

## **THE PRESENT STAGE IN THE KNOWLEDGE OF THE FOSSIL FLORA AT CHIUZBAIA, MARAMUREȘ, ROMANIA**

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**Abstract:** The present study, based on foliar remains, deals with the Chiuzbaia fossil flora of Maramureș. The total number of collected samples is of about 10000. The number of taxons is very large, being the richest and most representative flora in the field of Paratethys. New families, new species and new genera for the Romanian fossil flora have been described here. This fossil forest type that can be actually compared with the “mixed mesophytic forest” from the Appalachian Mountains, or the Beech-Maple-Forest in the southern part of North America.

**Key-Words:** fossil plants, fossil forest type, paleoenvironment, paleoclimate, Paratethys, Chiuzbaia, Maramureș, Romania.

### **1. Introduction**

The deposit of fossil plants at Chiuzbaia is situated in the Maramureș county, North-West of Romania. On the southern flank of Mount Igriș, at an altitude of 810-870 m, there appears a succession of diatomites and volcanic tuffs consisting of two complexes: an lower one and an upper one.

The diatomites, slightly hardened, bear a large number of fossil plants that have been collected from eight fossiliferous sites. The total number of collected samples is of about 10000.

More precisely it is situated in the northern part of the village with the same name, on the southern flank of Mount Igriș. The village lies at about ten km North of Baia Mare town.

The age of this diatomitic complex has been estimated, comparing it with other localities with fossil plants, as being a latest Pontian, or (according to the nomenclature of the Dacic Basin) Bosphorium, 5,5 M. J.

### **2. Previously studies**

The most important studies of the fossil flora at Chiuzbaia have been made by

Givulescu, between 1963-1983, time when, have been published a series of papers. Previous studies have been made by Staub (1885), Polonic & Polonic (1963), Macovei (1996,1998, and 2003).

### 3. Fossil flora and palynological profile

Systematic studies that have been carried out during the last two decades, up to the present moment, let us make a broad survey on the results of the paleobotanic research.

These studies have emphasised the existence of a forest of a warm temperate type with deciduous leaves situated in a relatively flat land, not far from some lakes of variable areas, a forest made up mainly of trees, less bushes and a certain number of ferns, mosses and grass. As a vegetal association we can speak about a *Querceto-Fageta* with plenty of *Acer*, *Carpinus*, *Betula*, *Carya* and *Zelkova*. The number of taxons is very large, this being the richest and most representative flora in the field of Paratethys. New families, new species and new genera for the fossil flora of Romania have been described from here, such as:

**new genera:** *Chiuzbaia tenella*(Bryophyta), *Pyrolaeanthus pseudosecundus* (Pyrolaceae).

**new species:** *Taxus inopinata*, *Carpinus cobălcescui*, *Betula pseudoluminifera*, *Quercus baikovskaia*, *Q. irregulare*, *Mahonia virginiae*, *Berberis goinai*, *Tilia megacarpa*, *Catalpa protobungeana*, *Syringa schweitzeri*, *Osmanthus lanceolatus*, *Polygonum pliocaenicum*, *Glumophyllum oenigmaticum*.

**new genera for Romania:** *Adiantum*, *Cephalotaxus*, *Torreya*, *Taxus*, *Tawania*, *Cyclocarya*, *Eucommia*, *Loranthus*, *Asimina*, *Epimedium*, *Berberis*, *Wistaria*, *Domboeyopsis*, *Catalpa*, *Syringa*, *Osmanthus*, *Polygonum*.

These enumerations exceed everything that has been written up to the present moment in the Romanian paleobotanical literature. It can also be pointed out that a series of taxons from Central Europe, extinct from the Miocene, have survived in Chiuzbaia in a final refuge, such as: *Torreya nucifera*, *Tetraclinis salicornioides*, *Ginkgo adiantoides*, *Sequoia abietina*, *Eucommia ulmoides*, *Asimina browni*, *Acer ruemianum*.

Describing in detail the respective observations we can say that apart from a massive attack of *Spaerites caryae* on the *Carya* leaves, the fungi are very rare. We can't say the same thing about the Bryophyta: seven types of mosses are known. The ferns are rare, yet the presence of *Adiantum cf. reniforme* that vegetes nowadays only in the Canary Islands and Madera represents a rarity. The conifers aren't very numerous either but they are represented by more special types, the epiderm of which was studied under the most favourable circumstances : *Taxus* wide - spread , *Cephalotaxus*, *Tetraclinis* and *Sequoia* in their last appearance in Europe, aslo *Torreya* and *Taiwania*. It is interesting to mention the scarcity of macroscopical remains of *Pinus*, though the palinological analysis sometimes indicates a massive participation of the pollen under discussion. However the presence of *Pinus cf. Strobilus* must be signalled as being a novelty. The great majority of leaves belongs to the angiosperms. A percentage evaluation made for the fossiliferous point "F" has shown the following

priority order: (table 1).

Table 1.

<i>Fagus attenuata</i>	21	27 %
<i>Quercus</i> div.sp.	9	06 %
<i>Acer</i> div.sp.	5	72 %
<i>Carya denticulata</i>	5	59 %
<i>Carpinus grandis</i>	5	42 %
<i>Zelcova</i> div. sp.	5	21 %

These five types are in fact edifying for the forest at Chiuzbaia, even if in some fossiliferous points their proportion appears changed. All the other types, very numerous as well, are present from 2,24 % to 0,04 %. Here are some of them: *Cyclocarya cyclocarpa*, *Juglans*, *Populus*, many types of *Corylus* (including *C. avellana*), of *Carpinus*, this one being represented especially by numerous bracts, *Ostrya*, *Betula*, *Alnus*, *Castanea* is also present. Regarding the number of types of *Quercus* it comes up to 18. It is interesting to mention the presence of several types of *Viscum* and *Lonathus* very rare in the European floras, in the same way in which the *Magnolia*, *Liriodendron*, *Sassafras*, *Euptelea*, *Cercidiphyllum*, *Mahonia* and *Berberis* give a special note in this context in the whole. Many *Rosaceae* (*Sorbus* cf. *aucuparia*, *S. proaria*, *S. Praetorminalis*), as well as numerous *Leguminosae*, (*Wisteria*, *Cercis*, *Robinia*, *Gleditschia*), can be added to the eleven types of *Acer*.

*Buxus* cf. *sempervirens* (with epiderm) is also present along numerous remains of *Tilia* (floral bracts), *Cornus*, *Fraxinus*, *Viburnum*. A special mention must be made for the climbers: *Celastrus*, *Smilax*, *Lonicera* and *Vitis*. Finally we know some certain herbaceous plants: *Epimedium*, and *Pyrola*, together with those known under a general term of *Glumophyllum*.

To the above mentioned facts we can add that our object of study hasn't been only the leaves, but the palynologic aspect as well. A palynological profile from Chiuzbaia has been achieved summing up a total of  $10 + 1,50 + 19 + 3 \text{ m} = 33,50 \text{ m}$  in all. The results of this palynologic study are notable, emphasizing genera that not appear macroscopically, such as: *Abies*, *Tsuga*, *Cedrus*, *Sciadopitys*, *Laryx*, *Pterocarya*, *Engelhardtia*, *Salix* and *Nyssa*, some of them being sporadic, others being frequent on the entire stratigraphic column. But the most important result of this study comes out from the emphasizing of several microclimatic oscillations. In other words, it has been proved in the so called warm temperate climate, that it hasn't been perfectly uniform and has been influenced by microclimatic oscillations having positive or negative aspects on the vegetation.

Galls, mines and other insect traces have been studied in the same context, this fact leading to the discovery of an unknown world full of insects that were eating and pricking the leaves of different vegetal species of Chiuzbaia.

#### 4. Statistical data

An important aspect of our research has referred to a statistical study. This

statistical data are presented as it follows.

*The statistics of samples, species, genera and families from five fossiliferous points from bottom to top in succession.*

*Table 2.*

Fossiliferous point	samples	species	genera	families
F	2344	72	81	48
G	332	71	41	26
E <sub>1</sub>	2416	109	57	34
H	2805	102	64	37
E	759	69	38	23

*The proportion of trees / bushes*

*Table 3.*

Fossiliferous point	trees	%	bushes	%
F	104	84.82	35	28.17
G	47	88.67	6	11.32
E <sub>1</sub>	61	80.26	15	19.73
H	63	78.66	19	23.17
E	42	80.76	10	19.23

*The proportion of entire and non entire margined leaves:*

*Table 4.*

Fossiliferous point	entire	%	non entire	%
F	45	30.82	101	68.17
G	17	33.33	334	66.66
E <sub>1</sub>	25	30.12	58	69.87
H	33	36.26	58	63.73
E	13	24.52	40	75.47

*The ratio of larges leaves over small leaves*

*Table 5.*

Fossiliferous point	Larges %	Small %
F	36.79	63.2
G	29.26	70.72
E <sub>1</sub>	41.66	58.32
H	35.2	64.78
E	41.02	55.97

*Foliar spectrum at five fossileferous points*

Table 6.

	E	%	H	%	E <sub>1</sub>	%	G	%	F	%
nanno	-	-	2	2.81	1	1.66	1	2.43	2	1.86
micro	23	58.85	44	61.97	34	56.66	28	68.29	65	60.74
noto	11	28.2	20	28.16	20	33.33	8	19.51	32	29.9
meso	5	12.85	5	7.04	5	8.33	4	9.75	8	7.47
macro	-	-	-	-	-	-	-	-	-	-
Total	39	9.9	71	99.9	59	99.9	41	99.9	107	99.9

*Foliar spectrum of the fossilifeous point "F" (after Raunkiaer)*

Table 7.

Entire leaves			Non entire leaves					
Camptodromous	%		Craspedodromous	%	Others %	Total	%	
nanno	1	0.93	-	-	1	0.93	2	1.86
micro	27	25.23	28	26.26	10	9.34	65	60.74
noto	7	6.54	18	16.82	7	6.54	32	29.9
meso	3	2.80	1	0.93	4	3.73	8	7.47
Total	38	35.5	47	43.91	22	20.54	107	99.98

The conclusions of such a statistic presentation are multiple: on one hand they show us an individuality proper to each forest that has succeeded on vertical line, a specific of each forest, on the other hand we watch a dynamic of forest association, dynamic that can be undoubtedly brought into contact with the microclimatic variations mentioned above; the presence of only some certain dimensions of leaves, four out of the seven possible ones, the predominance of the microphyllous type, the absence of the macrophyllous type represents a characteristic of the forest of Chiuzbaia that corresponds undoubtedly to a certain climate with its intrinsic oscillation. This fact comes out more obviously from the relation large leaves: small leaves.

### 5. Paleoclimate

Any paleobotanical study finally answers the question concerning the climate in which the vegetation under discussion has developed. The genera and species of the vegetation of Chiuzbaia have been presented above. The fact that comes up in the presence of a phytogeographical mixtum where the predominant types are those with actual correspondents in China, Japan and Atlantic North America. But while the first ones are spread on a large area in the Mixed Mesophytic Forest Formation, the second ones appear being grouped on a well-defined territory in the climatic sections 73, 74, 76, 78. The associations in these sections seem almost identical in the forest of Chiuzbaia as well, if we take into account point "F" only. The forest at Chiuzbaia has vegetated in a *Cfa*-type climate, with temperature of over 22<sup>0</sup> C in the hottest month and sufficient precipitation all through the year varying between 1144-1361 mm yearly.

In other words we can witness a forest of “europäische sommerlaubwälder” (Mai, 1981) respectively “Laubmischwald mit immer grünen Koniferen” (Szafer, 1947) types that can be actually compared with the “mixed mesophytic forest” from the Appalachian Mountains (Braun, 1964), or with the Beech–Maple Forest (Küchler, 1967) in the southern part of North America.

## 6. Conclusions

New families, new species and new genera for the Romanian fossil flora have been described here. These fossil forest type that can be actually compared with the “mixed mesophytic forest” from the Appalachian Mountains, or the Beech-Maple-Forest in the southern part of North America.

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Plate 1

- Fig. 1. *Prunus* cf. *laurocerasus*
- Fig. 2. *Magnolia cuneifolia*
- Fig. 3. *Daphnogene polymorphum*
- Fig. 4. *Betula* sp. aff. *B. papyrifera*
- Fig. 5. *Sassafras subtriloba*
- Fig. 6. *Tilia* sp.
- Fig. 7. *Diospyros brachysepala*
- Fig. 8. *Ulmus pyramidalis*
- Fig. 9. *Camelia* sp.
- Fig. 10. *Carya minor*
- Fig. 11. *Carya denticulata*
- Fig. 12. *Alnus* sp.

Plate 3.

- Fig. 1. *Acer* sp. aff. *A. campestre*
- Fig. 2. *Smilax* cf. *aspera*
- Fig. 3. *Rhus pseudosuccedanea*
- Fig. 4. *Rhus pseudosuccedanea*
- Fig. 5. *Acer* cf. *ruemianum*
- Fig. 6. *Lonicera* sp.
- Fig. 7. *Laurophyllum* sp.
- Fig. 8. *Cornus* sp.
- Fig. 9. *Ceanothus* sp.
- Fig. 10. *Ilex irregularis*
- Fig. 11. *Viscum* sp. aff. *V. album*
- Fig. 12. *Phyllites* sp.
- Fig. 13. *Viburnum inconforme*
- Fig. 14. *Acer ruemianum*
- Fig. 15. *Acer integrilobum*
- Fig. 16. *Populus latior*
- Fig. 17. *Taiwania japonica*
- Fig. 18. *Diversiphyllum truncata*

Plate 2.

- Fig. 1- 2. *Tilia megacarpa*
- Fig. 3. *Cercis* cf. *canadensis*
- Fig. 4. *Carpinus subtschonoski* 2 x
- Fig. 5. *Mahonia virginiae*
- Fig. 6. *Leguminosites* sp.
- Fig. 7. *Taiwania japonica*
- Fig. 8. *Carpinus kisseri* 3 x
- Fig 9 - 10. *Epimedium praeasperum*
- Fig. 11. *Acer integerrimum*
- Fig. 12. *Buxus sempervirens* - Stomata  
-700 x
- Fig. 13. *Spiraea* sp.
- Fig. 14. *Gleditsia allemanica*
- Fig. 15. *Tetraclinis salicornioides* –  
Stomata - 700 X

Plate 4.

- Fig. 1. *Cephalotaxus plioaenica*  
330 x
- Fig. 2. *Taxus inopinata* 330 x
- Fig. 3. *Sequoia abietina* 660 x
- Fig. 5. *Viscum plioaenicum*
- Fig. 6. *Zelkova zelkovaefolia*
- Fig. 7. *Asimina browni*
- Fig. 8. *Loranthus semakai*
- Fig. 9. *Pyrolaeanthus pseudosecundus*  
- flowers
- Fig. 10. *Eucommia* cf. *ulmoides*

PLATE 1

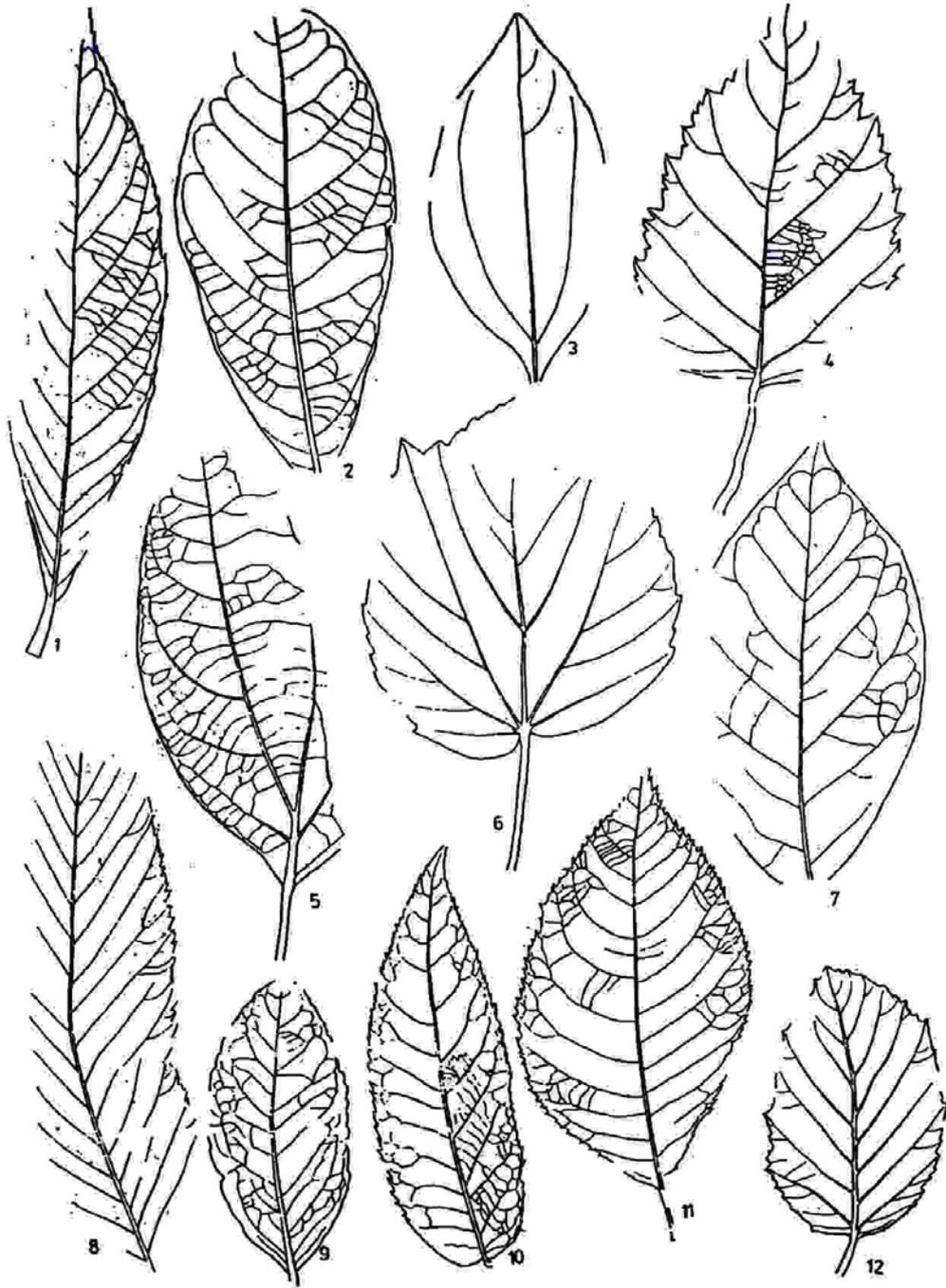


PLATE 2



PLATE 3

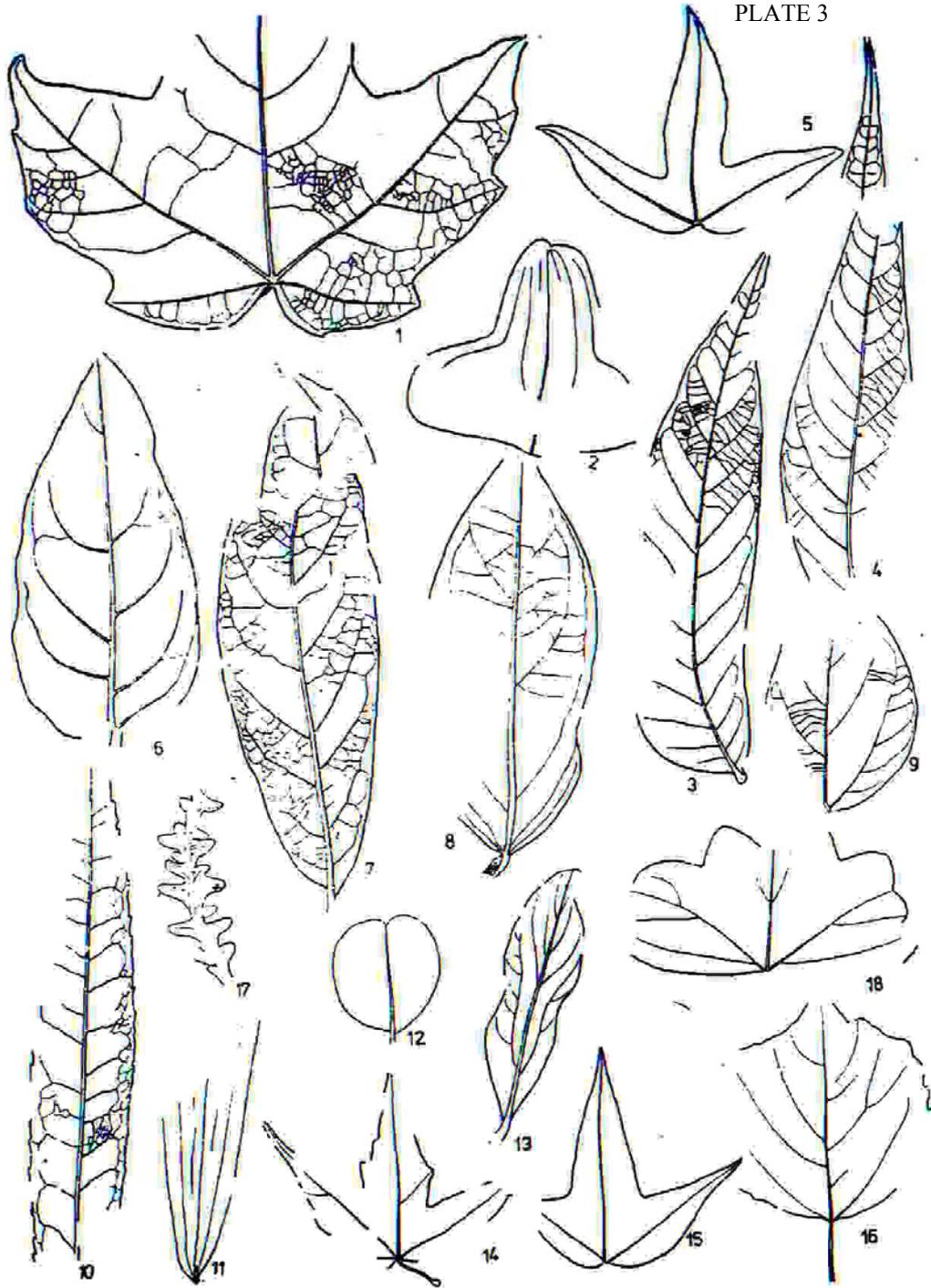


PLATE 4

