

# The conditions of existence of *Mammuthus primigenius* Blumenbach in the periglacial zone of Eastern Europe

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**SUMMARY:** This paper presents some material characterizing the conditions of existence of *Mammuthus primigenius* Blumenbach in the periglacial zone of Eastern Europe in the Late Pleistocene. On the basis of data, mainly about small mammals, it has been shown that there were tundra-steppe ecosystems in which mammoths lived.

## 1. INTRODUCTION

Three major climatic macrocycles are singled out within the limits of the Pleistocene. The first macrocycle is an early Pleistocene or Eopleistocene one (after 1.8 Ma). It is characterized by a general rise and dismemberment of the relief and precedes the beginning of the period of freezing. The second macrocycle is an early Neopleistocene or a middle Pleistocene one (after 0.8 Ma). It is characterised by the rise of the amplitude of the climatic fluctuations and the appearance of temperature contrasts on the background of tectonic sinkings. The third macrocycle is the Late Pleistocene (from 150 ka onwards) with a maximum of climatic oscillations and of low temperatures. It led to the formation of a hyperzone or a periglacial zone in the middle of Eastern Europe (Spasskaya *et al.* 1993).

The deposits of the Upper Pleistocene of Eastern Europe are divided into four levels of which the Mikulin level (Eemian) is the warmest while the Valdai (Würm) upper level with interstadials is rather cold. Opinions differ as to the climatic ranks of this period of freezing, its scales and spreading, chronology and stratigraphy of moraine and inter-moraine deposits, interrelation of data, etc. But the presence of the periglacial zone which has specific

tundra - steppe conditions and is populated by a set of species in specific ecosystems, has been proved. Low temperature conditions of the early and late Valdai potentially promoted the development of long-time freezing and the formation of river terraces connected with periodic changes of sea level of the Black and Caspian Seas.

Under these conditions, periglacial vegetation survived into the early Valdai and even in the middle Valdai interstadial, the time of the formation of the Bryansk soil. The late - Valdai epoch (25 - 17 ka), with its most rigorous climate, was accompanied by the development of ice cover and the shift of the hyperzone southwards, approximately to the latitude of Kiev and Kanev on the Dniepr (Velichko, 1973).

## 2. CHARACTERISTIC OF THE PERIGLACIAL CONDITIONS.

Paleobotanical data show that the quantity of tree pollen decreased and that broad - leaved forests disappeared completely. Dominating were the cenoses of the shrub birch (*Betula nana*), a representative of forest - tundra and northern taiga, partially the pine (*Pinus*), the *Efedra* and sphagna bog - mosses (*Sphagnum*). In the epoch of maximum fall of temperature the vegetation was a birch forest - steppe. Tundra herbaceous flora similar to that of modern

West Taimyr prevailed (Paleogeography of Europe 1982). In some regions (Western Dvina) remains of the Arctic - Alpine species have been found (*Selaginella selaginoides*, *Salix* ex gr. *polaris*, *Poligonum viviparum*, *Potentilla* cf. *nivea*) (Sanko 1987).

The open spaces were a cold steppe with wormwoods and cereals while small shrubs and herbaceous vegetation rich in biomass remained only in river valleys (Grichuk 1973). They were the main food for *Mammuthus primigenius* and other big hoofed animals. Mammoths fed on meadow cereals (*Poaceae*), sedges (*Carex*) as well as on sprouts of trees (willow - *Salix* sp.), birch (*Betula* sp.), alder (*Alnus* sp.). (Vereshchagin & Baryshnikov 1985).

The predominance of tundra - steppe and tundra landscapes is also confirmed by the fauna that populated these cenoses. A peculiar fauna complex formed on the whole territory of the middle zone of Eurasia - a mixed fauna linked to the periglacial zone of the Valdai glacier (Pidoplichko, 1934; Vangengeim, 1976; Nadachowski, 1982; Rekovets, 1985). The main peculiarity of this fauna is the coexistence of various ecosystems or cenoses in the same landscapes. They were populated by both tundra and steppe species of animals at the same time.

The species that are typical of open spaces (steppes, semi - deserts and tundra) make up about 50% of the mammal fauna of the periglacial zone. The number of species of periwaters biotopes are within 10 - 17%. Polyzoal species with broad ecological adaptability, mainly predatory animals (*Carnivora*) make up to 30%. Forest species are practically absent.

Arctic species at times spread far beyond the limits of the periglacial area and reached Moldova (*Dicrostonyx*) and the Crimea (*Rangifer*, *Alopex*, *Lagopus*) in the South. At the same time the northern spreading of steppe species was limited by the glacier front at an average of 54° North. The species of the interzone are smaller in number. They testify the corresponding development of lowered landscapes and water - meadow cenoses. The chronological peculiarities of the Valdai periglacial faunas were determined by the exis-

tence of two falls of temperature and of the mid - Valdai rise in temperature. It is expressed mainly by the changing ratios of the species of various ecological groups over time. Toward the maximum of the fall of temperature, the Arctic character of the fauna increased. That is, there was a constant dynamism in the environments. It determined changes of fauna and, in the first place, of mass species (*Dicrostonyx gulielmi*, *Microtus (Stenocranius) gregalis*, *Lagurus lagurus*, *Mammuthus primigenius*, *Rangifer tarandus*, *Alopex lagopus*). The landscapes of the periglacial zones and its inhabitants were not homogeneous in latitude and in a meridional direction. In the middle zone of Eastern Europe the periglacial conditions were less different in the meridional direction than in the latitudinal one. The change of conditions and therefore of ecosystems and their inhabitants from the west to the east was less considerable (Alexeeva 1980; Vereshchagin & Baryshnikov 1985). Eastwardly (as far as Zabaikalie), *Mammuthus* and *Rangifer* become rarer, *Ovibos*, *Alopex*, *Dicrostonyx* were absent. Typical of these regions are *Poephagus baikalensis*, *Spirocerus kiakhtensis*, *Procopra gutturosa*, *Microtus brandti*, *Lepus tolai*.

Westwardly, steppe species become rarer and rarer, especially *Ochotona*, *Allactaga*, *Lagurini*, while ecologically more adaptable species such as *Apodemus*, *Arvicola*, *Microtus oeconomus*, *Cervus*, *Capreolus* became more various.

Latitude ecosystems have their own North-South gradations. It is fixed as subzones (Vangengeim 1976) or local versions of the Mammoth fauna complex (Bibikova & Belan, 1979). For example, at latitude of 50 - 55° North, tundra - steppe with patches of forest - tundra predominated. It was populated mainly by representatives of the genera *Dicrostonyx*, *Lemmus*, *Ovibos*, *Gulo*, *Mammuthus*, *Rangifer*, *Alopex lagopus*, *Microtus (Stenocranius)*.

The quantitative and qualitative composition of this association changed southward. The species of the open steppes, the genera *Ochotona*, *Spermophilus*, *Marmota*, *Allactaga*, *Lagurus*, *Eolagurus*, partially *Bison*, were more and more numerous southward.

Such transformations in the system of relatively mixed biocenoses of the Late Pleistocene were uneven in their nature. At the taxonomical level it became apparent through the comparatively quick formation of new species: for example, *Spermophilus severskensis*, *S. superciliosus*, *Dicrostonyx gulielmi*, *Lepus tanaiticus*, *Ochotona spelaeus*, *Equus latipes*; or transitional subspecies such as *Microtus gregalis kriogeticus*, *M. oeconomus major*, *Eolagurus luteus antecessens*, *Lagurus lagurus major* and others. These mammals (mainly small) were specific elements of the periglacial environment, where the taxonomic composition was much variable. The periodically more stable association is characterised by *Arvicola*, *Lemmus*, *Carnivora*. The tendency towards an increase of species diversity of periglacial cenoses in the course of time is quite clearly traced and agrees with the tendency towards a higher specialisation. This is confirmed by the presence of specific morphological differences in the species of the periglacial faunas (Vereshchagin & Baryshnikov 1985; Rekovets 1983). Some species of mammals were larger (*M. (Stenocranius) gregalis*, *M. oeconomus*, *Lagurus lagurus*), or had more complicated morphostructures of the occlusal surface of molars than extant mammals (*Arvicolidae*, *Sciuridae*), or had higher tooth crowns (*Lepus*, *Equus*), or broadened distal parts of the extremities (*Allactaga*, *Equus*). The morphofunctional analysis of these adaptations confirms that the species of the mammoth fauna lived under conditions of low temperature in open landscapes with xenophile vegetation.

South of 50° (the latitude of Kiev and Kaney), the ecosystems were different from the northern or typically periglacial ones more in the quantitative and less in the qualitative taxonomical composition of each ecological groups. *Dicrostonyx* and *M. gregalis* are reduced to 5 - 7 %, *Lemmus* is absent, the number of species of the polar ecosystems increases to 30 %, the species of forest ecosystems are up to 5 %. Such a faunal composition, as well as paleobotanical and paleopedological data (Sirenko & Turlo 1986; Udra 1988), testify the existence of much more phytomass in the landscape, with a

predominance of sedge – grass vegetation, shrubbery and forest patches. Probably it suggests an increase of the number of mammoth and bison too. These species prevail in the faunas of Mezhyrich, Dobranichevka, Gontsy and other sites (Rekovets 1985). The mammoth took one of the first places in eating the rich vegetation biomass of the tundra - steppe interzone ecosystem. Such conditions are comparable to those of the northern part of West Siberia. There, highly productive tundra - steppe ecosystems predominated in the final phases of Valdai, especially in the river flood plains (Bolikhovskaya 1995). They provided optimal conditions, with a considerable density of mammoth and other herbivores.

### 3. REFERENCES

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