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THE AGE OF THE SUNGHIR UPPER PALEOLITHIC HUMAN BURIALS

ABSTRACT: The earlier Upper Paleolithic site of Sunghir, northern Russia yielded elaborate burials of an adult and of two immature individuals, dug into the sediments below a rich archeological horizon. The faunal remains and the human burials have yielded a series of radiocarbon dates, raising questions as to the age of the site and whether the burials postdated the archeological remains. Current radiocarbon dates on the human remains place them between 25,000 and 27,500 ^{14}C BP; this age is among the majority of the faunal dates, supporting the stratigraphic and artifactual evidence for contemporaneitys of the burials and the archeological levels. Multiple lines of evidence from the site indicate that the occupation and the burials were during a moderately warm phase of the Interpleniglacial (Marine Isotope Stage 3). Paleoclimatic correlation indicates that they must therefore date to one of the Greenland Interstadials, most likely GI-5 ~28,000 ^{14}C BP. These dates place the Sunghir site and the human burials among the earliest of the Mid Upper Paleolithic elaborate burials currently known.

KEY WORDS: Human paleontology – Radiocarbon – Russia – Dating – Paleoclimate

INTRODUCTION

In 1964 and 1969, during excavations at the site of Sunghir in northern Russia under the direction of O. N. Bader, V. I. Gromov and V. N. Sukachev, two spectacular earlier Upper Paleolithic burials (Graves 1 and 2) were discovered, dug into the sandy loess underlying the Cultural Layer of the site (*Figure 1*). Additional human remains, including a badly decayed burial (Grave 2bis), were found within the Cultural Layer, but it is the two intact burials, Graves 1 and 2, that have received the most attention. This focus on them is well-deserved, given that the remains are very complete for Paleolithic human remains (*Figure 2*), the bodies were lavishly decorated, and the immature individuals were accompanied by abundant grave goods (Bader 1998, Trinkaus *et al*. 2014). They were rich even relative to the often elaborate burials known from the Mid Upper Paleolithic of Europe (Henry-Gambier 2001, 2008, Pettitt 2011, Valoch 1959, Vanhaeren, d'Errico 2002).

Grave 1 contained the remains of a 35–45 year old adult male (Sunghir 1), buried on his back in an extended

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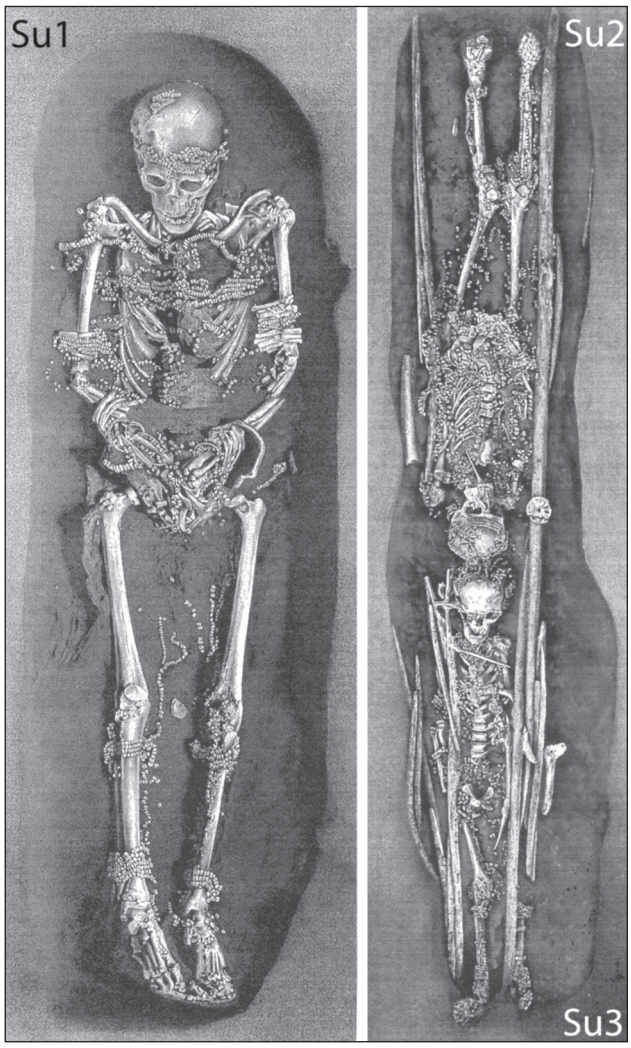

FIGURE 1. Drawings of the Sunghir burials. Left: Sunghir 1 (Su1) in Grave 1. Right: Sunghir 2 (Su2) and 3 (Su3) in Grave 2, with the Sunghir 4 femoral diaphysis by the left arm of Sunghir 2. Modified from O. N. Bader (1998: Plates 1, 9). Reproduced courtesy of N. O. Bader.

position, with ochre (especially abundant around the head and shoulders), a few grave items, ivory arm bands, and ~3000 mammoth ivory beads, the last apparently sewn onto clothing. He had died suddenly of an injury to the neck (Trinkaus, Buzhilova 2012). Grave 2 contained the head-to-head remains of a 11–13 year old male (Sunghir 2) and a 9–11 year old probable female (Sunghir 3), each in an extended position and accompanied by > 10,000 ivory beads, ~300 pierced fox canines (on Sunghir 2), upper body ochre, ivory arm bands, small ivory carvings, fibulae, tubular beads, 16 mammoth ivory spears (mostly with Sunghir 3), and a modified human adult femoral diaphysis (Sunghir 4, alongside Sunghir 2). Sunghir 3 had suffered from congenital femoral deformities and persistent stress (Buzhilova 2000, Formicola, Buzhilova 2004, Guatelli-Steinberg *et al*. 2013), and Sunghir 2 exhibits a curious lack of dental wear and masticatory muscle development, osteolytic cysts and a possible perimortem injury (Trinkaus *et al*. 2014). It remains unclear to what extent these biologically unusual features relate to the elaborateness of their burials (cf. Formicola 2007, Trinkaus *et al*. 2014).

The Sunghir human remains have received considerable human paleontological attention (Alexeeva *et al*. 2000, Trinkaus *et al*. 2014, Zubov, Kharitonov 1984), and the burials figure prominently in most discussions of Mid Upper Paleolithic human mortuary behavior (cf. Pettitt 2011 and references therein). However, there has been an ongoing debate concerning the geological ages of these elaborate burials since their discovery half a century ago. In light of currently available radiocarbon determinations for the site and on the human remains and in the context of the paleoenvironmental indicators from the site, it may be possible to provide some resolution to this chronological issue. These chronological considerations relate to both the site of Sunghir and to broader chronological issues regarding earlier Upper Paleolithic mortuary practices.

THE SITE OF SUNGHIR

The archeological site of Sunghir (Сунгирь, Sungir') is located along the northeastern edge of Vladimir, Russia, 192 km north of Moscow (56°10'30"N, 40°30'30"E) (Bader 1978). It is located on a rise adjacent to where the small Sunghir Stream flows into the Klyasma River. It was under several meters of loess, which was being commercially exploited and thereby exposed the archeological remains. As detailed by Bader (1978, see also Bader, Mikhajlova 1998, Gugalinskaya, Alifanov 2000), the basic site stratigraphy (over most of the excavated 4500 m^2) consisted (from above) of a modern humic level, a thick loess deposit with at least one depositional hiatus, a paleosol (the Cultural Layer, < 20 cm to ~1 m thick), and an underlying dense sandy loess (*Figure 3*). The overlying loess was heavily altered by ice wedges and solifluction. The internal stratigraphy of the Cultural Layer was also altered by the solifluction and ice wedges, as was the interface between it and the overlying loess, resulting in a variable mix of cultural

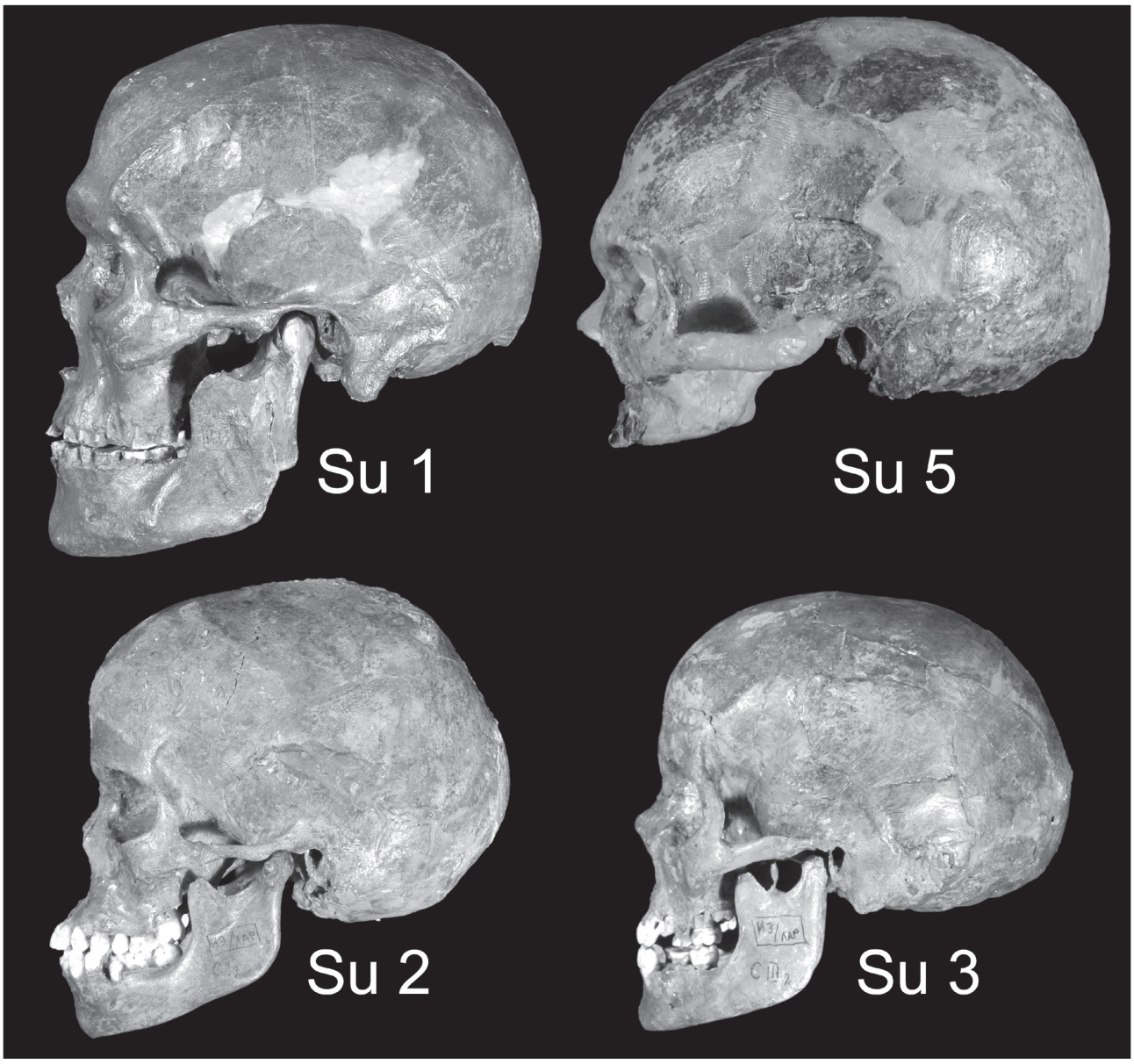

FIGURE 2. Left lateral views of the Sunghir 1 and 5 adult skulls (above) and the Sunghir 2 and 3 immature skulls (below).

materials within the Cultural Layer and some movement of them up into the overlying sediments. However, disturbance of the lower portion of the Cultural Layer appears to have been far less, in portions of it the internal stratigraphy remained, and a number of pits and hearths (plus the two graves) dug into the underlying sandy loess were undisturbed.

The Cultural Layer contained an abundance of faunal remains (Alekseeva 1998), including distinctly cold climate species (e.g., *Mammuthus primigenius*, *Saiga cf. tatarica*, *Vulpes* (*Alopex*) *lagopus*, *Dicrostonyx guilielmi*, *Lepus timidus* and *Ocotona* sp., *Lyrurus tetrix*), as well as more temperate species or subspecies (e.g., *Bison* sp., *Equus ferus latipes*, *Rangifer tarandus fennicus*, *Spermophilus citellus*, *Gallus* sp.). The pollen profiles indicate a boreal forest with an alternation in the frequencies of pines (*Pinus*), birches (*Betula*) and spruces (*Picea*) (Lavrushin *et al*. 2000), a vegetation that is only likely to have been present as far north as Sunghir on the eastern European plain during relatively warm

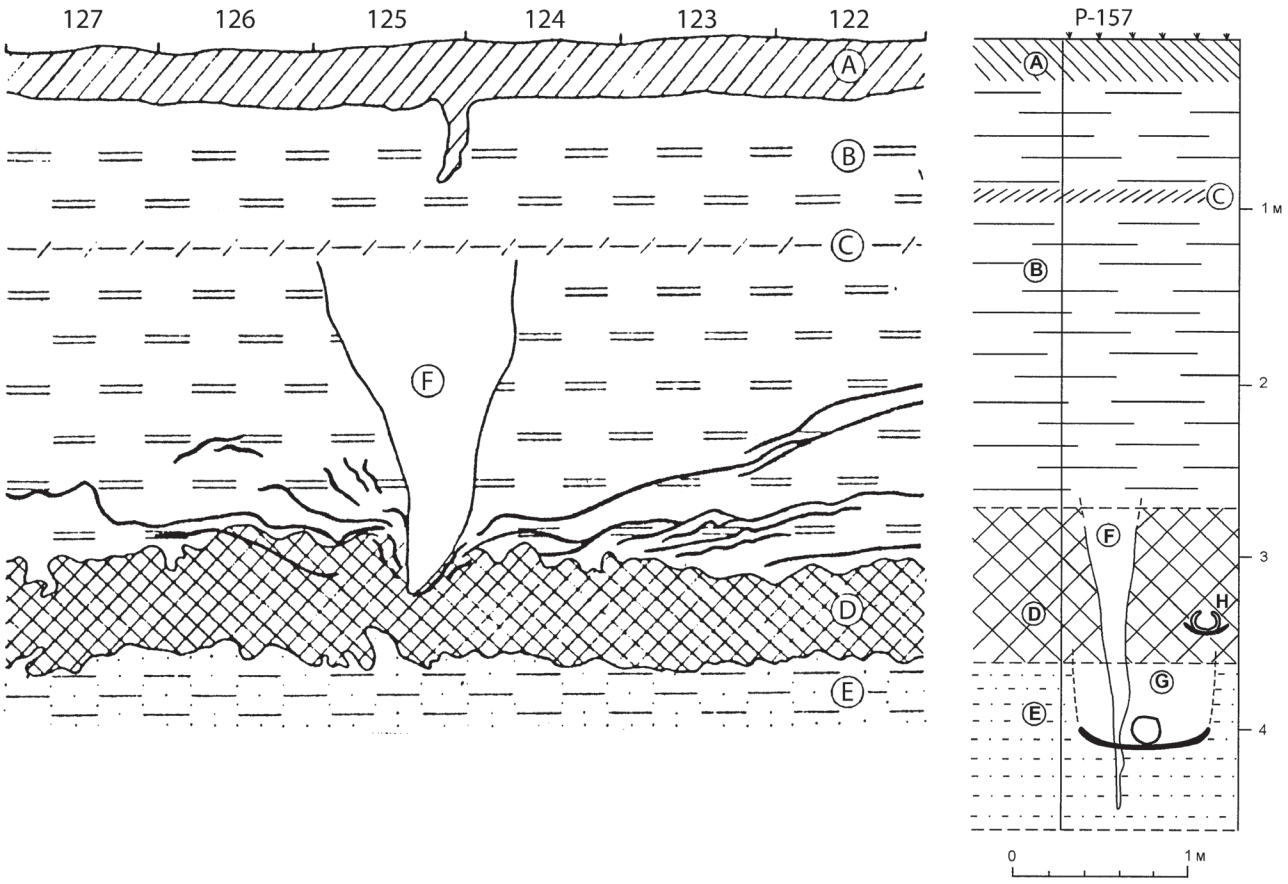

FIGURE 3. Left: representative stratigraphic profile from the excavations at Sunghir, squares 122 to 127 of Excavation III. Modified from O. N. Bader (1978: Fig. 16). Right: schematic stratigraphic profile of Square P-157 of the excavations with Grave 1. Modified from O. N. Bader (1998: Fig. 20). A, modern humic level; B, overlying loess levels with a depositional hiatus (C); D, paleosol of the Cultural Layer; E, light yellow dense sandy loam, underlying Cultural Layer; F, sediment filling ice wedges; G, the burial pit for Grave 1 / Sunghir 1 dug into the underlying sandy loam, with the position of the skull indicated by the circle; H, the position of the Sunghir 5 cranium within the Cultural Layer above Grave 1. Images reproduced courtesy of N. O. Bader.

periods of Marine Isotope Stage (MIS) 3 (Fletcher *et al*. 2010). In addition, Graves 1 and 2, as well as number of pits and hearths, were dug into the underlying sandy loess, indicating the lack of permafrost during the site's occupation. These climatic indicators, plus the sedimentology of the site (the organically rich paleosol between the loess levels) led to the Cultural Layer being referred to a moderately warm phase of the Late Pleistocene Bryansk interstadial (Gugalinskaya, Alifanov 2000), the Late Pleistocene Interpleniglacial or MIS 3 (cf. Velichko *et al*. 2011). The site was definitely not occupied by humans during one of the cold phases (or stadials) of the Interpleniglacial.

RADIOCARBON DATING AND THE AGE OF THE SUNGHIR BURIALS

These observations have been accompanied by a long series of radiocarbon determinations, mostly on faunal remains (principally mammoth) (*Table 1*). The resultant dates of those securely from the Cultural Layer range from ~26 to ~30 ka ^{14}C BP, but the majority of them (especially those from AMS determinations) are between ~27 and ~30 ka ^{14}C BP. Those species likely to have been hunted (reindeer and horse) yielded mean dates between ~26.3 and ~27.4 ka ^{14}C BP, with the mammoth remains providing the larger range of values. It is possible that some of the

TABLE 1. Radiocarbon determinations for faunal remains from Sunghir. Modified from Sulerzhitski *et al*. (2000) and Marom *et al*. (2012).[1,2]

Laboratory number	Material dated	Date (^{14}C BP)
GIN-8995	Mammoth – femur	26,300 ± 260
GIN-9034	Horse – 5 fragments	26,300 ± 300
GIN-9030	Mammoth – femur	26,600 ± 300
GIN-9035	Reindeer – vertebra	26,900 ± 260
GIN-9591	Mammoth – tubular bone	27,000 ± 320
GIN-9027	Mammoth – ulna	27,200 ± 400
GIN-9586	Mammoth – femur	27,200 ± 500
GIN-9036	Reindeer – vertebra	27,260 ± 500
GIN-9033	Horse – 6 fragments	27,400 ± 400
OxA-9039[3]	Mammoth – tubular bone	27,460 ± 310
GIN-9031	Mammoth – femur	27,630 ± 280
GIN-5880	Mammoth – humerus	27,700 ± 500
GIN-9588	Mammoth – vertebra	27,800 ± 600
GIN-8997	Mammoth – femur	28,000 ± 250
GIN-9029	Mammoth – femur	28,000 ± 300
GIN-8999	Mammoth – humerus	28,120 ± 170
GIN-8996	Mammoth – femur	28,130 ± 370
GIN-9032	Mammoth – femur	28,350 ± 200
GIN-9028	Mammoth – ulna	28,800 ± 240
OxA-15755[4]	Mammoth – unspecified	29,450 ± 180
OxA-15752[4]	Mammoth – unspecified	29,650 ± 180

[1] Unless otherwise indicated, they were done using conventional radiocarbon dating.
[2] Not included are three more recent dates from the mixed upper margin of the Cultural Layer (GIN-8998, GIN -9585, GIN -9001), since it is not clear how they relate to the occupation levels at the site (Sulerzhitski *et al*. 2000).
[3] AMS date using the gelatinization method (Pettitt, Bader 2000).
[4] AMS date using ultrafiltration of the sample (Marom *et al*. 2012).

mammoth remains with older (> 27.5 ka ^{14}C BP) dates were scavenged from the landscape and hence predate the Cultural Layer. Yet, there remains a considerable range of apparent ages for the fauna from Sunghir.

The direct dates on the Sunghir burials have provided a series of ages that mostly cluster among the younger of the dates on the faunal remains (*Table 2*). Moreover, only one date on Sunghir 1, KIA-27006, places it within dating error of most of the dates for Sunghir 2 and 3. These dates are all AMS determinations, but they have employed a variety of pretreatment procedures. Most of the recent ones (KIA-27006 on Sunghir 1, OxA-15753 on Sunghir 2, and KIA-27007, OxA-15751, and OxA-15754 on Sunghir 3) have employed ultrafiltration (Dobrovolskaya *et al*. 2012, Marom *et al*. 2012), which should remove the smaller collagen fraction and tends to give earlier and/or more precise determinations (Brown *et al*. 1988, Higham *et al*. 2006). Ignoring the younger age determinations (those < 25 ka ^{14}C BP), these direct dates range from ~25 to ~27.5 ka ^{14}C BP.

Yet, Graves 1 and 2 were dug into the underlying sandy loess, below the Cultural Layer. There was no indication that they were dug through the Cultural Layer (Bader 1978, 1998). Moreover, the human remains were in anatomical position when discovered, with only minor movement of some elements (such as mandibular protrusion or the mixing of the hand bones) (Bader 1998) that normally accompanies decomposition of the body (Duday 2009). Only the axial skeletons were badly compressed, especially that of Sunghir 1, but for Sunghir 2 and 3 51 of a possible 58 vertebrae and 47 of 48 ribs are known (Trinkaus *et al*. 2014). In addition, the

TABLE 2. Direct radiocarbon dates of the Sunghir human remains. Note that Sunghir 2 and 3 were part of the same burial and should therefore be strictly contemporaneous. Sunghir 1 was buried separately but in close proximity.

Laboratory number	Material dated	Date (^{14}C BP)	C:N[1]	Reference[2]
Sunghir 1				
OxA-9036[3]	Tibia fragments	22,930 ± 200		1
AA-36473	Vertebra fragments	19,160 ± 270		2.3
KIA-27006[4]	Femur	27,050 ± 210	3.1	4
Sunghir 2				
OxA-9037[3]	Tibia fragments	23,830 ± 220	3.5	1
AA-36474	Right ribs	27,210 ± 710		2,3
AA-36475	Left ribs	26,200 ± 640		2,3
OxA-15753[4]	Archived tibia fragments	25,020 ± 120	3.3	5
Sunghir 3				
OxA-9038[3]	Tibia fragments	24,100 ± 240	3.4	1
AA-36476	Rib fragments	26,190 ± 640		2,3
KIA-27007[4]	Humerus	26,000 ± 410	3.5	4
OxA-15751[4]	Archived tibia fragments	25,430 ± 160	3.2	5
OxA-15754[4]	Archived tibia fragments	24,830 ± 110	3.2	5

[1] The available carbon:nitrogen atomic mass ratio, which should be between 2.9 and 3.6 (Ambrose 1990, DeNiro 1985) to indicate appropriate collagen preservation.
[2] References: 1, Pettitt, Bader (2000); 2, Sulerzhitski *et al*. (2000); 3, Kuzmin *et al*. (2004); 4, Dobrovolskaya *et al*. (2012); 5, Marom *et al*. (2012).
[3] AMS date using the gelatinization method; C:N ratios from P. B. Pettitt (pers. comm.).
[4] AMS date using ultrafiltration of the sample.

abundant ivory beads on the remains were in their original, undisturbed sequences across many portions of the skeletons. Given the excellent preservation of these skeletons and their associated artifacts, it is not possible that the bodies were disturbed by more than sediment compaction after burial, or that the solifluction and ice wedges in the overlying Cultural Layer and loess substantially affected them. Moreover, almost all of the objects associated with the burials (ochre, ivory beads, ivory spears, animal carvings, round ivory disks, pierced fox teeth, tubular beads, schist pendants, and reindeer antler; all except the ivory arm bands) are known from the Cultural Layer (Bader 1978), and some of them were in the disturbed Grave 2bis within the Cultural Layer (Bader 1998). Therefore, on stratigraphic, depositional, preservational, and cultural grounds, there is little reason to suggest that the burials might be intrusive through the Cultural Layer into the underlying sandy loess or that they should be substantially different in age.

Given these considerations, it may be possible to place the Sunghir Cultural Layer and the associated burials within a Late Pleistocene, MIS 3 context. As noted above, all of the indications from the site place the Cultural Layer within a distinctly warm phase of the Interpleniglacial, between the underlying colder climate sandy loess and the overlying loess with abundant evidence of solifluction plus ice wedges through the sediment. The Cultural Layer paleosol should therefore date to one of the Greenland Interstadials (GI) within MIS 3. GIs are relatively brief warm periods that are reflected in sediments globally (Fleitmann *et al*. 2009, Svensson *et al*. 2008, Wang *et al*. 2001), and therefore they should apply to climatic cycles in the northern Russian plain.

An age of ~26,000 ^{14}C BP converts [Calib 6.1.1 (Stuiver *et al*. 2013)] to ~30,500 cal BP, and ~29,500 ^{14}C BP converts to ~34,000 cal BP. The more recent age is close to the very cold Heinrich Event 3 (HE-3) (Hemming 2004); it is an unlikely period of site occupation given the multiple indicators of a relatively warm phase during the formation of the Cultural Layer. The earlier age is close to the onset of the GI-6 (~33,690 (± 606) cal BP) (Wolff *et al*. 2010). In addition, the onset

of GI-5 is dated to ~32,450 (± 566) cal BP, which is close to a radiocarbon age of ~28,000 ^{14}C BP. If the Sunghir occupation was more recent than GI-5, it would have to have been post-HE-3, in the vicinity of GI-4 (~28,850 cal BP or ~24,000 ^{14}C BP), substantially later than almost all of the Sunghir radiocarbon dates although overlapping some of the more recent human burial dates. Making it older would place it in GI-7 (~35,450 cal BP or ~31,500 ^{14}C BP), more than two standard deviations older than the oldest of the Sunghir radiocarbon dates.

From the available radiocarbon dates and these comparisons, and inferring that Sunghir was occupied principally during one of these (relatively) warmer phases, the likely periods of occupations were ~28,000 or ~29,500 ^{14}C BP, or during GI-5 or GI-6. An age during GI-5 would place the Sunghir Cultural Layer and burials close to the majority of the radiocarbon determinations for the faunal remains and among the older of the AMS human dates. An age during GI-6 would be close to the two oldest mammoth dates, but older than the direct dates on the human remains, including the more recent ones using ultrafiltration.

DISCUSSION

The artifactual similarities between the Sunghir graves and between them and the Cultural Layer have long been used to argue for approximate contemporaneity of the burials and archeological horizon. More importantly, the stratigraphic context makes it unlikely that the burials (especially Grave 1, given its previous rather young dates) were intrusive through the Cultural Layer. The more recent direct ^{14}C determinations on them (especially Dobrovolskaya *et al*. 2012) support this contemporaneity. When the paleoclimatic information from the site is placed in the context of the global Greenland Interstadials, it is then very likely that the Sunghir Cultural Layer and the directly associated human burials in Graves 1 and 2 (and 2bis) date to GI-5 or ~28,000 ^{14}C BP (~32,500 cal BP); it is also possible that they derive from GI-6 or ~29,500 ^{14}C BP (~34,000 cal BP). The geologically younger radiocarbon determinations are likely to be the products of insufficient decontamination of the samples, a persistent issue in long-since curated bones of this geological age.

These dates, or time range, place the Sunghir burials among the earliest Upper Paleolithic ones known in Europe. Globally, they are preceded in the Upper Paleolithic only by the Nazlet Khater burials (Crevecoeur 2008, Vermeersch 2002) and the probable burial from Tianyuandong (Fernández-Jalvo, Andrews 2010, Shang, Trinkaus 2010). The Sunghir GI-5 date is between the latest dates obtained for Paviland 1 (Jacobi, Higham 2008) and the associated date for Cro-Magnon (Henry-Gambier 2002), and a GI-6 date would place it among the oldest Upper Paleolithic burials in Europe. These determinations are then followed sequentially, given current radiocarbon determinations for directly dated Mid Upper Paleolithic burials, by Dolní Věstonice 13–15 and 16, Lagar Velho 1, Brno-Francouzská 2, La Rochette 1, Arene Candide IP, and Kostenki 6 (Orschiedt 2002, Pettitt, Trinkaus 2000, Pettitt *et al*. 2002, 2003, Sinitsyn 2004, Svoboda 2006). The additional Mid Upper Paleolithic burials (see inventories in Henry-Gambier 2001, 2008, Trinkaus *et al*. 2014, Vanhaeren, d'Errico 2002, Zilhão, Trinkaus 2002) lack direct dates on the human remains and/or burial objects, although some have dates from the associated archeological level.

This chronological placement of the Sunghir burials, among the earliest of these internments, raises questions about the chronology of Upper Paleolithic burial practices. It has been suggested (cf. Pettitt 2011) that there may have been a time factor to the elaborateness of the Mid Upper Paleolithic burials, with the earlier ones being simpler with fewer body decorations and/or grave goods, and the more elaborate ones (especially those from Arene Candide and Brno-Francouzská; Cardini 1942, Valoch 1959) being later. Yet, the dating of the Sunghir burials proposed here indicates that some of the earliest of these burials are also the richest. The history of radiocarbon dating of the Sunghir burials, as well as of some of the other Mid Upper Paleolithic ones (cf. Jacobi, Higham 2008), should be sufficient to dispel any confidence in time-related scenarios of burial practice evolution within the Mid Upper Paleolithic. It also raises the question of whether a number of the current dates for such burials do little more than confirm that the burials are indeed from the Mid Upper Paleolithic. Redating of some of the burials could well change their chronological order and thereby change perceptions of trends in mortuary behavior.

OTHER SUNGHIR DATES

In this context, it should be mentioned that there are, or have been, alternative ages suggested for the Sunghir burials. For different reasons, there are difficulties with those assessments.

The first concerns an inadvertent mistake; two dates of ~22 ka ^{14}C BP on charcoal from the hearths in the

Cultural Layer (GIN-326a and GIN-326b) (Bader 1978: Tab. 3) were listed as deriving from beneath Sunghir 1 in Grave 1 (Sulerzhitski *et al*. 2000, see also Nalawade-Chavan *et al*. 2014, Dobrovolskaya *et al*. 2012). They do not relate to the burial and, as noted by Bader (1978), they are almost certainly too young even for the hearths.

Suggestions of a substantially older "pre-Aurignacian" date based on lithic typology comparisons to Streletskaya assemblages at the Kostenki sites (Bosinski 2013) would negate all of the radiocarbon dates from Sunghir and assume that stylistic attributes of the Sunghir lithic assemblage can be used to provide an accurate age independent of radiometric determinations. In addition to difficulties in making such stylistic inferences, there are differences between the Streletskaya assemblages at Sunghir and the Kostenki sites (Anikovich 2005, Bader 1978), and similar assemblages appear to have had a considerable time range during MIS 3 (Anikovich 2005, Otte *et al*. 2006).

In addition, there are two recent radiocarbon dates (Marom *et al*. 2012) from the hydroxyproline extracted from samples of Sunghir 2 and 3 and a mammoth, samples archived from the earlier AMS dating by Pettitt and Bader (2000). They yielded dates of 30,100 ± 550 (OxX-2395-6) for Sunghir 2, 30,000 ± 400 (OxX-2395-7) for Sunghir 3, and 30,100 ± 400 (OxX-2395-8) ^{14}C BP for the piece of mammoth bone. They are among the oldest AMS mammoth dates, older than the remainder of the Sunghir human dates, and close to the GI-6 warm phase. However, it is not apparent that the AMS dating of the hydroxyproline bone collagen fraction has been adequately validated, especially for the time period of these Sunghir determinations; Marom *et al*. (2012) provided validating results only for a late historic sample and one beyond the radiocarbon dating range. Hydroxyproline can also be abundant in plant cell walls, its concentrations enhanced by bacteria (Cassab *et al*. 1985, Deepak *et al*. 2010, Mazau, Esquerré-Tugayé 1986), and it therefore does not appear to be necessarily a bone-specific biomarker. It is also curious that Sunghir 2 and 3 and the mammoth bone of unspecified provenience within Sunghir provided essentially identical hydroxyproline ^{14}C results, something exceptional even for multiple samples of the same bone.

Subsequently, hydroxyproline ^{14}C dates have been determined for Sunghir 1 and for the Sunghir 4 femur diaphysis associated with the Sunghir 2 and 3 burial (Nalawade-Chavan *et al*. 2014). The results are more recent but statistically similar to the hydroxyproline ones for Sunghir 2 and 3 (Sunghir 1: 28,890 ± 430 ^{14}C BP (OxX-2464-12); Sunghir 4: 29,820 ± 280 ^{14}C BP (OxX-2462-52)). These hydroxyproline dates, if accurate for the Sunghir burials, would argue for a GI-6 age, as opposed to a GI-5, age for Sunghir its human burials.

CONCLUSION

In his 1978 monograph on the Sunghir site, Bader proposed that the age of the Sunghir remains should be "on the order of 30–27 thousand (^{14}C) years" (1978: 65). The extensive application of radiocarbon dating to the site's contents, as well as paleoclimatic indicators, confirm his estimate. The actual age is most likely close to 28,000 ^{14}C BP within GI-5 but may be slightly older within GI-6. More importantly, recent dates and assessments reinforce the general contemporaneity of the Sunghir burials and the Cultural Layer and place them among the earliest of the European Upper Paleolithic burials. And they (especially Grave 2) remain the most elaborate of those burials, most closely approached in that respect by those of Brno-Francouzská 2 and Arene Candide IP.

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