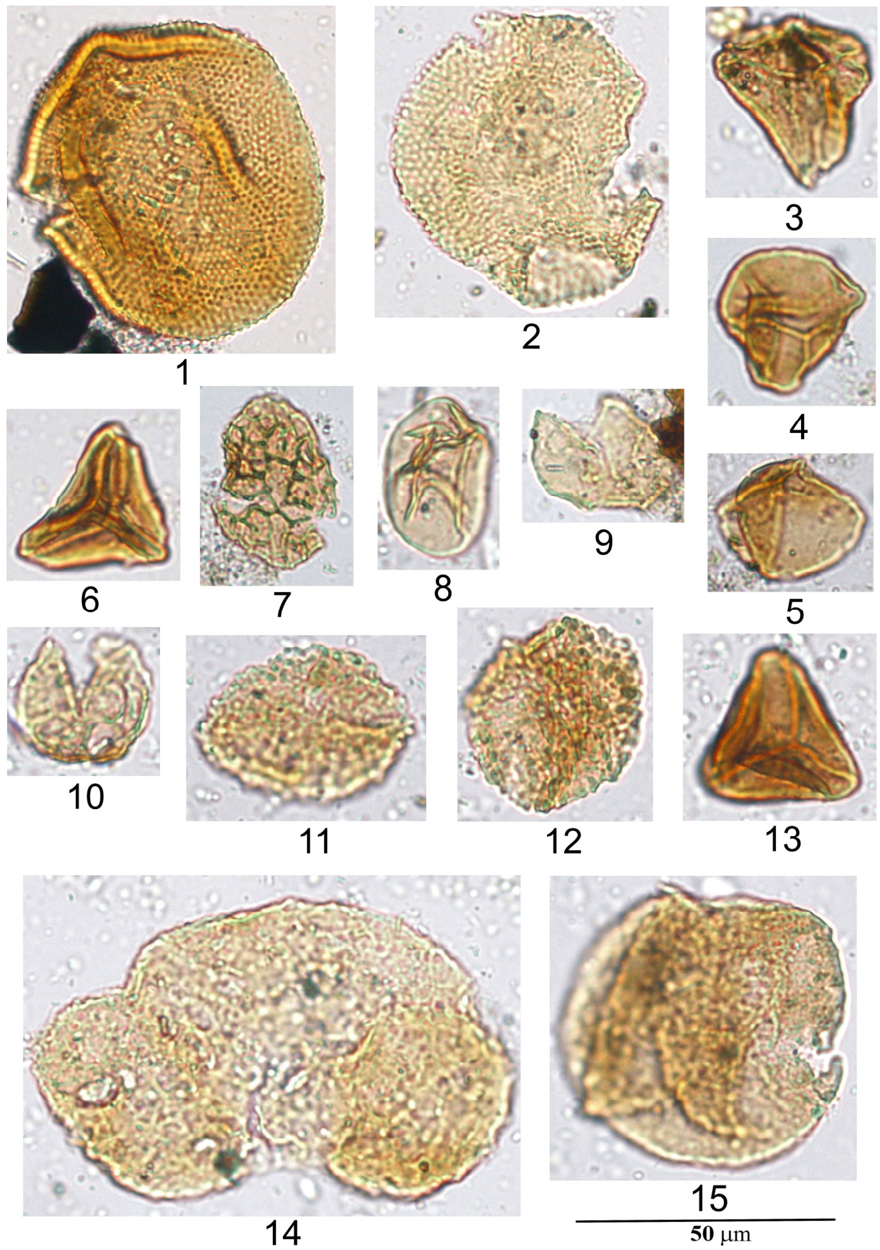
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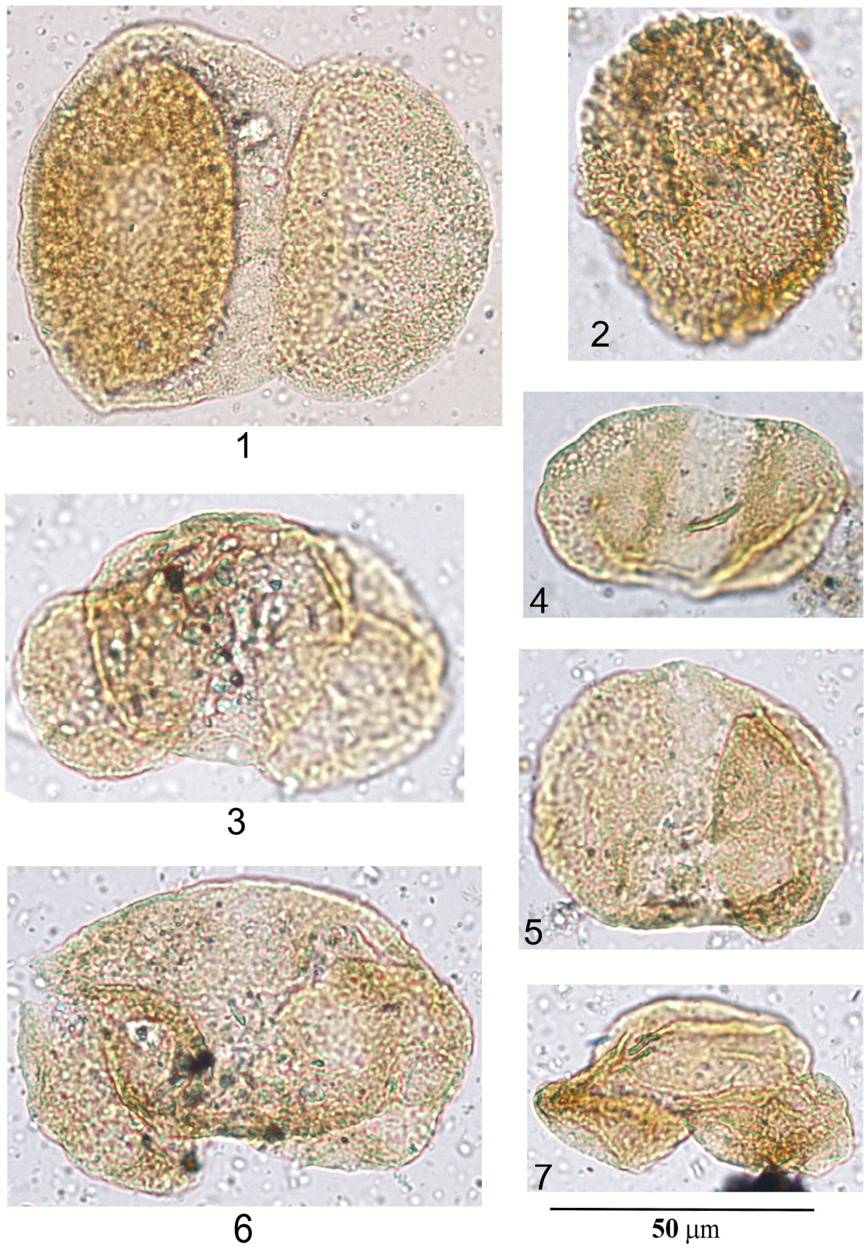
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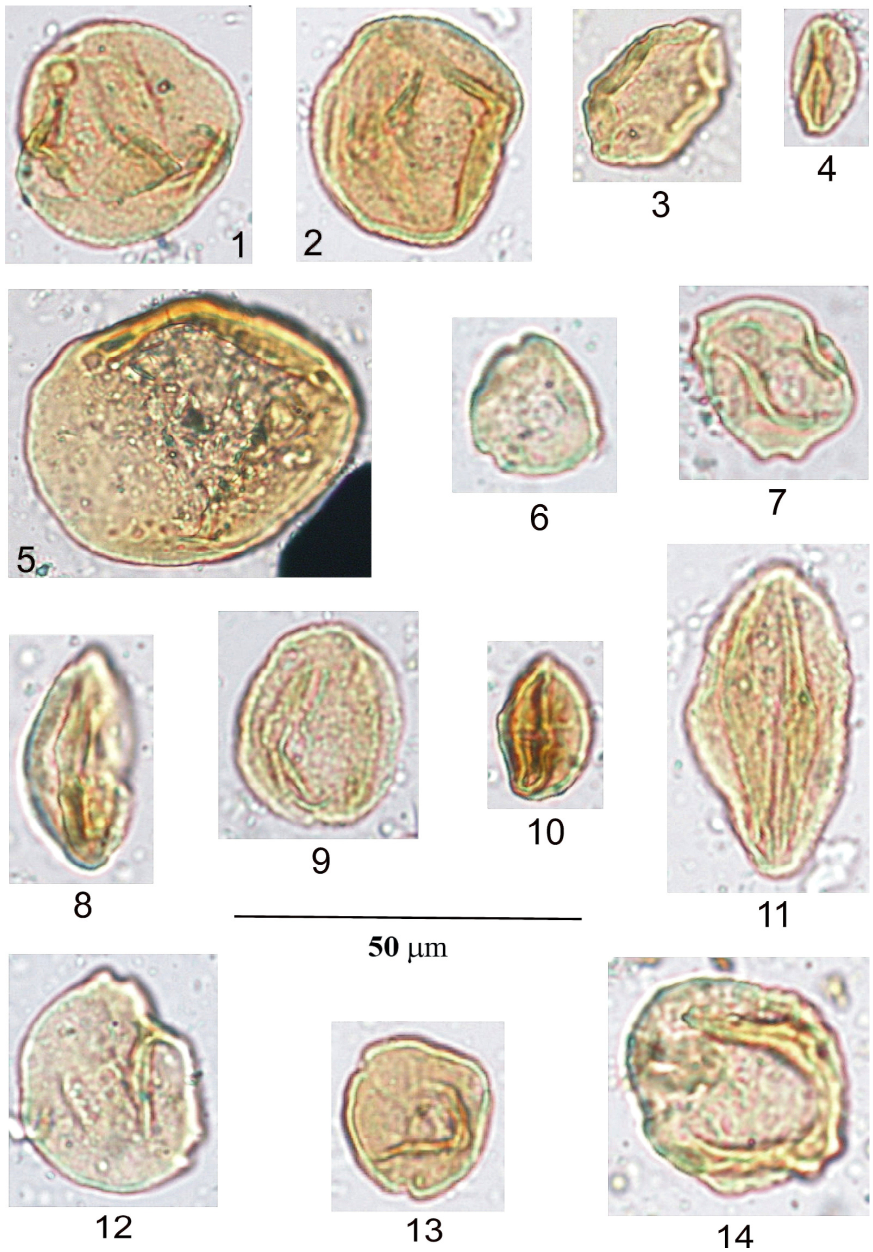
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