

Mammoths and the Environment

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Book Reviews

MAMMOTHS AND THE ENVIRONMENT. By Valentina V. Ukraintseva. Cambridge, U.K.: Cambridge University Press, 2013. xi + 345 pp. \$140.00 (hardcover). ISBN 978-0521196994.

This volume represents a detailed report of Valentina Ukraintseva's prodigious research concerning the paleoecology of northern Siberia. Her research is based on the rigorous study of pollen, spores, and plant macrofossils from the gut contents of frozen carcasses of the "mammoth faunal complex" found in the permafrost of northern Siberia. She also studied plant fossils from the surrounding sediments to strengthen her interpretation of the paleoecology at the time the animals died.

The volume contains three parts and 17 chapters. Part 1 consists of the Introduction, a methods chapter, and a synopsis of the mammoth faunal complex. Part 2 consists of ten chapters, each dealing with an individual frozen specimen including seven mammoths, one horse, and one bison. The last chapter deals with the famous mammoth bone bed at Berelekh that does not contain frozen flesh. Part 3 consists of four chapters that synthesize the data presented in Part 2 and provide a compelling framework for the climate changes that have occurred in northern Siberia during the last 50,000 years. She also tackles the difficult problem of what caused the extinction of many faunal species at the end of the Pleistocene.

The book is well organized and illustrated and is the usual high-quality product published by Cambridge University Press. There is one minor formatting error in Chapter 8 where the page heading on the odd numbered pages is "Conclusion" throughout the chapter. A list of tables and figures is not included, and these would have been useful to the reader.

There is a very interesting historical account in Chapter 4 concerning Otto Herz's five month grueling expedition from St. Petersburg across Siberia to excavate the Berezovka Mammoth in 1901. It is truly amazing that the scientific expedition was successful considering the primitive conditions encountered.

Following is a summary of some of Ukraintseva's major conclusions concerning climate and biotic changes and the extinction of many species of the mammoth faunal complex. She concludes that paleoecological conditions during the glacial periods produced more open treeless landscapes that were beneficial to the mammoth faunal complex that was adapted to the cold, dry glacial environment of northern Siberia. The two periods when the best ecological conditions for the mammoth faunal complex occurred were during the Zyryanka glaciation (100,000–55,000 years ago) (equivalent to Oxygen Isotope Stage 4 and the early part of Oxygen Isotope Stage 3) and the Sartan glaciation (25,000–12,000 years ago) (equivalent to Oxygen Isotope Stage 2). Warmer interglacials like the Karginskiy (40,000–25,000 years ago) (later part of Oxygen Isotope Stage 3) and the Holocene produced a northward expansion of forests, less open treeless landscapes, more lakes and bogs, and less permafrost, all conditions that were not beneficial to the mammoth faunal complex. The author postulates that ranges of mammoth and other species contracted during these periods with breeding populations becoming more isolated and more prone to extinction. Ukraintseva suggests many of these species were near extinction at the end of the Karginskiy Interglacial that ended

25,000 years ago. Future DNA analysis may be able to test this hypothesis.

Conditions for the preservation of frozen carcasses of the mammoth faunal complex were better during the warmer intervals, which produced more lakes and melting permafrost situations that could trap the animals. In fact, five of the nine frozen animals are dated to the generally warm Karginskiy Interglacial from 40,000 to 25,000 years ago. Only one mammoth was dated to the Sartan (Last Glacial Maximum), and the author thinks preservation of carcasses was much less likely during this period. Two mammoths died near the Pleistocene/Holocene boundary (11,400–10,000 radiocarbon years ago) when mammoths were becoming extinct. The massive Berelekh mammoth bonebed was formed during this later period when the climate was warming rapidly, causing major biotic reorganization.

The author bases her interpretation of the cause of megafaunal extinctions at the end of the Pleistocene on quantitative paleoecological data. She correctly points out that many theories of the megafaunal extinction event have been based on qualitative ideas that are difficult to prove or disprove. Ukraintseva's research indicates that the cause of the megafaunal extinction was the loss of habitat brought about by the warming climate at the end of the Pleistocene, which changed biotic communities and decreased the open treeless grasslands that animals of the mammoth faunal complex required to survive. The author hypothesizes that the mammoth faunal complex died out because they had a specialized adaptation to the cold dry glacial climate and could not adapt to the rapidly changing climatic and biotic conditions. Bison survived the rapid climate change because they had a less specialized adaptation. She does not think that overhunting by humans was the primary factor in extinctions, but that humans did play a minor role in the extinction event.

A volume of this magnitude usually has some inconsistencies and other problems and this volume is no exception. There is a need for a good map of Siberia for the non-Russian readers showing the physiographic regions discussed in the text. Figure 1.1 shows the general location of the individual finds of frozen carcasses, but the map is very small. Some chapters concerning individual finds of frozen carcasses have higher resolution maps but some of these are not useful to the reader who is not familiar with the detailed geography of northern Siberia. I found myself going to the internet for a detailed map of Siberia to better understand the various discovery locations and the general physiographic provinces.

This volume apparently was written some years ago based on the fact that in the References section with hundreds of listings there are only 12 references dated between 2000 and 2010, and of these 12, Ukraintseva is the lead author or co-author on eight. Many of the references used to support the author's interpretations are from the 1970s and 1980s and one is left to wonder if there is more recent literature that is not cited.

On page 197, Ukraintseva suggests that the Berelekh Paleolithic site is the most northerly human site in northeast Asia. However, the famous Upper Paleolithic Yana RHS site (Pitulko et al., 2004) is a 27,000-year-old site at 71°N latitude, the same latitude as Berelekh. Yana is a far more important and older occupation site, indicating that humans were in far northern Siberia hunting megafauna during the generally warm Karginskiy Interglacial.

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The extensive photographs of pollen and spores on pages 224-243 would seem to be more appropriate for publication in a specialized palynology journal. Extensive lists of plant species in text, tables, and graphs are useful to paleobotanists, but difficult for scientists from other disciplines to comprehend.

There appear to be some inconsistencies in the interpretation of the data. For example, on page 291, Ukraintseva, citing Gorodkov (1944), suggests that northern Eurasia and the continental shelf above sea level were arctic deserts during the Sartan glacial (Last Glacial Maximum). However, on page 299, she indicates that the continental shelf contained highly productive, herbaceous communities. One additional inconsistency should be mentioned because it is a critical part of her interpretation of the faunal communities during the Last Glacial Maximum. On page 294, she states that during the Sartan glacial there was an expansion of open treeless landscapes in northern Siberia that led to an expansion of ranges for large herbivores with continuous interbreeding populations across Eurasia and North America. But later, on page 310 she contradicts this by stating that during glacial periods large but isolated intrabreeding populations of herbivorous animals developed in Eurasia and North America. Based on her own interpretations, isolated intrabreeding populations would be more subject to extinction than large interbreeding populations over vast areas.

These few problems do not detract significantly from the overall quality of research presented in this volume. This book should be studied by every paleobotanist, paleoecologist, paleontologist, and archaeologist interested in arctic environments, climate change, extinctions, and early human adaptations to far northern latitudes. Ukraintseva's volume brings much of the paleoecological information available only in the Russian language to the English-speaking scientific community and this fact alone makes this a very valuable contribution. This volume is a very useful compilation of information regarding past environments of northern Siberia and the relationship to the ecology of the mammoth faunal complex. Valentina Ukraintseva should be congratulated on a job well-done.

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