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FIRST PALYNOLOGICAL DATA ON THE SALT DEPOSIT FROM PRAID (NE TRANSYLVANIA)

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Abstract: Samples of salt collected from the Praid deposit were studied from a palynological point of view. The investigation consisted in several stages. A number of 56 species of pollen-spores has been identified. Their quantitative and qualitative analysis provided the background for paleoclimate interpretations regarding the interval of salt formation (Middle Badenian) at Praid, and by extension, in Transylvania in general.

Introduction

The palynological analyses on the salt deposit from Praid were performed during several successive stages:

- in 1985, two samples of clayey salt recovered from the salt massif have been investigated by geol. eng. Otilia Sasu. The palynological study (done by one of the authors – I.P.) evidenced a well-preserved microflora. The results have been recorded in the diploma work of the – then - graduating student, Otilia Sasu [8].

- in 1988, geol. eng. Tibor Török [10] in the frame of his diploma work, collected two samples of clayey salt from the – 266 and – 339 horizons (Praid salt mine) that have been studied for their palynological content (I.P.); both samples were very rich in microflora, but the sample from the – 266 horizon was better preserved. Thus, only data on sub-samples obtained from this specific material are included in the current paper.

- in 2003, the co-author of this paper (NB-B) collected 8 samples from the cores 102 (samples 1, 2, 3), 106 (samples 4, 5) and 110 (samples 6, 7, 8) drilled in 1987 in Sării Hill – Praid. The microflora was well-preserved. Information on these analyses are included in the PhD thesis [2].

No palynological data has been published on the salt deposit from Praid. Accordingly, our paper presents the first microfloral data for this occurrence.

Geology of Praid salt deposit

Praid area is located at the contact of Transylvanian Depression and the Neogene volcanic chain of the Eastern Carpathians, more precisely in the place where Târnavelor Plateau meets the Gurghiu-Harghita Mountains alignment (Fig.1). Geologically, Praid area belongs to the Neogene molasse of the eastern border of Transylvanian Depression The pre-laramian Dacidic basement [9] is overlain by a Miocene and Pleistocene sedimentary cover. The post-Pliocene volcanic agglomerates and breccia, consisting the volcanic-sedimentary complex, is widely-spread in the area

The Praid salt deposit represents a diapir column piercing the Miocene-Pliocene sedimentary cover. It is cropping out around Sării Hill from Praid locality, at the junction of Târnava Mică and Corund valleys. The deposit belongs to the eastern salt alignment of the Transylvanian Depression.

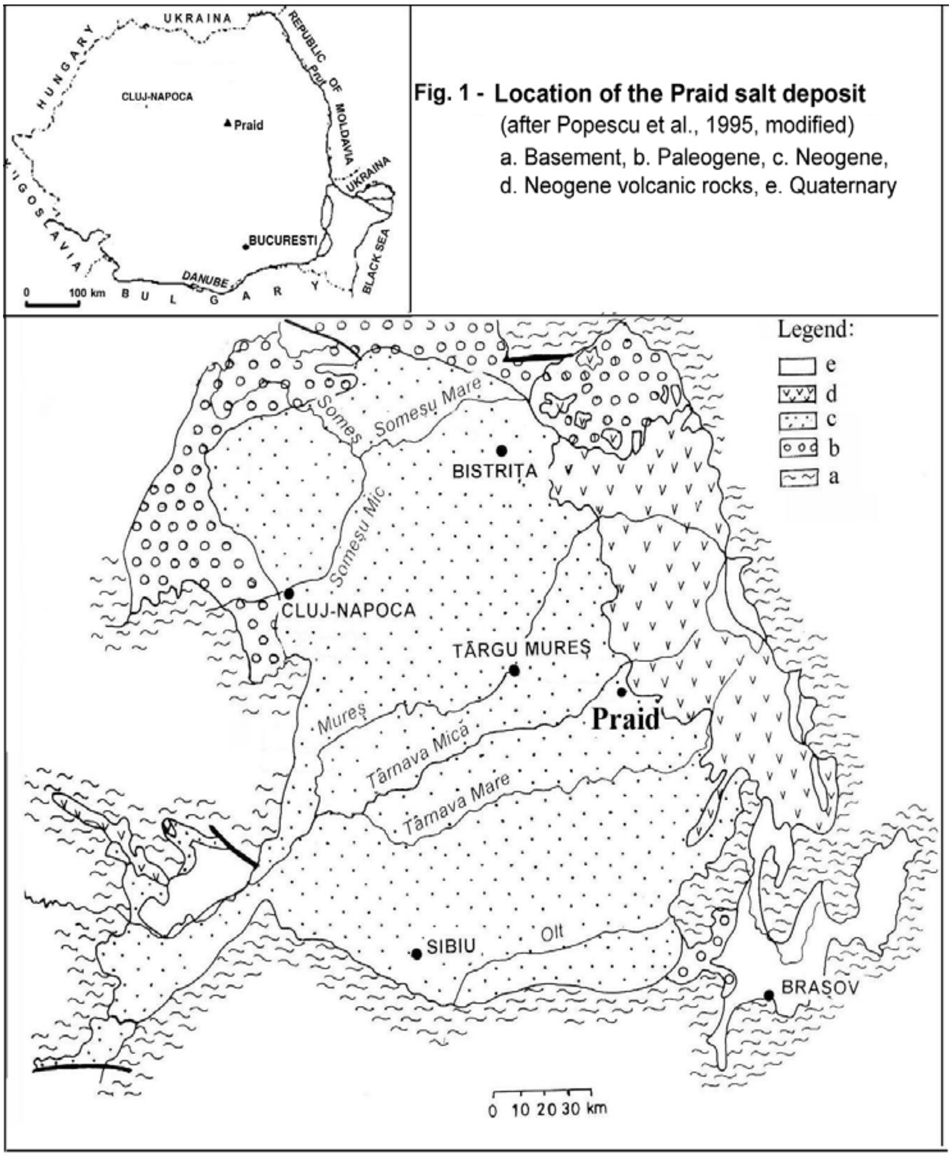


Fig. 1 - Location of the Praid salt deposit
(after Popescu et al., 1995, modified)
a. Basement, b. Paleogene, c. Neogene,
d. Neogene volcanic rocks, e. Quaternary

The salt is part of the evaporitic horizon extended throughout the whole Transylvanian Depression. The average thickness of this horizon is about 250 m, but locally, in some diapir bodies, salt may reach 2000 m (Praid). The formation of salt in the time interval 13.6 – 13.4 Ma is related by previous authors to the disconnection of Transylvanian Basin from the Pannonian Basin, as a consequence of the last global sea level fall during the Badenian, and additionally to a temperate-mediterranean climate [1].

Palynological study

The mineral residue resulted by salt dissolution in the studied samples was submitted to the standard preparation procedure for palynological studies.

Sample 87 collected from the – 266 horizon contained the best-preserved microflora. The list below refers to the results of its study.

Sample 104 from the – 339 horizon is rich in microflora, but its conservation status is poorer.

The PHYTOPLANKTON (<1%) is scarce. Colonies of *Botryococcus* have been (sporadically) identified.

Table 1: Polen-spores from sample number 87 (-266 horizon) Praid

TAXA	FREQUENCY
	Praid
CHLOROPHYTA	
1. *Botryococcus sp.*	●
PTERIDOPHYTA. FILICOPSIDA	
1. *Leiotriletes sp.*	●
2. *Laevigatisporites haardti* (Pot. et Ven. 1934) Th. et Pf. 1953	●●
3. *Verrucatosporites favus* (Pot. 1931) Th. et Pf. 1953	●
4. *Polypodiaceoisporites sp.*	●
GYMNOSPERMATOPHYTA. CONIFEROPSIDA	
1. *Abiespollenites absolutus* Thg. 1937	●
2. *Abiespollenites cedroides* (Thomson 1953) W. Kr. 1971	●
3. *Abiespollenites latisaccatus* (Trevisan 1967) W. Kr. 1971	●
4. *Pityosporites microalatus* (Pot. 1931) Th. et Pf. 1953	●●
5. *Pityosporites alatus* (Pot. 1931) Th. et Pf. 1953	●
6. *Pityosporites insignis* (Naum ex. Bolch. 1953) W. Kr. 1971	●●
7. *Pityosporites macroinsignis* W. Kr. 1971	●
8. *Pityosporites labdacus* (Pot. 1931) Th. et Pf. 1953	●●●
9. *Piceapollis praemarianus* W. Kr. 1971	●
10. *Piceapollis sacculiferoides* W. Kr. 1971	●
11. *Cedripites lusaticus* W. Kr. 1971	●
12. *Cedripites miocaenicus* W. Kr. 1971	●
13. *Podocarpidites libellus* (Pot. 1931) W. Kr.1971	●
14. *Zonalapollenites igniculus* (Pot. 1931) Th. et Pf. 1953	●
15. *Zonalapollenites maximus* (Raatz 1937) W. Kr. 1971	●
16. *Sciadopityspollenites verticillatiformis* (Zauer 1960) W. Kr. 1971	●
17. *Cupressacites bockwitzensis* W. Kr. 1971	●
18. *Sequoiapollenites polyformosus* Thg. 1937	●●
19. *Sequoiapollenites gracilis* W. Kr. 1971	●
20. *Inaperturopollenites sp.*	●
ANGIOSPERMATOPHYTA. MONOCOTYLEDONATAE	
1. *Graminidites* sp.	●
2. *Sparganiaceaepollenites polygonalis* Thg. 1937	●
3. *Monocolpopollenites* sp.	●
4. *Arecipites* sp.	●
ANGIOSPERMATOPHYTA. DICOTYLEDONATAE	
1. *Triatriopollenites myricoides* (Kremp 1950) Th. et Pf. 1953	●●
2. *Triatriopollenites bituitus* (Pot. 1931) Th. et Pf. 1953	●
3. *Engelhardtioidites microcoryphaeus* (Pot. 1931) Thomson et Thg. ex Pot. 1960	●
4. *Momipites punctatus* (Pot. 1931) Nagy 1969	●●
5. *Caryapollenites simplex* (Pot. 1931) W. Kr. 1960	●●
6. *Pterocaryapollenites stellatus* (Pot. 1931) Thg. 1937	●●
7. *Ulmipollenites undulosus* Wolff 1934	●
8. *Zelkovaepollenites thiergarti* Nagy 1969	●
9. *Alnipollenites verus* (Pot. 1931) Pot. 1934	●
10. *Carpinipites carpinoides* (Pf. 1953) Nagy 1985	●
11. *Intratriporopollenites insculptus* Mai 1961	●
12. *Intratriporopollenites instructus* (Pot. 1931) Th. et Pf. 1953	●●
13. *Periporopollenites stigmosus* (Pot. 1931) Th. et Pf. 1953	●
14. *Chenopodipollis multiplex* (Weyl. et Pf. 1957) W. Kr. 1966	●
15. *Eucommiapollis eucommi* (Planderova 1990)	●

16. *Tricolpopollenites liblarensis* (Th. 1950) Th. et Pf. 1953	●
17. *Tricolporopollenites microhenrici* (Pot. 1930) W. Kr. 1960	●●
18. *Tricolporopollenites cingulum* (Pot. 1931) Th. et Pf. 1953	●●
19. *Tricolporopollenites pseudocingulum* (Pot. 1931) Th. et Pf. 1953	●
20. *Tricolporopollenites marcodurensis* Pf. et Th. 1953	●
21. *Araliaceoispollenites edmundi* (R. Pot. 1931) R. Pot. 1953	●
22. *Nyssapollenites kruschi* (Pot. 1931) Nagy 1969	●
23. *Cyrillaceaepollenites exactus* (Pot. 1931) R. Pot. 1960	●
24. *Caprifoliipites sp.*	●
25. *Ericipites baculatus* Nagy 1969	●
26. *Ericipites callidus* (Pot. 1931) W. Kr. 1970	●
27. *Ericipites ericius* (Pot. 1931) Pot. 1960	●

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

The FERNS (about 2%) are represented by monolete (*Laevigatisporites* and *Verrucatosporites*) and trilete (*Polypodiaceoisporites*) spores.

The CONIFERALS (<60%) are dominated by the Pinaceae family, with *Pinus* pollen being the most frequent (> 35%). Each type of *Abies, Cedrus,* and *Picea* pollen represent 3-5%. *Tsuga* is even less frequent (2%).

The Taxodiaceae pollen (3-5%) is well-represented, especially by *Sequoia*. Besides, also pollen of *Sciadopitys* has been identified.

The average recorded frequency for the pollen of Cupressaceae (+Taxodiaceae) was 3-5%.

The ANGIOSPERMS may reach, in average, 38%.

Monocotyledons are rare (around 1%).

The most frequent dicotyledons belong to the following families: Juglandaceae, Fagaceae (Cvercinee), Ulmaceae, Myricaceae, Betulaceae, Ericaceae etc.

When considering the **paleoclimatic significance** of the identified microflora, the participation of macrothermal elements : Palmae, *Myrica, Engelhardtia, Momipites,* Cyrillaceae etc. is of special relevance.

The mesothermal elements are represented by *Cedrus,* Juglandaceae (*Carya, Pterocarya*), Ulmaceae (*Zelkova*), some Cvercinee etc.

The microthermal elements are mainly assigned to the conifers from the Pinaceae family: *Picea, Tsuga,* some forms of *Pinus* and *Abies*, but also to some types of dicotyledonous angiosperms: *Ulmus, Carpinus* and probably some of the Cvercinee.

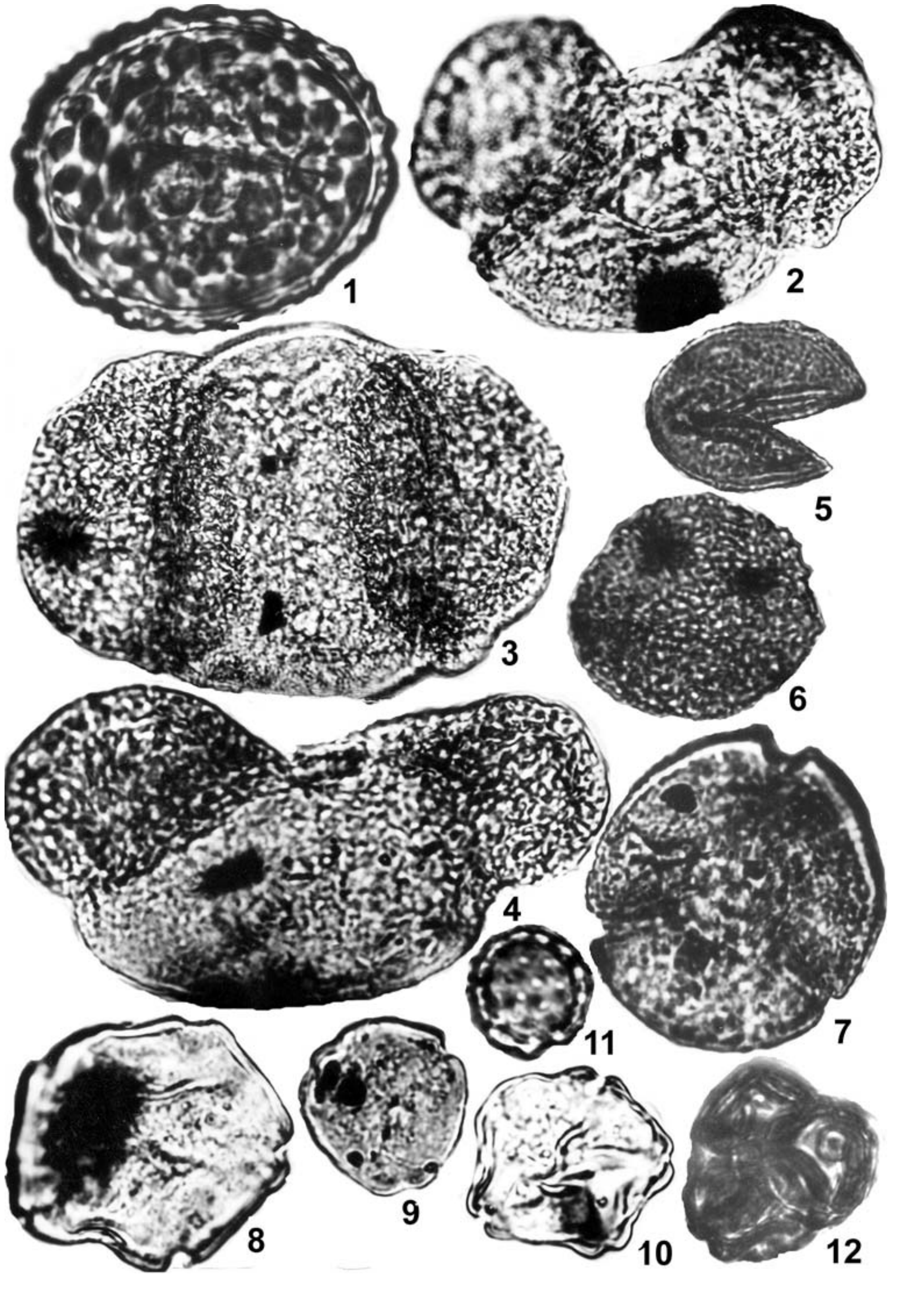
The facies pollen-spores belong to the freshwaters algae (*Botryococcus*), ferns (dominated by the Polypodiaceae family), conifers (Taxodiaceae), Monocotyledonous Angiosperms (Sparganiaceae), and Dicotyledonous Angiosperms (Myricaceae, *Alnus,* Nyssaceae, Cyrillaceae etc.).

Based on the identified microflora, we conclude that in the proximity of the sedimentary basin, valleys with associated meadows populated by a specific forest vegetation (*Alnus, Carya, Nyssa, Myrica, Cyrilla, Liquidambar*) were converging. The *Botryococcus* colonies formed in the adjacent river meadows. Some of the identified trees, mainly the Conifers, point to a vertical distribution of the fauna: *Cedrus, Abies, Pinus, Picea, Tsuga* etc. This is also supported by the general evolution of the Carpathian orogenic belt, in that stage submitted to the Styrian uplift.

The dry climate vegetation, typical for the inland areas is poorly represented in the studied pollen spectrum (Chenopodiaceae).

All these arguments plead for explaining the formation of the evaporites from the Praid area under specific paleogeographical circumstances [1]: a temperate-warm climate, probably including a dry season – with a greater influence in the inland areas – played a subordinate role.

Plate I (1000x)



1: *Verrucatosporites favus*; **2:** *Abiespollenites absolutus* (800x); **3:** *Pityosporites macroinsignis*; **4:** *Pityosporites labdacus*; **5:** *Cupressacites bockwitzensis*; **6:** *Sciadopityspollenites verticillatiformis*; **7:** *Nyssapollenites kruschi*; **8:** *Pterocaryapollenites stellatus*; **9:** *Momipites punctatus*; **10:** *Alnipollenites verus*; **11:** *Chenopodipollis multiplex*; **12:** *Ericipites ericius.*

When comparing the microfloral inventory from Praid with that from Ocna Dej [6] and Turda [5], one can conclude that the Middle Badenian vegetation was very similar in these salt-producing areas. Moreover, the same basic features were noticed also in the pollen spectrum of the Middle Badenian from Hungary [4], and Slovakia [7].

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PRIMELE DATE MICROFLORISTICE ASUPRA ZĂCĂMÂNTULUI DE SARE DE LA PRAID (NE TRANSILVANIEI)

(Rezumat)

În această lucrare sunt prezentate analizele palinologice ale zăcământului de sare de la Praid (Planşa 1) efectuate în câteva etape succesive, începând cu anul 1985 şi nepublicate până în momentul de faţă. In tabelul 1 este redată lista tuturor taxonilor identificaţi şi frecvenţa acestora. Microflora din sarea de la Praid (ce revine Badenianului mediu = Wielician) este asemănătoare cu microflorele de aceeaşi vârstă extrase din sarea de la Dej [6] şi sarea de la Turda [5], existând totuşi unele mici diferenţe. Cele constatate au permis concluzionarea faptului că sedimentarea evaporitelor în aria Praid a fost posibilă datorită unor condiţii paleogeografice specifice [1] (climatul temperat-cald, probabil cu un sezon uscat mai evidenţiat în interiorul uscatului continental, a avut un rol subordonat).