

Characterizing the Early Upper Paleolithic bone industry from Sungir

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Abstract

The open-air Upper Paleolithic site Sungir is located near Vladimir, in the basin of Klyazma river, Russia. It was discovered in the 1956. Later excavations were conducted almost annually. The expedition under the leadership of O. Bader, N. Bader and L.A. Mihailova discovered over 4000 square meters of the site area for 24 field seasons (1957-2004). The majority of radiocarbon dates is ranged from 29,000 to 26,000 BP (34,000–30,000 BP cal.).

Stone industry is characterized by an original stone assemblage with specific triangle points. Analogous industry is discovered at the sites of Streletskian culture at the Middle Done.

Moreover on the Sungir site were opened two burials with remains of four people with a very rich collection of accompanying inventory.

Fauna consist of large amount of reindeer, mammoth, horse and polar fox.

According to distribution of the material O. Bader reconstructed the Sungir as a seasonal camp that was visited traditionally for many years by the same group of hunters.

Many researchers attribute Sungir to Streletskian culture, and some scientists note in its material Aurignacian and Szeletian features.

As a part of this work a general analysis of bone findings from Sungir was carried out, including technical and typological characteristics (except objects from burials). Analysis was conducted of the 171 objects, of which 94 are bone objects, 28 — antler, 49 — ivory.

Key-word: Early Upper Paleolithic, bone industry, typological analysis, Sungir site, Aurignacian

Introduction

The open-air Upper Paleolithic site Sungir is located on the central part of the Russian Plain in the basin of Klyazma river, 192 km east of Moscow, on the outskirts of the city of Vladimir (56°11' NL, and 40°30' EL) (Bader, 1978). It was found in 1956. For 24 field seasons (1957-2004) an expedition under the leadership of O. Bader, N. Bader and L.A. Mihailova discovered over 4000 square meters of the site area. The site became world famous after the discovery of the four burials, one skull, and two femur fragments with a very rich collection of accompanying inventory. Based on a series of 14C the site dates to the period from around 29,000 to 26,000 BP, AMS over 30,000 BP (*Homo sungirensis*... 2000; Kuzmin et al., 2014; Marom et al., 2012).

The remains consist of stone and bone objects, faunal remains, fireplaces, firepits and ritual pits. A complicated burial complex with two graves and two burials in each grave was also found at the site. O.N. Bader singled four aboveground dwellings at the site, but this hypothesis is rejected by a number of specialists (Bader, 1978; Gavrilov, 2004; Seleznyov, 2004).

Stone industry is characterized by parallel reduction. The main type of blank is a flake. The tool kit has two sets of tools. The first one — Mousterian — consists of a side-scrapers, triangular points with concave base and projectile points. The second set — Upper Paleolithic — includes the end-scrapers (single end-scrapers, circular end-scrapers, oval end-scrapers, etc.), burins (truncation burins, straight burins, etc.), punches, pièces esquillées etc. (Bader, 1978; Seleznyov, 2004).

Analogous industry is discovered at the sites of Streletskian culture at the Middle Done. Also this industry has combined two techno-complex elements: Aurignacian and Szeletian (Bader, 1978; Gavrilov, 2004; Grigoriev, 1990; White, 1993).

The faunal record of the Sungir site contains numerous remains of reindeer (*Rangifer tarandus*), mammoth (*Mammuthus primigenius*), horse (*Equus caballus* cf. *Taubachensis* Friend), polar fox (*Alopex lagopus*), wolf (*Canis lupus*), etc. (Bader, 1978).

Stratigraphic Context

Some authors define the cultural layer as soil-cultural because remains are mixed greatly and can be found through the whole depth of the soil, thickness of this layer is up to 1 m (Bader, 1978).

Contrary to the arguments advocated by several researchers a number of lines of argument indicate that relatively little solifluction or mixing has taken place at the Sungir (*Homo sungirensis*., 2000; Upper paleolithic site Sungir..., 1998). In some parts of the layer fireplace, firepits and ritual pits accumulations of large bones, connected with habitation or household areas, have preserved. Edges and facets of most findings (splintered bones, non-diagnostic shatter) are irregular and rather sharp if not regularised additionally. In other words, the objects do not contain traces of roundness.

Bone, antler and ivory working

As the materials for the tools found at the site were used bone, antler and ivory. (Soldatova, 2014a, b).

The preservation of the objects is not uniform, the majority of the artifacts have damages of different nature

(weathered damages, damages containing traces of biogenic and biochemical corrosion, etc.) that reduces the informational value of the findings. It must be noted that bite marks on the surfaces of the findings are very scarce. A number of antler objects, regardless of their location in the cultural layer, has a poor conservation of cortical bone — it flakes off and crumbles upon contact with an object.

It must be mentioned that during restoration works a few objects were coated with glue or plaster to such extent that it is now not possible to assess any traces of treatment or exploitation, and in one case, to recreate the original look of the findings. In general, the preservation of the items is satisfactory.

The conducted analysis allows to say that the main hard organic raw material at the Sungir site was bones — 60% of the artifacts are made of this material.

It is impossible to say whether bone raw material was used as a fuel at the Sungir site, as the collection has only six items with the recorded traces of presumably fire nature.

The main bone treatment techniques at the Sungir site are: longitudinal and transverse fracture, sidestruck fracture with a preparatory sawing line, cutting, sawing, planing/scraping, cut-mark technique.

The most common long bone treatment technique is fracture. Thus, the prevailing number of the findings are fragments, debris and flakes. Taking into consideration technomorphological features only, it is impossible to give accurate information on whether these items are kitchen debris created as a result of bone fracture made with the purpose of bone marrow extraction, or whether they are by-products. At the same time the collection lacks tools made of this kind of debris, that leads us to consider the nondiagnostic bone fragments as by-products in this paper. There are several examples when the traces are recorded as small flakes or cuts at the sites of the same category, however, it is difficult to name their functions.

Transverse bone partition was done as a result of producing incisions by cutting, sawing or chopping (notches). For the partition of small diameter bones a circular cut was sufficient, after which the item was fractured. Traces of cutting, which later developed into sawing, are often discernible on the artifacts. A number of findings show cut-marks next to a fracture. In the majority of cases a circular sawing was employed, as indicated by an even edge of the bone's fracture.

It must be underlined that in the majority of cases long bones' mesials were used to make tools at the site — epiphyses were parted on both sides. However, the collection has only one epiphyse with treatment marks.

Cutting technique is demonstrated on the example of a big long bone which cortical bone has clearly defined traces of cutting of the blank, which is believed to have been drop-shaped.

Generally, a finished item was scraped at the final stage of the treatment.

In some cases cut-marks or notches were applied to a tool's proximal or mesial that were supposedly used to hold a thread during the reduction process of awls.

At the Sungir site the main treatment method of the antler was a fracture, the traces of which can be found on the 75% of the items. In three cases the antler main beam (or a tine) was exposed to percussion, after which the antler was fractured, that is proved by the dents on the opposite side. The other findings demonstrate traces of circular percussion.

In spite of poor preservation of several items' compact, they have clearly defined percussion traces that were left in an attempt to chop off a tine. Such deep traces attest to the archaic nature of the antler industry (Semyonov, 1968).

As a rule, the Sungir collection has items made of antler main beam with chopped brow and bey tines. However, the special emphasis must be laid on the fact that separate tines cannot be found in the collection.

Ivory ranks second at the site in the number of findings made of hard organic raw material — 26%.

The main methods of primary treatment of ivory at the Sungir site include transverse fracture, longitudinal and transverse splitting, and exfoliation. At the secondary treatment stage planing/scraping and abrasion were used.

Bone, antler and ivory artifacts

All the collection items can be divided into categories and subcategories: (fig. 1–4) :

- cores blanks: personal ornament blanks, shaft straightener blanks, hunting tools blanks, blanks of dissimilar purpose; ivory flakes;
- by-products;
- nondiagnostic fragments;
- tools: retouchers, hoes, chisels, shaft straighteners, awls, rods, hunting tools (points), items of dissimilar purpose;
- other: items of clothing, perforated discs.

The table 1 shows that nondiagnostic fragments form the biggest part of the collection (36,5%). Blank and tools rank second and third in the number of items — 26% and 22% respectively. Other categories are represented in a smaller quantity.

The collection has 3 ivory cores which were flaking and a negative flake scar that are overlaid by the exfoliation marks. The latter demonstrates that fractured ivory was used at the site. Two of the aforementioned cores compose the ivory's distal, the third core is the ivory's mesial; all of them were formed as a result of transverse fracture. It is not possible to examine the grooves that were used in the partition process due to a poor preservation of the items. Distal core served for the removal of longitudinal flakes, mesial core — for the removal of transverse flakes, which is proven by negative flake scars and traces of their removal. The fourth item is a bone

Category/raw material	Bone	Antler	Ivory	Total:
Cores	1 piece	-	3 pieces	4 pieces (2,5%)
Blanks	5 pieces	10 pieces	30 pieces	45 pieces (26%)
By-products	8 pieces	5 pieces	-	13 pieces (7%)
Nondiagnostic fragments	58 pieces	-	5 pieces	63 pieces (36,5%)
Tools	18 pieces	13 pieces	7 pieces	38 pieces (22%)
Other	4 pieces	-	4 pieces	8 pieces (5%)
Total:	94 pieces	28 pieces	49 pieces	171 pieces

Table 1: Categories of bone, antler and ivory items found at the Sungir site



Figure 1: Bone industry of the Sungir site: 1-5 – awls; 6 – flat pin; 7, 8 – hoe-like tools; 9 – chisel.

core, cortical bone of which has multiple negative flake scars. The function of these flakes is uncertain, since the site’s collection lacks tools made of similar blanks as well as items made of long bones flattened by the same technique.

Blanks are composed of 45 items, 5 were made of bone, 10 were made of antler, and the rest (30 items) were made of ivory.

The category under consideration can be divided into several subcategories, namely: personal ornament blanks, shaft straightener blanks and hunting tool blanks (pro-

jectile points). There is also a number of blanks the function of which can hardly be determined.

This category also includes various ivory flakes. All of them were produced deliberately, although there are no traces of additional treatment. It is probable that some of them are by-products of the ivory industry.

Personal ornament blanks include bracelet blanks, truncating flakes and rods designed to remove bead blanks.

Bracelet blanks’ fragments are thin, narrow and planed ivory blades, 0,8 and 1,35 cm wide, 0,2 and 0,3 cm thick respectively. They have elongated almond shape in section. Finished bracelets had perforations at the ends, but they are missing on the blanks (Muravyova, 2001).

Truncated flakes are represented by 7 items, all of which are small, subrectangular in profile ivory fragments. The artifacts have a clearly defined impact point that appeared as a result of the flake removal from the base. These linear preforms are believed to be related to the production of ivory personal ornament, such as beads and diadems. (Pitulko *et al.*, 2015).

Removal bead blank rods are composed by flattened, well-planed ivory “bars” that contain traces of longitudinal removal of its one end. Two rods contain traces of bead blank marking.

Shaft straightener blanks is a two item group. The first item of the category is a antler main beam fragment with a coronet and a brow tine. The second item is a antler tine with a main beam fragment. Both are T-shaped and contain traces of removal from the antler’s main beam. There are no perforations. The site’s collection has a finished shaft straightener, analogous to the abovementioned blanks.

The site’s collection has two hunting tool blanks (points) – fig. 2: 2, 4. Both are made of ivory and have oval flattened section. It must be noted that the blanks demonstrate different stages of the points’ production.

Thus, the first blank represents one of the initial stages of treatment when the tool’s form has already been



Figure 2: Hunting tools from the Sungir site: 1, 3 – points; 2, 4 – blanks for point.

outlined by the removal of the necessary ivory blade and by planing it in a certain way, however, the point's proximal has not been formed yet. The second blank is one of the final stages of treatment: the proximal has already been flattened and narrowed, and the distal has a visible negative flake scar, with the help of which the point's base was formed. Nevertheless, the blank was broken at the base and left unfinished: there are no marks of abrasion (it is to be mentioned that a finished point that forms part of the collection was thoroughly polished and, consequently, the traces of treatment are almost invisible).

The other blanks cannot be subcategorised.

5 blanks are bone items with treatment marks. One of the blanks is a long rod-shaped object made of long bone, oval and flattened in section. Throughout the item's surface there are biochemical corrosion marks, hence it is not seemed as possible to examine the object's traces of treatment or usage. The cutting marks of a drop-shaped item are clearly visible on the bigger flake of a mammoth long bone. The cut's edges contain traces of percussion, it is likely that it was done incorrectly and the blank was damaged (broken) as a result. 3 other blanks are made of

animal ribs. One of the blanks of this kind is an entire massive rib. The proximal is a rib's rear end (extremitas posterior). The rib was deliberately flattened from the item's ventral surface center to its distal. The second blank is a rib's fragment, fractured on both edges. The third blank's proximal was formed as a result of fracture with preparatory incision by sawing.

8 blanks are made of antler. 5 of them are fragments of antler's main beam with chopped tines and palms with separate treatment marks, such as incised lines, notches, etc. 2 blanks are entire reindeer antlers that have a few treatment marks — small notches and incised lines. These items were put into this category based on their formal parameters. Since the antlers were found in the upper burial of the grave №2 and no more similar findings were registered at the site, it is likely they might have had a certain ritual or symbolic purpose. The last blank is a fragment of an antler's longitudinal profile. The proximal had been fractured, the right lateral facet has a cut-mark next to the proximal. The surface had been polished after the cutting. The distal on the ventral surface has a longitudinal sawing, its left lateral facet has several notches.

There are 14 various ivory flakes at the site: 3 longitudinal flakes, 1 transverse. In addition, the collection has 2 triangular rod-shaped flakes. Flat exfoliation products (2 items) were also used as a material. There are 6 flake blanks with flat edges. The characteristic feature of these blanks is due to mutually perpendicular location of the flat ends. The methods of their production and the function of these items are yet to be determined in the future.

The by-products category has 13 items. It includes bone epiphyse with the traces of sawing diaphysis, several antler's coronets, a number of items made of bone and antler with treatment marks.

The nondiagnostic fragments category contains 63 bone and ivory objects. It is not possible to classify them in absolute terms as kitchen debris or by-products.

The tools include 38 items that can be further subcategorised: retouchers, hoes, chisels, shaft straighteners, awls, rods, hunting tools (projectile points).

Retouchers are represented by 7 objects. The functions of these tools can be deduced based on numerous distinctive notches on their ventral surfaces. 5 items of the examined category are fragments of long bones' longitudinal profile. 1 item is an animal rib, both ends of which were formed by a fracture with preparatory sawing 0.2–0.3cm deep. The last item is a biconic object with rounded edges made of ivory. Although the item was poorly preserved, some parts of its surface contain some treatment marks, such as longitudinal parallel lines, presumably formed as a result of planing. In addition to that, there are numerous notches that overlay the treatment marks. Since the tool was found in the grave №2, it might have also had a particular ritual or symbolic purpose.

8 items are hoes, or hoe-like tools, one of which is made of a fragment of a long bone's longitudinal profile,

and the rest — of antler (fig. 1: 7-8). Antler's main beam was used for the production of the main body of the tools. In 3 cases the working end was formed as a result of a longitudinal fracture, the edges were later regularised. 1 artifact is made of a fragment of a longitudinal antler profile. Neither of the items has handles as a separate constructive element. All artifacts of this category have oval and flattened blades. The working surfaces of a number of items are practically polished that leads us to believe they were extensively used.

2 items are antler chisels (fig. 1: 9). One of them has a shape similar to a hoe, but its working end is partly broken and truncated, and the proximal contains traces of microflaking and a negative flake scar. The other tool is made of a hollow antler. Its working edge is formed by a longitudinal cut of 2/3 of its length that lays open the cavity; the edges are rounded. The distal contains traces of exploitation: dents and small negative flake scars.

Shaft straighteners form a category of 4 items: 2 bone objects, and the other two ivory. One of the bone shaft straighteners is made of antler main beam with a fragment of a coronet and a brow tine, the other — of antler tine with a fragment of main beam. Lateral facets of one of the shaft straightener's "handle" there is an ornamental pattern in the shape of small incised lines (no similar ornaments have been recorded on any of the Sungir collection's items examined by the author of this paper) — fig.3.

Ivory shaft straighteners differ greatly in size (18,6 and 11,4 cm), but have the same structure: a quadrilateral



Figure 3: Antler tool from the Sungir site: shaft straightener.



Figure 4: Ivory tools from Sungir stand burials: 1,2 – shaft straighteners; 3 – "retoucher".

head (it was broken on the smaller shaft straightener) and a tapering "handle" (fig. 4). The bigger shaft straightener has a dotted ornamental pattern, analogous to the one on a horse figure and a small disc from the cultural layer and the one on a bracelet found in burial of a man (C 1) (Bader, 1978; Muravyova, 2001).

All the items of this category have round perforations located in the broad part of the proximal, their internal surface is polished enough due to their exploitation.

The site's awls are represented by 6 items (fig. 1: 1-6). The awls' length varies from 6,7 to 10,2 cm, but most tools of this subcategory are 7-8 cm long. All the items are made of animal long bones as a result of fracture or planing. This subcategory has the abovementioned artifacts due to the fact that their distals are broader than the main body of the tools (in 4 cases a handle is formed by bone epiphyse). Most awls have broken working ends. 3 items have cut marks/notches that was supposedly used to hold a thread and that are located closer either to the object's proximal or to its mesial.

One artifact is a flat bone awl, the mesial lateral facets of which also have several incised lines that were probably used to hold a thread.

The next sub category is composed of rods — 5 items. Each of them is a thoroughly treated long bone or ivory rods. The artifacts' proximals are sharpened or have a narrow oval form. The rods have a flattened oval or round profile and insignificant thickness (0,35–0,8 cm). It is difficult to examine their function without a special functional trace evidence analysis. One does not rule out the possibility that a number of items may have served as projectile points.

3 items represent hunting tools — projectile points (fig. 2: 1, 3). One of them was made of an antler tine fragment. The artifact is round in section, with sharpened proximal. The traces of treatment (planing) can be found throughout the surface in the form of long longitudinal parallel lines. As well as that, the mesial has a line of transversed incisions that are not connected with the item's fashioning — the ornamental pattern. 2 other points are made of ivory. The first is a point with beveled base. The section is flattened and oval, 13,9 cm long. The artifact is tapered to the proximal, the very tip is broken, however. Consequently, it is not possible to recreate its original form. The item is well-polished. The second point is ivory and belongs to a different type. It also has a flattened oval section and it is 9,9 cm long. The proximal is oval, slightly flattened. The distal is presumably broken. Hence, the points of the Sungir site's collection vary in raw material, size and form.

2 tool items cannot be placed into any specific category.

One antler artifact is preliminary classified as a striker, or one-side hammer, based on the dents on the coronet and its general morphology. The antler's main beam is broken as a result of preparatory circular percussion — the percussion marks can be seen next to a number of notches. The bey tine is broken diagonally (the lateral surface contains percussion marks), cut and blunted. The coronet contains percussion marks.

The function of a small flattened long bone fragment is not known either. The ventral surface has a negative longitudinal flake scar from the item's proximal. The distal is damaged. There are planing marks throughout the surface.

Nonutilitarian artifacts category consists of 8 objects that are further divided into two subcategories: items of clothing (pins) and slotted discs.

3 artifacts are items of clothing, namely pins. The pins are elongated, well-planed and polished bone objects with a subtriangular proximal — a head.

There are 4 slotted discs in the collection. The discs are thin round ivory artifacts with a circular central perforation and several oval or subtriangular perforations along the edges. The items' function is unknown. O.N. Bader hypothesized that these discs were designed to be put on ivory and wooden spears (Bader, 1998). Although all discs are polished, their surfaces contain clear traces of planing in the form of long longitudinal parallel lines.

An ornamented bone stemmed tool 3,45×1,1×0,8 cm in size, found at the lower burial of the grave №1 (C 1) is of special interest. One of the edges is produced by a bevelled cut and then blunted, the other is broken off. The ornament begins 1,6 cm from the bevelled edge and contains 8 separate slotted discs approximately 0,1 cm wide. It seems likely that the ornament extended farther since the last disc is located on the bevel. The artifact was found coated with ochre, hence it is intensely coloured.

Conclusion

Therefore, the technological analysis of the collection's artifacts has demonstrated a wide range of methods and techniques of bone, antler and ivory raw material treatment employed at the Sungir site: percussion, longitudinal and transverse fracture, sidetruck fracture with preparatory sawing line, cutting, sawing, scraping, cut-mark technique, abrasion. Although a primary fracture technique differs when applied to bone, antler or ivory raw material, further treatment was similar for all the site's artifacts. It can be stated that there is a certain uniformity in the treatment methods of different kinds of organic solids.

The Sungir site stands out for its comparatively high percentage of antler artifacts (13%) among other sites similar in chronological terms — the Streletskian and the Aurignacian culture sites of the Russian Plain, where treated antler can be found either in small numbers (one or two per examined site), or cannot be found at all. (Paleolit, 1982; Soldatova, 2014b). On the other hand, this fact brings the Sungir site closer to the early Upper Paleolithic sites in Central or Western Europe.

It must be noted that ivory items stand out among other bone artifacts for their meticulous treatment. As well as that, there are practically no objects that had household functions among these objects: hunting tools (projectile points), art objects and personal ornaments of different kinds. The collection has three ivory artifacts that can be attributed to hunting tools: a «retoucher» and two shaft straighteners (fig. 4). However, it is to be mentioned that these items were found in the graves.

It is of interest that there is a smaller number of tools made of various hard organic raw material in relation to the excavated site area. (176 items : <4600 m²).

Judging by the collection's composition, it includes items that belong to all of the knapping stages of the operation sequence. Due to the fact that the collection has by-products and a number of blanks with various stages of completion, it can be suggested that bone treatment was done directly at the site. The categories under consideration show the artifacts' functional diversity: there are different kinds of blanks and tools. It can be supposed that the site had various household activities for which solid organic items were used: presumably production of clothes (awls), work activities (retouchers, chisels), hunting-related activities (projectile points, shaft straighteners), agricultural activities (hoes).

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