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MURAVIAN (EEMIAN) AND EARLY POOZERIAN (WEICHSELIAN) DEPOSITS AT AZARICHI (EASTERN BELARUS)

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ABSTRACT. A new section of the Muravian Interglacial and the Early Poozerian deposits in Eastern Belarus were studied in 1997. Biostratigraphical subdivision of the section was carried out on the basis of palynological investigations. The pollen data enabled us to identify 10 local pollen assemblage zones in the studied deposits. The local zones L PAZ AZ 1 – L PAZ AZ 9 correspond to the RPAZ mr2 – RPAZ mr10 regional pollen assemblage zones of the Muravian Interglacial of Belarus and local zone L PAZ AZ 10 corresponds to the beginning of the Early Poozerian period. The pollen spectra of the Azarichi section represent the typical and plain plant successions of the Muravian Interglacial (=Eemian).

KEY WORDS: Pleistocene, Muravian Interglacial, Poozerian Glacial, biostratigraphy, pollen data

GEOMORPHOLOGICAL SITUATION AND STRUCTURE OF THE PROFILE

The Azarichi site is located about 200 km to the east-south-east of Minsk (Fig. 1). The borehole which revealed lake and bog deposits 7.5 m thick, was drilled by the “Geoservice” Geological Company (under the direction of V.I. Markevich) during an engineering – geological mapping project (scale 1:50 000). The borehole is located within the fluvio-glacial plain formed during the Dnepr (Saalian) Glaciation, its mouth lying 153 m above sea level. According to the drilling data, the lateral extent of the lens of interglacial deposits does not exceed 200 m, and is enclosed within the underlying till deposits of the Dnepr Glaciation and overlying Late Poozerian lake sediments (Fig. 2). The section is sited on a circular ridge surrounding the Travnische basin, a flat swampy area drained by the Subotka river, some 145–147 m a.s.l. The ridge stands 15–20 m above the basin and is formed of various fluvio-glacial fine-grained sands overlying deposits of till. There are many swampy depressions up to 3 m deep and 50–100 m in diameter on the summit and slopes of the ridge and the Azarichi section is situated in one of the shallower of these (1–1.5 m deep) on the ridge crest. From the drilling data all the depressions are apparently filled with deposits of organic origin, the section studied being typical. In the Travnische area the depth of the karst chalk rock is insignificant (30–35 m) (Fig. 2). The deepest of the organic sediments, lying immediately above the till, consists of peat, followed successively by layers of carboniferous gyttja, peat, gyttja, lacustrine sand and loam. Organic and mineral deposits containing vegetal detritus are burried beneath the sandy or sometimes silty lacustrine or slope sediments. It is presumed that these are of late Poozerian age. In general, transgressive deposition is a characteristic feature of the Azarichi section. The pollen analysis was carried out using 99 samples collected, layer by layer every 5 cm from the interval 4.7 – 11.2 m, by V.I. Markevich.

RESULTS OF THE POLLEN ANALYSIS

Percentage calculations were based on the total sum, consisting of tree, shrub and terrestrial herb pollen. The percentage values of aquatic vegetation and spores were counted in relation to the basic sum increased by the respective taxon. The results are given in a pollen diagram (Fig. 3).

The generally accepted method which involves treatment with heavy liquid (KI + CdI_2) and application of the acetolysis technique of Erdtman (Erdtman, 1936) was used to prepare pollen for the spore and pollen analysis.

Biostratigraphy is made on the basis of pollen analysis data, made it possible to distinguish 10 local pollen zones (LPAZ AZ1 – LPAZ AZ10) in the studied deposits.

L PAZ AZ1 *Pinus – Betula* (10.2 0– 11.00 m). The pollen of tree species (up to 96%), represented mainly by *Pinus* (up to 84%) and *Betula* sect. *Albae* (up to 15%). predominates in the total content of spore-and pollen

Fig. 1. Location of the Azarichi profile (black circle)

spectra. The presence of broad-leaved species is registered as well: *Quercus* (up to 9%), *Ulmus, Tilia, Carpinus* (no more than 1–2%). The content of the spectra shows that the accumulation of deposits during the interval concerned took place when pine and birch forest was dominant with just a hint of broad-leaved species.

L PAZ AZ2 *Quercus – Pinus – Corylus* (9.95–10.20 m). Spore and pollen spectra for this interval reflect the beginning of the climatic optimum of the interglacial, as is confirmed by the maximum content of *Quercus* pollen (44%) along with the presence of *Ulmus* and *Corylus*. Small leaved species are represented by the pollen of *Betula* sect. *Albae* and *Alnus* (up to 5%). The pollen of *Pinus sylvestris* L. does not exceed 37%. The pollen zone described shows expansion of broad-leaved and coniferous (oak, elm and pine) forest.

L PAZ AZ3 *Corylus – Quercus – Ulmus* (9.65–9.95 m). This zone is characterized by a high content of *Quercus* pollen (27%), as well as by the maximum presence of *Corylus* (58%) and *Ulmus* (4%) in the spectra. The pollen zone reflects the spread of broad-leaved forest formed by hazel, oak and elm. Wet areas were covered with alder forest.

L PAZ AZ4 *Tilia – Corylus – Carpinus* (9.55–9.65 m). This zone is remarkable for the simultaneous appearance of considerable amounts of *Tilia* pollen (up to 17%) and *Carpinus* pollen (up to 24%). As before the amounts of *Alnus* (24%) and *Corylus* (up to 28%) are high. From the spectra content, the area was covered during that time by deciduous forest formed by lime and hazel with some hornbeam, oak and elm. Wet areas were again covered with alder forest.

L PAZ AZ5 *Carpinus – Tilia – Corylus* (9.25–9.55 m). The zone is characterized by a high content of C*arpinus* pollen (up to 54%) and *Tilia* (up to 14%), and by the appearance of *Picea* (up to 3%). The zone reflects the spread of hornbeam and lime forest with some hazel and alder communities in damp areas.

L PAZ AZ6 *Carpinus – Picea* (9.20–9.25). The absolute maximum of *Carpinus* (66%) with an insignificant presence of *Tilia, Quercus* and *Ulmus* (no more than 3%) is

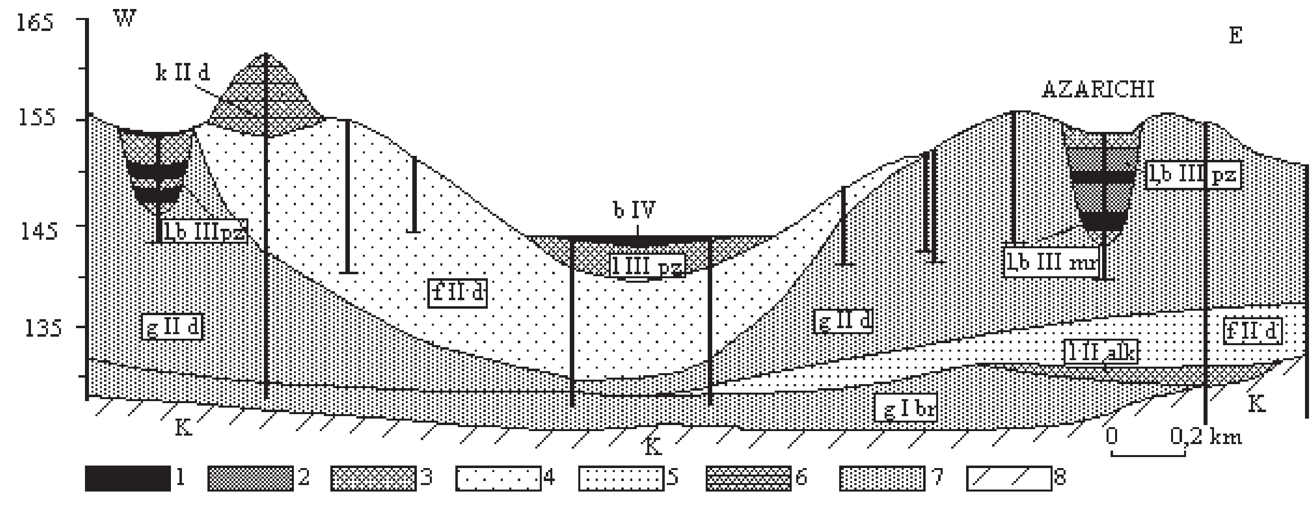

Fig. 2. Simplified geological cross-section through the Travnische locality. 1 – peat, 2 – gyttja, 3 – silts, 4 – fine-grained sands, 5 – various-grained sands, 6 – interbedded sands and silts, 7 – tills, 8 – marls and clays. Genesis: b – boggy, l – lacustrine, f – Fluvio-glacial, k – kame, g – morainic deposits. Indexes: IV – Holocene, III pz – Poozerian (Weichselian) Glacial, III mr – Muravian (Eemian) Interglacial, II d – Dnepr (Saalian) Glacial, II alk – Alexandrian (Holsteinian) Interglacial, I br – Berezina (Elsterian) Glacial, K – Cretaceous

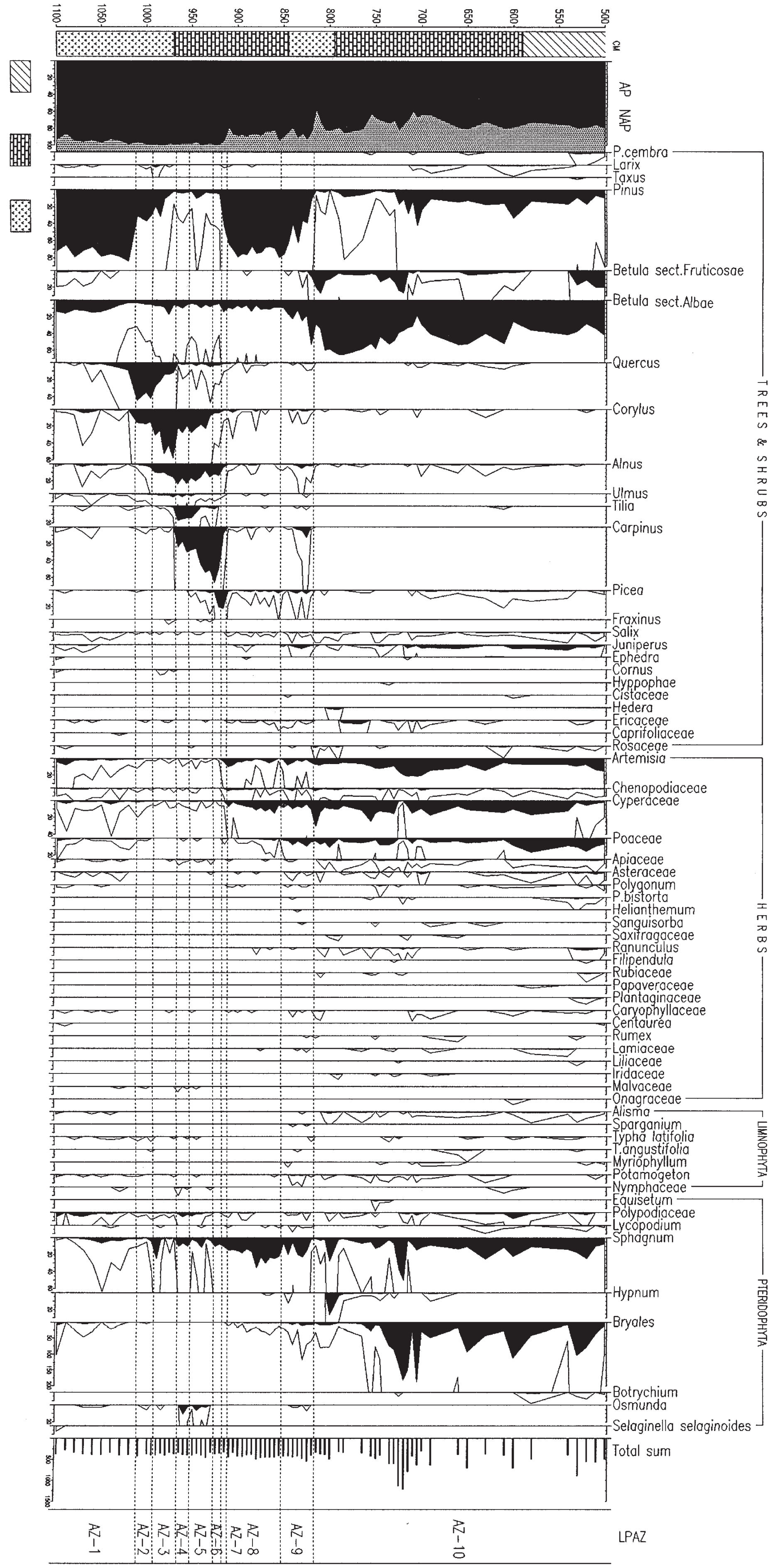

Fig. 3. Pollen diagram from Azarichi (analysed by I. Savchenko). 1 – silt, 2 – gytja, 3 – peat

characteristic of this zone. There is an abrupt increase of *Picea* pollen – up to 20%. The content the spectra points to the accumulation of deposits during the expansion of hornbeam and fir forest with some hazel, alder, oak, elm and lime.

L PAZ AZ7 *Picea – Pinus* (9.10–9.20 m). There is a significant increase in the amount of coniferous pollen, mainly *Picea* (22%) and *Pinus* (44%), in the spectra content. Broad-leaved species are losing their significance. The content of the spectra reflects the fall in temperature and redistribution of spruce-pine forest at that time.

L PAZ AZ8 *Pinus – Betula* (8.50–9.10 m). The pollen of *Pinus sylvestris* predominates (up to 80%) and the share of *Betula* sect*. Albae* reaches 13%.The pollen of *Picea abies* and *Juniperus* appears rarely. This zone marks the expansion of pine and birch forest.

L PAZ AZ9 *Betula – Pinus* (8.20–8.50 m). The characteristic feature of this zone is a decrease in the role of *Pinus* pollen (from 76 to 36%) and a simultaneous increase in significance of *Betula* sect*. Albae* pollen (up to 26%). *Betula* sect. *Fruticosa* is found in considerable amounts (up to 8%) and *Juniperus* and *Picea abies* pollen reaches 5%. The content of the spectra reflects the final phase of the interglacial, marked by the spread of birch and pine forest.

The local pollen zones L PAZ AZ1 – L PAZ AZ9 correspond to the regional pollen zones of the Muravian Interglacial RPAZ mr2 – RPAZ mr10.

L PAZ AZ10 *Artemisia* – Cyperaceae – *Betula* (4.70–8.20 m). The content of the spectra changes significantly. The share of tree species pollen in the total amount decreases to 57% because of an increase in the role of herb pollen (up to 43%). *Betula* pollen (up to 65%, including *Betula humilis* Schrank and *Betula nana* L. up to 26%) is the prevailing component in the pollen spectra. Herbs are represented by the pollen of *Artemisia* (up to 21%), Cyperaceae (up to 24%) and *Poaceae* (17%). The spores of *Selaginella selaginoides,* Bryales and others are found as well.

The spectra of the interval described above characterize periglacial vegetation. During the laying down of the studied sediments, vast areas covered with the vegetation of open habitats were common in the vicinity of lakes. There was scattered birch and birch/ pine forest as well.

CONCLUSIONS

The geological and geomorphological peculiarities of the area around the Azarichi section suggest a thermokarstic origin for the kettle of the interglacial lake. The interglacial deposits accumulated in the basin are derived from degradation of the permafrost. Pingos, presumbly of the closed type, formed within the deglaciated area, as the Dnieper glacier was retreated. The pressure of the ice and the subsequent melting of laccolite combined to produce the ring form of the ridge which surrounds the Travnische swamp. During the break down of the permafrost post-pingo lakes formed which became filled with deposits in the Muravian and Early Poozerian periods. The post-pingo origin of the lakes explains the small lateral size of the lenses of interglacial deposits and their relatively great thickness. The formation of the laccolite could have been causeded by the penetration of considerable amounts of underground water forced to the surface by the intense karstic processes in the chalk deposits lying beneath the Quaternary sediments.

The charakter of the spore and pollen spectra of the Azarichi section diagram shows 2 phases of sedimentation related to the Muravian Interglacial (depth interval 8.30–11.00 m) and the Early Poozerian Glacial (depth interval 4.70–8.30 m).

The spore and pollen spectra from the deposits of 8.30–11.00 m interval possess all the features which are characteristic of the Muravian Interglacial: a specific order of culmination in the pollen of certain species (pine – oak – hazel with alder – lime – hornbeam – spruce – pine – birch); the highest content of broad-leaved species pollen in the climatic optimum in comparison with other interglacials; the maximum amount of *Corylus* pollen; a high maximum of spruce pollen at end of the Interglacial.

These peculiarities prompt us to compare the pollen diagram from the Azarichi site with the diagrams of similar indicative sections of the Muravian Interglacial in Belarus as Murava (Makhnach 1971, Valchik *et al*. 1989), Boroviki and Svetlogorsk (Khursevich *et al*. 1995).

The Azarichi section diagram of can also be correlated by its spores and pollen peculiarities with the indicative diagrams deposits of the same age from Russia (the Miculino, Panfilovo and Milovidy sections); with diagrams of the Merkine Interglacial from Lithuania (the Jonionys, Ratnicha and Niatesos sections (Kondratene 1996)); with the diagrams of the Eemian Interglacial from Poland (the Imbramowice (Mamakova 1989) and Horoszki sections (Granoszewski 1998)).

The results of the pollen studies from the lake and bog deposits at the Azarichi site provide evidence of the continuous accumulation of lacustrine deposits throughout almost the entire Muravian Interglacial and Early Poozerian periods.

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