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Palynological Studies from the Ochozská Cave and from the Šošůvka Part of the Sloupsko-Šošůvská Cave (Moravian Karst)

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ABSTRACT. From the Ochozská Cave the samples from the two profiles were studied. The lower parts of the profiles contained representants of the heliophilous cold steppes (Helianthemum, Thalictrum, Selaginella selaginoides, Ephedra), cold resistent wood plants (Pinus, Betula, Salix) and hydrophilous plants and alges (Cyperaceae, Botryococcus, Pediastrum). These belong most likely to the one cold phase of the Late Glacial. In the upper part of the profiles high amounts of the genus Tilia and of the family Polypodiaceae were found. This accumulation was probably caused by special conditions during the sedimentation and it is probably of the Early Holocene age.

From the Šošůvka Cave individual samples were studied. They contained above all the steppe elements (Thalictrum, Galium, Centaurea, Asteraceae, Ranunculaceae, Daucaceae, Poaceae) and a small amount of the trees pollen (Pinus silvestris, P. cembra, Betula, Tilia, Alnus). Some samples contain cold elements (Selaginella selaginoides, Botrychium), other warmer ones (Teucrium, Scabiosa). Their ages are still not determinated.

The sediments from the Kůlna cave are dated archeologically. Their palynospectra are similar to the inner part of the Šošůvka cave and they may be used for comparison with the above mentioned ones.

KEY WORDS: Moravian Karst, palynology, Pleistocene - Holocene.

Cave sediments from the Moravian Karst were not intensively studied from the palynological point of view. Only Svobodová (1988,1992), Svobodová in Seitl et al. (1986) and Svobodová in Svoboda (1991) studied these sediments sofar.

My studies were made in the sediments of the caves Ochozská (the southern part of the Moravian Karst), Kůlna and Šošůvka part of the Sloup-Šošůvka caves (northern part of the Moravian Karst). Palynological studies were made in the collaboration with further geological and archeological disciplines.

Alltogether 52 samples were examined by palynological maceration. The samples from the Ochozská and Kůlna caves

came from the profiles. Individual samples from the whole cave were collected in the Šošůvka Cave. Samples from the Kůlna cave came from archeologically dated layers.

For the maceration HCl, HF and hard liquid $ZnCl_2$ were used. There were small amounts of palynomorphs in the majority of samples. Most of them (except one specimen) were therefore microscopically studied directly in the $ZnCl_2$.

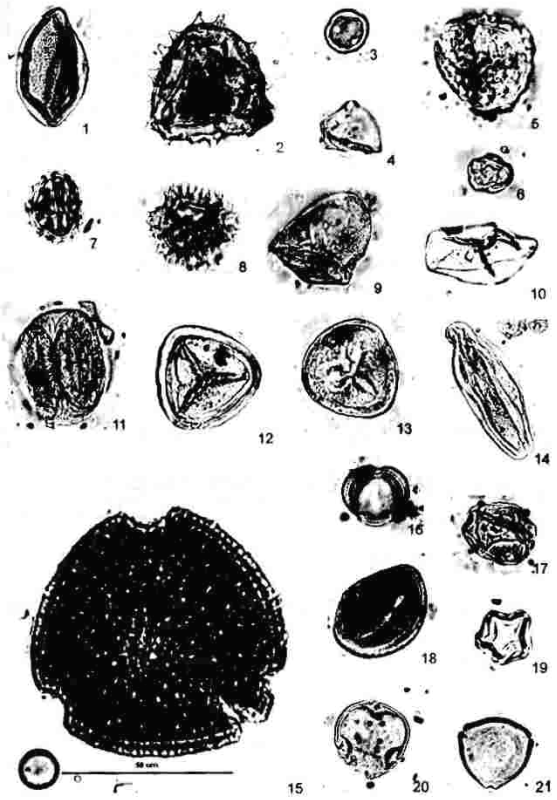

Fig. 1. Pollen assemblages from studied caves.
1. *Helianthemum* - Ochozská Cave (Oc)
2. *Selaginella selaginoides* - Šošůvská Cave (Sc)
3. *Thalictrum* - Sc
4. *Betula* - Sc
5. *Botrychium* - Sc
6. *Galium* - Sc
7. Asteraceae T. *tubiflorae* - Sc
8. Asteraceae T.*liguliflorae* - Sc
9. Cyperaceae - Oc
10. Poaceae - Oc
11. *Pinus* T. *cembra* - Sc
12,13. *Sphagnum* - Kůlna Cave (Kc)
14. *Ephedra. fragilis* - Kc
15. *Scabiosa* - Sc
16. *Artemisia* - Oc
17. *Campanula* - Sc
18. *Centaurea scabiosa* - Sc
19. *Alnus* - Sc
20. Tilia T. cordata - Sc
21. *Corylus* - Sc

The main problem of the palynological studies in the caves is, that the sediments do not contain the plant rests in their original positions. These facts cause two types of problems causing difficulties in the layers age determinations: a) possibility of mixing of the different ages components (palynomorphs from Neogene sediments are frequently redeposited here); b) selection of palynomorphs due to their different resistance.

From the Ochozská Cave the samples from the following two profiles were studied: I.- at the Zkamenělá řeka (Doláková, 2000; Kadlec, 2000), II - the main dome - the left side of the cave - palaeostream (Doláková and Nehyba, 1999). The lower parts of these profiles contained pollen and spores of the heliophilous cold steppe plants (*Helianthemum, Thalictrum, Selaginella selaginoides, Ephedra*), cold resistant wood plants (*Pinus cembra, P. silvestris, Betula, Salix*) and hydrophilous plants and alges (Cyperaceae, *Potamogeton, Botryococcus, Pediastrum*) (Fig. 1). Findigs of the species *Pediastrum kawraiskyi* demonstrate the cold climate (Jankovská and Komárek,1982). These parts of the profiles belong most likely to the one of the cold phases of the Late Glacial.

In the upper parts of the profiles high amounts of the genus *Tilia* and smooth monolete spores of the family Polypodiaceae were found. The accumulation of these elements was probably caused by special conditions during the sedimentation. Presence of the *Tilia* pollen demonstrate in every case the warmer climate. These samples are probably of the Early Holocene age.

From the Šošůvka Cave individual samples of the sediments were studied. As to the palynomorphs abundance, the richest sample was found in the dark lens 72.5 m from the cave entrance. The palynoassociations had steppe and wood-steppe character containing heliophilous herbs as *Centaurea*, *Campanula, Thalictrum, Galium*, Asteraceae, Ranunculaceae, Daucaceae, Poaceae, a few amount of the trees pollen *Pinus silvestris, P. cembra, Betula, Tilia, Alnus, Corylus* and *Quercus* very rarely (Fig. 1).

The herbs predominate over trees in the all studied samples. Human indicators were not found in any samples. *Asteraceae* represent the most frequent family. In some samples spores of the genus *Sphagnum* (Fig. 1) and algal colonies of *Botryococcus* were abundant. In some samples elements of the cold steppe occur (*Selaginella selaginoides*, *Betula nana*, *Botrychium*), the other ones contained plants demanding warmer climate (*Tilia*, *Corylus*, rare *Quercus*, or calciphyta *Scabiosa* and *Teucrium*). Ages of these samples are still not determinated.

The sediments from the Kůlna cave were archeologically and paleontologically dated (Musil, 1993,1997; Valoch, 1988). I studied samples from the layers 7a,b,c, 8a, 9b. Svobodová (1988,1992) elaborated the upper part of this profile (layers 1–6). My studied palynospectras were similar to the ones from the inner part of the Šošůvka Cave. They contained steppe and wood-steppe associations. The layer 7c (more frequent *Teucrium*,*Centaurea scabiosa, Tilia*) (Fig. 1) had the relatively warmest character. These palynospectras may be used for the comparison with the ones from the inner parts of the Šošůvka Cave.

Palynological studies from the Kůlna and Šošůvka caves are still not finished. They will be correlated with the results of the other geological and archeological methods.

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Late Glacial and Holocene Climatic Record in a Stalagmite from the Holštejnská Cave (Moravian Karst, Czech Republic)

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ABSTRACT. A stable isotope climatic record has been obtained from a 318 mm high stalagmite which grew up in the Holštejnská Cave located in the Moravian Karst, Czech Republic. The $^{230}Th/^{234}U$ age data from 7 segments separated from this stalagmite between its base and top document that its growth covers time span 13.6–4.3 ka BP. Variations of carbon and oxygen stable isotope ratios of calcite along a stalagmite vertical axis reflect climatic oscillations during the Late Glacial, a temperature increase and a vegetation development during the Pleistocene/Holocene transition as well as the Holocene Optimum.

KEY WORDS: cave carbonate, U-series dating, stable isotopes, climatic record.

Introduction

Cave carbonates are secondary mineral formations deposited in subsurface cavities from groundwater, which has percolated through the adjacent limestone rock. These carbonates, if precipitated in isotopic equilibrium with the seepage water, may provide paleoclimatic record and allow an estimation of mean annual paleotemperature changes.

The Moravian Karst formed by Devonian limestones is situated in eastern part of the Czech Republic 200 km SE of Prague (Fig. 1). Cave systems draining the Moravian Karst were formed by subsurface streams during the Cenozoic. The Holštejnská Cave located at the northern periphery of the Moravian Karst has a character of a horizontal, 40–50 m wide corridor, which represents the upper level of the ponor cave system. The lower level, called Cave No. 68, is situated 60 m below the Holštejnská Cave and was discovered by excavation of the sinkhole No. 68 in front of the entrance of the Holštejnská Cave (Fig. 1). Both levels are connected by vertical or subvertical karst shafts filled with fluvial deposits. The Holštejnská Cave is nearly completely filled with three sequences of fluvial sediments of different age divided by layers of cave carbonates. The sediments inside the Holštejnská Cave are exposed in extensive sections excavated by local cavers.

Methods and materials studied

The studied stalagmite was exposed in a section excavated in southern part of the cave corridor (Fig. 1). The oldest sediments exposed in this section are fluvial sandy gravels with strongly weathered greywacke pebbles. The middle fluvial sequence is missing in this section due to erosion by subsurface stream. The youngest fluvial sediments fill channels incised into older fluvial bodies. The youngest fluvial deposits are formed by clayey silts with horizontally lying, locally cross-bedded sands and are overlaid by a flowstone layer with stalagmites up to 318 mm high. Fine laminated infiltration sediments transported by meteoric water from the karst surface through a sinkhole No. 74