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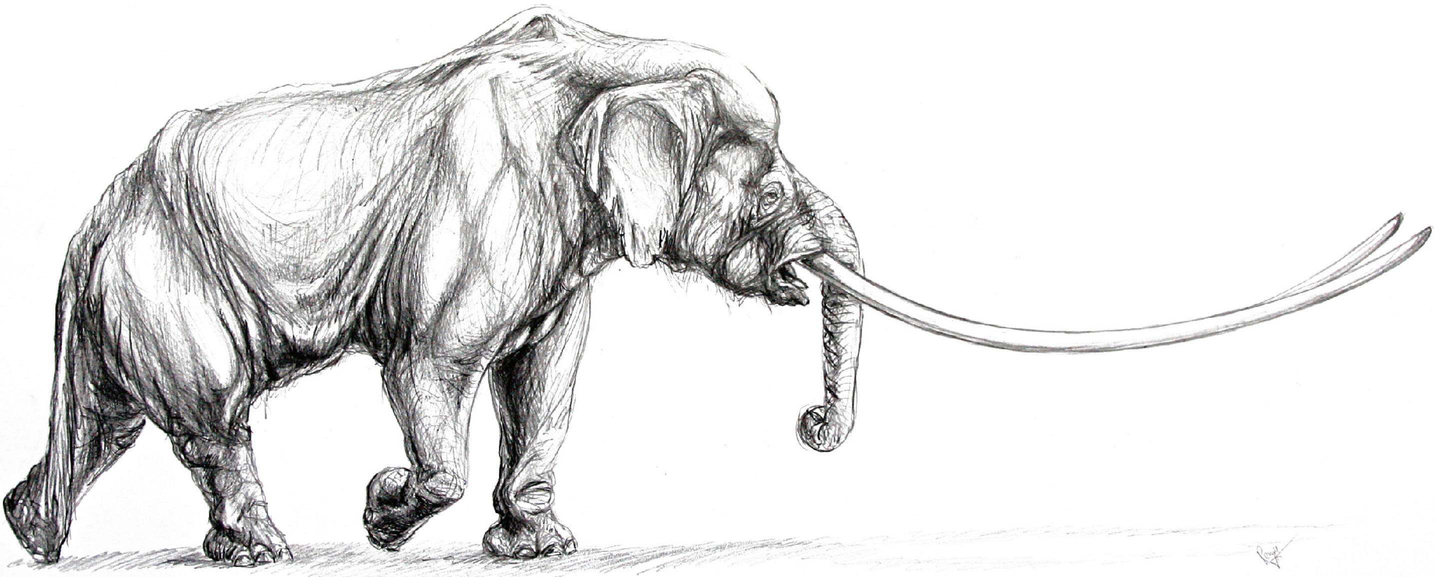

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ABSTRACT BOOK

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The relict steppe soils in the northeast Eurasia – refugium sites of the Pleistocene mammoth steppes

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The cold steppes, representing a nearly uniform zone, were widespread during the Pleistocene in North Eurasia and North America. During cold periods of the Pleistocene these steppes were stretching as a continuous strip from the Baikal region and Mongolia to the high latitudes of the Arctic. They were the basis on which the Mammoth fauna established. Today in the tundra and taiga zones of the vast territory of Yakutia there are areas of intrazonal relict steppes. These steppes occupy large areas in Central Yakutia, and sporadic ones to the north, in the basins of the Yana, Indigirka and Kolyma rivers (Yurtsev, 1981; Zakharova, 2009). These steppes are remains of the vast steppe zone of Pleistocene cold steppes. Results of palynological and carpological research show the significant similarity of the Late Pleistocene and Holocene plant association complexes and the identity of the modern Yakutia steppe associations to the vegetation of the Pleistocene cold steppes of Western Beringia (Ukraintseva, 1996; Maksimovich et al., 2005; Boeskorov et al., 2011).

Comprehensive study of the relict steppes biocenoses, including soil microbial ones allow better characterizing the unique structure of Mammoth steppe that supplied many herbivore species of the Late Pleistocene.

In the lower reaches of the Kolyma River (near Chersky settlement) we studied the microflora of steppefied soils, developed under petrophytic steppes on gravelly eluvium bedrock and under thermophytic steppes (Fig. 1) on the silty loam. The second type of steppes often appears after the fire impacts. Among the dominant pre-tundra woodlands these little spots of relict steppes are found only on the steep southern slopes. Steppefied soils are characterized by extreme dryness, increased supply of heat and longer (10-20 days) growing season compared to cryozems - zonal soils of the northern taiga. Steppe soils have sharply decreasing accumulative type of distribution of organic matter, close to neutral reaction of the soil medium, saturated at 80-99 % base soil absorbing complex. In the soil humus-accumulative horizon under petrophytic steppes the composition of humus is fulvic-humate, and under thermophytic steppes it is humate-fulvic. One of the main features of steppefied soils is the forming of water-stable structure with aggregate sizes ranging within 1,00-

Fig. 1. The plot of thermophytic steppe near settlement Chersky.

0,05 mm, which is not observed in any other soils of Lower Kolyma Region (Davydov et al., 2009).

The peculiar conditions of soil formation of relict steppe soils are reflected in the feature of their microbial cenoses. The relict steppe soils are distinguished from the forest soils of northern taiga by the large saturation of microorganisms of the soil profile. Our studies show that the number of major ecological trophic groups of microorganisms in the upper humus horizons of steppefied soils is of 10^6-10^7 cells/g, and in organic horizons of cryozems it reaches 10^5-10^7 cells/g. Distribution of microorganisms in the soil profile is of accumulative nature. In the steppefied soil profiles the number of microorganisms decreases with depth less sharply than in cryozems. Differentiation coefficient between the humus horizon and mineral horizon is 3-5 in steppefied soils, but 7-10 between the organic horizon and mineral horizon in cryozems. The number of bacteria in the middle part of the soil profile (at a depth of 40-50 cm) under the petrophytic steppe may reach 10^4-10^6 cells/g, and in cryozems it is 10^3-10^4 cells/g at the same depth.

Steppefied soils show higher stock of microorganisms compared with zonal northern-taiga soils. According to this model, they form a decreasing series: soil under thermophytic> soil under petrophytic steppe> cryozems. Moreover, 26-55% of the total stock of microorganisms is concentrated in the upper layer (0-10 cm) of the steppefied soil profile, and 70-80% of the stock is accumulated in the upper layer of the cryozems. Unlike to northern-taiga cryozems, the actinomycetes are actively developing in steppefied soils. Their number reaches 1.5 million colonies/g. They totally predominate among microorganisms utilizing mineral nitrogen, and reach 85% of their number. Actinomycetes are found to a depth of 50-80 cm in the soil profile. The widespread of actinomycetes in steppe soils depends of their dryness. This group of bacteria is adapted to arid conditions and prevails in all steppe soils series. The number of actinomycetes is significantly smaller (up to 0.5 million colonies/g) in cryozems, and they are found only in the upper 10cm layer of soil. The activity of actinomycetes is also binding more profound transformation of organic matter. In this regard it should be noted that the steppefied soils are characterized by higher stocks of dehydrogenase and polyphenol oxidase compared to cryozems. These enzymes are involved in the biogenesis of humus. Dehydrogenase and polyphenol oxidase activity in humus horizons is higher in soils under petrophytic steppe, than in soils under thermophytic steppe. In the same direction the processes of humification in soils is strengthened. The composition of humus is fulvate-humatic in the soil under petrophytic steppe, and humate-fulvatic in soil under thermophytic steppe.

Thus, the relict steppe soils of the Lower Kolyma Region have an arid “spectra” of the microbial cenosis and are higher biogenic compared to zonal soils of the northern taiga. Metabolic activity of the microflora in the steppefied soils is constrained by a shortage of moisture, and in cryozems it is constrained by a lack of heat. It was shown that the cellulose destruction processes proceed very slowly in the soils. During 2 years in the upper 20 cm layer of steppefied soils up to 58 % cellulose is destroyed, and in the cryozems it is of only 35%.

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