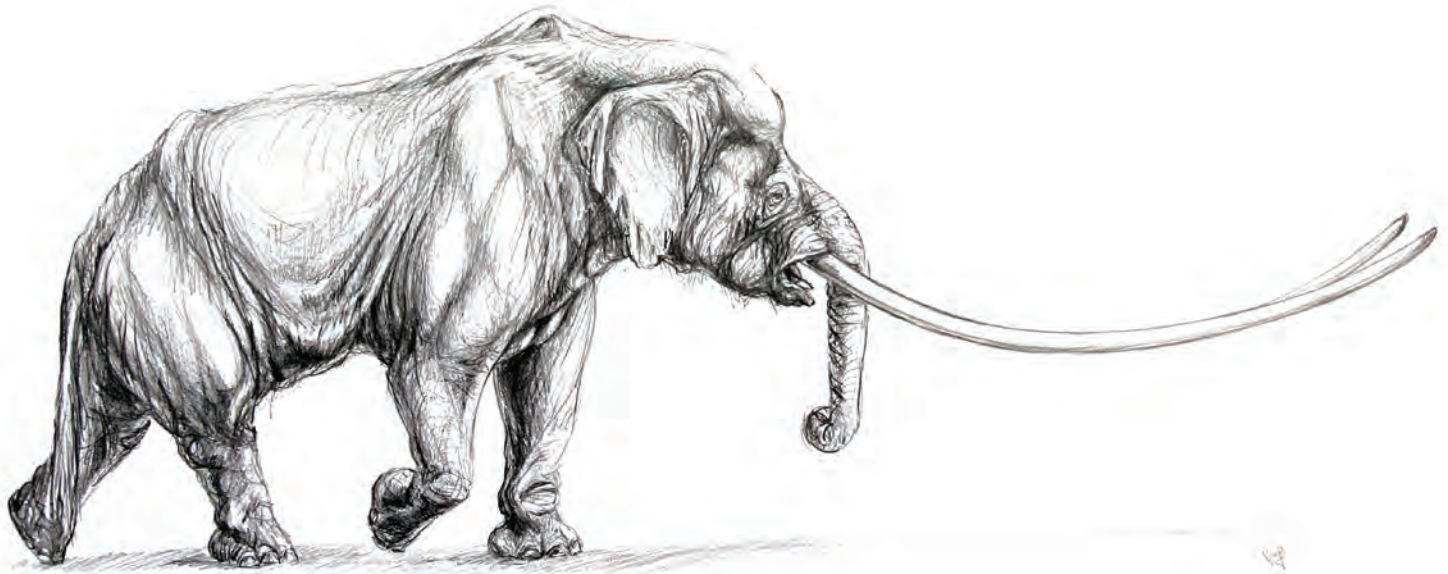




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ABSTRACT BOOK

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High-latitude steppe vegetation and the mineral nutrition of herbivores of the mammoth fauna

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High-latitude steppes were widespread and zonal in the Late Pleistocene and formed a landscape basis for the Mammoth Biome. Now the patches of these steppes survived on steep slopes with S, SW and SE expositions. These refugia serve as unique information source on the Late Pleistocene "Mammoth" steppe. Numerous data obtained by palynological, carpological, and DNA analysis of plant remains from feces and stomach contents of herbivore mummies, as well as from buried soils and enclosing deposits show that they are similar to modern xerophytic -steppe plant assemblage in taxa composition and structure of the vegetation cover. This is typical for Late Pleistocene vegetation in the studied area (Yurtsev, 1982; Berman et al., 2001). Plant's nutrient concentrations are of fundamental importance across Pleistocene grass-rich ecosystems because of their role in the support of large herbivores of the mammoth fauna complex. The average weight of an adult mammoth skeleton (about 0.5 tons) and of a woolly rhinoceros (about 0.2 tons) clearly suggests this. Detailed studies on fossil bone remains showed mineral deficiency in large Pleistocene herbivores (our data; Leschinskiy, 2012). Most often it was manifested as an osteodystrophy of bone tissue, especially in mammoths from South Siberia (Leschinskiy, 2009; 2012).

A two-year study of ash and mineral contents of two types of relict cold steppe vegetation at the Kolyma Lowland, Arctic Siberia has been carried out. During the Late Pleistocene vast steppes were stretching in this region. Petrophytic steppes (Fig. 1A; more than 60 vascular plant species) and thermophytic steppes (Fig. 1B; more than 30 species) were dominating amongst these steppe communities (Davydov et al., 2009a). Nowadays refugia of similar vegetation

are located not far (1 - 15km) from the outcrops of Ice Complex permafrost deposits were abundant remains of fossil mammals are found (Davydov et al., 2009b). For example, a site of a mummy woolly rhinoceros (Kolyma rhino) (Boeskorov et al., 2009) was located 5km from the sampling sites of steppe vegetation. Dominant species of the steppe vegetation were sampled throughout different phenological phases. Analysis of ash and nutrients of vegetation were carried out using standard methods (Grishina, Samoilova, 1971; Miller, 1998).

Preliminary studies indicate that the ash-content varied 1.5-2 times in species of steppe herbs of Compositae, Caryophyllaceae, and Rosaceae families. Ash-content for steppe-habitat grasses and sedges were insignificantly higher or similar to non-steppe grasslands at the peak of growing season. Fabaceae and Equisetaceae taxa which are usually characterized by high ash-content were insignificantly different between the steppe and non-steppe herbs. Nevertheless, the latter differences notably increased at the end of the growing periods. The Ca, P, Mg, K macroelement contents was higher for most steppe species than in the local herbaceous vegetation, especially in calcium and phosphorus. One of the most important elements of the mineral nutrition of animals, the phosphorus, was always found in higher concentrations in the steppe vegetation than in plants of recently dominant landscapes of the Kolyma lowlands. At the same time, the Na content was low and insignificantly different between steppe habitats and the non-steppe vegetation. We also noted an increase of mineral nutrients in steppe plants in years with dry warm summers. It should be noted that the mineral nutrient content of the modern steppe vegetation



Fig. 1. A, Petrophytic steppe. North-East Kolyma Lowland, Arctic Siberia. B, Thermophytic steppe. North-East Kolyma Lowland, Arctic Siberia.

of Siberian Arctic is comparable to that of the recent zonal steppe of Transbaikal Region. This study supports the hypothesis that aboveground mineral concentrations of late Pleistocene grass-rich ecosystem were consistently higher than that of the recent common species of Siberian Arctic grassland. The source of mineral nutrients in the Pleistocene high-latitude steppe vegetation served as one of the reasons for the existence and survival of large herbivores in the Mammoth Biome.

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