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Changes in the Eurasian distribution of the musk ox (*Ovibos moschatus*) and the extinct bison (*Bison priscus*) during the last 50 ka BP

A.K. Markova [a], A.Yu. Puzachenko [a], T. van Kolfschoten [b, *], P.A. Kosintsev [c], T.V. Kuznetsova [d], A.N. Tikhonov [e], O.P. Bachura [c], D.V. Ponomarev [f], J. van der Plicht [b, g], M. Kuitems [b]

[a] *Institute of Geography RAS, Moscow, Russia*
[b] *Faculty of Archaeology, Leiden University, The Netherlands*
[c] *Institute of Plant and Animal Ecology UB RAS, Yekaterinburg, Russia*
[d] *Moscow State University, Russia*
[e] *Zoological Institute RAS, St.-Petersburg, Russia*
[f] *Institute of Geology of Komi SC UB RAS, Syktyvkar, Russia*
[g] *Center for Isotope Research, Groningen University, The Netherlands*

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ABSTRACT

A recent update of the PALEOFAUNA database (including new ^{14}C dates) revealed new insights in the changes in the geographical distribution and the (local) extinction of larger mammals in Northern Eurasia during the second part of the Late Pleistocene and the Holocene, a period with dramatic changes in climate. In this paper, we present and discuss the observed changes in the distribution of two herbivore species: the musk ox *Ovibos moschatus* and the extinct bison *Bison priscus*, which are the major components of the "mammoth steppe" mammalian assemblage. The decrease of their ranges and their extinction during the Holocene (as a part of the Megafauna extinction in Eurasia) was primarily connected with changes in climate and partly the result of Anthropogenic pressure.

1. Introduction

To understand the impact of climate change on biota, in particular on large herbivores such as the musk ox and the bison, we have investigated the Late Pleistocene and Holocene Eurasian fossil record of both species. The information about the Eurasian large mammal fossil record is stored in the PALEOFAUNA database. The database has recently been updated and many new data have been added. Earlier reconstructions of the Holocene mammal assemblages from Eastern Europe and Siberia (Markova et al., 2001) should therefore be regarded as outdated.

In this paper, we present the data of two very characteristic species of the "Mammoth Steppe" fauna, which both belong to the family of the Bovidae: the musk ox *Ovibos moschatus* and the extinct bison *Bison priscus*. Only dated fossil remains are taken into account. In many cases, the musk ox or the bison bones have been ^{14}C dated. In other assemblages associated bones from other species or sediment have been dated (e.g. ^{14}C on bones; ESR, OSL or TL on sediments/material). The musk ox remains analyzed in the frame of this study were derived from 133 different localities and the information about the age of the remains is based on 385 ^{14}C dates (including 188 dated musk ox bones), 4 OSL dates, 3 TL dates, 1 ESR date and the age of 11 records is based on the archaeological context.

The main quality parameters for bone dates are the Carbon and Nitrogen content of the collagen, as well as the C/N ratio. These were all in acceptable range, i.e. the bones are not degraded. Such bones yield acceptable ^{14}C dates, no extra purification steps (like filtration) are necessary as shown by intercomparisons (Hüls et al., 2009; van der Plicht and Palstra, in press).

The PALAEOFAUNA database also includes a large number of Late Pleistocene and Holocene *B. priscus* records from 520 localities. The age of the remains is based on 1773 ^{14}C dates (178 dated bison remains), 7 OSL dates, 65 TL dates, 91 ESR dates and 55 dates are based on the archaeological context.

* Corresponding author.
E-mail address: t.van.kolfschoten@arch.leidenuniv.nl (T. van Kolfschoten).

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The results of our investigation confirm earlier statements that the observed changes did not take place synchronously in the different parts of Eurasia (Markov, 1960; Markov et al., 1965) due to geographical differences in climatic events that influenced natural components such as the structure of mammalian assemblages and the distribution of species.

Our conclusions about the dynamic changes in the distribution of the Eurasian musk ox and the bison are comparable to earlier conclusions based on modeling of the range and effective size of the musk ox and bison populations for four temporal intervals (Lorenzen et al., 2011). In this paper we present more detailed information about the geographical distribution of the musk ox and the bison during the period from about 46 ka BP until the late Holocene (Fig. 1), subdivided in fourteen different time intervals.

2. The main geochronological intervals of the second part of the Late Pleistocene (MIS 3 and MIS 2) and the Holocene (MIS 1)

The examined time period consists of two major intervals with distinct climatic conditions: a) the second part of the Last Glaciation (referred to as Valdai, Vistulian, Weischelian, Zyrianian/Sartanian Glaciation) correlated with the Marine Isotopic Stages (MIS) 3 and 2, and b) the Holocene Interglacial (MIS 1). The "mega-interstadial" of the Last Glaciation (MIS 3) with an age of 60–24 ka BP is characterized by a relatively warm climate but also by the occurrence of a large number of climatic fluctuations (stadials and interstadials) which differ in intensity (Zagwijn, 1974; van Huissteden, 1990; Vandenberge, 2002; Rasmussen et al., 2006; Svensson et al., 2008; Velichko and Faustova, 2009). The faunas

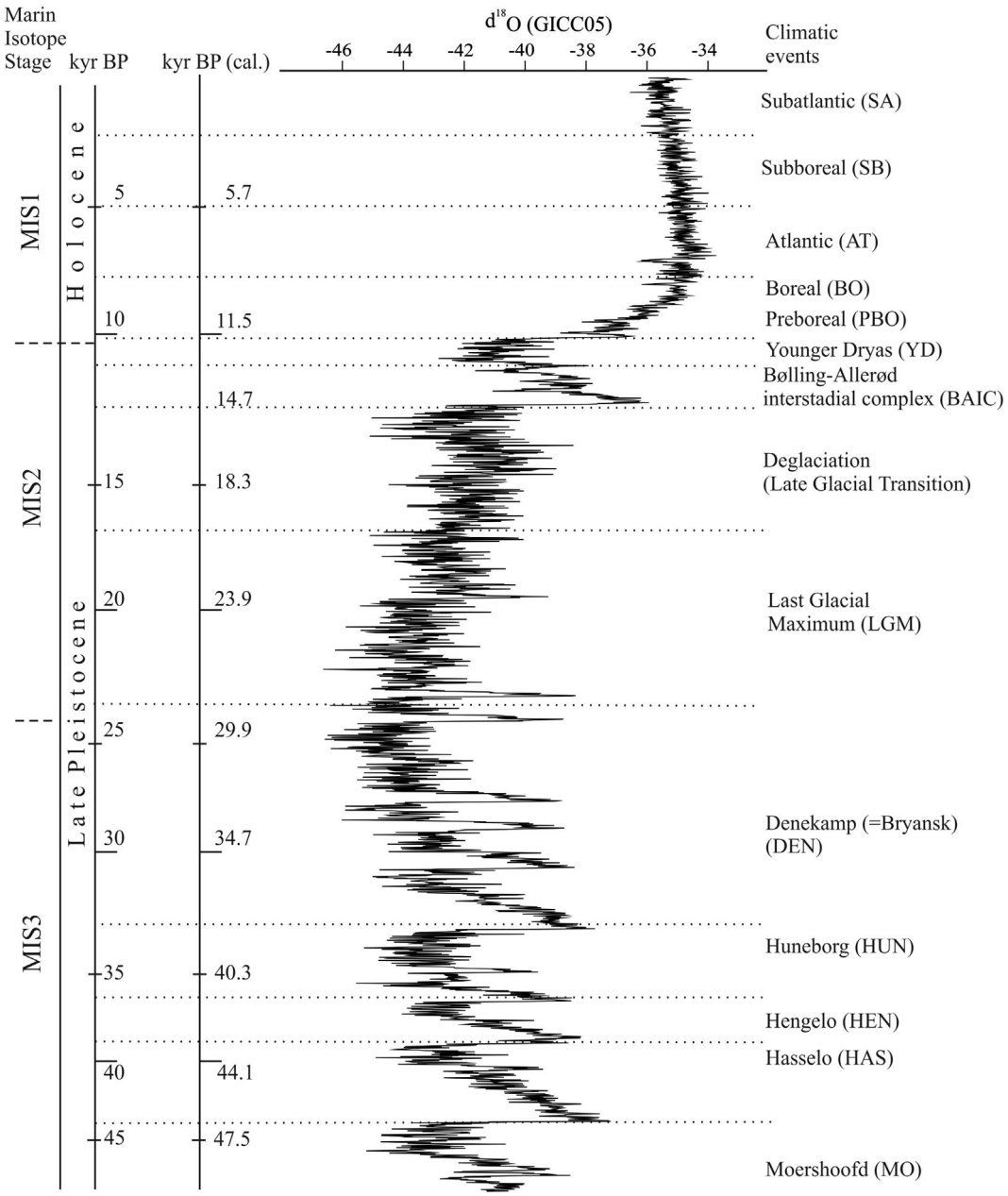

Fig. 1. Chronology of European climatic stages of the Late Pleistocene and Holocene.

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