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ABSTRACT BOOK

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A study of a frozen mummy of a horse from the Holocene of Yakutia, Russia

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In July 2010 the Yukagir tribe members found remains of the partial frozen carcass of a Pleistocene horse (the so-called "Yukagir" horse; Boeskorov et al., 2013) on the northern slope of the Oyagosskii Yar, at the coast of the Dmitry Laptev Strait in northern Yakutia (72°42'16"N, 142°50'15"E). The horse was found 50 meters far from the Yuka mammoth, which had AMS radiocarbon date 34,300 yr BP. However, despite the vicinity of the sites, the horse age appeared to be much younger, about 4,630±35 yr BP (GrA-540209; Boeskorov et al., 2013). This date falls at the end of the second half of the Atlantic period, the warmest period during the Holocene that lasted from about 6,0 to 4,5 kyr BP, just before a significant cooling recorded in many sites of northern Eurasia (Velichko et al., 1997).

The carcass was preserved in two large pieces: the head with the neck, and a part of the torso with inner organs, hind limbs and tail (Fig. 1). The missing part of the snout, ripped off (and missing) fore limbs with frontal part of the torso and numerous torn holes, gaps and stripes on the hide indicate that the horse was hunted and/or scavenged by a large predator, like bear or wolf.

The frozen mummy had intact skin on the hind limbs, on the large part on the head, on the back of the neck and on the sides of the torso. The predominant color of the skin was dark brown; the skin was mummified and very hard. It was 1-5.1 mm thick, as in the domestic horse. Short (45 - 70 mm), dark-brown and, in some places, black hair was preserved only on the distal parts of the limbs, below the tarsal-phalanx joint. Mammoth, bison, and horse carcasses frozen in permafrost usually have most of the body hair detached from the skin, but often retain the hair in distal parts of the limbs.

The horse is an adult female: the canines are absent and the state of the incisors' wear corresponds to that of a 5-years old domestic horse.

We managed to estimate some of parameters of the horse's skull by measuring the un-skinned and un-fleshed horse head. Most of the Yukagir horse skull measurements fall within the variation range of *Equus lenensis* Rusanov, 1968, which was studied by Lazarev (1980) and Kuzmina (1997). However, the Yukagir horse was relatively large-headed and possessed a relatively large dentition.

The Yukagir horse ear was shorter (length 14 cm) than that in *E. przewalskii* (14-18 cm). The tail was preserved intact, but had missing hair. It was relatively short (36.3 cm) in comparison to Przewalski's horse (38-60 cm).

The left hoof was 19 cm long and 15 cm wide, i.e., larger (wider) than hoofs of the Late Pleistocene horse (*E. lenensis*) and of the domestic Yakutian breed (Vereschagin, Lazarev, 1977). Wide hoofs would reduce weight load and allow the animal moving comfortably in lowland wetlands and boggy tundra, as well as enhance their ability digging out the grass from under snow during snowy winters.

The estimated height in hips is 132 cm. It is slightly shorter than that of the Selerikan horse mummy, *E. lenensis* (136 cm) from the Upper Indigirka River basin (about 38,000 yr BP) and comparable to the height of the modern Yakutian breed (Lazarev, 1980). The size of the distal parts of the hind legs was relatively large.

There are several records of the extinct Pleistocene horse remains (possibly *E. lenensis*) from the Holocene (ca. 4.6 - 2 kyr BP) of the Central and Eastern Siberia indicating that this species inhabited the wide area from Western Taymyr Peninsula to Indigirka River in the east and from Bolshoi Lyakhovsky Island in the north to Verkhoyansky Range in the south (Lazarev, 1980; Lazarev et al., 2011; Kuznetsova et al., 2001; Sulerzhitsky, Romanenko, 1997). The Pleistocene horse remains have never been dominant in the Holocene assemblages, and this likely indicates that the species survived through the Late Holocene in small populations



Fig. 1. Remains of the Yukagir horse partial frozen carcass.

in scattered and isolated steppe refugia.

The Yukagir horse lived in a period characterized by moister climate due to the ongoing marine transgression. The annual precipitation level was 200 mm more than present precipitation in Yakutia, which caused an expansion of moisture-demanding conifers (*Pinus sibirica*, *Abies sibirica*, *Picea obovata*) to the north, where currently only drought-resistant conifers (*Larix* spp.) exist (Monserud et al., 1998, Pisaric et al., 2001). The local vegetation consisted of open larch woodland with shrub alder alternating with dwarf birch and dwarf willow growths (Kaplina, Lozhkin, 1982; Velichko et al., 1997; Andreev et al., 2011). A significant cooling at the end of this period (4.0–3.0 kyr BP), implied the southern shift of vegetation zones and a retreat of the forest vegetation (*Picea*, *Larix*, *Pinus*) to the south (McDonald et al., 2000).

In contrast to the composition of the vegetation, the palynological spectrum of the samples from the Yukagir horse colon shows predominance of grass (97.4%), with low percentage of trees (1.9%) pollen, and spores (0.6%). The grass is represented by true grasses (91.6%), sedges (4.5%) and others. The analyses of macro-remains, which included fragments of leaves and stems of monocots, with rare remains of mosses (genus *Bryales*) and grass seeds (family Poaceae), confirmed that the Yukagir horse strongly preferred grasses for its diet.

The Yukagir horse diet included more “grasses” than the diet of the early Holocene Yukagir and “Chukotka” Bison (Boeskorov et al., this volume; Kirillova et al., 2013), which lived in unfavorably changing landscapes and vegetation shifting towards forest and swampy tundra. However, morphological adaptations (small body size, and large hoofs), and possibly smaller than *Bison priscus* size herds, were important factors for the survival of the Pleistocene horse during the late Holocene.

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