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# The mammalian fauna of Kulikovo Pole region (Upper Don River Basin) during the end of Pleistocene – Holocene

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**Abstract.** This paper includes information on mammalian faunas from eight localities investigated in the Kulikovo Pole region – the place at the confluence of the Nepryadva and Don River where the famous battle between Tartars and Russians occurred in 1380. The oldest faunal assemblages were recovered from the natural outcrops in the upper floodplains of these streams where only steppe and tundra species from the periglacial interval were encountered. The distribution of Middle Holocene forest-steppe landscapes in the Upper Don basin are correlated with mammalian species that indicate major environmental changes. Mammals identified at several medieval sites reflect steppe, forest and hydrogenous species, and remains of domesticated species (cattle, horse, pig, sheep, goat and dog) reveal the impact of human activities during this time. Thus, the study of mammalian faunas associated with the last ~14 thousand years BP demonstrates significant environmental and climatic changes from the cold periglacial tundra-steppe conditions at the end of the last glaciation to the establishment of forest-steppe habitats during the Middle and the Late Holocene.

## 1. Introduction

The Kulikovo Pole is located in the central part of the Russian Plain, in the interfluvium of the Don and Nepryadva Rivers, on the northern slope of the Middle Russian Highland where altitudes range from 210 to 234 m. The main part of the Kulikovo Pole has rolling terrain where slopes are cut by numerous balkas. The recent northern forest-steppe landscape has a relatively continental climate with mean annual temperatures of +4.5 °C and an annual precipitation of ~ 500 mm [1 – 3]. The open steppe and grassland vegetation is prevalent on the Kulikovo Pole, but oak forests also occur in the region.

Archaeological studies in the Kulikovo Pole region were carried out over many years under the direction of Dr. Mikhail Goniani (State Historical Museum of Russian Federation, Moscow) [4 – 6]. Interdisciplinary studies were part of these investigations and included palynological, soil science and zoological studies, and absolute dating techniques were also applied. During the archaeological studies of several sites in the region mammalian remains were found in the refuse of human settlements as well as in natural deposits.

Investigations of mammalian faunas are usually included in interdisciplinary geological and archaeological research of former landscapes, settlements and human habitation sites. Together with paleofloristic research, paleontology and archaeozoology can provide unique perspectives on past environments. However, the zoological materials used for palaeogeographical reconstructions are not as abundant as palaeobotanical and palaeopedological data. This is partly due to the difficulties of finding mammalian fossils in natural deposits where samples of osteological remains are very difficult to collect by way of washing sediments through small-sized sieves.



The main task of our study is to describe the mammalian faunas in the Kulikovo Pole region that were associated with natural deposits as well as from cultural deposits at the human habitation sites. The mammalian data help to elucidate the peculiarities of local habitats during different temporal intervals of the past and present an objective scenario of past regional environments. The positive feature of the mammalian collections obtained from the archaeological settlements is that the osteological materials were buried rapidly without major redeposition so as to permit an unbiased view of past environments.

Dr. T. Martin (Illinois State Museum) participated in these studies and investigated the remains of large mammals, birds and fishes [7–10], and A. K. Markova analyzed the small mammal remains [11]. In this paper we integrate the results of these studies to reconstruct climatic and environmental changes from the end of the Pleistocene through the Holocene in the upper Don River Basin in the present-day location of the State Historical-Military and Natural Kulikovo Battlefield Reserve.

## 2. Methods and materials

Small mammal remains were found during field excavations at different localities within the Kulikovo Battlefield Reserve, including the deposits from the natural outcrops and from the cultural levels of archaeological sites. These were obtained by water screening through 0.5 mm mesh. The bone material is relatively well preserved. Several whole mandibles with teeth were found as well as whole isolated teeth. Most of the bones are light yellow in color, and some are brown. The screened material was dried in the sun and the osteological materials were retrieved. The second stage includes the identification of small mammal remains utilizing a SMC 4, ASKANIA microscope. Teeth are especially useful for providing the most precise identification to the species level. The analysis includes measuring bones under the microscope and illustrating the remains with the help of the drawing apparatus. The remains from 3 mammalian orders (Eulipotyphla, Lagomorpha and Rodentia) were identified. A total of 563 small mammal remains were identified to the species taxonomical level. These bones were compared with the rich osteological collection of fossil small mammals collected by A. K. Markova over many decades from localities in Eastern Europe and curated at the Institute of Geography RAS.

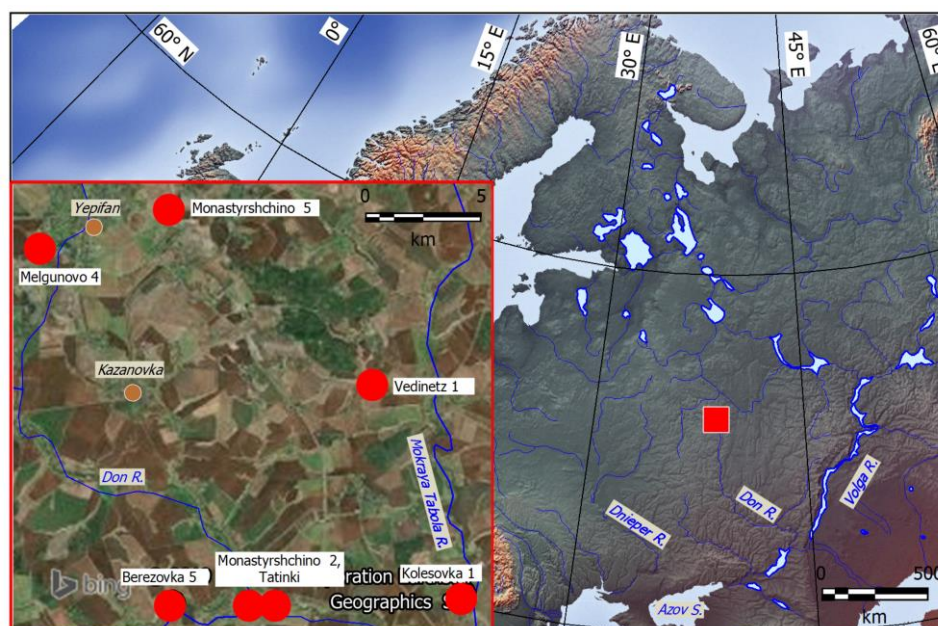
The remains of large mammals were found only in the cultural levels of the Upper Don basin archaeological sites. This material was compared to specimens from the other archaeological sites stored in the State Military-Historical and Natural Kulikovo Pole Reserve and to reference skeletons at the Zoological Museum in Moscow. Wild and domesticated large mammal species of Carnivora, Perissodactyla and Artiodactyla were identified. Approximately 1,700 large mammal remains were identified from the Kulikovo Pole sites, most of which were from domesticated mammals that included dog (*Canis lupus familiaris*), domestic horse (*Equus caballus*), cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), and pig (*Sus scrofa*).

In total, 20 species of wild mammals and 6 domesticated mammals were identified in the Kulikovo Pole natural localities and archaeological settlements. These specimens were obtained from the localities ranging in age from the Late Glacial through the end of the Holocene.

## 3. Mammalian fauna

Small mammal remains were recovered during field excavations in different localities within the Kulikovo Pole Reserve. These include two natural outcrops in the upper floodplain, near Tatinki and Monastyrshchino villages, as well as several other Late Holocene archaeological settlements (tables 1, 2).

3.1. *Tatinki locality* (upper Don River basin, 53°40'17.75" N; 38°39'51.91" E) (figure 1).



**Figure 1.** The position of mammal localities in Upper Don Basin.

The Tatinki locality consists of deposits from the high floodplain of the Nepryadva River near Tatinki village. The geology of this sequence was described by Dr. S. A. Sycheva (Institute of Geography RAS) (per.com.). From the surface to the base sediments consist of modern soil (Chernozem) underlined by grey-brown light loam, brown loam and sand loam with the levels of the sands. Sediments from 200 cm through 580 cm consist of a thick layer of coarse sand with two levels of cross-banded sands including small gravel, mollusk shells and small pieces of charcoal. All sections have a thickness of 5.8 m. Clay deposits exist below the water level.

A total of 158 small mammal remains were found in the lower layer of cross-banded sands with gravel and charcoal at 5.7 - 5.8 m from the surface (table 1). This layer includes steppe pika (*Ochotona pusilla*), collared lemming (*Dicrostonyx gulielmi-torquatus*), yellow steppe lemming (*Eolagurus luteus*), steppe lemming (*Lagurus lagurus*), and narrow-skulled vole (*Lasiopodomys [Stenocranius] gregalis*).

The upper fluvial layer with the gravel and charcoal located at the depth from the surface to 4.5 m and contained 177 small mammal remains including steppe pika, ground squirrel (*Spermophilus* sp.), yellow steppe lemming, steppe lemming, narrow-skulled vole, and root or tundra vole (*Microtus oeconomus*) (table 1).

Most of the species from these two layers are characteristic of open steppe-like environments, especially steppe pika, ground squirrel, yellow steppe lemming, steppe lemming, and narrow-skulled vole. Whereas one subaquatic species (root vole) and one sub-arctic tundra species (collared lemming) are also present in these deposits, forest species are absent (table 1). The C14 dates from charcoal indicate that these fluvial deposits were formed during the end of Late Glacial - during the Bølling-Allerød Interstadial complex:  $13,915 \pm 125$  cal yr BP (KI-5206) (upper layer) and  $14,350 \pm 230$  cal yr BP (KI-5207) (lower layer) (figure 2). Both of these layers were deposited during a rather short time and both contained fauna of very similar species composition and ecological features.

Because redeposition of older deposits can occur, it is possible that collared lemming bones are not contemporary to the other small mammal remains. However, the species composition of the Tatinki faunal assemblage is typical of the periglacial faunas at the end of the Valdai glaciation. Samples indicate the existence of tundra-steppe (“mammoth steppe”), the absence of forest zone, and severe climatic conditions in the upper Don River basin at the end of the Valdai glaciation. The structure of the Tatinki fauna is non-analogue and has no equivalent at the present time. Such climatic and

environmental conditions were very widely distributed throughout all Eurasia during last glaciation [12 – 14].

**3.2. *Monastyrshchino* locality** (left bank of the Nepryadva River basin, 30 m upstream from Monastyrshchino 2 archaeological site, 53°40'16.38" N, 38°35'48.96" E) (figure 1).

A low density of small mammal remains was recovered from the upper part of the coarse fluvial deposits located from 1.2 to 1.4 m below the surface of Nepryadva River floodplain.

This fauna is similar in species composition to that described for the Tatinki locality (table 1). It includes the remains of several steppe species: yellow steppe lemming, steppe lemming, and narrow-skulled vole. The bones of collared lemming also were found. Forest species are absent. The radiocarbon date from the upper part of coarse alluvium of the Nepryadva River is >13,000 cal yr BP (figure 2). The species composition indicates the distribution of periglacial tundra-steppe landscapes. The faunas of this time are characterized as mixed or non-analogue [12 – 17]. These species are presently found in the steppe and tundra zones. The near absence of forest species indicates the destruction of forest zones. The forest communities of plants and mammals survived in this period only in the southern mountains and partly in bush and forested “islands” in some river valleys. The species composition and the structure of mammalian complexes for the territory of whole Europe during several intervals of the Late Pleistocene and the Early Holocene was described in details in the several publications of the first author [13, 14]. Such faunas were widely distributed in the Northern Hemisphere during glacial epochs, including the Valdai glaciation of Eastern Europe (Vistulian glaciation in Western Europe and Wisconsin glaciation in North America). During glaciations the steppe species expanded their ranges to the north and to the west and penetrated the territories of the modern forest zone, which did not exist during last glaciation. Forest vegetation and mammals survived only in the restricted refuges located mostly in the southern mountains and in the depressions along the rivers.

It is interesting to note the species richness of the Monastyrshchino mammal assemblage. The steppe lemming and narrow-skulled vole are prevalent. The other seven species are represented only by a few remains (table 1). The domination of a few species is characteristic of a mammal community in extreme climate conditions. A similar structure of faunas is typical of the present-day tundra zone.

**3.3. *Monastyrshchino* 2 archaeological site** (left bank of the Nepryadva River, 30 m downstream from Monastyrshchino natural outcrop locality, 53°40'16.38" N, 38°35'48.96" E) (figure 1)

This site was discovered in 1982 by B. A. Falomeev. Later Falomeev, M. I. Goniani, and their colleagues excavated this multiple component site [19, 20]. The Monastyrshchino 2 site was occupied over a long sequence of time from 7,270 cal yr BP until the XII through XIII centuries. Neolithic, Bronze Age (in floodplain deposits), and XII through XIII century (in plow zone) occupations were represented there. This site was located on the high (northern part) and on the middle floodplain (southern part), along the edge of the old channel near the confluence of the Don and Nepryadva Rivers, 0.2 km northeast of the Monastyrshchino village. The top of the floodplain surface above the Nepryadva River level ranges from 5 to 6 m. The Neolithic cultural layers occur from 1.9 to 4.5 m under the modern soil within in the floodplain deposits. The C14 date obtained from wood remains associated with Early Neolithic artifacts in the lower cultural strata is 7,270±45 cal yr BP (IGAN-517). Materials from the upper cultural strata were associated with the arrival of Late Neolithic pastoral tribes and were dated by C14 from wood remains to 4,365±80 cal yr BP (IGAN-515) (20).

The remains of small mammals from the floodplain deposits could be correlated to the Middle Holocene (Atlantic period) through the beginning of the Late Holocene (Sub-Boreal period). Each 20 cm of the deposits were water screened. The remains of Microtinae and European hamster (*Cricetus cricetus*) were found in the upper part of the Holocene soil that that date to the XII through XIII centuries. The few remains of common shrew (*Sorex araneus*), European beaver (*Castor fiber*), greater mole-rat (*Spalax microphthalmus*), European hamster (*Cricetus cricetus*), water vole (*Arvicola amphibious*), narrow-skulled vole (*Lasiopodomys (S.) gregalis*), common vole (*Microtus arvalis*) and

field vole (*Microtus agrestis*) (table 1) were found in the lower part of brown-grey clay, which was located below the Holocene soil at the depth of 2.45 – 4.6 m. The layer from 3.25-3.45 m includes wood remains and was described as alluvium of a flood-plain lake. This could be correlated with the Middle Holocene by 14C dates mentioned above (figure 2). Falomeev and others [20] reported the presence of elk (*Alces alces*), and wild boar (*Sus scrofa*) remains in the lower cultural layer. These data also confirm the presence of forested areas near the site. Fish remains were also found also in these layers and suggests the development of fishing as well as hunting during the Neolithic.

The species composition of this faunal assemblage differs strongly from the collections from Tatinki and the natural deposits at Monastyrshchino. It includes not only open steppe and grassland species such as *Spalax microphthalmus*, *Cricetus cricetus*, and *L. gregalis*, but also subaquatic species *Castor fiber* and *Arvicola amphibious* and forest species *Microtus agrestis* and *Sorex araneus*. The forest-steppe landscapes were present during this time. These findings correspond very well to the Eastern European Atlantic ecosystems reconstructed by floristic and theriological data, which shows the distribution of the forest-steppes in the Upper Don River basin [21, 22].

**Table 1.** Species composition of wild mammals from the Upper Don River localities and sites (Kulikovo Pole region)

Species	Localities									
	Tatinki, lower layer, >12 ka BP	Tatinki, Upper layer, >12 ka BP	Monastyrshchino, Alluvium of upper flood plain, ~ 11 ka BP	Monastyrshchino 2. Brown loam	Monastyrshchino 2. Holocene soil	Berezovka 5. Cultural layer. End of XIII-beginning of XIV centuries	Kolesovka 1, XIV century	Monastyrshchino 5, XII-XIV centuries	Vedinetz, XIII-XIV centuries	Melgunovo-4, late XVI – early XVII centuries
<b>Eulipotyphla:</b>										
Common shrew, <i>Sorex araneus</i> L.				1						
<b>Lagomorpha:</b>										
Steppe pika, <i>Ochotona pusilla</i> Pall.	2*	2								
Hare, Leporidae gen.							6			
<b>Rodentia:</b>										
Bobak marmot, <i>Marmota bobac</i> Mull.						5	2			
Ground squirrel, <i>Spermophilus</i> sp.	3	7								
European Beaver, <i>Castor fiber</i> L.				2		10	2	1		1
Greater mole rat, <i>Spalax microphthalmus</i> Guld.				1		3				1
Greater jerboa, <i>Allactaga major</i> Kerr.						1				
European hamster, <i>Cricetus cricetus</i> L.				3	1	15	7			3

Collared lemming, <i>Dicrostonyx gulielmi - torquatus</i>	10	12	1							
Yellow steppe lemming, <i>Eolagurus luteus</i> Eversm.	1	8	1							
Steppe lemming, <i>Lagurus lagurus</i> Pall.	65	95	5							
Water vole, <i>Arvicola amphibious</i> L.		1		15		2				
Narrow-skulled vole, <i>Lasiopodomys (Stenocranius) gregalis</i> Pall.	80	150	11	1						
Common vole, <i>Microtus arvalis</i> Pall.				2						
Field vole, <i>Microtus agrestis</i> L.				6						
Root vole, <i>Microtus oeconomus</i> Pall		13								
Vole, <i>Microtus</i> sp.					5					
<b>Carnivora:</b>										
Stout, <i>Mustela erminea</i> L.					2	4				
<b>Artiodactula:</b>										
Eurasian Elk, <i>Alces alces</i> L.						6				1
Roe Deer, <i>Capreolus capreolus</i> L.						3		2		
Total	161	286	18	31	6	34	30	1	2	6

\* NISP, number of identified specimens

### 3.4. Monastyrshchino 5 archaeological site (53°40'28.54"N 38°35'48.03"E) (figure 1).

Located on the Nepryadva River floodplain terrace, approximately 3 km northwest of the present village of Monastyrshchino, the settlement of Monastyrshchino 5 covers an area of about 420 x 120 m on both sides of a ravine. Excavation of more than 10,000 m<sup>2</sup> of the site by M. I. Goniani and A. N. Naumov between 1984 and 1996 revealed two farmsteads, three pottery workshops, and a metallurgical workshop. The settlement was the center of an ancient Russian rural community and craft center that was occupied from the XII through the XIV centuries [23].

The structure of the floodplain soils and landscapes in the region of the Monastyrshchino 5 was studied by S. A. Sycheva [24]. She described the outcrop located opposite the settlement on the right bank of Nepryadva River, which reveals the structure of the high and middle floodplains. The high floodplain has the high around 5 m and includes from the top to the base the complex of the paleosols. This complex reflects the changes of landscapes from the plow zone (in the top) to Chernozem in the middle (steppe landscapes) and to lowermost forest one [24]. Below this soil complex between 165 – 320 cm is brown loam. Below is the lake clay is at the depth 320-480 cm. A similar brown loam is also present in the Tatinki and Monastyrshchino (natural deposit) sections.

T. Martin inspected 179 animal remains from excavations that occurred in 1989, 1990, and 1994. Sixty of 71 identified specimens are from mammals (tables 1, 2). Domesticated species include domestic pig, horse, ovicaprids, and cattle. The only wild mammal species is European beaver, which is represented by one humerus. Its presence suggests the existence of wooded areas around the settlement, and beavers occurred in modern broadleaved and mixed forests as well as the forest-steppe.



**Table 2.** Species composition of domestic mammal remains from Upper Don River Basin archaeological sites.

Species	Kolesovka 1	Monastyrshchino 5	Berezovka 5	Vedinetz 1	Melgunovo 4
	NISP/ MNI <sup>1</sup>	NISP/ MNI	NISP/ MNI	NISP/ MNI	NISP/ MNI
<b>Carnivora:</b>					
cf. Dog, <i>Canis lupus familiaris</i>			12/3	85/2	3/2
<b>Perissodactyla:</b>					
Horse, <i>Equus caballus</i>	110/5	19/3	60/3	25/2	60/2
<b>Artiodactyla:</b>					
Domestic Pig, <i>Sus scrofa</i>	142/10	22/3	247/15	19/3	149/8
Cattle, <i>Bos taurus</i>	119/5	7/2	138/7	25/3	134/6
Goat, <i>Capra hircus</i>	2/1			1/1	
Sheep, <i>Ovis aeries</i>	11/3		32/10	7/2	12/3
Sheep/Goat, <i>Ovis/Capra</i>	90/-	11/2	79/1	14/2	56/4
Large Artiodactyl	6/-			2/-	2/-
Small Artiodactyl	3/-				3/-
Totals	483/24	59/10	568/39	178/15	419/25

<sup>1</sup>NISP, number of identified specimens; MNI, minimum number of individuals.

### 3.5. Kolesovka 1 archaeological site (53°40'32.64"N 38°47'16.94"E) (figure 1).

The site of Kolesovka 1 is located along the floodplain of the Mokraya Tabola River, across from the modern village of Kolesovka. The site is part of the Ustie archaeological complex, which consists of eight settlements, a fort, and a cemetery that span the XII through XIV centuries. The complex was an administrative center in the Ryazan Principality. Kolesovka 1 was initially investigated by M. I. Goniani in 1987, followed by excavation of 5,500 m<sup>2</sup> of the southeastern portion of the site by A.N. Naumov from 1998 through 2012. Excavations revealed the remains of two pottery kilns, two “steel workshops”, along with other architectural remains, artifacts, and refuse deposits spanning the late XIII through the mid-XIV centuries [25].

Animal remains from mammals, birds, and fish that were obtained during the 1998 excavations were analyzed in 1998 and 2000. A total of 539 specimens were identified, 95 percent consisting of mammals (Table 1, 2). The faunal assemblage also includes more than 7,000 fish scales, 81 percent coming from one refuse pit. Fragmentary bones and teeth from pigs, cattle, horses, sheep, and goats comprise more than 92 percent of the identified mammal remains. The influence of humans on the landscape during the medieval period is shown by dominance of domesticated species.

Wild mammals are represented by seven taxa. Eurasian elk and possibly red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*) were tentatively identified from fragmentary bones and teeth, each representing two individuals. Mountain hare (*Lepus timidus*) is the only lagomorph. Rodents include European beaver, European hamster, and bobak marmot (*Marmota bobac*). Beaver inhabits rivers that have forested areas. Elk is a typical habitant of the forests, and roe deer prefers the forested areas in the forest-steppes. European hamster and bobak marmot are typical steppe mammals. Thus this community indicates the presence of forest-steppe habitats.

### 3.6. Berezovka 5 archaeological site (“selishche”) (53°39'42.38"N, 38°34'21.92"E).

The site of Berezovka 5 is located along the Nepryadva River and was occupied from the mid- XIII through the early XIV centuries. The settlement was discovered by M. I. Goniani in 1984 and was excavated by V. P. Gritsenko in 1990 and Goniani in 1993-1995 and 1998 [5, 6]. The rural settlement is approximately 1/5 km east of the current village of Berezovka, and the ancient habitation site is located on the lower floodplain of the right bank of the Nepryadva River. The cultural layer is 0.2 to 0.6 m thick in the arable sediments. The archeological complex consists of multiple residential and



commercial buildings including a pottery workshop, kilns, shelters for livestock, as well as a courtyard and pits for grain storage.

Small mammal remains were obtained from the Early Russian period cultural layer. Several remains of small mammals were found in this layer: European beaver (*Castor fiber*), great jerboa (*Allactaga jaculus*), greater mole-rat (*Spalax microphthalmus*), *Cricetus cricetus*, and *Arvicola amphibious* (table 1). Great jerboa, greater mole-rat, and European hamster are typical steppe mammals. Two of the wild mammals, water vole and European beaver, occur near rivers. The beaver's range covers the mixed and broadleaved forests and forest-steppe where part of its diet consists of branches of deciduous trees. The small mammal fauna indicates the open steppe-like landscapes, restricted areas of forest vegetation, and the vicinity of the river.

A faunal assemblage studied includes approximately 1,800 animal remains, from which 650 identified specimens provide perspectives on available animal populations and human subsistence practices [8, 9]. Although birds and fish were present, 90.8 percent of all identified specimens consist of mammals (table 2). Domesticated species contributed 96.3 percent of all identified mammal remains and include domestic pig, cattle, sheep/goat, horse, and domestic dog. Stout (*Mustela erminea*) was the only wild carnivore that was encountered in the cultural layer and is a typical forest animal that indicates the presence of forested areas near the site. European beaver also occurs along rivers in the mixed and broadleaved forests and in the forest-steppe where a significant portion of its food is the tree branches of the broadleaved trees.

The remains of numerous fishes and birds also were identified from the cultural layers of Berezovka 5. Birds include domestic chicken (*Gallus domesticus*), Eurasian black grouse (*Lyrurus tetrix*), golden eagle (*Aquila cf. chrysaetos*), Eurasian kestrel (*Falco tinnunculus*), and rook (*Corvus frugilegus*). The remains of black grouse reflect forested areas near the site. Fish include sturgeon (Acipenseridae), catfish (*Silurus glanis*), and common roach (*Rutilus rutilus*) [9]. The diverse faunal assemblage attests to human activities that include intensive hunting, fishing and animal husbandry.

The past vegetation in the vicinity of Berezovka 5 settlement was described in several papers [2, 3]. The forest-steppe vegetation were dominant during middle and late Subatlantic (2,4 cal kyr BP – present) including the time of the human occupation of this settlement. Theriological and bird data also indicates open forest-steppe landscapes.

### 3.7. Vedinetz 1 archaeological site (53°45'24.31"N 38°43'44.85"E) (figure 1)

The site of Vedinetz 1 is located on the Vedinetz River, a tributary to the Mokraya Tabula River, less than 3 km northwest of the village of Buchalki. Geomagnetic survey detected subsurface anomalies including a ceramic kiln, and excavations in 1990-1992 and 2000-2002 also revealed habitation debris and refuse pits from occupations that occurred from the end of the XIII century through the early XIV century [26].

Collections of animal remains from the site total 457 specimens, 93 percent of which consist of mammals. The assemblage also includes bones from domestic chicken and unidentified fish (including two scales). The 203 identified mammal remains consist mostly of domesticated species including horse, cattle, pig, sheep, and goat (table 2). At least two individual domestic dogs are represented, one of these being an incomplete *in situ* burial from Pit 1B. The only wild species is roe deer, which is represented by two metatarsal shaft fragments. An antler fragment was also encountered, but it can only be attributed to Cervidae. The presence of the remains of roe deer and Cervidae permits to reconstruct the presence of the forests near the settlement. Undoubtedly, open steppe-like landscapes occurred near the settlement, similar to other sites of this same age in the Upper Don basin.

### 3.8. Melgunovo 4A archaeological site (53°48'32.35"N 38°30'44.42"E) (figure 1)

The latest faunal assemblage is from the site of Melgunovo 4A, which is located on a broad floodplain of the Don River along an oxbow marsh, 1.5 km south of the current village of Melgunovo. The settlement was occupied from the late XVI century through the early XVII century and consisted of a complex of buildings, cellars, outbuildings, gardens, and pens for livestock that was enclosed within a

palisade of logs. Occupied for about 40 years, the Cossack settlement was within the district of the city of Epifan and was destroyed by the Tatars during the first decade of the 17<sup>th</sup> century. Archaeological investigations were initiated by M. I. Goniani in 1986 and continued by V. P. Gritsenko from 1990 through 1996 [5].

An assemblage of 1,175 animal remains was obtained from the northern part of the site that was excavated from 1993 through 1995. Other than 18 avian and three fish bones, 98 percent of the collection consists of mammal bones and teeth. Identified mammal remains (428 specimens) consist mostly of domesticated species including (in decreasing order of abundance) pig, cattle, sheep/goat, horse, and dog (tables 1, 2). Remains of wild species are rare and include elk or red deer (one maxillary molar), roe deer (one mandibular molar), European beaver, greater mole rat, European hamster, and unidentified small rodents (two incisor fragments) (table 1). These wild animals indicate open meadow and steppe landscapes near the settlement and the existence of forest-steppes nearby.

The fossil soils near the Melgunovo 4A settlement were described by A. L. Aleksandrovsky and M. P. Glasko [27]. They shown that on the placors the Chernozems were distributed what indicates the open steppe landscapes there. The forested landscapes were located on the floodplain were the dark grey forest soils were deposited during the Late Holocene.

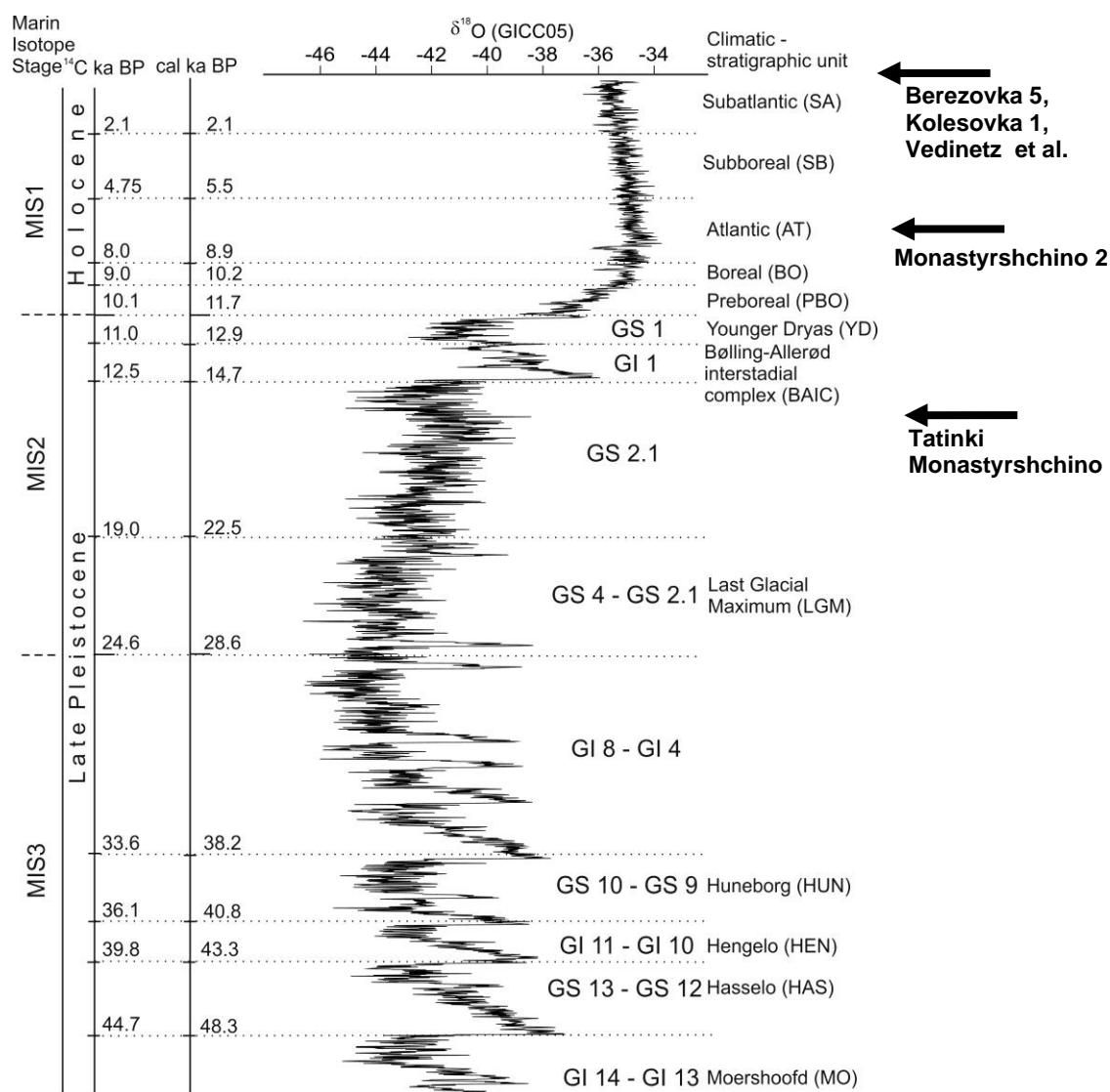
Similarly, the mammalian data indicates that forest-steppes existed near the Melgunovo 4A site during the end of XVI through the beginning of the XII centuries.

#### **4. Results and discussion**

The multidisciplinary investigations carried out in the Kulikovo Pole Reserve permitted the reconstruction of the main features of past environments not only at the time of the famous battle, but also during the preceding periods for the Upper Don River. Intensive studies of vegetation and fossil soils concentrated mostly on Holocene data. Investigations of the mammalian data included not only the studies of Holocene but also the Late Pleistocene. These data could be considered along with to the results of palynological and paleopedological studies. The materials of M. P. Glasko, B. A. Falomeev, A. L. Aleksandrovsky, S. A. Sycheva, E. Yu. Novenko and others together with the mammalian data permitted the reconstruction of the principal environmental settings in the Upper Don Basin from the Late Glacial through the XVII century [1 – 28].

Previous intensive studies of mammalian faunas of the Late Pleistocene and the Holocene are based on the information collected in the electronic database PALEOFAUNA [13], which provided an understanding of the evolution of the mammal community of Europe during past 130,000 yrs BP [13, 14]. This information was taken into account during the interpretation of theriological investigations of the faunas of the Upper Don basin.

The earliest mammalian localities found near Tatinki (two layers) and Monastyrshchino villages include only mammalian materials and were not the subject of other paleontological methods. As described above, theriological data suggests that severe climatic conditions were extant during the formation of these localities along with the spread of the periglacial tundra-steppes and the destruction of the forest zone. The absolute C14 dates indicated the end of Last Glacial and the beginning of the Bølling-Allerød interstadial complex (figure 2). During this time the central part of the Russian Plain was covered by tundra-steppe vegetation [29 – 37], and mammals of the so-called “mammoth” complex (mammoth, woolly rhinoceros, musk ox, steppe bison and others) were wide distributed but went extinct by the end of the Pleistocene and beginning of the Holocene [13, 14].



**Figure 2.** The position of the Upper Don localities in the geochronological scale (the geochronological scale was done by J. Mol, 2008 [31] and modified by A.Yu. Puzachenko)

Small mammals were represented by tundra species such as collared and Siberian lemmings, along with a large quantity of steppe species: narrow-skulled vole, steppe and yellow lemmings, ground squirrels, Eurasian hamster and others. Forest species were very rare because the continuous forest zone did not exist at this time on the Russian Plain. The forest vegetation was present only along rivers, in ravines, or in other depressions [12 – 16]. Similar reconstructions were made based on mammalian materials for many of Late Paleolithic sites of the central Russian Plain, such as Yudinovo, Eliseevichi, Khotylevo 2, Kostenki, Borshchevo, Novgorod-Severskaya and others [32 – 36 and others]. The species composition of the Late Glacial and Bølling-Allerød Interstadial theriocomplexes were described and mapped [14, 37]. The mammalian data obtained from the Kulikovo Pole localities for these ages concur with these reconstructions and portray the tundra-steppe environment in the Upper Don basin.

Younger fauna was derived from the Neolithic site of Monastyrshchino 2. C14 dates show that this corresponds to the Atlantic period of the Holocene. This fauna differs strongly from the previous one in that the species composition includes only open steppe and grassland species and few forest ones.

Few species habituated near the rivers also were found. The sub-arctic animals are absent. The forest-steppe could be reconstructed for this time. The palynological and plant macrofossil analyses of Berezovskoe swamp in the inner part of the Nepryadva River floodplain (near Berezovka 5 settlement) indicate that the forest-steppe communities dominated the region during this interval [2, 3]. The studies of the fossil soils on the Kulikovo Pole area show that the open steppe communities were widely distributed during the Middle Holocene [28]. Thus, mammalian, floristic, and paleosol materials are comparable. Our earlier reconstructions of ecosystems for the optimum of the Atlantic period for the territory of Eastern Europe, based on floristic and mammalian data, are also very similar to the previous ones and indicate the distribution of the forest-steppes in Upper Don Basin [21, 22].

By the end of Holocene, data from the several settlements (Berezovka 5, Kolesovka, Monastyrshchino 5, Vedinetz) in Kulikovo Pole region (during the XIII through XIV centuries) indicate that mammals of two main ecological groups – the steppe and the forest zones – were widely distributed. The remains of birds that inhabited forested and open areas were also present at the of Berezovka 5 site. Thus, the distribution of forest-steppe landscapes can be reconstructed for the Late Holocene. The floristic materials also support the forest-steppe habitat [2, 3]. The abundant remains of the domesticated mammals and birds in these settlements indicate intensive animal husbandry during the Late Holocene.

The mammals from the latest settlement at Melgunovo 4 also support the presence of forest-steppe landscapes in the region.

## 5. Conclusion

The mammalian data permits reconstructions of the principal environments in the Upper Don River basin during last 14,000 years. The earlier mammalian faunas (Tatinki and Monastyrshchino localities) support the existence of the periglacial open environments, that is, the so-called “mammoth steppe.” These faunas have no modern analogues and are characterized by a combination of steppe and sub-arctic mammalian species [13 – 18]. The forest species are absent in these assemblages because the continuous forest zone did not exist during the Valdai glaciation on the Russian Plain. Such assemblages are referred to as “mixed” or “non-analogue.” Faunal remains indicate that mammalian responses to global cooling were individualistic. The ranges of mammals changed under the influence of climatic cooling in different directions and in different scales. Sub-arctic mammals penetrated far to the south during this time. Steppe species expanded their ranges to the north and to the west. The forest species practically disappeared from the Russian Plain. Some forest species survived in local areas of forest and thickets that were located mostly in river valleys as well as in the southern mountain regions.

Middle and Late Holocene faunas have different compositions. Tundra species are absent, and yellow steppe lemming, steppe lemming and narrow-skulled vole also disappeared from the region. These open landscape species were typical not only of the steppe zone, but also for the periglacial tundra-steppes and were the part of the “Mammoth complex.” Several steppe species (bobac marmot, ground squirrel, greater mole-rat, European hamster, great jerboa) were present. Forest species (common shrew, field vole, stout, Eurasian elk, roe deer) and intrazonal species (European beaver, root vole, water vole) were characteristic of these faunas and indicated warm interglacial climatic conditions and the existence of forest-steppes in the Upper Don valley. A large number of domestic species appeared at medieval human settlements and indicated the heavy influence of human activities in the Upper Don basin as evident by the strong development of the animal husbandry.

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## References

- [1] Glasko M P, Sycheva S A 2003 Landscapes of the place of Don battle. Kulikovo Pole. *Historical landscape. Archaeology. History* (Tula: Vlasta Press) 7-22 (in Russian)
- [2] Novenko E Yu, Volkova E M, Glasko M P and Zuganova I S 2012 Palaeoecological evidence for the middle and late Holocene vegetation, climate and land use in the upper Don River basin (Russia). *Vegetation History and Archaeobotany* **21** 337–352
- [3] Novenko E Yu, Eremeeva A P and Chepurnaya A A 2014 Reconstruction of Holocene vegetation, tree cover dynamics and human disturbances in central European Russia, using pollen and satellite data sets. *Vegetation History and Archaeobotany* **23** 109–119
- [4] Goniani M I 2003 *Early Russian archaeological monuments of the end of XII – third part of XIV centuries in the Kulikovo Pole region (thesis of dissertation)* Moscow (in Russian)
- [5] Goniani M I, Gritsenko V P 1997 Kulikovo Pole in XII-XVII centuries. *Local history readings, devoted to 220 yr formation of Tula Province* (Tula) 18-20 (in Russian)
- [6] Goniani M I, Gritsenko V P 2000 The settlement of second half of XII century – beginning of XIV century Berezovka 5 on the Kulikovo Pole *Kulikovo pole Historical-cultural heritage* (Tula) 144-165 (in Russian)
- [7] Martin T J, Markova A K 1995 A collaborative study of historical faunal assemblages from the Central Russian Plain *Proc. of the Conference on Historical and Underwater Archaeology* Washington D.C.
- [8] Martin T J, Goniani M I, Markova A K 1996 Medieval archaeology in the Central Russian Plain: multidisciplinary investigations at Beryezovka 5 *61<sup>st</sup> Annual Meeting of the Society for American Archaeology* (New Orleans, Louisiana) 10-14
- [9] Martin T J, Potapova O R and Sychevskaya, E K 1996 Remains of mammals, birds, and fishes from the XIII century site of Beryezovka 5 *Reports on Archaeological Field Investigations and New Finds in 1991-1995* (Moscow: Russian Historical Museum Press) 105-108 (in Russian)
- [10] Martin T J, Goniani M I and Markova A K 1998 Medieval archaeozoology in Russia: investigations the Upper Don and Moscow regions *8<sup>th</sup> International Congress of the International Council for Archaeozoology (ICAZ)* (Victoria, British Columbia, Canada: proc. of ICAZ congress) 23-29
- [11] Markova A K 2000 The Late Pleistocene and Holocene small mammal faunas from the Upper Don River localities *Izv. RAS, Seria geogr* **2** 84-89 (in Russian)
- [12] Markova A K, Puzachenko A Yu, van Kolfschoten T, van der Plicht J and Ponomarev DV 2013 New data on changes in the European distribution of the mammoth and the woolly rhinoceros during the second half of the Late Pleistocene and the early Holocene *Quaternary International* **292** 4-14
- [13] Markova A K, Smirnov N G, Kozharinov A V, Kazantseva N E, Simakova A N and Kitaev L M 1995 Late Pleistocene distribution and diversity of mammals in Northern Eurasia (PALEOFAUNA database) *Paleontologia i Evolucio* **28-29** 5-145

- [14] Markova A K, van Kolfschoten T, Bohncke S, Kosintsev P A, Mol J, Puzachenko A Yu, Simakova A N, Smirnov N G, Verpoorte A and Golovachev I B 2008 *Evolution of European ecosystems during Pleistocene – Holocene transition (24 – 8 kyr BP)* (Moscow: KMK Scientific Press) (in Russian) p 556
- [15] Baryshnikov G F, Markova A K 2002 Animal world. Theriocomplexes of the Late Pleistocene. *Atlas-monograph. Dynamics of the terrestrial landscape component and inner marine basins of Northern Hemisphere during the last 130 000 years* (Moscow: GEOS Press) 124-147 (in Russian)
- [16] Markova A K, Puzachenko A Yu 2007 Late Pleistocene mammals of Northern Asia and Eastern Europe *Vertebrate records. Encyclopedia of Quaternary Science* (Netherlands: Elsevier) **4** 3158-3174
- [17] Graham R W 1986 Response of mammalian communities to environmental changes during the Late Quaternary *Community ecology* (New York: Harper and Row) 300-313
- [18] Semken H A Jr 1988 Environmental interpretation of the ‘disharmonious’ Late Wisconsinian biome of South-Eastern North America *Late Pleistocene and Early Holocene paleoecology and archeology of Eastern Great Lakes Region. Bull. of Buffalo Soc. of Natural Sciences* **33** 185-194
- [19] Falomeev B A, Glasko M P, Khotinsky N A, Guman, M A, Aleksandrovsky A L and Bylinskaia L N 1984 Monastyrshchino II – Neolithic and Middle Age settlements on the Kulikovo Pole in the Upper Don River basin *Archeology and paleogeography of Mesolithic and Neolithic of the Russian Plain* (Moscow: Nauka Press) 120-136 (in Russian)
- [20] Falomeev B A, Aleksandrovsky A L, Glasko M P, Goniani M I and Guman M A 1990 Ancient settlements and nature of the Nepryadva mouth. *Kulikovo Pole. Materials and investigations. Proc. of State Historical Museum* **73** 10-53 (in Russian)
- [21] Markova A K, Smirnov N G, Kozincev P A, Khenzykhenova F I, Simakova A N, Alekseeva N V, Kitaev L M and Kozarinov A V 2001 Zoogeography of Holocene mammals in Northern Eurasia *Lynx* **32** 233-245
- [22] Markova A K, Simakova A N, Puzachenko A Yu 2003 Ecosystems of Eastern Europe in the Holocene Atlantic Optimum based on floristic and theriologic data *Doklady Earth Sciences*, **39/A** (6) 883-887
- [23] Naumov A N 1990 To the results of investigations of Early Russian settlement Monastyrshchino 5 during 1984-1989 yrs. *Archeological studies in Central Chernozem region in 12 give year plan* (Belgorod) 35-36 (in Russian)
- [24] Sycheva S A 2009 Holocene evolution of floodplain soils and landscapes in the Kulikovo Pole field area *Pochvovedenie* **1** 18-28 (in Russian)
- [25] Naumov A N 2009 Craft workshops on the territory of northern part of Early Russian Ustinsk archeological complex of Kulikovo Pole. *Medieval town of S-E Russia*. (Kursk) 202-213 (in Russian)
- [26] *Archeological Map of Russia: Tula region Part 2* 2002 (Moscow: RAS Press) 15-17 (in Russian)
- [27] Gorskaya E A, Glasko M P and Aleksandrovsky A L 2016 The changes of soils and relief of the floodplain of Upper Don basin near settlements of XVI-XVII centuries. *Izv.RAS, ser.geogr.* **6** 67-81 (in Russian)
- [28] Aleksandrovsky A L, Chichagova O A 1998 Radiocarbon age of Holocene paleosols in the forest-steppe of Eastern Europe. *Eurasian Soil Sci.* **12** 1414-1422
- [29] Simakova A N, Puzachenko A Yu 2008 The vegetation during Late Glacial Transition (LGT) *Evolution of European ecosystems during Pleistocene – Holocene transition (24 – 8 kyr BP)*. (Moscow: KMK Scientific Press) 342-369
- [30] Bolikhovskaya N S 1995 *Evolution of loess-paleosol formation in Eastern Europe*. (Moscow, Moscow State University Press) (in Russian)
- [31] Mol J 2008 Definition of the time slices. Landscape and climate change during last glaciation in Europe; a review *Evolution of European ecosystems during Pleistocene – Holocene transition (24 – 8 kyr BP)* (Moscow: KMK Scientific Press) 73-90 (in Russian)

- [32] Vereshchagin N K, Kuzmina I E 1982 Mammal fauna. *Paleolithic of Kostenki-Borshchevo region on the Don River in 1879-1979* (Leningrad: Nauka Press) 223-232 (in Russian)
- [33] Markova A K 1995 Rodent remains from the Late Paleolithic site of Yudinovo (basin of Desna river) *Cytology* **37** (7) 626-627 (in Russian)
- [34] Markova A K 1997 Small mammal fauna of Eliseevichi site. *Primitive man and the extreme environmental conditions. Eliseevichi site* (Moscow: Nauka Press) 173-177 (in Russian)
- [35] Markova A K 1982. *Pleistocene rodents of Russian Plain* (Moscow: Nauka Press) p 185 (in Russian)
- [36] Markova A K, Puzachenko A Yu 2017 The reconstruction of environmental changes during the Late Pleistocene based on theriological data from Kostenki-Borshchevo sites and adjacent territories *Natural scientific methods in studying and preservation of Kostenki-Borshchevo archaeological region* (Voronezh: Voronezh State University Press) 47-56 (in Russian)
- [37] Markova A K, van Kolfschoten T, Simakova A N, Puzachenko A Yu and Belonovskaya E A 2006 European Ecosystems during the period of Late Glacial Bølling-Allerød warming indicated by palynological and theriological data *Izv. RAS, ser. geogr.* **1** 15-25 (in Russian)