Mammoth tusk processing using the knapping technique in the Upper Paleolithic of the Central Russian Plain

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SUMMARY: The utilization of mammoth tusks as a raw material for hunting weapons, tools, decoration and art, is one of the most characteristic features of Upper Paleolithic sites in the Central Russian Plain (25-12 Ka BP). My study of 18 collections of bone and ivory artefacts (more than 2000 specimens) from Kostenki 1, Avdeevo, Khotylevo 2, Gagarino, Eliseevichi 1, Suponevo, Timonovka 1, and Yudinovo suggests that experienced craftmanship was required to carry out tusk processing. Suprisingly, sawing, cutting or chopping techniques were not used (as previously interpreted), to break the tusk into smaller fragments, but employed to produce grooves which enabled subsequent splitting processes to be more carefully controlled. Proportions and sizes of the final artefacts were predetermined by the products of the initial splitting of the tusk.

1. Problems involved in investigating Mammoth Tusk Processing

The use of mammoth tusks as a raw material for the production of weapons and mobile arts is one of the characteristics of Upper Paleolithic sites in the Central Russian Plain (25 – 12 ka). In the first stage of processing, the tusk was usually divided. This procedure was more effectively conducted during *knapping*. Knapping resulted in the formation of cracks inside the tusk, along which the tusk divided, a method, which was recognized many years, ago (Gvozdover 1953, Semenov 1957, Abramova & Grigorieva 1997 *et al.*).

Studies of tusk processing during this period are based on analytical method suggested by S.A. Semenov in the 1950's. His method was based on studies of the traces of flint tools on bones artefacts which resulted from various techniques of bone processing, namely sawing, cutting, and chiselling transverse and longitudinal grooves (Semenov 1957: 175-194). However, this system made it difficult to understand the association between the processes of production involved from the first splitting of the tusk until the final stages of working.

Even when finds from a single site are analysed it is very difficult to identify the methods used to divide the tusk initially with the final shape of the objects (see for example, Hahn 1992: 120-123).

The special study of more than 2000 tusk-artefacts with traces of splitting in archaeological collections from the Upper Paleolithic sites of Avdeevo, Kostenki 1, I, Khotylevo II, Gagarino, Kostenki 4, Yelisseyevichi 1 and 2, Timonovka 1, Yudinovo and Suponevo showed, that initial tusk splitting is the most difficult part of the process and includes more stages than it was previously thought. It is the complexity of initial splitting techniques that makes it worthwhile to examine this part of tusk processing as a special technology.

2. Methods of Research

Our ideas about tusk splitting techniques are based on the final form of the artefacts. Assemblages of artefacts from each of the sites considered were analysed separately as were artefacts from different levels at Avdeevo and Kostenki 1 (layer 1). My special attention was given to artefacts with a common archaeological context, in other words those that were found in areas of occupation horizons where

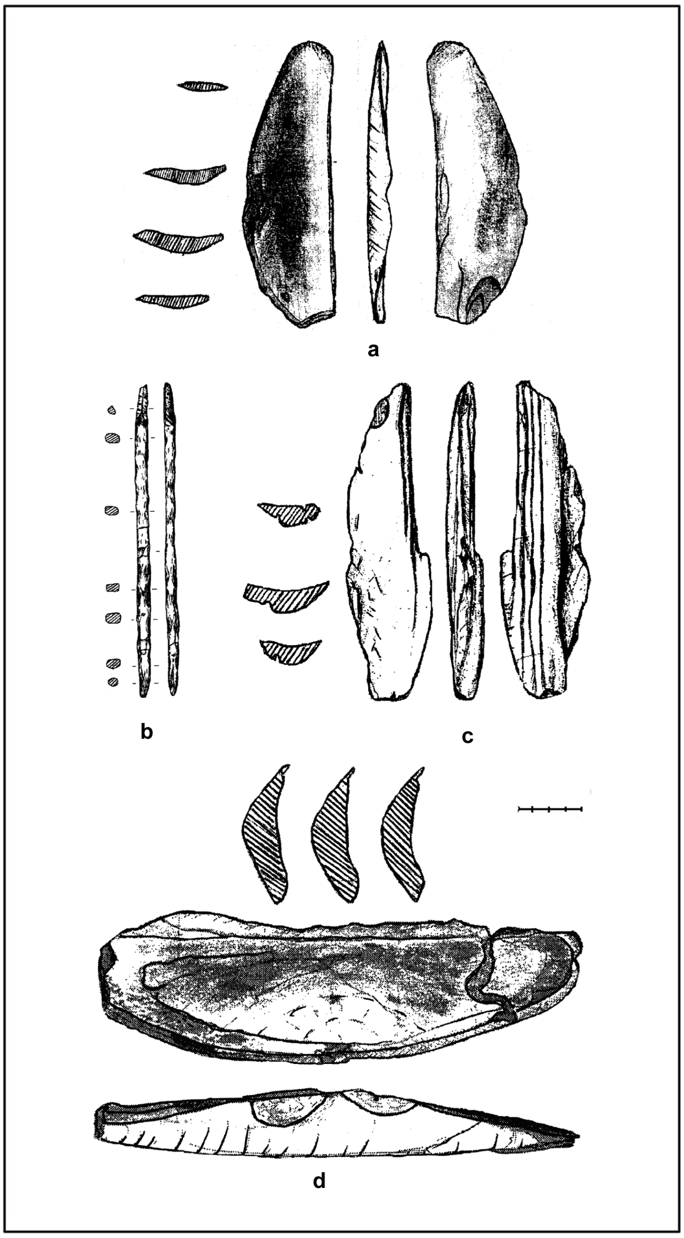

Fig.1 - Bone artefacts obtained from transverse flakes.

the initial processing of the tusk had been carried out. A comparative analysis of experimentally produced tusk artefacts, with artefacts found at Timonovka 1, Yelissevitchi 1, Yudinovo, Suponevo and Gagarino, permitted us to postulate the presence of initial tusk splitting areas at these sites. For example, I proposed the presence of such an area at Yelisseyevitchi 1. This area corresponded to a pit reconstructed by L.V. Grehova (Grehova 1993).

The description of the splitting methods included: 1) selection of tusk-fragments produced during initial splitting located within a half-closed complex; 2) The definition of morphological balance between the tusk-basis versus knapping products (positive-negative) and the intentional character of their splitting. Special attention was paid to negatives produced by splitting along cracks. These negatives did not appear as a result of the natural splitting of the tusk. Traces connected with the formation of the striking platform and the edges of the knapping fragment were also considered in detail.

The reconstruction of the chain operatoire of the initial knapping stage was based on the study of tusk-cores - the fragments of the tusks with negatives. The tusk-cores enabled us to trace connections between the knapping methods, core preparation, shape of the preparation platform and its position within the tusk.

3. Tusk knapping technology

3.1 Defining the term

Breakage patterns in tusks are always consistent regardless of the agent of fracturation: human or natural conditions. Anthropogenically induced fracturing is however characterised by its logical sequence of operations. There are many indications for this: control of the cracks in the material, deliberate use of this method to obtain a preconceived shape and size of the final product. Only when this is finally proven, can we refer to a knapping technology. In my opinion knapping technology is a materialized thinking algorithm, which is based on one side on knowledge of knapping possibilities and on the other on the existing cultural requirements to the shape of artifacts.

3.2 Specific features

The study of tusk knapping technology is currently less evolved than flint knapping studies. This is connected with the special particular attributes of of tusk-knapping technology. That is the reason why terminology common to flint knapping cannot be used. Tusk knapping technology differs in four aspects from flint knapping:

1. Tusk-knapping is influenced not only by mechanical force, but also by the internal structure of the tusk.

Tusk-knapping causes the fracture of the tusk into separate cone-shaped structures, recognised by all archeologists. The transverse section of the fractured tusk consists of concentric rings and longitudinal sections – "sugar-loaf cones". This structure is a repetition of the microstructure of the dentine at macrolevel. In biology specific cone-shapes are referred to as "blades", and result from the spontaneous stratification (= cleavage) of the tusk along the Shreger lines.

Stratification is the natural separation of the tusk into separate cone-shaped structures, due to the internal structure of the tusk.

2. Tusk-knapping could be carried out using two different modes. The first mode employs traditional techniques of flaking.

Flaking is a form of intentional knapping, where the crack inside the tusk was located close to the exterior shift and the obliged terms for its appearing were the outstanding core and the sharp corner between the platform and the flaking surface.

The second mode is referred to in this study as "breaking". Breaking utilises the naturally occurring resistance of the tusk, brought about by its morphology (the elongated form, differences between the cement layer and the dentine core, the microstructure (Shreger lines). Mechanical force creates tension. Fracture occurs at the place where the tension is highest.

Breaking is a form of intentional knapping, resulting in a crack penetrating deeply into the core of the tusk produced by two blows performed simultaneously on the outer surface in different directions.

3. The control over tusk-knapping was reached not through total transformations of the material but through skilled correction of natural tusk-shape. Such a correction was attained through making cracks or grooves on tusk exterior surface. The form of the groove and its orientation were intentionally produced and were not dependent on the structure of the raw material. Cut, sawed or gouged grooves functioned

as a sort of striking platform on the curved surface of the tusk, which if necessary could be used to strengthen the frontal surface of the base of the tusk.

4. Depending on the different mode of knapping, knapping products posessing a more definite geometrical form could be produced.

There are to main categories of geometrical forms: flat and rodshaped. Flat artefacts possess two opposing surfaces producing a wide thin artefact. *Rodshaped* pieces are long but equal in thickness and width.

The technology of tusk-knapping is the process of the deliberate and controlled division of fragments from mammoth tusks by flaking, breaking or stratification, which the intention of producing flat and rodshaped artefacts.

3.3 Debitage products

A range of forms among the flat and rodshaped artefacts enables us to divide them into separate categories each with their own technomorphological characteristics.

Techo-morphological characteristics are a collection of macrotraces, showing specific traits corresponding to the knapping technique employed. These traits depend firstly on the mode of knapping and secondly on the direction of the impact on the tusk.

The following example illustrates the relationship between the form of traditional artefacts made of ivory and knapping technologies.

The assemblage of modified bones from the site of Yelissevitchi 1 (17-13 Kyr) contains some 30 trasverse ivory flakes, many of which are decorated with geometric designs known as Yeliseevitchi churings. The transverse flake is a flake, which results from knapping directed across the longest axis of an artefact (Fig. 1d). A deep, V-shaped, longitudinal groove functioned as a platform for its removal. The ring-shaped structure of the tusk is preserved in the form of the base of this flake. The strong force of the impact has produced a fan-shaped flake. The bulbus marks the place where the flake is at its thickest. The flake becomes progressively thinner towards its edges. These morphometric traits can be clearly observed on artefacts produced from transverse flakes, such as several oval shaped rods (Figs. 1b, 1c) and knives (Fig. 1a), artefacts of irregular oval form with a straight worked edge opposite a sharp arch-like edge (Khlopatchev 1994).

4. References

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