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New Data on Mammoth Fauna Mammals in the Central Lena River Basin (Yakutia, Lenskie Stolby National Nature Park and Adjacent Areas)

G. G. Boeskorov^{a,b}, P. R. Nogovitsyn^c, E. N. Mashchenko^d, I. N. Belolyubsky^a, A. D. Stepanov^e,
V. V. Plotnikov^b, A. V. Protopopov^b, M. V. Shchelchkova^f, J. van der Plicht^g,
and Corresponding Member of the RAS N. G. Solomonov^{f, h}

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This paper considers the data on new findings of mammoth fauna remains in the Middle Lena basin used to specify the species composition of large Late Neopleistocene mammals represented by eleven species. The obtained range of radiocarbon dates made it possible to state that mass burials of Pleistocene mammal remains were formed in the region during the Karginsk Interstadial (24 000–55 000 years ago).

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The area of Yakutia is one of the few regions on the Earth where permafrost rocks and cold climate contribute to the preservation of loose Quaternary sediments containing numerous remains of the Pleistocene organic world, in particular, the Late Neopleistocene biome of mammoths. Numerous findings of mammoth fauna remains in the Arctic zone of Yakutia, where the global search for mammoth tusks is still in progress (up to 20–30 tons per year) [1], are known. Such remains are poorly preserved in the Central Yakutia Region due to the warmer and longer summer and more intensive permafrost melting, and thus they are not as numerous as in the Far North. As a result, the data on the composition and distribution of the

mammoth fauna in the Central Yakutia Region were incomplete until recently; moreover, radiocarbon datings of fossil mammal remains were rare.

Sediments of the Pleistocene formations were uncovered in the Central Yakutia Region on the right bank of the Lena River: the Bestyakh Formation (Middle Pleistocene, sand with pebbles, 1.0–7.5 m in thickness), the Mavrino Formation (Shirtinsk of the Middle Neopleistocene–Kazantsevo of the Late Pleistocene, sands, 14.5–16.5 m in thickness), and the Diolkuma Formation (Late Neopleistocene, sands, 5–20 m in thickness), the age of which is estimated by radiocarbon dating at 11 000–20 000 years [2]. Quaternary sediments on the left bank of the Lena occur as alluvial facies of multiple-elevation river terraces and river tributaries: buried sediments of the Pokrovsk Formation (the second half of the Lower Neopleistocene, Lebedskii horizon; pebble with rare boulders, sand with gravel, fine pebbles and loam); sediments of the second over-floodplain accumulative 18- to 22-meter terrace (Sergelyakh) (Upper Neopleistocene, Karginsk and Sartan horizons; pebble, sand, loam, up to 33 m in thickness) and sediments of the first over-floodplain accumulative 8- to 12-meter terrace (Yakutsk) (Upper Neopleistocene, Sartan horizon–Lower Holocene; basal pebble overlapped by sand with sandy loam and loam interbeds, up to 22 m in thickness) [2, 3].

The remains of fossil mammals of mammoth fauna were identified in the Lena middle flow near the Lenskie Stolby Nature Park and adjacent areas at varying times. The bones of the mammoth *Mammothus primigenius* Blum., woolly rhinoceros *Coelodonta antiquitatis* Blum., Lena horse *Equus lenensis*

^a Institute of Diamond and Precious Metals Geology, Siberian Branch, Russian Academy of Sciences, Lenina pr. 39, Yakutsk, 677007 Russia

^b Mammoth Fauna Investigation Department, Russian Academy of Sciences, Sakha (Yakutia) Branch, Yakutsk, Russia

^c Oi Secondary School, Nemyuginty Settlement, Khangalass Region, Yakutia, Russia

^d Borisyak Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya ul. 123, Moscow, 117997 Russia

^e Museum of Archaeology and Ethnography, M.K. Ammosov North-Eastern Federal University, Yakutsk, Russia

^f Institute of Natural Sciences, Ammosov Northeastern Federal University, Yakutsk, Russia

^g University of Groningen, the Netherlands

^h Institute of Biological Problems of the Cryolitozone, Siberian Branch, Russian Academy of Sciences, Yakutsk, Russia
e-mail: gboeskorov@mail.ru

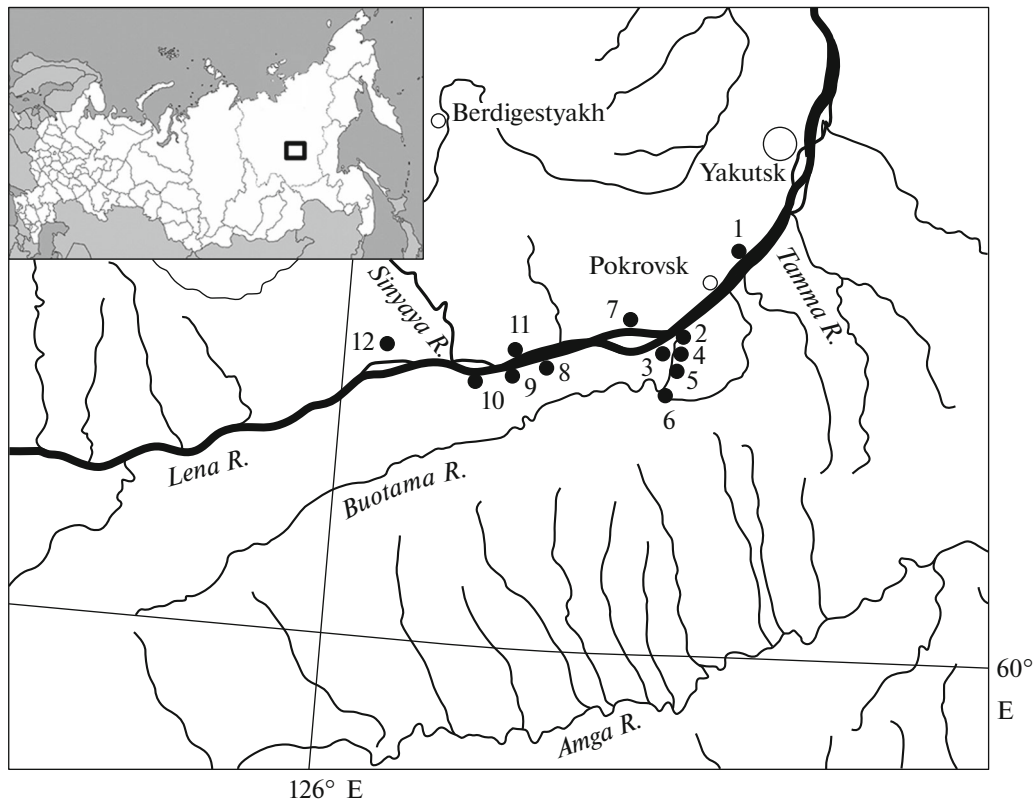


Fig. 1. Location of the mammoth fauna in the Middle Lena basin. (1) Kutalaakh Quarry, (2) Ulakhan-Ary Island, (3–5) Buotama River mouth, (6) Kuokh Khaya, (7) Chasovnya, (8) Diring–Yuryakh, (9) Labyia, (10) Kuranakh, (11) Batamaiy, and (12) Sanga–Saiylyk.

Russ., primeval bison *Bison priscus* Boj., bighorn sheep *Ovis nivicola* Esch., moose *Alces* sp., and reindeer *Rangifer tarandus* L. were found near the mouth of the Buotama River [5]. The Diring–Yuryakh outcrop, at the mouth of a cognominal creek, is composed of Upper Quaternary sediments with remains of *E. lenensis*, *B. priscus* Boj., and *Alces* sp. [2, 5]. In the 1980s, scientists from the Institute of Geology, Siberian Branch, Academy of Sciences of the USSR, identified the remains of mammoth, Lena horse, bison, bighorn sheep, reindeer, and red deer *Cervus elaphus* L. on Ulakhan-Ary Island, in the Lena River, near the mouth of the Buotama.

Large collections of bone remains of fossil animals have been made by participants of the Elaiada summer ecological expedition by the Oi Secondary School (Nemyugintsy Settlement, Khangalass Region, Yakutia, Russia) under the guidance of N.G. Solomonov, a corresponding member of the Russian Academy of Sciences, and P.R. Nogovitsyn, a deputy director of the school, from 1995 to the present. Twenty years of expedition operations has resulted in identification of mammoth fauna in Kutalaakh Quarry, in the Buotama River mouth, in creeks such as Chasovnya, Labyia, and Kuranakh creeks, and in areas such as Batamaiy, Kuokh Khaya, and Sanga-Saiylyk (Fig. 1).

A few hundred collected mammoth bone remains are currently kept in the museum of the Oi Secondary School and the Institute of Diamond and Precious Metals Geology, Siberian Branch, Russian Academy of Sciences. In 2012 and 2014, the expedition teams of the Academy of Sciences of the Republic of Sakha (Yakutsk) and the Institute of Diamond and Precious Metals Geology, Siberian Branch, Russian Academy of Sciences, searched for and studied mammoth fauna remains in the Buotama River mouth.

During the 1995–2014 expeditions, we studied a number of individual Upper Quaternary sediments in the Middle Lena basin (Kutalaakh Quarry, Kuokh Khaya, Diring–Yuryakh, Labyia, Kuranakh, and Chasovnya), and also local sites of alluvial bone remains of Pleistocene mammals (Ulakhan-Ary Island, Buotama River mouth, and the Batamaiy area) (Fig. 1). The investigation of these areas made it possible to obtain new data on the regional mammoth fauna (Table 1). A number of fossil animal bones have been dated by the radiocarbon method in different laboratories (Table 2).

Based on these collections, eleven species of large mammals inhabited the Middle Lena basin in the Late Neopleistocene (wolf, brown bear, cave lion, woolly

Table 1. Large mammals of mammoth fauna inhabiting the Middle Lena basin (Lenskie Stolby and adjacent areas)

Order, species	Kutalaakh Quarry	Ulakhan-Ary Island	Buotama R.		Chasovnya	Diring-Yuryakh Cr.	Labya Cr.	Kuranakh Cr.	Batamaiy	Sanga-Saiylyk
			Mouth	Kuokh Khaya						
CARNIVORES										
Wolf <i>Canis lupus</i>	-	-	-	-	+	-	-	-	-	-
Brown bear <i>Ursus arctos</i>	-	+	+	-	-	-	-	+	-	-
Cave lion <i>Panthera spelaea</i>	-	-	+	-	-	-	-	-	-	-
PROBOSCIDEANS										
Woolly mammoth <i>Mammuthus primigenius</i>	-	+	+	+	+	+	+	+	-	+
PERISSODACTYLS										
Lena horse <i>Equus lenensis</i>	+	+	+	-	+	+	+	+	+	-
Woolly rhino <i>Coelodonta antiquitatis</i>	+	+	+	-	+	+	+	+	+	+
ARTIODACTYLS										
Red deer <i>Cervus elaphus</i>	-	+	+	-	+	+	+	+	-	-
Moose, similar to American species, <i>Alces cf. americanus</i>	+	+	+	-	-	+	+	+	+	-
Reindeer <i>Rangifer tarandus</i>	-	+	+	-	+	+	+	+	-	-
Primeval bison <i>Bison priscus</i>	+	+	+	-	+	+	+	+	+	-
Bighorn sheep <i>Ovis nivicola</i>	-	+	+	-	-	+	-	+	+	+

(+) Presence of species in paleontological and archeological collections, (-) absence of species.

mammoth, woolly rhino, Lena horse, red deer and reindeer, moose, bison, and bighorn sheep) were noted. The predominant species likely included the mammoth, Lena horse, rhino, and bison (Table 1). This range does not reflect the full biodiversity of large mammals of mammoth fauna in Yakutia (up to sixteen species) [6]. The remains of widespread Yakutia species such as the polar fox *Alopex lagopus* L., fox *Vulpes vulpes* L., wolverine *Gulo gulo* L., Pleistocene musk ox *Ovibos pallantis* H. Smith, and Siberian saiga *Saiga tatarica borealis* Tschersky have not yet been found here. The remains of predators are rare, and perhaps they will be found here in the future. Musk ox and saiga seemingly could have found a suitable habitat in the predominantly lowland area of the Central Yakutia Region, but the corresponding findings are rare here. The number of these species could have been significantly reduced by the Upper Paleolithic humans [6], whose dwelling sites were found along the Middle Lena River not long ago [7].

Based on fossil remains of the bighorn, this species inhabited both sides of the Lena River in the Late Neopleistocene during both the Karginsk Interstadial [8] and the Sartan Glacial (Table 2). Today, *O. nivicola* does not inhabit these areas, being a typical mountain species [9, 10]. Fossil findings of bighorn sheep in the riverine areas of the Central Yakutia plain and near-Lena plateau, where some highlands reach (and reached in the Pleistocene) only 200–300 meters above sea level, are indicative of the fact that this spe-

cies was able to inhabit the lowlands and even the plains in the Pleistocene [11].

In 2014, a fragment of the cave lion's skull *Panthera spelaea* Goldfuss (Fig. 2) was found near the Buotama River mouth, which is indicative of the fact that this predator inhabited the Middle Lena basin. The Karginsk age of this finding is likely to be substantiated (Table 2), because this very thermochrone was marked by wide occurrence of the cave lion in the Eastern Siberia Region [6].

The radiocarbon dating of the Lena horse remains in Chasovnya Creek (Table 2) is indicative of the fact that this species was not extinct in the Central Yakutia Region at the end of the Pleistocene and existed here in the early Holocene. Previously, it was thought that *E. lenensis* inhabited only the far north of Yakutia in the Holocene [12, 13].

In 2011, a fragment of a primeval bison's skull with a very large horn core (high curvature length of 655 mm, base circumference of 420 mm), one of the largest fragments found in Yakutia, was discovered on Ulakhan-Ary Island [12]. By the horn core size, this sample is more similar to the Middle Neopleistocene large bison *B. priscus crassicornis* Rich. than to the Late Neopleistocene bison *B. priscus occidentalis* Lucas. Alongside with that, according to the radiocarbon dating, the age of this finding can be estimated at the end of the Late Neopleistocene and the end of the Karginsk Interstadial. The obtained data point to the

Table 2. Radiocarbon dating of mammoth bone remains from the Lenskie Stolby area

Animal species	Location	Material	¹⁴ C absolute age, years ago, source—laboratory number
Cave lion <i>Panthera spelaea</i>	Buotama R., 3 km from mouth	Skull fragment	41540 ± 355 (GrA-62445)
Woolly mammoth <i>Mammuthus primigenius</i>	Kuranakh Cr.	Skull fragment	>40000 (SOAN-7837)
Woolly rhino <i>Coelodonta antiquitatis</i>	Labyia Cr.	Skull fragment	36200 ± 330 (SOAN-7838)
Lena horse <i>Equus lenensis</i>	Chasovnya Cr.	Lower jaw fragment	9790 ± 60 (GIN-14697)
Red deer <i>Cervus elaphus</i>	Kuranakh Cr.	Antler fragment	17400 ± 200 (GIN-11024)
	Kuranakh Cr.	Antler fragment	35810 ± 280 (GIN-14701)
	Kuranakh Cr.	Antler fragment	36470 ± 280 (OxA-18925) [15]
	Kuranakh Cr.	Antler fragment	>37600 (AA-34500)
	Ulakhan-Ary Isl.	Antler fragment	>37900 (AA-34499)
	Buotama R.	Antler fragment	29980 ± 160 (OxA-18920) [15]
	Diring–Yuryakh Cr.	Skull fragment	30010 ± 230 (OxA-20921) [15]
Bison <i>Bison priscus</i>	Kuranakh Cr.	Skull fragment	31560 ± 240 (GIN-14696)
Bighorn sheep <i>Ovis nivicola</i>	Kuranakh Cr.	Skull fragment	>45000 (GrA-38803)
	Edyai R., Sanga–Saiylyk	Skull fragment	>40000 (GIN-14409)
	Sinyaa R., mouth area	Skull fragment	20520 ± 95 (GrA-62466)

Dates were obtained at the following institutions: (GrA) University of Groningen, the Netherlands; (SOAN) Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, Novosibirsk; (GIN) Geological Institute, Russian Academy of Sciences, Moscow; (OxA) Oxford University, Great Britain; (AA) Arizona University, Tucson, United States.

necessity to revise the *B. priscus* intraspecific taxonomy in Yakutia.

According to A.I. Tomskaya, bone-bearing horizons in the Kuranakh and Kuokh Khaya areas were formed in the Karginisk period [4]. Many radiocarbon dates of animal bones from the Middle Lena River (Ulakhan-Ary Island; Buotama River mouth; and Diring–Yuryakh, Labyia, and Kuranakh creeks) can be considered to be Karginisk (30 000–41 500 years) or

presumably Karginisk (>37 600, 37 900, 40 000, and 45 000 years). Only two dates can be referred to the Sartan Glacial (17 500 and 20 500 years) (Table 2). Hence, the mass burials of Pleistocene mammal remains were formed near Lenskie Stolby during the Karginisk Interstadial (24 000–55 000 years ago). This period of warming in summer was characterized by the formation of thermokarst “traps,” swamps, and wetlands, where mammoths, woolly rhinos, and other large massive animals sank and died [12, 14].

The revised species composition of the mammoth fauna in the Middle Lena basin and new radiocarbon dates will be used for further biostratigraphic subdivision of the Upper Neopleistocene sediments in the region.

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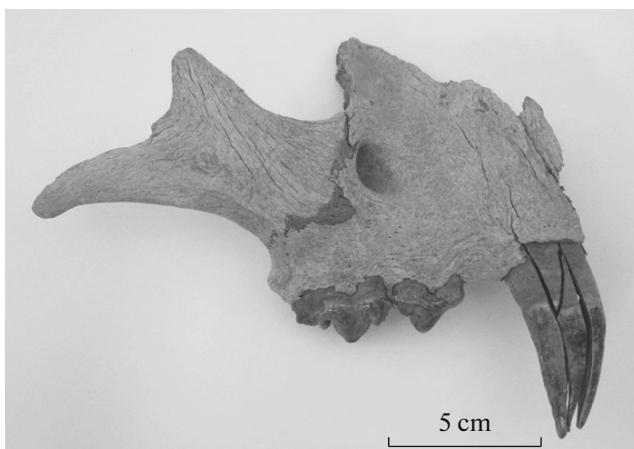


Fig. 2. A fragment of the cave lion's skull found near the Buotama River.

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