

SPOOLDE

WORKED AND UNWORKED ANTLERS AND BONE TOOLS FROM SPOOLDE, DE GASTE, THE IJSSELMEERPOLDERS AND ADJACENT AREAS

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C 14 dating, W.G.Mook

1. THE FIND-SPOTS*

1.1. Spoolde

In 1961 a large number of worked antlers and antler fragments were found during the construction of a new canal with a lock near Zwolle in the province of Overijssel (figs. 1-3) in the Netherlands.**

Although Zwolle has traditionally been one of the IJssel towns, it is not situated directly on the bank of this river but on the bank of the Zwarte Water (black water), a small waterway running in a northerly direction towards the former Zuiderzee. Where it reaches the Zuiderzee it is called Het Zwolse Diep (the canal of Zwolle). Since the 14th century Zwolle had been trying to get a direct connection with the river IJssel. This was at last realised in 1819. The canal was named Willemsvaart after the first King of the Netherlands, Willem I.

In 1950 a new town development was planned north of the Willemsvaart. This district was to be connected by bridges with the town centre. Since 20,000 ships passed through the Willemsvaart annually at that time, it was thought advisable to construct a new canal northwest of the old canal. In the foreshore area of the river IJssel a new harbour was to be constructed on the river-side of the lock, connecting the new canal with the river IJssel (figs. 2-3).

The work started in 1961 and was supervised by the State. The main contractors of the harbour and lock complex near Zwolle were the firms of Prins van Wijngaarden & Van Hattem (harbour) and Blankevoort (lock).

The artefacts were found during the preparations (Directie Overijssel Rijkswaterstaat, 1964) for the construction of the harbour outside the Bandijk and were discovered initially by Mr. J. Tolhuis, an amateur palaeontologist who, for many years, had been collecting fossils in the surroundings of Zwolle for the Rijksmuseum voor Geologie en Mineralogie

* Tables 1-2 have been reproduced as microfiches (5:A1-A11) in an envelope attached to the rearcover of this volume.

** The following is mainly based on an article by Van der Heide (1962) and information provided by the Directie Overijssel Rijkswaterstaat in 1964.



Fig. 1. The geographical situation.

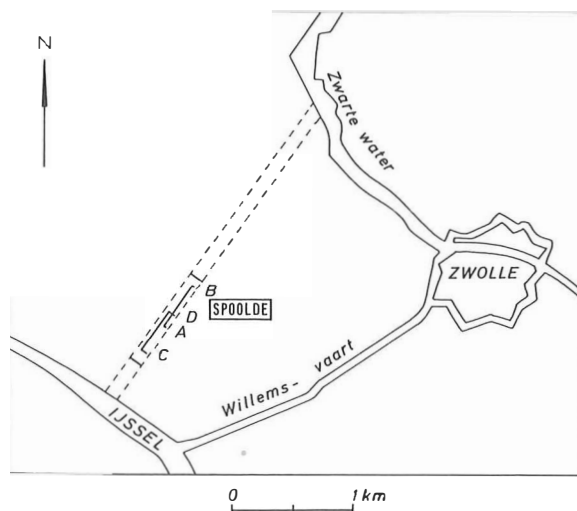


Fig. 2. The situation of the new canal north-west of the Willemsvaart near Zwolle (after Hamming, Knibbe & Maarleveld, 1965).

in Leiden. The finds were reported by J. Tolhuis to Prof. Dr. P.J.R. Modderman, at that time a member of staff of the Rijksdienst voor het Oudheidkundig Bodemonderzoek in Amersfoort, who thought an investigation necessary. He did not, however, have the time

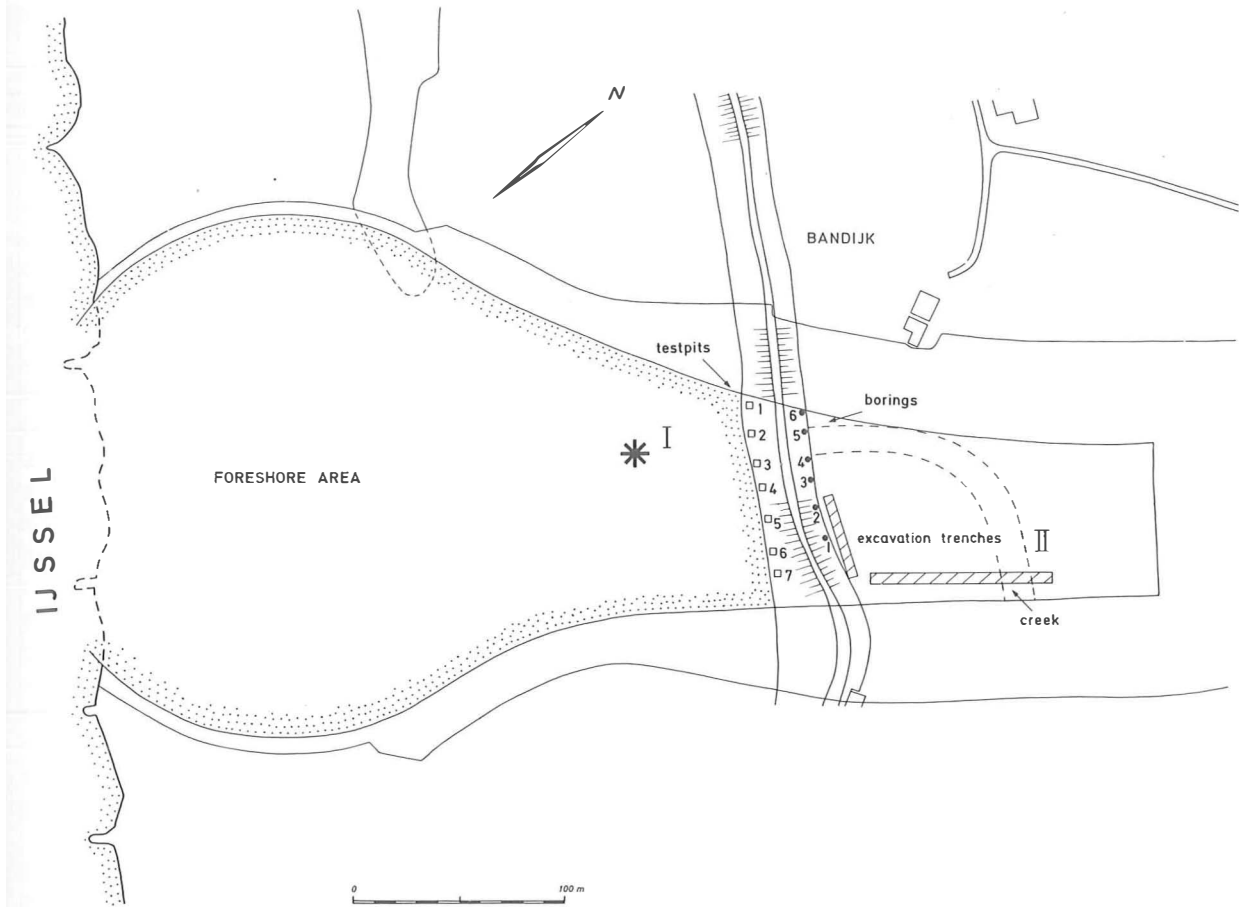


Fig. 3. The new harbour in the foreshore area (I), the Bandijk with the location of testpits and borings, and pit II. In pit II the trenches excavated by Van der Heide and the creek (after Van der Heide, n.d.).

to conduct this investigation personally. Therefore Mr. G.D. van der Heide, the head of the archaeological department of the Rijksdienst voor de IJsselmeerpolders was asked to take the necessary steps to determine if circumstances were favourable for an excavation. The area of the new harbour was then already under water and it was not possible to locate the exact find-spot of the worked antlers, just as it was impossible to establish whether the finds belonged together.

The objects came to light during dredging operations in the IJssel foreshore south of the Bandijk. The depth of the finds was probably between four and six metres, since it was only when sand was sucked up from that depth that antler objects came to light. It was also possible to locate, though only roughly, the spot where the objects were found (fig. 3).

At the landward side of the Bandijk, two pits were dug, separated by an intact area that was to serve as a provisional dike when the part of the Bandijk blocking the outer harbour under construction had to be taken away. In the pit situated furthest to the north-east, the lock would be built, and this pit was therefore dug to the greater depth of 8 metres. At the time of the finds this pit was already c. 7 m below ground level. In the pit between the provisional dike and the Bandijk, clay and peat layers overlaying the pleistocene sand had been taken away. This area was surveyed for traces of prehistoric habitation which could be connected with the antler objects. Pottery sherds dating from the late Neolithic to the Middle Ages were found, but only a few more antler objects were collected.

At the foot of the Bandijk at the landward



side, a trial trench was excavated. During the excavation sherds were found in concentrations. The sherds were decorated with nail impressions, with spatulae, with fishbone motifs, and a barbed wire motif, and could have belonged to the Bell Beaker Culture and Early Bronze Age. In a second trial trench, more or less perpendicular to the first in the north-eastern part of the pit, traces of a shallow creek were found, filled with peat. The filling with peat had been interrupted a few times when sandy layers were formed. From the upper peat layer, Iron Age finds were collected. The lower layers contained older sherds, bones, flints and a few red deer antler remains. The bones and antlers were badly preserved. At the bottom, some pointed wooden posts were found, suggesting a weir for fishing. The dragline had taken away the filling of the creek at other places in the pit, leaving depressions in the pleistocene surface. By tracing these depressions it was possible to follow the creek in the pit. The creek ended in the northern part at the foot of the Bandijk not too far from the place where at the riverside of the dike the antler objects were discovered.

At the landward side of the Bandijk, six borings were made up to a depth of —2 m N.A.P. (Dutch Ordnance Level). At the outside of the Bandijk, also to a depth of —2 m N.A.P. seven trial pits were dug, the profiles of which were sketched. Pit 1 is situated opposite boring 6 and pit 2 opposite boring 5, *etc.* Within the outlined course of the creek, the filling of the creek should be visible in boring 5 and in pit 2. Neither in the profile of pit 2 nor in sample 5 were there any visible traces of a creek filling. Nor could any traces of the creek be seen in the other profiles and borings either. A connection between the finds and the creek was not established (see also 3.1.).

1.2. De Gaste

In 1977/78 three T-shaped antler axes were found at the east side of a new canal, Hooge-

veense vaart, north of the small road along De Gaste towards Zwartsluis (fig. 4; v.d. Waals, 1972). They were found together with a l. horncore of an aurochs and two incisors and two premolars of a small horse (also in Swifterbant T-shaped antler axes were found together with remains of aurochs and horse: Clason, 1978; in print). The finds of De Gaste may belong to the same period as the Swifterbant site, the Late Atlantic period at the end of the fourth millennium B.C.

1.3. IJsselmeerpolders and adjacent areas

During the reclamation works in the IJsselmeerpolders after they had become dry land a number of antler tools were found which are also described and discussed in this paper. In most cases little is known of the context in which they were found (figs. 4, 5).

1.3.1. Wieringermeer

ZW 1935/

V320 - J 60, probably secondary find-spot

ZW 1935/

II6 - ?

1.3.2. Noordoostpolder

Z 1942/

XII⁴² - K 34

Z 1943/

IX⁴⁴ - R 28 or R 29

Z 1948/

VII⁸⁰ - O 29

Z 1950/

IV³⁰¹ - D 52, together with medieval pottery

Z 1950/

XII³³⁸ - J 78

Z 1950/

XII³³⁹ - J 78

Z 1952/

II⁴² - S 1, in the side of a ditch

Z 1952/

II²²⁷ - section C

Z 1953/I²² - P 91

Z 1953/I²³ - J 99/100

Z 1953/I²⁴ - Q 104

Z 1953/I²⁵ - B 22

ZO 1953/

II²¹ - section J, P or O

Fig. 4. The Pleistocene surface at the time of the habitation of Swifterbant, with Swifterbant (1), Spoolde (2) and De Gaste (3) (Ente *et al.*, 1983).

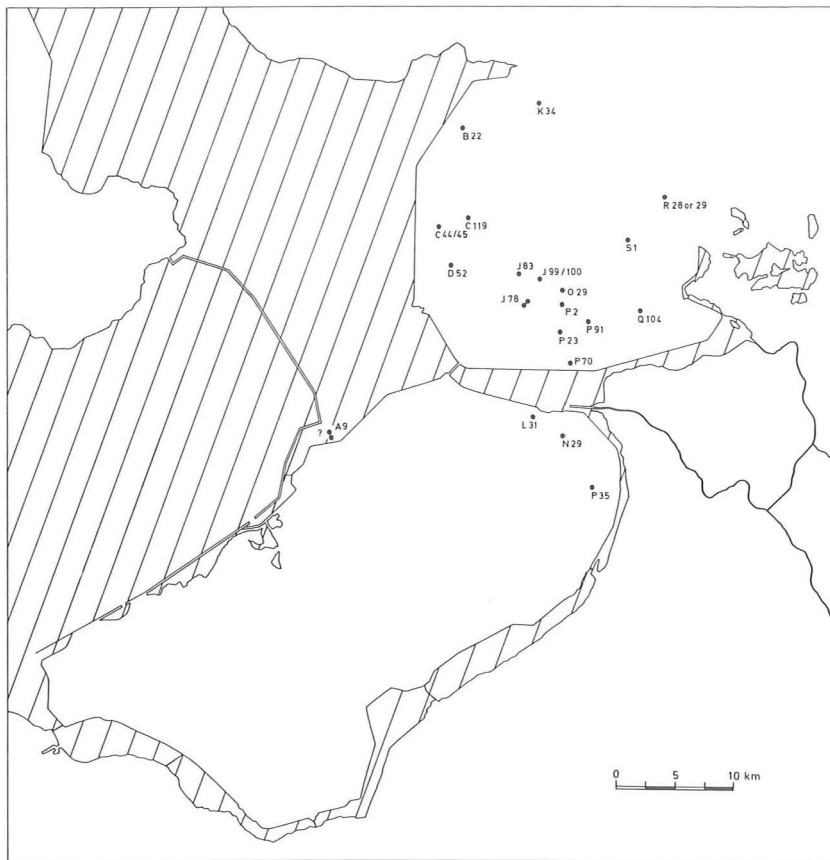


Fig. 5. The location of a number of the antler tools and antler fragments in the IJsselmeerpolders and adjacent areas (after Reinders, 1983).

Z 1954/
II⁷⁷ - dredged from the Enservaart
Z 1954/
II¹⁶⁹ - C 119
Z 1956/
V^{186(83?)} - P 23 during the levelling of the
foot of a dwelling mound
Z 1958/I⁵³ - D 91
Z 1958/
X[?] - C 44/45
Z 1961/
I¹⁰⁶ - P 2
Z 1961/
I¹¹⁷ - P 70
Z 1968/V³ - Vliegtuigweg, section J, P or O
? - J 83

1.3.3. Oostelijk Flevoland

Z 1953/I³³ - E 116
ZO 1953/
I¹⁶² - found during sand dredging
ZO 1958/
IX¹⁰⁴ - sand depot between Z 30 and Z

36 from pleistocene sand
ZO 1960/
I¹⁹⁰ - P 35
Z 1965/
I¹³² - dredged sand deposited section
A or B, Houtrib
Z 1965/
I¹⁷² - N 29
Z 1965/
IV²¹ - dredged from IJsselmeer oppo-
site section A/9
Z 1965/
IV²² - dredged from IJsselmeer oppo-
site section A/9
Z 1965/
VII⁸⁵ - section M
ZO 1960/
II⁸ - L 31
Z 1968/V⁴ - ?

1.3.4. Zuidelijk Flevoland

? - FZ 14

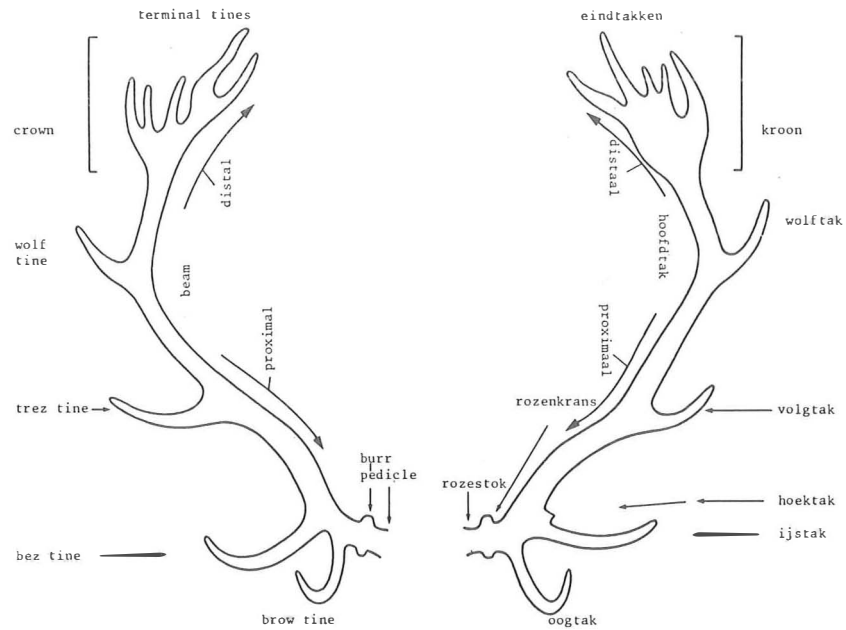


Fig. 6. Explanation of the names used for describing the red deer antlers and antler tools.

1.3.5. *Urk*

Z 1952/

VII^{20b} - ?

1.3.6. *Schokland*

Z 1968/

IV⁴ - section E, west coast of the island

1.3.7. *Kampen*

Z 1965/I²⁶ - Kattendiep near Kampen

Z 1965/I²⁵ - Kattendiep near Kampen

Z 1965/

VII⁸⁸ - Koelucht

St. no.

41496 - north of Kampereiland

1.3.8. *Kuinre*

Z 1957/

V³⁶ - found during digging of a building pit

1.3.9. *Miscellaneous*

ZM 1960/

II⁹ - sand dredging Markerwaarddijk

Z 1968/

III³⁹ - Meppelerweg, Den Hulst, near Zwolle

Z 1975/

II²⁸¹ - Afsluitdijk

? - Randmeer near Roggebot oppo-

site section N or O

Z 1965/

II¹⁶⁴

- from the river IJssel near Welssem (Deventer)

1.3.10. *Swifterbant*

After the *polder* of Oostelijk Flevoland came into existence, a submerged tidal system was discovered in the northern part of the *polder* near the village of Swifterbant (fig. 4). Traces of Mesolithic and Neolithic habitation were discovered on riverdunes in the east of the *polder* and on levees in the west. In the Neolithic sites, dating c. 3400-3300 B.C., a T-shaped axe and a socketed bone axe were collected during systematic excavations (Clason, 1978; Deckers, de Roever & van der Waals, 1980).

2. THE FINDS

2.1. The bone and antler tools

2.1.1. *The manufacturing process of the antler tools*

Most of the tools were made from red deer antlers (fig. 6). Both naturally shed and unshed antlers from animals that were probably hun-

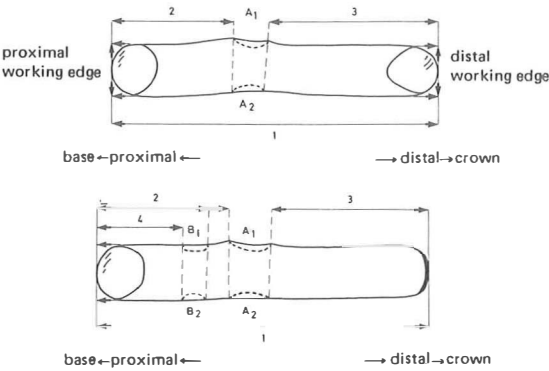


fig. 7

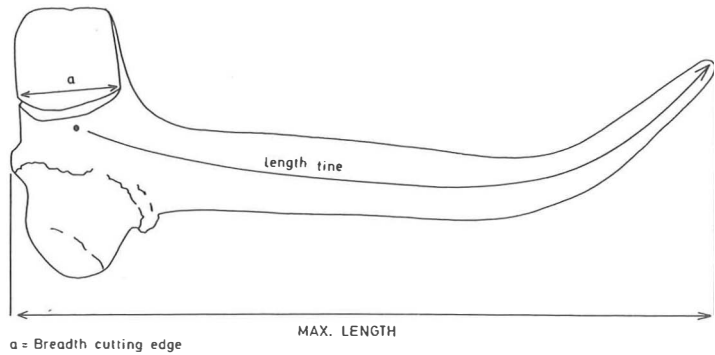


fig. 8

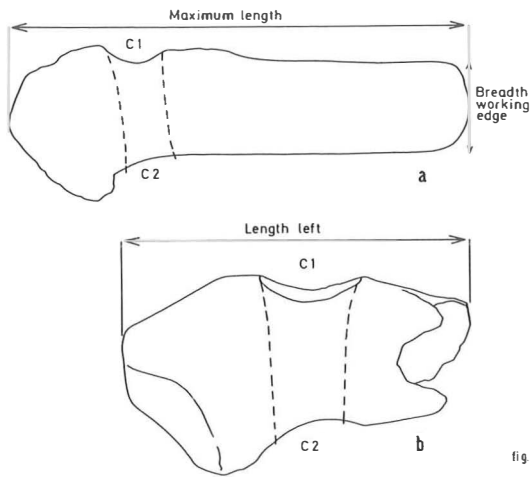


fig. 9

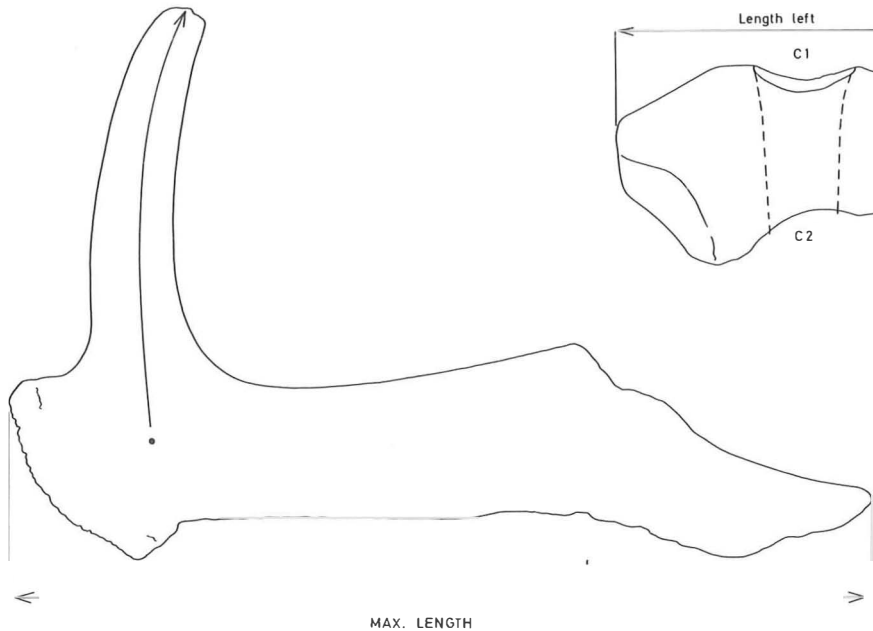


fig. 10

ted were used. In a number of cases the antlers or antler tools show gnawing traces of small rodents. Whether the antlers were processed when still green, or also after some time is difficult to say.

The tools were carved out of the antlers with a sharp and/or pointed flintstone. The scratches made by the flints in the cortex are often still clearly visible (pl. 1). The spongiosa was broken after the carving of the cortex. Another way to sever parts of the antler was to pick or chip the cortex away and then again break the spongiosa. Traces of this process, too, are still visible (pl. 2).

The oblique working part of the axes was obtained by carving the cortex and spongiosa halfway through and then breaking the beam in such a way that an oblique plane remained on both parts of the broken beam. This is best illustrated by the T-axes of which the workin plane was made out of the lateral or medial part of the antler near its base if the axe was a single bladed axe (pl. 3). If the axe was double, a rough working plane was similarly obtained from the medial or lateral side of the beam distal of the trez tine. The working plane was then probably further fashioned with a sharp flint by cutting away the rough parts of the cortex. It is possible that the working plane and edge were smoothed afterwards but this would not have been necessary. The waste from this process, the base and brow tines, were fashioned in some cases into axes (pl. 4).

For the manufacture of the base-axes the brow and bez tines were cut or picked away and the spongiosa broken. In some cases the trez tine was removed from the antler in the same way.

The shaft-hole was constructed in the majority of cases between the base of the removed brow and bez tines, in some cases overlaying either the base of the bez or the trez tine or partly both. The shaft-hole was carved or picked out of the cortex and runs from the basal to the dorsal side of the antler at a varying angle with the base of the antler (pl. 5). The working edge was constructed more

or less parallel with the shaft-hole.

The numerous tines are partly waste from the axe manufacture, but a number of cases also show traces of use. A small number of them had a perforation at the base. Those tines were not found at Spoolde.

Antler picks were found at Spoolde and as stray finds in the IJsselmeerpolders. From the antler picks, the brow tine was used for some purpose and the beam was the handle. The bez and if necessary the trez tine were cut off. The antler picks resemble those found in the flint mines of Rijckholt/St. Geertruid (Clason, 1981) (pl. 6, 7), where they were thought to have been used for the construction of mine shafts.

2.1.2. *The manufacturing process of the bone tools*

These are discussed briefly together with the description of the three bone tools collected at Spoolde.

2.1.3. *Different tools*

Most of the tools were damaged. The working edge of the majority of the axes is damaged, ranging from small cuts or irregularities in the edge to the complete absence of the working edge or part of it. The working edge or plane of the type I base-axes, in particular, is missing in the majority of the cases (pl. 8). The base-antler axes of the second type were all undamaged (pl. 9). Another way in which the axes were damaged is breaking of the shaft-hole. This is observed more often with the T-axes than with the base-axes (pl. 10).

In some cases the T-axes were 'repaired' by making a second shaft-hole (figs. 27, 28). It is difficult to say whether the working edges and planes of the base-axes were ever re-sharpened or re-fashioned after they were broken. The large variation in the length of those tools, however, may be an indication of this practise.

2.1.4. *The use of the antler objects*

It is still difficult to say anything about the

Figs. 7-10. Measurements taken of a T-antler axe (7), a brow tine axe (8), a base-axe (type I and II) (9) and an antler pick (10).

use of the antler objects. Since different well-defined tool types can be distinguished they must have been manufactured for a distinguishable purpose or purposes, but in many cases it is not possible for us to get any idea of what these aims or purposes may have been. A number of functions have been suggested for the T-shaped axe. Since one was found in Scotland near the skull of a rorqual, it has been thought that they were used for chopping off meat and blubber from the carcass (Clark, 1952). Their occurrence in Lepenski Vir (Srejović, 1979) and Vlasac (Bačkalov, 1979) in the Iron Gate Gorge in Yugoslavia may point to some function in fishing or hunting. It has also been suggested that they were used for the construction of wooden canoes, for the chopping away of charcoal from the inside of the trunk or as some kind of insignia worn on a stick because in general the shaft-holes are thought too narrow for a solid shaft (fig. 131) (Hucke *et al.*, 1973).

It has often been said of the base-axes, that they would not have been strong enough to be used as real axes. Therefore, for this tool, also, it was suggested that they were used for the construction of canoes in the same fashion as the T-shaped axes. It is also thought possible that they were used as hoes in the cultivation of fields (Rees, 1981). In any case they may have been used as hammers, since the bases are often rounded from use and the burr is missing or worn down. That they were used with force can be seen from the nature of the damage. It has recently been suggested that these tools were used as the share of an ard (Verlinde, 1982). Although this is an interesting suggestion, it is not clear to me how the base-axe could have been fastened to the beam of the ard. Rees (1979) describes three bone objects made from whale bone as bone shares. These shares were found at Foshigarry in Scotland in earth houses dated to the Iron Age. The objects are, however, quite different from antler base-axes. Glob (1951) mentions a piece of antler which may have been used as a share from Biskupin, dated to the middle of the first millennium B.C. But this antler fragment was not depicted. It is time for an attempt to establish experimentally whether it is possible to use the implements in the suggested ways.

2.1.5. Description of the tools and antlers

Measurements were taken to define the objects. In all cases the maximum length was taken in the direction of the beam, the maximum width perpendicular to the maximum length (figs. 7-10; table 1).

2.1.5.1. Bone tools

2.1.5.1.1. Socketed bone axe

Nr. ? (fig. 11). A socketed axe made of the proximal part of a r. metatarsus of an aurochs — *Bos primigenius*. The working part was cut off the dorsal part of the bone. The tool was broken and the working edge is missing. Possibly it was never used. On the dorsal surface of the bone, scratches are visible which may have been made when the pointed flint, with which the axe was being manufactured, slipped. Similar scratches were made during the experimental manufacture of bone tools in Groningen. On the volar side no such scratches are visible. In the proximal articular face of the bone, a hole has been made, which is well finished but does not show any signs of wear.

2.1.5.1.2. Bone awl

ZR 1962/III¹⁵⁸ (fig. 12). A long bone awl also belongs to the Spoolde collection. The upper part is broken off. The part that is left is slightly curved and smooth from frequent use.

2.1.5.1.3. Bone disc

ZR 1962/III¹⁵⁶ (fig. 13). A bone disc was found in 1962, at the same time as the other objects. The disc was made from the lateral side of the vertical ramus of a l. mandibula of a domestic ox or aurochs. The disc can be easily cut from the mandibula of a present-day Dutch black and white herdbook cow. The disc was perforated. The perforation was made from both sides. The perforation which was started at the lateral side is slightly narrower than the one started at the labial side. The perforation is not exactly in the centre of the disc.

Similar discs have been found in Denmark (Andersen, 1973-74).

2.1.5.2. Elk antler tools

2.1.5.2.1. Chisel

ZR 1962/V¹². A fragment of the base of a left antler of an elk which was probably made into some kind of axe or chisel. Owing to the poor state of preservation of the piece it is not possible to confirm this possibility. The object bears a certain resemblance to two other antler tools described in this article (Nr. ? [fig. 14], Nr. Z 1957/V³).

Nr. ? (fig. 14). This object was probably found at Spoolde. It was made from a tine of an elk antler. It most resembles a chisel. The working part is well-preserved and smooth. The opposite part of the tool

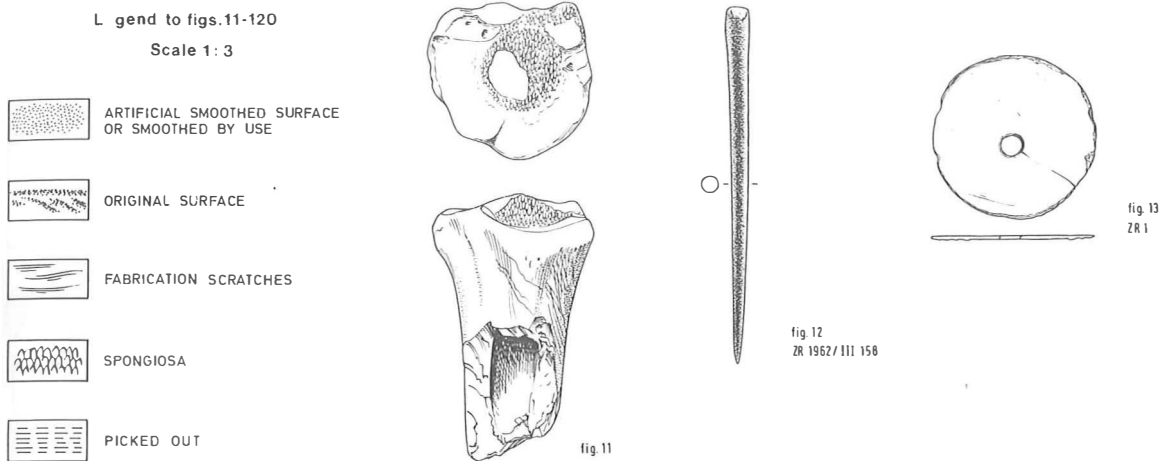


Fig. 11. Socketed bone axe; Fig. 12. Bone awl; Fig. 13. Bone disc.

is less well-preserved. It may have been hafted.

Nr. ? (fig. 15). Another piece of antler could have been part of a heavy chisel. A working edge may have been cut out of the beam. The blade is missing. The piece was earlier described by Louwe Kooijmans (1970-1971: p. 57) as 'very probably the cutting edge of a shaft-hole adze'. He came to this conclusion because he considered this piece identical with another elk antler tool found near Kuinre. This latter object indeed has a shaft-hole in the blade, but if we compare the cross-section of the Kuinre piece with that of Spoolde, and the distance from the shaft-hole to the working edge, then the shaft-hole should have been cut from the part of the Spoolde tool that is still left. The function of this object is not clear to me.

2.1.5.2.2. Shafted axes

Z 1957/V³⁶ (fig. 16). A shafted axe made from an antler of an elk. The working edge was made from the beam of the antler. The blade is present and rounded. At the side of the beam the antler is perforated. The shaft-hole is narrower at the inner side of the blade than at the outer, in other words, it tapers towards the inside. The axe (adze) was shafted from the outside. The shaft-hole is rounded and smooth at the inside. On the other side the scratches made during production are still visible, the working edge is damaged. The surface was smoothed by use.

ZO 1960/I⁹⁰ (fig. 17). A wide-bladed shafted axe was made from a naturally shed antler of an elk. Unlike the two previously described tools, the working edge was made from the blade, and the rectangular shaft-hole was cut in the narrow sides of the antler. The working edge is in the inner side of the blade. The axe was decorated with rows of rounded hollows, which, having been eroded by much use, have smooth surfaces.

Similar, but undecorated axes were found in Bonnerklap and Valthermond (Elzinga, 1962: fig. 10) in the southeast of the province of Groningen. These axes are probably rather late and belong to the Late Bronze or Iron Age.

2.1.5.2.3. Base-axe

J. 83 Noordoostpolder (fig. 18). An antler of an elk, probably naturally shed. The shaft-hole is nearly round. Cut from the beam. The working plane was made from the blade. The cutting edge is undamaged. This object resembles the base-axe of red deer antler.

2.1.5.3. Red deer antler tools

2.1.5.3.1. Tapering beam axe

ZR 1962/II¹⁸ (fig. 19). Axe probably made from the beam of a red deer antler. The working edge was carved out of the beam. The manufacturing scratches are still visible. The working edge seems to have been damaged but used again. The surface of the other end of the axe was smoothed, firstly by scraping off the cortex and secondly by frequent use later. The object may have been hafted and used as an axe. The working part is wider than the other, tapering end.

ZR 1962/II¹⁹ (fig. 20). An axe made from the beam of a red deer antler. At one side a working plane was carved from the beam, and a working edge was fashioned. The working edge is probably damaged. The other end is tapering, the cortex was scraped off and the surface smoothed. Part of the tapering base was broken in prehistoric times.

ZR 1962/II²⁰ (fig. 21). This axe is probably similar to the two axes described above, although the tapering end is missing. Probably it was broken in prehistoric times. There is no indication for a shaft-hole in which case it could have been part of a T-axe. Also, the working plane and the working edge resemble those of the two former objects more than those of the T-axes described later. The working plane was carved out, the working edge is damaged.

ZR 1962/II²¹ (fig. 22). An axe made from the beam of a red deer antler. The working plane was carved from the beam with a sharp flint(?) tool. The scratches made by this tool are still visible. The working edge is undamaged and is fan-shaped. The other part of the tool is slightly curved and naturally tapering. The cortex

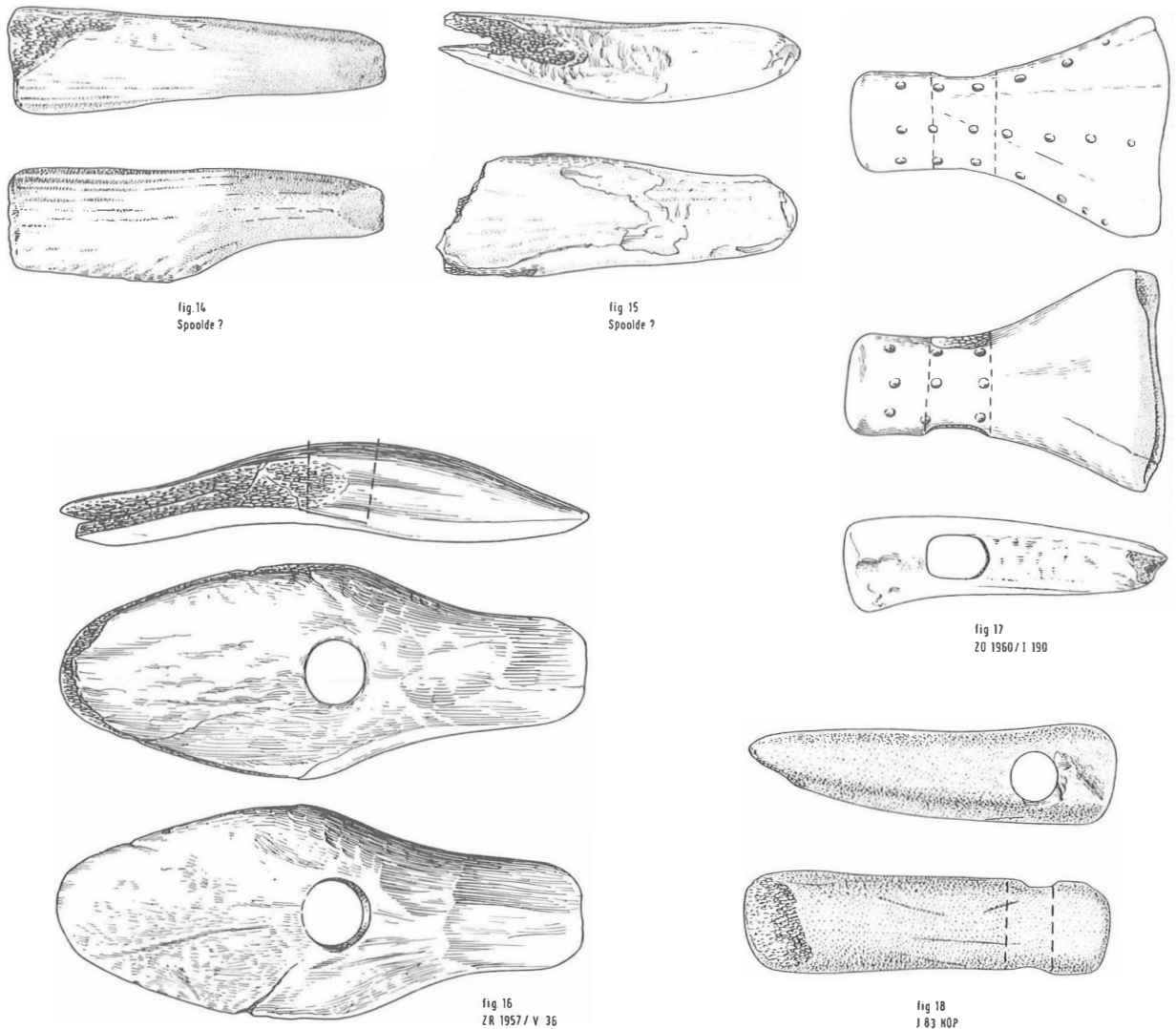


Fig. 14. Chisel? of an elk antler; Fig. 15. Chisel of an elk antler; Fig. 16. Elk antler adze; Fig. 17. Shafted axe of the antler of an elk. Fig. 18. Base-axe of elk antler.

was not removed and the surface has not been smoothed. Apparently this tool was unfinished and probably never used.

2.1.5.3.2. *T-axes*

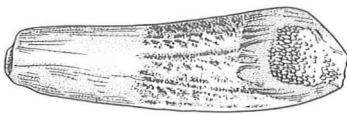
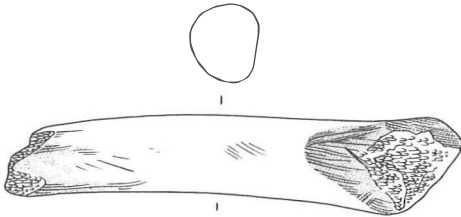
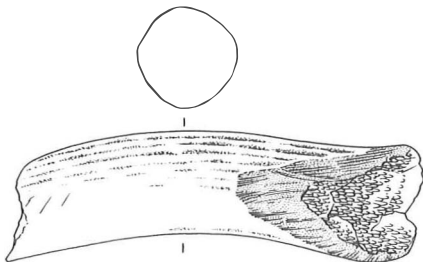
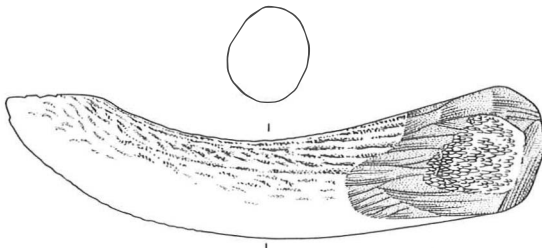
ZR 1962/II¹⁶ (fig. 23). A fragment of a beam of a red deer antler in which part of a shaft-hole is visible at the position of the base of the trez or wolf tine. The object is so severely damaged that we cannot be certain of its real nature, but it may have been a T-axe.

ZR 1962/II⁶⁴ (fig. 24). A beam of a r. antler of a red deer. Probably part of a T-axe. There is an indication for a shaft-hole at the position of the trez tine. The working plane was probably made from the medial side of the antler. The working edge is rounded. The scratches made by the tool used for carving the working plane and edge are still visible.

ZR 1962/II⁶⁶ (fig. 25). A broken T-axe probably made from the beam of a l. red deer antler. The axe was broken along the shaft-hole. The working plane was carved out of the beam with a flint tool. The scratches are still visible.

ZR 1962/II⁶⁷ (fig. 26). A fragment of a T-axe made from the beam of a red deer antler. The axe was broken along the shaft-hole. Since the distance between the shaft-hole and working edge is short, the axe may have been broken before and repaired by making a second shaft-hole much nearer the working edge. The working plane was carved out of the beam. Some of the carving scratches are still visible. The working edge is smooth and undamaged.

ZR 1962/II⁶⁸ (fig. 27). A damaged T-axe made from the beam of a r. red deer antler. The axe was broken along the first shaft-hole, after which a second shaft-

fig 19
ZR 1962/II 18fig 20
ZR 1962/II 19fig 21
ZR 1962/II 20fig 22
ZR 1962/II 21

Figs. 19-22. Tapering beam axes.

hole was made. This shaft-hole is smooth from much use. The working plane was carved out of the beam and smoothed by use. The carving scratches are still visible. The working edge is undamaged.

ZR 1962/II⁶⁹ (fig. 28). A T-axe made from a r. red deer antler. The axe was broken along the shaft-hole, which made the construction of a second shaft-hole necessary. The working plane was cut from the beam. The scratches made by the flint (?) are still visible. The working edge is slightly damaged.

ZR 1962/II⁸⁵. The beam of a red deer antler. This piece could possibly be a fragment of a T-axe. A few similar parts will be described later.

ZR 1962/II⁸⁶ (fig. 29). Slightly damaged T-axe made from the beam of a r. red deer antler. The trez tine was carved and broken off. The shaft-hole was made

at the position of the trez tine. The crown of the antler was carved and broken off straight. The working plane was cut from the proximal medial part of the antler. The working edge is slightly damaged.

Z 1968/V² (fig. 30). A double T-axe made from the beam of a r. red deer antler with two working planes, both on the medial side of the antler. Both working edges are damaged. The traces of the flint tool are still visible on the working planes. The shaft-hole is undamaged and seems to have been picked out at the position of the trez tine.

Nr. ? (fig. 31). A double T-axe made from the beam of a l. red deer antler with two working planes, both on the medial side of the antler. The axe is undamaged. Traces of the flint tool used for its manufacture are still visible on the distal working plane. The shaft-hole was cut out at the position of the trez tine. The working planes are smooth from much use. This T-axe resembles nr. ZR 1968/V² in form.

Z 1965/IV²¹. The beam of a l. antler of a red deer is possibly part of a T-axe with a straight end. The axe was broken along the shaft-hole. The cortex of the beam was carved off perpendicularly to the main direction of the beam, the spongiosa was broken.

FZ 14 (fig. 32). A fragment of a T-axe was found in Zuidelijk Flevoland. The axe was made from a l. red deer antler. The axe was broken along the shaft-hole, in all likelihood recently. The trez tine was carved and broken off. The shaft-hole was constructed at this position. The working edge is at the lateral side of the antler and undamaged.

Nr. ? (pl. 31). A T-axe made from a l. red deer antler was found near Roggebot near section N or O in Oostelijk Flevoland. This T-axe has no shaft-hole, but the working edge has been used.

De Gaste (fig. 33). A T-axe made from a ? red deer antler. The trez tine was carved and broken off. The shaft-hole was made at the position of the trez tine. The working plane is badly damaged. The other end is also damaged and it is not certain whether the axe may have been double bladed.

De Gaste (fig. 34). A T-axe made from a ? red deer antler. The trez tine was carved and broken off. The shaft-hole was made at the position of the trez tine. The working plane is badly damaged. The other end is also damaged.

De Gaste (fig. 35). A T-axe made from a ? red deer antler. The axe was broken along the shaft-hole at the position of the cut-off trez tine, after which a second shaft-hole was made parallel with the first. The working edge is undamaged.

2.1.5.3.3. Waste from T-axe manufacturing and brow tine axes

ZR 1962/II¹ (fig. 36). The base and brow tine of a r. antler of a red deer, unshed. The beam was carved at the lateral side and was then broken off. The remaining part of the beam was fashioned and could have been used as an axe.

ZR 1962/II² (fig. 37). A r. antler of a red deer. The base and part of the brow tine, the tip of the tine was broken off. The beam was carved at the medial side and was then broken off. The remaining part was possibly

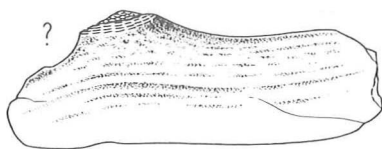


fig 23
ZR 1962 / II 16



fig
ZR 1962 / II 64

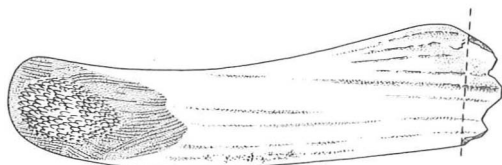
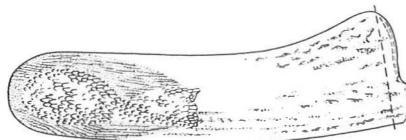


fig
ZR 1962 / II 66

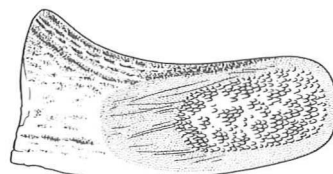
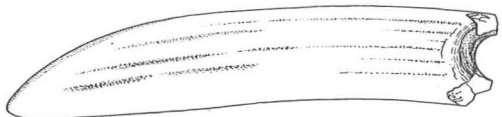


fig 26
ZR 1962 / II 67

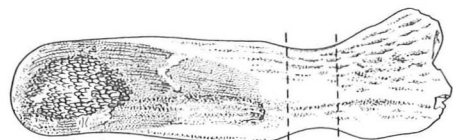
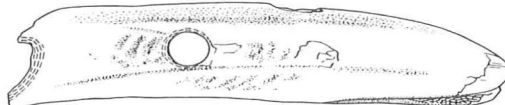
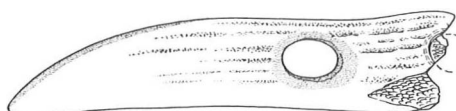


fig
ZR 1962 / II 68

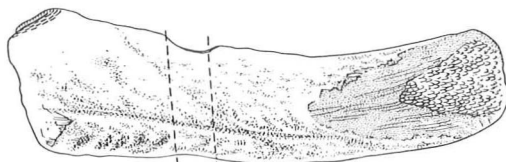


fig 28
ZR 1962 / II 69
voor C-14 bepaling gebruikt

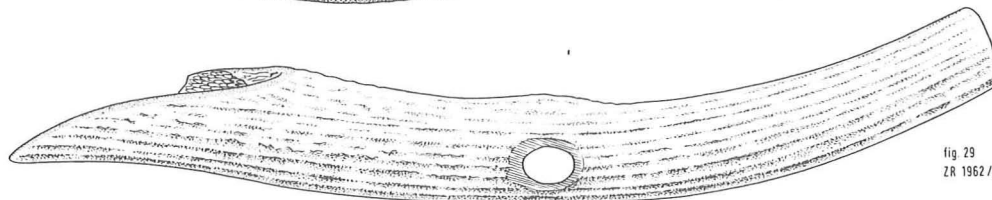
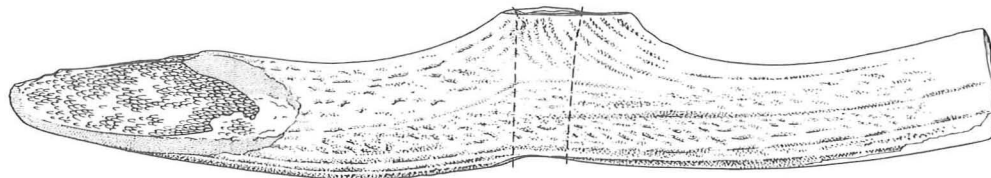
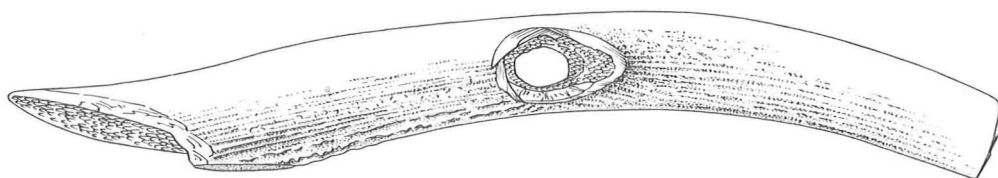


fig 29
ZR 1962 / II 86

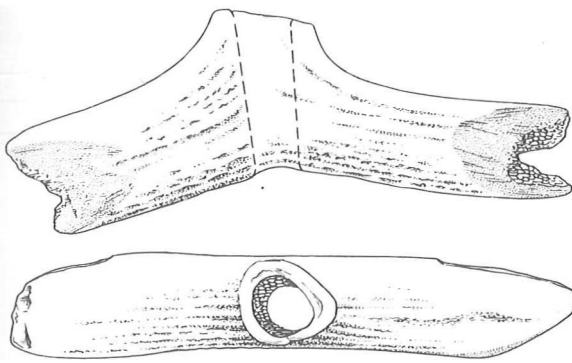


fig 30
Z 1968 / V 2

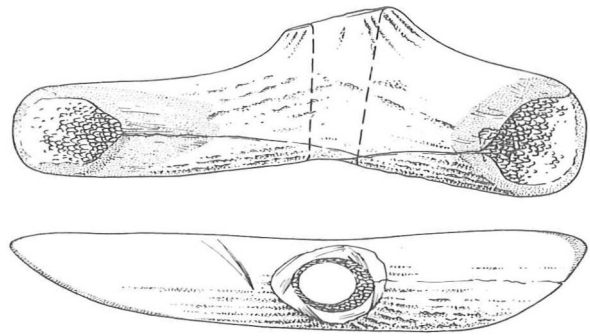


fig 31

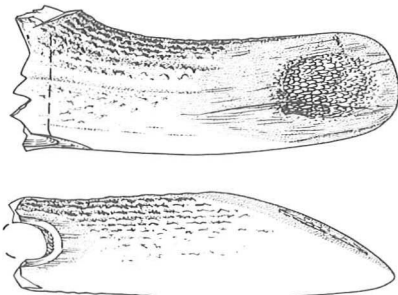


fig 32
FZ 14

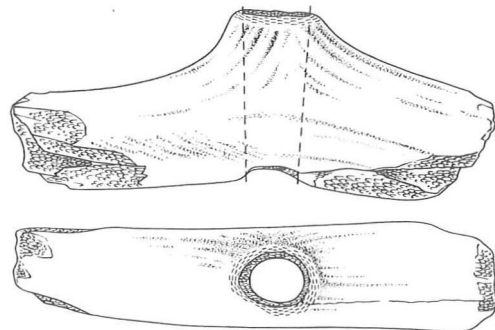


fig 33
De Gaste

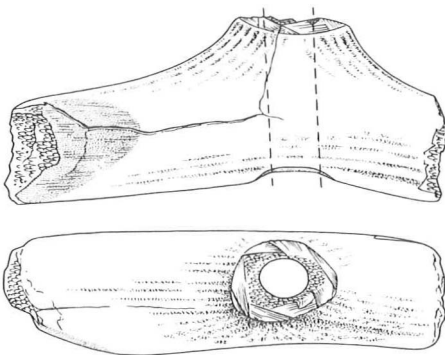


fig 34
De Gaste

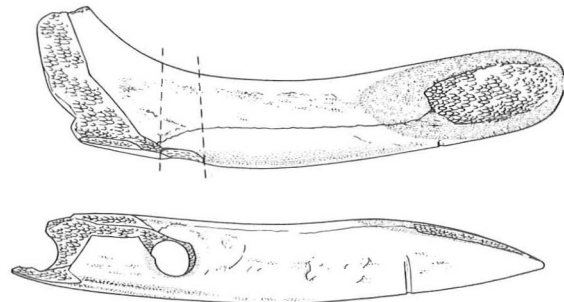


fig 35
De Gaste

Figs. 30-35. T-shaped antler axes.

used as a tool. Gnawing traces of rodents overlay the carving traces, and are thus younger.

ZR 1962/II³ (fig. 38). A l. antler of a red deer, naturally shed. The base and brow tine. The tip of the tine was broken off. The beam was carved at the medial side

as far as the spongiosa, and was then broken off. The remaining part was probably used as an axe.

ZR 1962/II⁴ (fig. 39). A r. antler of a red deer. The base with small fragments of the brow and bez tines, which were broken off, partly recently. The beam was carved just above the bez tine at the lateral side as far as the spongiosa, and was then broken off. Impossible to say whether it was used as a tool and for what purpose.

ZR 1962/II⁵ (fig. 40). A r. antler of a red deer, naturally shed. The base and the brow tine. The burr was worn

Figs. 23-29. Fragments of T-shaped antler axes (fig. 23 ?; figs. 27-28 'repaired').

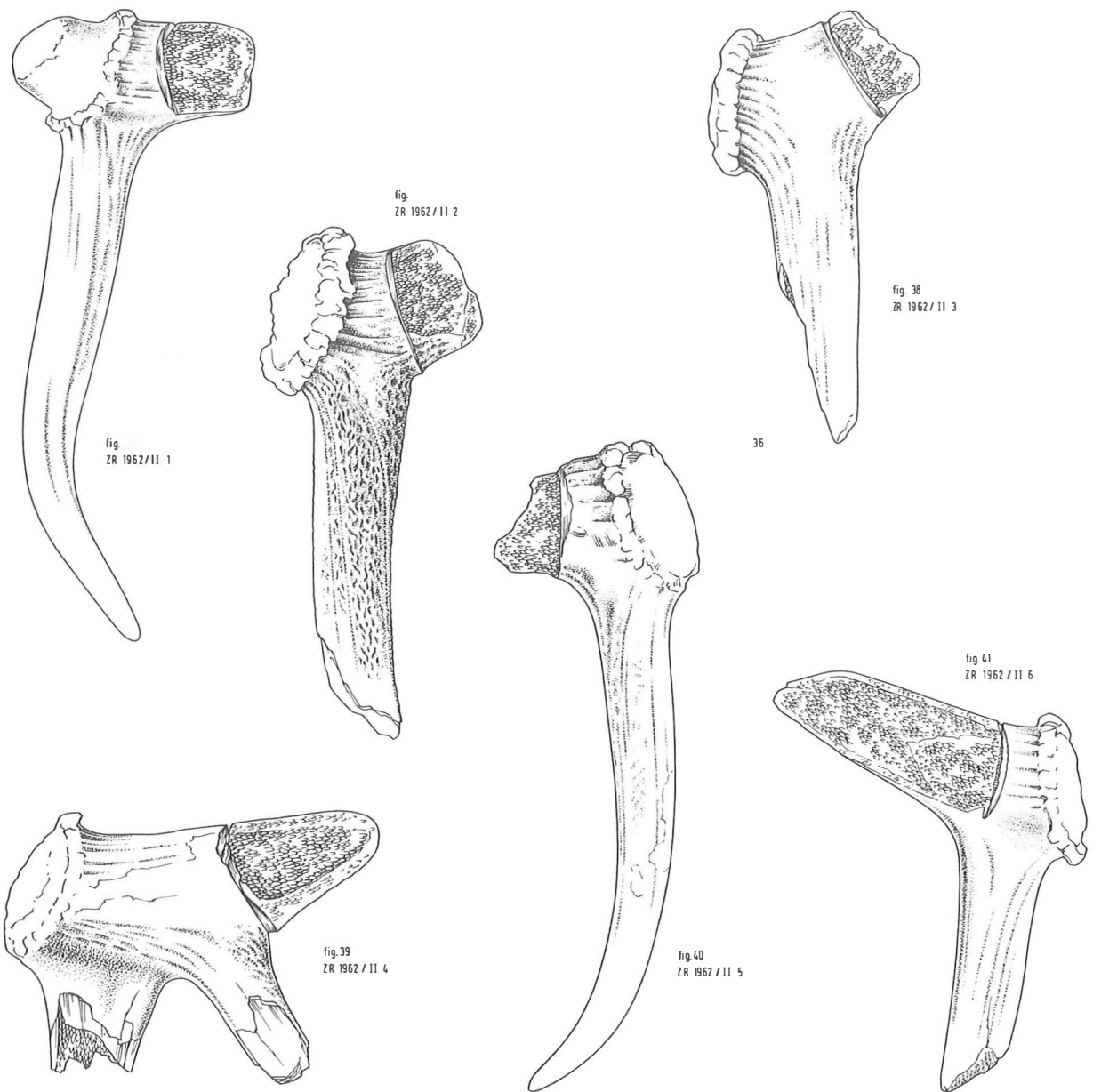


Fig. 36. Brow tine axe; Figs. 37-38, 40. Brow tine axes?; Figs. 39, 41. Waste.

off. The beam was carved at the lateral side to the spongiosa, and then broken off. The remaining part was possibly fashioned and used as an axe.

ZR 1962/II⁶ (fig. 41). A l. antler of a red deer, naturally shed. The base and part of the brow tine. The burr was worn off at the lateral side. The beam was carved halfway through at the medial side just above the brow tine, and was then broken off. The remaining part was possibly used as an axe.

ZR 1962/II⁷ (fig. 42). A l. antler of a red deer, naturally shed. The base and small fragments of brow and bez tines.

The beam was carved at the anterior side just in front of the bez tine as far as the spongiosa. A second cut was made at the lateral side perpendicular to the base. The beam was broken off. The angle between the two cuts is 95°. The remaining part was probably used as an axe.

ZR 1962/II⁸ (fig. 43). A l. antler of a red deer, naturally shed. The base and part of the brow and bez tines. The bez tine was recently broken off. The cortex of the beam was carved at the medial side as far as the spongiosa, the beam was then broken off. The carving and breaking were done clumsily. The burr was partly worn off.

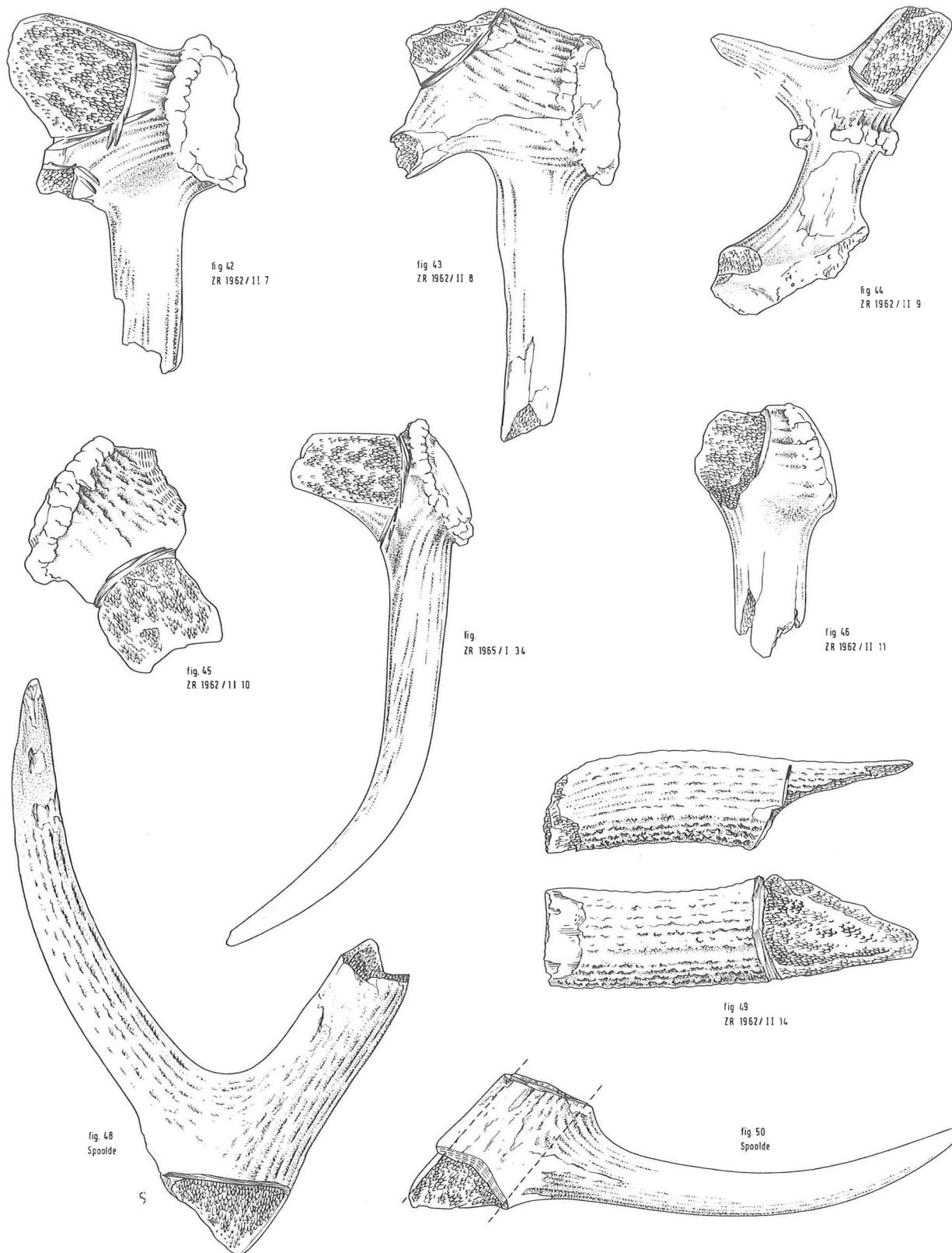


Fig. 42. Brow tine axe?; Fig. 43. Brow tine axe; Figs. 44-50. Waste.

ZR 1962/II⁹ (fig. 44). A l. antler of a red deer, with pedicle and part of the frontal bone. The brow tine was broken off. The cortex of the beam was carved at the lateral side to the spongiosa, the beam was then broken off. It is impossible to say whether the fragment was used for any particular purpose.

ZR 1962/II¹⁰ (fig. 45). A r. antler of a red deer, naturally shed. The base. The brow tine was carved all round as far as the spongiosa and was then broken off. The cortex of the beam was carved medially to the spongiosa, the beam was then broken off. The antler was not used as a tool.

ZR 1962/II¹¹ (fig. 46). A l. antler of a red deer, naturally shed. The base. The burr was worn off. The cortex of the beam was carved at the lateral side to the spongiosa, the beam was then broken off. The state of preservation is poor. Impossible to say whether it was used as a tool or not.

ZR 1965/I³⁴ (fig. 47). A l. antler of a red deer, naturally shed. The base and brow tine. The cortex of the beam was carved laterally as far as the spongiosa, the beam was then broken off. The remaining part was fashioned into an axe of which the working edge is damaged.

Z 1965/I¹⁷². A r. antler of a red deer. The base with pedicle and a fragment of the frontal bone still attached. The cortex of the brow and bez tines was carved as far as the spongiosa, the tines were then broken off. The cortex of the beam was carved at the lateral side, the beam was broken off. A large and heavy antler.

ZM 1960/II⁹. A r. antler of a red deer with burr, pedicle and part of the parietal bone still attached. The tip of the brow tine was recently broken off.

The cortex of the beam was carved laterally, the beam was then broken off. This fragment might be the waste from a T-axe and may have been fashioned into an axe.

? Zwolle-IJssel canal, dumping place Spoolde (fig. 48). A r. red deer antler. Part of the beam with the trez tine. The beam was carved to the spongiosa on the medial side and was broken off laterally. This fragment is probably waste from the base-axe manufacture.

ZR 1962/II¹⁴ (fig. 49). A r. (?) red deer antler. Part of the beam. The cortex was carved perpendicularly to the main direction of the beam as far as the spongiosa and was then broken off. This piece might be the waste from the manufacture of a double T-axe or a base-axe.

Nr. ? (fig. 50). A l. (?) antler of a red deer. A fragment of the beam with the bez or trez tine. Proximal of the tine the cortex of the beam was carved medially as far as the spongiosa and broken off. The beam was carved distal of the trez tine as far as the spongiosa and broken off.

2.1.5.3.4. *The base-axe*

There are two types of base-axes, one with the shaft-hole running anterior/posterior (I), and a second type with the shaft-hole running lateral/medial (II). The first type is in the majority.

Type I

ZR 1962/II²⁹ (fig. 51). A l. antler of a red deer, naturally shed. The burr was worn off, the base rounded. The brow and bez tines were picked off in a shoddy way. The shaft-hole is anteriorly situated between brow

and bez tines. The shaft-hole was picked out and tapers to the middle. The working plane was carved in the beam at the lateral side. The largest part of the working plane was broken off.

ZR 1962/II³⁰ (fig. 52). A l. antler of a red deer, probably naturally shed. The burr is missing. The base is rounded. The brow and bez tines were removed carelessly. The shaft-hole between brow and bez tine was carved out. The shaft-hole tapers towards the middle. The working plane was carved out, the working edge is missing.

ZR 1962/II³¹ (fig. 53). A l. antler of a red deer naturally shed. The burr is missing. The base is rounded. The brow and bez tines developed wide apart and were carved off. The shaft-hole is situated between brow and bez tines. The working plane is at the medial side. The larger part was broken off.

ZR 1962/II³² (fig. 54). A l. antler of a red deer, naturally shed. The brow and bez tines were carelessly broken off. The shaft-hole is at the base of the brow tine and was chipped out. The working plane was carved in the lateral side of the beam and part of it is missing.

ZR 1962/II³³ (fig. 55). A l. antler of a red deer, naturally shed, the burr is still present. The cortex of the brow and bez tines was carved all round the base as far as the spongiosa, the tines were then broken off. The shaft-hole is between the base of the brow and bez tines and well finished. The shaft-hole tapers towards the middle and is smooth. The working plane is at the lateral side and undamaged. This is a well-preserved axe of which the surface is partly smooth.

ZR 1962/II³⁴ (fig. 56). A l. antler of a red deer, naturally shed. Part of the burr is present. The cortex of the brow tine was carved all round at the base, but the beam was broken off above the cuts. The bez tine was carved off. The shaft-hole is situated between the bases of the brow and bez tines and is well finished. The working plane was most probably carved in the medial side, and is largely missing.

ZR 1962/II³⁵. (fig. 57). A l. antler of a red deer, naturally shed. Part of the burr present. The cortex of the brow tine was carved at the base, but the beam was broken off above the cuts. The bez tine was carved off. The shaft-hole is situated between the bases of the brow and bez tine and is well finished. The working plane was most possible carved in the medial side and is largely missing.

ZR 1962/II³⁶ (fig. 58). A r. antler of a red deer, naturally shed; the burr is missing. The brow tine was chipped away at the base, the bez tine was carved all round the base to the spongiosa and then broken off. The shaft-hole is between the base of brow and bez tines and is well finished. The working plane was carved in the lateral side and most of it is missing.

ZR 1962/II³⁷ (fig. 59). A r. antler of a red deer, naturally shed. The brow and bez tines were chipped away at their base. The shaft-hole is situated at the position of the bez tine. The working plane was chipped in the lateral side, and is largely missing.

ZR 1962/II³⁸ (fig. 60). A r. antler of a red deer, naturally shed. The burr is missing, the base rounded. The part with the bases of brow and bez tines is missing. The position of the shaft-hole is unknown, but probably

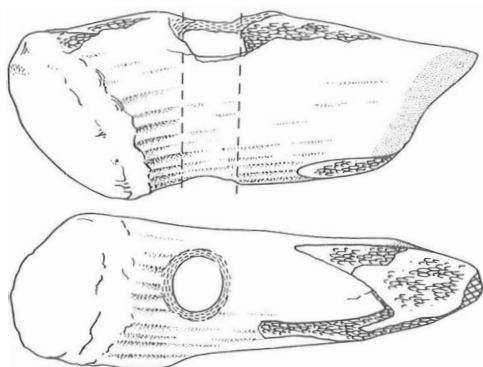


fig
ZR 1962 / II 29

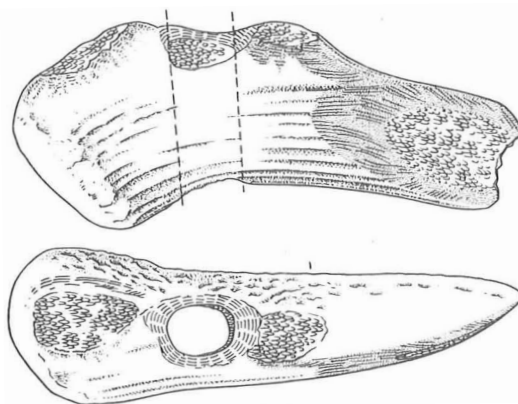


fig. 52
ZR 19

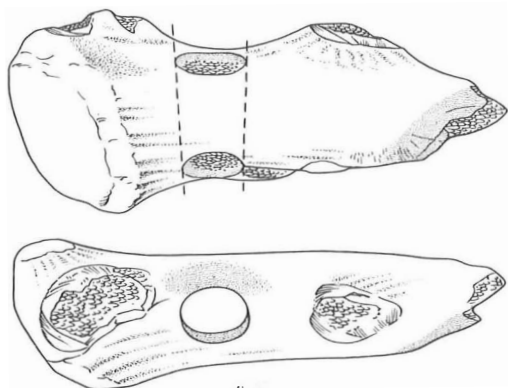


fig
ZR 1962 / II 31

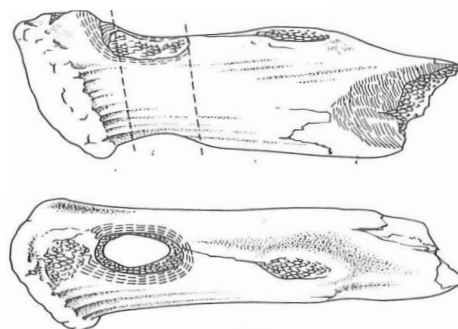


fig
ZR 1962 / 50 32

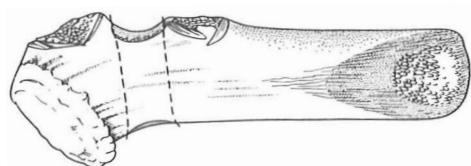


fig 56
ZR 1962 / II 34

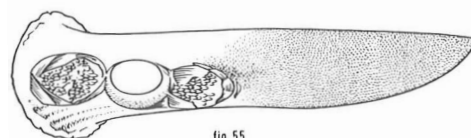


fig 55
ZR 1962 / II 33

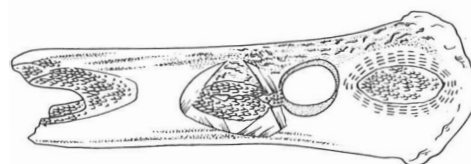
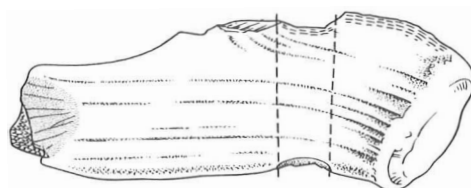


fig
ZR 1962 / II 36

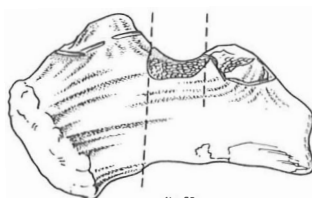


fig 57
ZR 1962 / II 35

Figs. 51-98. Base-axes, type I (pp. 95, 96, 98, 99, 100).

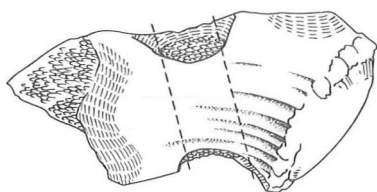


fig. 59
ZR 1962 / II 37

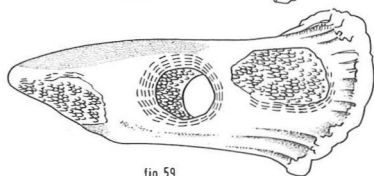


fig. 62
ZR 1962 / II 40

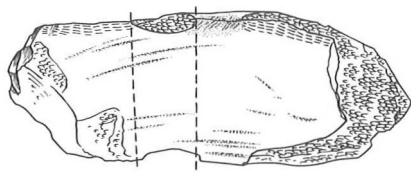


fig.
ZR 1962 / II 38

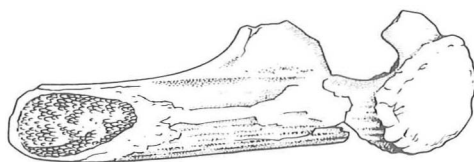


fig. 61
ZR 1962 / II 39

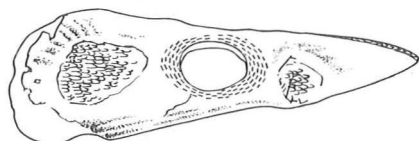
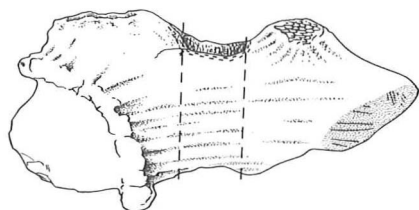
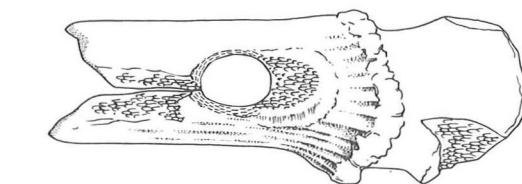
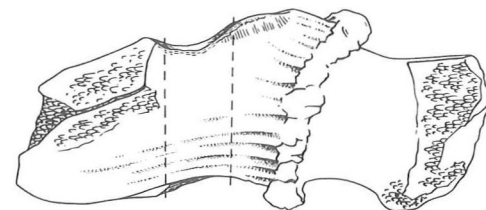


fig.
ZR 1962 / II 41

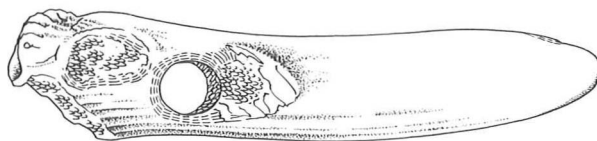
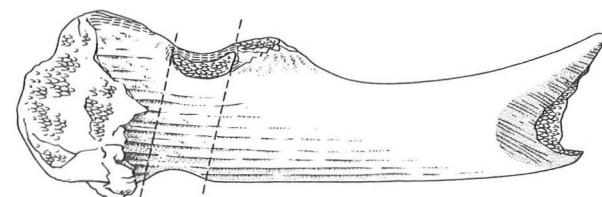


fig. 64
ZR 1962 / II 42

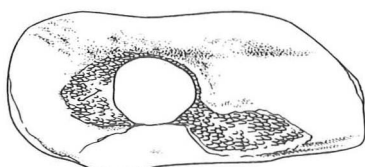
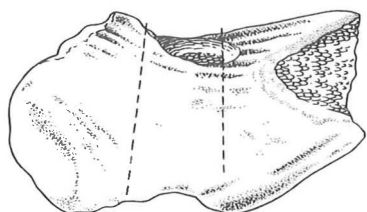


fig.
ZR 1962 / II 43

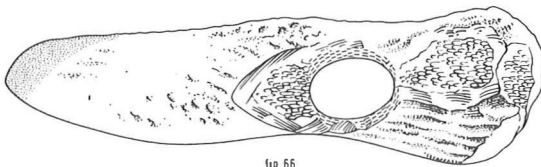
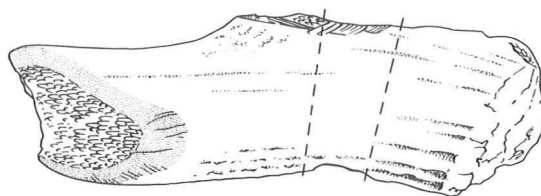


fig. 66
ZR 1962 / II 44
65

runs anterior/posterior. The working plane is still present.

ZR 1962/II³⁹ (fig. 61). A r. antler of a red deer, with burr, pedicle and part of the frontal bone still attached. The brow tine was chipped away. The shaft-hole is situated half over the base of the brow tine and was chipped from the beam. The working plane is missing.

ZR 1962/II⁴⁰ (fig. 62). A l. antler of a red deer, naturally shed. The burr is missing. The brow tine was removed and a shaft-hole created. The base of the brow tine and the edge of the shaft-hole were gnawed away by a rodent(s). The working plane was on the lateral side. The greater part was broken off.

ZR 1962/II⁴¹ (fig. 63). A l. antler of a red deer with a rounded fragment of the pedicle. The burr was removed on the lateral and medial sides. The brow and bez tines were chipped away. The shaft-hole was chipped from the anterior side and possibly also from the posterior side. The main part is missing.

ZR 1962/II⁴² (fig. 64). A l. antler of a red deer with a rounded fragment of the pedicle. Half of the base was broken off. The brow and bez tines were carelessly chipped away. The shaft-hole is situated just in front of the base of the trez tine and was chipped from the beam. The working plane was carved out of the medial side. Part was broken off.

ZR 1962/II⁴³ (fig. 65). A l. antler of a red deer, fragment of the base with rounded fragment of the pedicle. The burr was worn off. The brow and bez tines were carelessly removed. The shaft-hole is situated partly over the base of the brow tine. The working plane is missing. This is a well-used, worn tool.

ZR 1962/II⁴⁴ (fig. 66). A r. antler of a red deer with a rounded fragment of the pedicle and a worn off burr. The brow tine was chipped off, the bez tine partly chipped, partly carved and broken. The shaft-hole is situated between the base of the brow and bez tines. The anterior rim of the shaft-hole is chipped, the posterior rim is well finished and smooth. Along the upper rim are rodent gnawing marks. The working plane was carved out of the lateral side, the working edge is missing.

ZR 1945/II⁴⁵ (fig. 67). A l. antler of a red deer, with a rounded fragment of the pedicle and a worn away burr. The brow and bez tines were carelessly chipped out. The shaft-hole is situated at the base of the bez tine. The anterior rim is damaged, the posterior finished. The working plane is on the lateral side but largely missing.

ZR 1962/II⁴⁶ (fig. 68). A l. antler of a red deer, probably naturally shed. The burr was removed. The base was rounded. The brow tine was carved away, the bez tine chipped off. The shaft-hole is situated at the base of the bez tine. The rims are well finished. The working plane was carved out of the lateral side. The working edge was rounded and partly damaged.

ZR 1962/II⁴⁷ (fig. 69). A l. antler of a red deer, naturally shed. The base was rounded and the burr missing. The brow tine was chipped away. The shaft-hole is situated at the base of the brow tine. Part of the working plane is still visible at the lateral side. The base may have been used as a hammer.

ZR 1962/II⁴⁸ (fig. 70). A l. antler of a red deer,

naturally shed. The base was rounded, the burr worn away. The brow and bez tines were carved off at the base. The shaft-hole is partly situated over the base of the bez tine. The working plane was carved out of the lateral side but was smoothed by use. The working edge is intact. The surface of this axe is smooth.

ZR 1962/II⁴⁹ (fig. 71). A l. antler of a red deer, naturally shed, the burr worn away. The brow and bez tines were removed; it is not clear how. The shaft-hole is situated between the base of brow and bez tine. The working plane is at the lateral side. The working edge is undamaged. Two plaster casts of this piece were available for observation.

ZR 1962/II⁵¹ (fig. 72). A r. antler of a red deer, naturally shed. The brow and bez tines were chipped away. The shaft-hole is situated at the base of the bez tine. The working plane was in the lateral side but is almost entirely missing.

ZR 1962/II⁵² (fig. 73). A r. antler of a red deer, naturally shed. The burr was worn away under the brow tine. The brow tine was carved off, the bez tine chipped away. The shaft-hole is situated over the base of the bez tine. The working plane is missing.

ZR 1962/II⁵³ (fig. 74). A r. antler of a red deer, naturally shed. The brow and bez tines were removed. A shaft-hole is situated over the base of the bez tine. The working plane was carved off the lateral side and the larger part is missing.

ZR 1962/II⁵⁴ (fig. 75). A r. antler of a red deer, naturally shed. The base is rounded and the burr worn off. The brow tine was chipped away. The shaft-hole is situated over the base of the brow tine. The tool is much damaged but was probably a base-axe.

ZR 1962/II⁵⁵ (fig. 76). A l. antler of a red deer, with a rounded fragment of the pedicle and worn off burr. The brow tine and bez tine were chipped away. The shaft-hole is situated over the base of the bez tine. The shaft-hole was probably chipped out. The working plane was made from the lateral side, and part of it is missing. The part still visible is smooth from frequent use.

ZR 1962/II⁵⁶ (fig. 77). A r. antler of a red deer, naturally shed. The burr was worn away. The base is rounded. The brow and bez tines were carved away. The shaft-hole is situated between the base of the brow and bez tines and is practically round. The working plane was carved out of the lateral side and part of it is smooth from frequent use. The working edge is slightly damaged.

ZR 1962/II⁵⁷ (fig. 78). A r. antler of a red deer, naturally shed. The burr was worn off. The brow and bez tines were carved away. The shaft-hole is situated at the position of the bez tine. The shaft-hole was chipped out of the beam. The working plane was made from the lateral side and smoothed by use. The larger part is missing.

ZR 1962/II⁵⁸ (fig. 79). A r. antler of a red deer, naturally shed. The burr, the brow tine and possibly the bez tine were removed. The shaft-hole is probably situated over the base of the bez tine. The working plane was made in the lateral side. The working edge is damaged. The surface of the tool and working edge is smooth from much use.

ZR 1962/II⁵⁹ (fig. 80). A l. antler of a red deer, probably not naturally shed. The burr is absent, the

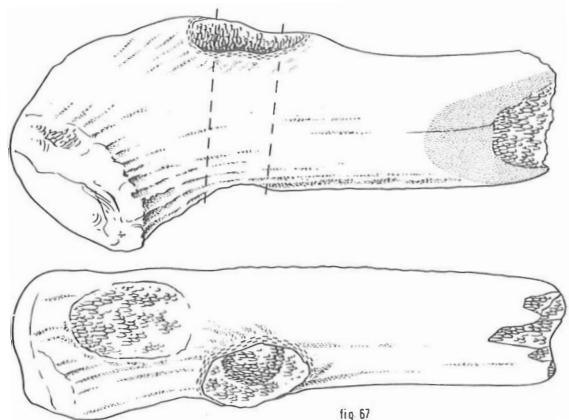


fig 67
Z R 1962 / II 45

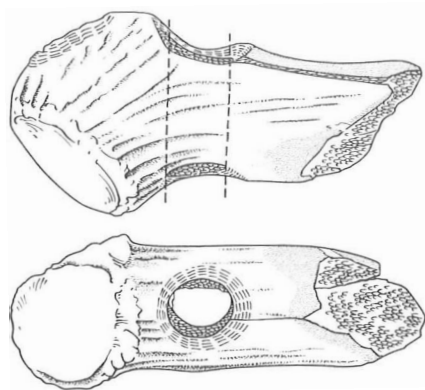


fig 69
Z R 1962 / II 47

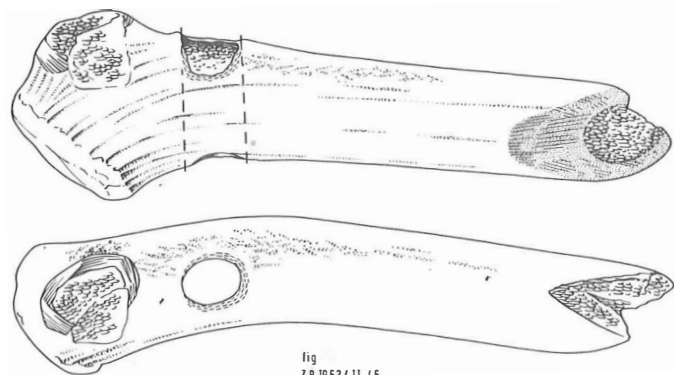


fig
Z R 1962 / II 46

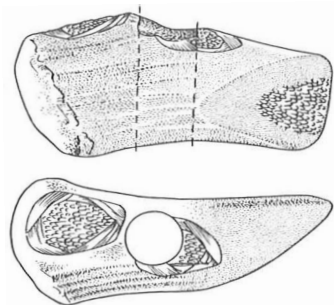


fig 70
Z R 1962 / II 48

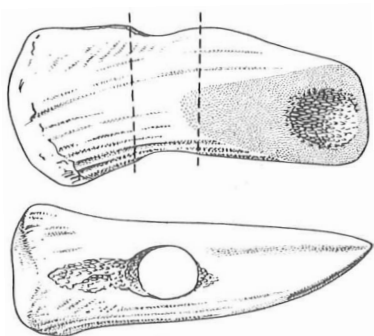


fig 71
Z R 1962 / II 49

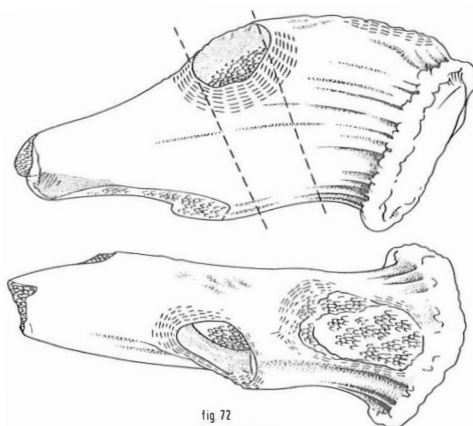


fig 72
Z R 1962 / II 51

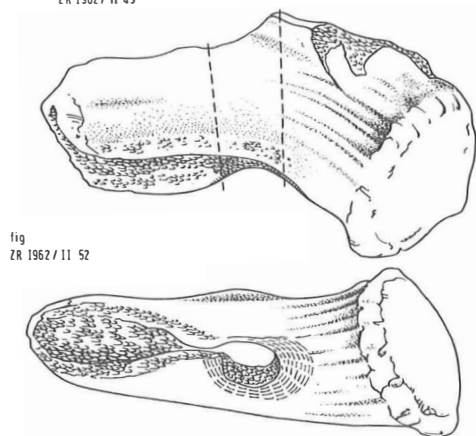


fig
Z R 1962 / II 52

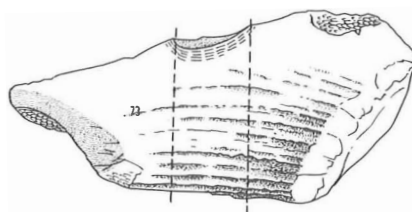


fig.
Z R 1962 / II 53

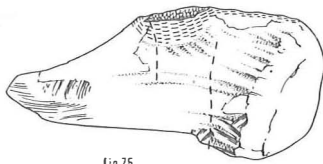


fig. 75
ZR 1962 / II 54

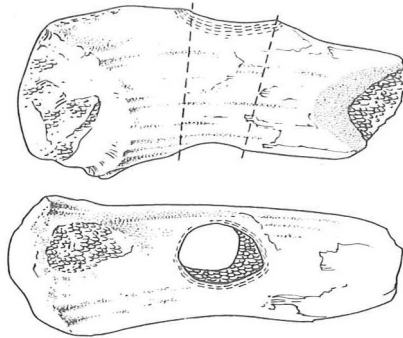


fig. 76
ZR 1962 / II 55

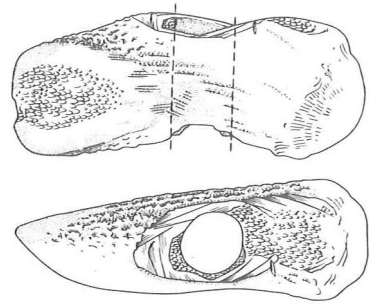


fig. 77
ZR 1962 / II 56

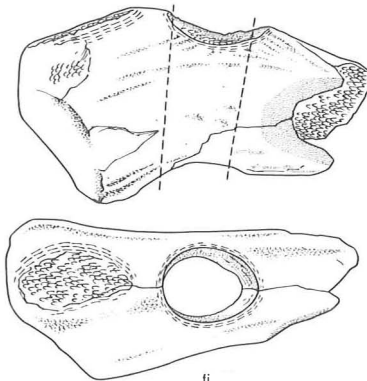


fig. 78
ZR 1962 / II 57

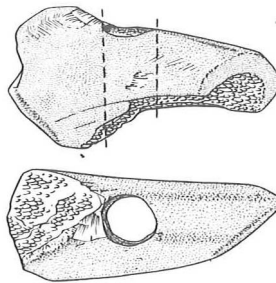


fig. 79
ZR 1962 / II 58

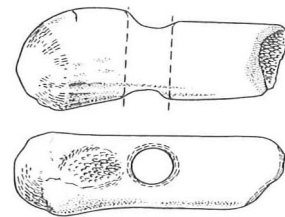


fig. 80
ZR 1962 / II 59

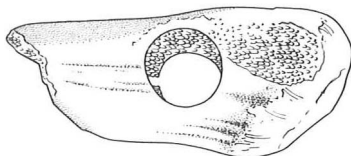


fig. 81
ZR 1962 / II 60

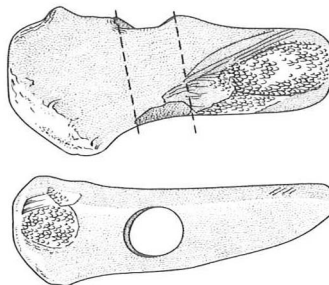


fig. 82
ZR 1962 / II 61

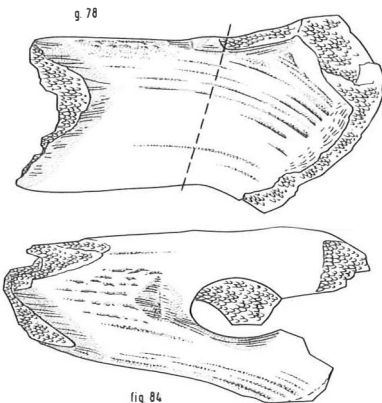


fig. 83
ZR 1962 / II 63

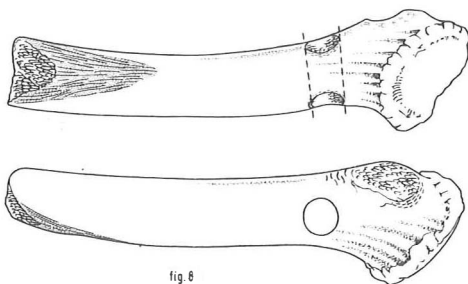


fig. 84
ZR 1962 / II 62

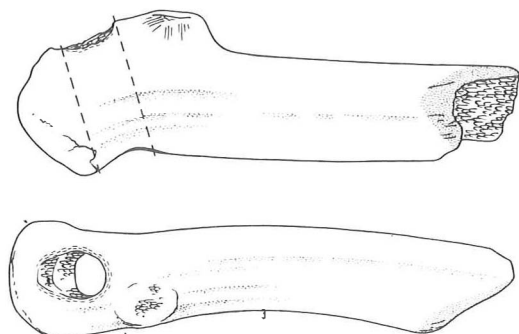


fig. 85
ZR 1962 / II 64

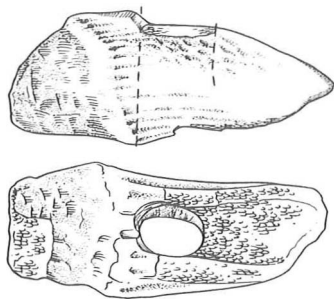


fig. 86
ZR 1962 / II 65

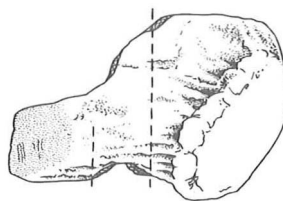


fig. 87
ZR 1962 / II 73

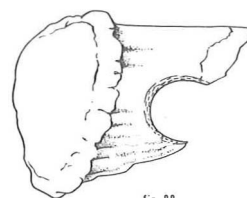


fig. 88
ZR 1962 / II 74

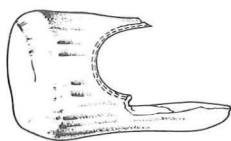


fig. 89
ZR 1962 / II 75

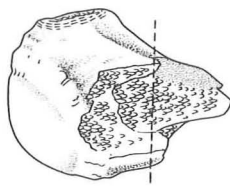


fig. 90
ZR 1962 / II 76

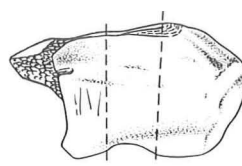


fig. 91
ZR 1962 / II 77

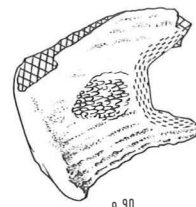


fig. 92
ZR 1962 / II 78

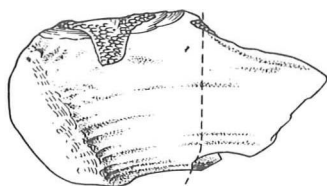


fig. 93
ZR 1962 / II 79



fig. 94
ZR 1962 / II 83

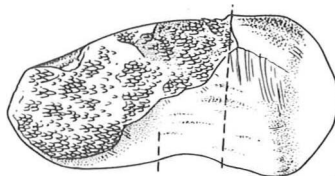


fig. 95
ZR 1962 / II 87

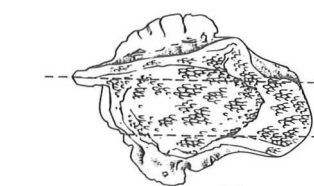
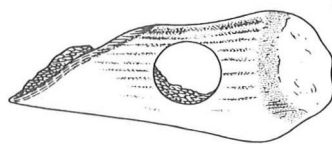


fig. 96
ZR 1962 / II 89

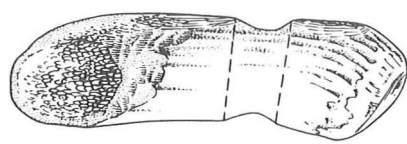
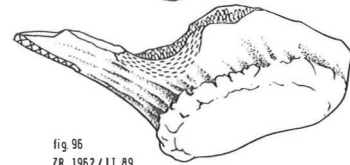


fig. 97
Z 1953 / I 24

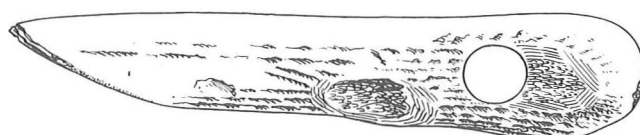
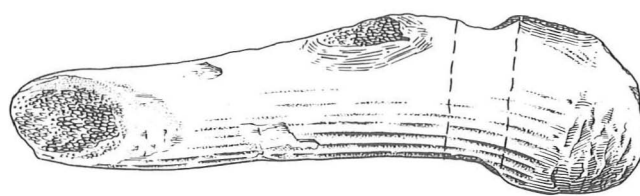
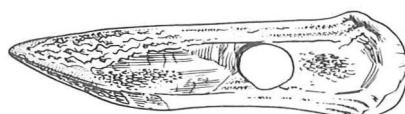


fig. 98
Spoolde

pedicle rounded by use. The brow tine was notched away, no bez tine is present. The shaft-hole is situated distal of the brow tine. The shaft-hole was smoothed by use, the working plane was made in the lateral side and broken. A much used tool.

ZR 1962/II⁶⁰ (fig. 81). A r. antler of a red deer, probably naturally shed. The burr has gone. The brow tine was notched away, possibly the bez tine. The shaft-hole is distal of the brow tine. The working plane is at the lateral side of the beam. The shaft-hole is large, round and straight.

ZR 1962/II⁶¹ (fig. 82). A l. antler of a red deer, naturally shed. The brow tine and bez tine were removed. The burr was worn away. The base was used as a hammer and rounded. The shaft-hole is at the base of the bez tine, more or less rounded at both sides. The working plane was carved from the beam at the lateral side of the antler. Smooth from frequent use.

ZR 1962/II⁶² (fig. 83). A r. antler of a red deer, naturally shed. The burr is still present. The brow tine was carved away. The shaft-hole is distal of the brow tine base. The working plane was carved in the beam and polished, partly broken. The shaft-hole is well finished. The object is smooth from much handling.

ZR 1962/II⁶³ (fig. 84). A r. antler of a red deer. Remnant of an axe. The base and working plane are missing. The brow tine was carved away. The shaft-hole was picked out of the beam. The working plane is on the lateral side of the beam.

ZR 1962/II⁶⁴ (fig. 85). A l. antler of a red deer, base, naturally shed. The burr is missing, the base rounded. The brow tine and bez tine were removed, the latter by carving. The shaft-hole is situated at the base of the brow tine. The working plane is at the lateral side and damaged. The surface was artificially smoothed.

ZR 1962/II⁶⁵ (fig. 86). A l. red deer antler, the base and pedicle. The pedicle tapers, showing clear cutting traces. The burr has gone. The brow and bez tines were cut off. The shaft-hole is situated at the base of the brow tine. The shaft-hole runs at right angles to the working edge. The working edge was broken, and was probably re-used.

ZR 1962/II⁷³ (fig. 87). A r. red deer antler, naturally shed. A damaged object, probably an axe. The shaft-hole is at the position of the brow tine. The burr was nearly worn away. The working plane is situated laterally.

ZR 1962/II⁷⁴ (fig. 88). A l. red deer antler, naturally shed. The burr was partially removed. Part of the shaft-hole is still visible. The working part is broken off.

ZR 1962/II⁷⁵ (fig. 89). A r. red deer antler, probably naturally shed. The burr was removed. Part of the shaft-hole is still visible. The working part is broken off.

ZR 1962/II⁷⁶ (fig. 90). A r. red deer antler, probably not naturally shed. The burr was worn off. The brow tine was picked away. The shaft-hole was possibly situated at the base of the missing bez tine. Probably an axe. The working plane is broken off.

ZR 1962/II⁷⁷ (fig. 91). A r. antler of a red deer, probably naturally shed. The burr and brow tine were removed, the base is rounded. The working part is missing. The shaft-hole lies in front of the base of the brow tine.

ZR 1962/II⁷⁸ (fig. 92). A l. antler of a red deer, unshed. The brow tine below the burr is missing. The object was probably an axe, the working part is missing.

ZR 1962/II⁷⁹ (fig. 93). A l. red deer antler, unshed. The pedicle and burr were cut away. The brow tine was removed. The shaft-hole is situated half over the base of the brow tine. The working part is missing.

ZR 1962/II⁸³ (fig. 94). A r. (?) antler fragment of a red deer. The shaft-hole is situated at the position of brow or bez tine. The object is broken and may have been an axe.

ZR 1962/II⁸⁷ (fig. 95). A l. antler of a red deer, naturally shed. The burr was removed. The base is rounded. The brow tine was picked away. The working part is missing. The shaft-hole is worn out. Badly preserved.

ZR 1962/II⁸⁹ (fig. 96). A l. antler of a red deer, naturally shed. Badly damaged object, probably base-axe.

ZR 1962/?. A r. antler of a red deer, naturally shed. Part of the burr is missing. The base was flattened. Badly damaged.

Z 1953/I²⁴ (fig. 97). A r. antler of a red deer, naturally shed. The burr is missing. The brow and bez tines were removed. The working part is on the lateral side cut and carved out of the beam. The working edge is rounded and polished. Has possibly been in contact with fire.

Z 1953/I³³. A fragment of a red deer antler, probably a base-axe. The burr is missing. The working part was recently broken off.

ZR 1965/I³². A fragment of a red deer antler, probably a base-axe. Badly damaged, seems to have been turned.

Z 1968/V⁴. A r. antler of a red deer. Naturally shed. The burr is missing. The brow and bez tines were picked away. The shaft-hole is between the base of brow and bez tines, rounded. Seems to have been turned.

Nr. ? Section B, Oostelijk Flevoland. A r. antler of a red deer. The base is rounded. The burr is missing. The object is badly damaged.

— Property of J. van de Berg (fig. 98). A r. antler of a red deer, unshed. Brow tine, bez tine and burr were removed. The shaft-hole is roughly round and situated at the base of the brow tine. The working plane is laterally situated.

Type II

ZR 1962/II⁷⁰ (fig. 99). A l. antler of a red deer, probably naturally shed. The base is rounded, the burr missing. The brow tine was picked out and partly broken off, the shaft-hole runs lateral-medial at right angles to the beam. The working edge is slightly damaged.

ZR 1962/II⁷¹ (fig. 100). A l. (?) antler of a red deer, probably naturally shed. The burr and brow tine were removed, the base is rounded, the shaft-hole is round and runs lateral-medial at right angles to the beam. The working edge is slightly damaged. The surface is smooth.

Z 1953/I²⁵ (fig. 101). A l. red deer antler probably naturally shed. The burr and brow tine were removed. No bez tine had developed. The shaft-hole is round and runs lateral-medial at right angles to the beam. The shaft-hole was carved out. The working edge was carved from the beam.

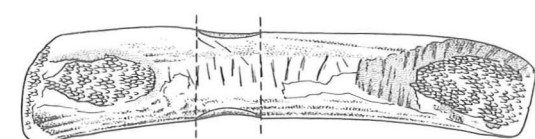


fig. 99
ZR 1962/II 70



fig. 100
ZR 1962 / II 71

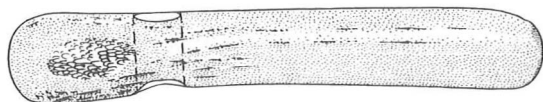


fig. 101
Z 1953 / I 25

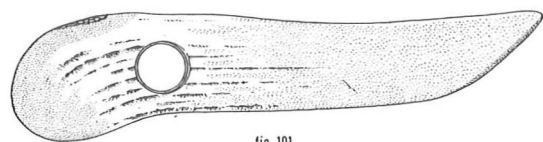


fig. 102
Z 1954 / II 77

Figs. 99-102. Base-axes, type II.

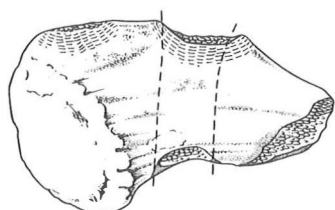


fig. 103
ZR 1962 / II 50

Fig. 103. Chisel.

Z 1954/II⁷⁷ (fig. 102). A r. red deer antler, probably naturally shed. The burr, brow and bez tines were carefully removed. The working edge was carved from the beam. The shaft-hole is round, running lateral-medial.

2.1.5.3.5. Chisel

ZR 1962/II⁵⁰ (fig. 103). A l. antler of a red deer, naturally shed, with a rounded base. The burr was worn off under the brow tine. The brow tine was chipped away; probably the bez tine too. The shaft-hole is situated at the base of the bez tine. Practically the whole working

plane is missing, but what is left is (situated) perpendicular to the shaft-hole. The piece is the only antler chisel in the Spoolde hoard.

2.1.5.3.6. Unfinished specimens

ZR 1962/II¹² (fig. 104). A l. red deer antler, naturally shed. The burr was removed. The brow and bez tines and beam were recently broken off. There are carving traces between brow and bez tines in the beam.

ZR 1962/II¹³ (fig. 105). A r. red deer antler, naturally shed. The brow and bez tines were carved and broken off. The cortex of the beam was carved as far as the spongiosa, the beam was broken off c. 10 cm distal from the bez tine. Possibly an unfinished axe.

2.1.5.3.7. Unknown tool

ZR 1962/II⁸⁰ (fig. 106). A l. (?) antler of a red deer, possibly the base. The brow tine was removed. There was probably a corner tine. The object was broken. Only part of the shaft-hole is visible.

2.1.5.3.8. Beam axe

1962/II⁶⁵ (fig. 107). An antler of a red deer, the beam. The working part and the shaft-hole are broken. The shaft-hole was carved out of the beam running parallel with the working part. The working part was carved out and polished. The object is possibly a T-axe of which the second shaft-hole was broken. The surface shows rodent gnawing marks.

ZR 1962/II⁷² (fig. 108). A l. antler of a red deer, the beam with a working plane at each end. Similar to a double T-axe. The shaft-hole, however, is not situated

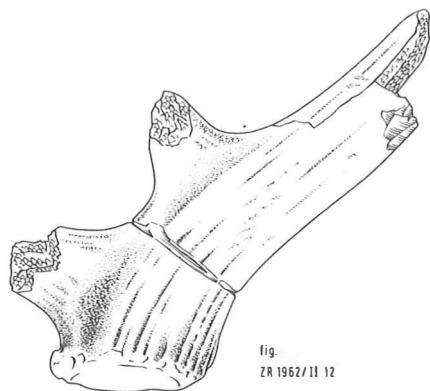
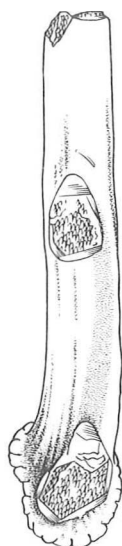


fig.
ZR 1962/II 12



fi
ZR 1962/II 13

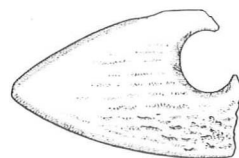


fig 106
ZR 1962/II 80

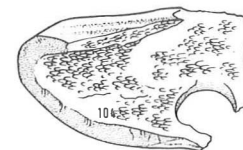


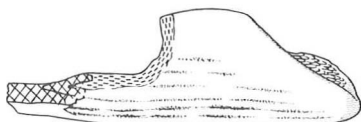
fig 107
ZR 1962/II 65



fig 108
ZR 1962/II 72



fig 109
ZR 1962/II 81



fi
ZR 196

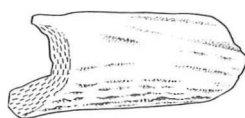


fig 111
ZR 1962/II 86

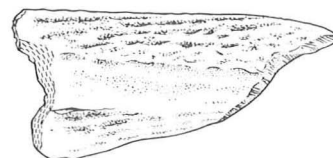


fig 112
ZR 1962/II 25

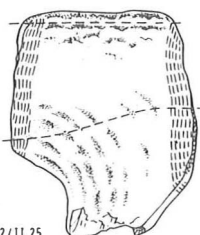
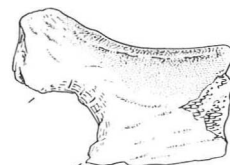


fig 113
ZR 1962/II 43



Figs. 104-105. Unfinished specimens; Figs. 106-113. Unknown tools.

at the base of the trez tine. The working part was roughly trimmed.

ZR 1962/II⁸¹ (fig. 109). A red deer antler. Fragment of the beam with part of a shaft-hole and working part still visible. Badly damaged.

ZR 1962/II⁸² (fig. 110). A fragment of a red deer antler. Fragment of the beam with part of a shaft-hole. The shaft-hole appears to be angular.

ZR 1962/II⁸⁴ (fig. 111). A fragment of a red deer antler, with working traces.

ZR 1962/II²⁵ (fig. 112). A fragment of a red deer antler, with working traces.

ZR 1962/II⁴³ (fig. 113). A fragment of a red deer antler, viz the beam, showing part of a picked-out shaft-hole. The piece is badly damaged.

ZR 1958/X². A r. antler of a red deer with pedicle and part of the frontal bone still attached. the cortex of the brow and bez tines were carved all round their base and broken off. Distal of the bez tine there is an oval hole carved with a sharp flint in the beam. The beam is broken under the trez tine. The object has been in contact with fire.

2.1.5.3.9. *Pick*

ZW 1935/V³²⁰. A l. red deer antler, probably unshed. Part of the pedicle is present and the burr is rounded (from use?). Traces of wear are visible under the brow tine. There is no bez tine. The beam was broken proximal to the wolf tine. The top of the brow tine is missing. The stump is rounded.

ZW 1942/XII⁴². A l. red deer antler, naturally shed. The brow tine is rounded. There was no bez tine. The trez tine was carved and broken off. The beam was broken proximal to the wolf tine. The antler is smooth as a result of much handling.

Z 1952/II²⁷⁷. A l. red deer antler, naturally shed. The top of the brow tine is rounded. The bez tine is broken. The trez tine and wolf tine were worn away. The beam is broken proximal to the wolf tine. A facet was carved on the beam at the side of the tines.

ZO 1958/IX¹⁰⁴. A l. antler of a red deer, naturally shed. The bez tine and trez tine were carefully removed. the beam was recently broken distal from the trez tine. The top of the brow tine is rounded.

ZO 1961/I¹¹⁷. A r. antler of a red deer, naturally shed. The top of the brow tine is missing. The bez tine had not developed. There is a corner tine. The trez tine was removed. The beam was broken proximal to the wolf tine. The surface is untouched. Possibly an unused pick.

Z 1962/VII⁴. A r. red deer antler, unshed. The pedicle was carved away. The bez tine was carefully removed. The tip of the brow tine was recently damaged. The beam was carved and broken proximally from the wolf tine. See also ZR 1962/III¹¹⁶ (2x).

2.1.5.3.10. *Hammer or pick*

ZO 1953/I¹⁶². A l. antler of a red deer, naturally shed. The top of the brow tine is missing. No bez tine had developed, the trez tine was cut away by a metal saw. Probably recently. The base and burr are partly rounded. The beam was broken distally to the trez tine. This object could have been a combination of hammer and pick.

2.2. Antlers

2.2.1. *Reindeer antlers*

At several places reindeer antlers were found in the IJsselmeerpolders, and one piece at Spoolde.

ZO 1953/II²¹. A r. naturally shed antler, probably of a female animal, was found in one of the sections J, P or O of the Noordoost-Polder. It was completely smooth, but apparently not used for any purpose.

ZR 1962/III⁹⁹ (fig. 114). A r. reindeer antler fragment belonging to the Spoolde 'hoard'.

ZR 1965/VII⁸⁵ (fig. 115). A left antler of a hunted female with scratches on the brow tine and a cut-off crown.

Nr. 41496. An antler fragment of which it is uncertain whether it belonged to a reindeer or a red deer. The brow tine and the beam were cut off perpendicularly to the length axes of the tine and the beam, respectively.

2.2.2. *Elk antler*

ZR 1962/V¹¹. A straight piece of antler possibly belonging to an elk. It is triangular in cross-section with a sharp edge on one side. It was probably cut off in some way; the tip is missing.

ZR 1962/III¹⁰. Two crown tines of an antler of a young elk. Damaged recently. Traces of gnawing by a rodent. The antler was not used.

Z 1950/XII³³⁹. A r. antler of an elk with pedicle and part of the skull still present. Not a tool or waste piece. With carving traces.

2.2.3. *Red deer antler*

2.2.3.1. *Groove and splinter technique*

ZR 1962/III⁹⁴. A fragment of beam and crown showing the beginning of a groove made with a sharp flint. The beam was broken recently.

Z 1963/II¹⁴⁸. Part of a right antler with the pedicle and part of the skull still attached to it. Nearly half of the beam was cut away lengthwise with a sharp flint tool. The beginning of three grooves may be observed just above the burr opposite the position of the brow and bez tines. The brow and bez tines were broken off. The same had happened with the trez tine and the beam just distal of the branching off of the trez tine. At least two heavy splinters were cut out of this antler.

There are no marks visible where the splinters were cut loose from the beam. Apparently, they were freed by breaking the ends perpendicularly to the main direction of the beam.

2.2.3.2. *Fragments with other working traces*

ZR 1962/II¹⁷. A l. antler fragment of a red deer. Probably the trez tine and beam distally of the trez tine. Shows carving traces.

ZR 1962/II²². A red deer antler, fragment of the beam. At one side recently broken. Badly preserved.

ZR 1962/II²³. A l. antler of a red deer, beam. Could be part of a T-axe. At one side picked out straight and well finished. Broken when making a shaft-hole at the other end.

ZR 1962/II²⁴. An antler fragment of a red deer viz, beam, showing working traces.

ZR 1962/II²⁶. An antler fragment of a red deer, viz beam and tine, showing working traces.

ZR 1962/III⁷⁷. A fragment of a red deer antler. Probably the beam with the trez tine. The beam was cut halfway and broken proximal of the trez tine, similar to the manufacture of T-axes. The surface is smooth.

ZR 1962/III⁸¹. A red deer antler fragment, probably part of the crown. The beam was chipped off straight, proximal to the crown. The tines were broken recently.

ZR 1962/III⁸⁷. A red deer antler fragment, probably the beam distally to the trez tine. The proximal end was cut off straight. The crown tines were broken recently.

ZR 1962/III⁹⁰. A r. antler fragment probably of a red deer. Base without brow and bez tines.

ZR 1962/III¹¹¹. A r. red deer antler with pedicle with a fragment of the skull still attached. The bez tine was broken off. The beam was broken near the trez tine.

ZR 1962/III¹¹². A r. red deer antler, naturally shed. The top of the brow, bez and trez tines are missing. The beam was broken distally from the trez tine. The surface seems to have been turned.

ZR 1962/III¹¹³. A r. red deer antler, naturally shed, the burr is missing. The brow tine was broken off. The top of the bez tine is missing. The beam was broken near the trez tine. The surface is smooth.

ZR 1962/III¹¹⁶. A r. red deer antler, naturally shed. The bez tine was cut off. The beam was chipped off proximal to the trez tine. The object is similar to a pick.

ZR 1962/III¹⁶⁶. A l. red deer antler, naturally shed. The beam was broken and is badly preserved. An object similar to a pick.

ZR 1962/III¹¹⁷. A r. red deer antler, unshed, the base has been in contact with fire. The burr has gone, the brow tine was burned off, the point of the bez tine is missing. The beam was broken proximal to the trez tine. Badly preserved. Smooth surface with scratches.

ZR 1962/III¹¹⁹. A l. red deer antler, the pedicle is still attached to the frontal bone. The bez tine had not developed. The surface shows artificial facets.

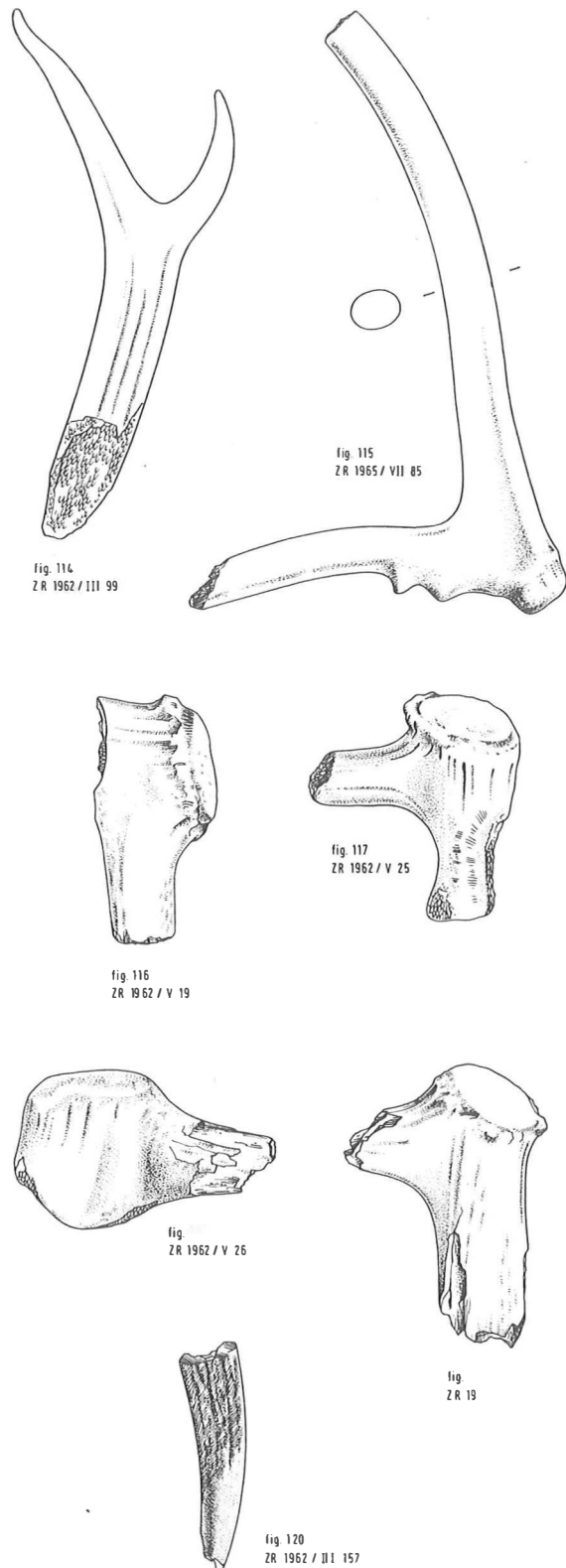
ZR 1962/III¹²⁰. A l. red deer antler, naturally shed. The tips of the brow and bez tine are missing. The beam was broken near the trez tine. The surface is smooth.

ZR 1962/III¹²¹. A r. red deer antler, unshed. The bez tine, and half of the trez tine, are missing. The beam was broken near the trez tine. The trez tine shows scratches.

ZR 1962/III^{121a}. A r. red deer antler, naturally shed. Brow, bez and tres tines were broken off. The beam was broken distally to the trez tine. The surface is smooth.

ZR 1962/III¹²². A l. red deer antler, naturally shed. The tips of brow, bez and trez tines are missing. The beam was broken distal to the trez tine. Distally the surface is smooth.

ZR 1962/III¹²³. A r. red deer antler, probably naturally



Figs. 114-115. Reindeer antlers; Figs. 116-119. Red deer antler fragments with working traces; Fig. 120. Worked tine.

shed. The burr has gone. The brow and bez tines were broken off, the beam was broken proximally to the trez tine.

Zr 1962/II¹²⁴. A l. red deer antler, naturally shed. The tip of the brow tine is missing. The bez tine was chipped off. The beam was carved off distally to the bez tine.

ZR 1962/III¹²⁵. A r. red deer antler, probably naturally shed. The burr has gone, the brow and bez tines were broken off. The beam was broken proximal to the trez tine. Possibly an unfinished base axe.

ZR 1962/III¹²⁶. A r. red deer antler, with a fragment of the frontal bone still attached to the short pedicle. Could be the waste from a T-axe.

ZR 1962/III¹²⁷. A l. red deer antler, unshed. Could be the waste from a T-axe.

ZR 1962/III¹⁵⁹. A r. (?) red deer antler, unshed. No brow or bez tine had developed. The tip of the trez tine is missing. Badly preserved.

ZR 1962/V. A r. red deer antler with a fragment of the frontal bone still attached to the pedicle. The burr, brow and trez tines are missing. The beam was broken. Badly preserved.

ZR 1962/V¹. A l. red deer antler, with a fragment of the frontal bone still attached to the pedicle. Only one fragment of the burr was preserved. The base was cut obliquely. Could be the waste from a T-axe.

ZR 1962/V². A l. red deer antler, with a fragment of the frontal bone still attached to the pedicle. Only the burr was preserved. It was not certain whether the damage is old or recent.

ZR 1962/V³. A r. red deer antler, a fragment of the frontal bone is still attached to the skull. The burr, brow and bez tines were broken off. The beam was broken off distal to the bez tine.

ZR 1962/V¹⁸. A l. red deer antler, naturally shed. One piece of the burr was preserved. The brow and bez tines were chipped off. The base is rounded. This piece could have been a kind of hammer.

ZR 1962/V¹⁹ (fig. 116). A r. red deer antler, naturally shed. One piece of the burr preserved. The brow tine was broken. The beam was recently (?) broken distal to the brow tine. The base is rounded. Could have been a kind of small hammer.

ZR 1962/V²². A r. red deer antler, naturally shed. The burr was cut off under and opposite the brow tine. The brow and bez tines and beam were broken, probably artificially.

ZR 1962/V²⁵ (fig. 117). A r. red deer antler, naturally shed. A piece of the burr was preserved under the brow tine. The brow tine was recently broken off. The beam was carved off distal to the brow tine. Could have been a small hammer.

ZR 1962/V²⁶ (fig. 118). A l. red deer antler, naturally shed. The burr is missing. The brow tine was broken recently. The beam was broken off distal to the brow tine. The base was rounded by use, looks like a small hammer.

ZR 1962/V³⁴. A r. red deer antler, naturally shed. The burr was removed. The brow tine is missing. The bez tine was carved off. The beam was broken recently.

ZR 1962/V³⁷. A l. red deer antler, naturally shed. The burr was partly removed. Most of the antler is

missing. Badly preserved.

ZR 1962/V³⁹. A l. red deer antler, naturally shed. The base is rounded, the brow and bez tines were broken off. The beam was broken distal to the bez tine.

ZR 1962/V⁶⁴ (fig. 119). A r. red deer antler, naturally shed. The burr was worn off. The brow tine was broken off. There was probably no bez tine. The beam was broken distal to the trez tine. Could have been a hammer.

Z 1952/VII^{20 a + b}. A l. red deer antler, naturally shed. There are carving marks distal to the brow tine in the beam. The beam was recently broken off. Could have been a pick.

Z 1956/V^{183(186?)}. A r. (?) red deer antler, unshed. The base with part of the brow tine. The burr has gone. Part of the brow tine and the beam were carved off.

ZW 1960/II⁶. A r. red deer antler, unshed. The tips of brow and bez tines were broken off. The beam was broken near the trez tine.

ZO 1960/II⁸. A l. red deer antler, naturally shed. Part of the burr is missing. The brow tine is missing. The bez tine was carved away. The beam was broken distal to the bez tine.

Z 1965/I²⁶. A r. red deer antler, unshed. Part of the frontal bone is still attached to the pedicle. The brow tine was broken. The beam was carved lateral. Could be the waste from a T-axe.

Z 1965/IV⁴¹. A l. red deer antler, naturally shed. The burr is damaged. The brow tine was carved away. The bez and trez tine are missing. The beam was severed distal to the trez tine. Impossible to say how it was done.

Z 1965/VII⁸⁸. A r. red deer antler, naturally shed. The base with part of the brow tine.

2.2.3.3. *Beam and crown*

ZR 1962/II¹⁵. Part of a beam probably distal to the wolf tine.

ZR 1962/II¹²⁹. A l.? beam with probably trez and wolf tines, of which the tips are missing. The crown or terminal tines were broken off. The proximal part was sawn/cut off.

ZR 1962/III²⁹. An antler tine. Used for C14 dating together with ZR 1962/III⁹¹ (GR. 7988).

ZR 1962/III³⁰. Antler beam. Brow and bez tines hardly developed with trez or wolf tine. Broken off distal to the tine. Heavy piece.

ZR 1962/III⁴⁰. Fragment of a beam with trez or wolf tine. The tip was carved.

ZR 1962/III^{48 a + b}. Two parts, probably of a beam or a heavy tine, proximally carved and broken off.

ZR 1962/III⁷⁸. A r. antler beam with trez tine. The beam was carved off proximal of trez tine, distally broken. The tip of the tine had broken off naturally.

ZR 1962/III⁷⁹. Beam distal of trez (?) tine. Tine partially chipped off. Recently broken.

ZR 1962/III⁸⁰. Fragment of crown of terminal tine. Broken recently.

ZR 1962/III⁸². Fragment of a beam with trez or wolf tine. Badly preserved.

ZR 1962/III⁸³. Probably a beam with crown. Tines were broken off. The surface is smooth.

ZR 1962/III⁸⁴. Fragment of a beam with tine.

ZR 1962/III⁸⁵. A r. antler, beam with trez tine.

Proximal the beam was carved off, distal broken off.

ZR 1962/III⁸⁶. Antler fragment with scratches and possible rodent gnawing marks on the surface.

ZR 1962/III⁸⁸. A l. antler beam and terminal tines. Recently broken.

ZR 1962/III⁸⁹. A fragment of a crown with gnawing marks of rodents. Used for C14 dating (Gr. 8590, Gr. 8605).

ZR 1962/III⁹⁰. An antler fragment.

ZR 1962/III⁹¹. An antler fragment, part of the crown. Used for C14 dating together with ZR 1962/III²⁹ (Gr. 7988).

ZR 1962/III⁹². Beam with two terminal tines. Scratches on the surface of the beam. Tips recently broken.

ZR 1962/III⁹³. Fragment of a crown? Badly preserved.

ZR 1962/III⁹⁵. Fragment of a beam with tine. Recently broken.

ZR 1962/III⁹⁷. Crown or two rounded end tines, beam recently broken.

ZR 1962/III⁹⁸. Fragment of terminal tine or crown tine.

ZR 1962/III¹⁰⁰. Beam with tine. The surface is smooth.

ZR 1962/III¹⁰¹. Fragment of a crown or a terminal tine. Part was recently damaged.

ZR 1962/III¹⁰⁴. Tine, fragment. Badly preserved.

ZR 1962/III¹²⁸. A beam, probably the part between the bez tine and trez tine. Proximally and distally chipped off.

ZR 1962/V¹⁷. Part of a beam.

ZR 1962/V²¹. Part of a beam.

ZR 1962/V²⁷. Fragment of a beam. Proximally cut off straight. Distally broken (?).

ZR 1962/V²⁹. Fragment of a beam with carving traces. Could be a fragment of a T-axe.

ZR 1962/V³⁵. Fragment of a beam with carved away tine. Could be a fragment of a T-axe.

ZR 1962/V³⁶. Fragment of a beam. Badly preserved.

ZR 1962/V⁴⁰. Fragment of a heavy beam.

ZR 1962/V⁴². Fragment of a beam, recently broken.

ZR 1962/V⁴⁷. Fragment of a beam.

ZR 1962/V⁴⁸. Fragment of a beam.

ZR 1962/V⁴⁹. Two fragments of a beam, broken near the trez tine. Badly preserved.

ZR 1962/V⁵⁰. Fragment of a beam.

ZR 1962/V⁵¹. Beam fragment, with a fragment of a wolf (?) tine.

ZR 1962/V⁵³. Fragment of a beam, hollow, the cortex is missing.

ZR 1962/V⁵⁷. Antler fragment, probably a beam. Badly preserved.

ZR 1962/V⁵⁸. Fragment of a beam, hollow, the cortex is missing.

ZR 1962/V⁵⁹. Fragment of a beam with the base of crown or terminal tines. Part of the cortex is missing.

ZR 1962/V⁶³. Part of a beam, badly preserved.

?. Fragment of a beam between trez tine or wolf tine and crown. Many parallel scratches.

? (Behind Bandijk). A beam of a l. (?) antler. The bez tine and probably trez tine were carved away. Different state of preservation and colour (yellow) from the other antlers.

Z 1943/IX⁴⁴. A beam with the brow (?) tine carefully removed. Beam distally carved off straight, proximally

broken off recently. Could have been a pick.

Z 1952/V¹⁶⁹. A beam of a l. antler between trez tine and crown. The beam was carved off proximally to the trez tine.

2.2.3.4. *Flattened tines, probably of red deer*

ZR 1962/III³⁵, ZR 1962/III⁹⁶, ZR 1962/III¹⁰⁹.

2.2.3.5. *Fragments*

ZR 1962/V¹⁰, Zr 1962/V³¹, ZR 1962/V³³ a + b, ZR 1962/V³⁸, ZR 1962/V⁴⁴, ZR 1962/V⁴⁶, ZR 1962/V⁵⁵.

2.2.3.6. *Crown and terminal tines*

ZR 1962/III³⁸. Fragment of crown or terminal tine. Recently broken.

ZR 1962/III⁴¹. Fragment of a crown or terminal tine. Working traces, recently broken.

ZR 1962/III⁶⁸. Fragment of a beam with three-tined crown showing carving traces proximally.

ZR 1962/III⁶⁹. Crown or three terminal tines.

ZR 1962/III⁷⁰. Fragment of a beam and crown with five terminal tines. The beam was chipped off straight.

ZR 1962/III⁷¹. Fragment of a beam and crown with three terminal tines. Recently broken.

ZR 1962/III⁷². Beaker crown with four terminal tines.

ZR 1962/III⁷³. Fragment of a beam and crown with four terminal tines. The beam was probably chipped off.

ZR 1962/III⁷⁴. Fragment of a beam and crown with two terminal tines. Recently broken.

ZR 1962/III⁷⁵. Fragment of a beam and crown with three terminal tines.

ZR 1962/III⁷⁶. Fragment of a crown with three terminal tines.

ZR 1962/III¹⁰⁵. Fragment of a crown.

ZR 1962/V¹⁶. Fragment of a beam and crown. The beam was damaged in the past. The crown damage is recent.

ZR 1962/V³⁰. Fragment of a crown. Recently broken.

Zr 1962/V⁶⁵. Possibly part of a crown, showing working traces.

?. Fragment of beam and crown with three terminal tines. Two tines were recently broken, the beam was broken off in the past.

Z 1950/XII³³⁸. Fragment of a beam and crown with three flattened terminal tines. Broken.

Z 1952/II⁴². Fragment of a beam and crown with two terminal tines, showing working traces.

Z 1953/I²². Fragment of a beam and crown with three terminal tines.

Z 1952/II²⁵. Fragment of a beam and crown. The beam was chipped off straight.

Z 1965/II¹⁶⁴. A fragment of a beam and crown with two terminal tines. The tines were recently broken off. The beam was probably carved off straight.

Z 1975/I¹. Fragment of a beam and crown fragment. The beam shows carving traces.

2.2.3.7. *Tines which might have been tools*

ZR 1962/II²⁸. Possible chipped off, the flattened tip shows carving traces.

ZR 1962/III³¹. Tip shows grating traces perpendicular to the main direction of the tine.

ZR 1962/III¹⁵⁷ (fig. 120). Worked tip, partly hollow.
 ZR 1962/V¹⁴. Tine with lattened tip.

2.2.3.8. *Tines with a hole at the base*

Zwolle-IJssel canal, Spoolde excavated soil. Tine with a recently pierced hole.

Z 1958/I⁵³. The tip has a green colour.

Z 1961/I¹⁰⁶. Polished tine with two sets of holes at the base.

Z 1968/IV⁴. Tine, top is missing. The hole at the base is damaged. All round the hole are carving traces.

Z 1968/V³. Tine cut off smoothly with a carving mark all round the top. Has a green colour.

2.2.3.9. *Tines*

ZR 1962/I²⁸. Tine or light beam, the tip is missing. The base was broken off in the past.

ZR 1962/II²⁷. Tine, broken off.

ZR 1962/III². Possibly a brow tine, the base was chipped off, the tip is missing.

ZR 1962/III³. Tine, the base was chipped off, the tip broken recently.

ZR 1962/III⁴. Tine, possibly chipped off at the base, the tip is missing.

ZR 1962/III⁵. Brown tine? Broken off recently, the tip is missing.

ZR 1962/III⁶, ZR 1962/III⁷.

ZR 1962/III⁸. Tine, carved off at the base in the past. The tip shows scratches.

ZR 1962/III⁹. Tine broken off.

ZR 1962/III¹¹. Tine, chipped off, the tip is damaged.

ZR 1962/III¹². Tine, chipped off at the base in the past and recently broken off.

ZR 1962/III¹³. Fragment of a beam with tine, the cortex was carved through and broken off.

ZR 1962/III¹⁴. Tine.

ZR 1962/III¹⁵. Tine with a carved rounded tip.

ZR 1962/III¹⁶. Tine with rounded tip, chipped off at the base in the past.

ZR 1962/III¹⁷. Tine, broken off.

ZR 1962/III¹⁸. Tine, broken off.

ZR 1962/III¹⁹. Tine, chipped off at the base, the tip is damaged.

ZR 1962/III²⁰. Tine, broken off in the past.

ZR 1962/III²¹. Tine, broken off recently.

ZR 1962/III²². Tine, chipped off at the base, the tip is missing.

ZR 1962/III²³. Brow tine, chipped off at the base.

ZR 1962/III²⁴. Tine, broken off at the base in the past.

ZR 1962/III²⁵. Tine, carved off at the base, carving traces at the top.

ZR 1962/III²⁶. Tine, broken off in the past.

ZR 1962/III²⁷. Tine, broken off at the base in the past, the tip was broken off recently.

ZR 1962/III²⁸. Tine, the tip is rounded.

ZR 1962/III³². Tine, badly preserved.

ZR 1962/III³³. Tine, broken off at the base in the past.

ZR 1962/III³⁴. Tine, broken off at the base in the past.

ZR 1962/III³⁶. Tine, broken off recently.

ZR 1962/III³⁷. Tine, broken off recently.

ZR 1962/III³⁹. Tine, carved off at the base, smooth surface.

ZR 1962/III⁴². Tine, the tip is missing.

ZR 1962/III⁴³. Tine, broken off in the past.

ZR 1962/III⁴⁴. Fragment of a beam with tine. Recently broken off.

ZR 1962/III⁴⁵. Tine, flattened. Badly preserved.

ZR 1962/III⁴⁶. Tine, broken off recently.

ZR 1962/III⁴⁷. Tine, tip is straight.

ZR 1962/III⁴⁹. Brow tine, broken off in the past.

ZR 1962/III⁵⁰. Tine, broken off recently.

ZR 1962/III⁵¹. Tine, broken off recently.

ZR 1962/III⁵². Tine, broken off recently. Smooth surface.

ZR 1962/III⁵³. Tine, broken off recently at the base.

ZR 1962/III⁵⁴. Tine, broken off recently, the tip is missing.

ZR 1962/III⁵⁵. Tine, chipped off and broken off in the past.

ZR 1962/III⁵⁶. Tine, badly preserved.

ZR 1962/III⁵⁷. Tine, broken off in the past.

ZR 1962/III⁵⁸. Tine, broken off recently.

ZR 1962/III⁵⁹. Tine, chipped and carved off.

ZR 1962/III⁶⁰. Tine, broken off recently.

ZR 1962/III⁶¹. Tine, tip is missing. Smooth surface.

ZR 1962/III⁶². Tine, broken off recently. Smooth surface.

ZR 1962/III⁶³. Tine, broken off recently, smooth surface.

ZR 1962/III⁶⁴. Tine, broken off, the tip is missing.

ZR 1962/III⁶⁵. Brow tine?, damaged recently.

ZR 1962/III⁶⁶. Tine, damaged at both ends recently.

ZR 1962/III⁶⁷. Tine, broken off recently.

ZR 1962/III¹⁰². Tine, carved off in the past and broken.

ZR 1962/III¹⁰³. Fragment of a beam and tine, broken off recently.

ZR 1962/III¹⁰⁶. Fragment of a beam and tine, broken off recently.

ZR 1962/III¹⁰⁷. Fragment of a beam and tine, broken off recently.

ZR 1962/III¹⁰⁸. Tine, possibly of a crown, broken off in the past.

ZR 1962/III¹⁵⁰. Tine, broken off.

ZR 1962/V¹⁵. Tine fragment, badly preserved.

ZR 1962/V²⁰. Tine fragment, or small beam, damaged recently.

ZR 1962/V²². Tine or beam fragment, badly preserved. Hollow.

ZR 1962/V²⁴. Tine, damaged recently.

ZR 1962/V³². Antler fragment, with carving traces.

ZR 1962/V⁴¹. Tine fragment, badly preserved.

ZR 1962/V⁵⁴. Tine fragment, split lengthwise. Badly preserved.

ZR 1962/V⁵⁶. Tine fragment, broken off recently.

ZR 1962/VI¹. Fragment of a beam with tine. Broken off recently.

Z 1950/IV³⁰¹. Tine, smooth surface.

Z 1954/II⁷⁸. Tine or crown tine, carved off with metal object. The tip shows facets carved with a metal or stone object.

Z 1965/IV²². Tine, broken off in the past, showing carving traces.

Z 1968/III³⁹. Tine, broken off at the base in the past, the tip was broken off recently.

2.3. Other animal remains

During the investigations of the pits dug for the canal and lock, a number of other animal remains were also found. They are in most cases badly preserved and cannot be linked up with the pieces from Spoolde found on the outward side of the Bandijk. Because some of them were given Spoolde find numbers they will, for the sake of completeness, be discussed briefly.

Shallow creek, lower peat layer

Nr. ? Badly preserved bones from an ox, including fragments of humerus, radius, phalanx I, pelvis and femur.

ZR 1962/III¹⁴⁶ and III¹⁴⁷. Eight fragments of molars or premolars of ox and small fragments of molars or premolars. M₃ domestic pig.

Nr. ? M₃, M²/₃ of an ox.

Nr. ? Badly preserved bone fragments a.o. of an ox, a horn core, metatarsus, vertebrae; a tibia of a domestic pig.

ZR 1962/III¹⁴² molar of the maxilla of an ox.

ZR 1962/III⁴¹ molar of the mandibula of an ox.

Shallow creek, upper peat layer

Nr. ? M₃ of an ox, M^{1/2/3} of an ox, six fragments of molars or premolars of an ox, six fragments of molars or premolars of an ox or red deer.

Find spot unknown

ZR 1962/V⁴, l. humerus of an ox.

ZR 1962/V⁵, probably the tibia of a wild ox, maybe a damaged tool.

ZR 1962/V⁶, two pieces of a l. metatarsus of a wild ox, probably a fossil.

ZR 1962/V⁷, r. tibia of a small ox.

ZR 1962/V⁸, metatarsus of a horse.

ZR 1962/V⁹, probably a humerus of an aurochs or wisent, is fossilized.

ZR 1962/V⁶⁰, long bone probably of an ox coated with iron.

ZR 1962/V⁶¹, l. tibia of a small ox.

ZR 1962/V⁶⁰, long bone, probably of a human.

ZR 1962/VI¹, a r. antler of a roe deer still attached to the frontal bone.

ZR 1962/VI², vertebrae of a young ox.

ZR 1962/VI³, r. ulna of a moderately sized dog. Length 160 mm.

ZR 1962/VI⁴, l. humerus, distal epiphyses of a small ox.

Nr. ?, sheep/goat, r. humerus, metatarsus.

Spoolde, dug out ground

Large number of badly preserved bone fragments, a.o. fragments of red deer antler, metatarsus of an ox, and two fragments of hazelnut-shells.

Spoolde, dug out ground

At least 8 molars or premolars of ox, 1 M₃ of a domestic pig.

Nr. ?, probably Spoolde. Lower jaw of a ♂ domestic pig.

Nr. ?, probably Spoolde. Two antler fragments attached to the frontal bone of a roe deer.

Nr. ?, probably Spoolde. Skull fragment of a young red deer stag. The base of both antlers is present. The face part is missing.

3. SPOOLDE, GEOLOGY, ZOOLOGY, DATING

3.1. Geology

Before the construction of the canal and the lock was started, Rijkswaterstaat had made a geological survey of the area by taking a number of borings reaching c. 1 m below ground level, as well as a smaller number to a depth of c. 5-5.5 m below ground level. Regrettably, it is impossible to connect any of these borings to the finds, so that these soil samples do not enable us to learn anything about the geological location of the finds, either.

Hamming, Knibbe & Maarleveld (1965) studied two cross-sections of the exposure in the Spoolde lock pit and the canal pit (fig. 121). They summarised their work as follows:

The results of soil surveys and the study of exposures, and especially of that at Spoolde, led to a more exact understanding of the origin of several deposits along the river IJssel in the area near Zwolle. At the end of the Würm Pleniglacial the IJssel followed approximately the same course as the present, whereas east of the river a predominantly eolian sedimentation (cover sand) took place. Along the IJssel fluvatile sedimentation (river loam and sand) prevailed. In Spoolde the eolian as well as the fluvatile landscape of the Allerød and part of the Younger Dryas time was exposed to great advantage.

At the beginning of the Holocene the discharge of the IJssel was of minor importance. At that time a part of the river dunes were formed and subsequently, with increasing humidity peat began to grow in the lower parts of the landscape. In accordance with the increasing sedimentation of clay after Roman times

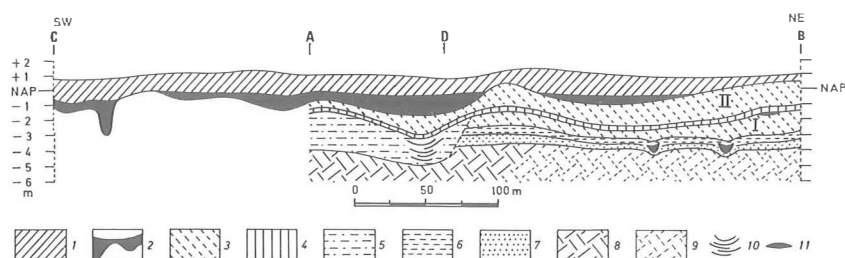


Fig. 121. Generalized cross-section of part of the exposure at Spoolde in the canal and lock pit (see fig. 2) (after Hamming, Knibbe & Maarleveld, 1965: figs. 2 and 7). 1. river clay; 2. bottom land peat; 3. younger cover sand II with humus podzol profile and younger cover sand I; 4. river loam in the north-east overlaying a thin peat layer belonging to the Allerød to Younger Dryas period; 5. fluvatile and eolian sands from the Late Glacial; 6. loamy older cover sand; 7. non-loamy older cover sand; 8. non-calcareous fluvatile low terrace; 9. calcareous fluvatile low terrace; 10. bands of peat and river loam from the Allerød and Younger Dryas time; 11. peaty and loamy, partly calcareous bands of gully aggradation from the Peniglacial B.

in other parts of the country, the IJssel also increased its discharge and formed the first holocene clay deposits along the river. In the late Middle Ages and thereafter clays have been deposited, which show a more irregular pattern and have a less extremely fine grained sandy component. In the same period another part of the river dunes formed and the mixed (river clay-river dune or cover sand) soils came into being.

In this summary nothing was said that can be used to clear up the geological and stratigraphical situation of the Spoolde antler. When we study the cross-section of part of the exposure at Spoolde, and the generalized cross-section of the Holocene peat and clay deposits (fig. 121), we see in the northeast, below c. 4-4.5 m N.A.P., a calcareous and a non-calcareous fluvatile low terrace or the upper part of the Kreftenheye formation belonging to the last Glacial. In the northeastern part of the cross-section this is overlain by a succession of the following layers of: non-loamy older cover sand, loamy older cover sand, younger cover sand I from the older Dryas period, river loam, younger cover sand II from the Younger Dryas period with humus podzol profile, bottom-land peat and river clay. In the middle part of the cross-section, the lower three layers overlaying the Kreftenheye formation and also the upper part of the Kreftenheye formation had been eroded away and part of a channel is visible, filled with fluvatile and eolian sands from the late Glacial. This filling was overlain by the uninterrupted thin layer of river loam, from the Younger Dryas, followed by bottom-land peat and river clay. In the southwest (fig. 7; H.

Kn. M.) the cross-section only reaches to a depth of c. 3 m. In this section, the formation of peat was studied.

As a result of the rise of the sea level there was an increasing humidity of the soil, which led to the formation of peat. Peat samples were taken at two places; one in the creek (Spoolde South) and another a little more to the southwest. In both, the peat formation begins in the Subboreal and ends in the Subatlantic. Cultural elements present are weeds such as *Plantago lanceolata*, *Rumex* and grains — *Cerealia*. *Secale* pollen was found in Spoolde South at a depth of —89 cm N.A.P. In the cross-section Spoolde West at —88 cm N.A.P. more or less correlated with the boundary peat-river clay. It is generally taken that *Secale* or rye was not cultivated in the Netherlands before the beginning of the Christian era. The end of the peat formation can be dated at the beginning of the Christian era, this being in agreement with the situation in surrounding areas (Koelbloed and Kroeze quoted by Hamming, Knibbe & Maarleveld, 1965). The beginning of the peat formation in the Subboreal was confirmed by the archaeological finds in Van der Heide's (1962) trial trenches.

3.2. Deer in the Netherlands

3.2.1. *Reindeer* — *Rangifer tarandus*

The reindeer is an arctic species, native to the tundra zone of the Palaearctic and Nearctic regions and, further south, in the more open country of the Taiga zone (Corbet, 1978).

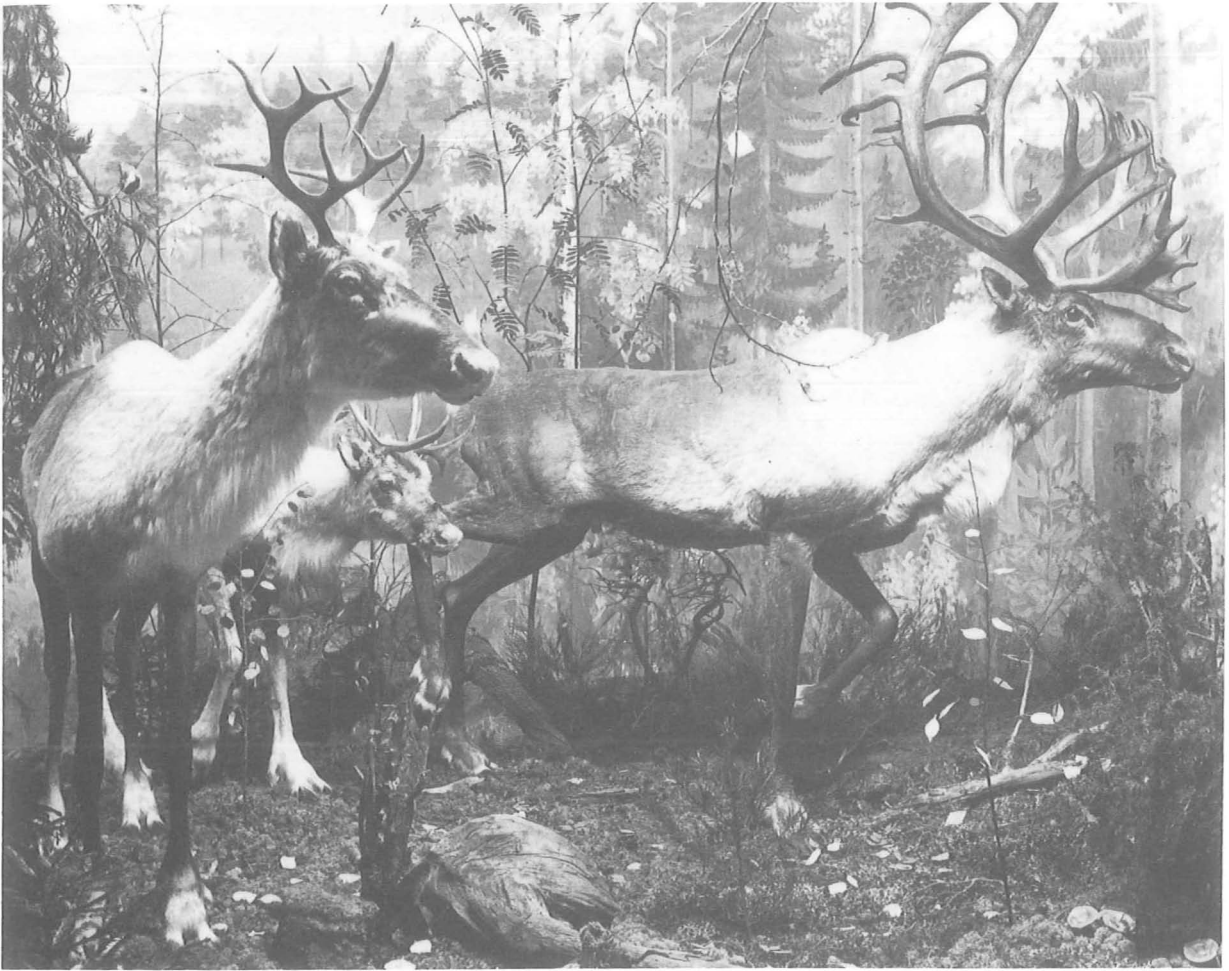


Fig. 122. Reindeer, ♀ + ♂, in the exhibition of the Zoological Museum in Helsinki (photograph R. Tynelä).

During the Ice Age the species also lived in the Netherlands, but disappeared after the onset of the amelioration of the climate (fig. 131). After c. 10,000 B.C. it was no longer a resident of this part of the world. The reindeer antler from Spoolde can not be younger, if we exclude the possibility that it was imported at a later date from Scandinavia.

During the Pleniglacial, Older and, possibly, Younger Dryas periods reindeer (fig. 122) must have lived in the Netherlands. Remains of reindeer were found in the IJsselmeerpolders and also during dredging operations from sand pits in the Late Glacial formation of Kreftehene (Hiddingh, 1983). The species will not be discussed in more detail.

3.2.2. Elk – *Alces alces*

The elk (fig. 123) is at present native to the coniferous forest zone from Scandinavia and East Poland to East Siberia (Corbet, 1978), but also lives in mixed-woods with lakes (Heptner, Nasimovič & Bannikov, 1966).

The elk probably did not live in our country at the Pleniglacial and Older Dryas periods. It came here during the Allerød period and may have stayed during the Younger Dryas. Since the Preboreal it must have lived as a resident in the Netherlands, but dated subfossil bones are unknown before the Late Atlantic. All the habitation sites known from the Allerød/Young Palaeolithic to the Late Atlantic



Fig. 123. Elk, ♀ + ♂, in the exhibition of the Zoological Museum in Helsinki (photograph R. Tynelä).

period are situated on the higher sandy areas in the east, and on loessic soils in the southeast, where no faunal remains are preserved. It was only at the dwelling sites of the middle of the fourth millennium B.C. in the coastal delta area that animal remains were well preserved. We know that the elk lived in the coastal area from this period onwards, at least till the Middle Ages. The last-dated find known to me are three antler fragments and a mandibula of elk (Prummel, 1983) from the Early Medieval town of Dorestad near the present-day Wijk bij Duurstede, south of Utrecht c. 700-800 A.D. Elk disappeared from our country because the suitable biotopes were destroyed by man. The finds of elk in settlements, however, are scarce and the implements from elk antler or bones are not numerous either.

It seems probable that the elk was a relatively scarce animal in the prehistoric and early historic woods compared with red deer, of which species numerous remains were found in the Late Atlantic and Subboreal settlements of Swifterbant, Hazendonk and the Vlaardingeng culture in the western coastal area (Clason, 1980).

3.2.3. Roe deer — *Capreolus capreolus*

The roe deer (fig. 124) can occur in a variety of biotopes from low-lying plains to the tree line in the mountains. It favours young deciduous or mixed woods, forest borders and open land with possibilities for cover (Van den Brink, 1978). Today the roe deer is a culture



Fig. 124. Roe deer, ♂ (photograph R.I.N., Arnhem).

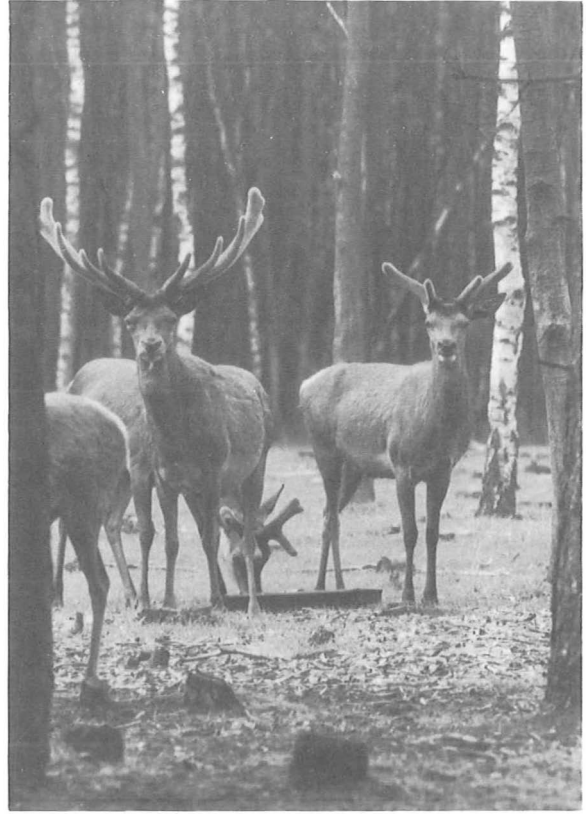


Fig. 125. Red deer (photograph R.I.N., Arnhem), males with the antlers in velvet.

follower. It did not live here during the Pleniglacial or Older Dryas period but can be expected from the Allerød period onwards. It also holds for roe deer that no dated remains are known before those found in the Late Atlantic Neolithic settlements (Swifterbant & Hazendonk). In Spoolde, three unshed antlers were collected, but it is not certain that they were found on the dump near the dredging pit and belong to the Spoolde 'hoard'; their colour is dark brown, however.

3.2.4. Red deer — *Cervus elaphus*

The red deer (fig. 125) is a species that mainly occurs in deciduous woods but occasionally also in pine forests. In Scotland it lives today in totally open country without cover (Corbet, 1978).

The red deer lived in the Netherlands as early as the Eemien (Van der Vlerk & Flor-

schütz, 1959). During arctic periods it must have disappeared to return during milder periods. This species cannot be expected to have occurred here again before the amelioration of the climate during the Allerød period. It probably lived here continuously from the Preboreal till the present. No dated finds are known before those from the settlements in the fourth millennium B.C. in the delta region of the big rivers in the west. In Swifterbant, Hazendonk and Vlaardingen it probably was the most frequently hunted species. After 2000 B.C., red deer remains are only found in small numbers in human settlements. It is possible that even by that time the biotope of red deer had been reduced by the replacement of woods by arable fields.

In the Netherlands, red deer are mentioned in a hand-written treatise for hunters, 'Jacht-Bedryff' (Swaen, 1948). The writer of the document was, in all probability Cornelis Jacobsz van Heenvliet, who was known as the

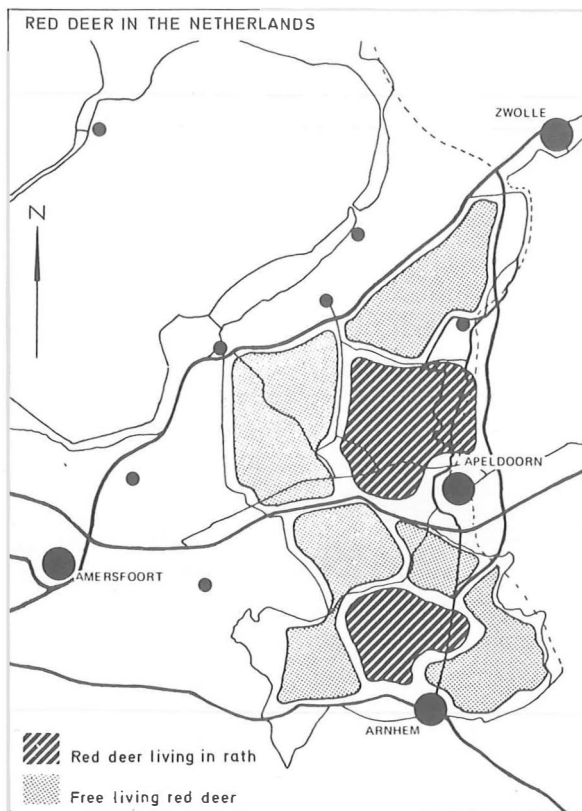


Fig. 126. The present distribution of red deer in the Netherlands (after Directie Faunabeheer, 1980).

deputy forester of Holland and West-Friesland. His name appears in acts between 8th January, 1615, and 2nd December, 1636. The manuscript is dated in the latter year. According to Van Heenvliet, red deer were still (or again) present in North Holland:

'T groffwildt hier te lande onthoudt sich meest in Noort-Hollandt voorts achter den Vogelesand, naar Langevelt bij Noortwijck, ende voorts omtrent Teijlingen en dan in Stalpershout tussen Leijden ende den Hage, ende bij wijlen in de Capittel diijnen achter Gravenzande omtrent de Mase (.). 'T meeste dat in Noort-Hollandt is heeft Prins Maurits H.M. uijt den Paltz laeten komen, waer aff de twee eerste troupes die gesonden wierden altesamen stierven, ende van die de derde mael overkwaemn, dat 35 stuc waren, zijn omtrent noch vijfhien in 't leven gebleven die nu dan (met die van outs daer zijn geweest) voort hebben geset ende daer vermenighvuldicht. onder de gecroonde, zijn noch vier schoone groote Palatijnsche stucken, om welke te conserveren heeft den Wildschutt eens vooral, last, soo wanneer hij ordre krijgt om een te schieten die te verschonen.

Om in Noort-Hollandt 't groffwildt uijt de koo-

renlanden te houden isser een herteheijninge gemaekt die van Brederoos-Duijn begint ende tot boven Egmont toestreckt.

In short, it is mentioned that red deer live in the dunes of the provinces of South and North Holland and that some of the animals had been imported from the Paltz by Prince Maurits. All the animals of the first two imported groups died, but 15 of the third group survived and mated with the animals that were already living there. In another passage it was mentioned that the other area where red deer were living was Gelderland.

Brouwer (1949), who collected all the historical data known till then about the existence of red deer in the Netherlands, thought it was likely that the red deer that were not imported by Prince Maurits had also been brought to the dune area, in earlier times. According to him it was unthinkable that a red deer population could have maintained itself in the dunes since Roman times. That during the Roman period red deer were still hunted in Holland is proved by red deer bones found in the Roman castellum of Valkenburg in the province of South Holland and in a Roman settlement in Egmond in the province of North Holland (Clason, 1984).

Today the species is only found on the infertile soil of the Veluwe, both free-living and in rath (fig. 126). Outside this area no red deer have been present for a long time. Whether they can be considered to be the descendants of the original population of the Veluwe, or are all contaminated with red deer imported since the early 17th century is a much discussed question. In the 20th century, red deer were imported from Mecklenburg and settled in the Soerense woods. Brouwer mentions that 'De Hoge Veluwe', part of the South Veluwe, was populated around 1935 with 200-250 animals. Among these animals were 30 imported from the Carpathians, c. 15 from Czechoslovakia and c. 7 animals from Scotland. According to Brouwer the interbreeding of red deer with imported animals should be studied intensively. In Germany, the first generation offspring of the small West European and, the larger Southeast European red deer was larger than the West European animals, and plump. In the succeeding generations this larger stature was lost again, till in the end no influence of the crossbreeding could be



Fig. 127. Two red deer skulls from the collection Van Pallandt with typical three tine crown and underdeveloped or absent bez tine (after Van den Hoorn, 1982).

seen. If this was the same on the Veluwe, then the type that occurs there today could still have the same characteristics as those of the older periods.

Reinders (1982) thinks that the original red deer of the Veluwe should have had an antler type (fig. 127) that can be distinguished from those influenced by four female animals which were imported from the Rominten heath in Brandenburg in 1929 and taken to the castle Het Loo near Apeldoorn on the Veluwe. These latter antlers should have been much more luxuriant and should have developed a crown (fig. 128) (Hoorn, 1982).

It is difficult to trace all the imports of red

deer in the Netherlands that have taken place during the last four centuries. Moreover, it is not certain that the imported red deer came from pure populations. In other parts of Europe attempts were also made to improve red deer and their antlers by importing larger animals from elsewhere.

A red deer population is often judged by the size and shape of the antlers of the stag. For centuries, the stags with large and well-developed antlers were hunted for the trophies and were often killed too early to be of importance for the succeeding generations. Today stags with capital antlers are allowed to survive for a number of years to be able



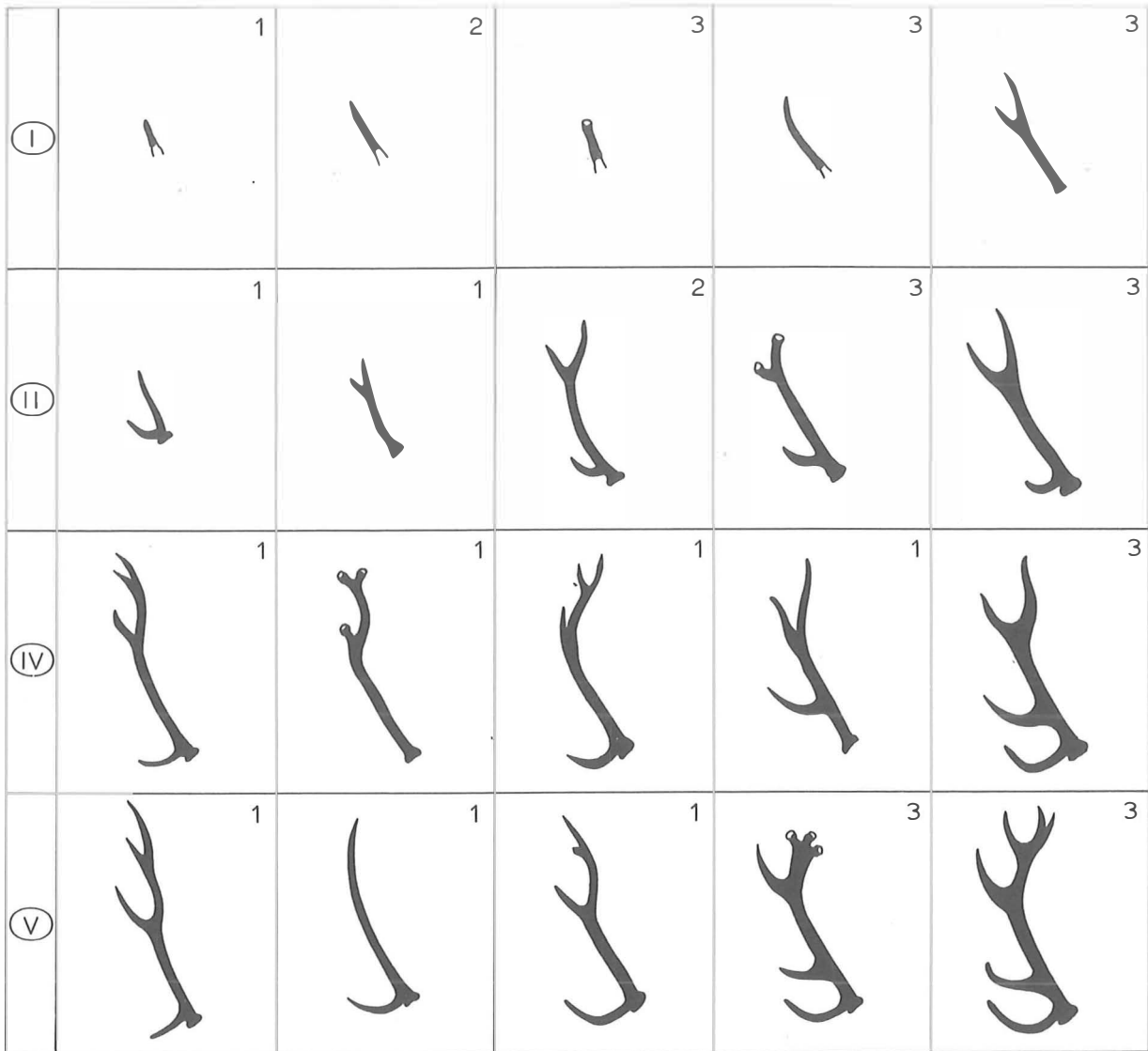
Fig. 128. Red deer stag with antler influenced by East European forbear(s) (December 1981, after Reinders & Van den Hoorn, 1982).

to procreate and give their genes to a new generation. Young animals which show poorly-developed antlers in successive years, however, are shot. An instance of assessment of antlers and whether their bearers should be shot or allowed to survive is taken from a Belgian hunting book (fig. 129) (Swartenbroekx, 1976).

In prehistoric and early historic times antlers were of importance for the fabrication of tools.

The antler is part of the frontal bone of the skull of the stag and develops and is shed annually. In the Netherlands the old stags shed their antlers in March, the younger in April or in May. A little later the growth of new antlers starts. The antler is fully grown in July

or August (IJsseling & Scheygrond, 1950). During the growth the antler is covered with velvet, a skin covered with short hairs containing many blood vessels. When the growth of the antler stops, the blood vessels are cut off at the base of the antler and the skin dies. The skin is then in a few days removed by rubbing. The fully grown antler consists of a spongiosum surrounded by a hard cortex. During the growth of the antler the cortex is pervaded with capillary vessels. The holes in the spongiosum are filled with blood or yellow bone marrow. After the skin has been rubbed off the antler becomes drier. The moisture percentage just after removal of the skin is 15-20 % higher than that of the shed



Some of the most common regular antler forms

		1	2	3
second year	I	inferior	doubtful	good - very good
third year	II	inferior-poor	doubtful	good - very good much bulk in upper part
fifth year	IV	inferior-poor	-	good - very good
sixth year	V	inferior-poor	-	much bulk in upper part

Fig. 129. The evolution of the antler of a red deer population of poor quality on infertile soil and their assessment (after Swartenbroekx, 1976).

antler (Bubenik, 1966). The growing and shedding of antlers is induced by the length of the day and controlled by hormones (Chaplin, 1977).

It is often thought that antlers contain sex and other hormones. Growing antlers were, and still are, sold in the markets of China and Korea as an aphrodisia. It has been established that the tissues of growing antlers of red deer and fallow deer have neural and sexual influences, although this influence should not be overrated. In this context it is interesting to read that Schlegel (1870: p. 61) mentions that antler jelly (Dutch: *hertshorengelēi*) was still being given to the sick as a restorative at that time.

Before the shedding of the antler, a demarcation line or shedding plane is formed. This line or plane is already more or less in existence during the rutting season. The line or plane lies proximal to the antler base. Along the separation line or plane the bone is resorbed. The separation plane is not straight but can be concave or convex. This concavity or convexity of the base of the shed antler is possibly connected with the health of the animal. A healthy animal sheds its antlers in a short time, which gives a convex base. When shedding takes a longer time, which occurs when the animal's health is not optimal, part of the antler base is also resorbed and a concave base is the result (Bubenik, 1966). It is not always easy to see the difference between the natural convex base of a shed antler or the pedicle of an unshed antler, which was partly removed by man.

Today antlers are compared with each other by giving points for certain features and measurements. Zsindely (1929, quoted by Bubenik, 1966) writes that red deer antlers were described, given points and assessed by the points they obtained for the first time in 1882 in Budapest. Since then a number of judging systems have been developed in which not only biometric criteria but also aesthetic criteria were used.

According to Bubenik (1966) it is impossible to get, in this way a properly biologically based description of the antlers of red and other deer species on the basis of which the stags they belonged to can also be judged. He proposes to measure the antlers, to weigh them and to establish their volume. The measurements that

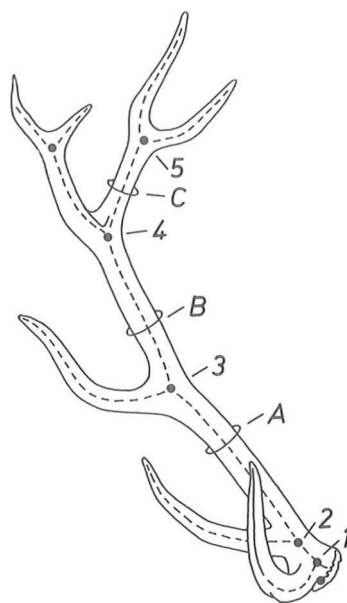


Fig. 130. The measurements that should be taken of a red deer antler according to Bubenik (1966).

he proposes should be taken are shown in figure 130. They are: along the beam the distance between the points 1-2, 2-3, 3-4, 4-5; the circumference of the beam proximal to the real tines; the length of the brow-tine, bez tine, trez tine and wolf tine (when the wolf tine is forked it is measured only to the fork); the length of the tines from points 1, 2, 3, 4, 5 to their tips. Extra tines and tines from bow and bez tine are not measured, although they are mentioned, because they are not specific for the species. An attempt has been made to measure the antler fragments of Spoolde and the IJsselmeerpolders in this way. Additionally, the circumference of the burr was measured because this measurement was traditionally included in the assessment formulae and is also often taken from subfossil antlers.

In table 2, the biometric and archaeological measurements are given together. The circumference of the burr could be measured most frequently.

Reichstein (1966) has calculated the mean of the circumference of the burr for the following countries: Yugoslavia 263.8 mm (n = 180), Hungary 256.3 mm (n = 38), Austria 243.5 mm (n = 50), Germany (boundaries of 1946) 238.4 mm, Benelux 230.6 mm (n = 52). The data were obtained from *Jagd und Hege*

aller Welt in 1955 for red deer which got a premium. What these figures would have been if the antlers of the animals which died without getting a premium had been taken into account also, is not mentioned. Reichstein compared those figures with those found for the early medieval red deer antlers collected in Haithabu in Northern Germany for which he found means of 215.9 (r.) and 211.0 mm (l.) for shed antlers (n = 738) and 213.3 (r.) and 215.5 mm (l.) for unshed antlers (n = 118). The mean of the antlers of the Mesolithic settlement Marienbad, Kr. Ostholstein is 204.0 (Hucke *et al.*, 1973) and is the same as that of Spoolde. The mean of the Spoolde antlers is 205.4 mm (n = 24), if two antlers with a circumference of 85 and 88 mm are left out of consideration. The mean for other antlers collected in the IJsselmeerpolders was 219.5 mm (n = 9). No other data about prehistoric or early historic antlers from the Netherlands are known to me except those concerning four antlers from the *terpen* area in the north, published by Van Giffen (1913), whose mean is 217 mm (n = 4) (table 2).

All three figures are lower than the figure for the premium antlers from the Benelux, the mean for the Spoolde antlers being the lowest. The mean figure for the Benelux countries is corroborated to a certain extent by the measurements of the successive antlers of Caesar, a stag considered by Reinders (1982) to be unique for the Netherlands (table 2).

That the subfossil antlers were larger than the present-day antlers is not confirmed by those either of Spoolde and the IJsselmeerpolders or the *terpen* area. But much more material has to be studied before this can be stated as a fact.

Reichstein (1966) pointed to a decrease in antler size from east to west. Pietschman (1977) studied the prehistoric and early historic red deer remains from Asiatic Turkey and Europe and found roughly a decrease in size of all skeletal elements from southeast to northwest, and again a decrease from north to south in the Iberian Peninsula.

3.3. Dating the antlers and the bone and antler tools of Spoolde

There are several possible approaches for

dating: 1. geological, 2. zoological, 3. archaeological and 4. C14.

3.3.1. Geological dating

The above-mentioned cross-section (fig. 121) does not provide direct information about the stratigraphical position of the Spoolde finds. But indirect information can be obtained. It seems improbable that most of the finds come from the pleniglacial loamy older cover sands, with the exception of the reindeer antler. However, in the pleniglacial lower cover sand, older Eemian material was redeposited at some places, and this may also have contained fossil antlers of *Cervus elaphus* (Hiddingh, 1983). Theoretically, some of the unworked antlers may belong to this older material, but this seems improbable. The reindeer antler and the elk antler fragments may come from the younger cover sands II belonging to the Younger Dryas period. The majority of the finds seems to come from a younger formation, probably peat, which may have started to grow earlier than the Subboreal in the foreshore area of the IJssel. The colour of most of the antlers is dark brown, and the inside of the antlers also has that colour.

3.3.2. Zoological dating

Antlers from four species of the Cervidae were collected at Spoolde, viz reindeer — *Rangifer tarandus*, elk — *Alces alces*, roe-deer — *Capreolus capreolus*, and red deer — *Cervus elaphus*.

The reindeer antler fragment from Spoolde may be contemporary with some of the elk antler fragments, but probably not with those of the roe and red deer. The antlers of elk, roe and red deer may belong to the same period. The reindeer antler indicates that the Spoolde collection is, at least partly, a mixture of older and younger material if we exclude the possibility of importation at a later date.

3.3.3. Archaeological dating

The Spoolde collection and also the stray finds from the IJsselmeerpolders include a number

of types of antler objects which have also been found elsewhere in Europe: finds that are, at least partly, dated by the archaeological context in which they were found. The same can be said about the 'groove and splinter' technique for working antlers and bone.

3.3.3.1. *The socketed bone axe*

In Spoolde a broken socketed bone axe made of the proximal part of a cattle metatarsus was found (fig. 11). The dating of the socketed bone axe, or tubular bone adze according to Brinch Petersen (1972), was discussed by Louwe Kooijmans (1970-1971). He came to the conclusion that the socketed axe (or tubular adze) fits in well with the Maglemose-series, and that, in spite of younger finds, a Boreal date can hardly be disputed; a long socketed bone axe from a cattle metatarsus is known from Hohen Viecheln (Schuldt, 1961) in Northern Germany. A similar socketed axe made from a radius of an ox has been found in Swifterbant (Clason, 1978). This Late Atlantic site has been dated by C14 between 3425 ± 40 B.C. and 3280 ± 40 B.C. (Deckers, De Roever & Van der Waals, 1980). Although the axe from Swifterbant was made from the proximal part of a cattle radius, it is the same type of tool as the metatarsus socketed axe of Spoolde, a date in the Late Atlantic period is one of the possibilities. At the Koerhuisbeek a similar, undated, radius axe was found (Louwe Kooijmans, 1970-71).

3.3.3.2. *The 'groove and splinter' technique*

One red deer antler was found in Spoolde with traces of the groove and splinter technique (pl. 12). Another antler showing marks of this technique was found in the IJsselmeerpolders. Clark (1954) described this technique for Star Carr, a Late Preboreal Mesolithic site. It was also reported by Schwabedissen (1958) for the settlement of Heidmoor, Kr. Segeberg in Schleswig-Holstein with habitation traces dating from the Ellerbek-Ertebølle culture to the Bell-Beaker period. The use of the groove and splinter technique thus gives a dating between the Late Preboreal and the Late Atlantic.

3.3.3.3. *The bone disc*

Similar pieces were found in Denmark in an Ertebølle context (Andersen, 1973-1974). The bone disc therefore gives a date in the Late Atlantic period.

3.3.3.4. *The elk antler adzes*

Two of the elk antler adzes were described earlier by Louwe Kooijmans (1970-1972), who also discussed finds in other parts of Europe. Similar tools were found at Star Carr and Hohen Viecheln and isolated finds are known from Esthonia to Great Britain. They are absent, however, from Danish Boreal sites. Louwe Kooijmans considers a (Late) Preboreal date the most probable. But a later dating, in the Late Atlantic, is also possible in this case since a hollow-edged specimen of that date was found at the settlement of Hude I (Deichmüller, 1963). In Spoolde only one piece of antler was found which could have been an adze (fig. 15). The other finds come from the IJsselmeerpolders. The Spoolde specimen cannot be used for dating.

3.3.3.5. *The T-shaped axes, waste pieces from the manufacturing process and brow tine axe*

The T-shaped axe, its distribution and its dating were amply discussed by Van der Waals (1972). Most of the T-shaped axes were found during the dredging of rivers in Central and Northern Europe. In the south of Scandinavia they could belong to the Ertebølle culture, but they could also be dated to the Subboreal. T-shaped antler axes were also found in the Ertebølle settlement of Ringkloster in East Jutland in Denmark (Andersen, 1973-74), in the middle level of the settlement. Charcoal associated with one of the T-shaped antler axes gave a C14 date of 3540 ± 100 B.C. (K-1653). Shoulder blades of aurochs, red deer and wild boar, from which bone discs had been cut, and a bone disc were found in the lower and middle layer. Two charcoal samples from the lower layer gave C14 dates of 3660 ± 110 B.C. (K-1652) and 3550 ± 100 B.C. (K-1765).

According to Schwabedissen (quoted by Van der Waals, 1972) they could belong to the *Fuchsberg Stufe* of the Funnel Beaker Culture (= FN-C nach C.J. Becker). In Belgium, a T-axe was found near Luik which belonged to the Omalian (De Laet & Desittere, 1972), and which can be dated by C14 to c. 3800 B.C. In the well-known Mesolithic/Early Neolithic sites of Lepenski Vir and Vlasac in the Iron Gate in Yugoslavia, similar objects were found (Srejović, 1979; Bačkalov, 1979). Clark (1952: p. 55) described a T-axe, collected

in 1877 near the skull of a roe deer on the Micklewood estate in Scotland, which could be Mesolithic. Fragments of T-shaped antler axes were also collected at the Swifterbant site, which was dated by C14 between 3425 ± 40 and 3280 ± 40 B.C.

Unfinished T-shaped antler axes and waste from their fabrication were found during recent excavations (1976-1977) of the Lengyel settlement of Breść Kujawski in Poland (Grygiel & Bogucki, 1981; Bogucki & Grygiel, 1983). No finished tools were found in the settlement. During earlier excavation in the 1930s, Jażdżewski (1938) found finished T-shaped antler axes in graves which are now thought to belong to the late Lengyel period.

T-axes and their waste have not been found so far in any of the Neolithic settlements known in the west of the Netherlands, but T-shaped axes have been collected as stray finds at many places in the east, especially during the dredging of rivers. That they have not been found elsewhere in the eastern part of the Netherlands is not surprising since organic material is only preserved along the rivers in this area. In the coastal delta region in the west they would have been preserved well if they had been used there.

No T-shaped axes or their waste were found (Van de Broeke, 1978), either in the Neolithic site of the Hazendonk in the Alblasserwaard, a place favourable for habitation in an environment, extremely rich in water and that was inhabited from the Swifterbant phase (c. 3400 B.C.) to the Late Vlaardingen 2b phase, or in the western coastal area of the Netherlands (Walvius, 1961). This seems to confirm the hypothesis of Van der Waals (1972: p. 162, Abb. 61) that such antler implements are not present in the western part of the Netherlands.

Verlinde (1982) describes a (supposed) T-shaped axe collected in the river IJssel near Deventer with part of the wooden shaft still in the shaft-hole. The find comes from sand dredged up from the foreshore of the river IJssel near the confluence of the Koerhuisbeek, a small stream, with this river. The wood was used for C14 dating and gave a date of GrN-10, 459/3050 \pm 180 B.P. This date seems rather late in the light of the other datings. The object (Verlinde, 1982: p. 210, Abb. 1) is, however, not a T-shaped axe but a beam axe, (the *Mittelstangen* Axt of Verlinde comprises both

T-axes and beam axes, pers. comm. Verlinde) so that the late date is not surprising.

Taken together the evidence points to a late Mesolithic-Neolithic date.

3.3.3.6. Base-axes

Type I. Base-axes were probably manufactured and in use for a long time (Elzinga, 1962). They are unsuitable for dating the Spoolde complex. The combination of base-axes and T-shaped axes was, according to Troels-Smith (1966, quoted by Van der Waals, 1972), typical for the Dyrholm II-phase of the Ertebølle Culture in South Scandinavia. Recently, a base-axe was found near the Koerhuisbeek (Verlinde, 1982) with the wooden shaft still preserved in the shaft-hole. C14 dating of GrN-10,460/2820 \pm 70 B.P. Another axe with a piece of wood still in the shaft-hole was dredged up from the river Maas near Roermond in the province of Limburg (Bloemers & Willemse, 1980-1981). The wood was beech wood. Since the beech probably did not appear in the Netherlands earlier than c. 2000 B.C., this axe cannot be older than that date, if we exclude the possibility of importation at an earlier date from a more southern region.

Type II. This type has not yet been described, but the Spoolde finds may be similar to an antler tool found near Schiedam in 1955 (Modderman, 1955). Although the surface of this latter object is not smooth like the Spoolde examples, the position of the roughly round shaft-hole is very similar to the Spoolde tools, medial-lateral in the proximal part of the antler, parallel to the base of the antler. It was associated with a piece of pottery that resembles Swifterbant pottery. According to Van der Waals (1972) this tool could be older than the Vlaardingen Culture with which it was correlated by Van Regteren Altena *et al.* (1962), and would fit in better with an older period. At the sites of the Vlaardingen Culture no similar tools were found; neither do they occur at the Hazendonk (Walvius, 1961; Van den Broeke, 1978).

3.3.4. C14 dating

An attempt was made to date the antlers by C14 and three antler fragments and a T-shaped axe were given to Prof. Mook of the C14

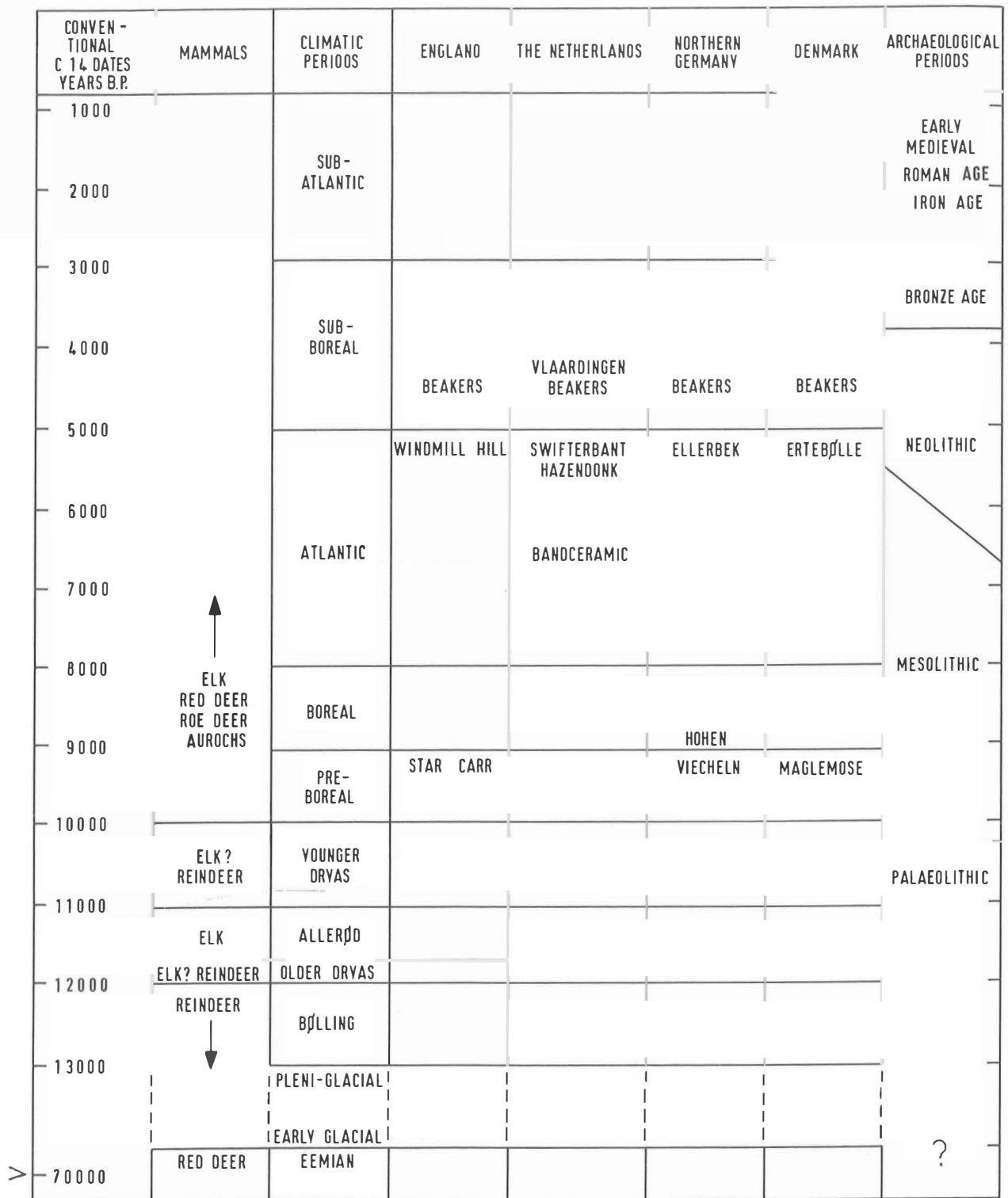


Fig. 131. The climatic sequence, C14 dates B.P., mammal species and archaeological notations (partly adapted from Louwe Kooijmans (1970-71) and Zagwijn & Van Staaldin (1975)).

Laboratory. At first a tine was used to establish whether the antler contained enough nitrogen for the C14 dating to be effective, nr. ZR 1962/III²⁹. The second fragment was part of a crown with two tine bases, nr. ZR 1962/III⁹¹: GrN-7988/8125 \pm 70 B.P. The third fragment was also part of a two-tined crown with no real traces of human working but covered by gnawing marks of a small rodent. This piece was given a special treatment, nr. ZR 1962/III⁸⁹: GrN-8590/7110 \pm 70 B.P. Both samples give a date which was considered too old. As Mook (see below) pointed out, the antler fragments were treated with a preservative, which may give too early a date. To be sure that the early date was caused by the preservative, a third antler was dated; this time a T-axe which can be dated, to a certain extent, archaeologically. This piece was treated more rigorously, nr. ZR 1962/II⁶⁹: GrN-8800/6050 \pm 30 B.P. This date is still earlier than the expected one — c. 3400 B.C. — within the expected range (see also Appendix W.G. Mook).

3.3.5. Summary

In summary it can be said that it is difficult to give an exact date for the Spoolde antler and bone tools and antler fragments. Most of the tools, however, can belong to the Late Atlantic habitation period of the Swifterbant settlements in the polder Oostelijk Flevoland.

The shafted axes or elk antler adzes may belong to the Late Preboreal but can be dated also in the Late Atlantic. The base-axes type I can be found in the Late Atlantic but also in younger periods, while the T-shaped antler axes have a Middle-Late Atlantic dispersion — a date which the last and best C14 date, viz 6050 \pm 30 B.P., seems to corroborate. Remains of red deer and elk can be expected to be found together from the (Late?) Preboreal onward. Only the one fragment of a reindeer antler must be from an earlier period. The majority of the finds can also have a Late Atlantic date (fig. 131).

4. DISCUSSION

It may be said that the Spoolde bone and antler

tools and objects are not a hoard in the true sense, though the possibility that most of the objects belong together has to be kept in mind. It is also possible that they did not belong together but found their way by different routes to the foreshore area of the river IJssel where they came to light more than 20 years ago. The same can be said of the fragments of elk and red deer antlers. The one fragment of reindeer antler cannot be of the same date as the majority of other finds.

Even if most of them could belong together it is still impossible to say why they were together. They may have belonged to a settlement, but if so, we should also have found other settlement material, e.g. bones, flints, pottery, wood, *etc.* As far as I know this material was not found, at any rate it was not collected.

In this connection it is plain that most of the tools were really used; heavily worn, repaired or so damaged that repair and further use seemed to be impossible. Only the tapering beam axes appear undamaged, and the base-axes type II are undamaged.

This brings us to a second possibility concerning the nature of the objects, namely that they were a kind of offering or votive gift. Since the majority of them are much used tools this does not seem a good explanation to me. This feature, however, leads us to a third possibility; that they indicate a place of some particular activity. In that respect we should remember the case of Breść Kujawski in Poland where no used T-antler axes were found in the settlement but only fabrication waste and unfinished axes! The finished tools seem in this case to have been taken outside the settlement. What kind of activity the Spoolde tools might represent is, however, difficult to say since we do not know for which purposes the tools were used.

Although most of the objects had been used, waste from the fabrication of tools was also found, and this waste points to the actual fabrication of the tools. This could have taken place in a settlement, which brings us back to the first possibility.

It will not be possible, however, for any of these four possibilities to be either confirmed or contradicted. Since it is not certain that the Spoolde antler tools and fragments belong together, it is not necessary to make counts

of naturally shed and unshed antlers which in this case can reveal nothing about the importance of hunting red deer or of collecting antlers in former times.

Since it has become clear that little is known about the purposes for which the antler tools could have been used, it would be necessary, firstly, to find out by experiment how the tools were really made, or could have been made, and, secondly, to see for what purposes they could have been used. Both fabrication and use will cause visible marks which can be compared with those of the prehistoric objects.

After the manuscript was finished the following articles appeared which are not considered in this paper:

- Bosscha Erdbrink, D.P., 1982. Red deer Keratic artefacts in Dutch collections. *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek* 32, pp. 103-137.
- Werning, J.A., 1983. Die Geweihartefakte der neolithischen Moorsiedlung Hüde I am Dümmer, Kreis Grafschaft Diepholz. *Neue Ausgrabungen und Forschungen in Niedersachsen* 16, pp. 21-187.

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7. KEYWORDS

The Netherlands, Spoolde, De Gaste, IJsselmeerpolders, Swifterbant, Neolithic, reindeer, elk, roe deer, red deer, antler tools.

APPENDIX: C14 dating

W.G. Mook

The efforts which were made in dating the antlers are an illustrative example of the problems encountered if the bone material has been treated for conservation.

Generally, the modern preservatives appear to be synthetic products. This means that the carbon content originates from fossil carbon (oil industry), which does not contain carbon-14. Therefore, if the preservative is not completely removed before dating, the resulting age will be too high. A remaining contamination of 1 % of the total sample increases the age by 80 years, 10 % by 850 years, 20 % by 1800 years and 50 % by about one half-life = 5568 years, independent of the true age of the sample.

In principle, the preservatives are soluble in organic solvents as acetone and ethylacetate.

A first sample (GrN-7988) was directly treated with hydrochloric acid, according to our standard procedures, after the outer layer of the antler had been removed. The resulting age of 8125 ± 70 B.P. is considered to be at least 2000 years too old, which is equivalent to a remaining fraction of preservative of over 20 %.

A second piece of antler (GrN-8590) was treated with acetone during 14 days, after which the sample was crushed and treated with HCl. According to the Longin-method the remaining collagen (± 17 g) was dissolved in boiling water and dated. The result of 7110 ± 70 B.P. is still too old, however, less than the first sample. The insoluble residue (± 8 g), which is considered to contain the preservative still present, resulted in an age of $12,800 \pm 150$ B.P. (GrN-8605).

A third sample (GrN-8800) was treated more rigorously. After the outer layer of the antler had been removed, the sample was crushed and subsequently treated with ethylacetate during 48 hours. After the HCl treatment for removal of the bone apatite and other inorganics, the sample was subjected to the treatment with acetone. After the following Longin treatment a C14 age of 6050 ± 30 B.P., which is well within the expected age range.



Plate 1. Scratches made on the cortex by carving.



Plate 2. Picking away of the cortex.



Plate 3. Cutting and breaking of an antler.



Plate 4. Waste fashioned into an axe.

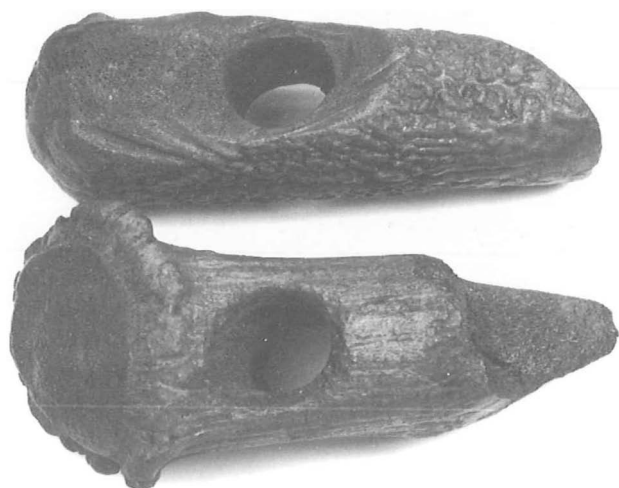


Plate 5. Shaft-hole carved (above) (ZR 1962/II⁵⁶) or picked (under) (ZR 1962/II³⁷) out of the cortex.



Plate 6. Picks from red deer antler from the Polder.

Plate 7. Picks from red deer antler from Spoolde (ZR 1962/III¹¹⁶ (2x)).



Plate 8. Damaged type I base-axes.



Plate 9. Undamaged type II base-axes.



Plate 10. T-shaped axes with broken shaft-hole.