The vegetation and mammoth distribution during the second half of the Late Pleistocene on the Russian Plain (33-17 ka)

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SUMMARY: The paleofloristic materials from 96 sections of the Russian Plain for the Briansk time and the Late Valdai have been united in a palynologic database. Analysis of the electronic maps made it possible to study temporal dynamics of distribution of indicator species of plants during the second half of the Late Pleistocene. The coenoses for the Briansk Interstade and Late Valdai glaciation were reconstructed from the north to the south of the Russian Plain. The predominance of open coenoses (the periglacial steppe and forest-steppe formations) during the Middle and Late Valdai on the territory of the Russian Plain was favorable for mammoths which mostly fed on forbs, leaves and branches of different bushes.

1. The Briansk Interstade - Late Valdai glaciation vegetation dynamics

1.1 Introduction

The findings of mammoth remains attributed to the second half of the Late Pleistocene (33-17 ka) are widespread on the Russian Plain from the Pechora River basin to the Dniester River middle reaches (Markova *et al.* 1995). It is important to elucidate the main characteristics of paleovegetation, surrounding the mammoth, because the mammoth (*Mammuthus primigenius*) was one of major Late Pleistocene representatives of large herbivorous.

Studies of V.V. Ukraintseva (1991) showed on the principal composition of mammoth food including mainly forbs, leaves and branches of different bushes. In the cold seasons mammoth used the undersnow plants.

1.2 Materials and methods

To the present time considerable palynological material was gathered. It permits to trace the main ways of paleovegetation development during the Briansk Interstade (33-24 ka) and the Late Valdai glaciation in the Russian Plain (<24-17 ka).

The available palynological (52 sites for the Briansk time and 64 sites for the Late Valdai) material has been summarized in a database and was formatted in the ARC/INFO and ARC/VIEW cartographic software. Electronic map series of different plant species that describe certain vegetative coenoses, and a series of maps of different plant communities determining a landscape as a whole, were constructed.

1.3 Vegetation dynamics and climatic cycles

The Briansk Interstade is the most significant warming of the last glacial epoch preceding the Late Valdai glaciation. The tundra and forest-tundra coenoses were considerably wider represented in the landscape structure than nowadays. The tundra and forest-tundra elements had a wide distribution in the Russian Plain. Spores and pollen of Arctic and hypoarctic species such as *Armeria, Dryas, Rubus chamaemorus, Alnaster fruticosus, Selaginella selaginoides*, and *Lycopodium apressum,* reached 53-54° N.

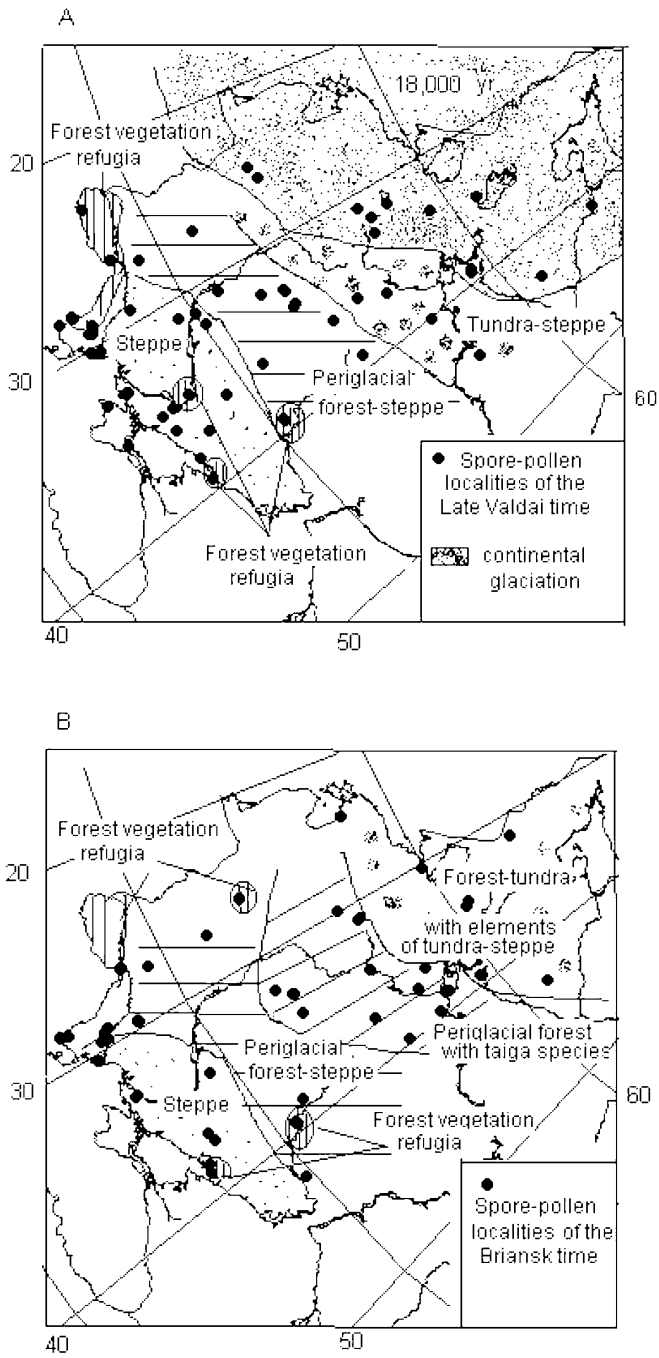

Fig. 1 - Scheme of reconstruction of vegetative coenoses:
A- during the Late Valdai glacial maximum (24-17 ka);
B- during the Briansk Interstad (33-25 ka).

So the southern border of these taxa ranges was shifted approximately at 1200 km southward. Forest-tundra plants *Alnaster fruticosus, Selaginella selaginoides,* and *Betula nana*, were found in the southwestern Russian Plain and in Carpathians. This indicates an expansion of areas of microthermic plants in these regions. Further expansion of the Arctic flora to the south, for ~ 60 up to 47° N (or more than at 600 km) occurred in the Late Valdai glaciation (Markova, Simakova, 1998). Northern taiga species ranges (*Picea, Abies, Larix, Pinus sibirica*) considerably expanded to the south, however the continious taiga zone did not exist. Probably it was the territories associated with highly dissected regions of the Russian Plain.

The presence of small amount of broad-leaved species in the forest communities have been established in the Neman, Valdai, and Moscow Uplands during Briansk Interstade. Broad-leaved plants occurred in more appreciable quantities in the Dniester River basin, in the Podol and the Middle Russian Uplands, in the Donetsky Ridge, the Carpathians, and Crimea.

In the Late Valdai time a further reduction of their ranges occurred. However, refugia of forest coenoses with broad-leaved species remained in the Dniester and Don River middle reaches, in the central part of the Russian Plain (49-51° N), in Moldova and near the Azov Sea.

In the second half of the Late Valdai the representatives of steppe phytocoenoses were widespread over the whole territory of Eastern Europe and reached 62° N. In the north of the Russian Plain steppe species were a component of tundra-steppe associations. Nowadays the similar plant associations occur fragmentary in northeast of Russia

(Eastern Siberia).

Therefore the following coenoses for the Briansk Interstade (I) and Late Valdai glaciation (II) were reconstructed from the north to the south of the Russian Plain (Fig. 1).

• I (33-22 ka)

1. Forest-tundra : combination of tundra and steppe vegetative communities with pine-birch light forest

2. Periglacial forest tundra-steppe located between 54° and 59° N: combination of birch-pine and spruce forest areas with meadow steppe formations, tundra communities and steppe halophyte species.

3. Periglacial forest-steppe: meadow steppes with pine-birch forest islands , with insignificant quantity of broad-leaved trees (54° N - 50°N).

4. Periglacial steppe: original forb steppe and forb steppe with *Chenopodiaceae* situated to the south of 49°-50° N.

5. Forest refugee: birch-pine and spruce forest with broad-leaved trees.

• II (24-17 ka)

1. Tundra with elements of forest-tundra and tundra-steppe.

2. 2. Periglacial forest-steppe:

a) meadow steppe with areas of birch-pine and spruce forest and with tundra-steppe communities occurred in the Russian Plain between 56° and 59° N;

b) association of meadow steppe, tundra-steppe and pine-birch light forest.

3. Periglacial steppe: forb- steppes were widespread to the south of 51° N.

3. Forest refugee: birch-pine and spruce forest with broad-leaved trees

2. Conclusions

The individualistic reorganization of communities in response to environmental changes is important for the understanding of the history of development of biological communities (Graham & Grimm 1990). The reconstructed biogeographical provinces of Russian Plain show that in this time the analogues of modern natural zones on the territory of the Russian Plain were absent. Late Pleistocene landscapes indicate the moderate cold climate of the Briansk Interstade and the cold and continental climate during the Late Valdai glaciation. Forest coenoses occurred fragmentary. They were mainly associated with the dissected territories with variable local habitats (uplands, mountain systems) and with the gullied relief. The distinctions between vegetative provinces were smoothed. The subarctic and steppe plants were represented practically every-

where. However, in contrast to the natural conditions of the Briansk time the Late Valdai maximum in the Russian Plain was characterized by a wider distribution of different types of periglacial forest-steppe and tundra-steppe landscapes. So the predominance of open coenoses (the periglacial steppe and forest-steppe formations) during the Middle and Late Valdai on the territory of the Russian Plain was favorable for mammoths which principal food includes forbs, leaves and branches of different bushes.

3. Acknowledgements

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