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A PALYNOLOGICAL CONTRIBUTION TO THE QUATERNARY DEPOSITS IN THE WIDER AREA OF ZAGREB (CROATIA)

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ABSTRACT. Within the research project "Geological Map of the Republic of Croatia, scale 1:50.000", palynological analysis has been carried out on sandy to clayey silts from the outcrops in the wider area of Zagreb, in order to define the stratigraphical position of these sediments which were previously assigned to be of "Plio-Quaternary" age. The analysed samples have yielded palynological assemblages, which indicate Pleistocene age. The assemblage consisting of *Sparganium,* Cichoriaceae, *Tilia,* Betulaceae*, Nyssa, Quercus* suggests interglacial conditions, and the assemblage dominated by Coniferae and *Sphagnum* suggests glacial conditions.

KEY WORDS: sporomorphs, palynology, Pleistocene, Croatia

INTRODUCTION

Mt. Medvednica is characterised by two different rock complexes. The core of the mountain massif is built of Palaeozoic and Triassic metamorphic and clastic rocks. The second complex is composed of mostly sedimentary rocks of Mesozoic-Tertiary-Quaternary age.

The stratigraphy of the Quaternary sediments of the investigated area was performed by Malez (1965) and Rukavina (1978, 1983) on the basis of the recovered vertebrate fauna. The problem in the study area arises from the sediments, which do not contain vertebrates. Therefore, first palynological analysis was made by Jović within the project "Basic Geological Map of the SFRJ" (in: Šikić *et al*. 1972). Unfortunately, her results could not resolve that problem and these successions maintained as "Plio-Quaternary" in age. In this paper we tried to solve that problem.

MATERIAL AND METHODS

At the laboratory of the "Institute of Geology", Sachsova 2, 10000 Zagreb, Croatia, the samples were prepared by the standard palynological method of maceration. Carbonates were dissolved in 15% HCl and silicates in 48% HF. The organic residium was sieved using 15 mm sieve. Palynological slides were mounted using glycerine-jelly.

Pollen analysis was performed under the light microscope combined with the interference contrast. Fluorescence technique was used in order to distinguish reworked sporomorphs. The qualitative analysis followed the criteria presented in Krutzsch (1963–1971), Jansonius & Hills (1976), Moore & Webb (1978), Planderová (1990), Nagy (1985, 1992) and Kohlman-Adamska (1993). Quantitative analysis enhanced frequency of palynomorphs per slide. Exotic markers weren't used because samples contained insufficent number of sporomorphs due to the weathering processes on outcrops.

Only 6 samples, out of 50 taken from the sediments on natural outcrops, contained identifiable sporomorphs.

RESULTS

Table 1 lists all palynomorphs from the studied sites. The sites are located on Fig. 1.

DISCUSSION AND CONCLUSION

A palynological analysis of the previously assigned "Plio-Quaternary" sites in the wider area of Zagreb has resulted in palynostratigraphical and environmental characterisation of these sediments.

Šercelj (1969, 1979) defined typical pollen assemblages of some Pleistocene sediments in the vicinity of Križevci (50 km northeast of Zagreb) and Brežice (Slovenia; 30 km west of Zagreb). It shows great similarity in the composition as compared to the assemblages from the investigated area (a lot of "Tertiary relicts", absence of *Taxodium* and very low portion of *Fagus*).

During the Pleistocene time, Mt. Medvednica today's alevation of 1035 m, was uplifted approximately 300 meters (Prelogović & Velić 1988), which is an important fact because the composition of the palynological assemblages from the plain deposits were strongly influenced by the sporomorph input from the neighbouring hill-vegetation. Due to this intense tectonics, the study area

Table 1. Frequency of palynomorphs in samples A-G

No.	Palynomorphs	Frequency of palynomorphs in samples						
	Sample	A	B	C	D	E	F	G
	number of determined palynomorphs	120	200	219	34	22	15	6
	number of observed slides	4	2	1	2	2	2	1
1	*Pteridium*	–	1	–	–	–	–	–
2	*Sphagnum*	–	–	–	–	2	–	–
3	*Pinus*	–	109	203	28	12	4	5
4	*Picea*	–	8	–	–	–	–	–
5	*Abies*	–	43	6	–	1	–	–
6								
7	*Podocarpidites*	–	6	1	1	–	–	–
8	*Tsuga*	–	7	4	–	–	–	–
9	*Carya*	–	6	–	1	–	–	–
10	*Juglans*	1	3	–	–	1	2	–
11	*Ulmus, Zelkova*	–	2	–	1	–	–	–
12	*Carpinus, Ostrya*	6	1	–	–	–	–	–
13	*Betula*	–	1	–	–	–	–	–
14	*Alnus*	–	1	–	–	–	–	–
15	*Tilia*	7	8	–	–	–	–	–
16	*Quercus*	7	–	–	–	1	2	–
17	*Nyssa*	9	2	–	1	–	–	–
18	*Rannunculus*	8	–	–	–	–	–	–
19	Liliaceae	–	–	4	–	–	–	–
20	*Sparganium*	61	–	–	1	–	6	–
21	Graminae	–	1	–	–	2	–	–
22	Cyperaceae	2	–	–	–	–	–	–
23	Cichoriaceae	18	1	–	–	–	–	–
24	Chenopodiaceae	–	–	–	–	1	1	1
25	Caryophyllaceae	1	–	–	–	1	–	–
26	*Polygonum*	–	–	1	1	1	–	–

was characterized by intended surface, which led to the formation of various types of sediments (mostly sandy to clayey silts). This was especially the case during the interglacial times because of the intense rainfalls and periodically existing swift streams.

Thus, during the interglacial period (sample A), aquatic environments (floodplain and swamps) existed with hydrophilous vegetation that produced the sporomorph assemblage represented dominantly by *Sparganium, Potamogeton* and Cyperaceae. Intense rain-falls

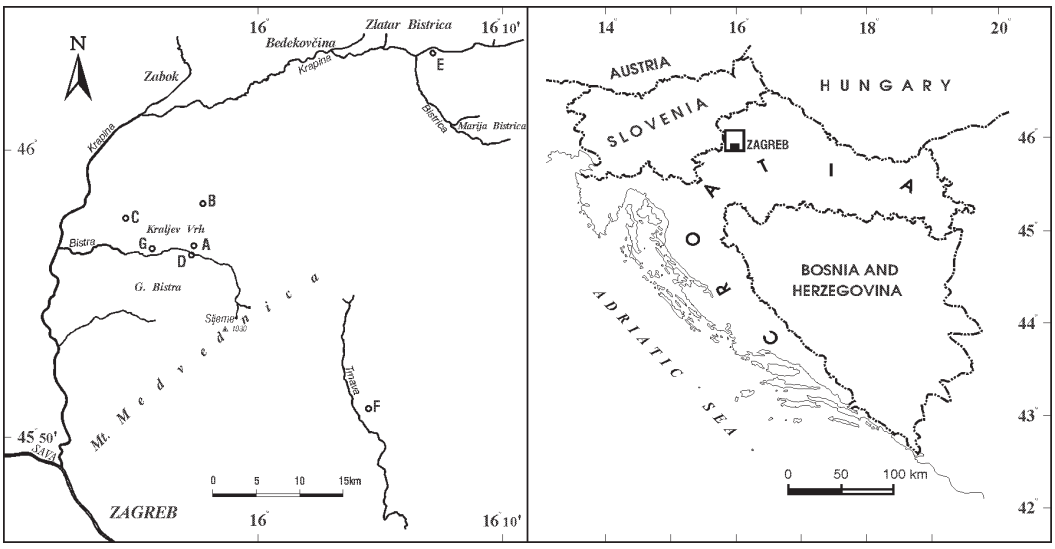

Fig. 1. Location of investigated sites

caused the formation of swift streams which enabled the transportation of sporomorphs from the hill-vegetation, mostly represented by deciduous trees *Tilia, Carpinus, Ostrya, Nyssa, Quercus* and herbaceous plants of Cichoriaceae, to the swamps.

During the glacial period – interstadial (samples B-G), sporomorphs produced by coniferae (pine-spruce forest), ferns (*Pteridium*) and mosses (*Sphagnum*) were deposited in the environment of very restricted stagnant waterbodies. Sedimentology and general palynofacies features of the analysed samples also support this environmental interpretation.

On the basis of the obtained palynological data from this work and the similarity in pollen assemblage with some sites, the Pleistocene age of the analysed samples was inferred. Taking into account the fact, that the analysed sample belong to the isolated sites without the possibility of recognising the gradual changes in the palynofloral development, as well as the distributional mechanisms, it is reasonable to treat the herein presented palynostratigraphical data as tentative. The abrupt decrease of Taxodiaceae may mark approximately the Pliocene-Quaternary boundary as it was earlier stated by Šercelj (1979) and Bertolani *et al*. (1979). According to them, a few of Taxodiaceae may steel be found in the Early Pleistocene palynological assemblages. Finaly, the Tertiary relicts (*Tsuga, Carya, and Nyssa*) and the absence of *Fagus* implicate the Early Pleistocene age, but without complete succession of that age and the area we couldn't be more precise.

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