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RADIOCARBON-BASED CHRONOLOGY OF THE PALEOLITHIC IN SIBERIA AND ITS RELEVANCE TO THE PEOPLING OF THE NEW WORLD

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ABSTRACT. The territory of Siberia is of crucial importance for the study of early human dispersal and the peopling of the New World. A Siberian Paleolithic Radiocarbon Database has been compiled. The Database allows us to compile a chronolgical framework for human colonization of Northern Asia. There are 446 ^{14}C dates for 13 Middle and 111 Upper Paleolithic sites older than around 12,000 BP. Seventeen percent of the dates were obtained by the accelerator mass spectrometry (AMS) technique, and the remaining 83% are conventional. From the viewpoint of the spatial distribution of the ^{14}C-dated sites, the majority of these are located at the Yenisey River Basin, Transbaikal, and the Altai Mountains. The general outline of the Upper Paleolithic colonization of Siberia is given here. The earliest traces of modern human occupation are dated to around 43,000–39,000 BP in the southern part of Siberia. It seems that by around 13,000 BP, almost all of northern Asia, including the extreme northeastern Siberia had been colonized by modern humans. We discuss some controversial problems that have provoked heated debates in current Russian archaeology. Notable among these are the surprisingly early AMS dates for the Early Upper Paleolithic, the age of the Dyuktai culture of Yakutia, the problem of human presence in Siberia at the time of the Last Glacial Maximum (20,000–18,000 BP), and the timing of the initial settling of the Chukchi Peninsula and northeastern Siberia.

INTRODUCTION

The territory of Siberia (or northern Asia; Figure 1) has attracted the attention of students of prehistory for many years. This area is of crucial importance to questions regarding the first entry of people to the New World, human–land relationship in periglacial environments, and prehistoric culture contacts in the northern Pacific. In light of new data, we discuss here the peopling of Siberia and the timing of the initial human entry into the Americas. We also discuss the controversial subject of the age of the Dyuktai culture of Yakutia.

The establishment of a firm chronological framework for the Paleolithic in Siberia is of direct relevance to the complicated issue of the initial peopling of the New World. In this work, we use radiocarbon (^{14}C) dates obtained mostly on the Upper Paleolithic sites (and few Middle Paleolithic ones) in Siberia since 1960. Several summaries of Siberian prehistoric ^{14}C dates have been published in English (see, e.g., Henry 1984; Kuzmin 1994; Kuzmin and Tankersley 1996; Kuzmin and Orlova 1998). The recent Russian monograph on the ^{14}C chronology of the Paleolithic of Russia includes 423 dates from Siberia (Lisitsyn and Svezhentsev 1997). Because the New World in general, and Alaska in particular, was already colonized at minimum around 12,000 BP (cf., West 1996), we excluded Siberian Paleolithic and Initial Neolithic ^{14}C dates younger than around 12,000 BP compared with previously published summaries (Lisitsyn and Svezhentsev 1997; Kuzmin and Orlova 1998; Orlova et al. 2000b, Kuzmin 2000).

In this paper, we present the updated ^{14}C Database of the Siberian Paleolithic with values earlier than around 12,000 BP (Table 1). One should bear in mind that in a number of cases the assemblages included in our roster (the Elenev Cave, Layer 18 and underlying deposits; Novoselovo 6, Maynin-

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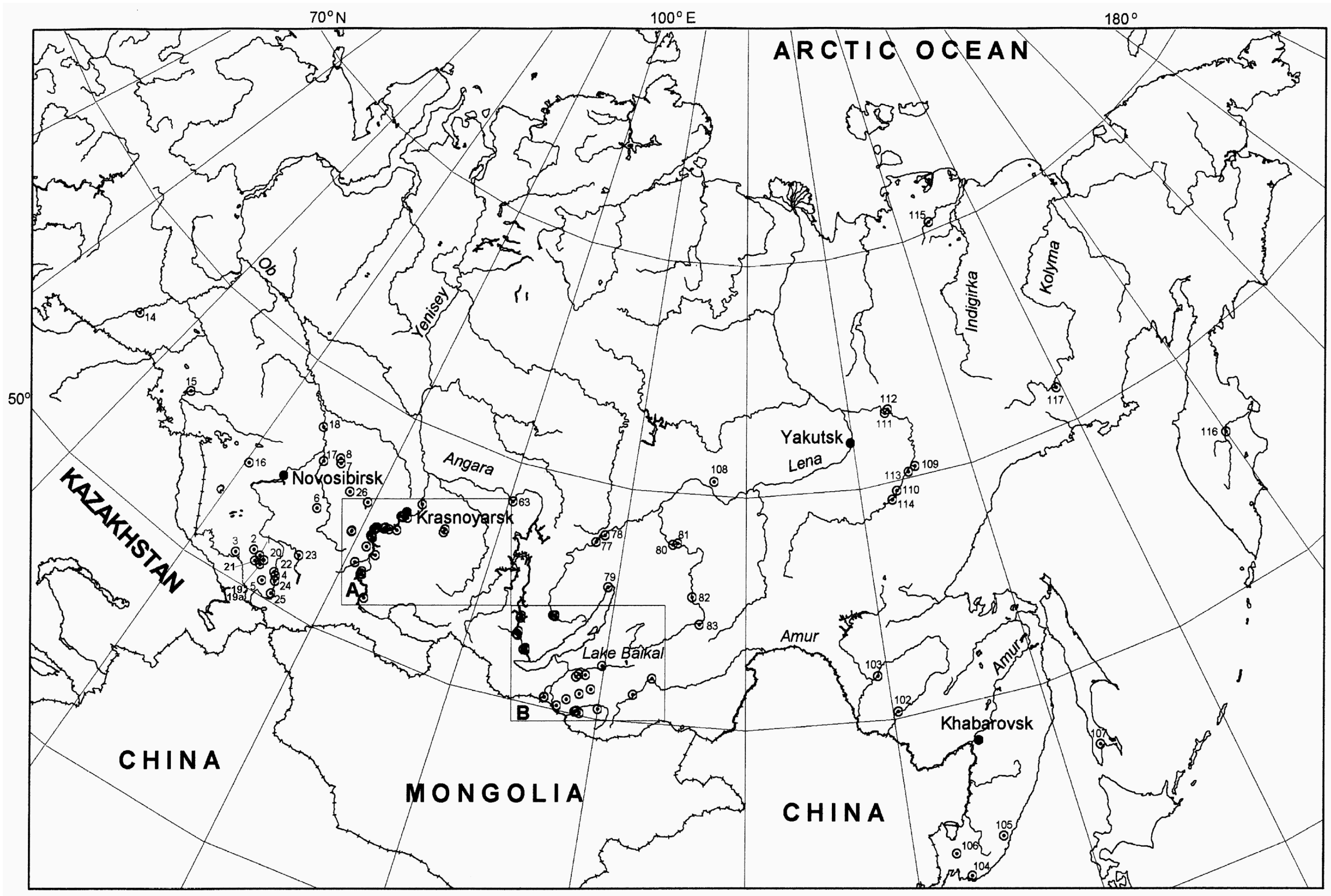

Figure 1 Radiocarbon-dated Paleolithic occurrences in Siberia

skaya, Layers A1-A3; Bolshoi Yakor 1, Layers 5 and 6; Ust'-Kyakhta 17; Studenoe 1; Malye Kuruktachi; Berelekh; Ushki; Siberdik, Layer 3), also produced dates younger than 12,000 BP, some of which are not included to the Table 1 (see appendix). Data presented are as of May 2001. In the columns "Latitude" and "Longitude", the geographic coordinates are given as decimal values (i.e., 70.50 means 70°30′) for using the Geographic Information System software, such as ARC/VIEW and ARC/INFO.

^{14}C DATABASE OF THE SIBERIAN PALEOLITHIC

Discussion of Siberian Paleolithic chronology in this paper is based on the ^{14}C dates directly associated with the Paleolithic assemblages. Thus, we omitted dates from paleontological localities without clear evidence of human presence, and dates from geological cross-sections located near the Paleolithic sites. For example, for the site of Berelekh in northeastern Siberia only ^{14}C dates from the cultural layer of the habitation site are included in the list (Table 1). The same is true for dates from archaeological occurrences run on samples lacking direct association with artifacts, for instance Filimoshki (Kuzmin 1996:138). At the same time, some dates included in the list (Afontova 2, GIN-117; Kashtanka 1, GrN-24482 and GrN-24481; Kunaley, GIN-6124; Gorbatka 3, SOAN-1922; and Ust'-Mil 2, LE-955) were run on samples lying below the artifact-bearing strata, thus providing only lower temporal limit for the assemblages. Some dubious Pleistocene-age ^{14}C dates of the apparently Holocene (Neolithic and Bronze Age) cultural strata, mostly from the Transbaikal (cf., Konstantinov 1994), are excluded. The ^{14}C dates, mentioned in the literature without indication of laboratory numbers and/or standard deviation, are also omitted. Finally, there are a lot of disappointing inaccuracies in individual data presentation in literature. Thus, we use the ^{14}C dates as these appeared in first publications.

As a result of careful dates selection, we roster 13 Middle and 111 Upper Paleolithic localities, which produced 446 dates (Table 1). Slightly more than 17% of the dates were obtained using accelerator mass spectrometry (AMS) technique; others are conventional. Largest ^{14}C datasets are known from the Shestakovo (21 values); Malta (19); Mayninskaya and Bolshoi Yakor 1 (15 for each one); Ust'-Karakol 1, and Ikhine 2, and Afontova Gora 2 (13 for each one); Geographical Society Cave (11); Kara-Bom and Kamenka 1 (10 for each one) sites. From the geographical viewpoint, the distribution of sites is no less uneven (Figure 1). The majority of the ^{14}C-dated sites locate in the Yenisey River drainage area and adjacent regions (33%) (Figure 2), Altai Mountains and the Kuznetsky Basin (19%), Transbaikal (14%), and areas around the Lake Baikal (9%) (Figure 3). At the same time, some areas extremely rich in prehistoric remains, such as the Angara and Upper Lena River valleys, yielded insufficient data compared to the number of sites (only 11% of total dates). Vast territories of the southern part of Northeastern Siberia (6%), the Russian Far East (less than 6%) and the West Siberian Plain (3%) produced only a few dates.

^{14}C DATING OF BONE COLLAGEN FROM SIBERIAN PALEOLITHIC SITES

The reliability of ^{14}C dates, made on animal and human bones, has been a complicated problem for decades (cf., Taylor 1997:87–91). There is a clear skepticism from some sources about the accuracy of bone ^{14}C dates made in Russian laboratories (cf., Goebel 1993:139–40). However, we are quite confident that the technique of collagen extraction developed in Russia (Arlsanov 1987:137–43; Sulerzhitsky 1997) is very reliable. The general idea is that slow dissolution of the mineral part of whole pieces of bones in diluted hydrochloric acid allows one to extract non-contaminated collagen, and to see the degree of preservation of initial fiber-like internal collagen structure after demineralization. This is different from widely accepted Longin's (1971) technique of collagen extraction,

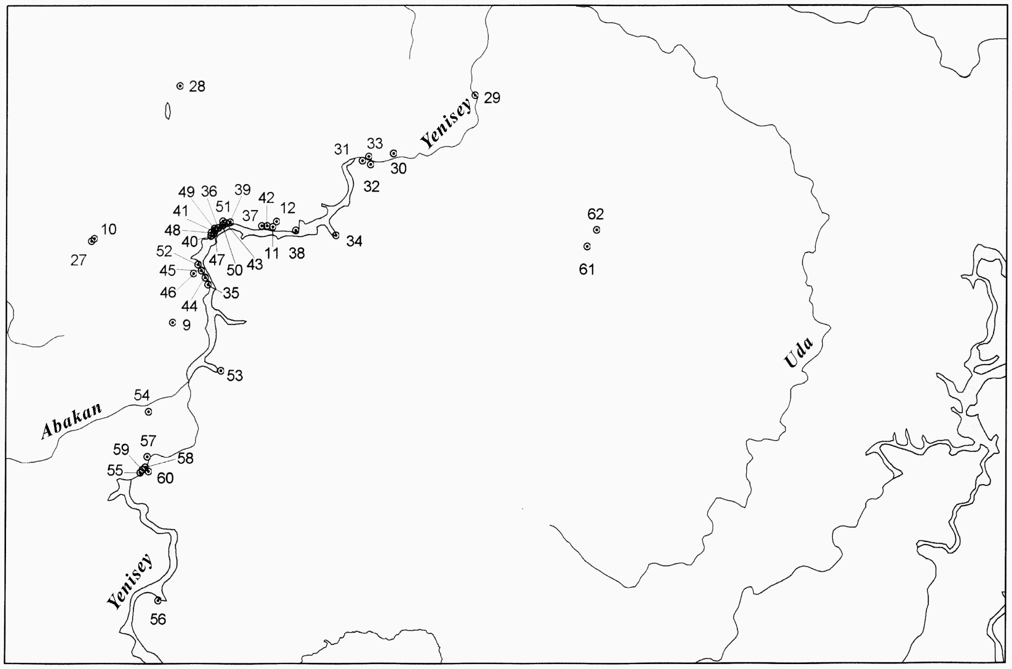

Figure 2 Radiocarbon-dated Paleolithic occurrences near the Yenisey River

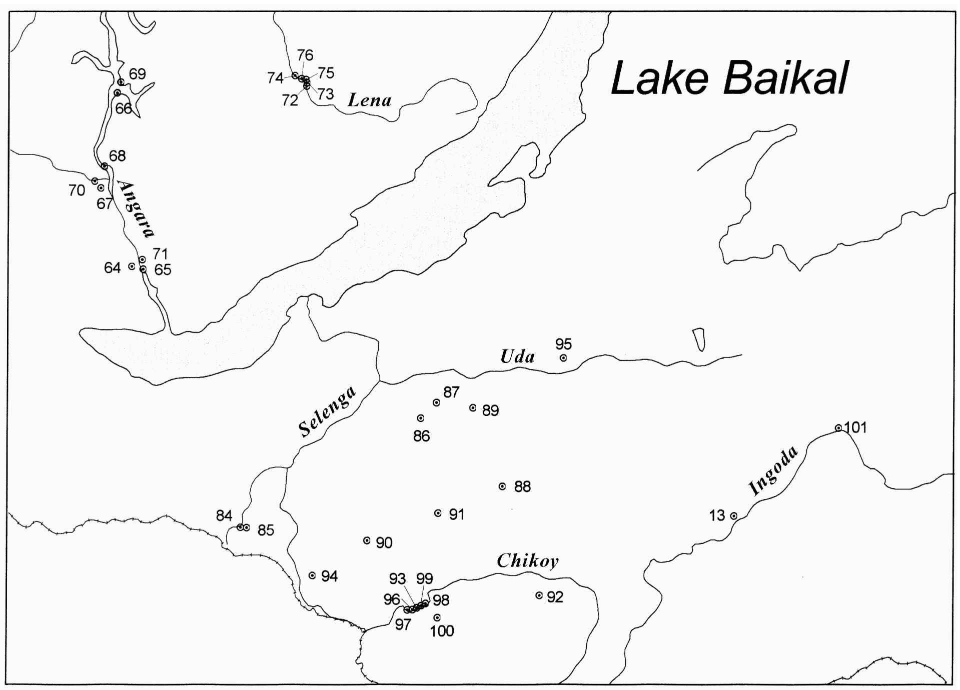

Figure 3 Radiocarbon-dated Paleolithic occurrences near Lake Baikal

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where bone material is powdered before demineralization. The reliability of the slow dissolution technique for collagen extraction is supported by parallel dating of the same pieces of bone in Moscow (Geological Institute, Russian Academy of Sciences), and in the NSF-Arizona AMS Facility at the University of Arizona (Tucson, Arizona, USA) (Vasil'chuk et al. 2000) and Beta Analytic, Inc. (Miami, Florida, USA) (MacPhee et al. 2002).

The following technique of collagen extracted has been used at the Novosibirsk ^{14}C laboratory (lab code SOAN) since 1985. The pieces of bones 10–20 cm long, once cleaned of any surface compounds, are demineralized by 5% HCl solution (the proportion is 7–8 L of solution for 1 kg of bones) under a temperature of 2–3 °C, usually in a refrigerator. As the surface layer becames soft, once every few days it was scraped with a knife, and the demineralization continued until the mineral part of bone was completely dissolved; sometimes this may take 1–2 weeks. Finally, the extracted gelatin-like collagen is thoroughly washed by distilled water. To remove the humic acids, the collagen is treated by a 0.1 N solution of NaOH for several hours. The remaining collagen is again washed by distilled water, dried, and carbonized by heating on 800 °C in oxygen-free environment. To remove the phosphorous compounds, carbonized collagen is treated with a mixture of HNO_3 and HCl ("aqua regia"). Finally, the cleaned collagen is washed by distilled water, dried, and used for benzene preparation.

In some laboratories (such as Geological Institute, Moscow, lab code GIN) centrifuging is used for separation of humic acids from collagen (acceleration of 2500–3000 g). As for any bacterial contamination remaining after collagen extraction, repeated washing by distilled water ensures the removal of all possible bacteria (L D Sulerzhitsky, personal communication 2000).

Thus, the extracted collagen and the ^{14}C dates run on it seem to be very reliable, and there have been no serious arguments so far against the accuracy of the extraction technique. The key issue is that if collagen is already degraded before sampling, there is no way to obtain reliable material for dating, even if separate amino acids are being used as a source of ^{14}C (cf., Stafford et al. 1991). As one can observe after bone demineralization by cold HCl, well-preserved collagen keeps the fiber-like structure but the degraded collagen usually has "amorphic" appearance.

Several examples of the reliability of such collagen extraction may be found in Sulerzhitsky (1997: 186–8). One of the best cases is dating of several woolly mammoth bones from Taymyr Peninsula (extreme northern Siberia), collected on the surface and partly covered with moss. After mechanical removal of moss and collagen extraction as described above, the Late Glacial ^{14}C ages (around 12,000 BP) were obtained. This clearly shows that well-preserved collagen is very resistant to any kind of contamination.

EVALUATION OF ^{14}C DATES IN SIBERIAN PALEOLITHIC GEOARCHAEOLOGY

The critical evaluation of a large series of ^{14}C dates has put forward the concept of "practicable accuracy" of ^{14}C dating of archaeological assemblages (Krenke and Sulerzhitsky 1992; see for details Kuzmin and Orlova 1998:24–5). The limit in accuracy of ^{14}C dating of the Paleolithic sites, being a part of the "practicable accuracy" concept, has been empirically estimated as 3000–4000 ^{14}C years (Krenke and Sulerzhitsky 1992). However, some archaeologists and geoarchaeologists are still disappointed by relatively large difference in ^{14}C date series from the same (and supposedly uniform) cultural layer. Recent examples for Siberia may be found in Goebel et al. (2000:572), and Goebel and Waters (2000).

We argue that the age difference of several hundreds or even thousands of ^{14}C years should be expected *a priori* in the series of ^{14}C dates from Paleolithic sites due to the complex taphonomic nature of organic material (charcoal, uncarbonized wood, bones, etc.) to be dated. This essentially means that a large (up to 3000–4000 ^{14}C years) difference in the date series from single cultural layer of a Paleolithic site should not confuse archaeologists, because it was observed on many well-dated sites with non-disturbed stratigraphy.

It seems that Paleolithic humans collected and brought to habitation sites wood (including fossil one), bones, antlers, tusks, and teeth of different (from the view of ^{14}C dating) ages. The dates found on mammoth bones and/or tusk should be considered with extreme caution, taking into account the possibility that the prehistoric inhabitants of a site collected these pieces from natural bone accumulations (deathsites or so-called "mammoth cemeteries"). The best controversial example is the date of around 43,000 BP obtained for the site of Druzhinikha at the Yenisey River basin of apparently Final Pleistocene age based on geological data. It should be added that some other dates included in our roster (Sabanikha, Shlenka, Pervomaiskoe 1, and Ulug-Bil') were also run on bones collected from the surface, thus these dates are controversial. In other cases, the faunal assemblages from the cave sites seem to be produced mostly by natural agencies, and the degree of human involvement is dubious (Proskuriakov Rockshelter and the Geographical Society Cave).

The site of Shestakovo in western Siberia (Zenin et al. 2000b, 2000d; Derevianko et al. 2000b) yielded evidence on scavenging of mammoth bones and teeth from the natural accumulation, and as a result ^{14}C mammoth dates show wide variation within one cultural layer, from 20,480 ± 180 BP to 22,340 ± 180 BP. Multiple human occupations of the site resulted in a wide range of ^{14}C ages of charcoal, from 20,800 ± 450 BP to 23,250 ± 110 BP. Another example of large variation in ^{14}C date series was obtained from the upper component of the Kostenki 1 site in central Russia, where 16 dates from the same dwelling unit vary from 20,800 ± 300 BP to 24,100 ± 500 BP (Praslov and Sulerzhitsky 1997).

Thus, we should expect that in the Paleolithic ^{14}C date series the range of dates might be quite wide, and it is almost impossible to judge which date is more reliable. This applies especially to sites where only woolly mammoth bones have been ^{14}C-dated. The general approach is that charcoal ^{14}C dates taken from hearth-like features could give us the age values most closely corresponding to the time of human occupation. However, such examples from Siberia are rare. Unfortunately, Paleolithic cultural layers could not be regarded as "snapshots" in terms of the age of organics recovered during the excavations and later ^{14}C-dated. Careful evaluation of ^{14}C data should be given when scientists are trying to find out the timing of human occupation of the Paleolithic sites.

CONTROVERSIES IN ^{14}C CHRONOLOGY OF THE UPPER PALEOLITHIC IN SIBERIA

It is far beyond our scope here to discuss the chronology of the Upper Paleolithic in Siberia in full detail (see e.g. Larichev et al. 1988, 1990, 1992; Vasil'ev 1993; West 1996; Derevianko 1997; Kuzmin and Orlova 1998; Kuzmin et al. 1998a, 1998b; Goebel and Slobodin 1999; Orlova et al. 2000b; Kuzmin 2000). Here we wish only to mention some controversial problems connected with the problem of ^{14}C chronology of the Dyuktai culture of Yakutia, which provokes hot debates in current Russian Paleolithic archaeology.

The timing of the Dyuktai culture has been discussed several times (e.g., Abramova 1979c; Yi and Clark 1985). This issue is important because the Dyuktai culture is considered to be directly related to the initial peopling of the New World (e.g. West 1996). Mochanov (1977) proposed the age of the earliest Dyuktai sites, Ust'-Mil 2, Ezhantsy, and Ikhine 2, to be as old as around 35,000 BP

(Table 1). Several scholars disagree with such an early age of typical microblade industry in remote northeast Siberian territory (Abramova 1979c; Kashin 1983; Yi and Clark 1985; Kuzmin and Orlova 1998). To re-evaluate the ^{14}C chronology of the earliest Dyuktai sites, we use both ^{14}C and palynological records from archaeological sites and geological Late Pleistocene sections in eastern and northeastern Siberia.

Through all the Late Pleistocene sections in northern part of Siberia, the distinct feature is the predominance of arboreal (tree) pollen in deposits dated to around 30,000–25,000 BP, and predominance of non-arboreal pollen (grasses) and spores in deposits dated to around 33,000–30,000 BP and around 22,000–18,000 BP (cf. Kind 1974). The most complete record of climatic fluctuations in the second part of Late Pleistocene in northern Siberia was obtained from the Molotkovsky Kamen section in the lower stream of the Kolyma River (latitude 68°00′N, longitude 163°00′E), based on palynological and ^{14}C data (Kaplina and Lozhkin 1982; Kaplina and Giterman 1983; Giterman 1985). In total, about 15 ^{14}C dates and about 70–80 pollen spectra were obtained for the Molotkovsky Kamen section. Two warm climatic episodes with a predominance of arboreal pollen (up to 40–60% of the total amount of pollen and spores) were ^{14}C-dated to around 43,000–34,500 BP and around 28,000–24,500 BP. Vegetation during those times was represented by birch-larch forests. Two cold episodes with an increase in non-arboreal pollen and spore content (up to 80% of the total amount) were ^{14}C-dated to around 34,000–28,000 BP and around 24,000–18,000 BP. Vegetation was presented by tundra, with small admixture of larch (sparse forest-tundra associations). The same features in the pollen spectra were recognized in the records from Chuiskoye and Vilyi cross-sections in Central Yakutia (Shofman et al. 1977; Alekseev et al. 1986).

Several early Dyuktai sites, such as Ust'-Mil 2, Ikhine 2, and Ezhantsy, also produced pollen records (Savvinova et al. 1996). At Ust'-Mil 2, in the lower (i.e. pre-cultural) part of the section at a depth of 4.00 m, ^{14}C-dated to 35,600 ± 900 BP (LE-965), the amount of arboreal pollen is about 11–39%. In the upper part of section with the Dyuktai culture artifacts at a depth of 1.75–2.50 m, ^{14}C-dated to around 23,500–30,000 BP, the amount of arboreal pollen decreases dramatically, and does not exceed 5–10% of total pollen and spores content. This fact could be interpreted as a reflection of the climatic deterioration. The next increase in arboreal pollen content on the Ust'-Mil 2 pollen diagram (up to 70% of total pollen and spores) is ^{14}C-dated to 12,200 ± 170 BP (LE-953).

Thus, in the Ust'-Mil 2 pollen records the time interval between around 33,000 BP and around 23,500 BP corresponds to a cold climatic event. However, in the Molotkovsky Kamen sequence this time is characterized by dominance of arboreal pollen, which reflects climatic amelioration. Only in the upper part of the Molotkovsky Kamen section, ^{14}C-dated between around 24,500 BP and around 10,000 BP, the dominance of non-arboreal pollen is noted. It should be stressed that similar features of very low arboreal pollen content are observed on the pollen diagrams of Ezhantsy, Ikhine 1, and Ikhine 2 (Savvinova et al. 1996). ^{14}C dates for those sites are more than around 16,600 BP (Ikhine 1), around 17,200 BP (Ezhantsy), and around 31,200 BP to 24,300 BP (Ikhine 2).

On the basis of pollen and ^{14}C records obtained from the Late Pleistocene sections in northern Siberia, along with critical re-examination of the Dyuktai culture records, we can assume that the portion of Ust'-Mil 2 section with low content of arboreal pollen corresponds to the final Karginsky Interglacial, ^{14}C-dated to around 30,000–24,000 BP (see details in Kuzmin and Orlova 1998: 35-39). The use of driftwood from older deposits by the earliest Dyuktai culture bearers could result in distortion of the ^{14}C age determinations of *human occupation* (sic!) (cf. Kuzmin and Orlova 1998).

In this case, bone material might be more reliable in the age estimation of the Dyuktai culture rather than driftwood, which can be re-deposited from older sediments of the Aldan River. The most suitable ^{14}C value from the Ikhine 2 site seems to be 26,030 ± 200 BP (IM-239) (Figure 4). However, the wood sample from the same depth yielded very close ^{14}C date, 26,500 ± 540 BP (IM-202). Nevertheless, the older ^{14}C values from the depth of 0.90–1.20 m between around 31,200 BP and around 27,400 BP could be considered as less reliable. The youngest wood ^{14}C date, 24,500 ± 480 BP (IM-203), might be more reliable.

MODERN HUMAN DISPERSAL IN NORTHERN ASIA: AN OUTLINE

The earliest known Upper Paleolithic occurrences in Siberia are dated to around 43,000–38,500 BP (Table 1). These are concentrated mostly at two areas in southern Siberia, at the Altai Mountains (Kara-Bom, Kara-Tenesh, Ust'-Karakol 1, etc.) and the Transbaikal (Tolbaga, Kamenka 1, etc.). At the same time, some occurrences at the Yenisey, Angara, and Upper Lena River basins witness the occupation of the whole southern Siberia. It seems to be premature to analyze the problem of the Upper Paleolithic genesis, associated with early *Homo sapiens sapiens* migration on the basis of the scanty data at hand. The earliest Upper Paleolithic traditions of Siberia share a lot of features in common with preceding Mousterian, thus demonstrating an apparent continuity between the Middle and Upper Paleolithic (Goebel et al. 1993). At the same time, these traditions evidenced the appearance of such typical Upper Paleolithic culture manifestations as mobile art objects, sophisticated bone technology, and personal ornaments. The southwestern way for early *Homo sapiens sapiens* migration seems to be plausible, and the Early Upper Paleolithic sites dated to the second part of the Karginsky Interglacial, around 40,000–25,000 BP, are identified at Altai Mountains, Angara River basin, and Transbaikal.

The data at hand indicate the sparse traces of humans during the final phase of the Karginsky Interglacial, around 30,000–25,000 BP. This scarcity of data could be explained by the large-scale erosion and cryoturbation of deposits during the advent of the Sartan Glaciation at around 25,000–22,000 BP. Meanwhile, we could argue about the permanent colonization of south Siberian mountainous areas, from the Altai to the Transbaikal, during the Early Upper Paleolithic.

The accidental discovery of the Upper Paleolithic artifacts in such a remote area as the northern part of the Chukchi Peninsula (Laukhin et al. 1989) led to speculation about human settlement in extreme northeastern Siberia during the warm phases of the Karginsky Interglacial. However, the age estimates and stratigraphic situation for the Kymyneikei site in the northern Chukchi Peninsula remains unclear (Goebel and Slobodin 1999:125; Orlova et al. 2000b:407–8). More data have been obtained for the Yakutia. Taking into consideration the age estimates for the Dyuktai culture, we can assume that modern people settled at this territory at least at around 18,000 BP (Verkhne-Troitskaya), and perhaps earlier, about around 25,000 BP (Ikhine 2).

The data referring to the Early Sartan Glaciation, around 25,000–22,000 BP, are more numerous. Unfortunately, all these data seem to be insufficient for a reconstruction of human dispersal in details. The idea of depopulation of Siberia under the harsh climatic conditions of the peak of Sartan Glaciation at around 19,000–16,000 BP was first put forward by Tseitlin (1979), and later by Goebel (1999). In spite of inevitable decrease of an area inhabited and population movements southwards, we could argue that even during the Late Glacial Maximum, around 20,000–18,000 BP, the occupation of southern Siberia and the Russian Far East was not interrupted. Stratigraphic columns of such sites as Shlenka, Ui 1, Krasny Yar 1, Varvarina Gora, etc. provide evidence. Also, at least 14 well-studied Upper Paleolithic sites in northern Asia have ^{14}C dates within time interval of around 20,000–18,000 BP (Table 1).

The Final Pleistocene provides evidence of dense population at all main drainage basins in southern Siberia. Beyond more familiar areas of the Altai Mountains—Yenisey, Angara, and Upper Lena River basins, and Transbaikal—the Late Sartan time span saw human dispersal in the southern portion of the West Siberian Plain, and along the Yenisey River valley downstream from modern Krasnoyarsk. Certainly, the most important event was human dispersal in northeastern Asia along the main rivers of Yakutia. Even such remote areas as the Indigirka River basin were inhabited in the Final Pleistocene (Berelekh site). This important movement resulted in peopling of Beringia at around 12,000 BP (see below), thus continuing the general trend of human movement in northern Eurasia from southwest to northeast.

BERINGIA AND THE PEOPLING OF AMERICA

In spite of numerous efforts to search for direct ancestors of Paleoindians in northeastern Asia carried out from radically different viewpoints (cf., Mochanov 1984; Dikov 1985; Yi and Clark 1985), there is a lot to be desired in the problem of timing and tracing of the first human entry to the New World. Before discussing the archaeological evidence on Pleistocene occupation of Beringia, let us look at paleoenvironmental data relevant to the Final Sartan, i.e. the time span that is thought to witness the peopling of the New World (Kozhevnikov and Zheleznov-Chukotskii 1995). It seems that the glaciation of Chukotka was restricted by mountainous areas and glaciers could not hamper faunal and human migrations. The Bering Land Bridge existed during the entire Final Pleistocene. From 13,000 to 12,000 BP the land bridge was a vast smooth plain, whereas from 11,000 BP its area began to decrease. First, the Anadyr Strait between Chukotka and St Lawrence Island was formed; later the Bering Strait appeared. It seems that around 10,500 BP the waters of the Pacific and Arctic Oceans joined (Elias et al. 1997). Meanwhile, even after the submerging of the land bridge, the Bering Strait could not be considered as an important barrier hampering human contacts, which were possible by boats as well as on ice during winters.

The territory of Alaska was not covered by ice. Cordilleran glaciation touched parts of the Aleutian and Alaska Ranges to the south (Glaciation Park McKinley) and the modern Aleutian Islands as well as a dry shelf. The glacial lobes were oriented mostly in a southern direction, but occasional mountain glaciers penetrated the upper parts of the Yukon tributaries valleys, including the Nenana River.

The favorable conditions for animal and human dispersal existed from 11,800 to 10,500 BP during the intermediary period between glacial advances McKinley III and IV (or Riley Creek III and IV, according to the old schemes). This time span was even labeled the "Critical Millennium" of the Pleistocene. It is followed by the Park McKinley IV Phase, correlated with Younger Dryas, but persisted as late as 9500 BP.

The northern part of the area demonstrates more restricted glaciation, mostly touched the central portion of the Brooks Range (Itkillik II Phase). The last glacial advance in this region is dated around 12,800 BP, later glaciers only retreated and the time span around 11,500 BP saw significant decrease of glaciated areas. Small glaciers existed in the mountains of the southern part of the Seward Peninsular, Kuskokwim Mountains, and Yukon-Tanana Highlands. Thus the central interior Alaska, the area with intense loess deposition at Final Pleistocene, rested open for animal and human migrations (Péwé 1975; Ten Brink 1984; Bigelow 1991).

Most scholars tend to argue that cold dry steppes with sagebrush—grasses and isolated willow stands—dominated the Bering Land Bridge, while woodland refuge (willow, birch) could survive along rivers. Numerous discoveries of Pleistocene fauna (horse, bison, reindeer, wild sheep, elk, etc.) indicate that Beringia provided a favorable place for large herds of ungulates, especially during the so-called "Birch Zone", which evidenced a climate amelioration from 14,000 to 10,000 BP. This time span seems to correspond to the presumed human entry to the New World. The dwarf birch area gradually widened from 14,300 to 13,500 BP, across the Alaskan territory. Starting in the western portion of the Peninsular, birch distributed along the Yukon from 12,500–12,000 BP. The mountains were woodland-free with patches of herbaceous tundra. From around 11,000 BP (the late phase of the "Birch Zone") the territory saw the gradual decrease of glaciated areas and expansion of forest—poplar along river valleys, and aspen on south-facing mountain slopes. Meanwhile, herbaceous tundra still dominated the landscape. A short-term cold spell corresponding to the Younger Dryas, between 10,500 and 10,200 BP, is marked by the appearance of grass tundra in the place of bush tundra in central Alaska (Elias 2001).

As seen above, pieces of archaeological evidence relevant to prehistoric human occupation of western Beringia (the extreme northeastern Asia) are far from numerous. It has been demonstrated that central Yakutia (the Lena and Aldan valleys) were inhabited from around 24,500 to 18,000 BP. What is known is the fact that the dispersal of the Dyuktai-type culture in the central (and probably also northern) portion of Yakutia, while Berelekh evidenced human movement northwards, to the Arctic Ocean coastline around 13,000–12,000 BP.

It is more difficult to argue about the settlement of Kolyma, Kamchatka, and Chukotka, due to scarcity. The sites attributed to the Dyuktai Complex, but located beyond the core area of the culture, at the Okhotsk Sea coastal zone or the Kolyma River basin (Maiorych and Kukhtui III) are dubious. The last site is even referred to as Neolithic. In other cases, the unambiguous dates are lacking and it is difficult to judge if the sites could be referred to the Final Pleistocene or Early Holocene as in the case of the lower component of Kheta. Some sites are claimed as Paleolithic (Druchak-Vetrenyi and Uptar) received the Early Holocene ^{14}C dates. The age of the unique presumable Pleistocene site at the Kamchatka Peninsular–Ushki, remains enigmatic. There are many disappointing inaccuracies in numerous writings by Dikov on the enumeration of cultural horizons, provenance of samples for ^{14}C determinations, etc. (for latest versions see Dikov 1996a, 1996b). It seems hardly possible to make a judgement about the so-called "Ushki culture/s" that share no element in common with Siberia, as well as with North American Pleistocene assemblages. One should bear in mind that several sites (Bolshoi Elgakhchan I and II at the Omolon River, surface scatters at the Chukotka Peninsular) were referred to the Paleolithic exclusively based on the morphological similarity of the lithics found to Ushki. The age and character of the occurrences with the so-called "Pebble-tool" industries at Kamchatka and Chukotka (Orlovka II, Lopatka IV, etc.) remain far from clear. Frankly speaking, in spite of long-term research activity in the area, we have no direct evidence of the Late Pleistocene human colonization of the vast areas adjacent to the submerged portions of the Bering Land Bridge, i.e. at the Chukotka Peninsular, in the Kolyma, Omolon, and Anadyr River valleys (see the recent review in Slobodin 1999). Even now we have no assemblages comparable to the Alaskan ones from the chronological viewpoint.

So far, we have one more site in extreme northeastern Siberia—Siberdik in the Kolyma River headwaters (Dikov 1977:213–21; 1979:90–100) (Figure 1, Nr 117). There are several age estimates for the lowermost cultural layer 3, range from around 13,200 BP to around 7900 BP (Kuzmin and Tankersley 1996:580; Kuzmin and Orlova 1998:17; Kuzmin 2000:123), and this fact is well known in spite of skepticism expressed by Goebel and Slobodin (1999:155). Unfortunately, no details about the degree of association between ^{14}C-dated charcoal and artifacts from layer 3 were given by Dikov (personal communication to Kuzmin, September 1994). But we cannot simply reject the earliest ^{14}C value of the layer 3 on Siberdik, 13,225 ± 230 BP (MAG-916) (Lozhkin and Trumpe 1990:178), as was done by Goebel and Slobodin (1999:114) without any discussion. Until there are new site excavations and dating, this age of the Siberdik still should be taken into account as the tentative evidence of human occupation of the Kolyma headwaters around 13,000 BP. Thus, we can conclude that at least at around 13,000 BP humans already settled the extreme northeastern Siberia, the "forepost" of the peopling of the New World, and the Berelekh, Siberdik, and Ushki might represent the earliest Paleolithic sites there.

Leaving aside faunal occurrences with more or less dubious evidence of human involvement (Old Crow, Trail Creek, and the Lime Hills 1 Caves) and sites with artifactual material but ambiguous stratigraphic resolution (unit B at the Bluefish Caves nos. 1 and 2), it could be said with confidence that the earliest human traces in Alaska are associated with the Nenana and Denali Complex sites, located in the Central Interior Alaska (West 1996). The oldest Nenana assemblages (Components 1 at Owl Ridge, Walker Road, and Dry Creek, Cultural Zones 4 and 3 at Broken Mammoth, Layer 1 at Moose Creek) are dated by ^{14}C from around 11,800–11,100 to 9000 BP. The age of the oldest Denali assemblages is generally slightly younger, around 10,700–9000 BP (Components 2 at Dry Creek and Moose Creek). Recent discoveries revealed more the complex character of the culture development in Beringia with early appearance of microblade industry as evidenced by the lowermost horizons at Swan Point, dated around 11,600 BP.

Assuming Nenana and Denali were separate culture traditions, the Alaskan sites could therefore be regarded as a reflection of two different migration waves from Asia. The oldest seems to be represented by the Nenana assemblages dated from around 12,000–11,000 BP. The second, presumably reflecting the spread of the Dyuktai populations in north-eastward direction, are represented by Denali and dated between 11,000 and 10,000 BP (West 1996).

Apart from these traditions, the northern Paleoindian is represented by the sites with projectile points located in northern and western portions of Alaska. The earliest dates are between around 11,700 and 9700 BP for Mesa, around 10,500 BP for Bedwell, 10,300 BP for Hilltop, and around 11,000 BP for Tuluaq (Bever 2000; Rasic and Gal 2000).

The revision of old data and a search for new data are needed. The achievements along these lines could be only possible through the development of cooperation between Russian and American scholars. There is little doubt that the frozen ground lands of northeastern Asia should contain the traces of the ancestors of the first Americans. The current surge in joint research allows us to see the future of our studies in favorable perspective.

CONCLUSION

More close collaborative efforts of archaeologists and scientists specializing in ^{14}C dating, Quaternary geology, and geomorphology are necessary for the solution of the problems mentioned above. There is a lot of discordance in publication of ^{14}C dates, especially in terms of laboratory numbers, cultural layer identifications and contexts, and the development of a standard general database is called for. Recently, the Siberian Paleolithic Radiocarbon Database has been compiled (see the website of the Institute of Geology, the Siberian Branch of the Russian Academy of Sciences [www.giscenter.ru]). This paper should be cited as a primary source of the ^{14}C dates for the Paleolithic of Siberia included in the Database.

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APPENDIX

Table 1 Results from the updated ^{14}C Database of the Siberian Paleolithic

Site nr	Lat. N	Long. E	Site name, sample position	Material	Lab code	^{14}C date BP	Reference
Mousterian assemblages							
1	51.40	84.67	Denisova Cave, Layer 21	Humic acids	SOAN-2499	39,390±1310	Derevianko et al. 1998
			Denisova Cave, Layer 21	Charcoal	GX-17599	35,140±670*	Kuzmin & Orlova 1998
			Denisova Cave, Layer 21	Humic acids	SOAN-2488	>34,700	Derevianko et al. 1998
			Denisova Cave, Entrance, Layer 9	Charcoal	GX-17602	46,000±2,300*	Kuzmin & Orlova 1998
2	51.67	84.33	Okladnikov Cave, Layer 3	Bone	RIDDL-722	43,300± 1,300/–1,500*	Derevianko et al. 1998
			Okladnikov Cave, Layer 3	Bone	RIDDL-720	40,700± 1,100*	Derevianko et al. 1998
			Okladnikov Cave, Layer 3	Bone	RIDDL-721	32,400±500*	Derevianko et al. 1998
			Okladnikov Cave, Layer 2	Bone	RIDDL-719	37,750±750*	Derevianko et al. 1998
			Okladnikov Cave, Layer 1	Bone	RIDDL-718	33,500±700*	Derevianko et al. 1998
			Okladnikov Cave, Layer 3	Bone	SOAN-2459	28,470±1,250	Derevianko et al. 1998
			Okladnikov Cave, Layer 3	Bone	SOAN-2458	>16,210	Derevianko et al. 1998
3	51.17	83.02	Strashnaya Cave, depth 4 to 3 m (Layer 3/3)	Bone	SOAN-785	>25,000	Orlova 1995
			Strashnaya Cave	Bone	SOAN-3219	31,510±2,615	Kuzmin & Orlova 1998
4	51.17	86.20	Biika 1, Layer 5	Bone	Bln-4981	37,000±1,000	Nokhrina et al. 2000
			Biika 1, Layer 5	Bone	Bln-4980	23,480±300	Nokhrina et al. 2000
5	50.72	85.57	Kara-Bom, Stratum M1	Bone	AA-8894	>44,000*	Derevianko et al. 1998
			Kara-Bom, Stratum M1	Bone	AA-8873	>42,000*	Derevianko et al. 1998
6	54.58	86.37	Mokhovo 2	Bone	SOAN-2861	30,330±445	Orlova 1995
7	56.82	86.23	Aryshevskoe 1, Stratum 2	Humic acids	SOAN-4178	>40,000	Zenin et al. 2000a
			Aryshevskoe 1, Stratum 2	Humic acids	SOAN-4179	>40,000	Zenin et al. 2000a
			Aryshevskoe 1, Stratum 6	Charcoal	SOAN-4180	33,630±995	Zenin et al. 2000a
8	56.87	86.17	Voronino-Yaya, above cultural layer	Bone	SOAN-3837	28,450±850	Zenin et al. 2000a
9	54.13	90.95	Dvuglazka Cave, Layer 7	Bone	LE-4811	27,200±800	Lisitsyn & Svezhentsev 1997
10	54.45	89.47	Proskuriakov Rockshel-ter	Bone	SOAN-1519	40,770±1,075	Ovodov et al. 1992
			Proskuriakov Rockshel-ter	Bone	SOAN-1517	40,690±1,150	Ovodov et al. 1992
			Proskuriakov Rockshel-ter	Bone	SOAN-1518	40,595±875	Ovodov et al. 1992
			Proskuriakov Rockshel-ter	Bone	SOAN-848	>40,000	Ovodov 1975
11	55.17	91.58	Kurtak 4, Stratum 17	Bone	LE-3638	32,280±280	Svezhentsev et al. 1992
			Kurtak 4, Stratum 17	Charcoal	LE-3352	31,650±520	Svezhentsev et al. 1992
12	55.22	91.65	Ust'-Izhul'	Bone	SOAN-3334	>45,000	Ovodov & Tomilova 1998
			Ust'-Izhul'	Charcoal	AECV-2034C	>42,190	Drozdov et al. 1999
			Ust'-Izhul'	Bone	AECV-1939C	>42,100	Drozdov et al. 1999
			Ust'-Izhul'	Charcoal	AECV-2032C	>41,810	Drozdov et al. 1999
			Ust'-Izhul'	Charcoal	AECV-2033C	>40,050	Drozdov et al. 1999
13	51.25	112.25	Arta 2, up from Layer 5	Charcoal	LE-2967	37,360±2,000	Kirillov & Kasparov 1990
Upper Paleolithic Assemblages							
Western Siberia and Altai Mountanis							
14	56.32	66.37	Shikaevka	Bone	SOAN-2211	18,050±95	This paper

*AMS dates are shown by asterisks; other dates are conventional

Table 1 Results from the updated ^{14}C Database of the Siberian Paleolithic

Site nr	Lat. N	Long. E	Site name, sample position	Material	Lab code	^{14}C date BP	Reference
15	55.50	73.43	Chernoozierye 2, Layers 3 to 2	Charcoal	GIN-122	14,500±50	Gening & Petrin 1985
16	54.65	80.25	Volchiya Griva	Bone	SOAN-111	14,450±110	Firsov et al. 1985
			Volchiya Griva	Bone	SOAN-78	14,200±520	Okladnikov et al. 1971
			Volchiya Griva	Bone	SOAN-111	13,600±230	Lisitsyn & Svezhentsev 1997
			Volchiya Griva	Bone	SOAN-111A	13,600±230	Orlova 1979
			Volchiya Griva	Bone	SOAN-4292	14,280±285	Orlova et al. 2000a
			Volchiya Griva	Bone	SOAN-4293	12,520±150	Orlova et al. 2000a
17	56.48	85.00	Tomsk	Charcoal	GIN-2100	18,300±1,000	Tseitlin 1983
18	57.73	83.55	Mogochino 1, cultural layer	Bone	SOAN-1513	20,150±240	Petrin 1986
			Denisova Cave, Layer 11	Bone	SOAN-2504	>37,235	Derevianko et al. 1998
19	51.38	84.68	Ust'-Karakol 1, Layer 10	Charcoal	SOAN-3259	35,100±2,850	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 9v	Charcoal	SOAN-3257	33,400±1,285	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 9v	Charcoal	SOAN-3358	29,860±355	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 9v	Charcoal	SOAN-3359	29,720±360	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 5	Charcoal	SOAN-3326	30,460±2,035	Kuzmin & Orlova 1998
			Ust'-Karakol 1, Layer 5	Charcoal	SOAN-3356	27,020±435	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 5	Charcoal	SOAN-3357	26,920±310	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 5	Charcoal	SOAN-3261	26,305±280	Derevianko et al. 1998
			Ust'-Karakol 1, Layer 4	Humic acids	SOAN-3356	26,920±310	Kuzmin & Orlova 1998
			Ust'-Karakol 1, Excavation 1, Layer 3	Charcoal	SOAN-2515	31,410±1,160	Derevianko et al. 1998
			Ust'-Karakol 1, Excavation 1, Layer 3	Charcoal	SOAN-2869	31,345±1,275	Derevianko et al. 1998
			Ust'-Karakol 1, Excavation 1, Layer 3	Charcoal	IGAN-837	29,900±2,070	Derevianko et al. 1998
			Ust'-Karakol 1, Excavation 1, Layer 2	Bone	SOAN-2614	28,700±850	Derevianko et al. 1998
19a	51.38	84.68	Ust'-Karakol 2, Layer 3	Bone	IGAN-1077	31,430±1,180	Derevianko et al. 1998
20	51.39	84.66	Anyi 2, Layer 12	Charcoal	IGAN-1425	27,930±1,590	Derevianko et al. 1998
			Anyi 2, Layer 12	Charcoal	SOAN-3005	26,810±290	Derevianko et al. 1998
			Anyi 2, Layer 9	Charcoal	SOAN-2868	27,125±580	Derevianko et al. 1998
			Anyi 2, Layer 8	Charcoal	SOAN-3006	24,205±420	Derevianko et al. 1998
			Anyi 2, Layer 8	Charcoal	SOAN-2862	22,610±140	Derevianko et al. 1998
			Anyi 2, Layer 8	Charcoal	SOAN-2863	20,350±290	Derevianko et al. 1998
			Anyi 2, Layer 6	Charcoal	IGAN-1430	23,431±1,550	Derevianko et al. 1998
			Anyi 2, Layer 4	Charcoal	IGAN-1431	21,502±580	Derevianko et al. 1998
			Anyi 2, Layer 3	Charcoal	SOAN-3007	21,280±440	Derevianko et al. 1998
21	51.28	84.47	Kaminnaya Cave, Layer 14b	Bone	SOAN-3923	15,350±240	Derevianko et al. 2000a
			Kaminnaya Cave, Layer 14a	Bone	SOAN-3922	14,550±230	Derevianko et al. 2000a
			Kaminnaya Cave, Layer 13	Bone	SOAN-3921	14,120±95	Derevianko et al. 2000a
			Kaminnaya Cave, Layer 12	Bone	SOAN-3920	13,870±390	Derevianko et al. 2000a
			Kaminnaya Cave, Layer 11g	Bone	SOAN-3919	13,550±140	Derevianko et al. 2000a
			Kaminnaya Cave, Layer 11v	Bone	SOAN-3918	12,160±225	Derevianko et al. 2000a
22	51.20	86.07	Tyitkesken' 3, Layer 6	Charcoal	SOAN-2989	12,850±205	Derevianko et al. 1998
23	52.45	86.92	Dmitrievka, Strata 4 to 3	Charcoal	SOAN-4233	14,750±250	Sulerzhitskiy et al. 1987
5			Kara-Bom, Layer 6	Charcoal	GX-17597	43,200±1,500*	Derevianko et al. 1998
			Kara-Bom, Layer 5	Charcoal	GX-17596	43,300±1,600*	Derevianko et al. 1998
			Kara-Bom, Layer 4	Charcoal	GX-17595	34,180±640*	Derevianko et al. 1998
			Kara-Bom, Layer 4	Charcoal	GX-17594	33,780±570*	Derevianko et al. 1998
			Kara-Bom, Layer 3	Charcoal	GX-17593	30,990±460*	Derevianko et al. 1998
			Kara-Bom, up from Layer 3	Charcoal	GX-17592	38,080±910*	Derevianko et al. 1998
			Kara-Bom	Charcoal	GIN-5935	33,800±600	Derevianko et al. 1998

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			Kara-Bom, Layers 4 to 3	Bone	GIN-5934	32,200±600	Derevianko et al. 1998
24	51.05	86.30	Kara-Tenesh	Charcoal	SOAN-2485	42,165±4,170	Derevianko et al. 1998
			Kara-Tenesh	Bone	SOAN-2135	34,760±1,240	Derevianko et al. 1998
			Kara-Tenesh	Bone	SOAN-2486	31,400±410	Derevianko et al. 1998
			Kara-Tenesh	Bone	SOAN-2134	26,875±625	Derevianko et al. 1998
			Kara-Tenesh	Charcoal	SOAN-3646	25,630±430	Derevianko et al. 1998
25	50.42	86.52	Malyi Yaloman Cave, Layer 3	Charcoal	SOAN-2500	33,350±1,145	Derevianko et al. 1998
26	55.90	87.95	Shestakovo, Layer 24	Bone	GrA-13238	25,660±200*	Zenin et al. 2000c
			Shestakovo, Layer 24	Bone	GrA-13239	24,590±110*	Zenin et al. 2000c
			Shestakovo, Layer 22	Bone	GrA-13235	23,330±110*	Zenin et al. 2000c
			Shestakovo, Layer 22	Bone	SOAN-4177	22,500±280	Zenin et al. 2000c
			Shestakovo, Layer 22	Bone	SOAN-3612	22,240±185	Zenin et al. 2000c
			Shestakovo, Layer 21	Bone	SOAN-3611	21,300±420	Zenin et al. 2000c
			Shestakovo, Layer 19	Bone	GrA-10935	24,360±150*	Zenin et al. 2000c
			Shestakovo, Layer 19	Charcoal	GrA-13233	23,250±110*	Zenin et al. 2000c
			Shestakovo, Layer 19	Charcoal	AA-35322	23,290±200*	Zenin et al. 2000c
			Shestakovo, Layer 19	Bone	GrA-13240	22,340±180/170*	Zenin et al. 2000c
			Shestakovo, Layer 19	Charcoal	SOAN-3606	20,800±450	Zenin et al. 2000c
			Shestakovo, Layer 19	Bone	SOAN-3218	20,770±560	Zenin et al. 2000c
			Shestakovo, Layer 19	Bone	SOAN-3607	20,480±180	Zenin et al. 2000c
			Shestakovo, Layer 19	Bone	SOAN-3608	20,360±210	Zenin et al. 2000c
			Shestakovo, Layer 17	Bone	GrA-13234	21,560±100*	Zenin et al. 2000c
			Shestakovo, Layer 17	Bone	SOAN-3609	19,190±310	Zenin et al. 2000c
			Shestakovo, Layer 17	Bone	SOAN-3610	18,040±175	Zenin et al. 2000c
			Shestakovo	Bone	SOAN-1386	22,990±170	Lisitsyn & Svezhentsev 1997
			Shestakovo	Bone	SOAN-1380	22,980±125	Lisitsyn 2000
			Shestakovo	Bone	LU-104	22,410±200	Lisitsyn & Svezhentsev 1997
			Shestakovo	Charcoal	SOAN-1684	20,490±150	Derevianko & Zenin 1995a
The Yenisey River basin and adjacent areas							
27	54.42	89.45	Malaya Syia	Bone	SOAN-1286	34,500±500	Muratov et al. 1982
			Malaya Syia	Bone	SOAN-1287	34,420±360	Muratov et al. 1982
			Malaya Syia	Bone	AA-8876	29,450±420*	Kuzmin & Orlova 1998
			Malaya Syia	Bone	LE-4918	25,250±1,200	Lisitsyn 2000
			Malaya Syia	Charcoal	SOAN-1124	20,300±350	Derevianko et al. 1992
28	55.85	89.57	Berezovyi Ruchei I	Bone	LE-4895	15,310±560	Lisitsyn 2000
29	56.80	93.52	Druzhinikha, a surface finding	Bone	LE-4894	43,580±8,800	Lisitsyn 2000
30	56.00	92.85	Afontova Gora 2, lower humified lenses	Charcoal	GIN-117	20,900±300	Tseitlin 1979
			Afontova Gora 2, below Layer 5	Charcoal	GrA-5554	14,180±60*	Drozdov & Artem'ev 1997
			Afontova Gora 2, below Layer 5	Charcoal	GrA-5555	12,400±60*	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 5	Bone	SOAN-3251	15,130±795	Kuzmin & Orlova 1998
			Afontova Gora 2, Layer 4	Charcoal	SOAN-3075	14,070±110	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 4	Charcoal	GIN-7541	13,930±80	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 4	Charcoal	GIN-7540	13,650±70	Drozdov & Artem'ev 1997
			Afontova Gora 2, up from Layer 4	Charcoal	GrN-22275	13,390±260*	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 3b	Charcoal	SOAN-3077	14,330±95	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 3b	Charcoal	GrN-22274	13,990±110*	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 3	Charcoal	GIN-7539	13,350±60	Drozdov & Artem'ev 1997

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			Afontova Gora 2, Layer 2	Charcoal	GrA-5556	14,200±60*	Drozdov & Artem'ev 1997
			Afontova Gora 2, Layer 2	Charcoal	GIN-7542	13,330±140	Drozdov & Artem'ev 1997
31	55.95	92.40	Listvenka, Layer 19	Charcoal	SOAN-3734	16,640±350	Akimova et al. 2000a
			Listvenka, Layer 19	Bone	GIN-6093	16,300±600	Drozdov 1992
			Listvenka, Layer 12	Charcoal	Beta-58391	19,000±60*	Akimova 1998
			Listvenka, Layer 12	Charcoal	GIN-6965	13,100±410	Drozdov 1992
			Listvenka, Layer 9	Charcoal	GIN-6967	14,170±80	Drozdov 1992
			Listvenka, Layer 8	Charcoal	IGAN-1078	12,750±140	Drozdov 1992
			Listvenka, Layer 7	Charcoal	GIN-6092	14,750±250	Drozdov 1992
			Listvenka, Layer 6	Charcoal	SOAN-3463	13,850±485	Kuzmin & Orlova 1998
			Listvenka, Layer 6	Charcoal	IGAN-1079	13,580±350	Drozdov 1992
32	55.95	92.53	Bolshaya Slizneva, Layer 8	Charcoal	SOAN-3315	13,540±500	Kuzmin & Orlova 1998
			Bolshaya Slizneva, Layer 7	Bone	SOAN-3009	12,930±60	Kuzmin & Orlova 1998
33a	55.87	92.20	Biruisa 1, Layer 4	Bone	LE-4962	14,700±270	Kuz'mina & Sinitsyna 1995
			Biruisa 1, Layer 4	Bone	LE-4910	14,680±400	Kuz'mina & Sinitsyna 1995
			Biruisa 1, Layer 4	Bone	GIN-8077	14,200±70	Lisitsyn & Svezhentsev 1997
			Biruisa 1, Layer 4	Bone	GIN-8075	13,840±90	Lisitsyn & Svezhentsev 1997
			Biruisa 1, Layer 3a	Bone	LE-3777	14,480±400	Kuz'mina & Sinitsyna 1995
33b	55.97	92.48	Eleneva Cave, Section no. 1	Bone	SOAN-3333	13,665±90	Kuzmin & Orlova 1998
			Eleneva Cave, Section no. 2	Charcoal	SOAN-3307	12,050±325	Kuzmin & Orlova 1998
			Eleneva Cave, Section no. 2	Charcoal	SOAN-3308	12,040±160	Kuzmin & Orlova 1998
			Eleneva Cave, Section no. 2	Charcoal	SOAN-3309	12,085±105	Kuzmin & Orlova 1998
			Eleneva Cave, Layer 18	Bone	SOAN-3252	12,040±150	Orlova et al. 2000b
9			Dvuglazka Rockshelter, Layer 4	Bone	LE-4808	26,580±520	Lisitsyn 2000
			Dvuglazka Rockshelter	Bone	LE-1433	22,500±600	Arslanov et al. 1981
			Dvuglazka Rockshelter	Bone	LE-1433	20,190±140	Arslanov et al. 1981
			Dvuglazka Rockshelter	Bone	LE-1433	19,880±200	Arslanov et al. 1981
34	55.32	92.50	Derbina 5	Charcoal	SOAN-4201	32,430±1,540	Akimova et al. 2000b
			Derbina 5	Charcoal	SOAN-4200	29,230±940	Akimova et al. 2000b
35	54.58	91.07	Sabanikha, a surface finding	Antler	LE-3747	25,950±500	Lisitsyn 2000
			Sabanikha	Charcoal	LE-4796	25,440±450	Lisitsyn 2000
			Sabanikha	Charcoal	LE-3611	22,930±350	Svezhentsev et al. 1992
			Sabanikha	Charcoal	LE-4701	22,900±480	Svezhentsev et al. 1992
11			Kurtak 4, Strata 12 to 11	Charcoal	LE-2833	27,470±200	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Bone	LE-3357	24,890±670	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Charcoal	GIN-5350	24,800±400	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Charcoal	LE-3351	24,170±230	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Bone	LE-4156	24,000±2,950	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Charcoal	LE-4155	23,800±900	Svezhentsev et al. 1992
			Kurtak 4, Stratum 11	Charcoal	LE-2833	23,470±200	Svezhentsev et al. 1992
36	54.97	90.95	Novoselovo 13, Layer 3	Charcoal	LE-3739	22,000±700	Svezhentsev et al. 1992
			Novoselovo 13, Layer 1	Bone	LE-4896	15,030±620	Lisitsyn 2000
			Novoselovo 13, Layer 1	Bone	LE-4805	13,630±200	Lisitsyn 2000
37	55.15	91.55	Kashtanka 1, buried soils (below cultural layer)	Charcoal	GrN-24482	36,130±510*	Drozdov et al. 2000
			Kashtanka 1, buried soils (below cultural layer)	Charcoal	GrN-24481	28,320±190*	Drozdov et al. 2000
			Kashtanka 1, below the main layer	Charcoal	GIN-6999	29,400±400	Derevianko et al. 1992

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			Kashtanka 1, below the main layer	Charcoal	IGAN-1048	24,400±1,500	Derevianko et al. 1992
			Kashtanka 1, below the main layer	Charcoal	IGAN-1050	23,830±850	Derevianko et al. 1992
			Kashtanka 1, Main Layer	Charcoal	SOAN-2853	24,805±425	Derevianko et al. 1992
			Kashtanka 1, Main Layer	Charcoal	IGAN-1049	21,800±200	Derevianko et al. 1992
			Kashtanka 1, Main Layer	Charcoal	GIN-6968	20,800±600	Derevianko et al. 1992
38	55.22	91.95	Shlenka, a surface finding	Tusk	GIN-2863	20,100±100	Astakhov et al. 1993
			Shlenka, a surface finding	Tusk	GIN-2862	18,600±2,000	Astakhov et al. 1993
39	55.05	91.05	Tarachikha, Loc. 1, a surface finding	Bone	LE-3821	19,850±180	Lisitsyn 2000
			Tarachikha, Loc. 1, a surface finding	Bone	LE-3834	18,930±320	Lisitsyn 2000
40	54.93	90.93	Kokorevo 4A, Layers 5 to 3	Charcoal	LE-469	14,320±330	Abramova 1979a
41	54.94	90.93	Kokorevo 2	Charcoal	GIN-90	13,300±100	Abramova 1979a
			Kokorevo 2	Bone	LE-4812	12,090±100	Lisitsyn 2000
42	55.16	91.57	Kurtak 3	Charcoal	GIN-2102	16,900±700	Abramova et al. 1991
			Kurtak 3	Charcoal	GIN-2101	14,600±200	Abramova et al. 1991
			Kurtak 3	Charcoal	LE-1456	14,390±100	Abramova et al. 1991
			Kurtak 3	Charcoal	LE-1457	14,300±100	Abramova et al. 1991
43	55.03	91.00	Divnyi 1	Bone	LE-4806	13,220±150	Lisitsyn 2000
44	54.60	91.02	Tashtyk 1, Layer 1	Bone	LE-4980	12,880±130	Lisitsyn 2000
			Tashtyk 1, Layer 1	Charcoal	LE-771	12,180±120	Abramova 1979a
45	54.61	91.01	Tashtyk 2, Layer 2	Bone	LE-4801	13,550±320	Lisitsyn 2000
46	54.58	91.00	Tashtyk 4	Charcoal	GIN-262	14,700±150	Abramova 1979a
47	54.93	90.94	Kokorevo 3	Charcoal	LE-629	12,690±140	Abramova 1979a
48	54.93	90.92	Kokorevo 1, Layer 3	Charcoal	IGAN-104	15,900±250	Abramova 1979b
			Kokorevo 1, Layer 3	Charcoal	LE-628	14,450±150	Abramova 1979b
			Kokorevo 1, Layer 3	Charcoal	GIN-91	13,300±50	Abramova 1979b
			Kokorevo 1, Layer 3	Bone	IGAN-102	13,000±50	Abramova 1979b
			Kokorevo 1, Layer 2	Charcoal	IGAN-105	15,200±200	Abramova 1979b
			Kokorevo 1, Layer 2	Bone	IGAN-103	13,100±500	Abramova 1979b
			Kokorevo 1, Layer 2	Charcoal	LE-526	12,940±270	Abramova 1979b
49	54.95	90.93	Kokorevo 4B, the lower layer	Bone	LE-540	15,460±320	Abramova 1979a
50	55.03	90.97	Novoselovo 6	Bone	LE-4807	18,090±940	Lisitsyn 2000
			Novoselovo 6	Bone	LE-5045	13,570±140	Lisitsyn 2000
51	55.03	90.98	Novoselovo 7	Bone	LE-4802	15,950±120	Lisitsyn 2000
			Novoselovo 7	Charcoal	GIN-402	15,000±300	Abramova 1979b
			Novoselovo 7	Bone	LE-4803	14,220±170	Lisitsyn 2000
52	54.63	90.90	Pervomaiskoe 1, a surface finding	Bone	LE-4893	12,870±140	Lisitsyn 2000
53	53.95	91.83	Pritubinsk, Layer 3	Charcoal	SOAN-2854	15,600±495	Orlova 1995
54	53.22	90.80	Ulug-Bil', a surface finding	Bone	LE-1404	15,020±150	Lisitsyn 2000
55	52.97	91.43	Ui 1, Layer 2	Charcoal	LE-4189	22,830±530	Vasil'ev 1996
			Ui 1, Layer 2	Bone	LE-4257	19,280±200	Vasil'ev 1996
			Ui 1, Layer 2	Bone	LE-3359	17,520±130	Vasil'ev 1996
			Ui 1, Layer 2	Bone	LE-3358	16,760±120	Vasil'ev 1996
56	52.08	92.35	Nizhny Idzhir 1	Charcoal	LE-1984	17,200±140	Astakhov 1986
57	53.08	91.42	Oznachennoye 1	Bone	LE-1404	15,020±150	Astakhov 1986
			Oznachennoye 1	Bone	LE-1404	14,100±150	Svezhentsev et al. 1992
58	52.97	91.45	Mayiniskaya, Layer 5	Bone	LE-2135	16,540±170	Vasil'ev 1996
			Mayiniskaya, Layer 5	Bone	LE-2135	16,176±180	Vasil'ev 1996
			Mayiniskaya, Layer 4	Bone	LE-4251	13,690±390	Vasil'ev 1996
			Mayniskaya, Layer 4	Bone	LE-2133	12,910±100	Vasil'ev 1996
			Mayiniskaya, Layer 3	Bone	LE-2149	14,070±150	Vasil'ev 1996
			Mayiniskaya, Layer 3	Bone	LE-2149	13,900±150	Vasil'ev 1996
			Mayiniskaya, Layer 3	Bone	LE-2149	12,330±150	Vasil'ev 1996

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			Mayiniskaya, Layer 3	Bone	LE-4252	12,120±650	Vasil'ev 1996
			Mayiniskaya, Layer 2-2	Charcoal	LE-2378	10,800±200	Vasil'ev 1996
			Mayiniskaya, Layer 2-1	Bone	LE-2300	12,280±150	Vasil'ev 1996
			Mayiniskaya, Layer 2-1	Bone	LE-2300	12,120±120	Vasil'ev 1996
			Mayiniskaya, Layer 1	Bone	LE-2299	15,500±150	Vasil'ev 1996
			Mayiniskaya, Layer B	Charcoal	LE-2383	15,200±150	Vasil'ev 1996
			Mayiniskaya, Layers A3 to A1	Bone	LE-3019	11,700±100	Vasil'ev 1996
			Mayiniskaya, Layer A1	Bone	LE-4255	12,110±220	Vasil'ev 1996
59	52.97	91.44	Ui 2, Layer 6	Charcoal	LE-3717	14,310±3,600	Lisitsyn 2000
60	52.98	91.52	Golubaya 1, Layer 3	Charcoal	LE-1101d	13,650±180	Astakhov 1986
			Golubaya 1, Layer 3	Charcoal	LE-1101a	13,050±90	Astakhov 1986
			Golubaya 1, Layer 3	Bone	LE-1101b	12,900±150	Astakhov 1986
			Golubaya 1, Layer 3	Bone	LE-1101c	12,980±140	Astakhov 1986
61	56.03	95.88	Brazhnoe	Bone	GIN-8481	>31,000	Vorob'eva et al. 1998
62	56.18	95.92	Strizhovaya Gora, Layer 18	Bone	GIN-5326	14,000±1,500	Generalov 2000
			Strizhovaya Gora, Layer 16 to 14	Bone	GIN-5820	12,250±150	Generalov 2000
			Strizhovaya Gora, Layer 16 to 14	Bone	GIN-5822	12,090±120	Generalov 2000
			Strizhovaya Gora, Layer 16 to 14	Bone	GIN-5821	12,000±150	Generalov 2000
The Angara River basin and the Lena River headwaters							
63	58.30	100.33	Ust'-Kova, Lower Component	Charcoal	GIN-5929	34,300±900	Drozdov et al. 1990
			Ust'-Kova, Lower Component	Charcoal	SOAN-1690	>32,850	Drozdov et al. 1990
			Ust'-Kova, Lower Component	Charcoal	GIN-1741	30,100±150	Drozdov et al. 1990
			Ust'-Kova, Lower Component	Charcoal	SOAN-1875	28,050±670	Drozdov et al. 1990
			Ust'-Kova, Lower Component	Charcoal	SOAN-1900	19,540±90	Drozdov et al. 1990
			Ust'-Kova, Middle Component	Charcoal	KRIL-381	23,920±310	Drozdov et al. 1990
			Ust'-Kova, Middle Component	Bone	LE-3820	13,860±680	Lisitsyn 2000
			Ust'-Kova, Upper Component	Charcoal	LE-1372	14,220±110	Drozdov et al. 1990
			Ust'-Kova, depth 1.5 m	Charcoal	KRIL-621	18,035±180	Starikov et al. 1991
64	52.30	104.17	Mamony 2, Layer 4	Bone	GIN-8480	31,400±150	Vorob'eva et al. 1998
65	52.30	104.32	Voenny Hospital	Bone	GIN-4410	29,700±500	Medvedev et al. 1990
66	53.58	103.42	Igeteisky Log I, Stratum 6	Bone	GIN-4327	24,400±100	Medvedev et al. 1990
			Igeteisky Log I, Stratum 4	Charcoal	IM-405	23,760±1,100	Medvedev et al. 1990
			Igeteisky Log I, Stratum 4	Charcoal	LE-1592	23,508±250	Medvedev et al. 1990
			Igeteisky Log I, Stratum 4	Charcoal	LE-1590	21,260±240	Medvedev et al. 1990
67	52.83	103.53	Malta, Stratum 6	Bone	OxA-6189	43,100±2,400*	Medvedev et al. 1996
			Malta, gravel	Bone	GIN-7707	41,100±1,500	Medvedev et al. 1996
			Malta, contact between Strata 7 and 3	Bone	OxA-6190	25,760±260*	Medvedev et al. 1996
			Malta, Stratum 8	Bone	OxA-6191	21,700±160*	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7708	21,600±200	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-8475	21,600±170	Medvedev et al. 1996
			Malta, Stratum 8	Bone	OxA-6193	21,340±340*	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7704	21,300±300	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7702	21,300±110	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7703	21,100±150	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7706	21,000±140	Medvedev et al. 1996

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Site nr	Lat. N	Long. E	Site name, sample position	Material	Lab code	^{14}C date BP	Reference
			Malta, Stratum 8	Bone	GIN-7710	20,800±140	Medvedev et al. 1996
			Malta, Stratum 8	Bone	OxA-6192	20,340±320*	Medvedev et al. 1996
			Malta, Stratum 8	Bone	GIN-7705	19,900±800	Medvedev et al. 1996
			Malta, washed sediments	Bone	GIN-7709	20,700±150	Medvedev et al. 1996
			Malta, Stratum 9	Tusk	GIN-8476	14,720±190	Medvedev et al. 1996
			Malta, main cultural layer	Bone	GIN-4367	20,900±200	Medvedev et al. 1996
			Malta, main cultural layer	Bone	GIN-4367	20,800±200	Medvedev et al. 1996
			Malta	Bone	GIN-87	14,750±120	Tseitlin 1979
68	53.00	103.50	Buret'	Bone	SOAN-1680	21,190±100	Abramova 1989
69	53.67	103.43	Krasny Yar 1, Layer 6	Bone	GIN-5330	19,100±100	Medvedev et al. 1991
70	52.87	103.43	Sosnovy Bor, Layer 3b	Bone	GIN-5328	12,060±120	Vorob'eva 1991
			Sosnovy Bor, Layer 4	Bone	AA-38038	12,090±110*	This paper
71	52.37	104.28	Verkholenskaya Gora 1, Layer 3d	Charcoal	Mo-441	12,570±180	Medvedev et al. 1990
72	54.00	105.82	Makarovo 4, Layer 3a	Bone	AA-8800	>39,000*	Goebel & Aksenov 1995
			Makarovo 4, Layer 3a	Bone	AA-8878	>38,000*	Goebel & Aksenov 1995
			Makarovo 4, Layer 3a	Bone	AA-8879	>38,000*	Goebel & Aksenov 1995
73	54.02	105.80	Makarovo 3	Bone	GIN-7067b	31,200±500	Aksenov 1993
74	54.02	105.67	Shishkino 8	Bone	AA-8882	21,190±175*	Aksenov 1993
75	54.03	105.82	Makarovo 2, Layer 4	Charcoal	GIN-481	11,950±50	Medvedev et al. 1990
76	54.03	105.78	Shishkino 2, Layer 3	Charcoal	GIN-5634	13,900±200	Aksenov 1996
77	57.48	107.77	Balyshevo 3, Layer 2	Bone	LE-3950	25,100±940	Lisitsyn & Svezhentsev 1997
78	57.83	108.37	Alexeevsk 1	Charcoal	LE-3931	22,415±480	Zadonin 1996
79	55.65	109.35	Kurla 3, Layer 2	Charcoal	SOAN-1397	24,060±5,700	Shmygun & Filippov 1982
			Kurla 3, Layer 1	Bone	SOAN-1396	15,200±1,250	Shmygun & Filippov 1982
			Kurla 3, Layer 1	Bone	SOAN-1396	13,160±350	Ineshin 1993
			Kurla 6	Charcoal	SOAN-1398	14,150±960	Shmygun & Filippov 1982
80	57.83	114.00	Bolshoi Yakor 1, Layer 9	Charcoal	GIN-8470	12,700±400	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 8	Charcoal	GIN-6468	12,630±230	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 7	Bone	GIN-6467	12,380±250	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 7	Charcoal	GIN-6466	12,330±250	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 6	Charcoal	GIN-7712	15,900±270	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 6	Charcoal	LE-4172	12,400±150	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 6	Bone	GIN-6425	12,380±200	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-7711	17,840±290	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-8470	12,700±140	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-8473	12,700±90	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-7713	12,530±90	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-8471	12,200±80	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 5	Charcoal	GIN-8472	12,050±120	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 3v	Charcoal	GIN-6460A	12,080±220	Belousov et al. 1997
			Bolshoi Yakor 1, Layer 3v	Charcoal	GIN-6460	12,000±250	Belousov et al. 1997
81	57.83	114.09	Avdeikha, depth 0.8 to 1.2 m	Charcoal	IM-236	15,200±300	Kostiukevich et al. 1977
			Avdeikha, depth 0.8 to 1.2 m	Charcoal	GIN-1022	12,900±300	Kind et al. 1976
82	55.63	115.87	Nizhniaya Dzhilinda 1, Layer 7	Charcoal	GIN-6466	12,330±250	Kuzmin & Tankersley 1996
83	54.47	116.52	Ust'-Karenga 12, Layer 8	Bone	GIN-8668	16,430±240	Vetrov 1995
			Ust'-Karenga 12, Layer 8	Bone	GIN-8070	13,560±1,950	Vetrov 1995
			Ust'-Karenga 12, Layer 8	Bone	GIN-6469	12,880±130	Vetrov 1995
			Ust'-Karenga 12, Layer 8	Bone	GIN-8069	12,710±380	Vetrov 1995
The Transbaikal							
84	50.53	106.30	Ust'-Kyakhta 4, Layer 2	Bone	SOAN-1553	12,595±150	Okladnikov 1981

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85	50.53	106.32	Ust'-Kyakhta 17, Layer 5	Bone	GIN-8493b	12,230±100	Tashak 1996
			Ust'-Kyakhta 17, Layer 5	Bone	GIN-8493a	12,100±80	Tashak 1996
86	51.63	108.17	Varvarina Gora	Bone	AA-8893	>35,300*	Goebel & Aksenov 1995
			Varvarina Gora	Bone	AA-8875	>34,050*	Goebel & Aksenov 1995
			Varvarina Gora	Bone	SOAN-1524	34,900±780	Bazarov et al. 1982
			Varvarina Gora	Bone	SOAN-850	30,600±500	Bazarov et al. 1982
			Varvarina Gora, Layer 2	Bone	SOAN-3054	29,895±1,790	Lbova 1996a
			Varvarina Gora, Layer 1	Bone	SOAN-3053	17,035±400	Lbova 1996a
87	51.77	108.33	Kamenka 1, Component A	Bone	AA-26743	40,500±3,800*	Buerachnyi & Lbova 2000
			Kamenka 1, Component A	Charcoal	SOAN-3133	31,060±530	Lbova 1996b
			Kamenka 1, Component A	Bone	SOAN-3354	30,460±430	Lbova 1996b
			Kamenka 1, Component A	Bone	SOAN-2903	28,060±475	Lbova 1996b
			Kamenka 1, Component A	Bone	SOAN-3353	26,760±265	Lbova 1996b
			Kamenka 1, Component A	Bone	SOAN-3355	25,540±300	Kuzmin & Orlova 1998
			Kamenka 1, Component A	Bone	SOAN-3031	24,625±190	Lbova 1996b
			Kamenka 1, Component C	Bone	SOAN-3052	30,220±270	Lbova 1996b
			Kamenka 1, Component B	Bone	SOAN-2904	35,845±695	Lbova 1996b
			Kamenka 1, Component B	Bone	SOAN-3032	28,815±150	Lbova 1996b
88	51.22	109.33	Tolbaga, Stratum 4	Bone	SOAN-1522	34,860±2,100	Bazarov et al. 1982
			Tolbaga, Stratum 4	Bone	SOAN-1523	27,210±300	Bazarov et al. 1982
			Tolbaga, Stratum 4	Bone	AA-8874	25,200±260*	Goebel & Waters 2000
			Tolbaga, Stratum 4	Bone	AA-26740	29,200±1,000*	Goebel & Waters 2000
			Tolbaga, Stratum 4	Bone	SOAN-3078	26,900±225	Sinitsyn & Praslov 1997
			Tolbaga, Stratum 3	Bone	SOAN-840	15,100±520	Bazarov et al. 1982
89	51.78	108.80	Mukhor-Tala 7	Charcoal	SOAN-3468	11,630±300	Lbova et al. 1997
90	50.62	107.80	Kunalei, below Layer 3	Humic acids	GIN-6124	21,100±300	Konstantinov 1994
91	50.93	108.60	Kandabaevo	Bone	SOAN-1625	38,460±1,100	Orlova 1995
92	50.43	110.00	Masterov Kliych, Layer 4	Bone	AA-8888	24,360±270*	Meshcherin 1996
93	50.18	108.55	Priiskovaya	Bone	AA-8891	25,825±290*	Kuzmin & Orlova 1998
94	50.27	107.23	Podzvonkaya	Bone	AA-26741	38,900±3,300*	Klement'ev 2000
			Podzvonkaya	Bone	AA-26742	>36,800*	Klement'ev 2000
			Podzvonkaya	Bone	SOAN-3404	26,000±1,000	Tashak 1996
			Podzvonkaya	Bone	SOAN-3350	22,675±265	Kuzmin & Orlova 1998
95	52.28	109.83	Khotyk 3, Layer 2	Charcoal	AA-32669	26,220±550*	This paper
96	50.17	108.50	Studenoe 1, Layer 19/1	Charcoal	GIN-6139	12,330±60	Konstantinov 1994
			Studenoe 1, Layer 18/2	Charcoal	GIN-2947	12,800±400	Konstantinov 1994
			Studenoe 1, Layer 18/1	Charcoal	LE-2061	13,430±150	Konstantinov 1994
			Studenoe 1, Layer 18/1	Charcoal	GIN-2935	12,110±150	Konstantinov 1994
			Studenoe 1, Layer 17	Charcoal	GIN-2934	12,140±150	Konstantinov 1994
			Studenoe 1, Layer 17	Charcoal	GIN-2934a	12,130±150	Konstantinov 1994
			Studenoe 1, Layer 15	Charcoal	GIN-2931	14,900±2,000	Konstantinov 1994
			Studenoe 1, Layer 15	Charcoal	LE-2062	12,290±130	Konstantinov 1994
			Studenoe 1, Layer 14	Charcoal	GIN-2925	12,300±700	Konstantinov 1994
97	50.17	108.49	Studenoe 2, Layer 5	Charcoal	AA-23657	17,165±115*	Goebel et al. 2000
			Studenoe 2, Layer 4/5	Bone	AA-26739	18,830±300*	Goebel et al. 2000
			Studenoe 2, Layer 4/5, hearth 1	Charcoal	AA-23653	17,885±120*	Goebel et al. 2000
			Studenoe 2, Layer 4/5, hearth 2	Charcoal	AA-23655	17,225±115*	Goebel et al. 2000
98			Ust'-Menza 2, Layer 21	Charcoal	GIN-5464	17,600±250	Konstantinov 1994
			Ust'-Menza 2, Layer 21	Charcoal	GIN-5464A	17,190±120	Konstantinov 1994
			Ust'-Menza 2, Layer 20	Charcoal	GIN-5465	16,980±150	Konstantinov 1994

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			Ust'-Menza 2, Layer 17	Charcoal	GIN-6117	16,900±500	Konstantinov 1994
			Ust'-Menza 2, Layer 17	Charcoal	GIN-5478	15,400±400	Konstantinov 1994
			Ust'-Menza 2, Layer 11	Charcoal	GIN-6116	14,830±390	Konstantinov 1994
99	50.21	108.62	Ust'-Menza 1, Layer 14	Charcoal	GIN-7161	11,820±120	Konstantinov 1994
100	50.13	108.82	Kosaya Shivera 1, Layer 14	Charcoal	GIN-6123	12,070±300	Konstantinov 1994
13			Arta 2, Layer 3	Charcoal	LE-2966	23,200±2,000	Kirillov & Kasparov 1990
101	52.02	113.43	Sokhatino 4, Layer 8	Bone	LE-3653	16,970±720	Lisitsyn & Svezhentsev 1997
			Sokhatino 4, Layer 7	Bone	LE-3647	16,820±390	Kirillov & Cherensh-chikov 1996
			Sokhatino 4, Layer 6	Bone	LE-3652	15,820±300	Lisitsyn & Svezhentsev 1997
			Sokhatino 4	Charcoal	SOAN-1138	26,110±150	Okladnikov & Kirillov 1980
The Russian Far East							
102	50.30	130.32	Malye Kuruktachi	Charcoal	SOAN-3287	14,200± 130	Kuzmin et al. 1998a
			Malye Kuruktachi	Charcoal	AA-13399	13,815± 150*	Kuzmin et al. 1998a
			Malye Kuruktachi	Charcoal	AA-13398	13,310 ±105*	Kuzmin et al. 1998a
			Malye Kuruktachi	Charcoal	AA-17212	12,485± 80*	Kuzmin et al. 1998a
			Malye Kuruktachi	Charcoal	AA-23128	12,010± 75*	Kuzmin et al. 1998a
103	51.92	129.30	Ust'-Ulma 1, Layer 2	Charcoal	SOAN-2619	19,360±65	Derevianko & Zenin 1995b
104	42.92	133.05	Geographical Society Cave	Bone	AA-37070	>40,000*	This paper
			Geographical Society Cave	Bone	AA-37068	>39,000*	This paper
			Geographical Society Cave	Bone	AA-37071	>38,000*	This paper
			Geographical Society Cave	Bone	AA-34074	>38,000*	This paper
			Geographical Society Cave	Bone	AA-37072	>37,000*	This paper
			Geographical Society Cave	Bone	AA-37073	>36,000*	This paper
			Geographical Society Cave	Bone	AA-37069	35,100±1,900*	This paper
			Geographical Society Cave	Bone	AA-38230	34,510±1,800*	This paper
			Geographical Society Cave	Bone	AA-37183	34,400±1,800*	This paper
			Geographical Society Cave	Bone	AA-38229	34,300±1,700*	This paper
			Geographical Society Cave	Bone	IGAN-341	32,570±1,510	Kuz'min 1994
105	44.27	135.30	Suvorovo 4	Charcoal	AA-9463	15,105±100*	Krupianko & Tabarev 2001
			Suvorovo 4	Charcoal	Ki-3502	15,300±140	Krupianko & Tabarev 2001
			Suvorovo 4	Charcoal	AA-36625	15,340±90*	Krupianko & Tabarev 2001
			Suvorovo 4	Charcoal	AA-36626	15,900±120*	Krupianko & Tabarev 2001
106	43.95	132.40	Gorbatka 3 (below cul-tural layer)	Organics	SOAN-1922	13,500±200	Kuznetsov 1992
			Ogonki 5, Layer 2b	Charcoal	AA-20864	19,320±145*	Kuzmin et al. 1998b
			Ogonki 5, Layer 2b	Charcoal	AA-25434	18,920±150*	Kuzmin et al. 1998b
107	46.78	142.43	Ogonki 5, Layer 2b	Charcoal	AA-23137	17,860±120*	Kuzmin et al. 1998b
The Yakutia and Northeastern Siberia							
108	59.99	117.35	Khaergas Cave, Layer 6	Bone	IM-887	16,000±300	Cherosov 1988
109	60.52	135.13	Ezhantsy, Layer 3 (depth 0.6 to 1.0 m)	Bone	IM-459	17,150±345	Kostiukevich et al. 1980
110	59.65	133.12	Ust'-Mil 2, Stratum 5 (below cultural layer)	Wood	LE-955	35,600±900	Mochanov 1977

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			Ust'-Mil 2, Stratum 4, middle part	Wood	LE-954	35,400±600	Mochanov 1977
			Ust'-Mil 2, Stratum 4, middle part	Wood	LE-1000	33,333±500	Mochanov 1977
			Ust'-Mil 2, Stratum 4, middle part	Wood	LE-1101	30,000±500	Mochanov 1977
			Ust'-Mil 2, Stratum 4, upper part	Wood	LE-999	23,500±500	Mochanov 1977
			Ust'-Mil 2, Stratum 3	Wood	LE-953	12,200±170	Mochanov 1977
111	63.12	133.60	Ikhine 1, Layer 2	Bone	IM-452	16,660±270	Kuzmin & Orlova 1998
112	63.12	133.62	Ikhine 2, Layer 2g	Wood	IM-206	27,800±500	Mochanov 1977
			Ikhine 2, Layer 2v	Wood	GIN-1020	31,200±500	Mochanov 1977
			Ikhine 2, Layer 2v	Wood	IM-201	26,600±900	Mochanov 1977
			Ikhine 2, Layer 2v	Wood	IM-201	26,500±900	Mochanov 1977
			Ikhine 2, Layer 2v	Bone	IM-239	26,030±200	Mochanov 1977
			Ikhine 2, Layer 2b	Wood	GIN-1019	30,200±300	Mochanov 1977
			Ikhine 2, Layer 2b	Wood	IM-205	27,400±800	Mochanov 1977
			Ikhine 2, Layer 2b	Wood	IM-155	24,600±380	Mochanov 1977
			Ikhine 2, Layer 2b	Wood	IM-203	24,500±480	Mochanov 1977
			Ikhine 2, Layer 2b	Wood	LE-1131	24,330±200	Mochanov 1977
			Ikhine 2, layer unknown	Bone	SOAN-3185	20,080±150	Kuzmin & Orlova 1998
			Ikhine 2, layer unknown	Bone	SOAN-3186	19,695±100	Kuzmin & Orlova 1998
			Ikhine 2, layer unknown	Bone	SOAN-3187	15,780±70	Orlova et al. 2000b
113	60.35	134.45	Verkhne-Troitskaya, Layer 6	Wood	LE-905	18,300±180	Mochanov 1977
			Verkhne-Troitskaya, Layer 6 (above artifacts)	Wood	LE-906	17,680±250	Mochanov 1977
			Verkhne-Troitskaya, Layer 6 (above artifacts)	Charcoal	GIN-626	15,950±250	Mochanov 1977
			Verkhne-Troitskaya, Layer 6 (above artifacts)	Wood	LE-864	14,530±160	Mochanov 1977
114	59.30	132.60	Dyuktai Cave, Depth 2.7 m	Bone	IM-462	12,520±259	Kostiukevich et al. 1984
			Dyuktai Cave, Layer 7v	Wood	LE-908	13,110±90	Mochanov 1977
			Dyuktai Cave, Layer 7b	Charcoal	GIN-404	14,000±100	Mochanov 1977
			Dyuktai Cave, Layer 7b	Charcoal	LE-784	13,070±90	Mochanov 1977
			Dyuktai Cave, Layer 7b	Charcoal	LE-860	12,960±120	Mochanov 1977
			Dyuktai Cave, Layer 7a	Charcoal	GIN-405	13,200±250	Mochanov 1977
			Dyuktai Cave, Layer 7a	Wood	IM-462	12,520±260	Mochanov 1977
			Dyuktai Cave, Layer 7a	Wood	LE-907	12,100±120	Mochanov 1977
115	70.43	143.95	Berelekh	Wood	IM-152	13,420±200	Mochanov 1977
			Berelekh	Wood	GIN-1021	12,930±80	Mochanov 1977
116	56.17	159.97	Ushki 1, Layer 7	Charcoal	GIN-167	14,300±200	Dikov 1996a
			Ushki 1, Layer 7	Charcoal	GIN-167	13,600±250	Dikov 1977
			Ushki 1, Layer 6a	Charcoal	LE-4185	13,800±600	Lisitsyn & Svezhentsev 1997
117	61.63	149.52	Siberdik, Layer 3	Charcoal	MAG-916	13,225±230	Lozhkin & Trumpe 1990