NEW DATA ABOUT PLANT MACROFOSSILS IN THE MIDDLE MIOCENE LIMESTONES AT MŁINY NEAR CHMIELNIK (Central Poland)

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ABSTRACT. New materials collected from detrital Middle Miocene limestones in the village of Młyny near Chmielnik made it possible to add the following taxa to the floristic list of this locality: Cupressaceae gen., Alnus cecropiafolia (Ett.) Berger, Platanus platanifolia (Ett.) Knobloch, Salix sp. (impression of a fruit), Crataegus sp., Viscum miceli (Geyler et Kinkel) Czezott, cf. Ampelopsis sp. New investigations of nanoplankton from the Chmielnik Formation (Dudziak & Łapaś 1991) has changed the age of the fossil flora of Młyny from Sarmatian to Badenian (coccilic zone NN 5–6).

KEY WORDS: leaf flora, detrital limestones, Middle Miocene

INTRODUCTION

Plant macrofossils were discovered in the Middle Miocene limestones in the Chmielnik region by Prof. J. Rutkowski in the 1960. The fossil materials collected then and in succeeding years were studied and the results published by Zastawniak (1980). The materials came from three limestone outcrops, two at Młyny (Młyny 164 and 165) and one at Stawian. Further materials, mainly from the exposure at Młyny 164 (Zastawniak 1980: Fig. 2), were collected by J. Rutkowski in 1978 (48 specimens) and by E. Zastawniak and G. Wrobiec in 1993 (127 specimens). These examples occurred in the same layer of micritic limestones of the Chmielnik Formation from which the leaf flora was described earlier (Zastawniak 1980).

The age of the Chmielnik Formation on the southern margin of Świętokrzyskie Mt. has been established for Upper Badenian – Lower Sarmatian (Rutkowski 1976, Alexandrowicz et al. 1982). New investigations of nanoplankton of a few sediment samples from this formation (Dudziak & Łapaś 1991) show the close relationship to the coccilic zone NN5–6 (Badenian) in the Pararethis lithostratigraphic scheme.

A total of 175 newly collected specimens were analysed. They are housed at the Palaeobotanical Museum, the W. Szafer Institute of Botany, Polish Academy of Sciences in Cracow, Nos KRAM-P 164/436–632. All the specimens have been preserved in the form of impressions, without any traces of plant tissue.

COMPONENTS OF ORICTOCENOSIS

Coniferae

Two specimens of the new material represent coniferous plants. One of them is a small fragment of a shoot, 1.5 mm wide, of a plant from the family Cupressaceae (Fig. 3:1), with opposite, short, scale-like leaves visible on it. The genera Chamaecyparis, Cupressus and Thuja have leaf shoots of this sort. A close determination on the basis of the morphology of a shoot, without any anatomical studies, is impossible.

The other specimen is an impression of a seed scale of pine (Pinus) with seed wings clearly visible (Fig. 1: 21). In the whole of the Młyny flora only these two families of conifers, i.e. Abietaceae and Cupressaceae, were represented in the remains found.
Angiospermae

Plant remains with vestiges of the venation typical of the Angiospermae prevail in the whole material. They are, for the most part, small indeterminable fragment of leaves. Some of them are, however, large and/or characteristic enough to make it possible to deter-
mine at least the genus of a given tree or shrub and even its species. The remains of alder (Alnus) leaves were most numerous, 14 specimens altogether, of which 4 represent the fossil species Alnus ceropiaefolia (Ett.) Berger (Fig. 1: 1,5–7), previously recorded only from Stawiany (Zastawiak 1980). Another species new to the flora of Mlyn, although known earlier also from Stawiany, is the fossil plane tree Platanus platanifolia (Ett.) Knobloch (Fig. 1: 10–12). Its leaves are generally very large, lobed, with characteristically toothed margins. Leaf fragments of this taxon can be distinguished by the third order venation typical of plane leaves. The remaining genera and species, viz. Acer aff. campestre L. (Fig. 2: 15), Carya denticulata (Weber) Iljinskaja (Fig. 1:9), Hemipeleps aff. davidii Hance (Fig. 3: 2, 4, 5), Podocarpium podocarpum (A. Braun) Herendeen (= Podognium oehningense, P. lyelium) (Fig. 2:10), Populus sp. (Fig. 1: 2, 4, 13–19), Pterocarya paradiisica (Unger) Iljinskaja (Fig. 2: 9), Quercus aff. pseudocastanea Goeppert (Fig. 2: 12) and Quercus aff. gigas Goeppert (Fig. 2: 13), Salix sp. (Fig. 1: 20), Ulmus plurinervia Unger (Fig. 2: 4–6, 8) and Zelkova zelkovaefolia (Unger) Bůžek et Kotlaba (Fig. 2: 1–3, Fig. 3: 3) were already known from the fossil flora of Mlyn. However, in the new materials, willow is represented not only
by the impression of a leaf but also by that of a fruit (Fig. 3: 9), the most reliable evidence of the presence of their genus in the fossil state.

One impression, almost complete, of a leaf of \textit{Crataegus} (Fig. 2: 14), in addition to the genera \textit{Pyra cantha}, \textit{Rosa}, \textit{Rubus} and \textit{Sorbus} determined before, proves the diversity of the Rosaceae shrubs in the orictocenosis of Mlyny. Some of the leaf impressions belong to the so-called Leguminosae type (Fig. 3: 10, 11). They are small leaves with entire or toothed margins and are fairly numerous in the whole flora of Mlyny (cf. Zastawniak 1980). The new materials comprise also impressions of elongate leaves with entire margins and only a very thick median vein visible, without any trace, or with only the slightest hint, of secondary venation (so-called Lauraceae type). Their mode of preservation and characters of venation are typical of plants, particularly shrubs, with leathery leaves (Fig. 2: 16–20).

A taxon completely new to Mlyny is \textit{Viscum miquelii} (Geyler et Kinkelín) Czeczott, a fossil species of mistletoe possessing small, oval leaves with entire margins, tapering to a form a short, broad petiole (Fig. 2: 11, Fig. 3: 7, 8). A fragment of another leaf bears characters typical of leaves from the family Vitaceae (Fig. 1: 22). It may have been a member of the genus \textit{Ampelopsis} and indeed could conceivably be \textit{Ampelopsis malvaeformis} (Schlothurm) Mai (= A. \textit{tertiaria} Dorofeev), whose seed had previously been found at Mlyny (Zastawniak 1980).

Remains of monocotyledonous plants are distinguishable at first sight by their regular parallel arrangement of leaf veins. The impressions of shoots and leaves of various genera, among them, \textit{Cyperacites}, \textit{Phragmites}, \textit{Poacites} and \textit{Typha} (cf. Zastawniak 1980) are grouped in abundant aggregations, the so-called “plant chaff” amid which can be seen, some impressions of marine molluscan shells (\textit{Cardium}) whose presence indicates that they were deposited by the seashore, in places where vegetable material floated in coastal reed and rush swamps.

CONCLUSION

The mode of preservation of the plant remains in the deposit, grouped in abundant aggregations, proves the allochthonous nature of the Middle Miocene flora of Mlyny, which means that this orictocenosis originated from an accumulation of plant material brought in from elsewhere. Because the impressions of leaves, whether from grassland communities or from trees and shrubs, are accompanied by
numerous impressions of shells of salt water molluscs, this accumulation must have taken place in a brackish environment. The plant material may have been transported not only by water currents but also by winds which carried leaves and light fruits (e.g. of willow) or winged seeds (e.g. of pine).

The new materials from Młyny support earlier statements about the composition and nature of the plant communities and the biotopic conditions of their occurrence. Such genera as Alnus, Caryya, Platanus, Populus and Pterocarya provide evidence of the presence of deciduous forests which grew in moist habitats in the alluvial littoral zone. Somewhat drier places and the slopes of small elevations were overgrown by mesopholic deciduous forests containing maples (Acer) and Zelkova and shrubs, Crataegus and others with Lauraceae-type leaves amongst them. Creepers (cf. Ampeleopsis) and parasitic mistletoe (Viscum) entwined the trees. Xerothermic thickets, typical of drier biotopes, grew on maritime sands and stony slopes and were made up of shrubs characterized by Leguminosae-type leaves. In places, these thickets passed into clear xerophytic woods with pine (Pinus) and oak (Quercus) and, in the group of lower trees, with elm (Ulmus pluvinitervia) and Cupressaceae. Reed-swamp communities with Phragmites, Typha and other monocotyledonous plants, occurred right by the edge of or in water.

A comparison of the climatic requirements of the plant genera identified in the orictocenosis from Młyny with those of modern plants indicates that they are now associated with the warm-temperate and temperate climates of the Holartic. The over representation of small forms of leaves in this orictocenosis is indisputable, a fact which in paleoclimatology is sometimes interpreted as an indication of a drier climate (Dilcher 1973).

However, in the present case it may have been due to particular, not very favourable, biotopic conditions under which the trees and shrubs grew by the sea.

The fossil flora of Młyny is very similar to the Sarmatic macroflora of Stare Gliwice (Szafer 1961) as well as to the pollen flora of the sulfur-bearing (Badenian) deposits at Piaseczno, 60 km east of Chmielenka (Oszast 1967). The great similarity suggests the same climatic conditions for these three fossil floras (Zastawniak 1980).

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REFERENCES


STREŚZCZENIE

Nowe dane o makroszczątkach roślin w środkowo-miocenńskich wapieniach w Młynach koło Chmielenka

Makroskopowe szczątki roślin w wapieniach środkowow-miocenowych w rejonie Chmielenka znalazli J. Rutkowski w latach sześćdziesiątych. Zebrane wówczas oraz w latach następnych materiały kopalne zostały opracowane i opublikowane przez E. Zastawniak (1980). Materiały te pochodziły z trzech odsłonięć skał wapiennych, dwóch w miejscowości Młyny (Młyny 164 i 165) oraz jednego w Stawianach. Dalsze materiały pochodzą głównie z odsłonięcia w Młynach 164 i były zbierane w latach 1978 (J. Rutkowski) i 1993 (E. Zas-
tawniak, G. Worobiec). Znajdowały się one w tej samej warstwie wapieni mikrytycznych, z której opisano wcześniej florę liściową (Zastawniak 1980).


Nowe materiały pozwoliły uzupełnić listę flory-tyczną oriktocenozy o następujące taksony roślin kopalnych: Cupressaceae gen., Alnus cecropiæfolia (Ett.) Berger, Platanus platanifolia (Ett.) Knobloch, Salix sp. (odecisk owocu), Crataegus sp., Viscum miquelii (Geyler et Kinkel) Czeczott, cf. Ampelopsis sp.

Wnioski dotyczące składu zbiorowisk kopalnych potwierdzają wcześniejsze ustalenia (Zastawniak op.cit.). Podobieństwo flory liściowej z Młynów do sarmackiej flory Starych Gliwic (Szafer 1961) oraz do flory pylkowej osadów siarkonośnych badenianu w Piasecznie (Oszast 1967) sugeruje te same warunki klimatyczne występowania tych trzech flor kopalnych (Zastawniak op.cit.).