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Faunal exploitation, subsistence practices and Pleistocene extinctions in Paleolithic Siberia

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The vast territory of Northern Asia attracted the attention of the students of prehistory for a long time. This area is of crucial importance for the study of Pleistocene extinctions. The paper summarises the available data from 29 Middle and 321 Upper Paleolithic faunal assemblages (only large mammals are included in the analysis) arranged in chronological and geographical order. Subsistence activities of the Middle Paleolithic were based on hunting of ungulates, mostly horse, wild goat, bison, deer, wild ass. It should be added that Okladnikov Cave witnessed also a prominent role of bird hunting and fishing. Meanwhile it is unlikely that specialised hunting took place and we need additional information to reconstruct subsistence behaviour. The Upper Paleolithic inhabitants of Siberia relied heavily on bison, reindeer and horse hunting, while the role of mammoth and woolly rhinoceros (except the Eastern Trans-Baikal) decreased. Different adaptations to periglacial steppe, forest-steppe, forest and mountain environments could be discerned. The end of the Pleistocene witnessed changes in subsistence behaviour as evidenced by an increasing role of fishing and gathering.

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INTRODUCTION

The vast territory of Northern Asia attracted the attention of the students of prehistory for a long time. This area is of crucial importance for the study of Pleistocene extinctions. Intensive research in recent decades resulted in the discovery of several hundreds of clearly stratified sites with good paleo-environmental control, including faunal data. Thus, a basis for the reconstruction of faunal exploitation and subsistence activities has been formed. Research into the Pleistocene in Siberia has always been hampered by difficulties in obtaining information and linguistic barriers between the scholars of different countries. Moreover, in many cases raw data are only partially published or found their way into widely scattered literature, some of which is difficult, if not impossible, to obtain even for Russian scholars. Time is long overdue for a new synthesis of such data. It should be added that a previous synthesis of this scope appeared over five decades ago (Gromov 1948). While admitting that the current attempt cannot be free from errors and misrepresentation, this nevertheless would hopefully serve as a convenient guidebook to understand the current state of knowledge on the Siberian Paleolithic, especially for the late time range.

Paleolithic discoveries so far made might be summarised as follows (Figs. 1 to 4). First, in Western Siberia, only isolated Paleolithic occurrences are known, mainly in

its south. The Altai region is much richer in Pleistocene localities, which form several clusters in the Anui and Charysh valleys, all in the western part of the Altai. In the Kuzbass Depression, in the Tom' River basin a number of occurrences is reported. In the Yenisei valley, sites are clustered in three areas. They are the northernmost concentration near Krasnoiarsk, on the left bank of the Yenisei in northern Minusinsk Depression and near the edge of the West Sayan in the vicinity of Maina. To the east of the Yenisei, a number of sites is under study along the River Kan, which is one of its right tributaries. However, the Yenisei-Angara watershed and the piedmont areas of the East Sayan are less investigated. Northern Angara produced no more than one stratified occurrence of Ust'Kova, while in the upper reaches of Angara are known a number of sites. Upper Angara localities also form some clusters at near Bratsk, around the mouth of the River Belaia and in the vicinity of Irkutsk. Only a single site cluster of Kurla is known in the Baikal region, along the coast of the lake. In the western Trans-Baikal concentrations of localities are seen in the valleys of Selenga, Uda, Chikoi and Khilok, while less localities are known from the eastern Trans-Baikal. Here, some sites are reported in the valleys of Ingoda, Onon and Shilka. Pleistocene occurrences are reported from the Vitim valley. To the east, distribution of Early Man sites is disrupted, and at about 750 km to the east only in the valley of River Selemdzha in the Amur Basin a rich cluster of Paleolithic sites are currently under study.

In the southern portion of the Russian Far East rare Pleistocene sites are reported from the Amur valley and its tributary, the River Bureia. Other sites are clustered in the southern most portion of the Maritime Region. In this area all open-air sites lack faunal remains due to the acidity of the soils. In Yakutia, sites are concentrated in the valleys of Aldan, Olekma and mid Lena. Despite the active archaeological surveys and unambiguous traces of the Early Man at such valleys, except some dubious finds, report of discovery has yet to be made from the other river valleys such as Viliui, Indigirka, Iana and Kolyma. The site of Berelekh in the Arctic remains an isolated point in the map and we know next to nothing about the Pleistocene human dispersal in the northeastern corner of Asia.

Such unevenness in the spatial distribution of Paleolithic localities also applies to the temporal distribution of the sites. West Siberian localities are mostly, if not all, datable to the latter half of the Upper Paleolithic. However, in the Altai, a number of Mousterian and Early Upper Paleolithic sites are known along with some Final Paleolithic ones. The Yenisei sites are mostly datable to the Final Paleolithic, but some Mousterian and Early and Middle Upper Paleolithic assemblages are known. Well-preserved stratigraphic successions of occupational horizons are reported from the Upper Angara and Upper Lena, however, even here the initial phase of the Upper Paleolithic remains dubious. In Yakutia, a number of sites commonly known as the Diuktai Culture belong to the latter half of the Upper Paleolithic. In the Trans-Baikal, the situation is similar to the Altai in many respects. Here, the initial and the final phases of the Upper Paleolithic are better known, while the middle phase remains less investigated.

FAUNAL ASSEMBLAGES: AN OVERVIEW

The earliest traces of humans in Northern Asia could be correlated with the Middle Pleistocene, c. 300-250 Ky. Thus it seems appropriate to present a brief overview of the Middle and Upper Pleistocene faunas in Siberia (Table 1). According to the stratigraphic schemes admitted in Russia, the advent of Middle Pleistocene was marked by the Tobol'sk interglacial. There is a series of TL and ESR-dates for this time span lying between 390 and 290 Ky. It was followed by the maximal (Samarovo) glaciation. Samarovo receives TL dates between 312 and

276 Ky; but a slightly younger age is probable. This maximal glaciation was followed by the Shirta interglacial dated by the ESR and TL from 210 to 170 Ky. The extent of the next, Taz glaciation was less that Samarovo. TL-dates for end moraines of Taz lie between 241 and 180 Ky.

Several successive faunal complexes are identified in the Middle Pleistocene (Vangengeim 1977). The Tatarka Complex characterised the fauna of West Siberia during Tobol'sk. Giant deer (*Megaloceros* sp.) dominates the assemblage. It is accompanied by elephant (*Paleoloxodon* ex gr. *antiquus*), an archaic species of horse similar to the Steinheim horse (*Equus steinheimensis*), cave bear (*Ursus spelaeus rossicus*), red deer, bison. Among small mammals *Arvicola* sp. are typical. Samarovo saw the formation of the faunal complex resembling to the Khazar fauna of Eastern Europe. It includes Khazar mammoth (*Mammuthus chosaricus*), woolly rhino (*Coelodonta antiquitatis*), long horn bison (*Bison priscus longicornis*) and Knobloch´s camel (*Camelus knoblochi*). Taz evidenced the appearance of woolly mammoth (*Mammuthus primigenius*). East Siberia yielded some occurrences of Khazar fauna, including remains of the Khazar mammoth. The peculiar character of the Trans-Baikal Middle Pleistocene fauna gave ground to identify the Ust'Kiran Complex dated by the early Samarovo. Alongside with Khazar mammoth, Knobloch´s camel, red deer and bison, it includes Baikal yak (*Poephagus* cf. *baikalensis*).

The advent of the Late Pleistocene is correlated with the beginning of Kazantseva interglacial. A series of TL and ESR-dates indicates the optimal phase of it between 130 and 122 Ky. Zyrianka, which can be correlated to Würm/Wisconsin Glacial in its broadest sense, followed it, and it divided into three periods. The earliest one is the Early or Lower Zyrianka, which is also called as Ermakovo or Murukta, glacial, the Karginsky interglacial and the Late Zyrianka, or the Sartan, glacial. The oldest TL-dates for the

Table 1 Pleistocene stratigraphy and faunal assemblages of Siberia.

Age (years BP)	Palaeo-magnetic Epochs	Isotopic Stages		European Scale	Siberian Scale		Faunal Complexes
	Bruhnes	1	Holocene	Holocene	Holocene		Modern
		2	Upper Pleistocene	Würm	Zyrianka	Sartan	Upper Palaeolithic (Mammoth)
		3				Karginsky	
		4				Ermakovo	
		5					
100,000		6		Riss/Würm	Kazantseva		?
		7	Middle Pleistocene	Riss	Bakhta	Taz	Ancient mammoth
200,000		8				Shirta	
		9				Samarovo	Khazar
300,000		10		Mindel/Riss	Tobol'sk		?
		11	Lower Pleistocene	Mindel	Niziamsky		Viatka, Oler Tologoi
400,000		12			Shaitansky		
		13					
		14		Günz/ Mindel	Talagaika		
500,000		15					
		16					
600,000		17					
		18					
		19					
700,000	Matyama	20	Upper Eo-Pleistocene	Günz			

Ermakovo moraines lie between 110 and 100 Ky.

Kind (1974) suggested a detailed subdivision of the Karginsky. She believed Karginsky interglacial to lie between 50,000 to 25,000 yBP. During these 25 millennia, warm climatic conditions during the first 7,000 years (Igarka-Zolotoi Mys period) were replaced by colder conditions around 43,000 yBP (Lokhpodgort cold episode), but it lasted only about 1,000 years. Between 42,000 and 35,000 yBP, the climate was noticeably warmer, especially around c. 39,000 yBP, and this period was named Malaia Kheta warm phase. Drastic climatic deterioration began around 34,000 yBP, and the following 3,000 years was marked as Konoshchel´e cold episode. The last 5,000 years between 30,000 and 25,000 yBP was named Lipovka-Novoselovo warm phase.

Detailed subdivision of the Last (Sartan) glacial is of special importance for Paleolithic archaeology. According to the recent version of the scheme proposed by Kind (1982), the Sartan began with the early maximal phase between 23,000 to 22,000 and 16,000 yBP, which is also called Gydansky or Karaul with cold maxima around 20,000 to 18,000 yBP. It was followed by an early interstadial around 15,000 yBP, the cold N´iapan phase between 15,000 and 13,000 yBP. Sartan ended with a double-peaked warm phase as marked by for-

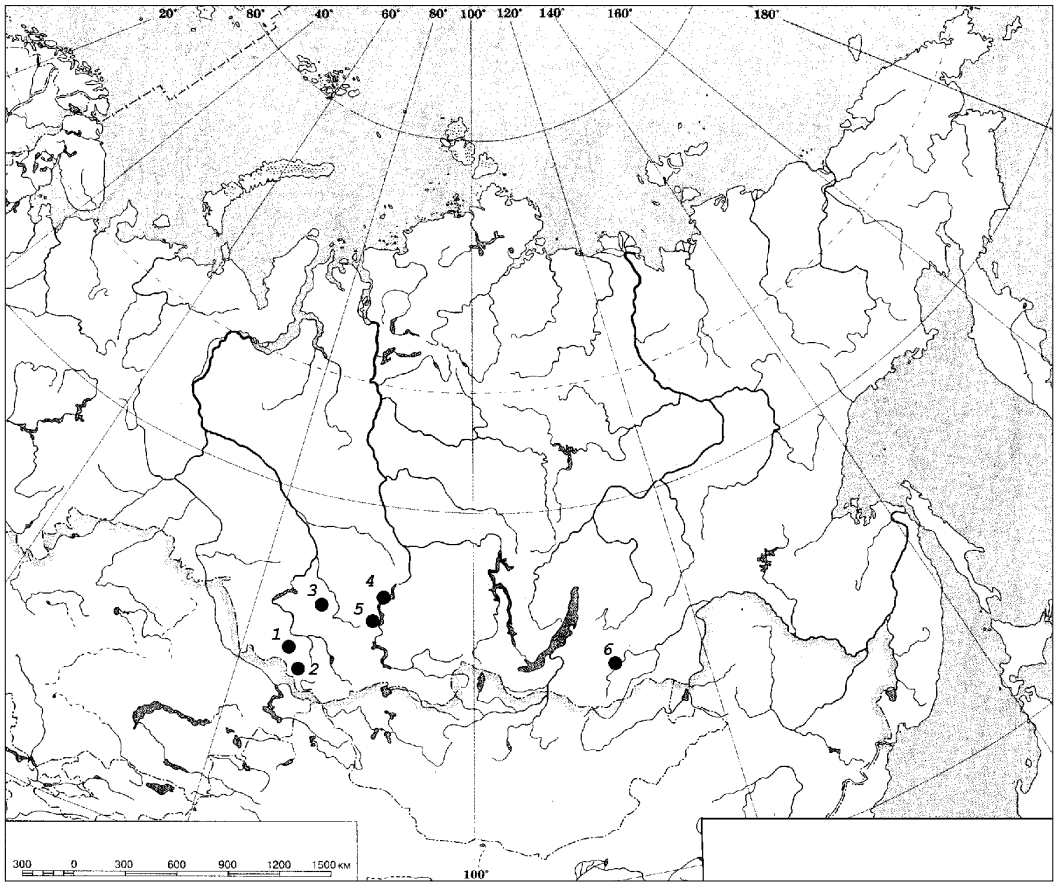

Figure 1 Map of major Middle Paleolithic occurrences in Siberia. **1**: Strashnaia Cave, Okladnikov Cave, Denisova Cave, Kaminnaia Cave, Ust'Karakol I; **2**: Ust'Kanskaia Cave, Kara-Bom; **3**: Mokhovo II; **4**: Ust'Izhul'; **5**: Dvuglazka Cave, Proskuriakov Cave; **6**: Arta II.

mation of two buried soils of Kokorevo around 13,000 yBP and Taimyr between ca. 11,700 and 11,400 yBP. The final Pleistocene episode is the short-lived cold phase of Noril'sk between 11,400 to 10,200 yBP. Sea regression during the Sartan led to the formation of vast land bridges joining the Sakhalin Island, Hokkaido and mainland Asia that facilitated the expansion of the Mammoth fauna to the islands. Another more important land bridge joined Chukotka and Alaska.

Due to the scarcity of occurrences it seems hardly possible to characterise Kazantseva fauna, while from Zyrianka onwards the Upper Paleolithic (or Mammoth) Faunal Complex was represented by those typical species as mammoth, woolly rhino, horse, musk-ox, bison, reindeer, saiga antelope, Polar fox, lemming, etc. In Trans-Baikal this assemblage was enriched by Central Asian species such as spiral horn antelope and yak. Due to the fact that the Mousterian and Upper Paleolithic sites are associated with this faunal assemblage, it seems appropriate to discuss the most abundant species, their distribution and extinction (Vereshchagin 1967; Vereshchagin & Baryshnikov 1982, 1984, 1991; Guthrie 1990).

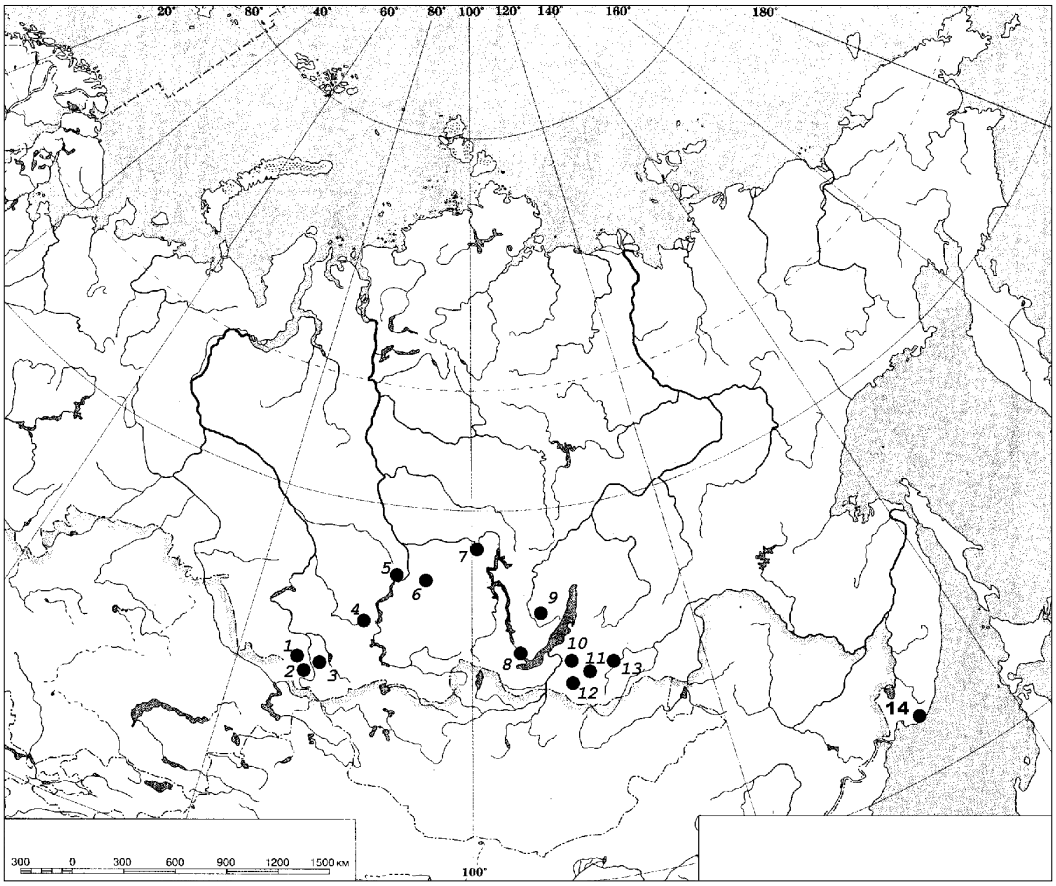

Figure 2 Map of major Early Upper Paleolithic occurrences in Siberia. **1**: Ust'Karakol I, Anui I, Strashnaia Cave; **2**: Kara-Bom, Maloialomanskaia Cave; **3**: Kara-Tenesh, Biika II; **4**: Malaia Syia; **5**: Afontova Gora V; **6**: Brazhnoe; **7**: Ust'Kova; **8**: Arembovskii, Voennyi Gospital', Kaiskaia Gora; **9**: Makarovo III and IV; **10**: Varvarina Gora, Kamenka I; **11**: Tolbaga; **12**: Mel'nichnoe, Priiskovaia, Podzvonkaia; **13**: Arta III; **14**: The Geographical Society Cave.

Mammoth

Let us begin this brief overview with woolly mammoth (*Mammuthus primigenius*). Mammoths were widely distributed in the Late Pleistocene in Siberia, in an enormous area stretching from the Arctic Ocean to Mongolia. Numerous discoveries of frozen mammoth remains in Northern Siberia have given us a lucky possibility to characterise in detail the appearance and nutrition of these giants of the Pleistocene world (Dubrovo 1990; Ukraintseva 1985, 1993; Ukraintseva *et al.* 1996). Consumed was mostly grass, bushes and bark in summers, during winters dry grass and sprouts of bushes and coniferous trees. Mammoths inhabited mostly bottoms of river valleys and floodplains, migrating along rivers. Deathsites of mammoths were associated with floods; also they died due to accidents while crossing frozen rivers and lakes. Occasionally Paleolithic man used these concentrations of animal bodies for obtaining bones and ivory. This is the case of Berelekh in Yakutia. It is worthwhile to mention that we are lacking the unambiguous evidence for active mammoth hunting. At most, passive hunting with traps could be deduced (*cf.* Haynes 1986).

Mammoth bones have been identified from many Paleolithic sites dispersed in Siberia from the Mousterian, although in small quantity in the majority of cases. According to relevant evidence from Upper Paleolithic sites, the mammoth became extinct in different portions of Siberia in different times. However, during the second half of the Sartan, they retreated to the north. There is no unambiguous trace of mammoth among the Yenisei archaeological sites younger than 15,000 yBP (except occasional bones, which could have been procured by prehistoric man elsewhere). The last mammoths seem to have existed in the Polar regions (Yakutia, the Gydansky and Taimyr peninsulas) as late as 11,000 to 9,600 yBP. A discovery of a Holo-cene degenerated population of dwarf mammoth at Wrangel Island, dated ca. 4,000 yBP became a true sensation (Vartanyan *et al.* 1993).

Woolly rhinoceros

Distribution of woolly rhinoceros (*Coelodonta antiquitatis*) was as wide as that of mammoth during the Karginsky. Its area expanded from the Kolyma and Anadyr' basins and the Sea of Okhotsk coastline to the Central Asia. Mousterian man at Altai regularly hunted woolly rhino. Among the Upper Paleolithic sites it was most abundant at Trans-Baikal. Rhinoceros is thought to consume grass. It became much rarer during the earlier phases of the Sartan. Remains of rhinoceros were not reported from the sites younger than 20,000 yBP in the Yenisei and Angara, although some West Siberian localities such as Mogochino I and Vengerovo V yielded their bones. Nevertheless, they were much more common in the east, so that in the Trans-Baikal they roamed the landscape up to the beginning of the Holocene.

Deer

Among the ungulates that constituted the main source of meat procurement the most abundant remains are those of reindeer (*Rangifer tarandus*). Reindeer remains occurred in the fauna of Mousterian cave sites; meanwhile it was not widely distributed in Altai during the Pleistocene. There is a clear indication that their remains increased with time at the Angara and Yenisei sites, especially in the Late Pleistocene, which could indicate specialised hunting. Numerous reindeer herds grazed in periglacial tundra and forest-tundra, feeding on grass and lichens. A cautionary note is appropriate in applying a model of large-distance seasonal migrations typical for Pleistocene reindeer population from the North to South Siberia. It seems that the evidence on modern reindeer populations in the last area with short-distance vertical migrations from woodland to highland meadows is more relevant to our data.
Apart from reindeer, prehistoric man hunted other deer, including red deer (*Cervus elaphus*) which occurred in faunal assemblages from the Mousterian. A discovery of red deer bones witness that even during the maxi-

mal expansion of mountain glaciers in South Siberia, some refugia of woodland did not ceased to exist.

Rare bones of roe deer (*Capreolus capreolus*) occurred in Mousterian Paleolithic living floors. Unambiguous evidence of roe deer exploitation began to occur from the second half of the Sartan, and its importance for humans seems to increase with time with other woodland species, such as red deer and elk (*Alces alces*). Some sites (Denisova cave) yielded bones of giant deer (*Megaloceros* giganteus) which is thought to be practically extinct in the Upper Pleistocene. It is worthwhile to mention a peculiar small form of deer - Siberian musk deer (*Moschus moschiferus*).

Bovids

Bison (*Bison priscus*) was one of the most abundant species in the Mousterian and Upper Paleolithic sites of Siberia. The area of its distribution in the Late Pleistocene covered all the territory up to the Gydansky and Taimyr peninsulas to the north, including Beringia as well. Bison inhabited both tundra and forest stands. Some authors (Ermolova 1978) distinguished long horn bison (*Bison priscus longicornis*) that survived till the Middle Würm, and a degenerate form (*Bison*

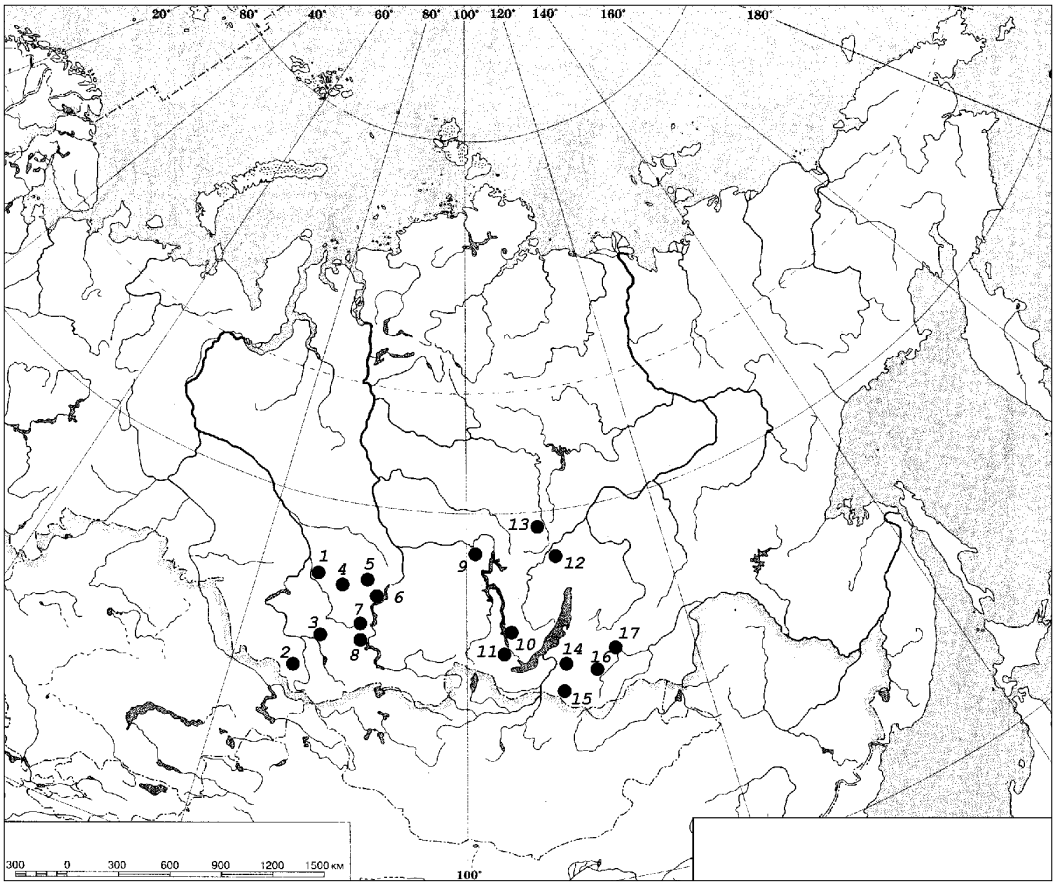

Figure 3 Map of major Middle Upper Paleolithic occurrences in Siberia. **1**: Tomskaia; **2**: Anui II; **3**: Ushlep VI; **4**: Shestakovo; **5**: Achinskaia; **6**: Tarachikha, Kashtanka I, Sabanikha, Kurtak IV and V, Shlenka, Novoselovo XIII, Primorskoe; **7**: Malaia Syia, Dvugazka Cave; **8**: Ui I; **9**: Ust'Kova; **10**: Krasnyi Iar I, Igeteiskii Log I; **11**: Sosnovyi Bor, Mal'ta, Buret', Buret' II; **12**: Alexeevsk I; **13**: Nepa; **14**: Kamenka I, Sannyi Mys; **15**: Kunalei; **16**: Arta II; **17**: Sokhatino II.

priscus deminutus) that was abundant in the Late Pleistocene. The site of Kokorevo I at the Yenisei yielded a unique evidence for active bison hunting - a bison scapula pierced by an antler spear point (Abramova 1979b). The bones of wild cattle (*Bos primigenius*) are more rarely found.

A specific south Siberian species is Baikal yak (*Poephagus baikalensis*). Its bones were identified from the Mousterian cave sites; meanwhile it is not clear if we are dealing with the Baikal yak or the modern yak. Later, the area of yak diminished and it survived mostly at Trans-Baikal. Goral (*Naemorhedus caudatus*) was hunted at the Maritime Province.

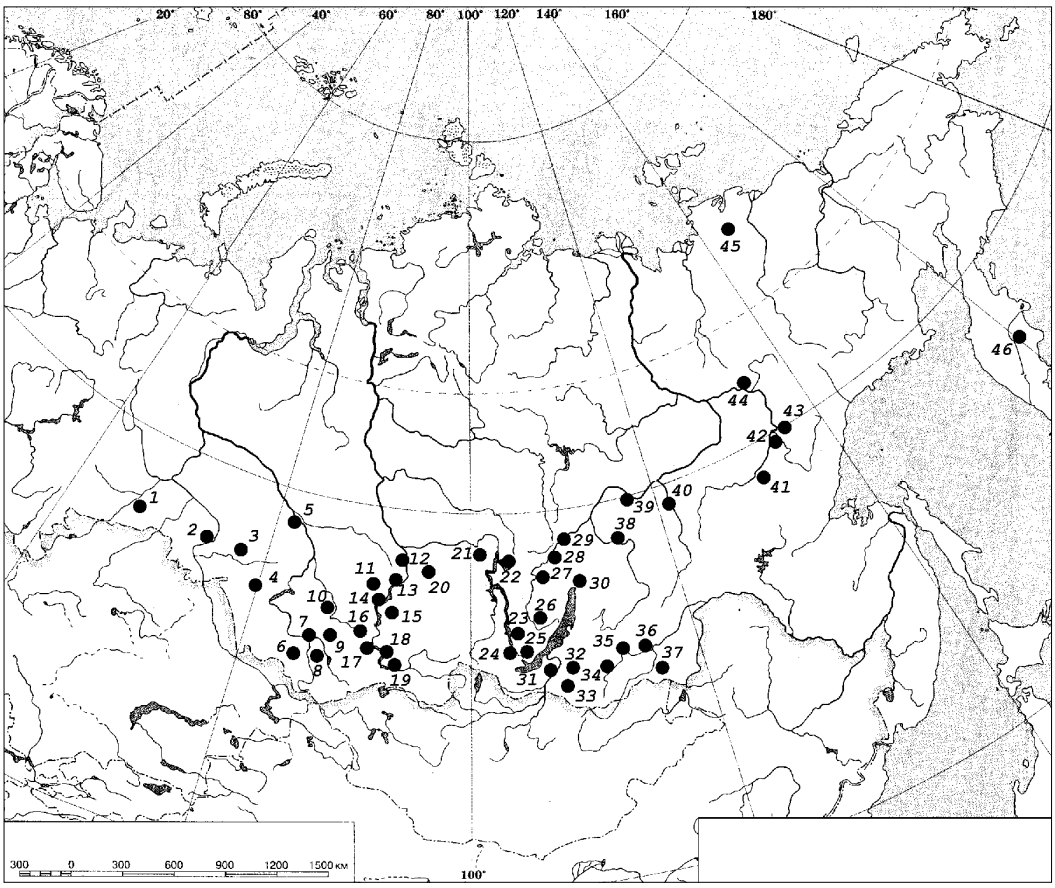

Figure 4 Map of major Late Upper Paleolithic occurrences in Siberia. **1**: Shikaevka II; **2**: Chernoozer'e II; **3**: Novo-Tartasskaia, Vengerovo V; **4**: Volch'ia Griva; **5**: Mogochino I; **6**: Kaminnaia Cave; **7**: Srostki, Chebashikhinskaia Gora; **8**: Maima, Ust'Kuium, Tytkesken' III; **9**: Ushlep III and VI, Dmitrieva; **10**: Shorokhovo I, Sarbala III, Bedarevo II; **11**: Berezovyi Ruchei I; **12**: Druzhinikha; **13**: Afontova Gora I to IV, Kacha I, Korovii Log II and III, Gremiachii Kliuch, Pereselencheskii Punkt; Karaul'nyi Byk, Shalunin Byk, Listvenka, Bol'shaia Slizneva, Biriusa I; **14**: Kokorevo I to IV, IVA, IVB, and VI, Tashtyk I, II and IV, Kurtak III, Divnyi I, Novoselovo VI, VII, and XIII, Aeshka II, Cheremushka, Chegerak, Chernovaia II, Abrashikha; **15**: Ulazy, Lepeshkino I, Buzunovo I and II; **16**: Sosnovoe Ozero; **17**: Oznachennoe I, Golubaia I, Maininskaia, Ui II; Kantegir; **18**: Nizhnii Idzhir I; **19**: Eilig-Khem; **20**: Mezensk, Strizhova Gora; **21**: Ust'Kova; **22**: Bol'shaia Kur'ia II; **23**: Krasnyi Iar I, Fediaevo; **24**: Sosnovyi Bor, Mal'ta, Ust'Belaia, Cheremushnik I and II, Shamotnyi Zavod, Kulakovo I; **25**: Verkholenskaia Gora I; **26**: Makarovo I and II, Shishkino II; **27**: Chaika II; **28**: Balyshovo III; **29**: Chastinskaia; **30**: Kurla III; **31**: Oshurkovo, Ust'Kiakhta IV and XVII; **32**: Sannyi Mys; **33**: Studenoe I, Kandabaevo, Chitkan, Ust'Menza I and II; **34**: Tanga; **35**: Sokhatino IV, Dvortsy; **36**: Kadakhta, Tsagan-Ola; **37**: Kubukhai, Chindant; Ikaral, Barzhigantai; **38**: Bol'shoi Iakor' I; **39**: Khaergas Cave; **40**: Novyi Leten I; **41**: Diuktaiskaia Cave; **42**: Verkhne Troitskaia, Ust'Mil' II; **43**: Ezhantsy; **44**: Ikhine I and II; **45**: Berelekh; **46**: Ushki I.

Antelope saiga (*Saiga tatarica*) inhabited cold tundra and steppes of Northern Asia. The role of saiga increased in faunal assemblages of the Final Pleistocene sites. Gazelle (*Gazella subgutturosa*) and Mongolian gazelle (*Procapra gutturosa*) were less abundant. These species occurred mostly in Trans-Baikal along with another peculiar Trans-Baikal animal, the spiral horn antelope (*Spiroceros kiakhtensis*), which survived in this area till the end of Pleistocene. The sites located in montane areas produced bones of wild sheep (*Ovis ammon*), which animal was abundant at plateaux, slopes and piedmont areas in the South Siberian mountains. A snowy sheep (*Ovis nivicola*) is more rarely found. Mountainous areas of Altai and Sayans yielded Siberian wild goat (*Capra sibirica*). The peculiar ecological setting of this animal (rocky cliffs and gorges) permitted a mostly individual hunt.

Horses

Periglacial steppes were the main biome for herds of wild horse (*Equus* sp.). Practically all known Mousterian and Upper Paleolithic localities yielded horse bones. The end of the Pleistocene witnessed the survival of wild horse only in the northeastern corner of Asia. Another inhabitant of the periglacial grass and shrub steppe was the Asiatic wild ass (*Equus hemionus*); it occupied ecological niches similar to those of the horse. Wild asses, like horse, are believed to make long-distance seasonal migrations. These were one of the most important game animals during the Mousterian.

Carnivores

Brown bear (*Ursus arctos*), wolverine (*Gulo gulo*) and wolf (*Canis lupus*) represent carnivores, which are far from being numerous in faunal assemblages of the Paleolithic sites. Altai caves added two species of cave bear to this roster - *Ursus spelaeus* and *Spelaearctos uralensis*. Discussing the wolf remains, it seems impossible to avoid the intriguing problem about age and place of initial dog domestication. In the past some authors (Gromov 1948) reported discoveries of dog bones from the Upper Paleolithic sites of Yenisei. Meanwhile Olsen (1985) regarded these identifications as dubious, so a re-examination of the data is needed. While discussing the fauna of Paleolithic sites, it is worthwhile to mention the discoveries of red fox (*Vulpes vulpes*) and Polar fox (*Alopex lagopus*). These were hunted for their fur. Several cave and open-air sites yielded bones of cave lion (*Panthera spelaea*) - a peculiar species of carnivora. His area in Pleistocene covered all Siberia to the Beringia while the disappearance of large herds of ungulates in Final Pleistocene resulted in its extinction. This is also the case for spotted hyena (*Crocuta spelaea*).

Other

Another species of some economic importance was hare (*Lepus* sp.). Paleolithic sites yielded bones of different birds (*Aves*) and fish (*Pisces*). The bones of latter are rare in sites older than Final Paleolithic, which seems to be related to a different degree of bone preservation.

DATABASE

The paper summarises the available data from 29 Middle and 321 Upper Paleolithic faunal assemblages (only large mammals are included in the analysis), arranged in chronological and geographical order (Tables 2 to 5, listed in the Appendix at the end of this paper). The oldest Middle Paleolithic evidence seems to be found from the lowermost layers of the Denisova Cave at Altai. These produced TL-dates from c. 282,000 yBP onwards. But most of the absolute dates associated with Mousterian levels are of Karginsky age, lying between 45,000 and 30,000 yBP. Therefore, if all these data are indeed correct, we have only very early and very late ages for the Siberian Middle Paleolithic assemblages. The Upper Paleolithic is divided into three phases - Early, Middle and Late. The earliest phase of the Upper Paleo-

lithic could be dated between c. 34,000 to 27,000-26,000 yBP, while the Middle phase covers the time span between 27,000-24,000 to 18,000 yBP. The Late Upper Paleolithic lies from ca. 16,000 to 15,000 to 10,500 yBP.

DISCUSSION AND CONCLUSIONS

On the basis of the data presented in Tables 2-5, we could make some preliminary suggestions about the faunal exploitation and subsistence practices of Pleistocene Man. Subsistence activities of the Middle Paleolithic were based on hunting of ungulates (mostly horse, wild goat, bison, deer, wild ass). Okladnikov Cave evidences mostly horse procurement while the inhabitants of Denisova also hunted bison, yak, wild sheep and goat. The fauna of the Dvuglazka Rockshelter was dominated by wild ass and horse, that of Ust'Kanskaia Cave by wild sheep and hare. It should be added that Okladnikov Cave witnesses also a prominent role of bird hunting and fishing. Meanwhile it is unlikely that specialised hunting took place and we need additional information to reconstruct subsistence behaviour.

As is the case for many Upper Paleolithic populations throughout the Old World, inhabitants of Siberia relied heavily on big game hunting during the late Pleistocene, exploiting mainly large ungulates. Faunal assemblages of Early Upper Paleolithic sites only slightly differ from those of the Mousterian. Horse, wild ass, sheep and woolly rhino were the major game. The Middle Upper Paleolithic sites witness intensive procurement of reindeer, mammoth and woolly rhinoceros and the sites of Kashtanka I, Malaia Syia, Mal'ta and Buret' evidence specialised reindeer hunting. Of course, hunting was not for meat only and discoveries of numerous bones of polar fox, wolverine, fox and wolf at Mal'ta implies the source of fur for Paleolithic inhabitants. The Final Paleolithic saw the diversification of hunting activities in different areas of Siberia. While bison and mammoth were important game in West Siberia, the Paleolithic inhabitants of Altai and Tom' exploited mostly wild horse and bison and these sites lack traces of reindeer. On the contrary, the Final Paleolithic of Yenisei evidenced specialised reindeer procurement along with intensive hunting for horse, bison and wild sheep. Several habitations of Listvenka, Biriusa I and Kokorevo III evidenced specialised hare procurement. Southwards, at the West Sayan, Paleolithic hunters procured mostly bison, red deer and ibex; at the Angara horse, bison, and red deer, later supplemented by roe deer; at the Trans-Baikal reindeer, horse, wild sheep, bison and spiral horn antelope. The eastern Trans-Baikal witnessed woolly rhino hunting. At Yakutia, mammoth, bison, horse and reindeer with occasional rhino were major game. This big game hunting was supplemented by procurement of carnivores as a fur source (polar fox, red fox, wolf) and by bird hunting, especially grouse.

Slotted bone and antler spear points, which are so widely found, should have been very important hunting weapons. At Kokorevo I, the importance of these weapons is evidenced by a piece of bison scapula pierced by the point of a projectile. However, there is no indication that ancient hunters of Siberia knew bows and arrows until immediately before the end of the Paleolithic since they are known only at Verkholenskaia Gora I and Ust'Belaia. Animal bodies should have been dismembered on site to bring in meaty parts, so that usually long bones and vertebrae were found together at base-camp sites.

Compared to hunting, evidence of gathering is extremely scanty, which could be partly explained by the severe Siberian climate. The evidence is limited to occasional pestles and a grinding stone slap found from Layer 2 of Ui II, which might imply the increased importance of gathering at the end of Paleolithic.

Abundant fish bones in Mousterian layers of the Okladnikov Cave seem to demonstrate that fishing was already important before the beginning of the Upper Paleolithic. Fish bones are rather rare in general among the

Upper Paleolithic faunal assemblages because of bad preservation. Nevertheless, fishing should have been important, and especially during the final phase of Upper Paleolithic it should have played a role as important as hunting. Such sites like Chernoozer'e II at Western Siberia, Ust'Belaia and Verkholenskaia Gora in the Angara basin, Makarovo I and II in the Upper Lena basin, Strizhova Gora in the Kan basin and Oshurkovo in the western Trans-Baikal are all with plenty of fish bones. Also, the oldest harpoons are known from these, and the fish-hooks found at Strizhova Gora and Sosnovyi Bor are the oldest fishhooks so far known.

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APPENDIX Table 2

Faunal remains (large mammals) of the Middle Paleolithic sites of Siberia. Where possible, NISP is indicated; MNI is shown in brackets. References: **1**: Derevianko *et al.* 1990, Germonpre 1993, Ovodov & Ivleva 1986, Baryshnikov 1998, **2**: Derevianko & Markin 1992; **3**: Okladnikov *et al.* 1973; **4**: Derevianko et al. 1990; **5**: Tseitlin 1979; **6**: Derevianko *et al.* 1998; **7**: Derevianko *et al.* 1992b; **8**: Ovodov & Martynovich 1992; **9**: Okladnikov *et al.* 1975; **10**: Ovodov *et al.* 1992; **11**: Ovodov & Tomilova 1998; **12**: Kirillov & Kasparov 1990.

Sites		Denisova	Okladnikov					
Layers		1	1	2	3	4	5	6
References		1	2					
Proboscideae								
Mammoth	Mammuthus primigenius	+	+	+				+
Perissodactyla								
Horse	Equus caballus	+	+	+	+	+		+
Asiatic wild ass	Equus hemionus				+			
Wooly rhinoceros	Coelodonta antiquitatis	+	+	+	+		+	+
Artiodactyla								
Red deer	Cervus elaphus	+	+	+	+		+	+
Roe deer	Capreolus capreolus	+		+	+		+?	
Giant deer	Megaloceros sp.	+						
Elk	Alces alces	+						
Reindeer	Rangifer tarandus	+			+			
Baikal yak	Poephagus baikalensis	+						
Bison	Bison priscus	+		+	+		+	+
Bison/yak	Bison/poephagus	+						
Wild sheep	Ovis ammon	+			+		+	+
Saiga antelope	Saiga tatarica	+						
Ibex	Capra sibirica	+		+	+			
Ibex/Sheep	Capra/ovis	+						
Carnivora								
Wolf	Canis lupus	+	+	+			+	+
Red fox	Vulpes vulpes	+		+	+	+	+	+
Corsac	Vulpes corsac	+				+		
Dhole	Cuon alpinus	+						
Brown bear	Ursus arctos	+		+	+			
Cave bear	Ursus spelaeus	+						
Sable	Martes zibellina	+						
Marten	Martes martes	+?						
Wolverine	Gulo gulo				+?			
Ermine	Mustela erminae	+						+
Weasel	Mustela nivalis	+						
Polecat	Putoris eversmani	+			+?			
Otter	Lutra lutra	+?						
Spotted hyaena	Crocuta spelaea	+	+	+	+	+	+	+
Cave lion	Panthera spelaea				+		+	+?
Bob cat	Felis lynx				+			+

APPENDIX Table 2, continued

Sites		Okladnikov		Strashnaia	Kaminnaia			
Layers		7	without layer	3	B1	B2	V	G
References		2		3	4			
Perissodactyla								
Horse	Equus caballus	+						
Horse/ass	Equus sp.				+	+	+	+
Wooly rhinoceros	Coelodonta antiquitatis	+		+	+	+		
Artiodactyla								
Red deer	Cervus elaphus			+			+	+
Roe deer	Capreolus capreolus					+		
Bison	Bison priscus			+				
Bison/yak	Bison/poephagus				+		+	+
Wild sheep	Ovis ammon			+				
Saiga antelope	Saiga tatarica			+?				
Ibex/Sheep	Capra/ovis					+	+	
Carnivora								
Wolf	Canis lupus			+	+			
Red fox	Vulpes vulpes			+			+	
Dhole	Cuon alpinus		+					
Brown bear	Ursus arctos	+		+				+
Sable	Martes zibellina		+					
Weasel	Mustela nivalis		+					
Altai weasel	Mustela altaica		+					
Badger	Meles meles		+	+				
Otter	Lutra lutra			+				
Spotted hyaena	Crocuta spelaea			+	+		+	
Bob cat	Felis lynx						+	

Sites		Kaminnaia	Ust'Kanskaia					
Layers		D	2	3	4	5	6	without layer
References		4	5					
Perissodactyla								
Horse	Equus caballus		+			+	+	62(4)
Asiatic wild ass	Equus hemionus							40(3)
Horse/ass	Equus sp.	+						
Wooly rhinoceros	Coelodonta antiquitatis				+			10(1)
Artiodactyla								
Baikal yak	Poephagus baikalensis							27(2)
Bison/yak	Bison/poephagus	+		+?				
Spiral-horn antelope	Spiroceros kiakhtensis							19(1)
Mongolian gazelle	Gazella gutturosa							30(2)
Wild sheep	Ovis ammon		+				+	159(5)
Ibex/Sheep	Capra/ovis	+						
Carnivora								
Wolf	Canis lupus	+						23(1)
Red fox	Vulpes vulpes						+	1(1)
Brown bear	Ursus arctos	+						3(3)
Ermine	Mustela erminae							1(1)
Badger	Meles meles							1(1)
Spotted hyaena	Crocuta spelaea	+						35(2)

APPENDIX Table 2, continued

Sites		Ust'Karakol I	Kara-Bom		Mokhovo II	Dvuglazka	
Layers		13 to 18	M1	M2		5	6
References		1	6		7	8	
Proboscideae							
Mammoth	Mammuthus primigenius		+			1	
Perissodactyla							
Horse	Equus caballus	+			+	132	51
Horse/ass	Equus sp.	+	+	+			
Wooly rhinoceros	Coelodonta antiquitatis		+	+	+	65	32
Artiodactyla							
Red deer	Cervus elaphus					2	3
Baikal yak	Poephagus baikalensis	+					
Bison	Bison priscus					26	12
Bison	Bison sp.		+	+			
Mongolian gazelle	Gazella gutturosa					57	14
Wild sheep	Ovis ammon	+					
Snowy sheep	Ovis nivicola					1	
Saiga antelope	Saiga tatarica					2	
Ibex	Capra sibirica	+	+	+			
Ibex/Saiga	Capra/saiga					57	
Carnivora						1	2
Arctic fox	Alopex lagopus					5	
Cave bear	Ursus spelaeus					5	
Otter	Lutra lutra					49	24
Cave lion	Panthera spelaea		+	+			

APPENDIX Table 2, continued

Sites		Dvuglazka		Proskuriakov		Ust'Izhul'	Arta II
Layers		7	without layer				5
References		8		9	10	11	12
Proboscideae							
Mammoth	Mammuthus primigenius			2(1)	18(2)	200(11)	+
Perissodactyla							
Horse	Equus caballus	1		29(2)	22(7)		
Asiatic wild ass	Equus hemionus		+		5(2)		
Horse/ass	Equus sp.					6(1)	
Wooly rhinoceros	Coelodonta antiquitatis			6(2)	95(3)	1(1)	+
Artiodactyla							
Red deer	Cervus elaphus			18(5)	83(14)		
Roe deer	Capreolus capreolus			1(1)			
Deer	Cervus sp.				5(2)		
Elk	Alces alces		+	5(1)	3(1)		
Reindeer	Rangifer tarandus		+				
Baikal yak	Poephagus baikalensis				5(3)		
Bison	Bison priscus	1		1(1)	10(5)	1(1)	+
Bison	Bison sp.					1(1)	
Mongolian gazelle	Gazella gutturosa		+				
Wild sheep	Ovis ammon	2		1(1)	15(9)		
Saiga antelope	Saiga tatarica			2(2)	32(16)		
Ibex	Capra sibirica			2(1)	9(6)		
Carnivora							
Wolf	Canis lupus			5(1)	22(3)		
Arctic fox	Alopex lagopus			1(1)	1(1)?		
Red fox	Vulpes vulpes			7(3)	77(3)		
Brown bear	Ursus arctos			1(1)	3(2)		
Cave bear	Ursus spelaeus		+				
Wolverine	Gulo gulo		+		2(1)		
Badger	Meles meles				3(1)	2(1)	
Spotted hyaena	Crocuta spelaea			2(1)	95(11)		+
Cave lion	Panthera spelaea		+		1(1)		+
Tiger	Panthera uncia			1(1)	2(1)		
Bob cat	Felis lynx				5(1)		

APPENDIX Table 3

Faunal remains (large mammals) of the Early Upper Paleolithic sites of Siberia. Where possible, NISP is indicated; MNI is shown in brackets. References: **1**: Derevianko *et al.* 1998; **2**: Ovodov 1988; **3**: Derevianko *et al.* 1990; **4**: Okladnikov *et al.* 1973; **5**: Drozdov & Artem'ev 1997b; **6**: Larichev & Kholiushkin 1995; **7**: Vorob'eva *et al.* 1998; **8**: Vasil'evskii *et al.* 1988; **9**: Vorob'eva *et al.* 1990; **10**: Gerasimov 1926; **11**: Aksenov 1993; **12**: Ovodov 1987, Vasil'ev *et al.* 1987; **13**: Ovodov 1987; **14**: Germonpré & Lbova 1996; **15**: Tseitlin *et al.* 1987; **16**: Bazarov *et al.* 1982; **17**: Tashak 1996; **18**: Kirillov & Kasparov 1990; **19**: Okladnikov *et al.* 1968.

Sites		Kara-Bom				Kara-Tenesh	Ust'Karakol I
Layers		3	4	5	6		2
References		1				2	3
Proboscideae							
Mammoth	Mammuthus primigenius					+	
Perissodactyla							
Horse	Equus caballus					+	
Asiatic wild ass	Equus hemionus					+	
Wild ass	Equus hidruntinus				+		
Horse/ass	Equus sp.		+		+		
Artiodactyla							
Red deer	Cervus elaphus					+	+
Elk	Alces alces					+	
Baikal yak	Poephagus baikalensis					+	
Bison	Bison priscus					+	+
Bison	Bison sp.		+	+			
Ibex	Capra sibirica	+			+	+	
Carnivora							
Red fox	Vulpes vulpes					+	
Spotted hyaena	Crocuta spelaea				+		

APPENDIX Table 3, continued

Sites		Anui I	Maloialomanskaia	Strashnaia		Biika II
Layers		3	2	3a	3b	
References		3	1	4		1
Proboscideae						
Mammoth	Mammuthus primigenius			+	+	
Perissodactyla						
Horse	Equus caballus	1		+	+	
Asiatic wild ass	Equus hemionus	1			+	
Horse/ass	Equus sp.		+	+	+	
Wooly rhinoceros	Coelodonta antiquitatis	1	+	+?	+	+
Artiodactyla						
Red deer	Cervus elaphus			+	+	
Roe deer	Capreolus capreolus			+	+	
Elk	Alces alces			+	+	
Baikal yak	Poephagus baikalensis		+?			
Bison	Bison priscus			+?	+	
Bison	Bison sp.	+?				
Wild sheep	Ovis ammon			+		
Ibex	Capra sibirica	+	+			
Carnivora						
Wolf	Canis lupus		+	+	+	
Red fox	Vulpes vulpes		+	+		
Brown bear	Ursus arctos			+		
Cave bear	Spelaearctos uralensis			+?		
Ermine	Mustela erminae			+		
Weasel	Mustela nivalis			+		
Polecat	Putoris eversmani			+		
Badger	Meles meles			+		
Otter	Lutra lutra			+		
Spotted hyaena	Crocuta spelaea		+	+?		+
Tiger/lion	Panthera sp.					+
Snow leopard	Uncia uncia		+			
Manul cat	Felis manul		+			

APPENDIX Table 3, continued

Sites		Afontova Gora V	Malaia Syia	Brazhnoe	Ust'Kova
Layers			3		lower
References		5	6	7	8
Proboscideae					
Mammoth	Mammuthus primigenius		2(1)		327
Perissodactyla					
Horse	Equus caballus	+	40(2)	+	
Asiatic wild ass	Equus hemionus				+
Horse/ass	Equus sp.		31		
Wooly rhinoceros	Coelodonta antiquitatis		3(2)		+
Artiodactyla					
Red deer	Cervus elaphus		12(2)	+	
Reindeer	Rangifer tarandus	+	223(6)		+
Bison	Bison sp.	+	54(3)		
Wild sheep	Ovis ammon		3(2)		
Saiga antelope	Saiga tatarica		1(1)		
Ibex	Capra sibirica		3(2)		
Ibex/sheep	Capra/ovis		54(3)		
Carnivora					
Red fox	Vulpes vulpes		2(1)		
Brown bear	Ursus arctos		4(1)		
Spotted hyaena	Crocuta spelaea		2(1)		
Cave lion	Panthera spelaea	+			

Sites		Arembovskii	Voennyi Gospital		Kaiskaia Gora	Makarovo IV
Layers				1 to 3		
References		9	9		10	11
Proboscideae						
Mammoth	Mammuthus primigenius		+?		+	
Perissodactyla						
Horse	Equus caballus	1	+	+	+	
Wooly rhinoceros	Coelodonta antiquitatis		+?			
Artiodactyla						
Red deer	Cervus elaphus		+			
Deer	Cervus eucervus		+			
Manchurian deer	Cervus elaphus xanthopigus		+			
Roe deer	Capreolus capreolus		+			
Elk	Alces alces				+	
Reindeer	Rangifer tarandus		+		+	+
Aurochs/bison	Bos/bison		+		+	

APPENDIX Table 3, continued

Sites		Makarovo III	Tolbaga	Varvarina Gora	Kamenka I	
Layers					A	A
References		11	12	13	14	
Proboscideae						
Mammoth	Mammuthus primigenius	+	+			
Perissodactyla						
Horse	Equus caballus	+	78(3)	247(8)	150(6)	28(4)
Asiatic wild ass	Equus hemionus		1(1)	3(1)		1(1)
Wooly rhinoceros	Coelodonta antiquitatis	+	265(4)	192(4)	5(1)	2(1)
Artiodactyla						
Camel	Camelus sp.				3(1)	
Red deer	Cervus elaphus	+	8(1)			
Giant deer	Megaloceros sp.				2(1)	
Reindeer	Rangifer tarandus	+	13(1)	1(1)		
Baikal yak	Poephagus baikalensis		3(2)	5(2)		
Bison	Bison priscus		+		5(1)	8(1)
Bison	Bison sp.		15(2)?			
Aurochs	Bos primigenius	+				
Aurochs/bison	Bos/bison				11	3
Spiral-horn antelope	Spiroceros kiakhtensis		11(1)	8(1)	1(1)	
Goitred gazelle	Gazella subgutturosa		+			
Mongolian gazelle	Procapra gutturosa		13(1)	348(17)	225(6)	2(1)
Wild sheep	Ovis ammon	+	70(4)	125(7)	4(1)	3(2)
Snowy sheep	Ovis nivicola	+				
Saiga antelope	Saiga tatarica		+			
Ibex	Capra sibirica			7(1)		
Carnivora						
Wolf	Canis lupus	+	12(2)	76(3)		
Red fox	Vulpes vulpes			2(1)		
Corsac	Vulpes corsac			5(1)		
Brown bear	Ursus arctos	+		1(1)		
Cave lion	Panthera spelaea				1(1)	

Sites		Kamenka I	Priiskovaia	Mel'nichnoe	Podzvonkaia	Arta III
Layers		C		2		
References		14	15	16	17	18
Perissodactyla						
Horse	Equus caballus	13(2)	+		?(3-5)	
Wooly rhinoceros	Coelodonta antiquitatis	1(1)		+	+	+
Artiodactyla						
Red deer	Cervus elaphus					+
Deer	Cervus sp.		+			
Bison	Bison priscus	1(1)	+			+
Mongolian gazelle	Procapra gutturosa	1(1)				
Wild sheep	Ovis ammon				?(3)	

APPENDIX Table 3, continued

		Sites	Geographical Society Cave
		Layers	
		References	19
Proboscideae			
Mammoth	Mammuthus primigenius		+
Perissodactyla			
Horse	Equus caballus		+
Wooly rhinoceros	Coelodonta antiquitatis		+
Artiodactyla			
Manchurian deer	Cervus elaphus xanthopigus		+
Roe deer	Capreolus capreolus		+
Musk-deer	Moschus moschiferus		+
Bison	Bison priscus		+
Goral	Naemorphedus caudatus		+
Carnivora			
Wolf	Canis lupus		+
Brown bear	Ursus arctos		+
Spotted hyaena	Crocuta spelaea		+
Tiger/lion	Panthera sp.		+

APPENDIX Table 4

Faunal remains (large mammals) of the Middle Upper Paleolithic sites of Siberia. Where possible, NISP is indicated; MNI is shown in brackets. References: **1**: Kashchenko 1901; **2**: Derevianko *et al.* 1998; **3**: Kungurov 1998; **4**: Okladnikov & Molodin 1980/1981; **5**: Avramenko 1963, Anikovich 1976, Larichev & Arustamian 1987; **6**: Larichev & Kholiushkin 1995; **7**: Ovodov & Martynovich 1992; **8**: Lisitsyn 1997; **9**: Derevianko *et al.* 1992a; **10**: Abramova 1983: **11**:Astakhov *et al.* 1993; **12**:Vasil'ev 1996; **13**:Vasil'evskii *et al.* 1988; **14**: Medvedev 1969; **15**: Medvedev 1982; **16**: Ermolova 1978; **17**: Berdnikova *et al.* 1991; **18**: Lezhnenko *et al.* 1982; **19**: Zadonin 1996; **20**: Zadonin & Semin 1990; **21**: Okladnikov & Kirillov 1980; **22**: Germonpré & Lbova 1996; **23**: Konstantinov 1994; **24**: Kirillov & Kasparov 1990.

Sites		Tomskaia	Anui II	Ushlep VI	Anui II	Ushlep VI	Shestakovo
Layers			11	3	11	3	
References		1	3	4	2	3	4
Proboscideae							
Mammoth	Mammuthus primigenius	+					+
Perissodactyla							
Horse	Equus caballus					+	+
Artiodactyla							
Reindeer	Rangifer tarandus						+
Bison	Bison priscus		+		+	+	+
Carnivora							
Arctic fox	Alopex lagopus						+
Brown bear	Ursus arctos						+

Sites		Achinskaia	Malaia Syia		Dvuglazka	Sabanikha	Kurtak IV
Layers			1	2	4		main
References		5	6		7	8	8
Proboscideae							
Mammoth	Mammuthus primigenius	+			+		+
Perissodactyla							
Horse	Equus caballus	+		6(1)	62		
Asiatic wild ass	Equus hemionus		1(1)	2(1)	62		+
Wooly rhinoceros	Coelodonta antiquitatis				13		
Artiodactyla							
Red deer	Cervus elaphus		1(1)	6(1)	1	+	+
Roe deer	Capreolus capreolus				2		
Reindeer	Rangifer tarandus		2(1)	23(1)	+	+	
Baikal yak	Poephagus baikalensis				+		
Bison	Bison priscus		5(1)	7(1)	7	+	+
Wild sheep	Ovis ammon		1(1)	+?	87	+	+
Snowy sheep	Ovis nivicola				1		
Saiga antelope	Saiga tatarica	+					
Ibex/saiga	Capra/saiga	+					
Ibex/sheep	Capra/ovis	+	3(1)	53(5)			
Carnivora							
Wolf	Canis lupus	+			2		
Arctic fox	Alopex lagopus	+				+	
Red fox	Vulpes vulpes				2		
Corsac	Vulpes corsac				1?		
Brown bear	Ursus arctos						+?
Spotted hyaena	Crocuta spelaea				29		
Tiger/lion	Panthera sp.						+

APPENDIX Table 4, continued

Sites		Kurtak V	Primorskoe		NovoselovoXIII	Kashtanka I	
Layers			Loc. 1	Loc. 2	3	1	2
References		8	8		8	9	
Proboscideae							
Mammoth	Mammuthus primigenius			+			
Perissodactyla							
Horse	Equus caballus	+				2(1)	
Asiatic wild ass	Equus hemionus	+					
Artiodactyla							
Red deer	Cervus elaphus	+				1(1)	
Reindeer	Rangifer tarandus				+	223(5)	+
Bison	Bison priscus	+	+			41(2)	+
Carnivora							
Red fox	Vulpes vulpes					2(1)	

Sites		Tarachikha, Loc.1	Shlenka	Ui I			
Layers				2	2/1	2/2	2/3
References		10	11	12			
Proboscideae							
Mammoth	Mammuthus primigenius	124(8)	+				
Perissodactyla							
Horse	Equus caballus	1(1)	+				
Asiatic wild ass	Equus hemionus		+	28(3)		18(2)	16(3)
Horse/ass	Equus sp.			1(1)			1(1)
Artiodactyla							
Red deer	Cervus elaphus		+			4(1)	
Elk	Alces alces		+				
Reindeer	Rangifer tarandus	6(1)	+				
Bison	Bison priscus	1(1)	+	9(1)		22(2)	21(2)
Aurochs/bison	Bos/bison	2					
Wild sheep	Ovis ammon	4(2)	+	8(1)			9(2)
Ibex	Capra sibirica					10(3)	16(2)
Ibex/sheep	Capra/ovis			31(3)	4(1)	28(3)	23(3)
Carnivora							
Wolf	Canis lupus		+				
Arctic fox	Alopex lagopus	1(1)	+				
Red fox	Vulpes vulpes		+	1(1)			
Brown bear	Ursus arctos		+				

APPENDIX Table 4, continued

Sites		Ust'Kova	Krasnyi Iar I		Igeteiskii Log I	Mal'ta	Buret'
Layers		middle	6	7		main	
References		13	14		15	16	16
Proboscideae							
Mammoth	Mammuthus primigenius	+				?(16)	6(2)
Perissodactyla							
Horse	Equus caballus				+	?(2)	
Asiatic wild ass	Equus hemionus	+					+
Horse/ass	Equus sp.						+
Wooly rhinoceros	Coelodonta antiquitatis	+	+		+	?(25)	8(3)
Artiodactyla							
Red deer	Cervus elaphus						4(4)
Reindeer	Rangifer tarandus	+	+	+	+	?(589)	42(24)
Bison	Bison priscus		+	+?		?(5)	2(2)
Aurochs	Bos sp.				+		
Snowy sheep	Ovis nivicola					+?	
Sheep	Ovis sp.					?(1)	
Carnivora							
Wolf	Canis lupus					?(1)	
Arctic fox	Alopex lagopus					?(50)	+
Red fox	Vulpes vulpes					?(3)	
Brown bear	Ursus arctos					+?	
Wolverine	Gulo gulo					?(4)	
Tiger/lion	Panthera sp.					?(1)	

Sites		Buret' II	Sosnovyi Bor	Alexeevsk I	Nepa	Sannyi Mys	
Layers			5			6	7
References		17	18	19	20	21	
Proboscideae							
Mammoth	Mammuthus primigenius			+			
Perissodactyla							
Horse	Equus caballus	+	3		+		
Wooly rhinoceros	Coelodonta antiquitatis	+				+	+
Artiodactyla							
Red deer	Cervus elaphus		1	+?			
Roe deer	Capreolus capreolus			+	+		
Reindeer	Rangifer tarandus	+		+	+	+	+
Bison	Bison priscus	+	1			+	
Spiral-horn antelope	Spiroceros kiakhtensis					+	+
Ibex	Capra sibirica					+	
Carnivora							
Wolf	Canis lupus	+?					
Brown bear	Ursus arctos				+?		

APPENDIX Table 4, continued

Sites		Kamenka I	Kunalei	Sokhatino II	Arta II
Layers		B	3	5	1 to 3
References		22	23	24	24
Proboscideae					
Mammoth	Mammuthus primigenius	1(1)		+	
Perissodactyla					
Horse	Equus caballus		+	+	+
Wooly rhinoceros	Coelodonta antiquitatis	2(1)	+	+	+
Artiodactyla					
Deer	Cervus sp.		+?		
Bison	Bison priscus	3(1)	+?	+	+
Mongolian gazelle	Procapra gutturosa	1(1)			
Saiga antelope	Saiga tatarica				+
Carnivora					
Brown bear	Ursus arctos		+		

APPENDIX Table 5

Faunal remains (large mammals) of the Late Upper Paleolithic sites of Siberia. Where possible, NISP is indicated; MNI is shown in brackets. References: **1**: Petrin 1986; **2**: Gening & Petrin 1985; **3**: Okladnikov & Molodin 1983; **4**: Okladnikov *et al.* 1971; **5**: Derevianko *et al.* 1990, 1998; **6**: Gromov 1948; **7**: Kungurova 1994; **8**: Kungurov 1993; **9**: Lapshin & Kadikov 1981; **10**: Kungurov 1987; **11**: Markin 1998; **12**: Shun'kov 1987; **13**: Markin 1986; **14**: Vishniatskii *et al.* 1986; **15**: Abramova *et al.* 1991; **16**: Gromov 1948, Astakhov 1966; **17**: Drozdov & Artem'ev 1997a; **18**: Gromov 1948, Sosnovskii 1935; **19**: Derevianko *et al.* 1992a, Akimova 1998; **20**: Gromov 1948, Auerbach & Gromov 1935; **21**: Kuzmina & Sinitsyna 1995; **22**: Makarov & Yamskikh 1995; **23**: Makarov *et al.* 1995; **24**: Abramova 1979a; **25**: Astakhov 1987; **26**: Lisitsyn 1997; **27**: Abramova 1979b; **28**: Akimova *et al.* 1995; **29**: Lipskii 1963; **30**: Astakhov 1986; **31**: Vasil'ev 1996; **32**: Astakhov 1993; **33**: Kol'tsov & Medvedev 1989; **34**: Generalov & Dziubas 1987; **35**: Vasil'evskii *et al.* 1988; **36**: Vasil'evskii 1978; **37**: Ermolova 1978; **38**: Lezhnenko *et al.* 1982; **39**: Medvedev 1971; **40**: Aksenov 1969; **41**: Lezhnenko 1974; **42**: Gerasimov 1935; **43**: Tarasov 1978; **44**: Aksenov 1980; **45**: Aksenov 1974; **46**: Tseitlin 1979; **47**: Vorob'eva *et al.* 1990; **48**: Okladnikov 1964; **49**: Zadonin *et al.* 1991; **50**: Ineshin *et al.* 1991; **51**: Shmygun & Endrikhinskii 1978; **52**: Okladnikov 1960, 1961; **53**: Tashak 1996; **54**: Tashak 1993; **55**: Okladnikov & Kirillov 1980; **56**: Bazarov *et al.* 1982; **57**: Konstantinov 1994; **58**: Shamsutdinov 1966; **59**: Kasparov 1986; **60**: Kirillov & Kovychev 1976; **61**: Kirillov 1975, 1987; **62**: Ineshin 1995; **63**: Cherosov 1988; **64**: Mochanov 1977; **65**: Vereshchagin 1974; **66**: Dikov 1993.

Sites		Shikaevka II	Chernoozer'e II	Novo-Tartasskaia	Vengerovo V
Layers					
References		1	2	3	3
Proboscideae					
Mammoth	Mammuthus primigenius	227(2)		73	
Perissodactyla					
Horse	Equus caballus		9(1)		
Wooly rhinoceros	Coelodonta antiquitatis				1(?)
Artiodactyla					
Reindeer	Rangifer tarandus	+?			
Bison	Bison priscus		117(7)		23
Saiga antelope	Saiga tatarica	+	18(3)		
Carnivora					
Wolf	Canis lupus	+			
Wolverine	Gulo gulo		3(2)		

APPENDIX Table 5, continued

Sites		Volch'ia Griva	Mogochino I			Kaminnaia		
Layers			Exc. 1	Exc. 2	Exc. 3	A1	A3	10
References		4	1			5		
Proboscideae								
Mammoth	Mammuthus primigenius	1380	17(1)	2(1)	18(1)			
Perissodactyla								
Horse	Equus caballus	5	17(1)	3(1)	9(1)	+	+	
Horse/ass	Equus sp.							5
Wooly rhinoceros	Coelodonta antiquitatis		2(1)			+	+	1
Artiodactyla								
Red deer	Cervus elaphus						+	5
Roe deer	Capreolus capreolus					+		8
Elk	Alces alces					+?		
Reindeer	Rangifer tarandus		3(1)	2(1)	1(1)			
Bison	Bison priscus	2	1(1)?					
Bison/yak	Bison/poephagus					+	+	
Wild sheep	Ovis ammon							4
Ibex	Capra sibirica							7
Ibex/sheep	Capra/Ovis					+		
Carnivora								
Wolf	Canis lupus	5						
Fox/Arctic fox	Vulpes/alopex		4(1)					
Spotted hyaena	Crocuta spelaea							1

Sites		Kaminnaia				Srostki	Ust'Kuium
Layers		11	12	13	14		
References		5				6	7
Perissodactyla							
Horse	Equus caballus					+	
Asiatic wild ass	Equus hemionus	2					
Horse/ass	Equus sp.	31	2	1	5		
Wooly rhinoceros	Coelodonta antiquitatis	16			5		
Artiodactyla							
Red deer	Cervus elaphus	23	2		4		+
Roe deer	Capreolus capreolus	6					
Bison	Bison priscus						+
Aurochs/bison	Bos/bison	26			5		
Wild sheep	Ovis ammon	19	3	4	3		
Ibex	Capra sibirica	19	3	2	6		
Carnivora							
Wolf	Canis lupus	8	1		2		
Red fox	Vulpes vulpes	2					
Bear	Ursus sp.	1			2		
Spotted hyaena	Crocuta spelaea	8			1	+	
Cave lion	Panthera spelaea	5			1		

APPENDIX Table 5, continued

Sites		Chebashikhinskaia Gora	Maima	Tytkesken' III	Ushlep III
Layers			2	7	
References		8	9	8	10
Perissodactyla					
Horse	Equus caballus			+	
Artiodactyla					
Roe deer	Capreolus capreolus			+	
Elk	Alces alces			+	
Bison	Bison priscus	+	+	+	+
Aurochs	Bos primigenius		+		
Carnivora					
Brown bear	Ursus arctos			+	

Sites		Ushlep VI	Dmitrieva	Sarbala III	Bedarevo II	Shorokhovo I
Layers		2			2	
References		11	12	13	13	13
Proboscideae						
Mammoth	Mammuthus primigenius	+	+			
Perissodactyla						
Horse	Equus caballus	+		1	3	+?
Artiodactyla						
Bison	Bison priscus				1	

Sites		Berezovyi Ruchei I	Druzhinikha	Afontova Gora II		
Layers				B	C1-C2	C3
References		14	15	16		
Proboscideae						
Mammoth	Mammuthus primigenius		+	+		?(6)
Perissodactyla						
Horse	Equus caballus	+	+	+		?(2)
Asiatic wild ass	Equus hemionus					?(1)
Artiodactyla						
Red deer	Cervus elaphus					?(3)
Roe deer	Capreolus capreolus					?(2)
Reindeer	Rangifer tarandus	+	+	+	+	?(46)
Bison	Bison priscus	+		+		?(2)
Aurochs	Bos primigenius					?(1)
Wild sheep	Ovis ammon					?(3)
Saiga antelope	Saiga tatarica					?(2)
Ibex	Capra sibirica					?(3)
Carnivora						
Wolf	Canis lupus	+		+		?(2)
Wolf/dog	Canis sp.					?(2)
Arctic fox	Alopex lagopus					?(32)
Red fox	Vulpes vulpes					?(2)
Fox/Arctic fox	Vulpes/alopex	+				
Brown bear	Ursus arctos					?(1)
Wolverine	Gulo gulo					?(3)
Cave lion	Panthera spelaea					?(1)

APPENDIX Table 5, continued

Sites		Afontova Gora II						
Layers		1	2	3	3b	4	5	6
References		17						
Proboscideae								
Mammoth	Mammuthus primigenius	+	+	+		+	+	+
Perissodactyla								
Horse	Equus caballus				+	+		+
Artiodactyla								
Red deer	Cervus elaphus	+						
Reindeer	Rangifer tarandus	+			+	+		+
Bison	Bison priscus	+				+		
Wild sheep	Ovis ammon				+	+	+	+
Carnivora								
Arctic fox	Alopex lagopus					+		
Red fox	Vulpes vulpes	+				+		

Sites		Afontova Gora III		Afontova Gora III, Loc. 3		Afontova Gora I
Layers		upper	lower	1	2	
References		16		16		16
Proboscideae						
Mammoth	Mammuthus primigenius	+	+	+		+
Perissodactyla						
Horse	Equus caballus		+			+
Artiodactyla						
Red deer	Cervus elaphus					+
Roe deer	Capreolus capreolus					+
Reindeer	Rangifer tarandus	+	+	+	+	+
Bison	Bison priscus				+	+
Carnivora						
Wolf/dog	Canis sp.			+		
Brown bear	Ursus arctos		+			

Sites		Afontova Gora IV	Korovii Log II	Korovii Log III	Kacha I
Layers					
References		16	18	18	18
Proboscideae					
Mammoth	Mammuthus primigenius		+		+
Perissodactyla					
Horse	Equus caballus		+		
Reindeer	Rangifer tarandus	+	+		+
Bison	Bison priscus	+			
Aurochs	Bos primigenius		+		
Carnivora					
Wolf	Canis lupus				+
Arctic fox	Alopex lagopus		+?	+?	+

APPENDIX Table 5, continued

Sites		Gremiachii Kliuch	Pereselencheskii Punkt	Listvenka	
Layers				1 to 2	3
References		18	18	19	
Proboscideae					
Mammoth	Mammuthus primigenius	+			
Perissodactyla					
Horse	Equus caballus		+		
Red deer	Cervus elaphus		+		
Roe deer	Capreolus capreolus		+		
Elk	Alces alces			+	
Reindeer	Rangifer tarandus	+	+	+	+
Baikal yak	Poephagus baikalensis				+
Bison	Bison priscus			+	
Aurochs	Bos primigenius		+		
Ibex	Capra sibirica		+		
Carnivora					
Wolf	Canis lupus		+		
Cave lion	Panthera spelaea		+		

Sites		Listvenka						
Layers		4	5	6	7	8	9	10
References		19						
Proboscideae								
Mammoth	Mammuthus primigenius			+			+	
Perissodactyla								
Horse	Equus caballus	+			+	+	+	+
Asiatic wild ass	Equus hemionus							+?
Artiodactyla								
Red deer	Cervus elaphus			+			+	
Elk	Alces alces	+						
Reindeer	Rangifer tarandus	+	+	+	+	+	+	+
Bison	Bison priscus	+	+	+	+	+	+	+
Ibex/sheep	Capra/Ovis	+			+	+	+	+
Carnivora								
Wolf	Canis lupus				+	+		
Fox/Arctic fox	Vulpes/alopex							+

Sites		Listvenka						
Layers		11	12	13	14	15	16	17
References		19						
Proboscideae								
Mammoth	Mammuthus primigenius			+		+		
Perissodactyla								
Horse	Equus caballus		+		+			
Artiodactyla								
Red deer	Cervus elaphus					+		
Reindeer	Rangifer tarandus	+	+	+	+		+	+
Bison	Bison priscus	+	+	+	+	+	+	+
Ibex/sheep	Capra/Ovis		+		+	+		
Carnivora								
Wolf	Canis lupus		+		+			+

APPENDIX Table 5, continued

Sites		Listvenka		Bol'shaia Slizneva					
Layers		18	19	4	5	6	7	8	9
References		19		19					
Proboscideae									
Mammoth	Mammuthus primigenius		+				+		
Perissodactyla									
Horse	Equus caballus		+		+		+		
Artiodactyla									
Red deer	Cervus elaphus						+		
Elk	Alces alces						+		
Reindeer	Rangifer tarandus	+	+	+	+	+	+		
Bison	Bison priscus	+	+		+	+	+	+	+
Aurochs	Bos primigenius						+		
Wild sheep	Ovis ammon				+	+	+	+	
Ibex	Capra sibirica				+?		+	+?	
Carnivora									
Wolf	Canis lupus	+							

Sites		Biriusa I			Karaul'nyi Byk			Shalunin Byk	
Layers		B	C	1 to 4	3 to 5	6 to 8	9	5	6
References		20		21	22			23	
Perissodactyla									
Horse	Equus caballus	+	+?	+		+?			
Asiatic wild ass	Equus hemionus			+					
Artiodactyla									
Red deer	Cervus elaphus	+	+					+	
Roe deer	Capreolus capreolus	+	+?	+					
Elk	Alces alces	+					+		
Reindeer	Rangifer tarandus		+	+					
Bison	Bison priscus			+					
Aurochs	Bos primigenius	+	+						
Wild sheep	Ovis ammon	+							
Saiga antelope	Saiga tatarica			+	+	+			+
Ibex	Capra sibirica	+			+	+			
Ibex/sheep	Capra/Ovis		+						
Carnivora									
Wolf	Canis lupus	+?							
Red fox	Vulpes vulpes			+				+	+
Fox/Arctic fox	Vulpes/alopex				+				
Wolverine	Gulo gulo		+?						

APPENDIX Table 5, continued

Sites		Kokorevo II	Kokorevo IVA				
Layers			2	2n	3	4	Exc. 5
References		24	25				
Proboscideae							
Mammoth	Mammuthus primigenius	148			1		
Perissodactyla							
Horse	Equus caballus	93	26	+	1		2
Artiodactyla							
Red deer	Cervus elaphus	12					
Elk	Alces alces	11					
Reindeer	Rangifer tarandus	162	65	+	78	+	22
Bison	Bison priscus	15	7		6		
Wild sheep	Ovis ammon	21			1		2
Snowy sheep	Ovis nivicola				1		
Saiga antelope	Saiga tatarica	11					
Carnivora							
Wolf	Canis lupus	35					
Arctic fox	Alopex lagopus	1					
Lion/tiger	Panthera sp.	24					

Sites		Kokorevo IVB		Tashtyk I					
Layers		1	2		1	1 to 2	2	3	Exc. 2
References		15		24					
Perissodactyla									
Horse	Equus caballus			4	2		42	119(4)	2(1)
Artiodactyla									
Red deer	Cervus elaphus	1(?)		1	7			1(1)	
Roe deer	Capreolus capreolus	1							
Reindeer	Rangifer tarandus	57	67	31	11	2(1)	119	207(5)	
Bison	Bison priscus		2	3			18	3(1)	1(1)
Wild sheep	Ovis ammon				12	9(1)	52	25(4)	2(1)
Saiga antelope	Saiga tatarica			2	3		11	3(1)	
Carnivora									
Wolf	Canis lupus							1	
Wolf/dog	Canis sp.	3	2						
Arctic fox	Alopex lagopus					15(2)	2	6(1)	
Cave lion	Panthera spelaea							1	

Sites		Tashtyk II			Tashtyk IV		Kurtak III	Kokorevo III
Layers		1	2	1 to 2	1	2		
References		24			15		26	24
Perissodactyla								
Horse	Equus caballus	19	1	7(1)				2
Asiatic wild ass	Equus hemionus							1
Horse/ass	Equus sp.							1
Artiodactyla								
Reindeer	Rangifer tarandus	48	23	176(6)	+	+	+	131
Bison	Bison priscus			3(1)		+	+	7
Wild sheep	Ovis ammon			1(1)				
Saiga antelope	Saiga tatarica	2	5					

APPENDIX Table 5, continued

Sites		Kokorevo VI	Divnyi I	Kokorevo I				
Layers				1	2	3	4	4a
References		15	26	27				
Perissodactyla								
Horse	Equus caballus				8	22	25	6
Asiatic wild ass	Equus hemionus	+			3	5	13	
Horse/ass	Equus sp.						1	
Artiodactyla								
Red deer	Cervus elaphus			14	86	33	3	
Roe deer	Capreolus capreolus				2-6?	3		1
Reindeer	Rangifer tarandus	+	+	40	1533	1023	527	111
Bison	Bison priscus	+	+		3-4?	20	7	2
Aurochs/bison	Bos/bison				1	4		
Wild sheep	Ovis ammon			1?	11-12?	30	125	
Carnivora								
Wolf	Canis lupus				15	12	2	
Wolf/dog	Canis sp.					3	2	
Arctic fox	Alopex lagopus				1		3	

Sites		Kokorevo I		Novoselovo VI	Novoselovo VII	Novoselovo XIII	
Layers		5	6			1	2
References		27		27		26	
Proboscideae							
Mammoth	Mammuthus primigenius			1			
Perissodactyla							
Horse	Equus caballus				5(1)		
Asiatic wild ass	Equus hemionus					+	
Artiodactyla							
Red deer	Cervus elaphus			1			
Reindeer	Rangifer tarandus	30	4	9280	887(27)	+	+
Bison	Bison priscus			142	5(2)	+	
Wild sheep	Ovis ammon	2				+	
Saiga antelope	Saiga tatarica				3(1)		
Carnivora							
Wolf	Canis lupus			27	2(1)		
Wolf/dog	Canis sp.			3			
Arctic fox	Alopex lagopus	3		8	5(2)		
Wolverine	Gulo gulo			12			

Sites		Aeshka II	Cheremushka, Loc. 2		Chegerak	Abrashikha	
Layers			1	2		1	2
References		15	15		15	28	
Artiodactyla							
Red deer	Cervus elaphus		+				
Roe deer	Capreolus capreolus		+		1		
Reindeer	Rangifer tarandus	+	+	+		+	+
Aurochs/bison	Bos/bison		+				
Carnivora							
Brown bear	Ursus arctos		+				

APPENDIX Table 5, continued

Sites		Chernovaia II	Lepeshkino I	Ulazy	Buzunovo I	Buzunovo II
Layers						
References		15	15	15	15	15
Artiodactyla						
Red deer	Cervus elaphus			+		
Roe deer	Capreolus capreolus			+		
Reindeer	Rangifer tarandus	+		+	+	+
Bison	Bison priscus		+			
Aurochs	Bos primigenius			+	+	
Wild sheep	Ovis ammon					+
Carnivora						
Wolf	Canis lupus	+		+		

Sites		Sosnovoe Ozero	Oznachennoe I	Maininskaia			
Layers				A-1	A-2	A-3	B
References		29	30	31			
Perissodactyla							
Horse	Equus caballus	+					
Asiatic wild ass	Equus hemionus		1				6
Artiodactyla							
Red deer	Cervus elaphus			14	24	17	3
Roe deer	Capreolus capreolus			4	4	2	4
Elk	Alces alces		1				
Reindeer	Rangifer tarandus		+				
Bison	Bison priscus			5	1	5	
Wild sheep	Ovis ammon				1	2	
Ibex	Capra sibirica			22	5	15	10
Carnivora							
Wolf	Canis lupus			37			

Sites		Maininskaia								
Layers		V	0	1	2/1	2/2	2/3	3	3a	3b
References		31								
Artiodactyla										
Red deer	Cervus elaphus	1		11	16	4	2	23		2
Elk	Alces alces				5			3	4	
Bison	Bison priscus			3	6			4		
Wild sheep	Ovis ammon			5	1			7		
Ibex	Capra sibirica	2	1	19	12			17	7	
Carnivora										
Red fox	Vulpes vulpes				8					
Wolverine	Gulo gulo							1		

APPENDIX Table 5, continued

Sites		Maininskaia					
Layers		4	5	6	7	8	9
References		31					
Perissodactyla							
Horse	Equus caballus						1
Artiodactyla							
Red deer	Cervus elaphus	1	23	5	1	2	1
Elk	Alces alces	3					
Bison	Bison priscus	10	35	2			
Wild sheep	Ovis ammon				5	2	
Ibex	Capra sibirica	47	26	3		2	1
Carnivora							
Red fox	Vulpes vulpes					1	

Sites		Ui II					
Layers		2	3	4	6	7	Exc. 1 - lower
References		31					
Perissodactyla							
Asiatic wild ass	Equus hemionus	1(1)					
Artiodactyla							
Red deer	Cervus elaphus	4(1)	3(1)	3(1)	6(2)		1(1)
Bison	Bison priscus	6(1)	3(1)				
Ibex/sheep	Capra/Ovis	18(2)	2(1)		1(1)	1(1)	

Sites		Kantegir				Golubaia I		Nizhnii Idzhir I
Layers		2	3	4	5	1	3	
References		30				30		30
Perissodactyla								
Asiatic wild ass	Equus hemionus						?(1)	
Artiodactyla								
Red deer	Cervus elaphus		+	+	+		?(2)	
Bison	Bison priscus		+	+	+			
Aurochs	Bos primigenius						?(1)	
Ibex	Capra sibirica	+	+	+	+	+?	?(1)	+

Sites		Eilig-Khem	Strizhova Gora			Mezensk	Ust-Kova
Layers			4	8 to 16	17	4	upper
References		32	33			34	35
Proboscideae							
Mammoth	Mammuthus primigenius						+
Perissodactyla							
Horse	Equus caballus			+	+		+
Artiodactyla							
Red deer	Cervus elaphus			+			
Roe deer	Capreolus capreolus		+				
Elk	Alces alces						+
Reindeer	Rangifer tarandus			+			+
Bison	Bison priscus					+	+
Wild sheep	Ovis ammon	+					
Carnivora							
Red fox	Vulpes vulpes			+			

APPENDIX Table 5, continued

Sites		Bol'shaia Kur'ia II	Krasnyi Iar I		Sosnovyi Bor		Ust'Belaia
Layers			2 to 4		3	4	14 to 16
References		36	37		38		39
Perissodactyla							
Horse	Equus caballus	+	231		53		
Asiatic wild ass	Equus hemionus				1		
Artiodactyla							
Red deer	Cervus elaphus		4		35	13	+
Roe deer	Capreolus capreolus				3	2	+
Reindeer	Rangifer tarandus		135		2		
Bison	Bison priscus		6				
Aurochs/bison	Bos/bison				1		
Carnivora							
Wolf	Canis lupus				1		
Red fox	Vulpes vulpes		1				
Brown bear	Ursus arctos		1				

Sites		Cheremushnik I	Cheremushnik II		Mal'ta	Shamotnyi Zavod	
Layers			1	2	upper	1	2
References		40	41		42	43	
Proboscideae							
Mammoth	Mammuthus primigenius						3
Perissodactyla							
Horse	Equus caballus	10	+	+		1	5
Wooly rhinoceros	Coelodonta antiquitatis						1
Artiodactyla							
Roe deer	Capreolus capreolus	1					
Reindeer	Rangifer tarandus		+	+	+		
Bison	Bison priscus			+?	+?		7
Snowy sheep	Ovis nivicola						1
Carnivora							
Cave lion	Panthera spelaea						1

Sites		Kulakovo I	Fediaevo	Verkholenskaia Gora I		Makarovo II	
Layers				2	3	3	4
References		41	37	44		45	
Perissodactyla							
Horse	Equus caballus	+	+		+	+	+
Asiatic wild ass	Equus hemionus					+	
Artiodactyla							
Red deer	Cervus elaphus		+	+	+	+	+
Roe deer	Capreolus capreolus			+	+		
Musk-deer	Moschus moschiferus			+			
Elk	Alces alces		+	+			
Reindeer	Rangifer tarandus	+	+				
Bison	Bison priscus		+	+	+	+	
Aurochs/bison	Bos/bison					+	
Carnivora							
Wolf	Canis lupus					+	
Brown bear	Ursus arctos			+			

APPENDIX Table 5, continued

Sites		Makarovo I	Shishkino II	Chastinskaia	Balyshovo III	Chaika II
Layers			2			
References		46	47	48	49	50
Perissodactyla						
Horse	Equus caballus				+	
Wooly rhinoceros	Coelodonta antiquitatis			+?	+	
Artiodactyla						
Red deer	Cervus elaphus	+				
Roe deer	Capreolus capreolus		+			
Reindeer	Rangifer tarandus			+	+	+
Bison	Bison priscus				+	

Sites		Kurla III		Oshurkovo	Ust'Kiakta IV	Ust'Kiakhta XVII	
Layers		1	2	3 to 4	1 to 2	3	5
References		50		52	53	54	
Perissodactyla							
Horse	Equus caballus				+		?(1)
Artiodactyla							
Red deer	Cervus elaphus	+	+	5(1)		?(1)	?(1)
Elk	Alces alces			6(1)			
Reindeer	Rangifer tarandus			4(1)		?(1)	
Bison	Bison priscus			10(2)	+?	?(1)	?(1)
Spiral-horn antelope	Spiroceros kiakhtensis						?(1)
Goitred gazelle	Gazella subgutturosa				+		
Wild sheep	Ovis ammon	+	+				
Carnivora							
Fox/Arctic fox	Vulpes/alopex	+	+				

Sites		Sannyi Mys			Studenoe I				
Layers		3	4	5	14	15	17	17 to 18	19/4
References		55			56				
Perissodactyla									
Horse	Equus caballus			+					
Wooly rhinoceros	Coelodonta antiquitatis	+	+	+					
Artiodactyla									
Red deer	Cervus elaphus				+	+	1		
Reindeer	Rangifer tarandus			+					
Baikal yak	Poephagus baikalensis								1
Aurochs/bison	Bos/bison								1
Spiral-horn antelope	Spiroceros kiakhtensis							1	
Wild sheep	Ovis ammon						1?		

APPENDIX Table 5, continued

Sites		Kandabaevo	Chitkan	Ust'Menza II	Ust'Menza I	Ikaral
Layers			2	4 to 27	19	
References		57	57	57	57	58
Proboscideae						
Mammoth	Mammuthus primigenius	+				
Perissodactyla						
Horse	Equus caballus	+		+		
Asiatic wild ass	Equus hemionus	+				
Wooly rhinoceros	Coelodonta antiquitatis	+				2
Artiodactyla						
Red deer	Cervus elaphus	+		+		
Roe deer	Capreolus capreolus			+		
Bison	Bison priscus	+			1	
Aurochs/bison	Bos/bison		+	+		
Spiral-horn antelope	Spiroceros kiakhtensis	+				
Saiga antelope	Saiga tatarica	+				
Ibex/sheep	Capra/Ovis			+		
Carnivora						
Wolf	Canis lupus			+		
Spotted hyaena	Crocuta spelaea	+				

Sites		Chindant	Kubukhai	Barzhigantai	Tsagan-Ola
Layers					
References		55	55	55	55
Perissodactyla					
Horse	Equus caballus	+			
Asiatic wild ass	Equus hemionus			+	
Wooly rhinoceros	Coelodonta antiquitatis	+	+	+	+
Artiodactyla					
Reindeer	Rangifer tarandus	+		+	
Bison	Bison priscus	+		+	+

APPENDIX Table 5, continued

Sites		Sokhatino IV							
Layers		1	2	3	5	6	7	8	10
References		59							
Perissodactyla									
Horse	Equus caballus	4(1)	29(3)	43(4)		8(2)	1(1)		3(1)
Przewalski's Horse	Equus przewalskii		4(1)	2(1)					
Asiatic wild ass	Equus hemionus			1(1)					
Wooly rhinoceros	Coelodonta antiquitatis	1(1)	2(1)	1(1)	1(1)				
Artiodactyla									
Red deer	Cervus elaphus		40(3)	14(2)		7(1)			1(1)
Roe deer	Capreolus capreolus		2(1)						
Elk	Alces alces		3(1)	4(2)		3(1)			
Reindeer	Rangifer tarandus	2(1)	134(4)	91(5)		110(5)	7(1)		
Baikal yak	Poephagus baikalensis		2(1)						
Bison	Bison priscus	17(2)	113(4)	35(3)	2(1)	15(1)	4(1)	1(1)	3(1)
Spiral-horn antelope	Spiroceros kiakhtensis	1(1)	7(2)	3(2)	1(1)				
Goitred gazelle	Gazella subgutturosa		14(2)	7(1)		22(3)			
Wild sheep	Ovis ammon	24(2)	271(7)	161(5)		20(2)	5(1)		4(1)
Saiga antelope	Saiga tatarica	1(1)	16(1)	7(1)		15(2)	1(1)		
Ibex	Capra sibirica		3(1)	2(1)					
Carnivora									
Wolf	Canis lupus		2(1)		1(1)				
Bob cat	Felis lynx		1(1)						

Sites		Dvortsy	Tanga	Kadakhta		Bol'shoi Iakor' I		
Layers			3	2	3	3v	4	4a
References		60	61	61		62		
Proboscideae								
Mammoth	Mammuthus primigenius				+			
Perissodactyla								
Wooly rhinoceros	Coelodonta antiquitatis	+	2	+	+			
Artiodactyla								
Roe deer	Capreolus capreolus	+						+
Reindeer	Rangifer tarandus			+		+	+	
Bison	Bison priscus			+				

APPENDIX Table 5, continued

Sites		Bol'shoi Iakor' I						Khaergas
Layers		4b	5	6	7	8	12	6
References		62						63
Perissodactyla								
Horse	Equus caballus			+		+		
Artiodactyla								
Red deer	Cervus elaphus		+	+				
Manchurian deer	Cervus elaphus xanthopigus							+
Roe deer	Capreolus capreolus		+		+	+		
Elk	Alces alces	+	+	+	+	+		
Reindeer	Rangifer tarandus		+	+	+	+		
Bison	Bison priscus				+		+	
Carnivora								
Wolf	Canis lupus					+		
Arctic fox	Alopex lagopus	+	+	+				
Red fox	Vulpes vulpes		+	+				
Brown bear	Ursus arctos		+	+				
Badger	Meles meles		+	+		+		

Sites		Novyi Leten I	Ezhantsy	Ust'Mil' II		
Layers		4		A	B	C
References		64	64	64		
Proboscideae						
Mammoth	Mammuthus primigenius		8	+	+	+
Perissodactyla						
Horse	Equus caballus	+	20	+		+
Wooly rhinoceros	Coelodonta antiquitatis		9		+	+
Artiodactyla						
Red deer	Cervus elaphus		1?			
Reindeer	Rangifer tarandus		10	+		
Bison	Bison priscus		8	+		+
Musk-ox	Ovibos moschatus			+?		

Sites		Ikhine I			Ikhine II				
Layers		1	2	3	1	2a	2b	2v	2g
References		64			64				
Proboscideae									
Mammoth	Mammuthus primigenius	1	3	1		7	4		9
Perissodactyla									
Horse	Equus caballus	1	4	2	5	71	50	14	43
Wooly rhinoceros	Coelodonta antiquitatis		1			4	5	2	1
Artiodactyla									
Red deer	Cervus elaphus								1?
Elk	Alces alces			1		1			
Reindeer	Rangifer tarandus	2	5			16	6	2	10
Bison	Bison priscus	3	8	3	6	50	58	14	29
Carnivora									
Wolf	Canis lupus								1
Arctic fox	Alopex lagopus						1		
Red fox	Vulpes vulpes						1		

APPENDIX Table 5, continued

Sites		Verkhne-Troitskaia	Diuktaiskaia				
Layers			7a	7b	7v	8	9
References		64	64				
Proboscideae							
Mammoth	Mammuthus primigenius	8	24	4	7	621	132
Perissodactyla							
Horse	Equus caballus	9	1	4	9		2
Wooly rhinoceros	Coelodonta antiquitatis	3					
Artiodactyla							
Elk	Alces alces		33	3		5	
Reindeer	Rangifer tarandus	2	32	1	2	3	4
Bison	Bison priscus	23	2	1	3	3	6
Snowy sheep	Ovis nivicola		4	6?		3	
Musk-ox	Ovibos moschatus					1	
Carnivora							
Wolf	Canis lupus	1	4			4	
Arctic fox	Alopex lagopus		12	12	1	16	6
Red fox	Vulpes vulpes		9	5		3	1
Fox/Arctic fox	Vulpes/alopex					14	
Cave lion	Panthera spelaea			3		6	

Sites		Berelekh	Ushki I			
Layers			5 to 6	6	7	
References		65	66			
Proboscideae						
Mammoth	Mammuthus primigenius	79(2)				
Perissodactyla						
Horse	Equus caballus	1(1)	+	+		
Elk	Alces alces			+	+	
Reindeer	Rangifer tarandus	2(1)	+			
Bison	Bison priscus		+	+		
Carnivora						
Wolf	Canis lupus	18(4)				
Wolf/dog	Canis sp.			+		