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WALPURGA ANTL, MARJOLEIN BOSCH

# THE USE OF IVORY AT THE GRAVETTIAN SITE GRUB/KRANAWETBERG, LOWER AUSTRIA

*ABSTRACT: From 1993 to 2011, excavations at the site Grub/Kranawetberg exposed four archaeological horizons (AH) separated by sterile loess deposits. The assemblage of adornments made from ivory is the biggest in the Austrian Palaeolithic comprising a wide range of varieties. Apart from tools, weapons, and adornments, there are pieces of raw material as well as semiproducts, waste from tool production and a series of unmodified fragments. This contribution gives a first view to the whole spectrum of ivory objects at this place. While ivory was found in all layers, AH4, the lowest cultural layer, contains more than 90% of the ivory unearthed at the site.*

*KEY WORDS: Gravettian – Ivory – Personal adornments – Settlement structures*

## INTRODUCTION

The Prehistoric Department of the Natural History Museum Vienna, Austria started archaeological investigations (Antl-Weiser *et al.* 1997) at the Kranawetberg, a hill west of the village Grub near Stillfried in the March valley in the northeast of Lower Austria in 1993 (*Figure 1*). From 1993 to 2011 excavations at this site exposed two different areas of activity (Antl, Fladerer 2004) (*Figure 2*). First, from 1993 to 1995, a bone accumulation with remains of *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Megaloceros giganteus*, *Equus* sp., *Rangifer tarandus*, *Lepus* cf. *timidus*, *Canis lupus*, *and Ursus* cf. *arctos* was excavated (Antl-Weiser *et al.* 1997, Bosch *et al.* 2012). Then, approximately 20 metres to the east an area with hearths and a high find density was exposed (Antl, Fladerer 2004, Antl-Weiser *et al.* 1997). Interestingly an upper left first molar of mammoth, found in AH4 of the settlement area, belongs to the same maxilla as a right upper first molar found at the bone accumulation. This observation fits very well with the intense use of ivory in AH4 (Bosch 2009).

The radiocarbon dates between 24,620 ± 230 BP and 25,300 ± 90 BP as well as the material culture of AH4 suggest the occupation dates from the end of the Pavlovian (Antl 2013).

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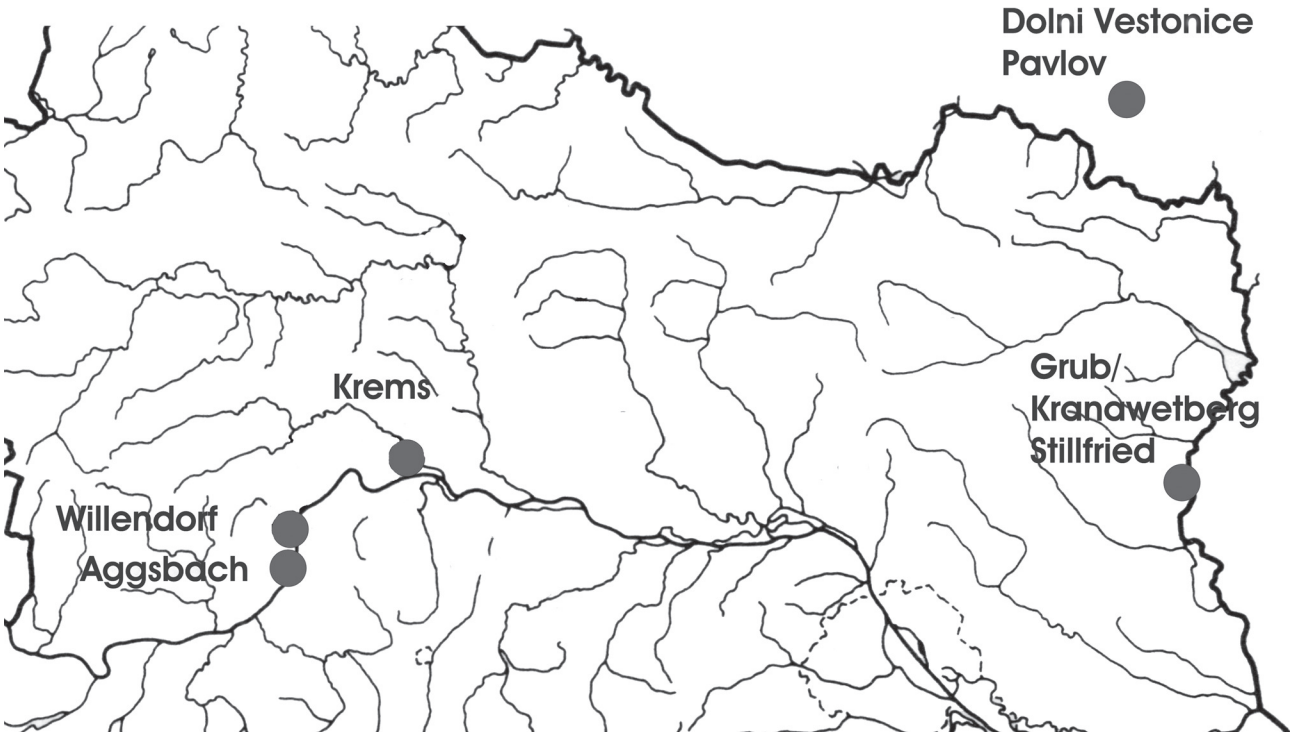


FIGURE 1. Map of Austria with the geographical position of Grub/Kranawetberg (small inset) and a more detailed view to the north of Lower Austria and Southern Moravia with the geographical position of Grub/Kranawetberg and other sites mentioned in the text.

## METHODS

### Fieldwork methods

First, we removed the recent top soil (30 to 40 cm) and 120 to 180 cm of sterile loess covering the deposits containing the AHs 1 to 4. Then, AHs were excavated following their lithostratigraphic boundaries. All objects larger than 1cm were recorded three-dimensionally, i.e. piece-plotted. Additional to the digital excavation documentation system, we kept a separate diary (by the archaeologist in charge of the excavation) containing further remarks and drawings. Parallel to the measurements, minutes were kept containing the reference points and the degree of possible deviations. All sediment removed was collected per quarter-square meter and wet-sieved with a grid size of 1 mm, and the dried residues then sorted according to the material.

During the excavation the ivory objects were treated like other faunal remains and were recorded three-dimensionally when of a size larger than 1 cm, except for clear artefacts such as ivory beads. Due to their small size – most beads did not exceed 6–8 mm – and their fragmented condition, only few beads were piece-plotted. More than 90% of them were collected in the residues of wet sieving of the sediment. At the present stage of analysis a large proportion of sediment samples have still to be wet sieved and sorted. Therefore this paper gives a representative but not a complete, overview of the ivory distribution at Grub/Kranawetberg.

Bigger pieces of ivory – 5–20 cm – had to be pre-treated in the field before they could be unearthed. The largest objects from 40 to 50 cm had to be embedded in plaster and restored in the laboratory.

### Laboratory methods

To ascertain the raw material used for ornament and tool production microscopic analysis of a large portion of the material reported here ($n$ = 394), including all artefacts, was carried out. Beads were refitted, sorted by type, photographed, and the raw material identified with the help of a Dino-Lite microscope (20× to 200× magnification) and imaging software. Whereas a detailed analysis of the faunal remains of the bone accumulation was made by F. Fladerer and M. Bosch (Antl-Weiser *et al.* 2010, Bosch *et al.* 2012), other faunal remains apart from ivory have still to be analysed.

For this contribution 644 ivory objects have been studied – among them raw material, probable semiproducts and finished objects (*Table 1*). As many of the ivory objects had first only been registered as "faunal remain" these 644 studied items are a representative sample but not the complete number of ivory pieces, because there are still "faunal remains" left to be studied which potentially might be ivory. This is another reason why we do not present a final distribution of the different categories of ivory objects at this stage of analysis. Nevertheless clear tendencies of distribution are already evident while a representative characteristic of ivory use at the site can also be presented.

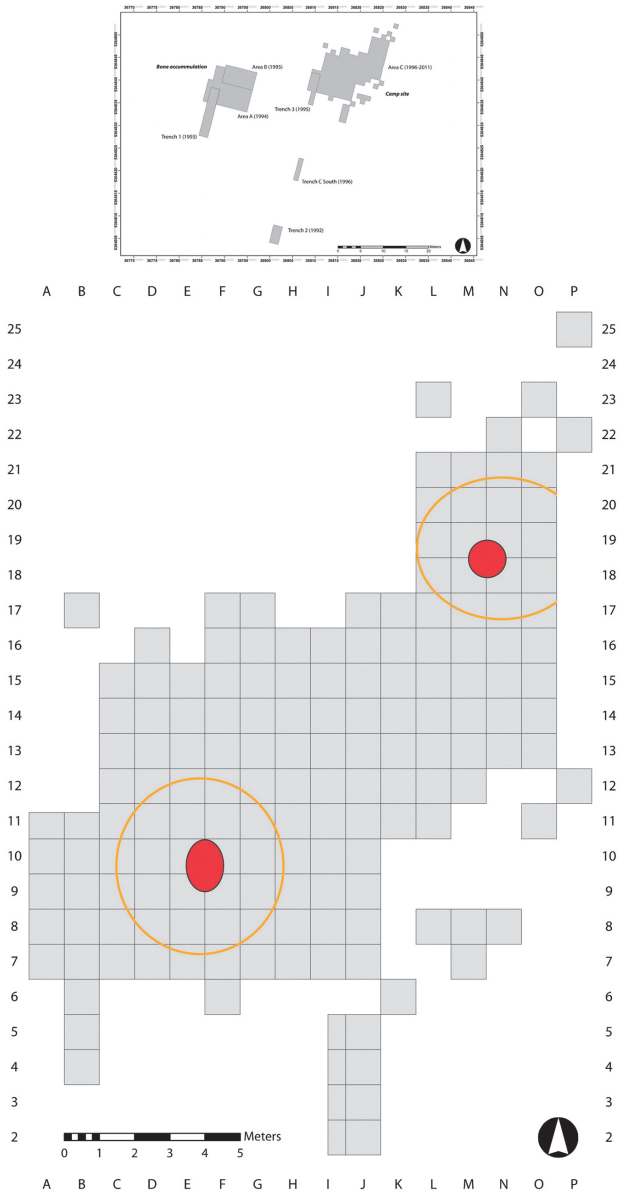


FIGURE 2. Grub/Kranawetberg: general map of the excavated area (small inset) with a more detailed view of the area with settlement structures after P. R. Nigst, showing the two hearths (in red) and the area with pits around the hearths (in orange).

## RESULTS

Within the area with hearths four AHs can be distinguished. At least 90% of the ivory is concentrated within AH4 but there are also some pieces of ivory in AH3–1. As AH4 seems contemporaneous with the bone deposit the ivory of both areas has to be regarded as a whole.

TABLE 1. List of studied ivory objects from Grub/Kranawetberg.

| Type | NISP | MNO |
|---|---|---|
| Unmodified | 198 | |
| Modified | 80 | |
| Objects | | |
| Spatula | 1 | 1 |
| Points | 2 | 2 |
| Round bars | 3 | 3 |
| Plates with incisions | 2 | 2 |
| "Fasteners" | 2 | 2 |
| Needles | 100 | 30 |
| Pendants | | |
| Button shaped | 1 | 1 |
| Basket shaped | 1 | 1 |
| Pointed | 1 | 1 |
| Sphericai | 1 | 1 |
| Drop shaped | 1 | 1 |
| Red deer canine shaped | 1 | 1 |
| Beads | | |
| Double headed | 156 | 116 |
| Perforated | 62 | 27 |
| Head fragment | 15 | na |
| Fragment | 17 | na |

NISP, number of identifiable specimen.
MNO, minimum number of objects.

FIGURE 3. Karel Valoch at one of his regular visits at the excavation Grub/Kranawetberg together with Alexander Verpoorte and Walpurga Antl.

## RAW MATERIAL

At the bone accumulation ivory was only present as raw material. We recovered large parts of six tusks and a facial skull fragment including the premaxillary bone with both alveoli intact from which the tusks were extracted. One tusk had already disintegrated to a great extent. The size of the tusk fragments varied from 34 to 86 cm. There are no clear signs of systematic fragmentation, and proximal, medial as well as distal tusk portions were found.

In AH4 at the periphery of the settlement area in the southwest and southeast two big tusk fragments – between 25 and 45 cm long – have been documented. Both pieces are well preserved. A heavily weathered piece which is 50 cm long was found in AH3. Although both tusk fragments from AH4 do not show traces of controlled fragmentation some modifications are visible.

The next size category is tusk fragments between 10 and 16 cm. Two fragments are split in the middle: one shows clear traces of systematic fragmentation (*Figure 4*) whereas the other one might finally have been split by a heavy stroke. Apart from splitting the first piece shows negatives of flakes and other traces of modification. On the second piece there are also some traces of red colour. Two other fragments are in different stages of disintegration. There are splits filled with sediment and even completely dissolved structures where the original object degraded to a package of splinters with dislocated and even turned over elements (i.e. weathering stage 5 after Behrensmeyer 1978).

Apart from another series of fragments between 3 and 7 cm there are numerous unmodified fragments around 1 cm. All of them are broken naturally according to the structure of the tusk. There are two special concentrations

of these fragments: one from two to six metres northeast of hearth I and another one around hearth II.

Further fragmentation of ivory pieces is documented by ivory flakes (*Figure 5a–b*) and pieces with negatives from flakes. Another technique to split ivory can be shown with a series of splinters which do not follow the structure of natural breaks. One of them shows a clear incision parallel to the break (*Figure 5c*). On the other hand there are wedge-shaped ivory pieces (*Figure 5d*). Most of these modified pieces represent modification waste and are concentrated in the same area as the small unmodified pieces. Some of the unmodified fragments show traces of use, such as clearly smoothed breaks.

There are also five unmodified pieces with remains of colour. According to the distribution of the dots and traces we cannot assign an artificial character to the colour patterning. As remains of colour are present in all parts of the settlement area these could well be accidental.

FIGURE 4. Modified piece of ivory with traces of systematic fragmentation.


FIGURE 5. Fragmentation of ivory: a–b, ivory flakes; c, splinter with clear incision parallel to the break; d, wedge shaped ivory piece.

## TOOLS

Needles are the most abundant group of ivory tools, comprising around one hundred fragmentary pieces with a length of 1–6 cm. From these hundred fragments thirty pieces are needles in the strictest sense of the term as these have the pointed tips characteristic of needles (*Figure 6*). The other fragments are medial pieces which could also have served for other purposes such as raw material for bead production. Among the fragments described as needles in a wider sense there are no perforated pieces. Most of the needle fragments are located around hearth I and hearth II as well as in the area two to six metres northeast of hearth I. At the present stage of analysis there are no differences in the distribution of needle points and medial fragments which might have been expected if the points and medial fragments represented two different categories of tools. One of the needle tips again shows remains of red colouration.


FIGURE 6. A selection of needle fragments.

Other tool categories are listed with only a few pieces: a tip of a spatula with stains of red colour, three points (*Figure 7a–c*), two round bars (*Figure 7f*) and two artefacts with unclear function (*Figure 7d, e*). The ivory points are of two different types, pointed round bars and one piece with two pointed endings and a rather thick middle part (*Figure 7b*). Among the round bars is a fragment which was originally broken along the ivory structure and could be refitted (*Figure 7f*), and a small fragment of another bar. All of them were found in areas where the modification of ivory can be supposed to have occurred.

The two artefacts with unclear function are both pointed, and both show a sort of separated head on the other end of the pointed corpus. Possibly, they could have been used as fasteners.

## ADORNMENTS

The biggest group of ivory artefacts are ivory beads and pendants. This group with a rich variety of different types consists actually of 256 beads and pendants including 17 unclear fragments of beads. There are six different types of bigger pendants (*Figure 8*) between one and two centimetres: a big pendant or button with two spherical heads, a pointed pendant with perforation, a basket shaped pendant, a big perforated spherical bead, a lower part of a drop shaped bead and a pendant shaped like a red deer canine. Traces of use-wear are visible on all specimens especially the basket shaped pendant where traces of use can be seen at the hole of the pendant.

The pointed pendant is 25 mm long and shows scratches perpendicular to the needle shaft and radiating from the hole. The flat piece is only 1 mm thick and 6.6 mm wide at the perforation. The traces of wear

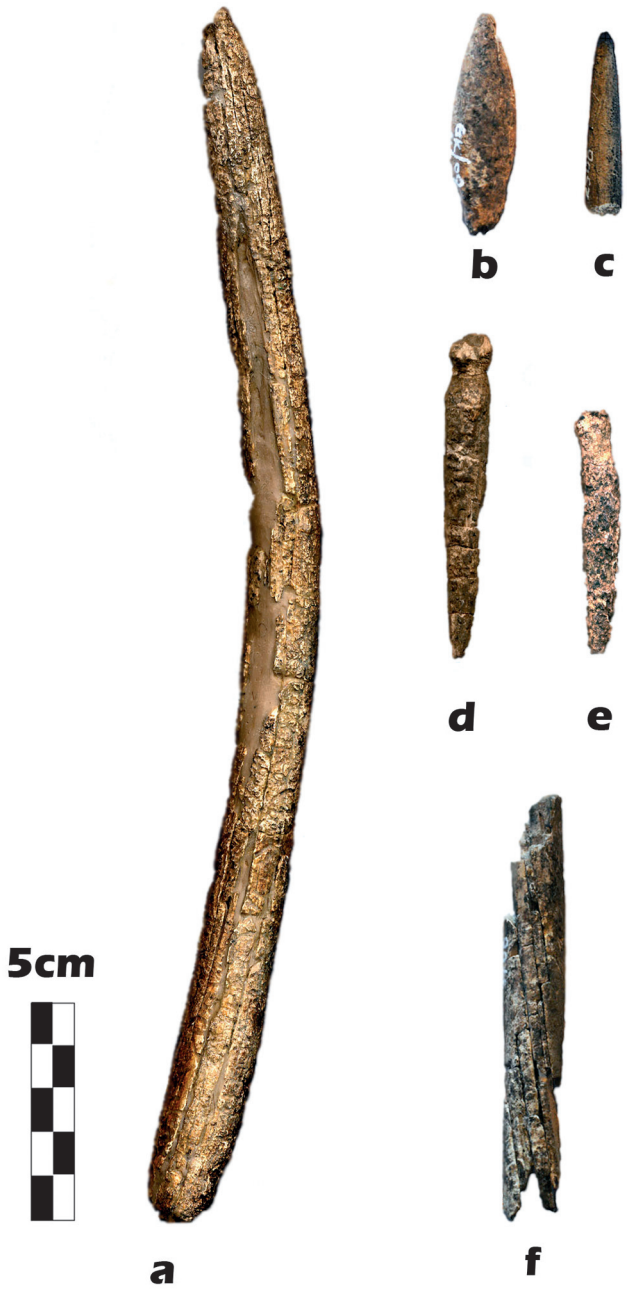


FIGURE 7. a–c, ivory points; d–e, fasteners; f, round bar.


FIGURE 8. Series of big pendants.

clearly visible under the microscope suggest a frequent turning of the object.

The pendant shaped like a red deer canine is heavily smoothed at the back and is calcined. The biconic perforation was carried out from both sides. The front side is round and the back is flat.

Three out of six big pendants were found around hearth I, other two pieces within the area of the ivory concentration two to six metres northeast of hearth I and only one near hearth II. Due to the small number of big pendants this distribution might be considered as accidental.

Most of the adornments are small beads with a length of 5 to 8 mm. The majority are beads with two opposite heads which are either spherical or olive shaped, heart shaped or simple cylindrical beads with an incision in the middle of the bead (*Figure 9*). A tendency towards symmetric positioning of the heads can be observed, but there are also differently shaped heads fitting together. The heads vary from a rounded cylindrical shape to completely spherical ones but there are also pieces which are not rounded at all. The heads are separated by an incision which can be either abrupt or smoothed. In some cases the traces of widening of the initial incision are visible as cuts from both sides of the incision. In some cases this middle part is completely smoothed and the bead is consequently shaped like an hourglass. Others show a short cylindrical middle part giving the bead the shape of a small barbell. A few beads are very plastic and round on one side and more flattened on the other. Within the range of beads with two heads a great variation can be observed which might reflect a high degree of individuality. There are also traces of use like scratches and shallow incisions on the rounded heads. Wear from use cannot be excluded as a cause for the asymmetrical appearance of some of the beads.

As to the manufacture of this type of beads there are a few pieces which can be regarded as semiproducts. Among the beads themselves, there are pieces where the cut from a round bar was not completely smoothed. Apart from that there is a portion of a bar with three prefabricated round heads (*Figure 10*) and another round bar with an incision on one side. It is possible that at least the thicker medial needle fragments mentioned above with a diameter of 3 mm and more could have served as bars for the production of beads.

The distribution of beads with two heads does not follow a distinct pattern. They are most frequent in areas with a high concentration of ivory items but they occur also between these areas.

There are also different types of perforated beads (*Figure 11*). Most of the small perforated beads are

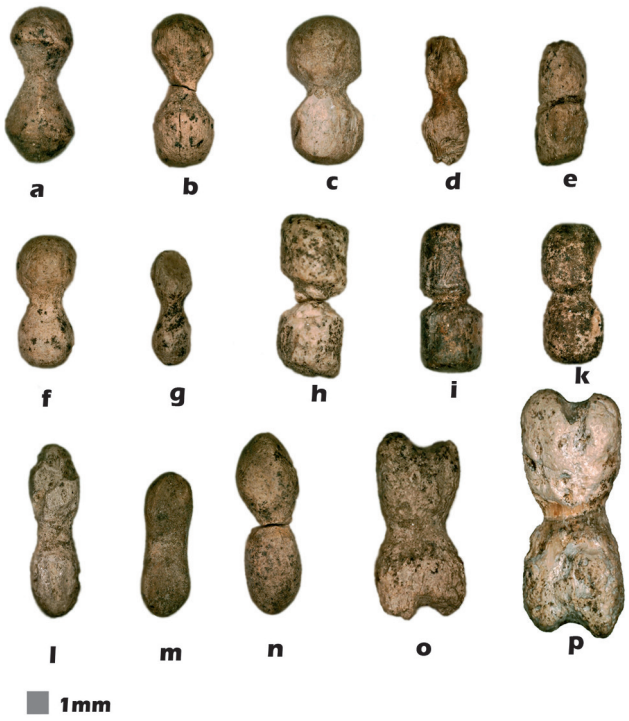


FIGURE 9. Beads with two opposite heads: a–d, f, g, l–n, spherical or olive shaped; o–p, heart shaped; e, h–k, cylindrical beads with an incision in the middle of the bead.

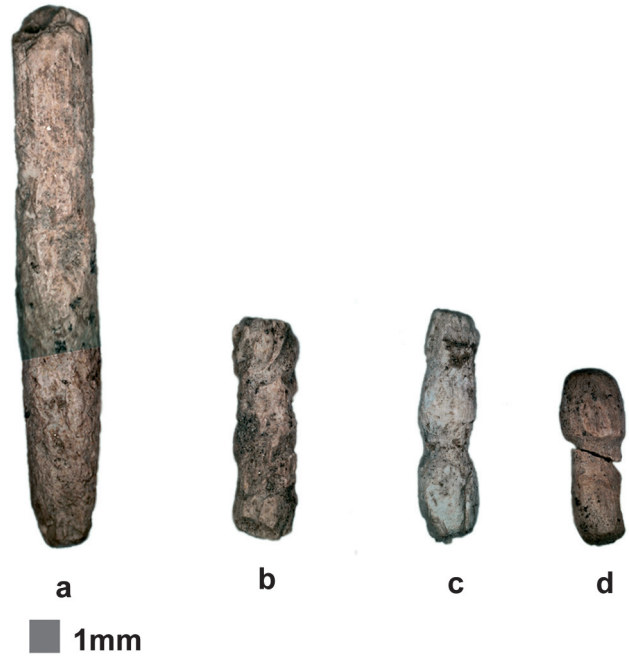


FIGURE 10. Production of ivory beads: a, needle fragment or round bar for the production of beads; b–d, notched ivory bars.

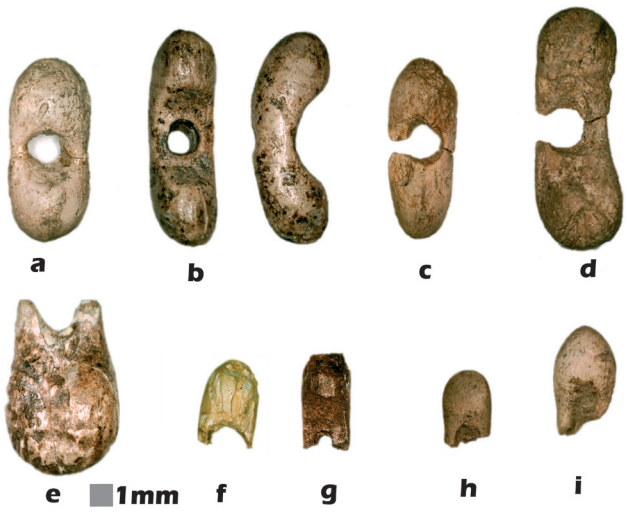


FIGURE 11. Perforated beads: a, c–d, perforated beads; b, kidney shaped perforated bead; e, drop shaped bead; f–i, head fragments of perforated beads.

fragmented because the remaining ivory on both sides of the perforation is very thin. The maximum length of this bead type is 10 mm and the maximum width 4 mm. The perforation is situated in the middle of the bead. The perforation itself was carried out from one side, with scratches produced in making the perforation clearly visible inside. Nearly all perforated beads have a more or less flat back and a more or less plastic front side with semispherical endings. The perforation is carried out from the front side. Like the beads with two heads the perforated beads show a series of individual variations. The most perfect bead is a kidney shaped bead with a very small cylindrical hole in the thinnest part of the bead. Another fragment of a perforated bead demonstrates that round bars might also have been the semiproduct of at least some perforated beads (*Figure 11g*). The shape of a round bar is still visible, also the cut at the end of the bead. After that the middle part was thinned out and then the very thin remaining ivory was pushed through to form the hole. Traces of use are mainly at the rear of the beads. Some of the perforated beads are in very poor condition and can only be identified as perforated pieces under the microscope.

Perforated beads occur in all areas of ivory distribution but they are especially frequent between the concentration two to six metres northeast of hearth I and hearth II. Beads with two heads are rather rare in this area, especially in the southern part.

## SPECIAL OBJECTS

A special find consists of two fragments of a small decorated plate (*Figure 12a*) from the area of hearth II. The piece is framed with a straight incision. Inside this frame there are bundles of incisions forming an angle of approximately 45° with the frame line. Apart from single incisions this is the clearest decorative pattern among the ivory objects.

Another ivory artefact is a piece shaped like a stylised animal (*Figure 12b*) but it cannot be excluded that this is a semiproduct from the production of bigger pendants. With respect to the basket shaped pendant there are marked differences for this attribution. Other pendants which might have produced a similar waste are not so far known from Grub/Kranawetberg.

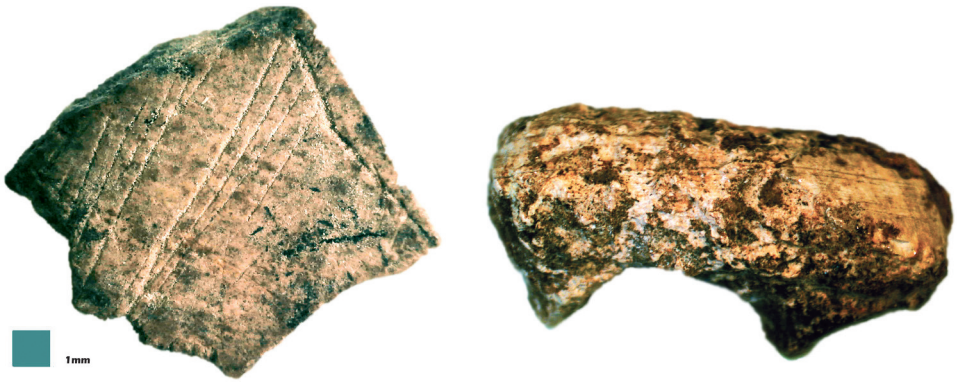


FIGURE 12. Special objects: a, ornamented plate fragment; b, stylised animal figurine or semiproduct of bead production.

## DISCUSSION

For reasons noted above the bone accumulation and AH4 of the settlement area can be regarded as an archaeological unit. This indicates that ivory was not only an important raw material for the occupants of Grub/Kranawetberg, but that they also disposed of a great amount of this material. As there are massive remains of mammoth bones at the bone accumulation as well as at the settlement area in AH4, mammoth seems to have been important not only for ivory processing but also as a source for the meaty parts of the carcass. Accordingly, there was no need to separately collect ivory in the region.

The ivory objects in AH4 include many well-preserved objects but also some pieces that have completely disintegrated. Apart from raw material in different stages of weathering there are also modified pieces like a round bar (*Figure 7f*) which had already disintegrated at the time of excavation whereas the long ivory point (*Figure 7a*) was in a markedly better condition. In spite of the observation of different stages of weathering there was no clear evidence of the systematic use of old ivory. There were only traces of use on one splinter of disintegrated ivory. As the parts of tusks at the bone accumulation show different weathering conditions as well, these different stages of conservation might also be due to a use of the place over a longer period. This aspect was already mentioned by Bosch and colleagues (Bosch *et al.* 2012) when they argued that the waste removal strategy documented at the bone accumulation locality might have been a necessary consequence of extended occupancy of the settlement area in AH4. Péan (2001) referred to this aspect, when he characterised the long term settlements of the Pavlovian in Moravia by their combination with huge accumulations of mammoth remains.

The big tusk fragments in the settlement area of Grub/Kranawetberg are pieces from the front part of the tusk comprising the end of the pulp cavity and the tusk point. The material at Grub also includes wedge shaped objects. Similar pieces were successfully used experimentally by Malina and Ehmann (2009) for splitting ivory. However, whilst at Grub/Kranawetberg there are wedge shaped ivory objects, there are no split pieces with similar traces of grooving and splitting comparable to those in Malina's experiment. There is only one splinter with an incised line parallel to the break of the splinter. So there is no clear evidence that this technique was used at Grub/Kranawetberg.

There are two main concentrations of ivory raw material and semi products at the settlement area: around hearth II and from two to six metres northeast of hearth I. A series of ivory flakes and splinters may be an indication that ivory was reduced there to smaller pieces by flaking and splitting. A small piece of a notched ivory rod for serial production of ivory beads and the rest of a thin round bar with an incision found in these areas seem to strengthen the impression of ivory processing at these places. In the same area there are also many beads, fragments of needles and the two smaller round bars.

The use of hematite and water for an easier abrasion of the ivory surface was tested in an experiment by Heckel (2009). Hematite is abundant at Grub/Kranawetberg and stains of red colour in combination with pieces of ivory might support this interpretation. Some of the beads also show traces of red colour. The use of stone in this process seems possible as there are fragments of stone with traces of grinding and red colour. Nevertheless one would expect a more frequent presence of colour remains on the smoothed heads of beads if this method was often used.

All ivory points are close or in the vicinity of hearth II. According to Christensen (1999) the compact second halves of tusks were used for the production of ivory points. For the biggest piece there is a similar object known from the Gravettian layers of the Grotte du Pape at Brassempouy published by Goutas and Simonet (2009) and another one from the Brillenhöhle in Germany presented by Barth (2007) which is rather similar to the pointed ivory bar from Grub but the point from the Brillenhöhle (Barth 2007) is made of bone, not ivory. The points at Pavlov I – Southeast (Brühl 2005) are clearly smaller than the rather long point from the Kranawetberg. The fragmented smaller points might be compared to the small ivory point from the Kranawetberg in Grub but these are fragments whereas the piece from Grub is the result of a controlled break.

The beads are distributed within the complete area with a high density of finds. According to our present knowledge beads seem to have been produced at the above mentioned localities but it will need further evidence to demonstrate the systematic production of beads.

Comparing the assemblage of Grub/Kranawetberg with other sites, the closest parallels can be found in the sites of Pavlov I – Northwest (Klíma 1997) and Southeast (García Diez 2005). In spite of the similarities there are also big differences: whereas in Pavlov the beads with two heads show systematically one flat side and the other incised and plastic, the majority of the beads from Grub/Kranawetberg have two completely rounded heads with an incision in the middle. The plastic side of the beads from Pavlov

resembles the rounded cylindrical beads of Grub. As at Grub/Kranawetberg all beads are made from ivory. On principle the Grub/Kranawetberg inventory comprises all elements of the production process described by García Diez (2005) except for the fact that the differently shaped beads with two heads of Grub/Kranawetberg also required different final modifications. Use-wear patterns suggest that the beads were attached to fabric. As to the use of the beads, we follow García Diez in regarding the pieces as beads sewn on clothes rather than as buttons due to their small size. We disagree, however, with the argument that the finding of single pieces supports the idea of buttons. If sewn on the clothes as at Sungir (Rybakov 1984) it is also possible to lose single pieces during daily activities at the site. Only the large double headed bead from Grub might have been used as button.

As to their distribution, García Diez demonstrated that this type of bead is mainly found in areas close to the Danube and Don rivers. The beads from the Pavlovian sites in Southern Moravia represent the oldest phase of distribution and Grub/Kranawetberg the final phase of the Pavlovian, whereas sites in Russia are the youngest within the distribution of this bead type. Her conclusion that this reflects population movements towards the east (García Diez 2005) is especially important for the situation at Grub/Kranawetberg. A movement of populations towards the east at the end of the Pavlovian has also been considered in connection with groups using shouldered points (see Escutenaire *et al.* 1999, Otte 1993, Otte, Noiret 2004). At Grub/Kranawetberg there is evidence of two layers (AH3 and AH4) deposited at the end of the Pavlovian (Antl 2013, Antl-Weiser 2005, 2009b, Antl-Weiser *et al.* 2010). In AH4 – the lowest layer – at the present state of research contacts to the north concerning raw material and adornments seem rather clear whereas in AH3 – the following layer – raw material procurement points to the East probably the Carpathian Mountains.

As to the few pieces of double headed beads with heart shaped heads to our knowledge there are no parallels elsewhere.

The closest parallels for the perforated pieces are at Sungir (Rybakov 1984) and Buran-Kaya III, layer 6-1 (Prat *et al.* 2011). However, there are also similarities between some beads and the more or less rectangular ones from the final Gravettian at Abri Pataud in France (Vercoutère *et al.* 2011), demonstrating that this type of bead is regionally and chronologically widespread within the European Upper Palaeolithic. The pendant which is shaped like a canine tooth of red deer can be compared to another ivory pendant from Lubná II (Šída 2009). There are also similar pieces known from the Brillenhöhle in Southern Germany (Riek 1973) and from Kostenki IV (Abramova 1995) made of bone. The German examples of this bead type are clearly larger than the one from Grub/Kranawetberg. The perforated drop shaped bead is a form known elsewhere – from Pavlov I – Northwest and Dolní Věstonice (Klíma 1997: 227–286) and from Germany: Mainz-Linsenberg, Geißenklösterle Hohle Fels (Scheer 1985: 269–285).

The decorated object is only a fragment from a possibly bigger one, but there also exist small decorated pieces in Southern Moravian sites such as Předmostí (Farbstein, Svoboda 2007). The decoration with gridlines differs from the piece from Kranawetberg which shows bundles of lines, but decoration with lines is in general typical for the time.

As to the two pointed objects with shouldered heads Buisson (2001) describes these – named "fastener" in this contribution – as a tool to close the wounds of hunted animals in order to stop the blood flow (Antl-Weiser 2009a, Buisson 2001). In general the two pieces – especially the bigger one – can be used to perforate hides as well as to hold perforated hides together.

## CONCLUSION

The ivory assemblage of Grub/Kranawetberg is especially rich in different types of beads and needles. However – at least in the area excavated so far – there are only a few other tools made of ivory. Therefore, the site can be compared to sites in Southern Moravia in relation to the number of ivory beads recovered, but not as far as other ivory tools or artefacts are concerned. The variety of beads illustrate very well the position of the site between east, west, and north both in chronological and in geographical (supra-regional) respects. Given the large amount of raw material and the numerous adornments recovered from the site – ivory processing was certainly an important activity at this locality but it will take further studies to evaluate the exact role of ivory production at Grub/Kranawetberg.

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Walpurga Antl
Department of Prehistory
The Natural History Museum Vienna
Burgring 7
A-1010 Wien
Austria
E-mail: walpurga.antl@nhm-wien.ac.at

Marjolein Bosch
Department of Human Evolution
Max Planck Institute for Evolutionary Anthropology
Deutscher Platz 6
D-04103 Leipzig
Germany
E-mail: marjolein.bosch@eva.mpg.de