

MAMMOTH FAUNA BURIAL PLACES OF THE NORTH-EAST KOLYMA LOWLAND SUBMONTANE ZONE.

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The Pleistocene megafauna of the permafrost of Kolyma Lowland is studied rather well and detailed enough (Sher, 1971, Sher et al., 1979, Lazarev, Tomskaya, 1987, Belolyobsky et al., 2008 and others). Enclosing sediments of the great majority of remains of fossil mammals is presented by icy loess-like loams of the Yedoma suite (Ice Complex) of the Late Pleistocene Age that have the cover spreading. Basic transections of frozen Quaternary sediments are known in the valleys of Kolyma and other long rivers of the lowland – Malyi Anyui and Bolshoy Anyui, Omolon, Chukochya and on the sealine of the East-Siberian Sea. Nevertheless, the fossil fauna buried in the permafrost layers of small watercourses (especially in the contact zone of the lowland and surrounding uplands) is not adequately studied.

Numerous findings of the fossils found during last years are connected with the beginning of development of the auriferous gravel deposit. During the mine exploitation of Quaternary permafrost sediment covering valleys of low order streams in the region of the Kolyma river lowland and the Anui highland conjunction a considerable amount of remains of the animals of Mammoth fauna complex was found (Davydov, 2007), including unique finding of the woolly rhino mummy (Boeskorov et al., 2009).

Modern relief of the region is represented by the group of elevations with altitudes of 200-630 meters above sea level formed by Triassic sediments with small injections of granitoids of the Cretaceous Age and volcanic rocks of the Neogen Age and the valleys of Malaya Filippova, Finish, Drevniy streams. The development of placer deposits gave a possibility to make more detailed researches of the foothills permafrost and the species diversity of animals of the Mammoth faunal complex buried inside them. The study carried out by the authors on the placer polygons of the Finish, Drevniy and Malaya Filippova streams in 2006-2008 years shows that periods of local sedimentation were equal for all area being occurred in similar tectonic, geomorphologic and climatic condition (that had caused forming of stratigraphical horizons of similar genesis and lithology in the low order valleys).

The upper reaches of the Finish stream. The data of drilling hole made by authors in 2006. Absolute height of the wellhead is 145m.

1. 0.0 - 0.6m – loess-like dark-grey loams. Upper part (8-15cm deep) is peat-like organic horizon interlaced with shrub and grass roots. Material in the lower part - grayish-dark with gently bluish tint, gley spots and rusty small lens. Frozen forest-tundra peaty - gleyey soil. Thickness (T) is 0.6m.

2. 0.6 - 2.2m - dark-grey and grey loams is with a bluish tint of in the lower part of horizon. It contains the remains of filiform grass rootlets, bunches of small twigs and the infrequent small lenses of peaty material. Its layering is rather flat. The layer is very ice-rich cryotexture (ground-ice). It presents the transitional horizon of the permafrost. T - 1.6m

3. 2.2 - 6.45m – grey and dark-grey loess loams and loamy sand, contains the remains of filiform grass rootlets with the inclusion and interbed of a peaty material. At the range of 2.20 – 4.50m – polygonal-wedge ice of gently grey color with the vesicular texture. T - 4.25m.

4. 6.45 – 8.00m – bluish-grey and dark-grey loess loams and loamy sands with dark-brown streaks of organic matter (remains of grasses and small twigs of dwarf shrubs) and rust that increased to bottom of layer. The sediment bedding has the traces of drifting ground that are similar to pseudomorphoses of ice wedges. Ground iciness is rich. T - 1.55m.

5. 8.00 – 8.70m - dense loess loamy sands of bluish-grey color with rusty spots. Sediment has infrequent slanting streak of loamy sand, small lens of brown peat and not numerous remains of grasses and flinders of little twigs. Ground is icy and gas-producing. T – 0.7m.

6. 8.70 – 10.20m – debris-and low-rolled pebble of sedimentary and intrusive rocks with the loamy sand filler and contain slight plant detritus in lower part of the horizon. Organic matter has flood origin. Ground iciness is low. T - 1.50m.

7. 10.20 – 10.80m – brown sand-debris-pebble horizon with the rusty tint that increased to bottom of layer. The pebble material is high-rolled. Petrographic composition of the sediment presented with a big portion of intrusive rocks. Ground iciness is middle. T – 0.6m.

8. 10.80 – 11.35m - dark-grey and brown-grey with greenish tint grus and small-sized detritus. The filler is gritty-clay soil of the gentle bluish color. Residual weathering crust of granodiorites. T - 0.55m.

The thickness of the permafrost layer of this stream varies from 5m deep in the upper course and up to 15 – 20m in the middle course. The upper biggest part of frozen sediments (horizon #3 in the profile description) alike in the other watercourses of investigated area. They represented by loess-like loams with developed system of polygonal ice wedges of the Late Pleistocene that called Yedoma complex (Ice complex). The type of cryogenic structure indicates the syngenetic freezing of the sediments. Hypothetically, lower parts of loamy soil horizon belong to Olyorian sediments (Sher, 1971), though there wasn't found any accompanying fauna. Nevertheless, cryolithologic features – the lack of polygonal ice wedges, the traces of drifting ground (that are similar to pseudomorphoses appears after ice wedges melting), development of the epigenetic cryostructures, predominately bluish color of sediments – indicates its Early or Middle Pleistocene age. Underlying layer that formed by debris -pebble material at the valley head or pure pebbles in the middle part of the valley – refers to Begunov Suite of the Pliocene Age (Sher, 1971). Basic sediments are underlay by Paleogene-Neogene residual weathering crust. Analogous geological structure is typical for the rest of foothills valleys; it is differs only in depth and thickness of horizons. Thus in the Malaya Filippova stream there was exposed the most thick horizon of loams of Yedoma complex; in the Drevniy stream there was registered the most thick pebble horizon together with small strata of Yedoma soil; in the Finish stream there is greater part of hillslope material in the valley sediments. In tote, thicknesses of frozen sediments are changing by the common rule – they are increasing as the absolute height decrease. Basic palaeontological material is confined clearly both with the valley thalweg and with the basis of Ice complex sediments. In the taphocenosis of the Finish stream the horizon with fossils marked by a layer with abundant remains of branches of shrubs, roots and plant detritus. Fragments of skeletons of woolly mammoth (*Mammuthus primigenius*), primeval bison (*Bison priscus*) (several tens of different age individuals), less often woolly rhinoceros (*Coelodonta antiquitatis*), red deer (*Cervus elaphus*), primeval horse (*Equus lenensis*) and isolated finds of musk-ox (*Ovibos pallantis*) and reindeer (*Rangifer tarandus*) are predominately found among fossil fauna in the stream. Finds of fauna of Malaya Filippova and Drevniy streams are numerous as well. The fauna assemblage here is slightly different – no red deer and musk-ox remains were found, and number of fragments of skeletons of woolly mammoth is lesser, while Lena horse's

(*Equus lenensis*) ones are more numerous. In Drevniy stream ulna of a grey wolf (*Canis lupus*), phalanx and ulna of cave lion (*Panthera (Leo) spelaea*) were found. The bone material appears rather fresh, with partially preserved soft tissues and bone marrow inside with insignificant decay in addition to traces of predators gnawing. Horns of bison skulls are often found with horn sheaths. Such condition of the palaeontological material preservation points out its relatively quick burial. In the mammoth fauna of the studied area appears the rule that is somewhat common for Lower Kolyma region in general: remains of primeval bison (*Bison priscus*) are constantly present as a background among the composition of quite numerous fossils. Side by side with the typical representatives of the Mammoth fauna – mammoth, bison, horse, musk-ox, etc., - the extremely large amount of the woolly rhino remains (parts of skulls, horns, fragments of skeletons and skins) found in the Late Pleistocene sediments of uplands. The finding of the mummified carcass of woolly rhinoceros (*Coelodonta antiquitatis* Blum., 1799) in frozen loams of Malaya Filippova stream in June of 2007 year became true scientific sensation (Boeskorov et al., 2009). The depth of burial place of the carcass is 5-7m from the surface, which absolute height is 130m. A greater part of the fossil animal is preserved. It was determined that the carcass belongs to mature female of woolly rhinoceros. This is the fourth of such a findings in the world and the best one by the preservation of soft tissues. The absolute age of mummy is $39\ 140 \pm 390$ years (OxA-18755).

For the study of palaeoecological conditions of mammoth fauna existence of the area there was held the pollen spectra analysis (PSA) of a ground sample that adhered to the rhinoceros corpse and two samples from enclosing sediments. These samples are characterized with rather high content of variously preserved pollen grains (574, 323 and 573 in each preparation). The taxonomic composition of the pollen assemblage differs from the recent association one by dominating pollen of grasses and dwarf shrubs (61.0; 70.3 и 61.0%), where the greater part is the pollen of Gramineae (23.9 18.9 and 24.1%). There is abundant pollen of wormwoods (15.3; 14.0 и 9.9%) and Cyperaceae (4.9; 12.8 и 14.9%), less Caryophyllaceae, Astereae and Ranunculaceae. Taxa of secondary forbs is represented by single pollens of Polygonaceae, Chenopodiaceae, Papaveraceae, Saxifragaceae, Fabaceae, Brassicaceae, Labiatae, Polemoniaceae, Valerianaceae and plants of other families. Tree-shrub vegetation (27.3; 13.9 и 6.9%) is reflected by presence of pollen of dwarf birches (9.7; 6.1 и 2.0%), willows (single pollen grains, 1.9; 3.1%), alder (3.8% and the single pollen grain) and the only larch's one. Important results were received with PSA of fossil excrements of herbivore that were selected in situ from the outcrops of Yedoma sediments of the Finish stream. The greater part of the pollen assemblage (578 pollen grains in 1 preparation with the square of 24X24 mm), especially Poaceae, very good preserved. The peculiarity of spectra is the high content of pollen of the grass-dwarf shrub plants (95.9%) The dominating part of pollen here compounds Poaceae, (81.1%) represented with eleven morphological types. An important component of a spectra is the presence of a morphologically diverse pollen of Caryophyllaceae family (4 species) and *Artemisia* (up to 8 species), partly similar to the recent *Artemisia tilesii*, *A. borealis*, *A. arctica* (*A. subarctica*). The taxonomic composition of the background forbs is poor and represented by single pollen of Cichorieae, Astereae, Chenopodiaceae, Plantaginaceae and Cyperaceae and Ranunculaceae as well. It is need to notice the very low content of tree-shrub plants (1.9%) and the absence or the single presence of a shrub, dwarf shrub, sedge, sphagnum and green mosses.

The results of PSA are definitely shows the domination of grassland, i. e. steppe, meadow-steppe and meadow phytocoenoses in the Late Pleistocene landscapes of submontane areas of Kolyma Lowland. The spreading of tree-shrub coenosis was extremely insignificant. It were predominantly steppe ecosystems with grass-wormwood-forbs cryo-xerophytic communities with high floristic diversity, dry and firm ground and rich herbivore fauna, in which woolly rhinos acted the significant part. It is need to say, that the investigations of fossil fauna burial

places in the valleys of these streams have totally confirmed the hypothesis that rhinos preferred the submontane valley-hillslope biotopes in the conditions of open spaces of the cryoaridic steppe (Sher, 1976; Boeskorov, 2001). Modern zonal landscapes of the studied area are represented by the northern taiga consisting of thin larch forests, underwood of dwarf birches, willows, sometimes alders and often with continuous moss–lichen cover. In the stream valleys wet shrub-moss and tussock sedge-moss thin forest are omnipresent. The subvertex hillslopes of the foothills are covered by an abundant dwarf stone pine that is changing above into the vegetation of the alpine tundra. It is notable, that in the modern vegetation, in several kilometers from the places of findings of the fossil fauna there were noticed small areas of steppe communities that are occupying steep slopes of the southern exposures on the river bluffs or forming microcoenoses in the alpine tundra of uplands (Davydov et al., 2008). The taxonomic composition despite of its poverty has a big likeness with the vegetation of the pollen assemblage of the Late Pleistocene sediments containing remains of mammoth fauna.

Research was partly supported by the Russian Foundation for Basic Research (projects 06-05-65032, 07-05-00313-a and 09-04-98568-r_vostok_a).

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