Written in Bones

Studies on technological and social contexts of past faunal skeletal remains

edited by
Justyna Baron
Bernadeta Kufel-Diakowska

Uniwersytet Wrocławski
Instytut Archeologii

Wrocław 2011

INSTITUTE OF ARCHAEOLOGY, UNIVERSITY OF WROCŁAW, 2011

Editors
Justyna Baron and Bernadeta Kufel-Diakowska

Reviewers
Arkadiusz Marciniak, Jarosław Wilczyński

Layout
Janusz M. Szafran, Jarosław Michalak

Cover
Justyna Baron

ISBN 978-83-61416-64-7

Wrocławska Drukarnia Naukowa PAN im. Stanisława Kulczyńskiego Sp. z o.o.
53-505 Wrocław, ul. Lelewela 4

Katrin Struckmeyer

The bone tools from the dwelling mound Feddersen Wierde, Germany, and their functions

The excavation of the dwelling mound (*Wurt*) Feddersen Wierde, located in northwest Germany, yielded a well preserved assemblage of bone, antler and horn tools with more than 1,400 artefacts. The site was established in the 1st century BC and ended in the 5th century AD. The focus of the paper is on the functional identification of the bone objects which cover a wide range of types. Most of the artefacts were only slightly modified and can be interpreted as tools for scraping or rubbing activities. But it is unknown what processes these tools were used for in detail. To gain further information about their functions microscopic use-wear studies were carried out. This was done in combination with experiments by which different materials were worked with replicas of bone tools. In addition, ethnographical sources were included in the analysis.

Keywords: Northern Germany, 1st millennium AD, dwelling mound, use-wear

The site

Between 1955 and 1963, the Lower Saxony Institute for Historical Coastal Research excavated the site of Feddersen Wierde (Fig. 1). The settlement was established in the marshland of north-western Germany in the 1st century BC and ended in the 5th century AD. Initially, the houses were standing parallel to each other at sea level. Increasing oceanic flooding led to the construction of an elevated village in the 1st century AD. This time the design was altered to a circular arrangement of houses. In the 3rd century AD the dwelling mound reached its maximum size of approximately 4 hectares and a height of 4 metres (Haarnagel 1979; Schmid 2002).

The economic basis of the settlement consisted of agriculture, especially animal husbandry. In the farm houses, which were up to 30 m long and 7 m wide, as many as 32 large animals, mainly cattle could be kept. The zoological analysis of the animal bones proves that cattle formed the highest percentage followed by sheep and horses. There are only a few pig remains. Such a distribution of animal bones is characteristic of settlements along the coast of northwest Germany (Reichstein 1991).

Among the finds of Feddersen Wierde there are a lot of imports such as millstones, Roman glass, beads, fibulas, coins, and *terra sigillata*. Moreover, an ophthalmologic instrument and an ivory handle of a folding fan were excavated. These imports prove the intensive connections to both neighbouring and remote Germanic settlements and to the Roman Empire.

The assemblage

Because of the humidity of subsequently added layers of flooring, the organic matter from the settlement Feddersen Wierde, such as the wooden foundations of the buildings, plant rests, textiles and animal bones,

Fig. 1: View of Feddersen Wierde during excavations (photo: NIhK)

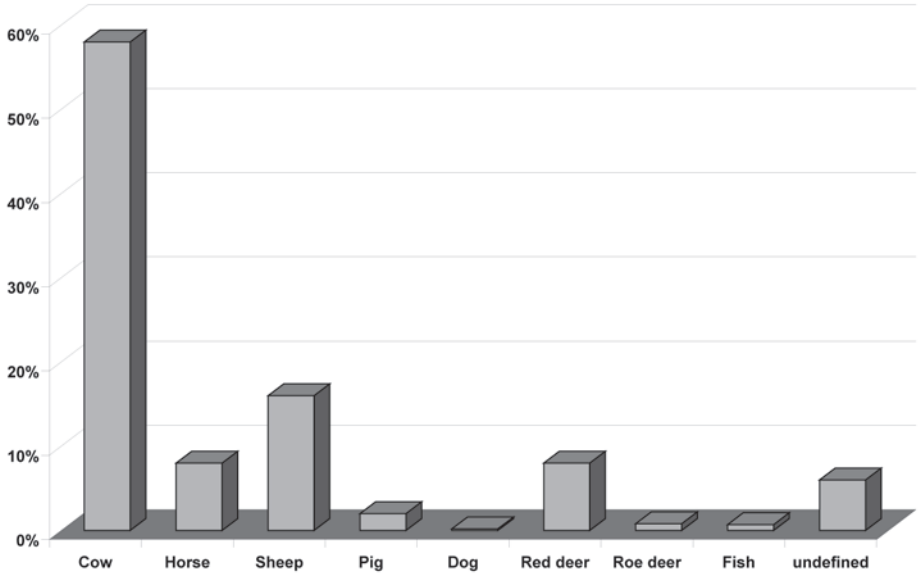

Fig. 2: Relative frequency of animal species among the raw materials

was outstandingly well preserved (Fig. 1). Among the artefacts there are about 1,400 bone, antler and horn tools and 58% of these tools were made of cattle bones. The remaining pieces are bones of sheep (16%) and horses (8%). Occasionally, also bones of pigs and dogs were found among the tools (Fig. 2). The worked antlers of Feddersen Wierde were derived from red deer and roe deer. As there was no habitat for these animals in the surroundings of the settlement, antler had to be imported. Probably only the antler was imported, because there were nearly no bones of red and roe deer in the village. Finally there are some worked bones of sturgeons (*Acipenser sturio*) and one perforated vertebra of a meagre (*Argyrosomus regius*). In manufacturing the different types of objects similar skeletal elements of only particular species were used.

Microscopic use-wear studies and experiments

The bone tools of Feddersen Wierde cover a wide range of types. Most of these objects were only slightly modified and may have been used in many different ways. To gather more information about the function of tools in the past, microscopic use-wear analyses were carried out. This was com-

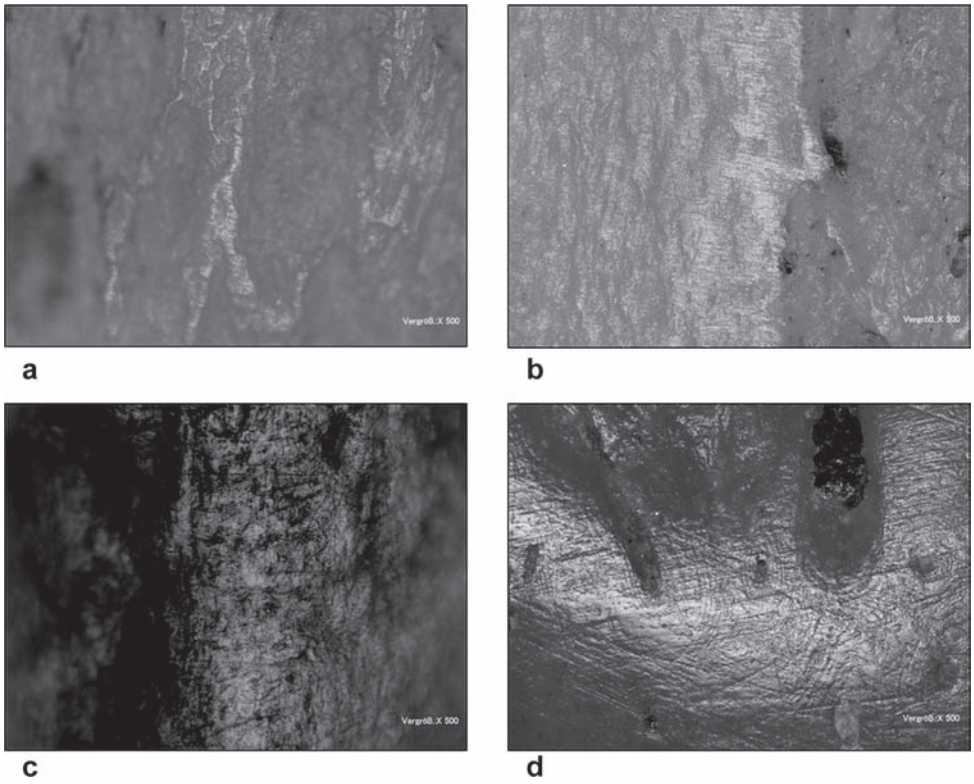

Fig. 3: Experimental wear traces.
a, b: bone used to smooth clay for 120 minutes.
c: bone used to smooth fresh cattle skin for 140 minutes.
d: bone used for debarking willow for 90 minutes;
a-d: 500x magnification

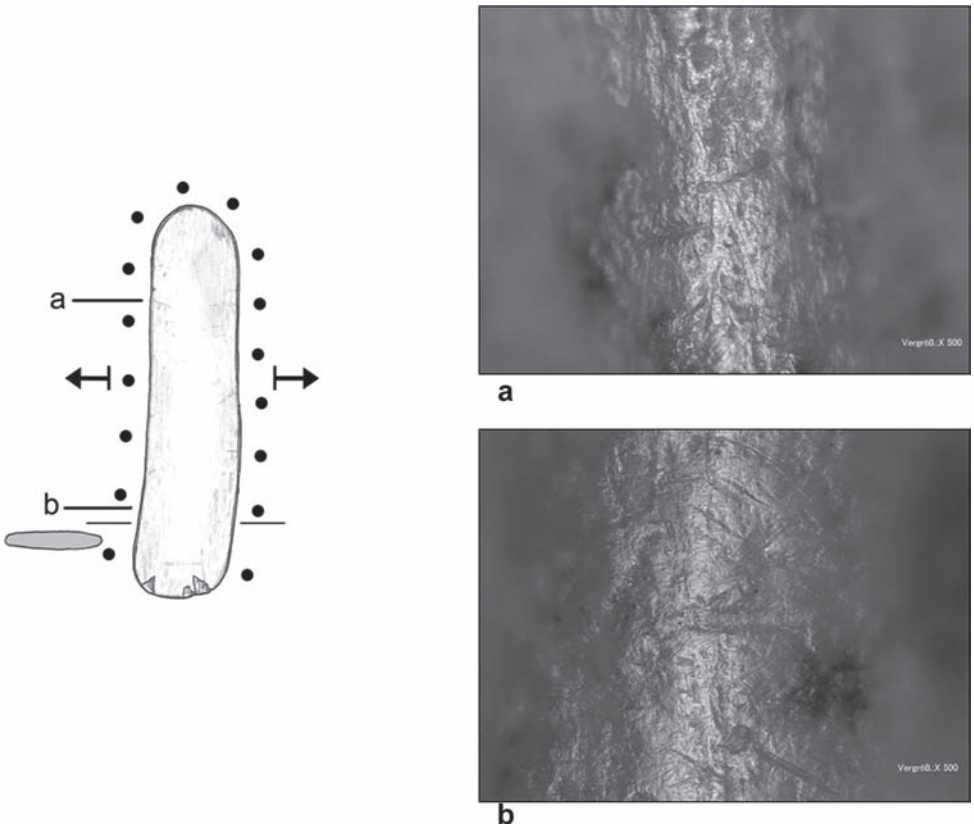

Fig. 4: Rib with rounded ends (nr. 224);
a-b: 500x magnification.
Drawing by T. Peek

bined with experiments which partly took place in the Lejre Experimental Centre, Denmark. In the course of these experiments different materials, which were available in the surroundings of Feddersen Wierde, were worked with replicas of bone tools (Fig. 3).

Ribs with rounded ends

Among the bone tools there are more than 400 objects made of cattle and horses' ribs. The modification of these ribs is restricted to the ends which have a rounded shape. The microscopic analysis shows that the flat edges and the rounded ends of the tools were in contact with the worked material. The use-wear appears as a bright polish whose structure looks much closed. It is mainly distributed at the high points of the surface whereas in the depressions the polish is only sporadic and less intense. Moreover a lot of closely spaced, very flat striations run perpendicularly to the edge (Fig. 4).

Experiments have revealed that on reconstructed bone tools used for polishing pottery comparable wear traces are visible which are characterized in particular by flat striations. In addition, the polish is spread on the highest areas of the surface and is closely linked (Fig. 3:a-b; van Gijn 2006:217, fig. 10:9e; Gates St-Pierre 2007:112, fig. 13). Due to these typical features the modified ribs of Feddersen Wierde are interpreted as tools used for the manufacture of pottery. The direction of the wear suggests that the working motion runs transverse to the edge of the artefacts.

By using these tools it was possible to smooth leather-hard pottery and to produce a uniformly thick surface. This reduced the risk of disruption during the firing process. Moreover the clay could be compressed with the tools so that the vessels became impermeable. Finally the treatment of burnishing lefts a slight gloss on the surface (Peacock 1982:60; Abbink 1999:54). The variability among the rounded ribs of Feddersen Wierde can be attributed to the fact that a wide range of tools having different size and shape was necessary in order to facilitate the production of various types of vessels. Long, slightly curved ribs could be used for finishing large vessels with a flat curvature, whereas small bone objects were also suited for smoothing their inside.

Metapodia with a bevelled edge

More than 200 tools of Feddersen Wierde are made of metapodia of cattle and horses. They were split lengthwise and have a bevelled edge with rounded sides at their distal end (Fig. 5). Under the microscope, the bones display a smooth surface and extensive rounding. The polish, which is also found at the bottom of depressions, is characterized by a rough, grainy texture. The distribution of the traces is perpendicular to the bevelled edge and follows the irregularities of the bone surfaces (Fig. 5:b).

The use-wear points to rubbing or scraping activity consisted of a back and forth movement. The rounded edges of the tools suggest that soft materials came in contact with them. The microscopic analysis of bone tools experimentally worked with animal skins have shown similar use-wear like rounded edges and a rough polish which is also present in depressions and scratches (Fig. 3:c; Christidou, Legrand 2005; van Gijn 2007:82, fig. 6:a-b). Probably animal skins were smoothed and stretched or remains of meat and tissue were removed with the bone tools.

Besides the use in leather manufacture the function of the objects should also be considered in the context of textile processing. On the one hand the objects could be utilized as pin beaters. By pushing up the loose weft use-wear develops at the tools' working edge. On the other hand it was possible to smooth textiles with the bones. Furthermore seams could be squeezed out. A comparable object made of a roe deer's metatarsus came from a sewing kit of the 19th century and was used to smooth line seams (Pfeiffer 1912:181, fig. 4).

In contrast to these carefully manufactured tools there are some objects whose surfaces were less smoothed and their working ends show no intense rounding (Fig. 6). These features apply mainly to artefacts over 15 cm long or which have a wide working end. Among the tools there are an increased number of metapodia taken from horses, which naturally are of great length, and some metapodia from cattle which were cut directly above their distal end so that a wide edge could be created. Wear traces indicate that these roughly manufactured artefacts have to be regarded as final products.

Analysing one of these tools, compression of the surface can be demonstrated at one point (Fig. 6:a). Moreover there is very smooth and bright, closely linked polish visible (Fig. 6:b). Next above the distal end the wear occurs more scattered. The edge is slightly split out and not regularly rounded.

It seems that hard material was worked with a tool such that high pressure had to be imposed onto the bone's edge. Identical traces in terms of a very bright polish with only a few striations are visible on tools used in processing bark (Fig. 3:d; Gates St-Pierre 2007:111; van Gijn 2007:82, fig. 5:a). The direction

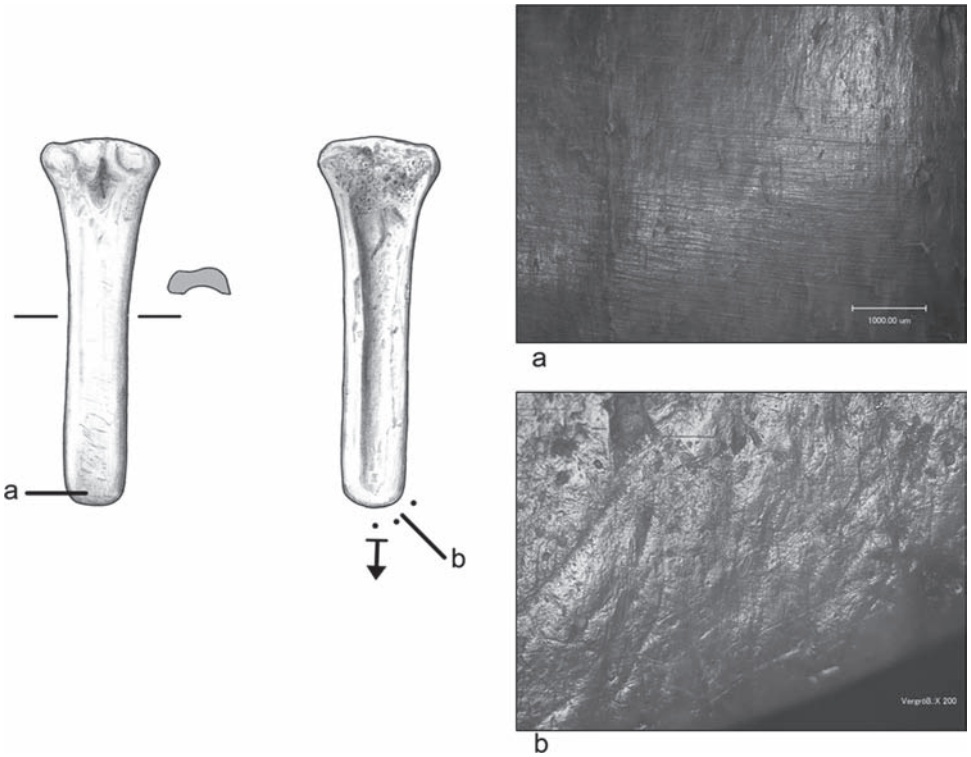

Fig. 5: Metatarsus with a bevelled edge (nr. 571); a: 50x magnification, b: 200x magnification. Drawing by T. Peek

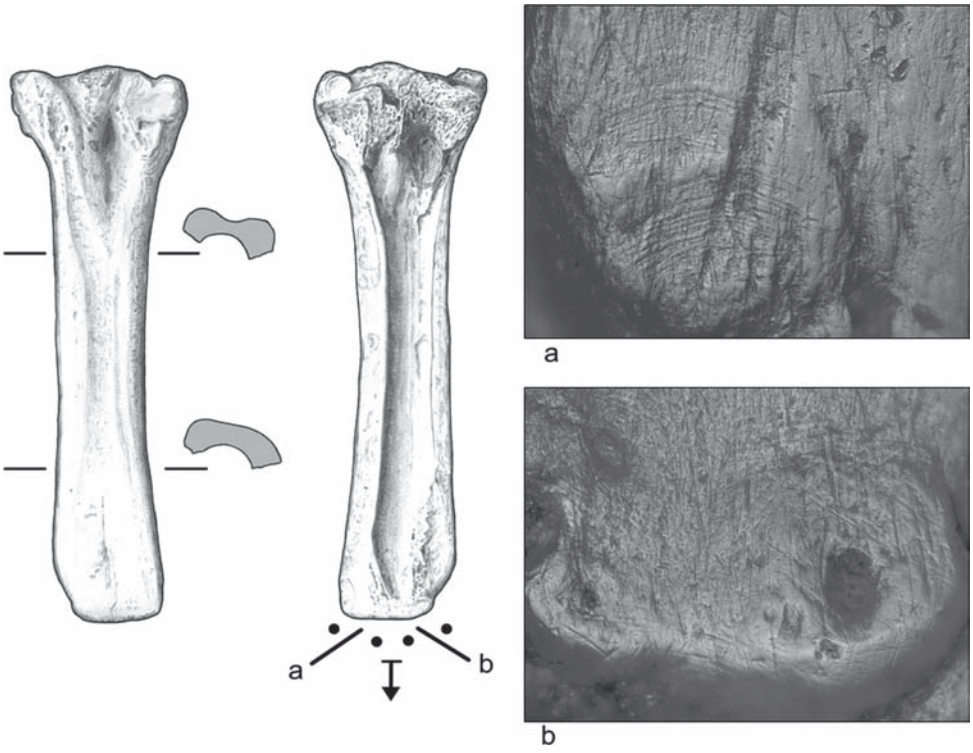

Fig. 6: Metatarsus with a bevelled edge (nr. 532); a, b: 500x magnification. Drawing by T. Peek

of the wear suggests that the object was used longitudinally to the diaphysis, at a steep angle.

Some of these bone tools were probably involved in woodworking activities within the settlement. They may be used for peeling willow bark during the manufacturing process of basketry. Also a function as a chisel cannot be excluded. However, there is only one artefact with clearly visible impact marks on the proximal articular surface.

Similar tools made of metapodia are known from equipments of the last decades (Herman 1902:238; Boucard 2000:125 ff., fig. 12). These long bones have a split and bevelled end like the objects of Feddersen Wierde and were used for peeling oak bark for tanning.

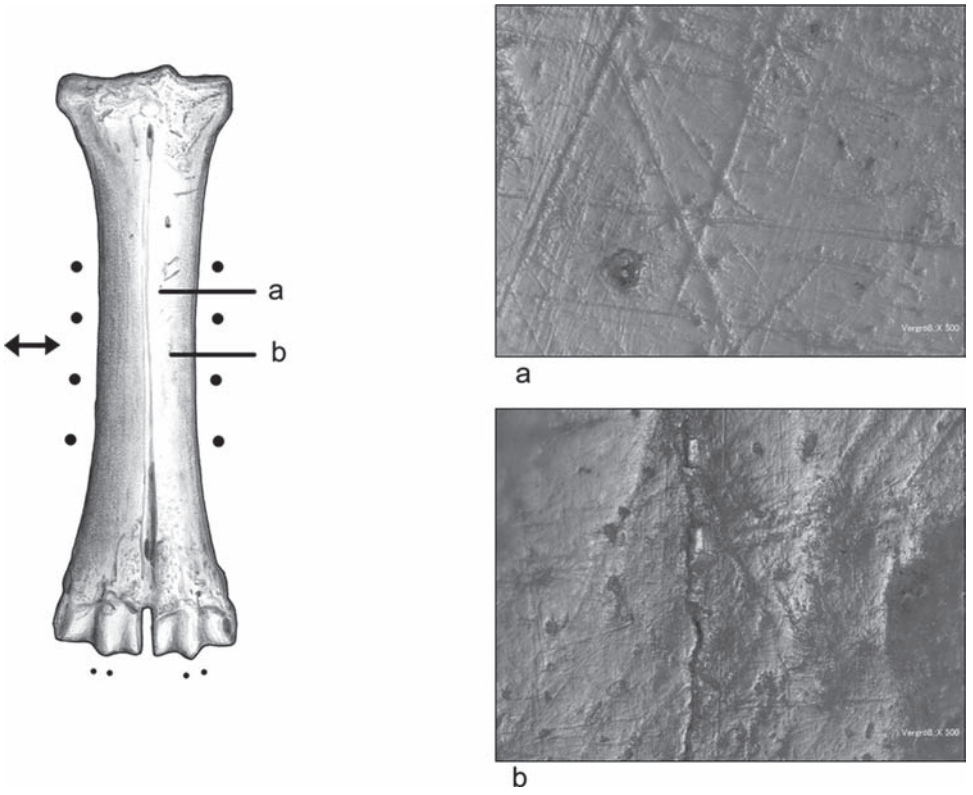

Fig. 7: Metacarpus with a smooth surface (nr. 751); a-b: 500x magnification. Drawing by T. Peek

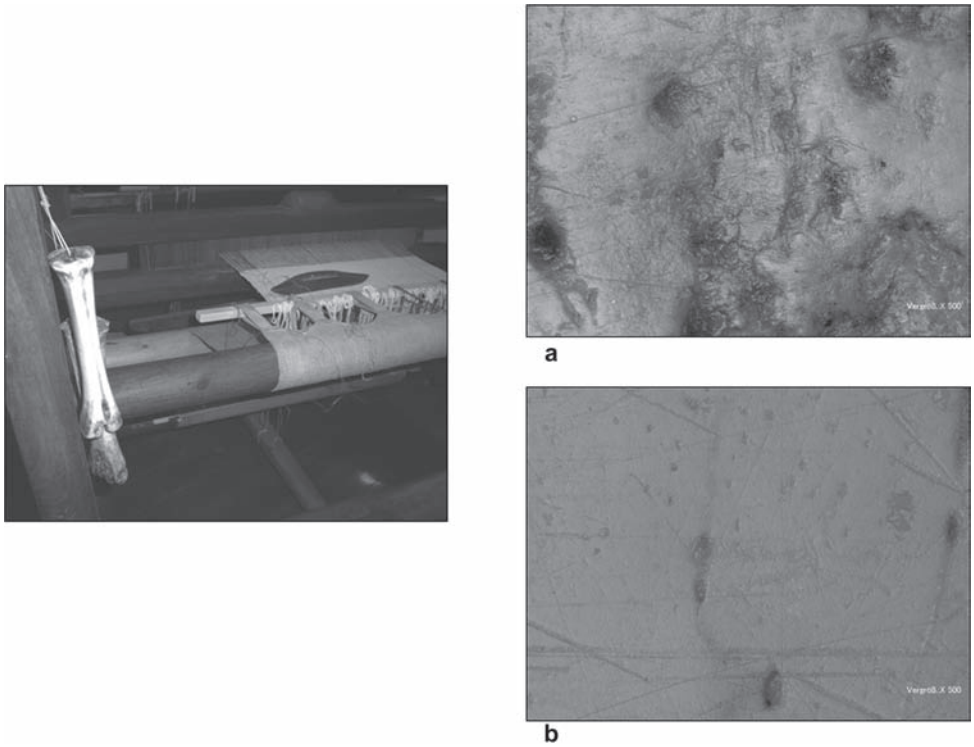

Fig. 8: Recent metapodia used for smoothing textiles at a loom in a museum; a-b: 500x magnification

Metapodia with a smooth surface

Further bone tools of the settlement consist of metapodia taken from cattle and horses which were left in their natural size and shape. However, fine manufacturing traces can be seen with the microscope and some of the bones have perforations.

The dorsal surface of one metacarpus is slightly flattened and shows use-wear (Fig. 7). At high points the wear forms a very smooth and closely linked surface whereas at the bottom of depressions there is a more granular polish. It is clearly visible that

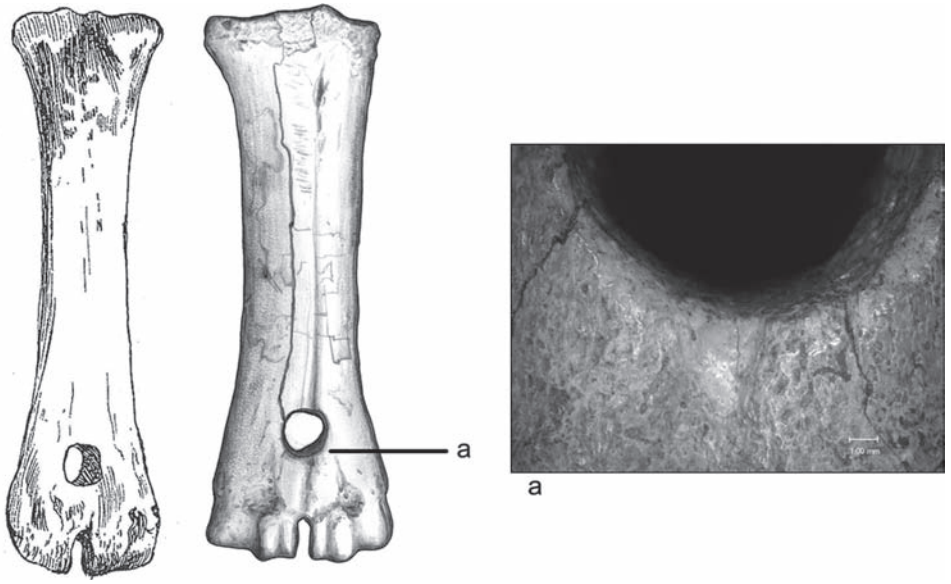

Fig. 9: Recent metacarpus (left) used for smoothing textiles (Herman 1902:238) and a metacarpus from Feddersen Wierde (nr. 748); a: 20x magnification. Drawing by T. Peek

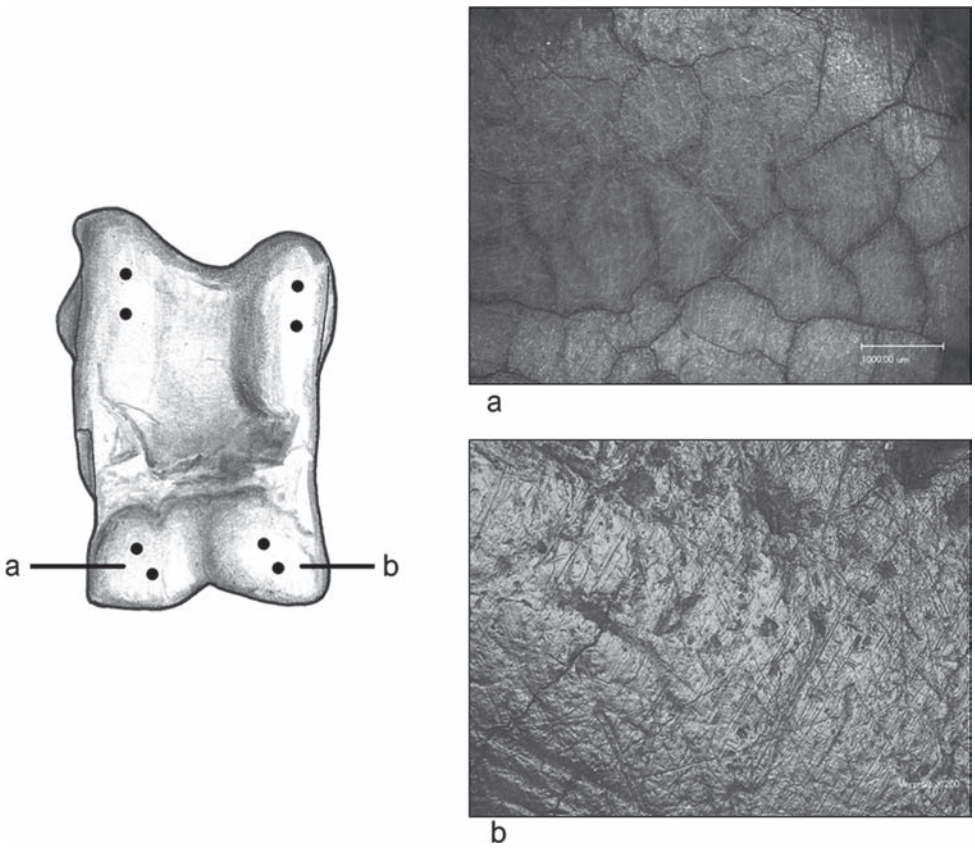

Fig. 10: Talus with a smooth surface (nr. 1223); a: 50x magnification, b: 200x magnification. Drawing by T. Peek

the dull polish has spread in a transversal direction following the contour of the bone surface. Very flat and short striations may also be associated with the function of the tool. Finally, the rolls of the distal epiphysis are smooth.

In order to identify the contact material, two metapodia taken from cattle were analysed. These were used for smoothing textiles at a loom in a museum (Fig. 8). The polish seen on these tools has a smooth structure, follows the irregularities of the surface and also occurs in depressions. These features agree with the use wear of the analyzed metacarpus of Feddersen Wierde. It can be assumed that textiles, which were still at the loom, were rubbed with this bone tool perpendicularly to its axis. In this way linen fabrics could be treated to smooth them and to give them a shiny appearance.

There are many records of the past centuries which support the effectiveness of metapodia as weaving implements (Friedel 1874:156; Virchov 1871:20; Schoneweg 1923:149). Among these objects one metacarpus taken from cattle has a perforation for hanging up the tool. From Feddersen Wierde there are two metacarpi known which have an identical hole. One of these perforations has a smooth bulge that was certainly caused by the friction of a rope (Fig. 9). Accordingly, this bone was also tied to a rope and probably hung at the frame of a loom.

Tali with a smooth surface

Finally, tali which have a remarkably smooth surface will be discussed. These were taken from cattle. The pronounced areas on the dorsal side of the bones show diagonal traces produced by a grinding stone whereas on the remaining sides such traces are only found occasionally. Moreover there is use-wear on the pronounced parts of the dorsal side. Due to this abrasion the manufacturing traces can only be seen at the edge of these areas, where a lower friction occurred with the contact material (Fig. 10).

The use-wear shows that the dorsal side of the analyzed bone came into contact with the material to be processed. Also the intentional flattening and smoothing of the pronounced surfaces suggests the importance of these areas for using the tool. Probably a rubbing movement in different directions was carried out. The dull and smooth polish, which follows the irregularities of the bone's surface, is similar to the use-wear of tools used to smooth fabrics (Fig. 8). Such a function is also adopted for the analyzed talus.

It is conceivable that the talus was utilized as a substitute for glass linen-polishers. These semi-circular objects, whose flat side is often slightly drawn in, appear since the 2nd century AD. They were used to smooth fabrics, to squeeze out seams and to create a shiny gloss on linen (Friedel 1874:156; Haevernick, Haberey 1963:138; Steppuhn 1999:115). It is also known that bones are excellently suited for smoothing textiles. Thus, even in the 20th century garments made of linen, such as hoods and collars, were smoothed with a cattle's mandible in Norway (Noss 1965:97 ff.).

In the literature tali taken from cattle are usually regarded as gaming pieces. Although such a function may be the case for many of these bones, the use-wear study shows that not all of them can be interpreted unreservedly as gaming pieces. Instead, other functions like smoothing textiles or grinding seeds and herbs have to be considered.

Conclusions

Due to the excellent state of preservation of the bone tools from Feddersen Wierde it was an opportunity to carry out extensive microscopic use-wear analyses. Involving morphological and technological factors the study reveals information about the functions of different bone tools.

It seems that a lot of objects were primarily used for processing textiles. Working with fabrics it would have been very important that the implements had rounded edges and a smooth surface, so that they did not got caught on these sensitive materials and cause damage. The carefully rounded bone tools without any sharp edges were perfectly suited for such a purpose.

Furthermore the use-wear analyses show that a general determination of the tools' functions cannot be supported. The typological classifications often consist of artefacts which were used for varied purposes. This applies for example to the tools made from metapodia which were split lengthwise and have a bevelled edge. Although the objects have a similar appearance, they differ in their use-wear from each other. For this reason, results of use-wear analyses cannot be transferred without reservation to other objects. But the wide range of various purposes of the tools becomes visible. In that way the study demonstrates that bone tools were essential for a settlement's workaday life during the first millennium AD.

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