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PALAEOBOTANICAL AND PALYNOLOGICAL STUDY OF THE UPPER BADENIAN SEDIMENTS FROM THE NE PART OF THE VIENNA BASIN (LOCALITY DEVÍNSKA NOVÁ VES)

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ABSTRACT. Studied clay sediments from the Devínska Nová Ves locality belong to the Studienka Formation. They are very rich in micro- and macrofaunal and also micro- and macrofloral assemblages. Plant remains and pollen spectra composition reflects warm-temperate almost subtropical climate during the Upper Badenian.

KEY WORDS: Western Carpathians, Vienna Basin, Upper Badenian, clays, macroflora, pollen analysis

INTRODUCTION

The Devínska Nová Ves locality (DNV) is situated 20 km west of Bratislava. The fossil flora comes from a clay pit, where the clay material for brick production has been exploited since 1870. The original clay pit was situated 300 m north of the present pit. Since the marine fauna (Foraminifera, Nannoplankton, Ostracoda, Mollusca) and the fossil remnants of the terrestrial vegetation occur in the clays, the DNV locality is of considerable interest to palaeontologists. The sediments are very rich in micro and macrofaunal assemblages. These are documented by abundant representation of the Bolivino-Bulimina Foraminifera zone.

The first detailed locality description was given by the geologist Schaffer from Vienna in 1898. Schaffer classified the layers with plant remnants as the Middle Tortonian (Badenian). Many other palaeontologists and geologist have concentrated their attention on the study of fossil fauna, including Thenius (1952), Zapfe (1950), Toula (1900, 1915), Lehotayová (1977), Švagrovský (1981) and others.

The Austrian palaeontologist Berger (1951) specialized in the fossil flora from the DNV clay pit. He described 11 species: *Pinus taedaeformis, Alnus rotundata, Carpinus grandis, Fagus attennuata, Castanea atavia, Zelkova* cf. *praelonga, Liquidambar europaeum, Cinnamomum scheuchzeri, C. polymorphum, Sapindus falcifolius,* Poaceae sp. In his 1951 book W. Berger wrote: 'These are the first leaf remnants of the Middle Miocene in the Vienna Basin. They indicate warm – temperate and some of them almost subtropical climate and they represent the Central European vegetation during the Miocene'.

COMPOSITION OF FOSSIL FLORA

Except for the species found by Berger (1951), we have found other forms, mainly taxa belonging to the family Phaeophyceae. The Phaeophyceae indicate marine sedimentary organic origins. Many other authors, e.g. Kovar (1982), Knobloch (1969), Zastawniak & Worobiec (1997) and Heer (1855), have described similar forms under names *Cystoseirites altoaustriacus* Kovar, *Cystoseirites flabelliformis* Ung., *Algites* sp., *Cystoseira communis* Ung., *Sphaerococcus crispiformis* Heer and *Enteromorpha stagnalis* Heer. Our examplers are most similar to *Cystoseirites altoaustriacus* Kovar. There have also been Coniferopsida reported with *Pinus* and *Picea* present, either like leaf imprints or reproductive organs. From the Magnoliopsida *Magnolia dianae* Ung. has been identified and large-size leaf representants with toothed borders named *Dicotylophyllum* sp., *Juglans acuminata* A. Br., *Betula macrophylla* (Goepp.) Heer, *Betula prisca* Ett., *Quercus pseudocastanea* Goepp., *Q. mediterranea* Ung., *Castanea atavia* Ung., *Platanus platanifolia* (Ett.) Knobloch, cf. *P. neptuni* (Ett.) Bůžek, Holý et Kvaček, *Daphnogene bilinica* (Ung.) Kvaček et Knobloch, *Diospyros brachysepala* A. Br., *Acer integerrimum* (Viv.) Mass., *Acer* sp. – fruit, *Pinelea oeningensis* (A. Br.) Heer, *Fraxinus* cf. *praedicta* Heer – fruit, *Sapindus falcifolius* A. Br. are known to occur.

A portion of palaeotropical and arctotertiary geoflora elements reflects climatological changes during the Upper Badenian. Generally, it can be stated that the arctotertiary elements dominate, especially pollen of the warm-temperate elements: Pinaceae, Taxodiaceae, Nyssaceae, *Caryapollenites simplex, Juglandipollis* cf. *verus, Pterocaryapollenites stellatus, Zelkovaepollenites*

Table 1. List of pollen taxa determined from the clay sediments at the Devínska Nová Ves locality. ****very rich, ***abundant, **common, *rare

Middle Miocene Upper Badenian																		
clay																		*lithology*
12	11,5	11	10	9	8,5	8	7	6	5,5	5	4	3	2,5	2	1	0,8	0,5	Depth (m)
18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Samples
****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	****	***	**	*Pinus*
***	***	**	**	**	**	***	**	***	***	**	**	**	**	**	**	**	***	*Picea*
***	***	***	**	**	**	**	**	**	**	***	***	***	***	**	**	**	**	*Abies*
**	**	**	**	**	*	**	**	**	**	**	**	**	**	**	*	*	**	*Tsuga*
**	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*Podocarpus*
*	*	*	*	*	*	*	*	*	**	*	*	*	*	*	**	**	**	*Sciadopitys*
*	*	*	*	*	**	*	*	*	**	**	*	**	*	*	*	**	**	*Carpinus*
**	*	**	**	*	*	**	**	**	*	*	*	*	*	*	**	**	**	*Juglans*
*	*	**	**	**	**	**	**	*	*	*	**	**	**	**	**	**	**	*Carya*
**	**	**	**	**	*	**	**	*	*	**	**	**	**	**	**	**	**	*Castanea*
*	*	*	*	*	**	*	*	*	**	*	*	*	*	*	*	*	*	*Fagus*
*	**	**	**	**	**	**	**	**	**	*	**	**	**	**	**	**	**	*Ulmus, Zelkova*
**	**	**	**	***	**	***	***	**	**	***	**	**	**	**	***	***	***	*Quercus*
*	*	*	**	**	**	*	*	*	*	*	*	*	*	*	*	**	*	*Tilia*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	**	**	*	*	*Pterocarya*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	Oleaceae
*	*	*	*	**	*	*	*	*	*	*	*	*	*	**	**	**	*	*Magnolia*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*Engelhardtia*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*Platycarya*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**	*	*Aralia*
*	**	**	**	**	**	**	*	**	**	**	**	**	**	**	**	**	**	Taxodiaceae, Cupressaceae
*	*	**	***	*	*	*	*	**	**	**	*	**	**	**	**	**	*	*Nyssa*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*Salix*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*Alnus*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**	**	*	*Betula*
*	*	*	*	**	**	**	**	**	**	**	**	*	*	*	**	**	*	*Myrica*
**	*	*	*	**	**	*	*	*	*	*	*	**	**	**	*	*	**	Cyrillaceae
*	*	*	*	*	*	*	*	**	*	*	*	*	*	*	*	*	*	*Reevesia*
*	*	*	*	*	*	*	*	*	*	*	*	**	*	*	*	*	*	*Rhus*
*	**	**	**	**	*	*	**	*	*	*	**	*	**	**	**	*	**	Poaceae
**	**	**	*	**	*	*	*	*	*	**	*	**	*	*	**	*	**	Fabaceae
*	*	*			*	*	*	*					*	*	*			*Laevigatosporites haardti*
*	*	*	*	*	*	*	*	*	**	*	*	*	*	*	*	*	*	*Osmunda*
					*						*				*			*Artemisia*
*	*	*	*	*	*	*	*	*		*		*	*	*	*	*	*	Ericaceae
*	**	**	*	*	*	*	*	*	**	**	*	*	*	**	**	*	**	Chenopodiaceae

potoniei, Betulaepollenites sp.*, Quercoidites* sp. and the taxa of the cool – temperate elements: *Carpinipites* cf. *carpinoides, Intratriporopollenites cordataeformis, Ulmipollenites undulosus, Faguspollenites* type. It is possible to observe clearly the decrease of the elements of the palaeotropical geoflora type. There are rare, even commonly present specimens of *Podocarpidites libellus, P. nageiaformis, Myricipites bituitus, M. microcoryphaeus, Engelhardtia* type*, Platycarya* type, and continuous taxa such as *Ilexpollenites margaritatus* and *Castanea* type.

From the character of the pollen spectra it appears that the climatic conditions favoured the start of forest development with *Inaperturopollenites hiatus, I. dubius, Nyssapollenites analepticus* and humiphilous vegetation *Myricipites bituitus, M. microcoryphaeus, Alnipollenites verus, Salixipollenites* sp.*, Osmundacidites* sp.*, Ericipites callidus* and Cyrillaceae. The pollen *Pinuspollenites* sp., *P. alatus, P. labdacus, P. peuceformis, Abiespollenites maximus, Piceapollis tobollicus*, *Tsugaepollenites spinosus, T. viridifluminipites* and *Sciadopityspollenites* sp. prefer more arid habitats. NAP were represented by *Graminidites* sp. and *Chenopodiipollis multiplex.*

CONCLUSION

The character of the climatic conditions favoured swamp forest development with *Taxodium, Nyssa, Alnus*, and *Myrica*. The drier areas were overgrown with mixed deciduous-coniferous forest represented by: *Pinus*, *Scia-*

dopitys, Picea, Tsuga and *Quercus, Carya, Juglans, Pterocarya* and *Ulmus*.

By comparing palaeoecological conditions in which palaeoflora spread from the comparison of recent related species, it can be supposed that climate was warm-temperate even subtropical and humid enough for development of swampy communities in this area.

According to quantitative representation of individual species and genera it is possible to observe decreasing of tropical (P1), subtropical elements (P2) and identifing elements increasing arctotertiary geofloral, Lauraceae representants appear only sporadically because of gradual cooling, which influenced flora development in whole Europe during the Upper Badenian to Quaternary.

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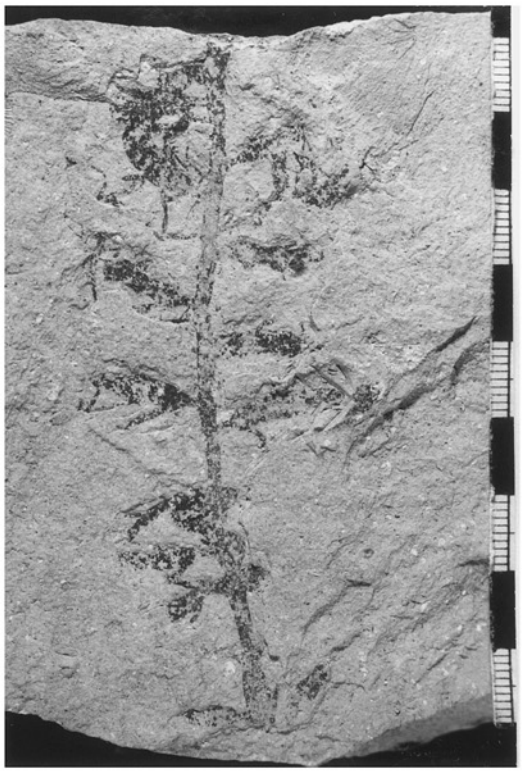
PLATES

Plate 1

1. *Cystoseirites altoaustriacus* Kovar, × 1
2, 3. *Algites* sp., × 1
4. *Picea* sp. cone, × 1
5. *Acer* sp. fruit, × 2
6, 7, 8. *Zelkova zelkovaefolia* (Ung.) Bůžek et Kotlaba, × 1



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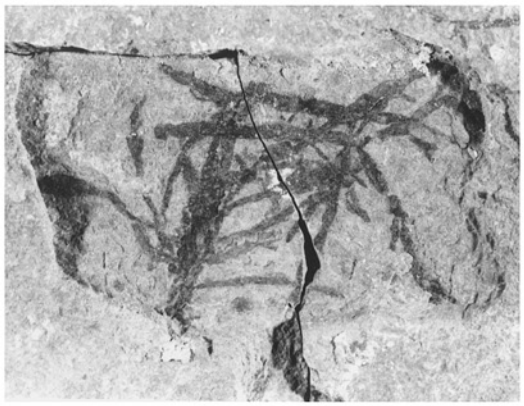

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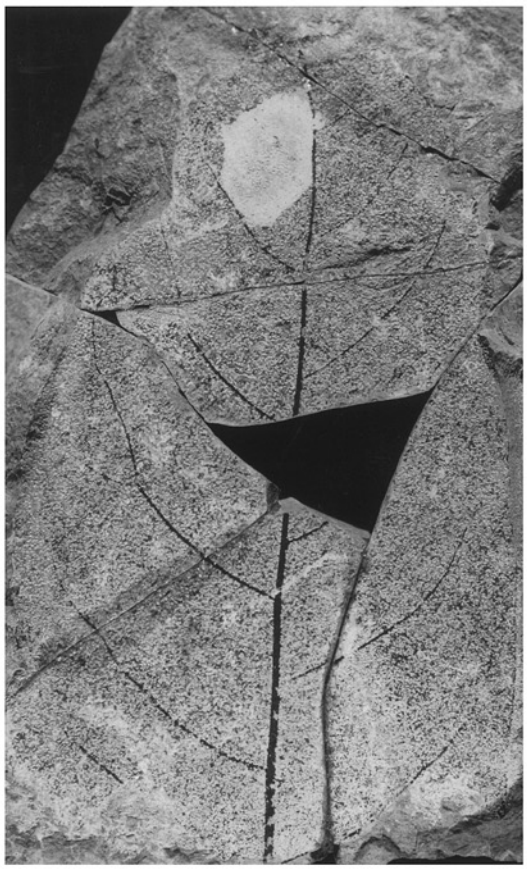
Plate 2

1. *Magnolia dianae* Ung., × 1
2. *Quercus pseudocastanea* Goepp., × 1
3. *Dicotylophyllum* sp., × 1
4. *Juglans acuminata* A. Br., × 1



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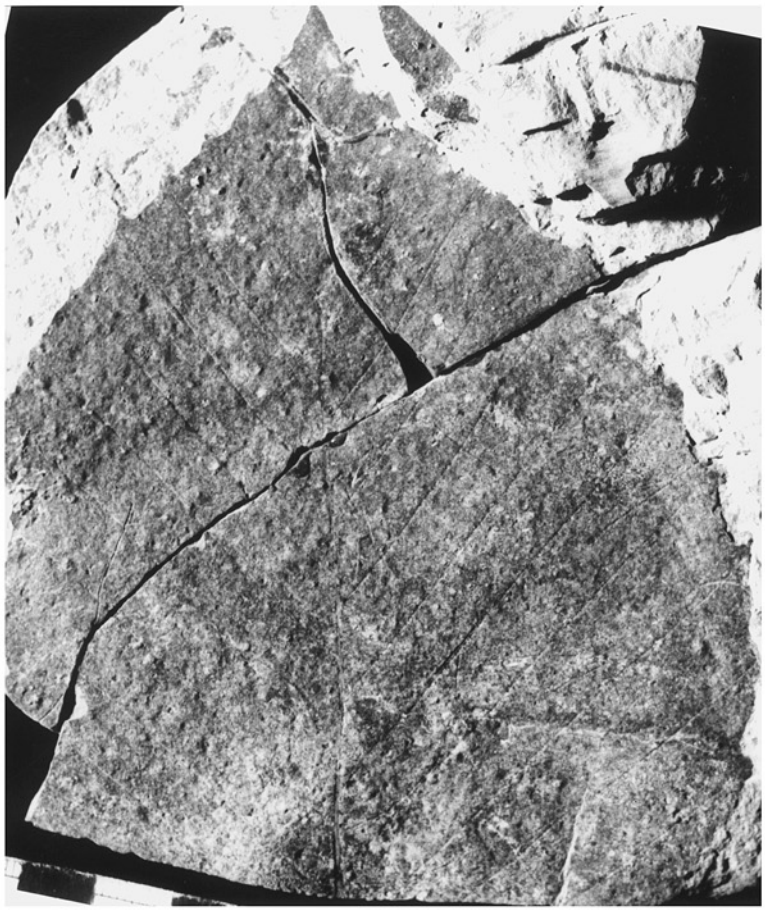

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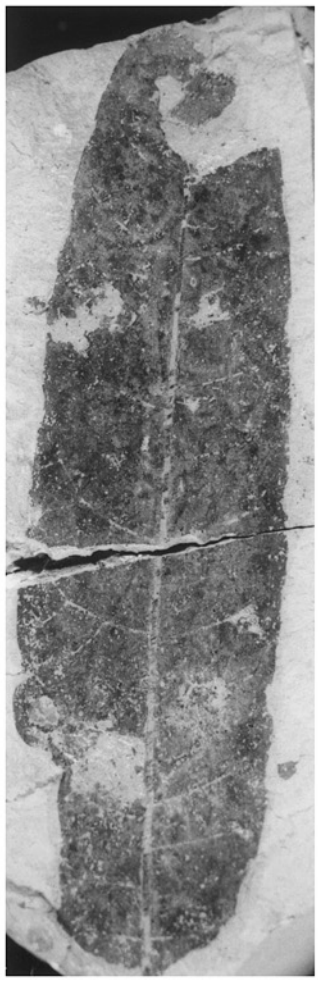

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Plate 3

1. *Betula macrophylla* (Goepp.) Heer, × 1
2. *Platanus platanifolia* (Ett.) Knobl., × 1
3. *Acer integerrimum* (Viv.) Mass., × 1
4. *Platanus neptuni* (Ett.) Bůžek, Holý et Kvaček, × 1
5. *Pinelea oeningensis* (A. Br.) Heer, × 2
6. *Sapindus falcifolius* A. Br. × 1
7. *Fraxinus* cf. *praedicta* Heer, fruit × 2
8. *Juglans acuminata* A. Br., × 1
9. cf. *Pterocarya* sp., × 1
10. *Carpinus grandis* Ett., × 1

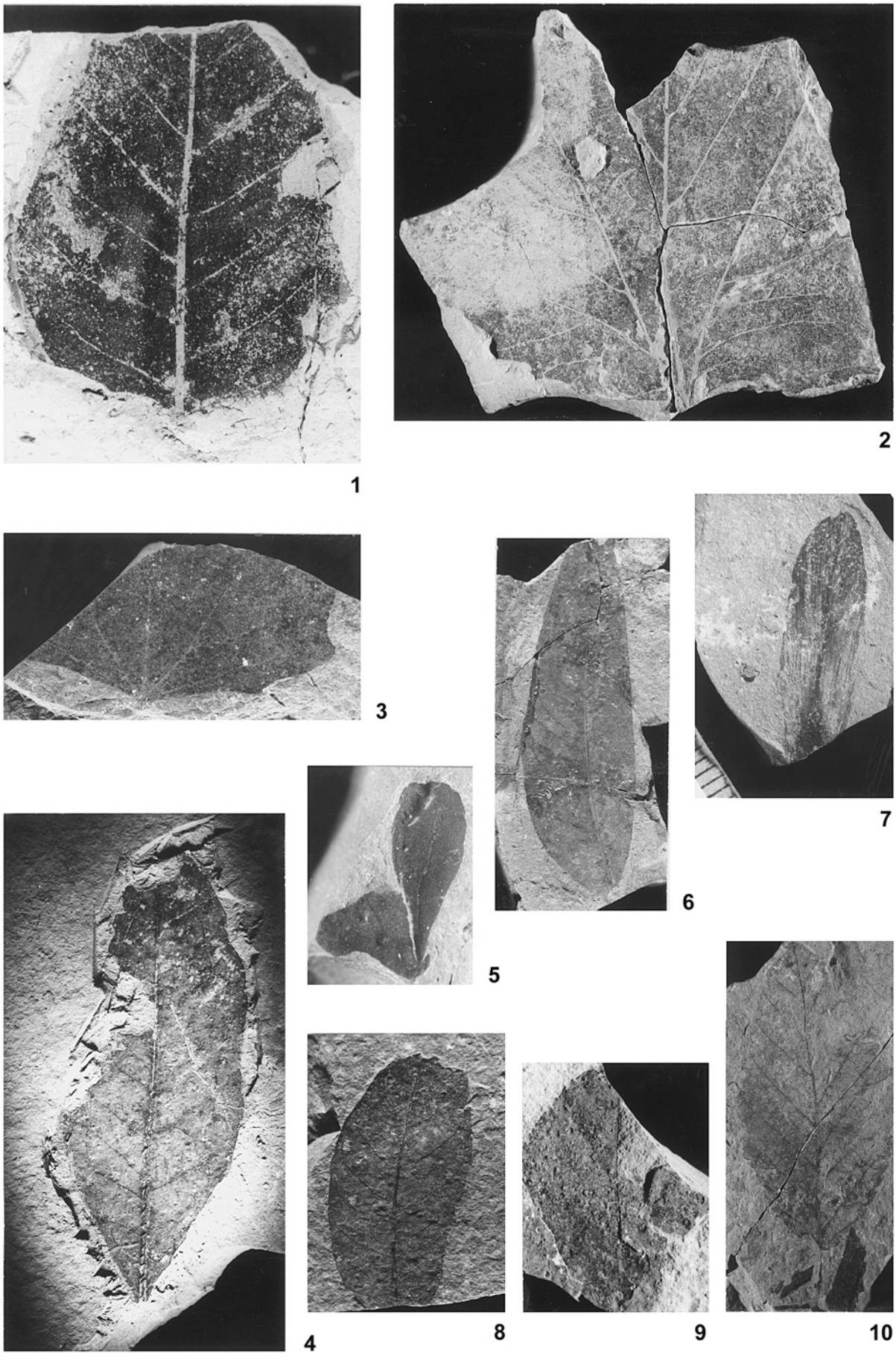
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Plate 4

× 1000

1. *Inaperturopollenites hiatus* (Potonié) Thomson et Pflug
2, 3. *Inaperturopollenites dubius* (Potonié et Venitz) Thomson et Pflug
4, 5. *Tsugaepollenites spinosus* (Doktorowicz-Hrebnicka) Słodkowska
6, 7. *Tsugaepollenites viridifluminipites* (Wodehouse) Potonié

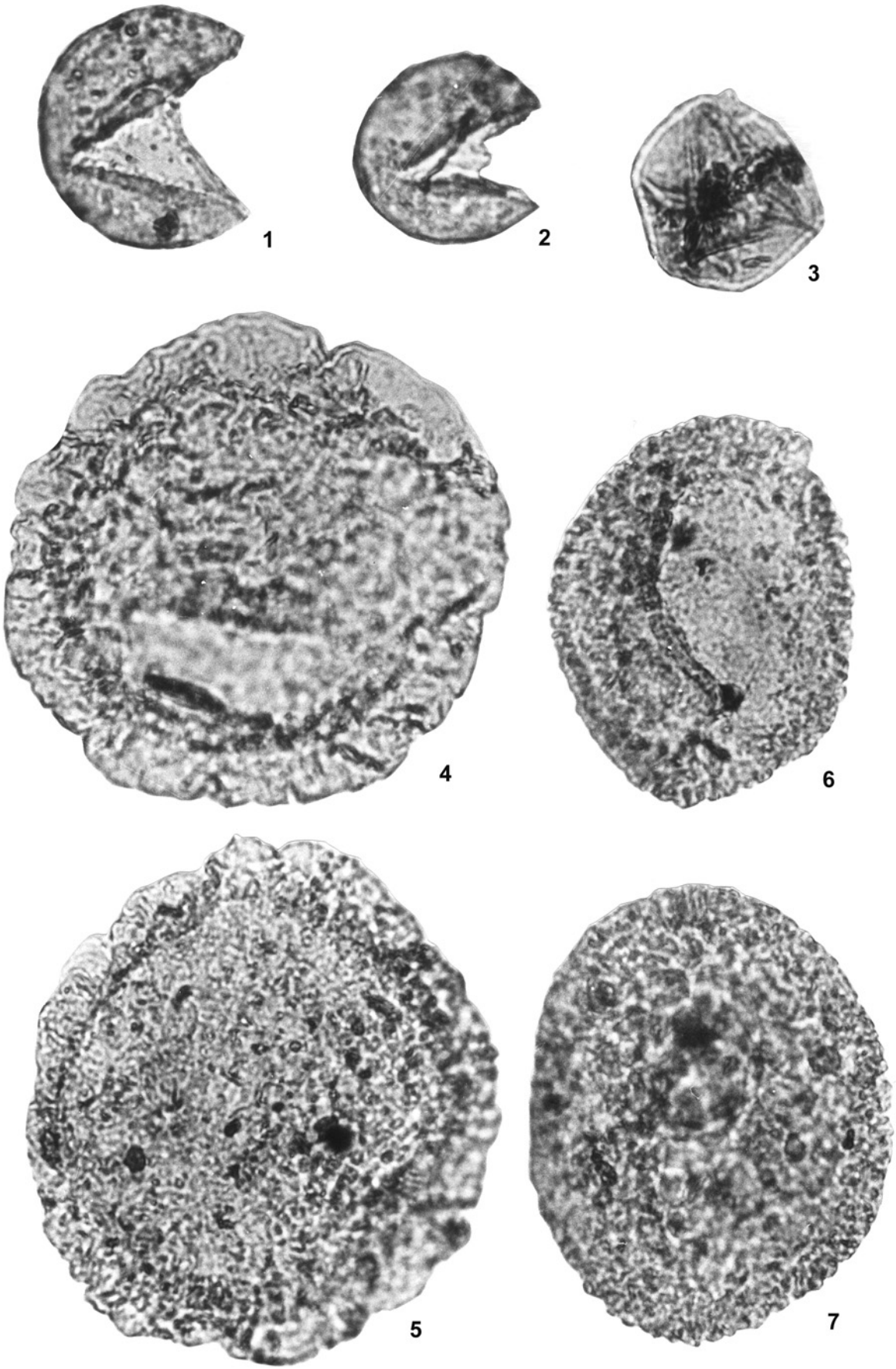
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Plate 5

× 1000

1. *Pinuspollenites alatus* (Potonié) Planderová
2. *Pinuspollenites labdacus* (Potonié) Raatz ex Potonié
3, 4. *Pinuspollenites peuceformis* (Zaklinskaja) Planderová
5. *Pinuspollenites* sp.
6. *Podocarpidites libellus* (Potonié) Krutzsch
7. *Podocarpidites nageiaformis* (Zaklinskaja) Krutzsch

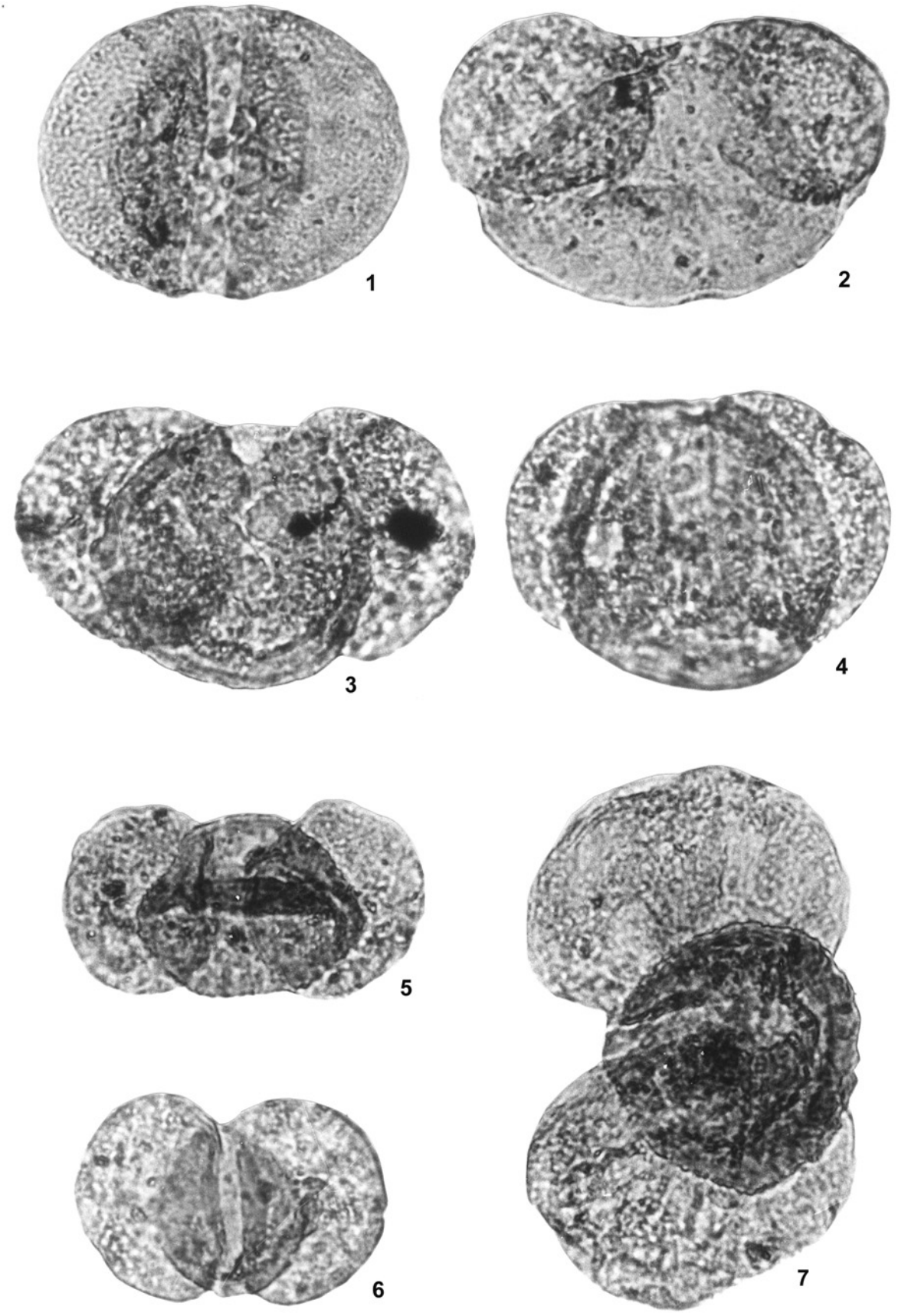
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Plate 6

× 1000

1. *Abiespollenites* sp.
2. *Abiespollenites maximus* Krutzsch


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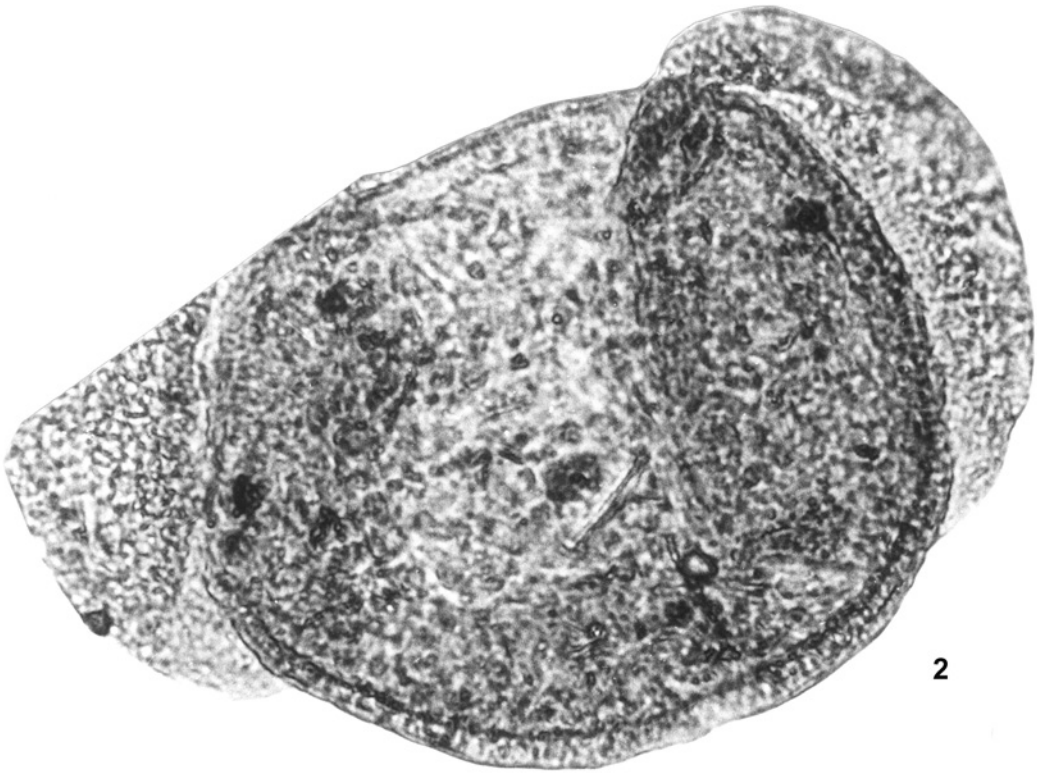
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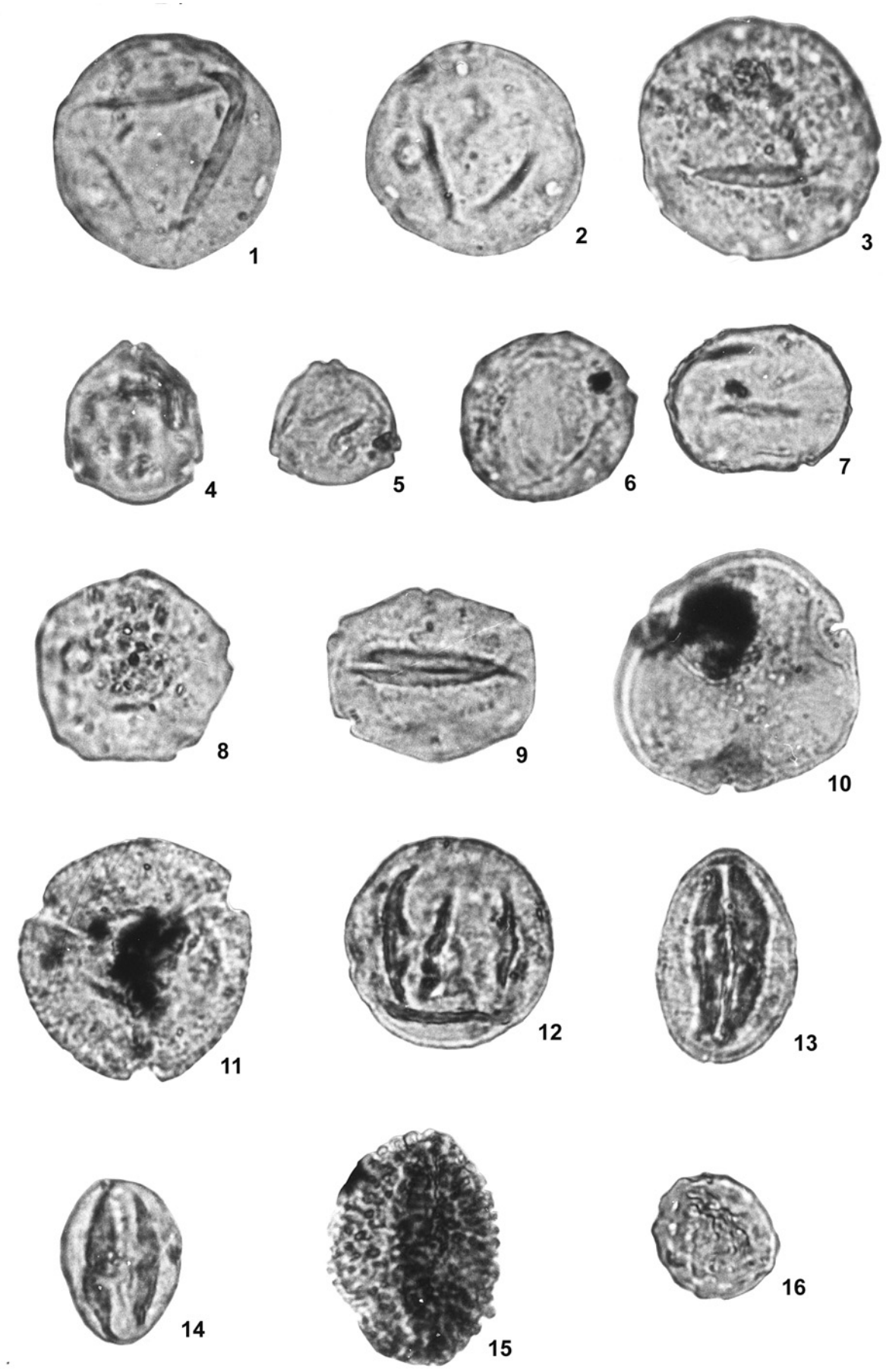
Plate 7

× 1000

1. 2. *Caryapollenites simplex* (Potonié) Raatz
3. *Juglanspollenites* cf. *verus* Raatz
4. *Myricipites bituitus* (Potonié) Nagy
5. *Myricipites microcoryphaeus* (Potonié) Słodkowska
6. *Ulmipollenites undulosus* Wolff
7. *Carpinipites* cf. *carpinoides* (Pflug) Nagy
8, 9. *Pterocaryapollenites stellatus* (Potonié) Thiergart
10. *Intratriporopollenites cordataeformis* (Wolff) Mai
11. *Faguspollenites crassus* Nagy
12. cf. *Nyssapollenites analepticus* (Potonié) Planderová
13. *Quercoidites henrici* (Potonié) Potonié, Thomson, et Thiergart
14. *Tricolporopollenites* sp.
15. *Ilexpollenites margaritatus* (Potonié) Raatz
16. *Chenopodipollis multiplex* (Weyland et Pflug) Krutzsch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