

The production of Upper Palaeolithic mammoth bone artifacts from southwestern Germany

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SUMMARY: This analysis discusses mammoth (*Mammuthus primigenius*) remains from the Aurignacian layers at the Geissenklösterle and from the Gravettian layers at the caves of Geissenklösterle, Hohle Fels and Brillenhöhle. All the caves are situated in the Ach Valley between Blaubeuren and Schelklingen in the Swabian Jura. The role of mammoth is often underestimated at central European sites, simply because its remains are less abundant here than at Upper Palaeolithic sites in eastern Europe and Russia. But the selection of specific elements of mammoth shows the importance of this species as a raw material for the manufacture of tools. Mammoth ribs and ivory are the predominant elements of mammoth at these sites. The great length of mammoth ribs and tusks was an important advantage in the production of projectile points. This contribution emphasizes the importance of including bone tools into archaeozoological analyses, as opposed to examining them simply as artefacts.

1. INTRODUCTION

The region of the Ach Valley has a long history of research conducted by the Institute of Prehistory and Archaeology of the Middle Ages at the University of Tübingen. During the last decades, this research focused on the Geissenklösterle and Hohle Fels sites. Other important cave sites in the Ach Valley are the Grosse Grotte (Wagner 1983, Weinstock 1999), the Brillenhöhle (Riek 1973, Boessneck & v. d. Driesch 1973) and the Sirgenstein (Schmidt 1912).

The analysis of the Geissenklösterle fauna was recently completed (Münzel *et al.* 1994, 1997, 1999) and an analysis of the Hohle Fels fauna is currently being undertaken.

1.1 The Geissenklösterle-Cave

The Geissenklösterle is part of a limestone massive, a rock formation which rises 60 m above the valley bottom, and which was 10 m deeper during the Pleistocene. Excavations at Geissenklösterle were initiated in 1973 when

E. Wagner (Landesdenkmalamt) opened up a test-ditch, and were continued from 1974 until 1991 by J. Hahn (1988). The site has provided a stratigraphic sequence from at least 43,000 up to 10,000 BP. The deepest layer exposed so far contains finds from the Middle Palaeolithic (AH IV), stratified above this is a Lower Aurignacian (AH III) layer (dated to ca. 38,400 BP - ¹⁴C-accelerator method (AMS) and ca. 40,200 BP -thermoluminescence (TL), Richter *et al.* 2000), followed by the Upper Aurignacian (AH II, with split based points), which was dated by ¹⁴C-AMS to ca. 33,500 BP and with TL to ca. 37,000 BP (Richter *et al.* 2000). The Upper Aurignacian layer (AH II) has produced four carved ivory figurines depicting a human, a mammoth, a (cave) bear and a bison. A limestone pebble painted with three colours, as well as ivory beads, perforated and dyed fish vertebrae and ornamented objects of antler and ivory were also found. More recently, fragments of two flutes made from the bones of birds were recovered in wet-sieved samples and could be reconstructed. The more intact flute was manufactured from the

radius of a swan, probably a Whooper swan (*Cygnus cygnus*) (Hahn & Münzel 1995, Münzel *et al.*, in press).

The horizon above the Upper Aurignacian contains a Gravettian (AH I) occupation with several living floors (¹⁴C AMS date ca. 27-29,000 BP). After the Gravettian there appears to have been a hiatus in the occupation of Southwestern Germany, probably caused by the Last Glacial Maximum. A small fireplace (¹⁴C AMS date ca. 13,000 BP) is the only evidence of a Magdalénian occupation of the cave.

The large mammal species in the Geissenklösterle represent a diverse faunal spectrum and are indicative of the "Mammoth steppe environment". Prior to the Last Glacial Maximum there are no significant differences in either species composition or species representation in the faunas from the three main occupational layers in the Geissenklösterle. Alongside cave bear, which is the best represented species in nearly all the caves in the Swabian Alb, the most frequent game animals are horse, mammoth and reindeer.

1.2 The Hohle Fels Cave

The Hohle Fels, located some 2 kms from the Geissenklösterle, is one of the largest caves in the Swabian Alb, with a history of research dating back to the 1870s. Since 1977, J. Hahn conducted excavations in a niche of the entrance tunnel (Hahn 1977, Hahn & Waiblinger 1997), and after Hahn's death in 1997 these investigations were continued by N. Conard and H.-P. Uerpmann (Conard, Langguth & Uerpmann 1999, 2000). The palaeolithic stratigraphy begins with the Magdalénian (AH I), which is dated to around 13000 BP, followed by three Gravettian horizons (AH IIb, IIc, IId) dated to between 25-29,000 BP. An Early Upper Palaeolithic industry (AH III, IV, ca. 31,000 BP). was recovered in the oldest deposits exposed so far at the site. Excavations in 1997-2000 recovered a stone fragment decorated with red dotted lines from the Magdalénian (Conard & Floss 1999, Conard & Uerpmann 2000) as well as a small head of a horse which was part of an ivory fig-

urine and dates to around 30,000 BP (Conard & Floss 2000). A silex projectile point embedded in the vertebra of a cave bear found in the Gravettian deposits gives indisputable proof of the hunting of cave bears in the caves of the Swabian Alb (Münzel, Langguth, Conard & Uerpmann, in press).

2. MATERIAL AND METHOD

The role of mammoth is often underestimated in central European sites, simply because its remains are less abundant than at Upper Paleolithic sites in eastern Europe and Russia. One reason for the underestimation of mammoth remains is their fragmentary condition and the difficulty in identifying these bone fragments. Another reason is the use of inadequate quantitative methods. The use of minimum number of individuals (MNI) is very common in quantitative analyses, but is not an appropriate method for the highly processed faunal remains at sites with dense occupation "floors" such as Geissenklösterle and Hohle Fels. MNI's and other quantitative methods based on articular ends mainly reflect the taphonomic survival of certain elements or bone parts (Brain 1967, 1969) and not their value or importance for the Palaeolithic hunter.

Therefore, this analysis uses bone weight to compare the mass of different species brought into the site, a method which was introduced by Uerpmann in the 1970s (1973). This method is a useful quantitative tool not only for species representation, but also for skeletal element representation. For the skeletal element analysis bone weight highlights under- and overrepresented elements respectively in comparison to a standard individual (Münzel 1988).

3. RESULTS

The bone weight analysis of the Geissenklösterle fauna shows that mammoth is the most important game animal after the horse. The element representation of the mammoth remains is highly biased. Mammoth ribs and ribs of rhino-mammoth size predominate in the Gravettian (AH I).



Fig.1 - Two rib fragments of rhino-mammoth size showing notches along the edges, Geissenklösterle AH1.

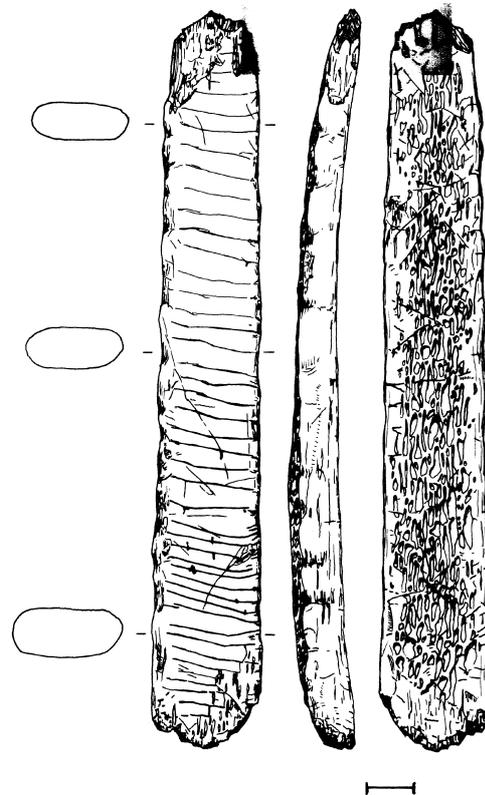


Fig.2 - Skin smoother made from a rhino-mammoth sized rib, Hohlefels AH II c.

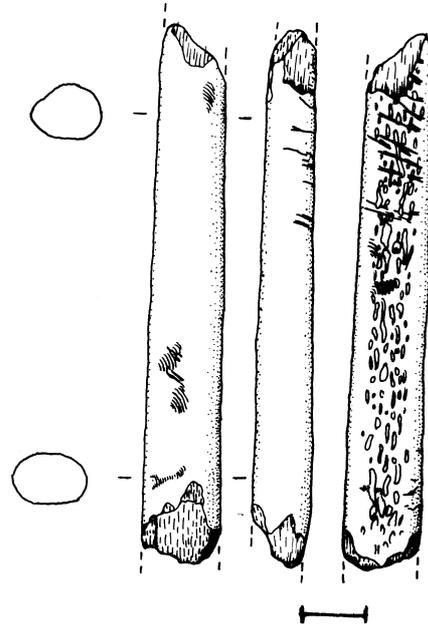


Fig.3 - Bone point made from a rhino-mammoth sized rib, Hohlefels AH II c.

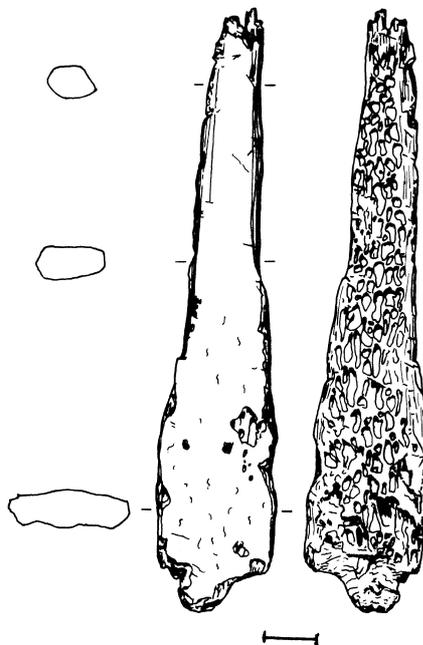


Fig.4 - Rejected base part of a bone point, Geissenklösterle AH I.

In the Aurignacian layer (AH II), remains of several very young mammoths were found, including skull fragments, milk tusks, foot bones and finger bones. These remains are from at least three infants of ca. 2 months of age (see poster: Seasonal hunting of mammoth in the Ach Valley). In addition, ivory and ribs of older individuals are present. In the Early Aurignacian layer (AH III) mammoth is represented almost exclusively by ivory, but also by ribs of mammoth-rhino size, while in the Middle Palaeolithic layer no remains of mammoth have been found so far. Perhaps continued excavation of the Middle Paleolithic layer over a larger area will produce mammoth remains.

A similar situation was recorded at Sirgenstein (AH VII-VIII, Early Late Moustérian) and Grosse Grotte (AH II, Moustérian with leaflet points), where only a few remains of mammoth were recovered from the Middle Paleolithic layers at these sites.

To conclude, ribs and ivory are the predominant elements of mammoth in all the layers discussed here. In terms of identifiability these are also easily identifiable elements. On the other hand, it is obvious that ivory and ribs were the preferred raw material for manufacturing tools.

During the Gravettian, mammoth ribs were preferred for the production of long bone points, and this is a characteristic feature in the Gravettian layers of Geissenklösterle, Hohle Fels and Brillenhöhle. According to Knecht (1991) the distribution of these "mammoth rib points" is temporally and regionally limited to Gravettian sites in South Germany. All of the thick bone points show on one side the spongiosa as well as the compacta typical of mammoth ribs. The ribs were processed in a standardized fashion. First they were notched along the edges on both sides (Fig. 1) to facilitate splitting afterwards. After splitting, the ribs were either used as a skin smoother (Fig. 2) or manufactured into points (Fig. 3). To thin the split rib halves, they were planed along the edges and smoothed on both dorsal and ventral sides until they developed a typical circular or oval cross-section. At the Geissenklösterle all stages of this "*chain opératoire*" were found:

the ribs with notches, split rib pieces, partly finished products, rejected base parts (Fig. 4) and even the bone spalls produced when planing and smoothing the points. The length of the mammoth ribs and their straightness is an important pre-requisite for the production of points and lances.

In the Aurignacian layers at Geissenklösterle the typical Aurignacian points with split bases were made from reindeer antler, but the long projectile points from ivory. Obviously mammoth ribs were not favoured for these purposes in the Aurignacian, even if the splitting of ribs is a much easier task than the, technically more complicated, sectioning of tusks into segments and baguettes and the shaping of ivory points. The technology of producing these long ivory points and lances is still not quite understood (Christensen 1996, Liolios 1999). Hahn (1986) suggested that the grooving technique used to produce long spalls has still not been proven for the Aurignacian.

Why did this change in the use of the raw material for long projectile points occur? Is it a technical aspect of the technology of weapons or was it simply due to a shortage of ivory in the Gravettian?

In all three main occupation layers at Geissenklösterle (AH I, II and III), remains of individuals of very young mammoths occurred, which must have been hunted together with their mothers in spring/early summer. Thus, although the raw material situation was probably the same in all the cultural horizons, different skeletal elements were preferably brought to the site for the manufacture of the long projectile points or lances. On the other hand the repeated hunting of cows and calves might have also endangered the local mammoth population in this area where mammoths were not as frequent as in the eastern European areas of its distribution.

4. CONCLUSIONS

The Geissenklösterle faunal analysis shows that mammoth skeletal elements important for tool manufacture are predominant at the site. Other game animals, such as horse and rein-

deer, show similar patterns.

Due to the presence of large hearth areas with thick layers of burned bone, particularly in the AH II layer at Geissenklösterle, and at other cave sites in the Ach Valley, and the fact that those elements of bone left behind at the site are the ones useful for tool production, we conclude that since wood was rare, the bulk of the bone refuse was used as fuel.

A detailed archaeozoological analysis including the provenance of the organic artefacts is necessary for the understanding of the sites in the Ach Valley and elsewhere. The results show that during the Aurignacian and Gravettian periods, mammoth was an important resource in the Ach Valley. Even if the remains of these animals are less frequent at sites in this region in comparison to sites in eastern Europe and Russia, the mammoth rib tool production and the well developed ivory industry at the Geissenklösterle demonstrate the importance of this species during the Upper Palaeolithic in Southwestern Germany.

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