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A BROWN COAL SEAM FROM THE Ag. THOMAS-PREVEZA (W. GREECE)

Złoże węgla brunatnego z Ag. Thomas-Preveza (Zachodnia Grecja)

ABSTRACT. A profil at Ag. Thomas was coal petrographically and palynologically investigated. The coal shows high mineral component and a high gelification. In addition to the conventional representatives of forest-swamp environment, high percentage of the alluvial environment was found in this investigation. The age of this profile is Upper Pliocene, following the fossil content.

INTRODUCTION

The Uniwersity of Athens and Göttingen cooperated in a research on the genesis of Greek brown coal. A profile near Ag. Thomas-Prevesa was napped samples were taken and analyzed. The exposed profile shows the upper 40 cm of the seam and layers of clay, marl and sand with a total thickeness of about 2.5 m. These strata are probably the topset of a brown coal basin which extends inland and seaward.

Thirteen samples were analyzed for a pollen diagram. Moreover, three samples of the coal were used for a maceral analysis. These samples differ from all the brown coals. Previously labexamined by other authors, due to a high content of clay and high degree of gelification.

These specific micropetrographical features relate to certain conditions of the peat formation and to certain factors during the time of the genesis. This paper is an attempt to contribute not only to paleobotanical but also to stratigrophical aspects.

LOCATION OF THE INVESTIGATED PROFILE

The profile is situated ner Ag. Apostolos at the coast, 3 km SE of Prevesa (Fig. 1) The exposure is about 50 m long and 2.5 m high. The thickeness of the seam cannot be measured because the lower part of the profile is still concealed. To find out the total thickeness drilling is required.

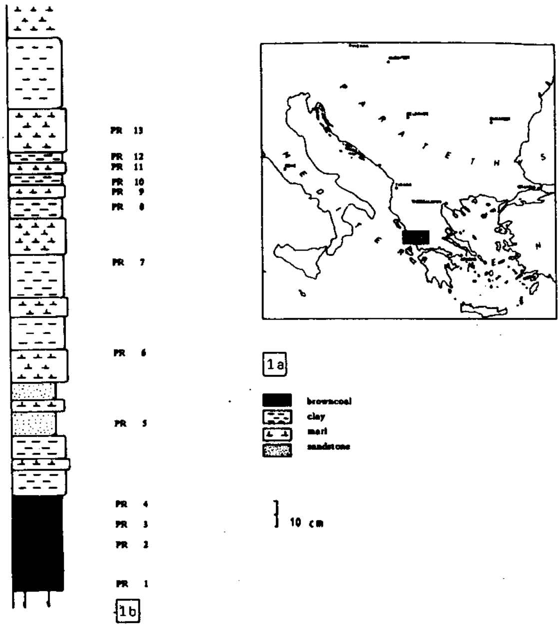

Fig.1. 1a — Map showing the investigated area. 1b — Profile containing coal seam and overlying layers and the positions of the samples selected for analysis

COAL PETROGRAPHICAL RESEARCH

Three samples of the upper part of the seam were analyzed (Pl. I). They were comminuted and divided into four parts. A representative sample was imbedded in cold hardenring synthetic resin.

The microscopical examination of the polished cosal grains in the resin was carried out by means of bright field illumination and blue light lenses using high magnifying oil-immersion.

A macroscopic description was considered to be unnecessary in account of the shallowness of the seam, even though such a description would allow a determination of the degree and the kind of decay of the plant remains in the coal and their botanic nature. This description is of practical use especially for the determination of technical properties regarding combustion, cooking, briguetting and hydrogenation.

The amount of mineral components is very high. The organic constituents are chiefly composed of gelled huminites. The ungelled components are mostly made of attrinit (detrital huminite particles) while textinit (ungelled tissue) does not occur so often. Compared to the huminite macerales the inertinite macerals are insignificant and the liptinite macerals are even more unisgnificant (see Table 1).

Table 1. Micropetrographic composition of the Browncoal of Prevesa (in Vol. % org. matter)

Sample No.	PR 1	PR 2	PR 3
Textinite	11.94	0.52	3.88
Texto-Ulminite	0.24	0.10	—
Eu-Ulminite	0.24	—	—
Attrinite	48.50	49.30	50.97
Densinite	21.39	20.10	20.38
Levigelinite	5.47	7.30	8.49
Porigelinite	1.49	0.10	—
Corpohumunite	3.48	2.90	0.48
Huminte-Group	92.75	88.32	84.20
Spornite	0.49	0.90	0.72
Cutinite	0.74	4.62	6.79
Resinite	—	—	—
Suberinite	—	—	—
Liptinite-Group	1.23	5.52	7.51
Fusinite	4.22	5.39	6.79
Semifusinite	0.24	—	—
Sclerotinite	0.74	0.32	0.24
Inertodetrinite	0.74	0.42	1.21
Inertinite-Group	5.94	6.13	8.24

In the fine grained substance of the former herbaceous or wooden (humodetrinite) plants fractions, many pollen and other waxy plant fragments (Liptodetrinit) can be found. The high amount of cutinite (cuticles of leaf epiderma) is quite unusual. The darkgrey weakly fluorescing „ribbons" also belong to the cutinites. The inertinite components are fusinites with swollen cell walls. This leads to a genesis based on microbial decay, because fusinites from burning origin have thin cell walls (Teichmüller 1950:439).

A characteristic micropetrological feature of the brown coal of Ag. Thomas is the fine lamination which is due to the altermation between cutinite (cuticles of leaf epiderma) and corpohuminite aggregate gel coming out of the mesophyll of leaves. This indicates that leaf-falling has considerably participated in the genesis of the coal. Algae colonies (= alginites) could not definitely be deterimined. They would have referred to a accumulation of plant remains in a very wet swamp with oben sheets of water.

PALYNOLOGICAL RESEARCH

For the detailed description of the whole microflora, fifty permanent slide preparations (two to three for each sample) have been made and described. Only few were rich in sporomorphs like the sample PR 7 which contains a rich and excellent microflora. In general, the degree of preservation of the pollen is very good. Thirty one types could be determined (26 of them are presented on Pls II-V). There will be not detailed description of the well konown sporomorphs because this was done in previous works.

The purpose of the palynological research of a description of the amount of pollen, the determination of specific pollen associations as well as the relation between the petrographical and palynological aspect and their meaning for comprehension of the genesis of the seam.

Table 2. The Flora constituens

Mycophyta		*Fungi, teleutospora multicellular*
Phycophyta		*Ovoidites* sp.
		Planktonites sp.
Pteridophyta	Polypodiaceae	*Verrucatosporites alienus*
Gymnospermae	Cupressaceae	
	Pinaceae	*Pinus* sp.
		Piceapolis praemaranus
		Abies sp.
		Tsugaepollenites viridifluminipites
		Cedrus sp.
	Taxodiaceae	*Inaperturopollenites hiatus*
Angiospermae		
Monocotyle-donaeae	Cyperaceae	*Cyperaceapolis piriformis*
	Gramineae	*Graminidites gramineoides*
	Sparganiaceae	*Sparganiaceapollenites polygonalis*
	Typhaceae	*Typha* sp.
Dictotyledoneae	Asteraceae	*Artemisia*-Typ
	Betulaceae	*Polyvestibulipollenites verus*
		Chenopodipollis multiplex
		Pterocaryapollenites stellatus
		Trivestibulopollenites betuloides
		Triporopollenites coryloises
		Polyporopollenites carpinoides
	Chenopodiaceae	Chenopodisceen-Typ
	Compositae	Compositae-tubuliflorae Typ
	Cupuliferae	*Tricolporopollenites genuinus*
	Fagaceae	*Quercus* sp.
	Hamamelidaceae	*Periporopollenites stigmosus*
	Juglandaceae	*Caryapolenites simplex*
	Nymphaeaceae	*Nymphaea* sp.
	Oleaceae	*Tetracolporopollenites* sp.
	Tiliaceae	*Intratriporopollenites instructus*
	Ulmaceae	*Polyporopollenites undulosus*
	Verbenaceae	*Tricolporopollenites wackerdorfensis*

The combination of the pollen (see Table 2) relates to a type of brown coal swamp discussed by Teichmüller (1958) as a modell for the young Tertiary brown coal swamp of the Lower Rhine bay. This model is very common in the Neogene. Besides the common representatives of the Neogene forest swamp, there is high quantity of elements of the alluvial deposit zone and open water sheets.

DISCUSSION

How do the petrographic results agree with the pollen spectra and which conclusions can be drawn?

The undisturbed lamination indicates a deposit under subaquatic conditions. This is also proved by the high gelification rate of the tissue. The bigger plant fragments i.e. *Nymphaeaceae, Typhaceae, Cyperaceae, Cupressaceae* leaf to wet habitats, which drifted on the open water until they sank to the bottom and were covered by clay.

Also representatives of a forest surrounding of the swamp such as oak-trees, elm-trees, birches, forestnut treees a.s.o. existed. The high content of clay within the coal shows that the whole material was more or less flushed together. Few wood fragments of the environment around the swamp were embedded in the clay.

A direct interference of atmospheric oxygen in the sediment that means the lake has dried up occasionally, can be excluded, because the consequent shrinkage of the gels would have destroyed the lamination.

The development of the fusinite rich coal implies an interruption of the usual still water deposition. The fusinite came probably from the dry swamp marginals regions, where the wood had been exposed to intense aerobic conditions of decay most likely in connection with fungal destruction (see Tëichmüller 1950:441). The environment can therefore be interpreted as relative shallow, with had air circulation.

Humic detrital gyttja was deposited. Increased suppley of mineral components led to the development of clay media which finally deposited in the stagnant waters.

The conditions of origin are supported by the pollen analysis as well as the strongly limnic character of the sedimentation by paleontological findings. Limnic gastropods (Kaouras & Velitzelos 1985) indicate the existence of high productive lake pools. This explanation of the conditions of origin have been confirmed by the first paleocarpological publication (Velitzelos & Gregor 1985), which states that aquatic and fenland plants can be found.

The fossil content of the profile strata has a definitely stratigraphic guiding value. According to the paleontological finding, the age of this strata is Upper Pliocene. This is confirmed by the palynological analysis im comparison with the literature (Krutzsch 1957, Potonie 1931).

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PLATES

PLATE I

1. Laminated browncoal. The microlaminax is visible through the dark cuticules. The mesophyll is composed of partly gelified and partly dentritic bayd, (Light gray and dark). Sample No. PR 1, light field, approx. x 400
2. Algal remains, (bor yococcus). Sample No. PR 1, fluorescence, approx. x 400
3. Gelinite surfaces. Below right in the dentritic bed, the cellumina are filled up by humic gel, (corpohuminte). Sample No. PR 1, light field, approx. x 400
4. A pressed sporinite. Sample No. PR 1, fluorescence, approx. x 400
5. Folded cuticules showing weak fluorescence. Sample No. PR 4, fluorescence, approx. x 400
6. Fusinite. The change from thick-walled sommer wood, to thinwalled spring wood is easily recognized. Sample No. PR 1, light field, approx. x 400
7. Tabular formed corpohuminite in gell unit. Sample No. PR 1, light field, approx. x 400

Plate I

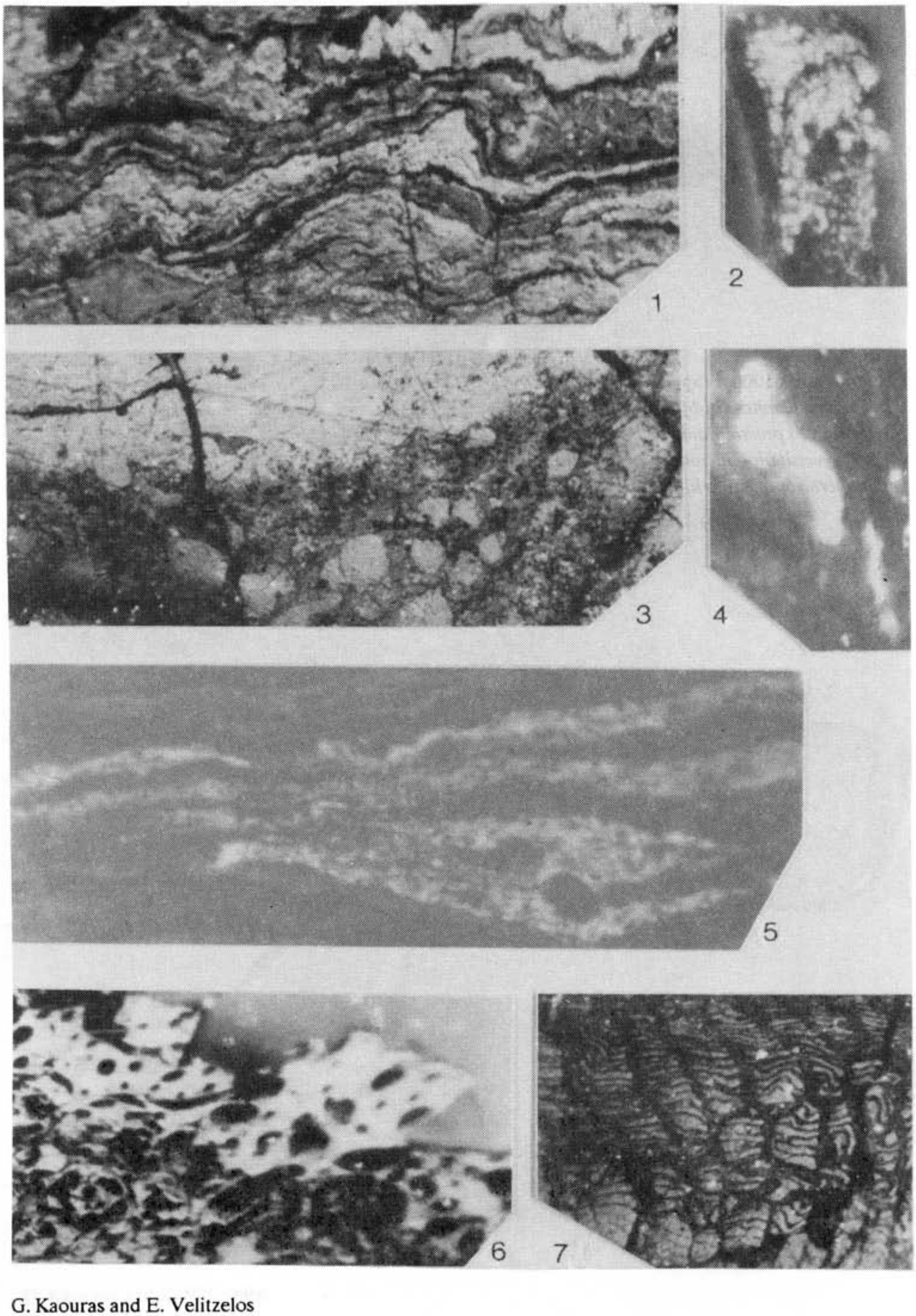

PLATE II

1. *Pinus* sp., x 1000, Präp. PR 7, 44, 8/110,9
2. *Tsugaepollenites viridifluminipites*, x 1000, PR, 23,5/111,2
3. *Piceapolis praemarianus*, x 1000, Präp. PR 7, 40,4/110,8
4.5. *Polyvestibulopollenites verus*, x 1000, PR 7, 46,3/115,3
6. *Inaperturopollenites hiatus* (R. Pot. 1931b) Th. & Pf., x 1000, PR 7, 16,9/103,8

Plate II

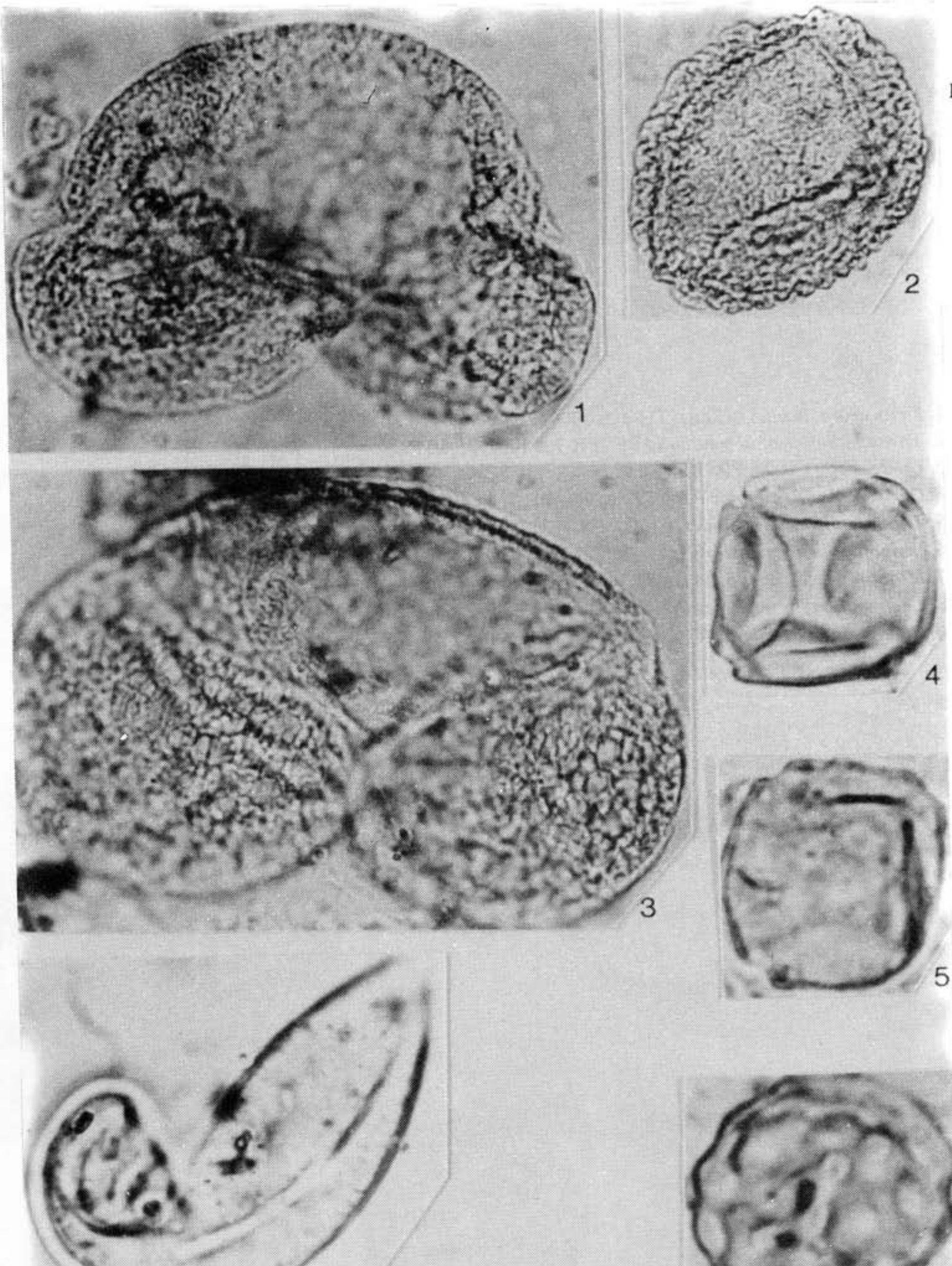

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PLATE III

1. *Pterocaryapollenites stellatus* THG., x 1000, PR 7, 34,9/116,2
2. *Trivestibulopollenites betuloides* PF., PR 7, x 1000, 35,6/112,2
3. *Quercus* sp., x 1000, PR 7, 33,3/100,6
4. *Carxyapollenites simplex* RAATZ, x 1000, PR 7, 44,4/110,1
5. *Triporopollenites coryloides*, x 1000, PR 7, 37,2/111,9
6. *Periporopollenites stignosus*, x 1000, PR 7, 45,0/112,2
7. *Intratriporopollenites instructus*, x 1000, PR 7, 46,8/107,0
8. *Chenopodipollis multiplex* (W. Krutz.), x 1000, PR 7, 55,6/110,8
9. *Compositae-tubuliflorae* Typ, x 1000, PR 7, 44,2/102,2

Plate III

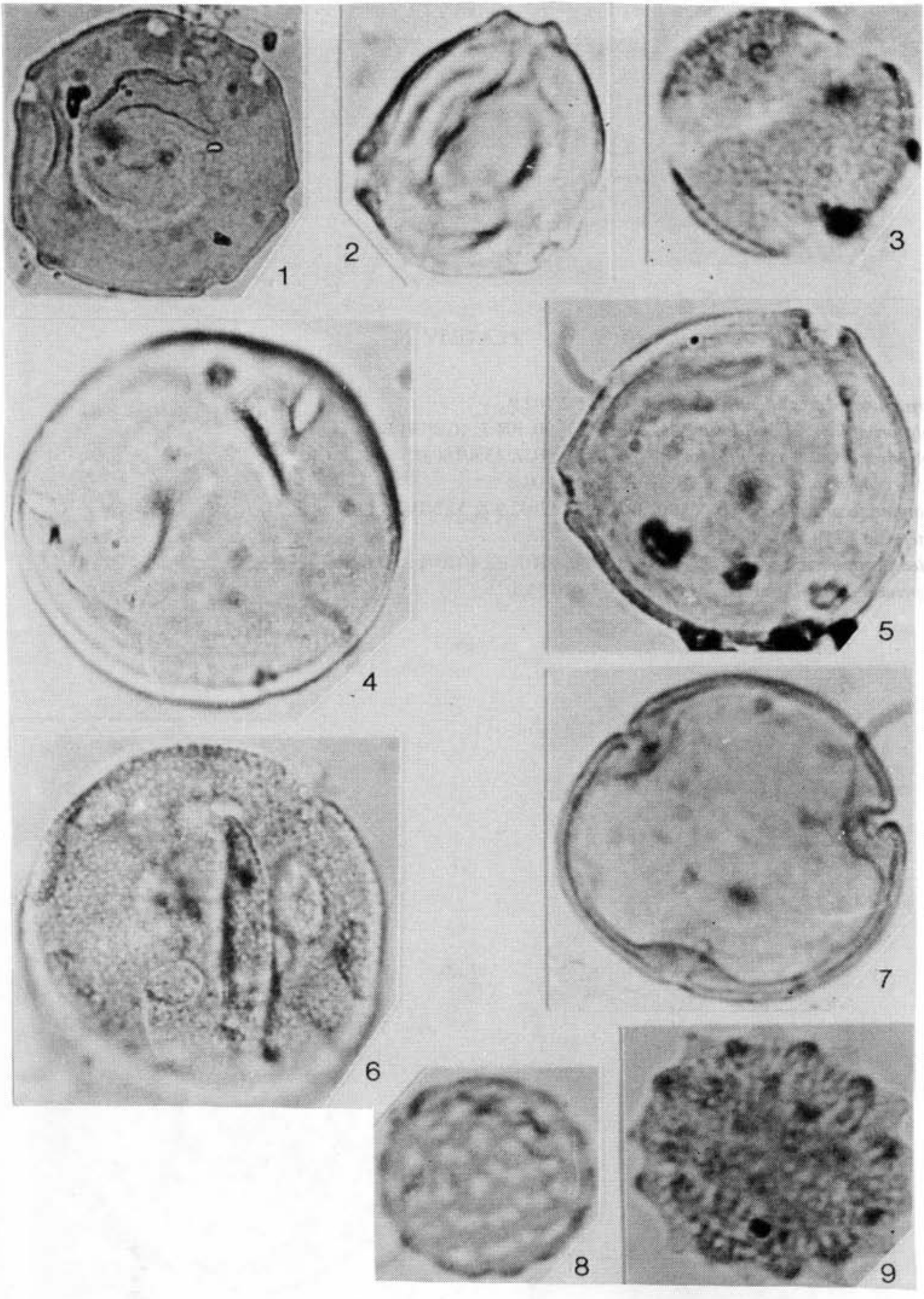

PLATE IV

1. *Verrucatosporitres alienus*, x 1000, PR 7, 41,2/102,9
2. *Polyporopollenites undulosus* TH. & PF., x 1000, PR 7, 46,2/101,8
3. *Polyporopollenites carpinoides* (PF.), x 1000, PR 7, 43,6/100,0
4. *Tetracolporopollenites* sp., x 1000, PR 7, 29,9/108,6
5. *Sparganiaceaepollenites* sp., x 1000, PR 7, 33,1/102,9 & 33,0/102,8
6. *Artemisia* - Typ, x 1000, PR 7, 33,0/102,8
7. *Tricolporopollenits wackersdorfensis*, x 1000, PR 7, 32,4/103,1
8. *Cyperaceapolis piriformis*, x 1000, PR 7, 36,2/103,4

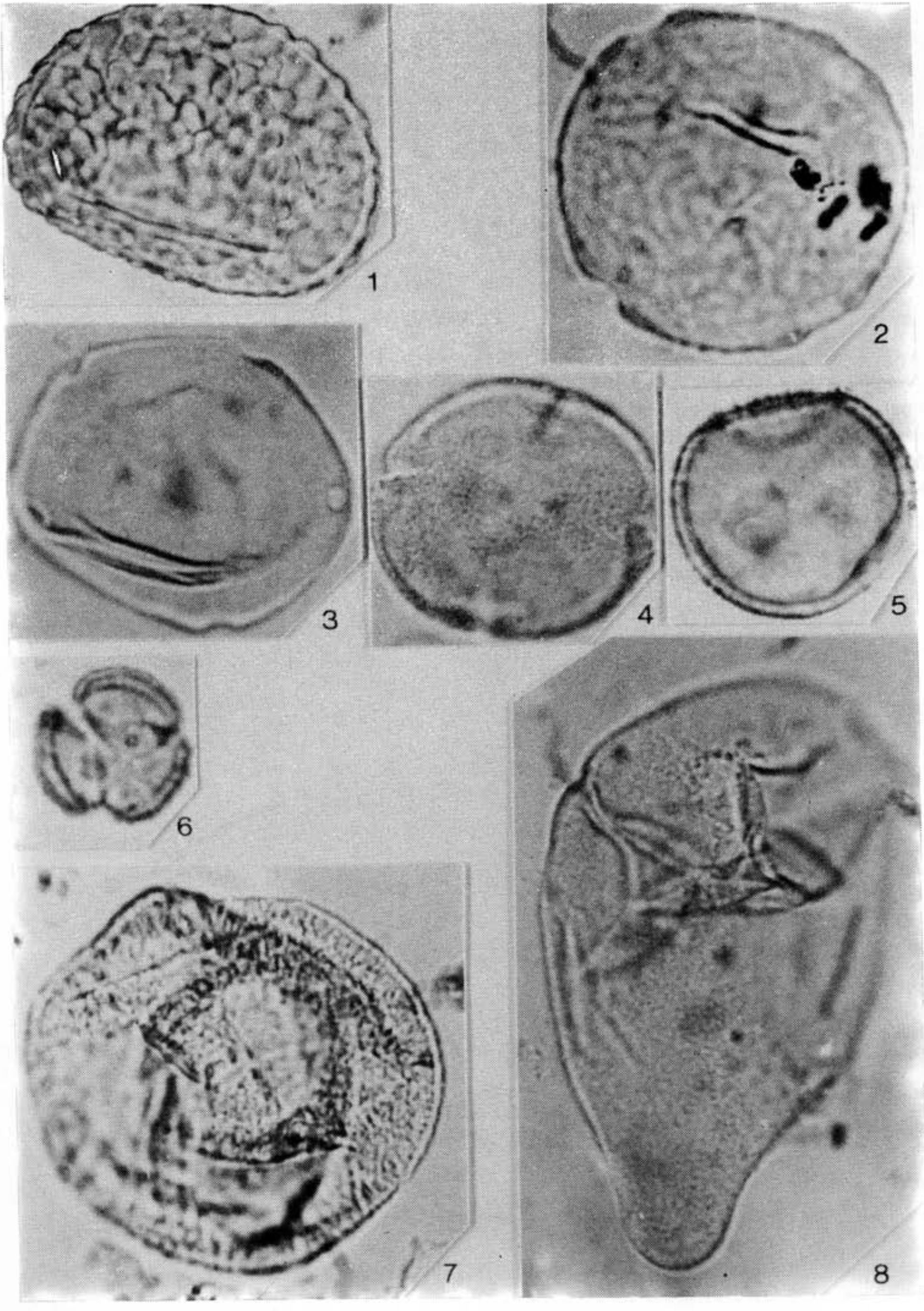
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PLATE V

1.2. *Nymphaea* sp., x 1000, PR 7, 48,5/102,5
3. Fungi, teleutospores, multicellular, x 1000, PR 7, 31,1/101,5
4. *Graminidites gramineoides*, x 1000, PR 7, 36,2/103,4
5. *Planktonites* sp., x 100, PR 7, 35,3/103,7
6. *Ovoidites* sp., x 400, PR 7, 32,4/103,1

Plate V