

**Technological Innovation in the Early Upper Paleolithic
of Eastern Europe**

**A Report to the L.S.B. Leakey Foundation
2007 General Grant**

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July 2008

Summary

During 2007, field research was conducted at the Kostenki-Borshchevo sites, which are located on the Don River in Russia, and contain occupation levels and human skeletal remains that date to the Upper Paleolithic. The Kostenki-Borshchevo sites contain the earliest known traces of the Upper Paleolithic in Eastern Europe, but the 2007 research was focused on the later phase of the early Upper Paleolithic (EUP), which dates between 40,000 cal years BP and the appearance of the Eastern Gravettian (often classified as “middle Upper Paleolithic”) roughly 30,000 cal years BP. In terms of the stratigraphy of the Kostenki-Borshchevo area, this phase is represented by occupation levels that overlie a volcanic tephra (CI Y5 tephra) but underlie loess-like loams deposited at the beginning of the Late Pleniglacial (or MIS 2 age equivalent). The topical focus of the project was evidence for *technological innovation* during this interval, which precedes major increases in settlement size and perhaps population density associated with the Gravettian. Excavations were undertaken at Kostenki 1, Kostenki 8, Kostenki 14, and Borshchevo 5 during July-August 2007 with a particular emphasis on the layers containing occupations dating to the 40,000-30,000 cal years BP interval, and several thousand artifacts and vertebrate faunal remains were recovered. Sediment samples were collected from Kostenki 1 and Kostenki 8 as part of a continuing analysis of site formation processes and other aspects of the geoarchaeology, and the senior author continued study of large mammal taphonomy with a special focus on the identification of kill-butcherery locations within the wider pattern of settlement during EUP times at Kostenki-Borshchevo.

Background and Research Objectives

The Kostenki-Borshchevo sites are located on the west bank of the Don River 40 km southwest of the city of Voronezh. In this region, the Don flows along the eastern margin of the Central Russian Upland, which is primarily composed of Cretaceous limestone and rests up to 100 meters above the modern river level. Upper Paleolithic open-air sites are found in fill of the first and second terraces. These terraces are preserved along the main valley and also extend up several large ravines incised into the high west bank of the valley in the vicinity of the villages of Kostenki and Borshchevo (Klein 1969; Velichko 1961). Most of the archaeological sites are found at the mouths, or along the upper reaches, of these large side-valley ravines, which today—as in the past—contain active springs.

Occupation layers dating to the early Upper Paleolithic (EUP) are buried in a sequence of loam, calcareous rubble, and organic-rich layers that overlie alluvium of the second terrace (15-20 meters above the present level of the Don River). At many sites, layers of loam and organic-rich sediment are inter-bedded with bands of calcium carbonate. These deposits have traditionally been assigned to the *Upper Humic Bed* and the *Lower Humic Bed*, which are subdivided by a volcanic tephra horizon (e.g., Velichko 1961; Klein 1969; Lazukov 1982).

Pleistocene large mammal remains have been turning up at Kostenki for more than two hundred years, but evidence of Paleolithic occupation was first recognized in 1879. During the late 19th

century and the first half of the 20th century, investigation was primarily focused on the large Gravettian settlement at Kostenki 1 (Efimenko 1958). During the years following the Second World War, the late A. N. Rogachev uncovered many stratified occupation levels of EUP age (see Praslov and Rogachev 1982) and Kostenki became a major source of information on this critical period of human prehistory.

The 2007 research at Kostenki-Borshchevo represented part of an interdisciplinary Russian-American project initiated with Leakey Foundation support in 2001. The project continued during 2002-2003 with primary support from the National Science Foundation (NSF), and joint support from the Leakey Foundation and NSF in 2004 (which included an international field seminar in late August of that year). In 2007, the project resumed with a new general grant from the Leakey Foundation and a new two-year grant from NSF (BCS-0715519). Some support also was received from the Russian Academy of Sciences (RFFI 05-06-80493a), although most of the research has been funded through Leakey Foundation-NSF awards.

From the outset, the interdisciplinary project at Kostenki-Borshchevo has been focused on the study of the EUP. During the 2001-2004 phase of the project, the emphasis was on the earliest traces of Upper Paleolithic occupation, which are buried in sediments that underlie the volcanic ash—recently identified at the Campanian Ignimbrite (CI) Y5 tephra, deposited approximately 39,000 cal years BP (Pyle et al. 2006). The occupation layers below the CI Y5 tephra appear to date to as much as 45,000-44,000 cal years BP (Anikovich et al. 2007), and represent the oldest known Upper Paleolithic occupations in Eastern Europe; in fact, they appear to date as early as any known Upper Paleolithic industries in Europe as a whole. The artifact assemblages from these levels comprise typical Upper Paleolithic forms (burins, end-scrapers, bone awls, etc.), but do not correspond to defined EUP industries in other parts of the continent. At Kostenki 14 (Layer IVb), they included an ivory carving that may represent the head of a human figurine and perforated shells imported more than 500 km from their source (Anikovich et al. 2007: 225).

The 2001-2004 phase of the project also reflected a strong emphasis on geoarchaeology—not only problems of stratigraphy and geochronology, but also questions concerning site formation processes. The latter were complex at the Kostenki-Borshchevo sites, especially during EUP times, and involved an interplay of slope action, spring activity (also common today), soil weathering, and other factors (Holliday et al. 2007). Analysis of the soil micromorphology during 2001-2004 revealed the importance of springs and seeps in creating the humic beds, which are deposited both above and below the CI Y5 tephra and contain many EUP occupation horizons; this remains one of the most significant results of the Russian-American interdisciplinary project to date.

During 2007, the focus of the project shifted to the younger EUP occupations. These levels are buried in the Upper Humic Bed (and its stratigraphic equivalent), which overlies the CI Y5 tephra, but underlies the loess-like loams that were deposited at the beginning of the Late Pleniglacial (or MIS 2 age equivalent). They date to between 39,000 cal years BP (i.e., age of the CI Y5 tephra) and the end of the Middle Pleniglacial or roughly 30,000-28,000 cal years BP. Occupations of this age have been identified at many Kostenki-Borshchevo sites on the second terrace level above the Don River, including Kostenki 1, 8, 12, 14, 15, 16, 17, and Borshchevo 5, and they have yielded a

substantial body of data in terms of stone and non-stone artifacts, complex features, and vertebrate faunal remains.

In topical terms, the 2007 phase of the project adopted a focus on technological change during this interval (roughly 10,000 years), which precedes major developments in economy and settlement at the beginning of the middle Upper Paleolithic (represented on the East European Plain by the “Eastern Gravettian” industry) (e.g., Hoffecker 2005). How many important technical innovations were developed during this period? For example, the earliest eyed needles (presumably for sewing tailored clothing) have been recovered from the Upper Humic Bed (specifically at Kostenki 14, Layer II and Kostenki 15), along with the oldest examples of what appear to be small shovels (e.g., Klein 1969). From the stable isotope analysis of human bone at Kostenki 1 (Layer III), there is evidence of increased consumption of freshwater aquatic foods (Stiner et al. 1999), suggesting innovations in technology for obtaining fish or waterbirds. What was the pattern of innovation during this interval? Was there a steady stream of novel instruments and devices, or a burst of innovation towards the close of the period?

Field Research 2007

During July-August 2007, excavations were undertaken at four sites: Kostenki 1, Kostenki 8, Kostenki 14, and Borshchevo 5. The principal efforts were concentrated at Kostenki 1, Kostenki 14, and Borshchevo 5. The excavations at Kostenki 8 were smaller in scale in terms of area exposed and crew size. Some sampling also was undertaken at Kostenki 15 and Kostenki 16. Although these sites all contain EUP occupation layers buried in the Upper Humic Bed or its stratigraphic equivalent (i.e., dating to the later phase of the EUP), they also contain occupations representing other phases of the Upper Paleolithic and—especially at Kostenki 14—excavation of these layers required time and effort during the 2007 season.

Kostenki 1 (Polyakov’s Site). The site of the original 1879 discovery remains an important focus of research, including research on the EUP, although the stratigraphy now appears anomalous. Located on the north side—near the mouth—of a large ravine (*Pokrovskii Ravine*) in the northern portion of the village, Kostenki 1 was investigated by the Russian-American interdisciplinary project in 2004, and was subject to limited field study in 2005-2006; the focus was an area located along the western periphery of the site. In this area, excavations in 2004-2006 revealed that middle-late Upper Paleolithic remains were scarce, but EUP occupation levels were comparatively well represented by artifacts and faunal remains.

Under the direction of M.V. Anikovich with the assistance of A.E. Dudin, an area of 46 m² was exposed on the western periphery of Kostenki 1 during July-August 2007. Only isolated materials were encountered in the uppermost post-EUP levels (Layers I and II). A primary objective was recovery of new data from Layer III, which is associated with a well developed buried soil that dates to the final phase of the Middle Pleniglacial (MIS 3 age equivalent) (see Figure 1). In previous years, Layer III has yielded an assemblage containing diagnostic Aurignacian forms, and is widely recognized as the most typical such assemblage in Eastern

Europe. More recently, however, this level has also yielded artifacts typical of the East European Streletskaya culture, characterized by a high percentage of Middle Paleolithic tool types (manufactured on poor quality local raw material). A total of 47 artifacts was recovered from Layer III, along with some faunal material, in 2007—most more typical of the Streletskaya culture than the Aurignacian (e.g., side-scraper, flake knife), although many items of imported rather than local stone.

Below the buried soil associated with Layer III lie two older occupation levels (Layers IV and V) that have been tentatively dated to the earliest phase of the EUP (i.e., stratigraphically below the CI Y5 tephra). However, possible traces of the tephra reported from samples collected from these levels in 2006 by G. A. Pospelova (Institute of Earth Physics, Russian Academy of Sciences) raised the possibility that they might postdate 40,000 cal years BP. The senior author collected a new set of sediment samples for future analysis. Resolution of the chronology at Kostenki 1 is a major objective of the 2008 research.

In 2007, Layer IV yielded only 8 stone artifacts, but Layer V produced almost 800 artifacts, including points, bifaces, end-scrapers, burins, one side-scraper, and others. Associated faunal remains were dominated by mammoth and included teeth, scapulae, ribs, limb bones, foot bones, and others (examined by J. F. Hoffecker). More than 575 mammoth bones and teeth were recovered from Layer V during 2004-2005, and they appear to represent a single adult—possibly a location where an individual mammoth was killed and/or butchered. The mammoth remains recovered in 2004-2005 were identified by I. E. Kuz'mina (Zoological Institute, Russian Academy of Sciences).

Kostenki 14 (*Markina gora*) is located on the second terrace level on the south side of Pokrovskii Ravine, roughly one kilometer upstream from the ravine mouth and Kostenki 1. The stratigraphy exhibits a classic Upper Humic Bed profile and volcanic tephra horizon and has been extensively dated with radiocarbon and OSL (Sinitsyn and Hoffecker 2006; Holliday et al. 2007). Kostenki 14 has yielded some of the best known EUP assemblages in Eastern Europe and these include Layer II and Layer III in the Upper Humic Bed.

New excavations were conducted in July-August 2007 under the direction of A.A. Sinitsyn, who unexpectedly encountered a dense concentration of mammoth bones and some associated artifacts in the uppermost cultural level (Layer I); this level contains Gravettian materials and postdates the EUP. Excavation of Layer I (total of 15 m² exposed) occupied much of the 2007 season at Kostenki 14, yielding a total of 1,157 mammoth bones and teeth (MNI = 6), along with 9 bones of wolf (MNI = 1) (see Figure 2). The faunal remains were identified by K. Petrova (Zoological Institute, Russian Academy of Sciences). Only 36 artifacts were recovered from layer I, although they included shouldered *Kostenki points* (diagnostic of Eastern Gravettian). By contrast, Layers II and III, which were the principal target of the 2007 field research at Kostenki 14 (20 m² exposed), produced only isolated materials. In sum, Kostenki 14 yielded virtually no new data that were pertinent to the topical focus of the 2007 project.

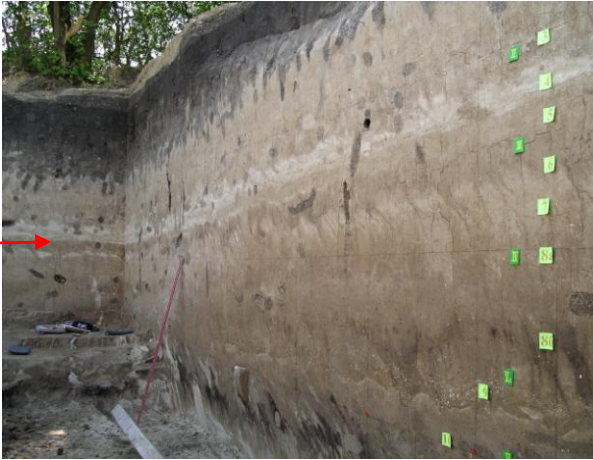


Figure 1. Kostenki 1 west wall 2007 excavations; red arrow indicates position of buried soil containing Aurignacian assemblage (Layer III).



Figure 2. Excavations at Kostenki 14 in Layer I (Gravettian) containing large concentration of mammoth remains.

Kostenki 8 (Tel'manskaya). For the first time in many years, new excavations were undertaken at this major EUP site, under the direction of V.V. Popov. Kostenki 8 is located near the mouth of a ravine (*Aleksandrovka*) located roughly 2 km south of Pokrovskii Ravine. After some preliminary testing designed to locate the original excavation units (Rogachev), a 2 x 3 meter unit was excavated into a previously undisturbed area at the site (see Figure 3), yielding a typical set of wall profiles for Kostenki 8 and several hundred artifacts and faunal remains from Layers I-III (Layers II and III are buried in the Upper Humic Bed and date to the later EUP). Sediment samples (for soil micromorphology analyses) were collected by the senior author from the major stratigraphic units, including the loess-like loam that overlies the Upper Humic Bed at this locality. The results from the 2007 field research will be used to plan more substantial excavation in 2008.

Borshchevo 5. The village of Borshchevo is located on the west bank of the Don River roughly 6 km southeast of Kostenki. Like the Kostenki sites containing EUP occupations, Borshchevo 5 is found on the second terrace level of a large ravine that contains an active spring. Discovered in 1998 and initially excavated in 2002-2004, new work was undertaken by S. N. Lisitsyn with a small crew during July-August 2007. Approximately 20 m² was exposed and artifacts and faunal remains were recovered from Layer I (Gravettian), Layer II (late EUP in the Upper Humic Bed), and Layer III (overlying the volcanic tephra, which is relatively thick and unweathered here).



Figure 3. Kostenki 8: 2 x 3 meter test unit excavated in 2007 showing Upper Humic Bed (arrow) containing Layer II & III (late EUP).



Figure 4. Kostenki 14, Layer II: distal tibia of horse exhibiting stone tool cut-marks (photographed by JFH in St. Petersburg in March 2008).

Zooarchaeology Research: March 2008

During March 2008, the senior author (Hoffecker) collected data on faunal remains excavated from late EUP levels by Rogachev during the 1950s at Kostenki 14 (Layer II) and Kostenki 15, and stored at the Zoological Institute in St. Petersburg. Taphonomic data, including represented skeletal parts, weathering, breakage patterns, carnivore damage, traces of tools, and other information were gathered from the large assemblages of horse (*Equus latipes*) from these two occupation layers (both associated with the Upper Humic Bed) (Figure 4). Hoffecker also examined, for the first time, the small mammal remains from Kostenki 14, Layer IV (Rogachev 1954 excavations), which reflect a significant expansion of diet (with implication for technological innovation) to smaller vertebrates during the EUP relative to the preceding later Middle Paleolithic.

Conclusions

New excavations were undertaken at four sites containing one or more occupation levels dating to the later EUP (39,000-30,000 cal years BP) and associated with the Upper Humic Bed or its stratigraphic equivalent at Kostenki-Borshchevo. More than a thousand stone artifacts and several hundred associated faunal remains were recovered from these levels, and more than thousand mammoth bones and teeth were recovered from a younger level (Layer I) at Kostenki 14. The research focus of the 2007 project was the pattern of technological innovation during the second phase of the EUP in Eastern Europe, prior to the appearance of the Eastern Gravettian industry 30,000-28,000 cal years BP.

The data collected during 2007 will not contribute significantly to the information base needed to address the problems defined as the research focus of the project. Most of the data required to investigate these problems will be retrieved from earlier excavations and existing collections (including those of Rogachev during the 1950s). The limitations of the 2007 field research in this respect are tied to the unexpectedly high concentration of material in Layer I (Gravettian) at Kostenki 14, which occupied most of the time and effort at this locality, as well as the comparatively low density of material recovered from Layer III at Kostenki 1.

Nevertheless, the 2007-2008 research at Kostenki may ultimately contribute substantially to the study of the EUP in Europe. The results of the new research seemed to reinforce two patterns that have emerged since the Russian-American project began in 2001. The first of these is the growing evidence of multiple locations at Kostenki-Borshchevo where the butchery (and in some cases probably the killing) of large mammals took place. They now include Kostenki 1, Layer V (where an adult mammoth apparently was dismembered) and Kostenki 12, Layer III, where both horses and reindeer seem to have been butchered (see Hoffecker et al. 2005). To these may added both Kostenki 14, Layer II and Kostenki 15, where large numbers of horses probably were butchered.

The second pattern that has become increasingly apparent is the co-occurrence of artifact types once believed to represent discrete “archaeological cultures.” The most recent manifestation of this has been at Kostenki 1, Layer III, where many artifacts diagnostic of the Streletskaya culture (containing a high proportion of typical Middle Paleolithic forms) have been recovered from an occupation layer previously regarded as exclusively Aurignacian. But the pattern has been emerging for years, and there are few if any EUP occupation layers at Kostenki-Borshchevo that do not contain a “mixture” of cultures (e.g., Praslov and Rogachev 1982) with the exception of those assemblages assigned to the Gorodtsovskaya culture—defined as comprising a mixture of Middle and Upper Paleolithic forms (Hoffecker 2002: 172).

From the perspective of the senior author, the varying percentages of typical Middle Paleolithic forms (e.g., side-scrapers, bifaces) appear more likely to reflect functional rather than cultural differences; high percentages of them are invariably associated with evidence of large-mammal butchery (and this applies to other EUP sites on the East European Plain). It should be kept in mind that the variety of open-air sites on the East European Plain probably offer a more complete picture of EUP activities than the rockshelters of southwest France, which seem to be heavily biased toward habitation sites (and against kill-butchery locations). Traditionally, the EUP assemblages at Kostenki-Borshchevo have been classified in accordance with a French model, but this now seems inappropriate, and the EUP cultures identified here as “archaic” (or “transitional”) and compared with the Chatelperronian may be absent.

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