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SOME RESULTS OF PALEOBIOCOENOSIC STUDIES OF MIKULINO (MGIN) DEPOSITS IN THE ROSTOV BASIN, REGION OF YAROSLAVL

The complex studies of the organic remains and conditions of their occurrence allowed to make a reconstruction of paleobiocoenosis and its development. Fossil organic remains constitute a special, though not complete geological record that shows a composite process forming a continuously developing biogeocoenosis. The course of development of nature is specific in various periods but there exists a general trend and regularity. Therefore, the fuller historical record of interrelations and dynamics of living and fossil components of the natural units (biogeocoenosis) — the better dating of the sediments examined and recognition of paleogeographic characteristics of interglacials.

Data concerning fossil peat bogs of the Rostov Basin have been obtained by Sukačev and Gorlova & Nedoseyeva. These sediments had been discovered by Čižikov, an enthusiastic explorer. The present authoress has studied the geological and geomorphological conditions of the peat bogs and fossil mammals, which correlate and correct one another, applying various paleobotanical methods (pollen, carpological and botanical analyses and determination of fossil trees). She has also analysed fossil flora from the morphological, systematical, ecological, coenotypical and paleogeographical points of view.

The complex studies of three fossil peat bogs near Čeremošnik village, lacustrine deposits near the Šurskol village and a peat bog near Levina Gora resulted in dating of their age.

The Mikulino (Mgin) interglacial sediments mentioned above occur almost on the same altitudinal levels, they display similar stratigraphy and are underlain by the Moscow moraine (except for those occurring near Levina Gora, where the material in their bottom part has not been examined so far); they are overlain by a thick layer of boulder clay (2 peat bogs near Čeremošnik, sediments near Šurskol and in the lower part of the profile near Levina Gora) and by silty sands (a peat bog near Čeremošnik and upper part of the Levina Gora profile).

There are various opinions on the origin of boulder clay overlying the sediments. By some scientists it is regarded as a colluvial (delluvial) or gully—alluvial deposit

(MARKOV, 1961; ČEBOTAREVA, 1950 and others), whereas some authors (MOSKVITIN, 1965; NOVSKIJ, 1968; SUKAČEV, *et al.*, 1958; TYUREMNOV and VINOGRADOVA, 1952) hold that it is a moraine of the Kalinin glaciation.

Upper parts of the peats are deformed, squeezed and folded. Small lumps of peat are detached from the main peaty mass. Edges of the peat horizons near the Čeremošnik village are steep. In exposure the peats have a small extension regardless of their remarkable thickness, which suggests that they are only fragments of some formerly large peat bogs.

In the border part of the peat bog near Čeremošnik there have been found some macrofossil remains of different species: *Brasenia schreberi* and *Betula nana.* From the ecological point of view, this different coexistence is explained by SUKAČEV (1954) as the result of the activity of exogenic processes leading to redeposition.

The interglacial sediments near Levina Gora are synclinally folded and the central part of the syncline, distinctly lowered, can be observed on the floor of the river Sara on a distance of over 50 m. The overlying moraine is discontinuous.

All the peats in question have the same floristic character — angiospermous plants decidedly predominate, gymnosperms are represented by 4 species, and the higher sporomorphous (excluding moss) — by 6 species. According to ŠIMKEVIČ, the statistical index of the floral affinity is very high, which bears evidence to their synchronous development.

The full analogy can be also noticed in the composition of geographical elements of plants. The main part belongs to Holarctic elements both European and Eurasiatic, which can be easily detected from the bottom up to the top in all the interglacial sediments mentioned above. It is worth emphasizing that the east-Asiatic and north-American components are also present; their percentage and composition indicate the Mikulino age of the peat bogs investigated by the present authoress.

The analysis of organic material permitted to determine laws, general course and sequence of changes of vegetation which reflect the history of the whole biogeocoenosis of the Rostov Basin; it also facilitated cognition of the characteristics of spatial changes of trees during various periods of the Upper Pleistocene.

Due to the advancement and retreat of glaciers, some composite vegetation communities involving the tundra-, steppe-, and forest elements originated in the Rostov Basin at the very beginning of the Mikulino (Mgin) interglacial. In the course of migration, the plants became ecologically differentiated. As the whole, the vegetation was poor and resistant to the severe climatic conditions.

In the Rostov Basin, forests covered areas situated near water basins at the beginning of the interglacial (Figs. 1, 2, 3). The composition of the forests gradually changed. Figures 1, 2 and 3 present the data obtained by the present author, which enabled her to distinguish the following phases of the forest development in the Rostov Basin.

Phase 1 — spruce forests (lower spruce). In the spore-pollen spectrum the spruce pollen dominate. Macroscopic remains clearly indicate the species *Picea obovata*. Small quantity of pine and birch pollen grains was also present, but their occurrence may be of allochtonous character which is proved by the lack of their macroscopic remains in the sediments of corresponding phase. Thus, spruce was the only one dominant species. Grass was represented by the arctic-alpine and boreal species. In all probability, the growth of trees of deep root-systems was hampered by remnants of permafrost as it has been the case in the Holocene (PYAVČENKO, 1957). Spruce with its surficial root-system was the first to invade the river valleys and low-lying terrains where climatic and edaphic conditions were favourable for its growth. In this period the climate was cold and humid. The water basin near Levina Gora was drained, as evidenced by the presence of sthetoblasts (*Cristatella mucedo*).

Phase 2 — birch—pine forests. Pollen grains of trees rapidly increase in number and present more differentiated spectrum: instead of spruce prevailing so far, gradually birch and pine predominate. Amelioration of climate, which became milder and more arid, caused permafrost to disappear. Birch and pine having a very large ecological amplitude, quickly occupied the area free from spruce. At that time the whole vegetation cover in the Rostov Basin was of boreal character. Sediments corresponding to this phase are rich in calcium which means that accumulation was rather slow. Further climatic amelioration favoured the occurrence of thermophilous species.

Phase 3 — birch—pine forests with an admixture of deciduous trees. Climatic conditions of this phase were almost the same as today.

Phase 4 — deciduous forests (climatic optimum). Progressive warming of the climate brought the development of deciduous trees which became predominant in this phase: elm and oak, and later on lime and hazel, and at the end of the phase hornbeam. Vegetation of the Rostov Basin at this time was very rich and of great taxonomical variety; the present author has distinguished 73 families and 219 species. Very interesting are the local exotic species (*Aldrovanda vesiculosa, Brasenia schreberi, Caldesia parnassifolia, Cladium mariscus, Hydrocharis morsus ranae, Najas flexilis, N. marina, N. tenuissima, Potamogeton oxyphyllus, Salvinia natans, Sambucus nigra, S. racemosa, Tilia platyphyllos, Trapa natans*).

It should be emphasized that the sediments of this phase contain Far-East species (*Osmunda cinamomea, Vitis parasilvestris*) and north-American species (*Dulichium spataceum*). The occurrence of carpospores of Hydrophytes (*Lemna triscula, L. minor, Stariotes aloides*) proves that the period was characterized by favourable conditions. Aquatic plants are the excellent indicators of general conditions (SZAFER, 1954), because they depend to a lesser degree on the local physico-geographical agents. Climatic indicators show that the climate was warm; dry at the beginning of this phase and more humid at its end. Gradually the deciduous forests were intermingled with spruce which hampered their blooming and superseded them becoming predominant.

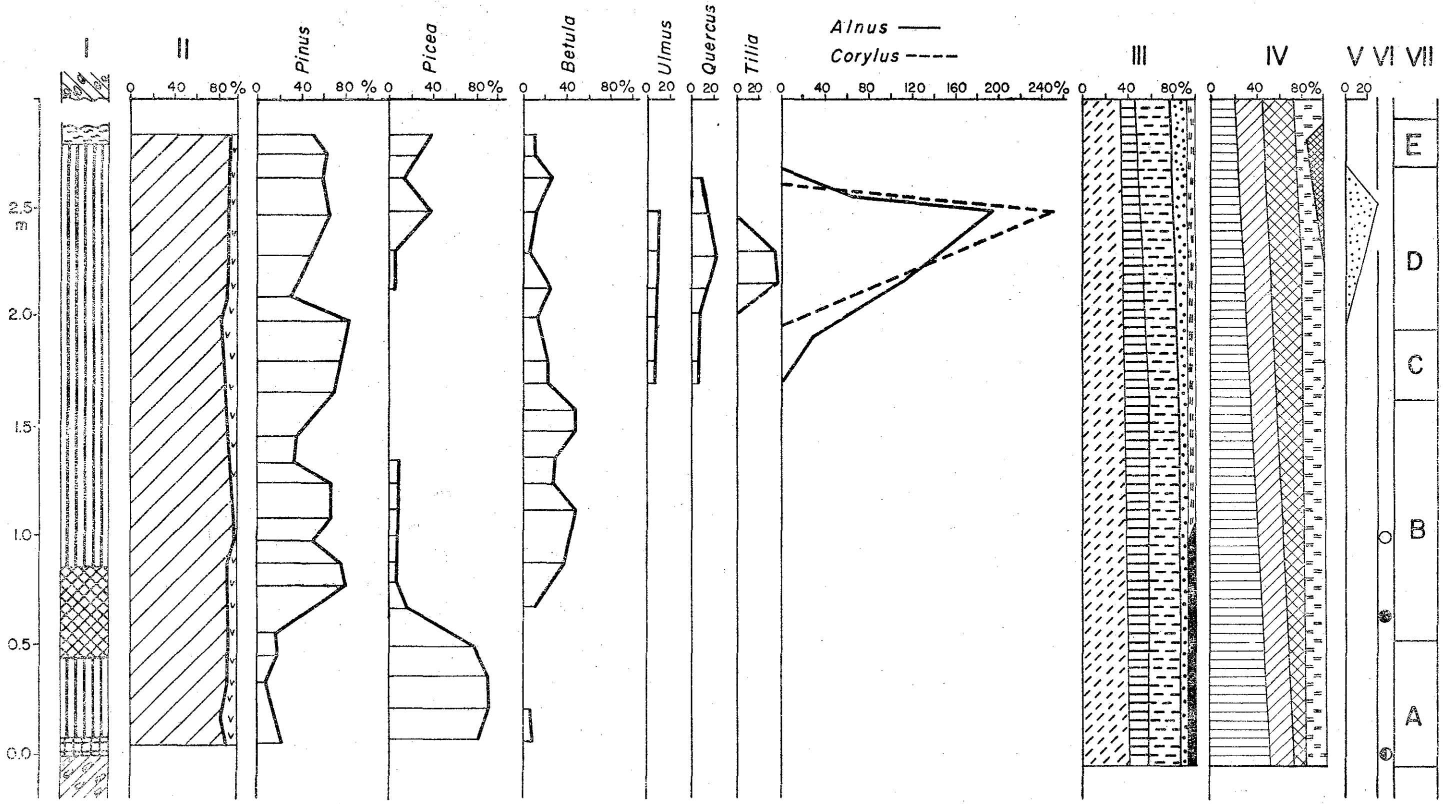

Fig. 1. Spore–pollen and carpological diagram of the Mikulino deposits, gully near Čeremošnik: exposure 2217 (analyses made by R. N. Gorlova and A. K. Nedoseeva)

Explanations — see fig. 3

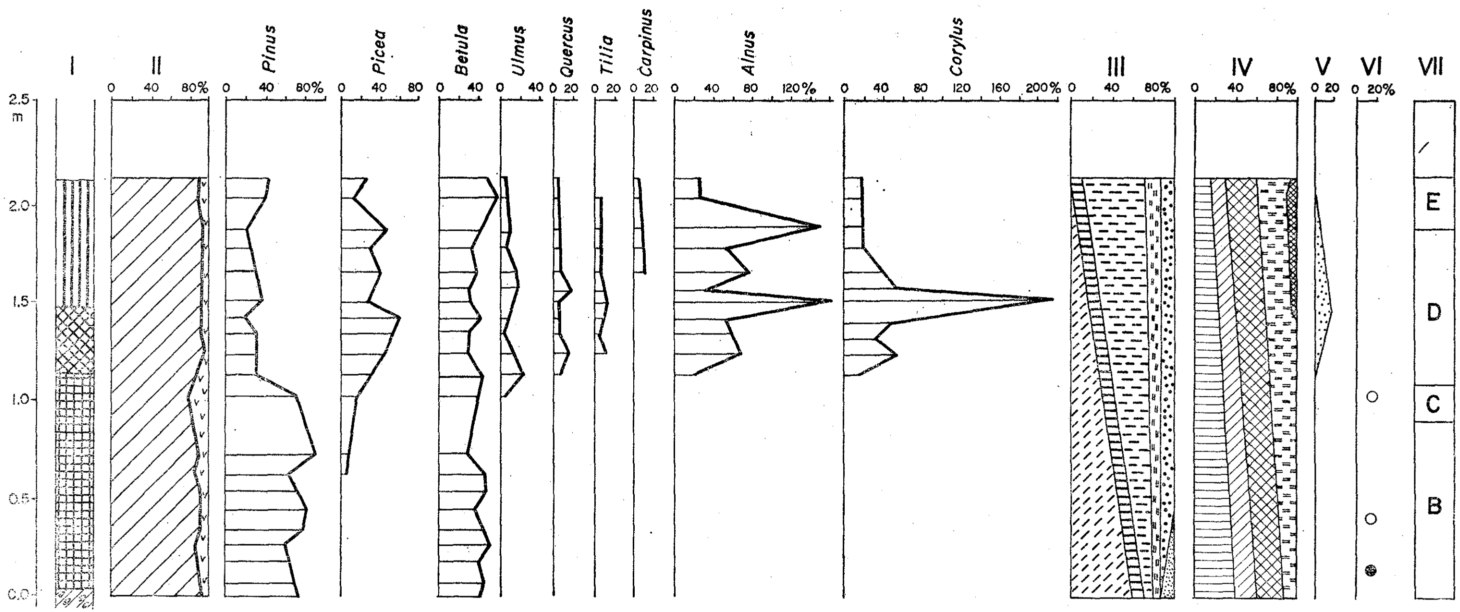

Fig. 2. Spore—pollen and carpological diagram of the Mikulino deposits, gully near Čeremošnik: exposure 2218 (analyses made by R. N. GORLOVA and A. K. NEDOSEEVA)

Explanations — see fig. 3

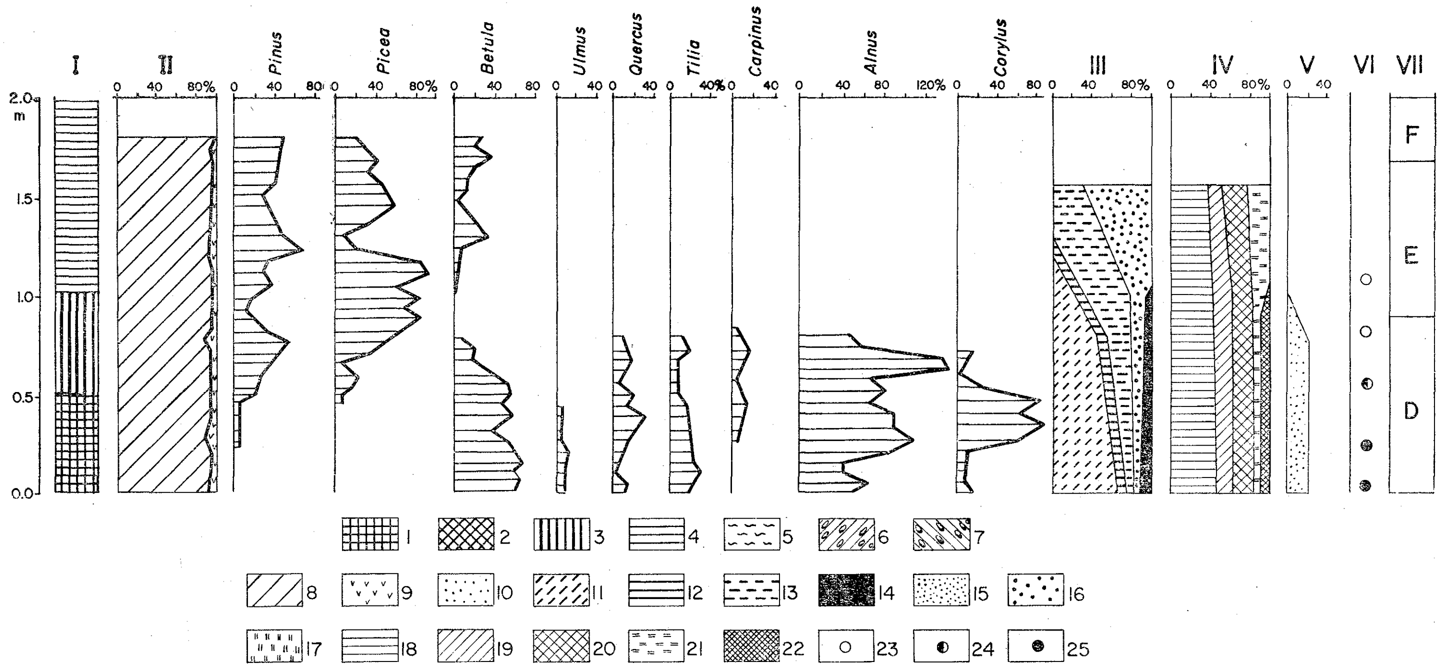

Fig. 3. Spore—pollen and carpological diagram of the Mikulino deposits at Levina Gora

I. stratigraphic profile; II. sum of AP and NAP; III. sum of carpoides distinguished of various ecological groups and vital forms of plants; IV. share of geographical elements of fossil flora; V. local exotic forms; VI. abundance of erosiophilous plants, after P. A. NIKITIN; VII. phases of vegetation development: A — phase of spruce forests (lower spruce); B — phase of birch-pine forests; C — phase of birch-pine forests with admixture of deciduous trees; D — phase of deciduous forests; E — phase of spruce forests; F — phase of spruce-birch-pine forests

1. sapropel; 2. peaty sapropel; 3. peat; 4. silts with organic-matter; 5. silty sand (*suglinok*); 6. boulder clay (Moscow glaciation); 7. boulder clay (Kalinin glaciation); 8. sum of AP pollen; 9. sum of NAP pollen; 10. local exotic forms; 11. aquatic plants; 12. coastal plants; 13. bog plants; 14. erosiophilous plants; 15. shrubs; 16. trees; 17. forest herbaceous plants; 18. Holarctic species; 19. European species; 20. Eurasiatic species; 21. cosmopolitic plants; 22. Far-East and North-American species; 23. individual; 24. numerous enough; 25. frequent

Phase 5 — predominance of spruce forests. Spruce spread wide replacing thermophilous trees not only due to its adaptation to shade but also because of deterioration of the climate. The thermophilous plants gradually disappeared giving way to boreal species.

Phase 6 — spruce—birch—pine forests. Further cooling promoted the spreading out of boreal species and developments of the arctic-alpine plants resistant to cold.

When comparing the Mikulino peat bogs of the Rostov Basin with the synchronous deposits of the Russian Plain and of Western Europe it can be noticed that they display many common features of the natural environment; the differences between them are due to local physico-geographical conditions.

The application of paleobiogeocoenosic methods to the paleogeographical problems gives a better knowledge of interrelations and conditions under which the processes operated and facilitates the explanation of causes and agents provoking changes of biocenoses.

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