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Worked Bones from Buran-Kaya III Level C and their Taphonomic Context

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Composite tools, hafting, and, in particular, the production of bone and ivory tools, with techniques specifically conceived for these materials, such as scraping, grinding, grooving, and polishing, are generally considered by archeologists to be important features characterizing modern human behavior (Mellars 1973; Klein 2000; McBrearty and Brooks 2000; Ambrose 2001). Complex bone technologies have long been seen as an invention of anatomically modern humans (AMH) during their spread across Europe, ca. 35,000 BP (Mellars 1973, 1992, 1996; Bar-Yosef 1992, 1998; Klein 1994, 1999; Harrold 1992; Stringer and Gamble 1993; Farizy 1994; Mithen 1996). In the last few years, however, several occurrences of worked bones and personal ornaments have been reported from sites attributed to transitional technocomplexes, such as the Châtelperronian in France and Spain, the Uluzzian in Italy, and the Szeletian in the east of Europe (Gioia 1990; Granger and Lévèque 1997; Gambassini 1997; d'Errico et al. 1998, in press; Palma di Cesnola 1993; F. Lévèque, personal communication). Formal bone tools have also been found in relatively old African Middle Stone Age sites, such as Katanda (Brooks et al. 1995) and Blombos (Henshilwood et al. 2001). Buran-Kaya III is one of the sites that has provided some of the most ancient evidence for bone tool manufacture in Eurasia.

Original publications by Marks and others (Marks 1998; Yanevich et al. 1997) reported the discovery of several bone rods and a possible bone handle from a layer (Level C) that also yielded an original stone tool assemblage (Marks and Monigal 2000a; Monigal, Chapter 5). This assemblage showed no Aurignacian affinities two millennia earlier than the first known Aurignacian in the region. They described three bone rods, one made of a small mammal bone and two made of bird bones, and a distal segment of an horse metatarsal cut in the middle of the diaphysis. While the bone rods found in 1996 unquestionably come from Level C, the stratigraphic provenance of the cut metatarsal found in 1994 is more uncertain due to the excavation technique adopted that year (horizontal arbitrary levels). It may come from the base of the lower Kiik-Koba Level B1 or from Level C. The latter hypothesis is supported by the AMS dating of this object (32,350 ± 650 OxA-6869), closer to that of a bone fragment (32,350 ± 700) and a rod from Level C (36,700 ± 1500 OxA-6868) than those obtained from two bones from the Kiik-Koba Level B1, both around 28,600 BP (Pettitt 1998a). Subsequently, the worked bone and the faunal assemblage from Level C of 1996 excavations were analyzed by us (d'Errico and Laroulandie 2000). We included in our analysis two previously undescribed cut epiphyses identified among the faunal material, a burnt bone flake found during our analysis of the faunal assemblage that refit onto one of the already mentioned rod fragments, and a fragment of another *Equus* metatarsal possibly used as an handle. We showed that the bone rods were made of hare rather than bird bones, reconstructed the manufacture techniques involved in the production of the rods and the handle, conducted a taphonomic analysis of the faunal assemblage from Level C recovered in 1996, and discussed the significance of this material for the debate on cultural and biological interactions between late Neandertals and the first anatomically modern humans. Here we complete the taphonomic analysis of Level C, including in our study the faunal remains recovered since 1996. One clear and one probable additional bone tubes were identified by us in the faunal material from the 2001 excavation. The second aim of this paper is to integrate these new artifacts in our previous analysis of the Buran-Kaya III worked bone assemblage and to propose a new evaluation of their significance for the debate on the origin of bone manufacturing techniques.

Taphonomic Analysis of the Faunal Assemblage

Level C yielded 2,600 faunal remains (Table 7-1), 97% of which consist of unidentifiable mammal bone fragments. Most are small fragments (less than 3 cm long) of ribs and limb bones of large-sized mammals. The others correspond to limb bone fragments of small sized mammals. The remaining 48 bones correspond to a few *Lepus*, fox, *Saiga tatarica*, *Equus* sp., large cervid, and wolf remains. The assemblage also includes few micro-mammals. None of the taxa has an NMI exceeding 1 or 2. Although most of the remains carry traces of root etching and chemical diagenesis, this did not significantly affect the identification of the taphonomic agent responsible for the accumulation of the bone assemblage. Carnivore tooth marks are present on only four specimens, the cut horse metatarsal (see below), a distal epiphysis of a tibia of *Alopex*, and two shaft fragments from unidentified mammals. The dimension of punctures and scoring suggests that carnivores of different sizes were responsible for the traces on these four specimens. Typical etching produced by carnivore gastric acids (d'Errico and Villa 1997) was recorded on 17% of the remains (Figure 7-1). Clear signs of heating were observed on 8% of the fragments of large size mammals. One burned fragment was identified as hare and refitted onto a tube fragment (see below). Apart from the sawed bones (see below), anthropic modifications consisting of cutmarks (Figure 7-2) and percussion pits (Figure 7-3) are present on 0.6% and on a single specimen respectively.

Figure 7-1—Bone fragments digested by carnivores from Buran-Kaya III Level C. Scale = 1 cm.

Table 7-1
Faunal remains from Buran-Kaya III Level C

	NISP	*MNI*	*Burnt*	*Cutmarks*	*Percussion*	*Sawing marks*	*Tooth marks*	*Digested*
Canis lupus	1	1	–	–	–	1	–	–
Alopex lagopus	1	1	–	–	–	–	1	–
Vulpes/Alopex	12	–	–	–	–	–	–	3
Large deer	1	1	1	–	–	–	–	–
Saiga tatarica	10	2	–	2	–	–	–	3
Caprinae	5	–	–	–	–	–	–	4
Equus	4	1	–	–	–	1	1	–
Lepus sp.	14	2	–	2	–	5 +1?	–	1
Micro-mammals	17	–	–	–	–	–	–	–
Macro-mammals	2,535	–	212	13	1	–	2	431
Total	2,600	8	213	17	1	7 + 1?	4	442

NISP - number of individual specimens; MNI - minimum number of individuals.

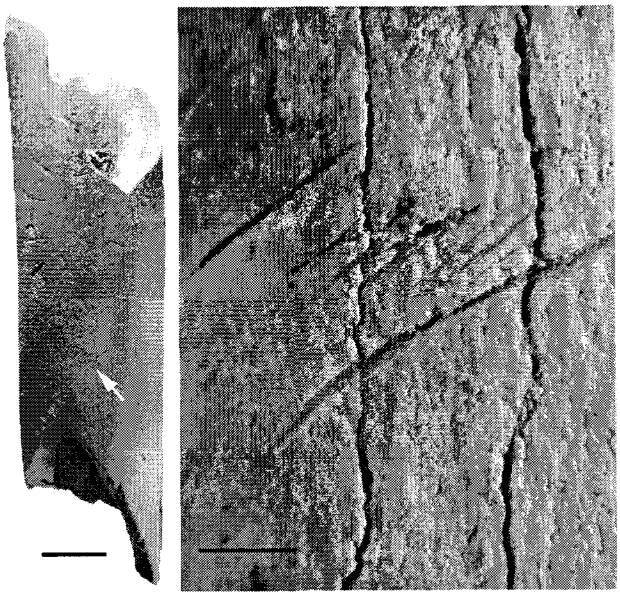

Figure 7-2—Cutmarks on the anterior aspect of a *Saiga tatarica* radio-ulna from Buran-Kaya III Level C. Left: scale = 1 cm; right: scale = 1 mm.

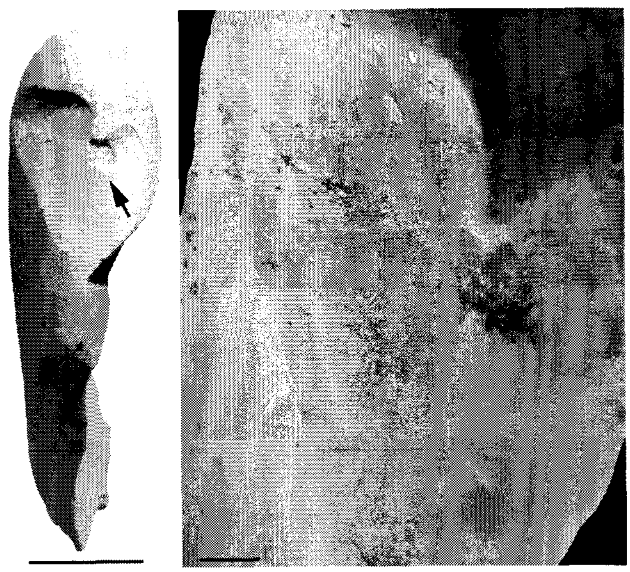

Figure 7-3—Percussion pit and related flake removal on a long bone shaft fragment from Buran-Kaya III Level C. Left: scale = 1 cm; right: scale = 1 mm.

Zooarcheological and Technological Analysis of the Worked Bones

Worked bones from Level C consist of one complete tube, four fragmentary tubes, and two by-products of tube manufacture. The other worked bone attributed to Level C is a distal portion of horse metatarsal, cut by sawing. Another distal epiphysis of horse metatarsal, heavily damaged, may have been modified in the same way and used as a handle.

One tube is made from the left tibia of a wolf (Figures 7-4: *1*; 7-5: *2*). Two others, described in the first report on the worked bones as being bird bone, come, in fact, from the right femur and left tibia of a hare (Figures 7-4: *2*, 4; 7-5: *1*, *4*). This last tube is represented by two conjoinable fragments, one of which shows clear traces of heating. One of the two tubes we found in the 2001 material was made from the femur of a hare (Figures 7-4: *3*; 7-6). The other is made from a right hare humerus (Figures 7-4: *7*; 7-7). The identification of this last piece as a manufactured tube is based on the presence of scraping marks similar to those seen on the other specimens, and on the possible remnants of traces of sawing on a tiny portion of the distal fracture. The two by-products are the proximal epiphysis and the distal segment, respectively, of a right and a left hare humerus (Figure 7-4: *5*, *6*). Therefore, they resulted from the production of two different tubes. In sum, the manufacturing remnants represent a minimum of six tubes from Level C.

The tube made from the wolf tibia comes from a sub-adult individual—a fact demonstrated by the great number of vascular openings, indicating the

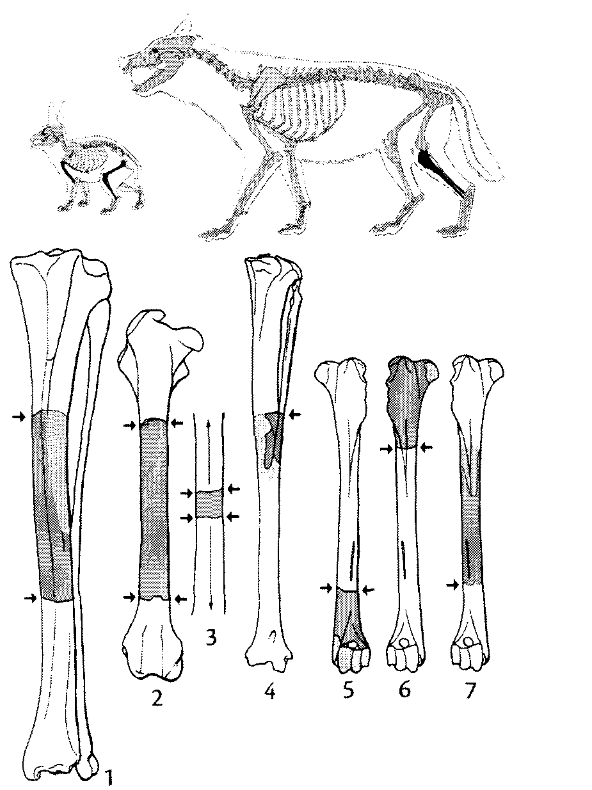

Figure 7-4—Anatomical provenance of the bone tubes and by-products of bone tube manufacture: 1–left wolf tibia; 2–right hare femur; 3–hare femur; 4–left hare tibia; 5–left hare humerus; 6, 7–right hare humeri. Light gray pattern indicates missing area. Black arrows indicate the area whence the tube comes. Small arrows indicate the location of the sawing.

Figure 7-5—Bone tubes and by-products of bone tube manufacture from Buran-Kaya III Level C found during 1996 excavations. 1–hare femur; 2–wolf tibia; 3, 4–hare humeri; 5–hare tibia. Scale = 1 cm.

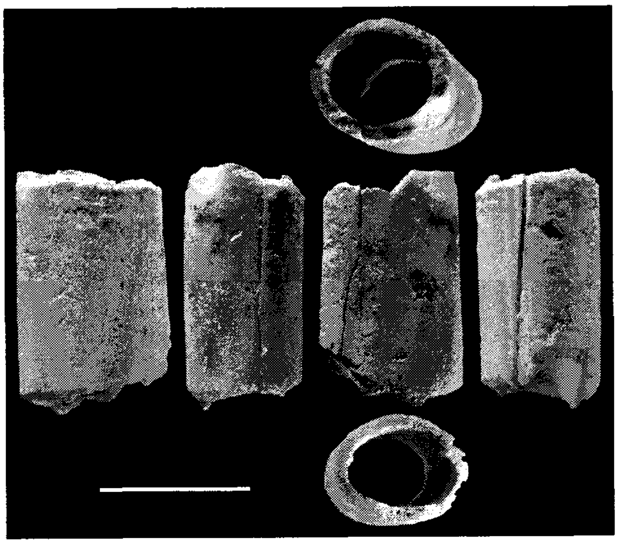

Figure 7-6—Bone tube made on a hare femur from Buran-Kaya III Level C, 2001 excavations. Scale = 1 cm.

high degree of vascularisation typical of immature animals.

All of the worked hare bones may come from a single animal. The closure of the epiphyses and the high density of the cortical bone, in all cases, indicate an adult individual. Its carcass was brought to and processed at the site before the bones were cut. The former is suggested by the identification of conjoining proximal segments of a right ulna and radius with a cut-mark crossing both epiphyses (Figure 7-8); the latter by the presence of the by-products of tube manufacture. Microscopic analysis of manufacturing traces and their experimental reproduction has allowed a detailed reconstruction of the craftsperson's technical behavior.

The two best preserved hare tubes (Figure 7-5: *1, 2*) and both by-products (Figure 7-5: *3, 4*) show scraping marks, indicating that entire long bones had been extracted from the carcass and cleaned before being cut (Figures 7-9: *1*; 7-10). In all cases, the scraping was made with a flint point or an irregular cutting-edge that produced single overlapping striations. The tubes were then produced by first cutting several intersecting notches around the circumference of the bone and subsequently snapping the residual uncut bone

Figure 7-7—Possible bone tube made on a hare humerus from Buran-Kaya III Level C, 2001 excavations. Scale = 1 cm.

Figure 7-8—Proximal epiphysis of a left hare radius and ulna crossed by an oblique cutmark (arrow) from Buran-Kaya III Level C. Scale = 1 cm.

by flexion. The use of this technique is demonstrated by the fact that the notches never completely saw through the bone and leave, in places, a thin uncut bridge broken by flexion, still visible on by-products and tubes (Figure 7-9: *3*). In three cases the notches were not perfectly aligned and in one case we find notches a few millimeters from the edge of the cutting (Figure 7-9: *4*). This is the consequence of an accidental side-skipping of the tool during the sawing action, as demonstrated by the accidental production of the same features during the experimental sawing of similar small bones (Figure 7-9: *2*). Experimentation also suggests that the Level C notches were made with a thick retouched cutting edge. This is demonstrated by the comparison of the section of the archeological notches with that of notches experimentally made with different types of tools. The notch profile is obtained through an image analysis system linked to a low power microscope (d'Errico 1991, 1998; d'Errico and Nowell 2000). Notches made with retouched tools can be distinguished from those produced by unretouched blanks by examining the notch morphology and measuring the angles formed by the notch walls. In our experiments, retouched tools produced notches between 60° and 91°, while unretouched ones resulted in angles between 39° and 67°. Overlapping of the two populations covers only 10% of the two samples and does not include the values obtained by measuring the Buran-Kaya III notches (74° and 92°), which clearly fall within the retouched sample (Figure 7-11).

The new tubes contradict the impression of size homogeneity suggested by the pieces available at the time of our previous study (d'Errico and Laroulandie 2000). The new complete tube made of hare femur is just 1.5 cm long, much shorter than the 7 cm length of the specimen made on the same bone and of that manufactured on the wolf tibia.

No traces indicating the function of the tubes have been detected. The ends of the tubes show the same unworn appearance as the by-products and the technological marks are very fresh. This may be due to the fact that the tubes were abandoned before being finished or that they were used in a way that did not produce any detectable wear. The refitting of two fragments of the same tube (Figure 7-5: *5*), one of which was burnt, indicates that the fracture of the object took place during the apparently short human presence associated with Level C and that, after break-

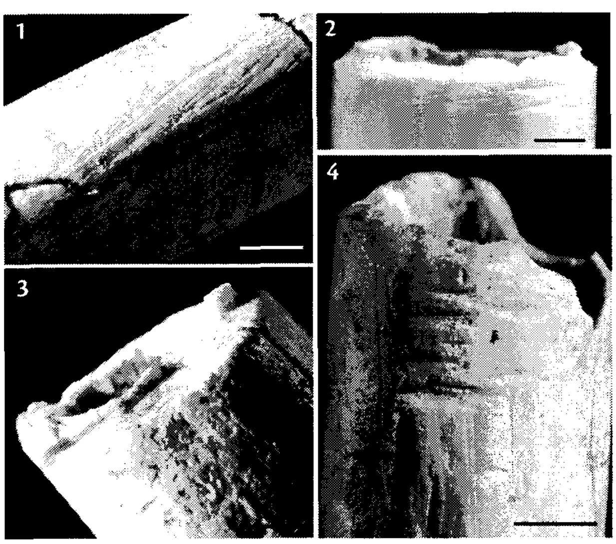

Figure 7-9—Traces of manufacture on archeological (1, 3, 4) and experimental (2) bone tubes: *1*–scraping marks on the tube made of hare femur, indicating that the bone was cleaned before being cut; 2–rabbit limb bone experimentally sawed and snapped, showing cutmarks a few millimeters from the tube end, similar to those present on the archeological specimens; 3–adjacent notches made to produce a groove around the hare femur before snapping it. Note the presence of a bridge broken by snapping the bone after sawing it; 4–scraping marks parallel to the object's main axis and notches produced accidentally during the sawing of the bone. Scales = 5 mm.

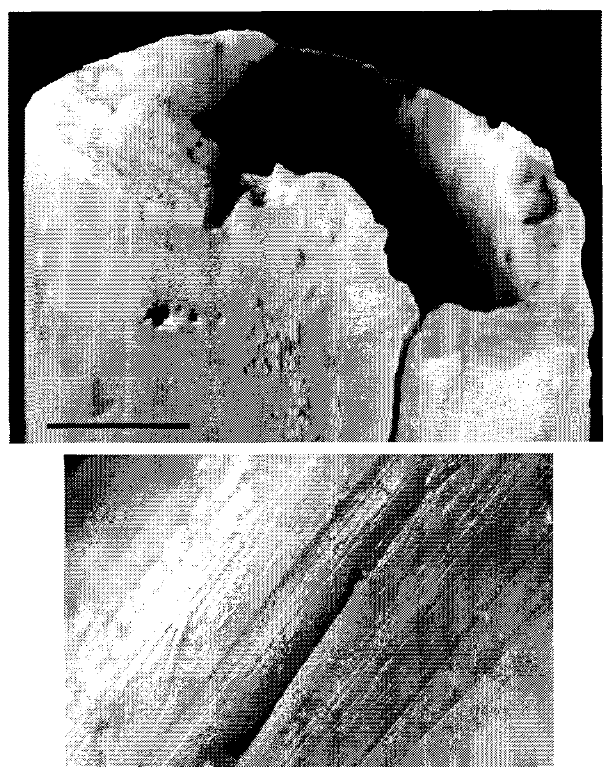

Figure 7-10—Traces of sawing (top) and scraping (bottom) on a bone tube from Buran-Kaya III Level C, 2001 excavations. Top: scale = 5 mm; bottom: scale = 1 mm.

age, one or both fragments were displaced, probably by trampling.

The size of the horse metatarsal (Figure 7-12) suggests that it comes from an *Equus ferus* or *caballus* rather than from a *hydruntinus*, as was proposed by Uerpmann (Yanevich et al. 1997). No scraping marks like those described on the tubes are present on this bone. However, our experimental butchery of an adult horse foot, with the aim of recovering and cutting the metatarsal, has shown that it is difficult to clean the bone, especially its distal epiphysis, without leaving tool marks. The absence of these marks on the archeological specimen, the virtual absence of other horse remains from the same level, and the fact that this is the only bone from Level C with damage produced by a large carnivore, suggest that the metatarsal was acquired by scavenging a bone already weathered and damaged by carnivores.

The horse metatarsal was cut slightly below the middle of the diaphysis (Figure 7-12). The technique used to saw it was the same applied to produce the tubes. However, experimental sawing and snapping of an adult horse metatarsal (Figure 7-13) and of two adult cow tibiae indicate that the manufacture of this object was a far more complex and time consuming operation. In order to produce a clean cut perpendicular to the bone's main axis like that visible on the archeological specimen, the artisan first had to engrave a continuous circular groove around the bone, before deepening it and eventually breaking the remaining bridge.

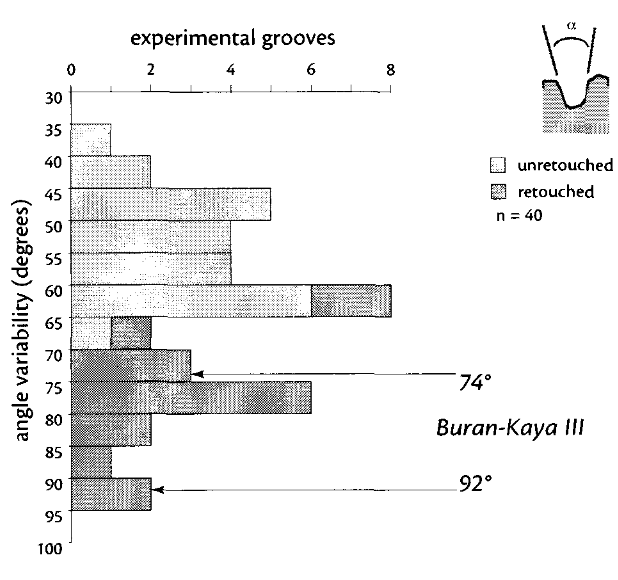

Figure 7-11—Angle variability of notches made experimentally by retouched and unretouched flakes. Values recorded on the Buran-Kaya III Level C notches adjacent to the tube ends fall within the range of notches made by retouched tools.

Figure 7-12—Horse metatarsal cut by sawing, with damage by a large carnivore on the distal epiphysis, from Buran-Kaya III Level C, 1994 excavations. Scale = 1 cm.

Several retouched artifacts were certainly used to deepen the groove, since unretouched blanks would have become quickly ineffective as they were used to saw thick compact bone. In our experiment, the sawing of the 1-cm-thick bone shaft took an hour and a half and required the use of seven unifacially or bifacially retouched artifacts between 7 and 14 cm long, all of which were used on both sides and were resharpened three to five times each during the process (Figure 7-13). The thickness of the uncut bone, broken by this action, suggests that the snapping of the metatarsal was done by a robust adult. The time and energy required by the production of this object rules out, in our view, the possibility that this might have been done just to recover the marrow.

It is more likely, as suggested by Yanevich et al. (1997), that this bone was used as a handle. The dimension of the medullar cavity, which is 3 cm deep by 2 cm wide, is perfectly compatible with the size of some of the endscrapers made of cortical flakes from Level C. Yet, no traces of its use as a handle are detectable on the metatarsal. The absence of spongy bone inside the bone shaft can be due to a taphonomic process or to a deliberate cleaning out, although no traces of this action are visible and the residual spongy bone does not appear crushed, as one might expect, by the pressure exerted by a hafted tool. Therefore, we cannot rule out the hypothesis that this object represents the by-product of the manufacture of another object, not found at the site. Another distal segment of an adult horse metapodial comes from Level C (Figure 7-14). This bone lacks the portion of the shaft where the sawing line is located on the cut metatarsal, which makes its identification as a worked bone speculative. The inner spongy tissue, however, shows a shallow regular pit that might be the result of a deliberate cleaning of the medullar cavity to insert a stone tool.

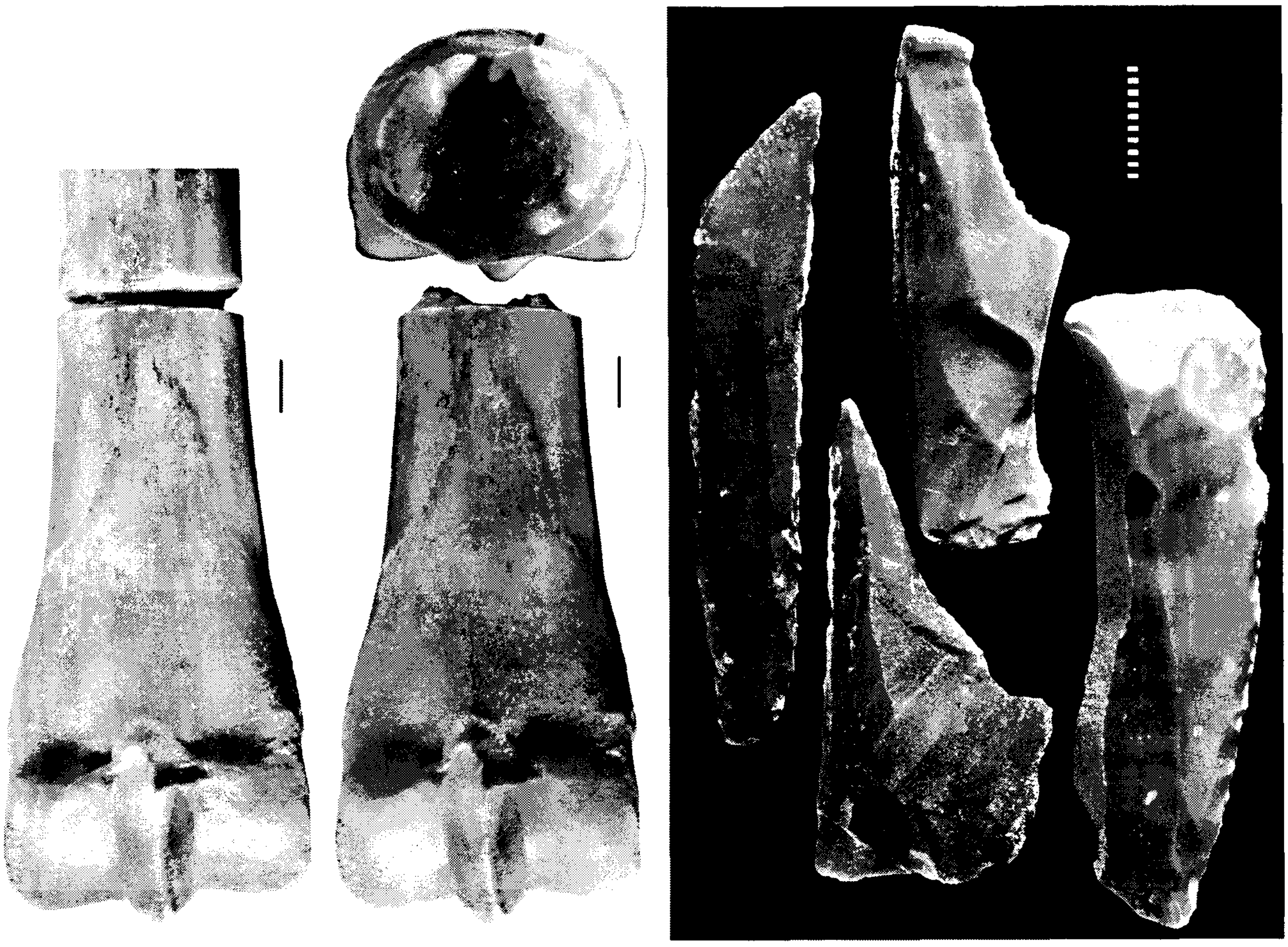

Figure 7-13—Left: adult horse metatarsal experimentally sawed and snapped. Note the striations left on the cut surface by the retouched artifacts used to deepen the circular groove. Right: experimental tools used to cut the bone. This technique leaves residues of bone (white area) on the tool edge. Left: scale = 1 cm.

Figure 7-14—Distal epiphysis of a horse metatarsal showing a conical pit that might be the result of a deliberate cleaning of the medullar cavity to insert a stone tool from Buran-Kaya III Level C. Scale = 1 cm.

Discussion

Both carnivores and humans were responsible for the accumulation of the Level C bone assemblage. The crucial role of carnivores is demonstrated by the high proportion of digested fragments and the debris of coprolites found during the screening of the faunal material. The low percentage of bone with carnivore tooth marks is probably due to the highly fragmented nature of the assemblage. The above observation suggests that humans may not have contributed much to the bone accumulation. This is also indicated by the low proportion of bone with percussion and cut marks and the relatively small volume of recovered burnt bone. In sum, results of our taphonomic analysis are consistent with the hypothesis that, on one hand, the faunal assemblage from Level C represents a palimpsest, recording one or a few short human occupations during which limited processing of mammal carcasses took place and, on the other hand, the use of the shelter as a carnivore den.

Our study shows that the human group responsible for the Buran-Kaya III Level C assemblage was in possession of a technology specifically conceived for working bone. They knew the species and the bones to be used for producing tubes of cylindrical morphology. This implies that animals were not only hunted for consumption, but that an appropriate treatment of the carcasses was applied in order to recover the bones to be used as raw material for bone tool manufacture. These bones were worked with the same techniques and using similar retouched tools. In our previous study, we emphasized the size similarity of the tubes available at the time and proposed that the goal of the Buran-Kaya III artisans was that of producing bone tubes of the same length, irrespective of the species and the type of bone used. The small size of the best-preserved new specimen demonstrates instead that different sizes of bone tubes were sought, suggesting a higher degree of technical complexity. Evaluation of the significance of such complexity, however, is difficult, considering that we have no idea of the final use of these artifacts.

In cases such as the cut metatarsal, their production required a certain experience, skill, time, strength, and the waste of a relatively large number of stone tools. Experimental manufacture of these objects reveals that Buran-Kaya III artisans were affected by the same neuromotor constraints as were the modern experimenters. Some of these objects, such as the probable handle, were certainly meant to be carried and repeatedly used. Although one might argue that similar planning and technical ability is suggested by the elaborate bifacial reduction sequence found in the same layer, it is a fact that clear evidence of specialized bone working has been sparse in the Middle Paleolithic archeological record, so far.

What is the significance of these behaviors? It is difficult to evaluate the implications of the Buran-Kaya III bone technology for the Middle/Upper Paleolithic transition of Eastern Europe; no human remains were found in Level C. As a consequence, we have no direct information on the human type responsible for the production of the bone industry.

The Level C assemblage (Marks 1998; Marks and Monigal 2000a) shows no taxonomic similarity with the local Aurignacian, which, in addition, does not seem to appear in the region before 30,000 BP. In contrast, bifacial foliates of this assemblage show some analogies with Kostienki-Streletskaya assemblages of the Middle Don region (Bradley et al. 1995), but it lacks some types, such as the concave base bifacial points. Level C bifacial tools also show very general affinities with geographically closer Ak-Kaya Middle Paleolithic assemblages of the eastern Crimea (Chabai et al., 1995), but do not include, in this case too, the

Middle Paleolithic tools that one would expect to find associated with the foliates. Even if the lack of Middle Paleolithic tools may be attributed to the specialized nature of the site and the ephemeral character of the occupation, still the numerous characteristic geometrics made on the by-products of bifacial reduction remain a peculiar feature of this assemblage, suggesting that only future research will establish sound cultural links.

If a relation with the Streletskayan is established, this might suggest that AMHs were the authors of the Buran-Kaya III assemblage, since this human type is responsible for the more recent phases of this industry. In contrast, a local Mousterian origin might suggest that they were Neandertals. As far as we know now, however, the Level C assemblage may have been produced by Neandertals, by Non-Aurignacian Anatomically Modern Humans, or even by a hybrid population, as recently suggested for Portugal (Duarte et al. 1999).

For the time being, the Buran-Kaya III worked bones confirm what it is already known for other industries at the Middle–Upper Paleolithic transition: specialized techniques to produce bone objects were not the monopoly of the Aurignacian, but rather a component of various industries of the transition. Bone and ivory tubes, often decorated with incisions, are well known, of course, in Aurignacian contexts from France, Belgium, Germany, Italy, and Russia (Figure 7-15). At Isturitz and Geißenklösterle, tubes produced by sawing bird bones were used to make flutes (Buisson 1991; Hahn and Münzel 1995; Lawson and d'Errico, in press). The only known unfinished tube, from Fumane Cave (Bartolomei et al. 1994), in northern Italy, shows a circular groove, indicating the use of the same technique described for Buran-Kaya III. Production and use of bone tubes, however, is not peculiar to the Aurignacian. Tubes decorated with notches made of swan long bones were found in the Châtelperronian layers of the Grotte du Renne, at Arcy-sur-Cure, in northern France (Leroi-Gourhan and Leroi-Gourhan 1965; d'Errico et al. 1998). As at Buran-Kaya III Level C, the tubes from Arcy were produced at the site, a fact demonstrated by the presence in the same layers of waste from their manufacture and by a possible refitting. As at Buran-Kaya III, long bone shafts of purposefully selected species were used to produce perfectly cylindrical tubes. Human remains associated with this material suggest that Châtelperronian Neandertals were the authors of these objects. Arcy is not the only site proving the use of tubular elements by late Neandertals. Several cut dentalium shells were found at Saint-Césaire in the Châtelperronian level that has yielded the Neandertal skeleton (F. Lévèque, pers. comm.), confirming that late Neandertals used personal ornaments, and suggesting that decorated bone tubes from Arcy may also have had this function. Dentalium shells were also found in Uluzzian sites of the Italian Peninsula (Gambassini 1997).

A number of Upper Paleolithic handles made of cut long bone and antler segments, some of which still have flint tools embedded in the medullar cavity (Absolon and Czizek 1932; Gerasimov 1958), are known from Eastern Europe. We know, however, that stone tools were also hafted during the Middle Paleolithic, a fact suggested by use-wear studies (Beyries 1987; Shea 1988; Friedman et al. 1995), as well as by the recent publication of traces of bitumen on Middle Paleolithic stone tools, and by the discovery of a Levallois point embedded in a wild ass cervical vertebra from the site of Umm El Tlel in Syria (Boëda et al. 1996, 1999). Two possible bone handles come from the Middle Paleolithic levels of the Vaufrey cave, in France. One is a fragment of antler, cut perpendicularly to the object's main axis with the same technique described at Buran-Kaya III. This object shows several deep notches, probably made to facilitate hafting (Vincent 1988). The other is a piece of antler which appears longitudinally split, with the spongy bone purposely taken out. Two birch-bark pitches have been recently found at the Middle Paleolithic site of Königsaue, Germany (Grünberg 2002). These pieces come from two different layers dated to 43,800 BP and 48,400 BP. One shows the imprint of a wooden haft, the other that of a bifacial tool.

In sum, recent discoveries indicate that hafting techniques were not limited to the Upper Paleolithic and that we are far from having a reliable picture of their use in earlier times.

Conclusions

Scholars who have a reductive view of Neandertal cognitive abilities have often considered that they were incapable of using sophisticated techniques specifically conceived for bone materials, based not just on percussion but on shaping by cutting, scraping, grinding, and polishing. The evidence presented above suggests, in contrast, that there is no reason to assume that the Buran-Kaya III artisans were AMHs just because they produced bone tools. The fact that similar objects are found in the Aurignacian should not be automatically considered, as it has in the past, as proof that Neandertals were acculturated by Aurignacian moderns. This interpretation, not supported by the archeological record, is based on the

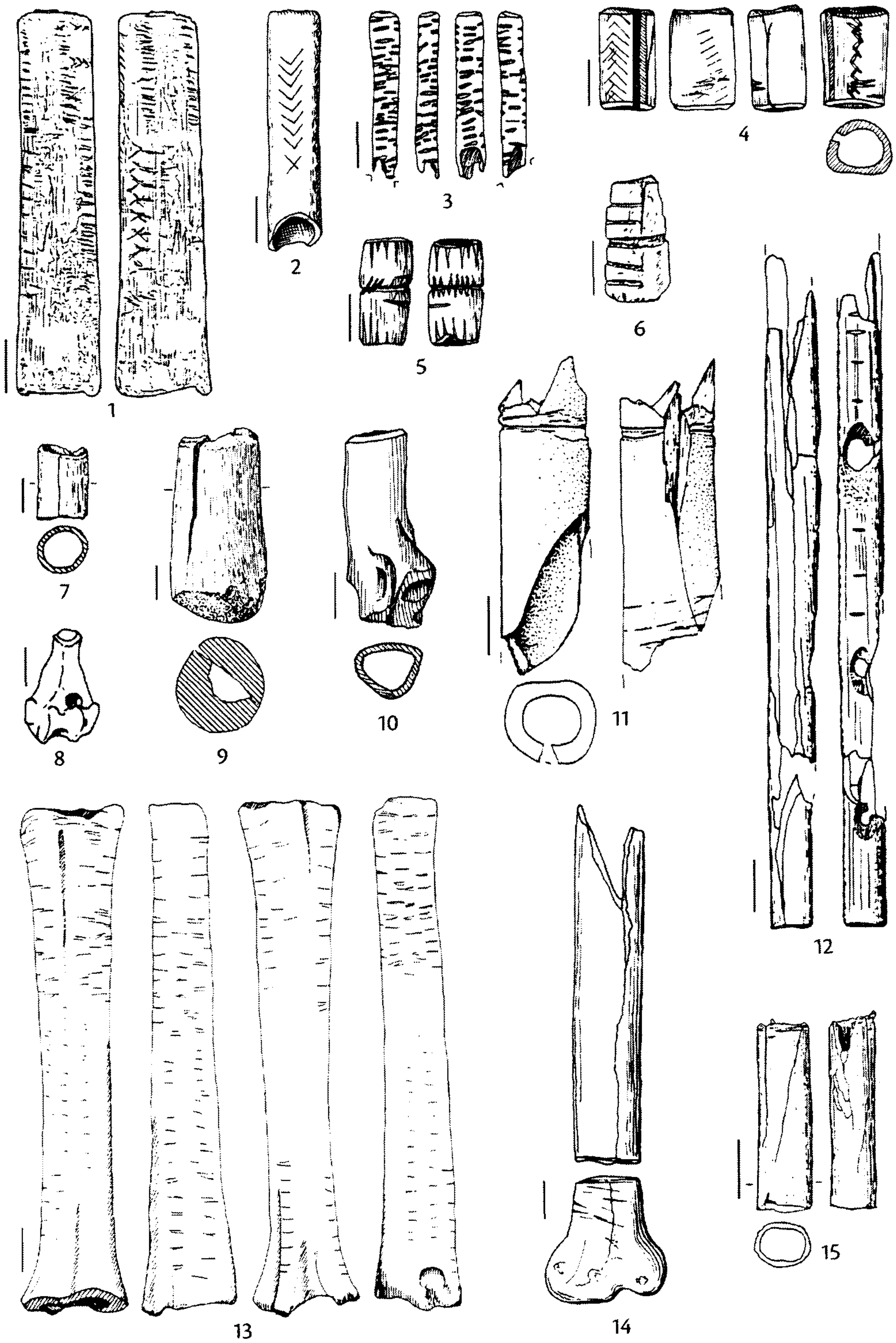

Figure 7-15—Bones tubes from Aurignacian and Châtelperronian sites: *1*–Spy, bone tube (Lejeune 1987, fig. 15); *2, 4*–Spy, bone tube (Otte 1979, fig. 127); *3*–Spy, bird bone tube (Otte 1979, fig. 127); *5*–Spy, ivory cask (Otte 1979, fig. 123); *6*–Spy, ivory cask (Lejeune 1987, fig. 11); *7*–Tarté, bird bone tube (Bouyssonie 1939, 193); *8*–Kostienki I, by-product of bone tube manufacture (Sinitsyn 1993, fig. 12); *9*–Tarté, reindeer antler armhole (Bouyssonie 1939, fig. 9); *10*–Spy, by-product of bone tube manufacture (Otte 1979, illus; 121); *11*–Fumane, bone shaft fragment with groove produced by sawing (Bartolomei et al. 1994, fig. 28); *12*–Geißenklösterle, bird bone flute (Hahn and Münzel 1995, fig. 4); *13*–bone tube (Otte 1979, fig. 54); *14*–Grotte du Renne, bird bone tube and the possible by-product of its manufacture (redrawn after d'Errico et al. 1998, fig. 4); *15*–Vogelherd, bone tube (Otte 1993, fig. 4). Items 1-12 and 15–Aurignacian, 14–Châtelperronian. Scale = 1 cm

assumption that industries such the Châtelperronian and the Uluzzian are contemporary with the first Aurignacians or even that they developed after the arrival of AMH. This contemporaneity, however, neither seems demonstrated by the stratigraphic evidence, nor by the radiocarbon evidence (Zilhão and d'Errico 1999; Bordes 2002). The Buran-Kaya III stratigraphic pattern, with a thick Kiik-Koba Middle Paleolithic assemblage separating the Upper Paleolithic from the level which has yielded the worked bones, provides further corroboration that, if made by Neandertals, Level C worked bones might represent the material expression of an independent cultural development of Eastern European late Neandertals.