

International Symposium on Yukagir Mammoth:

Recent Advance in Yukagir Mammoth Researches



Proceedings of International Symposium on Yukagir Mammoth

June, 2005
Nagakute, Japan

Edited by
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Japan Association for the 2005 World Exposition

Pleistocene paleosoils of tundra zone of Yakutia at the Yukagir mammoth find site

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The witnesses of thousand-year remoteness are preserved remains of large extinct animals - woolly mammoths. Their study will make possible theoretical reconstruction of the Pleistocene epoch with its climate, flora and fauna. Knowledge of cause and effect of climate and paleoecosystems change will serve as a key for understanding future global climatic transformations on the Earth. Goal of our research work is studying paleosoils, their genesis and soil formation processes conditioned by ecological factors of that time; studying activity of wide range of hydrolytic and oxidation-reduction enzymes of tundra peat-clay soils formed in the Holocene as well as in rocks and buried soils of the late Pleistocene. The latter represent sediments containing the Yukagir mammoth head and remaining in frozen state for thousands of years (since the Sartan glacial period, i.e. some 11-25 thousand years ago). Thus in this case soil formation rock is the complex of fluvioglacial alluvial-eolian sediments. According to the soil-geographical zoning, the studied region is related to tundra subbrown soils: frozen tundra subbrown soils on watershed sites combined with peat-marsh soils in depressions. At the find site, the first upper half-meter is represented by modern soil underlain by ancient soil-grounds. Throughout the whole profile, ice veins are observed on equal distances evidencing of border of seasonal melting in certain historical periods of time. Total number of such ice veins is 3 which is the same as for buried humus horizons. The first vein on one-meter depth corresponds to modern level of active soil layer whereas the other two underlain veins indicate two periods of soil formation under permafrost conditions and conserved by it for several millennia. In the lowest layer, where the mammoth remains were found ice veins were not detected. Generally, all genetic horizons of the soil profile are inclined westwards facing sea coast-line. Fraction composition of all mentioned humus horizons is prevailed by humic acids whereas modern frozen soils are always dominated by fulvoacids. This allows concluding that buried paleosoils formed under more mild, favorable climatic conditions. For instance, such ratio of humus composition is characteristic for chemozems of steppe zone. Enzymes in frozen soils and sediments at negative temperatures remain active for long period. It can be explained by special soil structure and immobilization of enzymes on surface of organo-mineral colloids. Most likely, the higher adhesive power between enzymes and organic molecules and mineral particles the longer they remain intact during certain time span. Thus the studied area is characterized by three developed soil profiles including modern one and with more ancient profile situating on lower level. These profiles remained intact just like the mammoth carcass which is evident from presence of humus layer with root remains at the depth of 200-230 cm. The other evidence of conservation is the fact that modern soils haven't undergone aleuritization of granulometric composition. In future, more detailed study of active layer localization and its thickness may yield in chronological reconstruction of climate change; specifying glacials along chronological scale and learning more about ecological conditions of that time.

Problems of conservation of mammoth fauna remains with soft tissues under cryogenic conditions

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In olden days, remains of ancient animals with soft tissues were treated with formalin solution and kept under room temperature. Such material lost its original properties and became of little use for microbiological, histological and molecular-genetic investigations.

Despite of the fact that the frozen monolith of internal organs of the Shandrin mammoth, 2-meter thick piece of skin of the young mammoth from the Lyakhovsky island and some other finds had been stored at the underground pit of the Institute of Permafrost (Siberian Branch of Russian Academy of Science) under 3-5 °C below zero, later they all were unfrozen as there was no special freezer, preserved and placed to a warm storage room. In 1990's, when the Museum of Mammoth was founded, a whole museum complex was designed with cold underground halls. Unfortunately, this idea has not been realized yet. The first underground museum, where mammoth remains were exhibited under cryogenic conditions, was built by famous businessman and mammoth investigator B. Buigues in Khatanga village situated in the northern part of Krasnoyarsky region.

Since 2001, the Institute of Applied Ecology of the North has conducted the serial experiment on conservation of ancient animal remains under cryogenic conditions. It was started with the frozen monolith of two preserved legs of the Maksunuokha mammoth. Immediately after excavation, it was placed into a domestic freezer and is stored now at the Mammoth Museum (IAEN AS RS (Ya)) under 8°C below. In 2003, a special freezer was made for keeping remains of mammoth and other mammoth fauna representatives with soft tissues. This camera keeps constant temperature of minus 6-18°C. The Yukagir mammoth remains have been stored there during six months. At present, remains of the Olchan mammoth calf found in October 2004 in Oymyakonsky ulus of Sakha Republic are stored in that camera.

In summer 2004, aiming to provide more favorable conditions for conducting research works, the Yukagir mammoth remains were moved to a spacious hall of the "Sakhaproduct" company's ice-chamber. This ice-chamber was built in the middle of last century based on very original design on ground level. First, a 40-meter framework of common corridor and branch halls were built. Then an outward building was erected. Several-meter thick space between the framework and the external building was filled with ice blocks and liquefied snow. During the hottest summer month, the temperature in this chamber is constantly kept at -16°C.

One should admit that this design of cryogenic storage room for mammoth fauna remains with soft tissues is the most optimal one since natural climate with proper moisture conditions is kept in there. In Yakutsk, where the 4th International Mammoth Conference will be held in 2007, construction of the Mammoth Museum is planned with such freezing building.

Year of 2005 can be considered as the beginning of experiment on exhibition of frozen specimens. For the first time in the world, exhibition of the paleontological object, the Yukagir mammoth, at EXPO-2005 in Nagoya (Japan) is done under cryogenic conditions similar to natural conditions of preservation in frozen grounds of Yakutia. For that purpose a special exhibiting pavilion and transportation container were designed. Moreover, during exhibition the process of scientific research work is not interrupted. This experience can be used for implementation of other scientific and exhibition projects.

Problem of establishing especially protected natural area in the Maksunuokha river basin

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Proposals of establishing especially protected natural area in the Maksunuokha river basin in Ust-Yanskiy ulus of Sakha Republic have been put forward by the Institute of Applied Ecology of the North since 2003. The board of directors of the Institute raised this question before the Ministry of nature conservation of Sakha Republic several times.

Within the Maksunuokha river basin, three unique burial places of the second half of Sartan glacial period (20-15 thousand years ago) were found not far from each other: horse's (*Equus sp.*) head and lower jaw (1979); fragment of mammoth's skeleton with skull and tusks (1988); fragments of mammoth carcass (three legs) (1994 and 2002), fragment of mammoth carcass (head, 2002-2003). Mentioned finds testify higher concentration of fossil remains of the mammoth fauna specimen at the examined territory.

At the International Scientific Conference "The Yukagir mammoth: Outcome of the first stage of research work" held in Yakutsk in November 2004, it was marked that high information potential of the remains from permafrost gave impetus to scientific community for elaboration of new methodology of deriving such information. The same circumstance (high information potential) is the stimulus for international and interdisciplinary cooperation.

Taking into account the uniqueness of information kept in organism remains located permafrost, the participants of the Conference offered to establish the "Maksunuokha" International paleontological reservation-site in cryolithozone with the objective to preserve bone remains and carcasses in their original condition. Besides, the reservation-site may solve problems of protection of waterfowl nesting sites and caribou procreation and summer sites.

Establishment of especially protected natural area in the Maksunuokha river basin would undoubtedly play very important and significant role in supervising commercial extraction of mammoth tusk and other mammoth fauna remains. At present, there is uncontrolled extraction and export of mammoth tusk from northern uluses outside the republic. Local legal bodies, heads of ulus administrations and tribe communities try to prevent drain of precious raw material beyond the republic's border being often helpless. Along with mammoth tusks, unique paleontological remains including carcasses of enormous scientific and cultural value being national property of Yakutia are exported outside.