THE FAUNA OF ALAS SEQUENCES IN THE ICE COMPLEX AREA: THE CASE OF MAMONTOVY-BYSAGASA NORTHWEST EXPOSURE, BYKOVSKY PENINSULA

T. Kuznetsova[1], S. Kuzmina[2], V. Kunitsky[3], L. Schirrmeister[4], A. Sher[5]

[1] Moscow State University, Faculty of Geology, Moscow, Russia
[2] Paleontological Institute, Russian Academy of Sciences, Moscow, Russia
[3] Melnikov Permafrost Institute, Siberian Branch, Russian Academy of Sciences, Yakutsk, Russia
[4] Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany
[5] Severtsov Institute of Ecology & Evolution, Russian Academy of Sciences, Moscow, Russia

The paleoecological study of alas (thermokarst depression) sections, extremely widespread in the distribution area of the Ice Complex (1C), is of primary importance f(5r the reconstruction of the chronology and sequence of the major environmental changes that occurred in the Arctic around the Pleistocene/Holocene boundary. One of such sections was studied at the Laptev Sea coast, in the east-central part of the Bykovsky Peninsula. It is located within the Mamontovy-Bysagasa (MB) alas, a large thermokarst depression with lakes and creeks, elevated for 4-10 m a.s.l. The alas is adjacent to yedoma hills up to 40 m high and is abraded by sea as well as the hills. The cliff of the SE hill is the key section of 1C (Mamontovy Khayata). The coastal exposure of the terrace-like surface (7-10 m a.s.l.) at the NW edge of the MB alas reveals that its section includes two different units.

The upper unit, up to 3.5 m thick, is built by silt and sand, rich with various plant remains, and includes narrow ice wedges. The silty upper member of this unit (2 m) has numerous inclusions of autochthonous peat, "hummock-like" in shape. One of them (depth 0.8 m) has been dated as 5316+193 y BP (PI-1999) (conventional ^{14}C, non-calibrated). The lower member is built by fine sand and includes many various parts of large shrubs, sometimes with bark (shrub alder and birch), and tree logs and stumps (larch?), some of the latter in life position. This member also contains shells of freshwater bivalves and gastropods. Thick branches and roots showed conventional ^{14}C ages of 90671230 y BP (PIUS 1), 9443±242 y BP (PI-2000) and AMS date 9475±40 y BP (KIA 6739). The lower unit (visible thickness 5 m) is built by compact grey silt with lenses of fine-grained sand and plant detritus. By the cryogenic features, this unit is considered as taberal – thermally transformed deposits, presumably of 1C, thawed in place (without redeposition) and later refrozen.

This assumption is confirmed by the composition of fossil insect assemblages from this unit. Four samples are similar to each other and to the Late Pleistocene assemblages, known from the middle part of the Mamontovy Khayata Ice Complex section (MKh). They are dominated by mesic tundra species, with an essential role of dry tundra inhabitants and the presence of steppe species. The insect assemblages from the upper unit (3 samples) are very different. Insect fossils are more numerous here, have better preservation and much higher diversity. The sample from the "wood" horizon is peculiar for the presence of forest insects. The northward advance of trees and tall shrubs to the Bykovsky Peninsula in the Early Holocene, 9-9.5 ka (non-calibrated 14C age) can be correlated with the regional thermal optimum. However, the presence of steppe insects, characteristic of Pleistocene tundra-steppe assemblages, in all samples from the upper unit suggests that the Early Holocene plant communities were not analogous to modern ones.

More than 150 fossil bones of mammals have been collected on the beach under the NW MB cliff. They all belong to common late Pleistocene species (mammoth, horse, reindeer, bison), but have a preservation different from those from the 1C (darker surface coloration, vivianite), that seemingly indicates their alteration during the matrix sediment thaw and indicates that they come from the taberal unit. Eight 14C dates on mammoth, horse, and bison bones range from 39.2 to 28.7 ka, which corresponds to the dates from the middle part of the MKh section. Although the absence of younger dates may be caused by a small sample size, their close grouping may suggest that this age range is not coincidental.

The results obtained from the NW MB and MKh sequences allow to suggest the following scenario. The accumulation of 1C probably terminated around 12 ka. This is evidenced by the AMS dates from the uppermost level of 1C in MKh - 12,525+50 y BP .(KIA 6718) and 12,355±50 y BP (KIA 6719), accompanied by the typical Pleistocene insect assemblage, and the date 11.090+.270 y BP (NUTA-2231) from the organic layer, overlying 1C (Fukuda, 1994). Thus, the denudation of 1C and the development of thermokarst kettle could have started around 12-11 ka. The large lake in the MB alas was ' probably an open system, with the outwash of silt material. It existed until about 10-9.5 ka. At the time of the Early Holocene optimum, the alas bottom (or at least its peripheral part) was overgrown with shrubs and trees. This stage was accompanied (or followed) by the freezing of the sub-lake talik, while the accumulation of deluvial-solifluction and paludal sediments continued until about 5 ka. During the second half of the Holocene, further deepening of the alas took place, possibly related to the creek outwash to the sea. Except minor details, this scenario correlates well with the regional pattern of the alas development in Northern Yakutia (Kaplina & Lozhkin, 1979) and can be extrapolated to countless similar cases.