The broken beauty of Benschop

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A Middle Bronze Age spearhead with wooden shaft and wooden peg

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Keywords: spearhead, Bronze Age, wooden shaft, wooden peg, dating, object biography

Trefwoorden: speerpunt, bronstijd, houten schacht, houten borgpen, objectbiografie

Introduction

On the 14th of November 2020, the second author was metaldetecting on a ploughed field in the village of Benschop. Whereas most of the finds were rubbish, one of the signals proved to be a large fragment of a Bronze Age spearhead (fig. 1). The find was reported to the appropriate provincial authorities and eventually the first author became involved. Thankfully, the finder had not thoroughly cleaned the inside of the artefact yet, which meant its contents could be studied under laboratory conditions (*infra*).

Description

The Benschop spearhead measures 7.1 cm in length, but will originally have been 8-9 cm in length, as the top parts of the blade and shafthole are missing. A longitudinal crack at the blade-shaft interface is visible on the front right blade wing, and it extends as a shallow crack into the blade. The maximum width across the blade is 3.7 cm and the socket width is 2.3 cm. In the socket, two diametrically opposed pegholes are visible. This helps to classify the Benschop find as a SPP (spearhead, pegged) of generic West-European type. What sets the Benschap spearhead apart amongst the wider corpus of similar spearheads, is the small overall size and the angular morphology at

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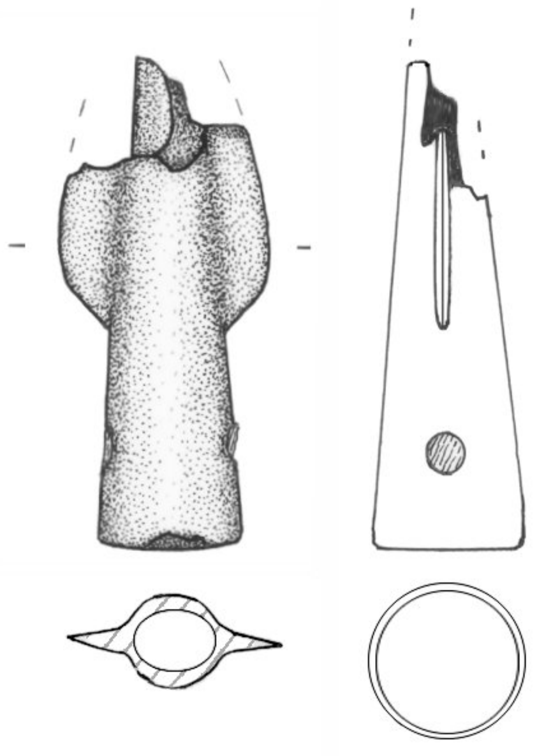


Figure 1. The bronze spearhead of Benschop. Top: photographs of front, back and side (G. van Oortmerssen, Groninger Institute of Archaeology). Bottom: drawing (H. Steegstra, Groninger Institute of Archaeology).

the point where the lower blade edges meet with the socket. Also, the breakage pattern (with intact socket and lower part of blade, but absent top part of blade) is rare. No signs of obvious recent impacts (*e.g.* ploughing, spade marks, bending/warping, tears) are visible. The breaks are crisp but patinated and show oxide formations – suggesting they date to antiquity rather than reflect modern damage.

Landscape context

The Benschop spearhead was found in the central Dutch river area, in the topsoil (25 cm depth) of an agricultural field consisting of sandy sediments (fig. 2). This landscape shows a stacking of former river systems, of which the Benschop and Blokland-Snelrewaard systems have affected the landscape most. It is clear from figure 2 that on the LiDAR altitude map (AHN) ample crevasse deposits can be seen in the floodbasins adjacent to the Blokland-Snelrewaard levee deposits. Most likely, the Benschop spearhead was originally left or deposited in a crevasse splay landscape that consisted of sandy-silty intercalations, alternating with more clayey floodbasin deposits. Small crevasse channels that terminate in the floodbasin are clearly recognisable on the LiDAR map. The darkgreen patina and limited corrosion pitting of the spearhead, suggests that it was in anaerobe conditions for most of its subsoil existence.

The Benschop river system functioned between *c.* 6220-4070 BCE and was thus long inactive before the onset of the Bronze Age (Berendsen & Stouthamer 2001, Appendix III-15). The Blokland-Snelrewaard fluvial system was active between *c.* 5290 and 4440 BCE. Near Lopik, the residual channel was dated to *c.* 2398-2206 BCE (GrN-7575; *op.cit.*, Appendix III-23) and floodbasin deposits of the Blokland-Snelrewaard fluvial system became covered in peat by *c.* 2868-2580 BCE (GrN-7955; *ibid.*). This means that around *c.* 2200 BCE, the higher but inactive levee deposits

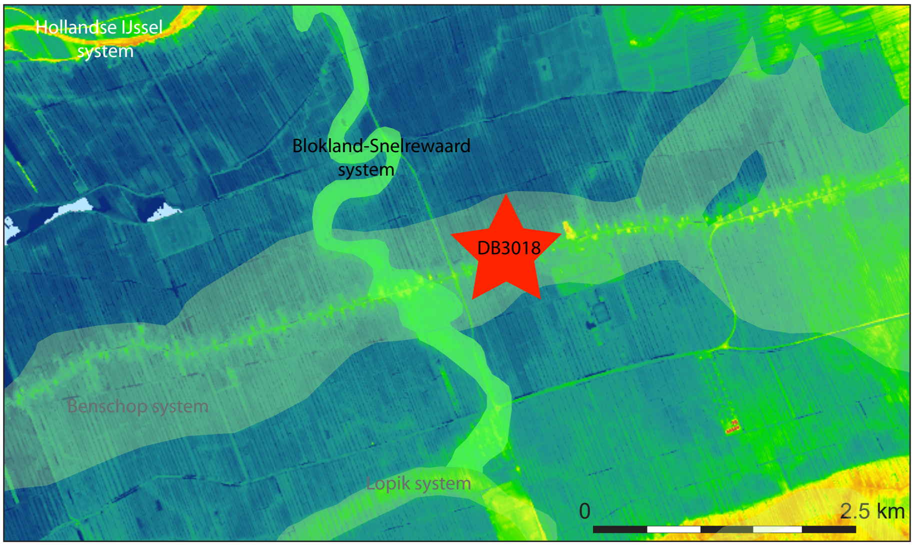


Figure 2. Location of the Benschop spearhead (DB3018) in relation to the Benschop and Blokland-Snelrewaard fluvial systems (after: Berendsen & Stouthamer 2001) and the present-day altitude (AHN; © Rijkswaterstaat / AHN).

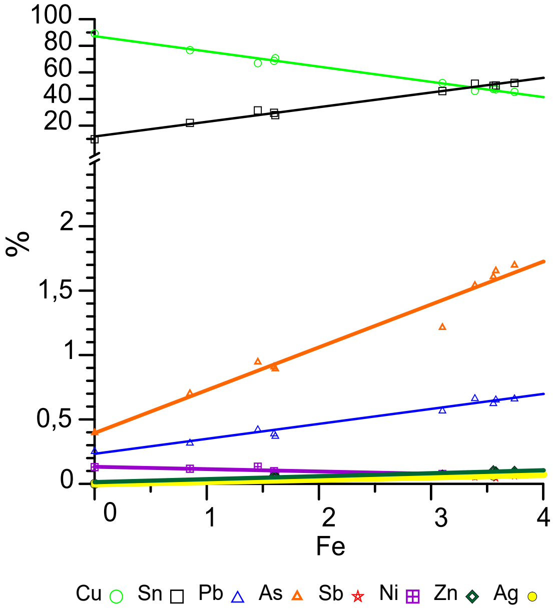
of the Blokland-Snelrewaard fluvial system may have been a favourable settlement location (*cf.* Arnoldussen 2008, 408). Moreover, the points where younger fluvial systems intersected older underlying levee deposits, were prone to crevasse formation (Weerts 1996, 54; Makaske 1998, 57; Stouthamer 2001, 144; Arnoldussen 2008, 38).

Bronze Age occupation of this landscape zone is to be expected, as at Benschop (boerderij 'Op 't Rietveld') charcoal from a vegetation horizon with prehistoric pottery was dated to *c.* 1330-1010 BCE (GrN-5356: Vogel & Waterbolk 1972, 94). At 1.8 km to the south of that location, eight Bronze Age sherds were found in 2008 at Lopik – Bedrijfsweg (Warning 2008). In terms of prehistoric bronzes, the region is relatively empty beside the spearhead here discussed. At Vianen a Late Bronze Age spearhead was recovered from the river Waal (DB911) and at Bodegraven a spearhead was recovered from the river Rhine (DB2001). At Bodegraven – Weypoort a 42.5 cm long basal-looped spearhead was dredged-up (DB1903; Verhart 1993, 51). These three spearheads are however all found at distance of 6-15 km from the Benschop example, and cannot be used to postulate local habitation.

Composition

In order to determine the composition of the bronze alloy, a series of pXRF measurements were undertaken by Bertil van Os of the National Heritage Agency (RCE) of the Netherlands. The measurements were taken with a Thermo Scientific NitonXL3t, that analyses up to 25 elements simultaneously (spanning the elemental range from sulphur (atomic nr. 16) to uranium (atomic nr. 92) and which can moreover detect lighter elements (in the range of magnesium (atomic nr. 12) to chlorine (atomic nr. 17)) as well. Locations were measured in 'Electronic Mode' for a duration of 30-69 seconds. For calibration, factory standards and reference samples were used. In total, 9 measurements on the outside of the spearhead were taken, but from the inside of the socket a sample of the uncorroded alloy was taken as well (sample preparation and restoration by G. van Oortmerssen). This sample was analysed as well (four repeated measurements, exposure times of 74-120 seconds) to determine the effects of surface corrosion on the pXRF results (see discussion and references in Nørgaard 2017, 102).

The Benschop spearhead shows a strong correlation of alloy constituents versus iron (fig. 3). This correlation is caused by the fact that in a depositional context, more soluble elements become overrepresented in the corrosion layer compared to the original alloy. As iron is not part of the alloy, the iron enrichment is correlated to the intensity of this corrosion effect. By extrapolating the observed data towards a hypothetical 'zero iron' composition, the base alloy can be approximated (fig. 3, right). The values obtained from the drilled (unpatinated/non-oxidised) sample are shown on the Y-axis (fig. 3, left). These both validate the extrapolation and provide the most reliable compositional data. The Benschop spearhead is thus created from an alloy of mainly copper and *c.* 9.8 %wt tin, with only minor additions of arsenic (*c.* 0.4 %wt), lead (*c.* 0.26 %wt) and nickel (*c.* 0.13 %wt). This suggests that an oxidic ore (*e.g.* malachite gossan) may have been used for its base materials. The ratios and values of arsenic to nickel, and silver to antimony are comparable to those of the Pentrywyn copper frills 1.2 km from the Great Orme mine (Williams & Le Carlier de Veslud 2018, 1183 fig. 3; 1181),



Element	% wt
Cu	89
Sn	9.8
As	0.40
Pb	0.26
Ni	0.13
Ag	0.06
Zn	0.04
Sb	0.02

Figure 3. Results of the pXRF analysis: a correlation plot of main alloy constituents (y-axis) versus iron (x-axis), the intersection points of the y-axis at zero represents the calculated original percentage in the alloy.

hinting at an insular origin of the ore. This alloy composition is also known for two spearheads in Twente (Junne (DB1036) and Witharen: (DB1037; Butler 1987, 10, fig. 1)) an unpublished dagger blade from Scheveningen and a knobbed sickle fragment of the Lisse – Veeneburg hoard (DB418; Arnoldussen & Steegstra 2016, 79). The Witharen spearhead is datable to the 16th or 15th century BCE (Arnoldussen *et al.* 2012,123) and the Lisse – Veenenburg hoard is dated to *c.* 1325-1200 BCE (Arnoldussen & Steegstra 2016, 79). Remarkably, for the Treboul spearheads of both Witharen (DB1037), Berlicum (DB2936) and Goor (DB2993), the use of Welsh ores has also been suggested.

Beauty is on the inside: the shaft contents

Remarkable, despite the broken state, the shafthole of the spearhead appeared to have preserved some of its original content (fig. 4). Not only was a tapering section of the original shaft preserved (remaining length 3.9 cm), but also a part of the wooden peg used to fix the spearhead onto the shaft had been preserved.

The wood fragments were handed over to wood identification specialist Nicolien Bottema-Mac Gillavry, for identification of the species used. The larger wood fragment consisted of the tapered end of the shaft (3.4 x 1.1 cm). A smaller fragment was first examined under incident light because the wood was very brittle and this condition made it difficult to take thin sections (Adapted metallurgic Olympus microscope, with objective lenses for 5x, 10x and 20x magnification). However, because the surface was decayed and without distinguishable features, it was necessary to find or prepare

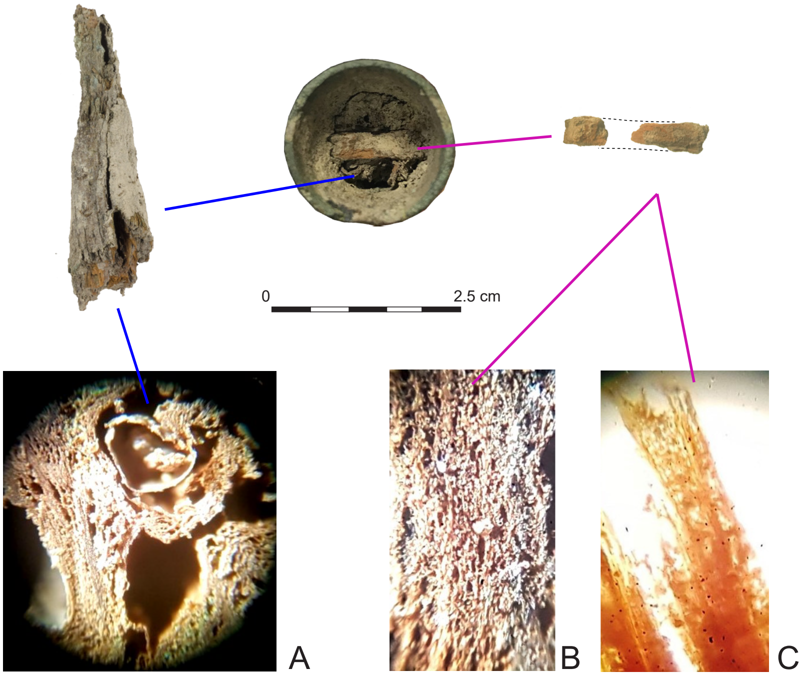


Figure 4. Wood preserved in the Benschop spearhead. Left is shown the whittled fragment of the shaft (photo: G. van Oortmerssen, GIA), and to the right is a reconstruction of the wooden peg (two fragments remaining; photo S. Arnoldussen, GIA). The lower images show microscopic details of the shaft (left) and peg (right). Left/A: Shaft wood, Ash (Fraxinus excelsior), transversal plane: ring porous, early wood vessels large, rays 2-3-seriate (Photo: N. Bottema, 2022). Right: Peg wood. Malinae, either hawthorn (Crataegus laevigata) or crab apple (Malus sylvestris). A: transversal plane, diffuse porous, pores solitary, C: tangential section, rays 2- and 4-5-seriate (photo N. Bottema, photo editing F. Bottema, 2022).

fresh planes. By wetting a small part, it was possible to slice off some material and get a relatively clear picture of the transversal (fig. 4, lower left: A) and radial planes. Although the wood was much compressed and wavy it was possible to observe large earlywood vessels and rays of two to three cells wide on the transversal plane. Because the sample tended to split into narrow slivers, it was nearly impossible to get a good view of the tangential plane, but some three-seriate rays were observed. Based on the combination of large early wood vessels and bi- and triseriate rays, in addition to some other microscopic characteristics, the wood was identified as ash (*Fraxinus excelsior*). Due to its strength and flexibility, ash was a popular choice for spear shafts in the bronze age as well as in later periods, but hazel was sometimes utilized as well (Drenth & Bouwma 2015, 55 tab. 1; Arnoldussen *et al.* 2020, 475).

The two small fragments surmised to be parts of a peg, were not cylindrical. One fragment was flat (0.95x0.45x<0.1 cm), the other fragment was thicker and angular (0.55x0.35x(0.2-0.3 cm). The first fragment was brittle and broke when handled. Therefore, the second fragment was boiled for 20 minutes, after which it was possible to get a relatively good transversal view. Under incident light, this showed that the wood was diffuse porous with mostly solitary pores (fig. 4, lower right B), which meant that the wood used for the peg was different from the species (ash) that was used for the shaft. The rays were one- to three-seriate, but some four to five-seriate parts could be seen as well. The longitudinal planes were observed under incident light and boiling the wood even made it possible to take some thin sections of the tangential and radial planes. In tangential view, parts of one to five cells wide rays were visible (fig. 4, lower right C). A great amount of thin fibres was present, often in bundles, but their pitting could not be observed. At one spot some intervessel pits were visible, and here and there elements sported some helical thickenings. In radial view the rays appeared to be homogeneous. The condition of the wood made it impossible to observe more fine details. When the observed characteristics were loaded into the online Inside Wood database for Modern Hardwoods (InsideWood, 2004-onwards), only two species met the criteria, namely *Malus sylvestris* (wild apple or crab apple) and *Crataegus laevigata* (Midland hawthorn). As these species are difficult to distinguish, it is customary to identify them as Malinae type Malus, Crataegus and Pyrus. Both species were already present in the Early Bronze Age and especially hawthorn would have been a good candidate for a fixing peg as its wood is very hard and durable.

The usage of wooden pegs is often assumed, but rarely documented. For the 236 known Bronze Age spearheads with pegholes listed in the Netherlands Bronze Age Catalogue (NBAC) database, fourteen fragments of wooden shaft are listed but this is the only case where a wooden peg has been identified. A miniature spearhead from Gelderland (DB6; Museum Apeldoorn, Inv.No. 66) showed an iron (!) peg, and bronze pegs were reported for the ash shaft of the Heeswijk-Dinther spearhead (DB912; Verwers 1990, 140-141, *cf.* Fig. 6) and the spearhead of unknown provenance in the Legermuseum Leiden collections (DB1117; Inv.No. Caa-20). The scarcity of non-organic pegs for spearheads that *had* their organic shaft preserved, indicates that most will have been organic (*i.e.* wood, antler) and have decayed or have gone otherwise unnoticed. For the (majority of) spearheads for which no wood of their shaft remained, the absence of organic pegs (and shafts) can be either related to decay or removal prior to deposition.

A fragment of the main shaft wood was sent in for radiocarbon dating. It returned an age of *c.* 1422-1286 BCE (GrM-28797: 3092 ± 24 BP). This places the Benschop spearhead in the final decades of the 15th century BCE up to the early 13th century BCE (fig. 6). Together with the spearhead of Heeswijk-Dinther (Verwers 1990, 140-141) it is one of the few examples of spearheads reliably datable to the Middle Bronze Age-B.

Its broken state

As the Benschop spearhead was found on a field that has been subjected to mechanized agriculture, it would be reasonable to suspect that its fragmented state was due to being struck by farm implements such as a plough. However, we know that bronze artefacts were occasionally also destroyed prior to deposition (*infra*). Could this also be the case for the Benschop spearhead? Detailed study of the break patterns showed no (a) external pressure point or fissure track, and (b) no bending or warping indicating a shear zone. Instead, a major crack (at the interface of blade and conical shaft section) and minor cracks (radiating from the aforementioned crack across the blade's surface)

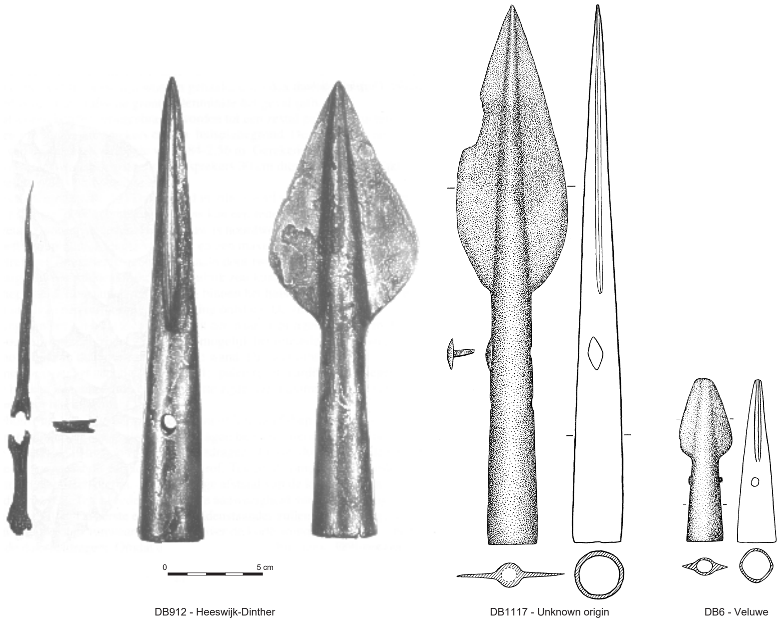


Figure 5. Later Prehistoric spearheads from the Netherlands with preserved pegs.
DB912: Heeswijk-Dinther, bronze tubular peg (from: Verwers 1990, 140-141 afb. 10),
DB1117: Legermuseum Leiden, Inv.No. Caa-20 (drawing Groninger Institute of Archaeology),
DB6: Museum Apeldoorn, Inv.No. 66 (drawing Groninger Institute of Archaeology),
all to same scale.

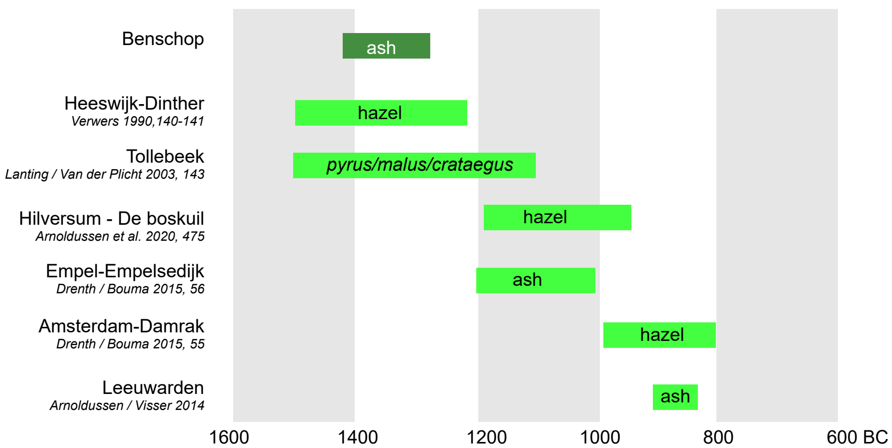


Figure 6. Overview of spearheads dated by wood of their shaft (from Arnoldussen et al. 2020, 476, fig. 6, with additions).

were observed under the microscope (50x magnification). Also, at the location of the major crack – and in a few locations elsewhere on the blade – dark organic patches with linear (cellular) structures were visible (fig. 7). The texture and sometimes shiny outlook of these organic patches suggest the presence of charred wood. This indicates that in any case, the Benschop spearhead was deposited in a charcoal-rich environment. The major and minor cracks, however, suggest that the spearhead itself was exposed to a heat source prior to, or upon depositioning. If the Benschop spearhead was placed in a fire (open fire or smithy?) and became brittle due to heat stress cracks, this could explain why it would break without any tears, warping or visible impact. It is however difficult to determine *when* exactly its top was lost: already in antiquity or in modern times due to the plough? The even and well-developed oxidation patterns at the breaks, could suggest the former.

We know that in the Bronze Age, bronze items could be scrapped and fragmented in order to facilitate remelting (*i.e.* fitting into the crucible). For example, the Voorhout (Fontijn 2008, 6) and Drouwenerveld hoards (Butler 1986, 135-137; Arnoldussen 2015, 21) appear to reflect (parts of) imports of scrapped bronze intended for the crucible. In this light fragmentation of bronze items makes sense, and it is known that heating bronze objects helps in their fragmentation (with crisp breaks, rather than tears, or deformations; Knight 2019, 254-256). Temperatures in the range of 100-600 °C effectively help fragment bronze items (Knight 2019, 267). The presence of wood inside the shaft however is a paradoxical observation (as this wood showed no signs of charring). Smiths are careful to avoid polluting the smelt with impurities, suggesting that removal of the wooded shaft *prior* to scrapping and smelting would be the logical choice. However, both the preserved peg and shaft wood suggest that the Benschop spearhead entered the ground with wood in place. Several scenarios are possible: perhaps the shaft helped to handle the heated spearhead in the process of scrapping, but the wood was never removed from the socket, or perhaps the destruction of the spearhead was not related to intended recycling.

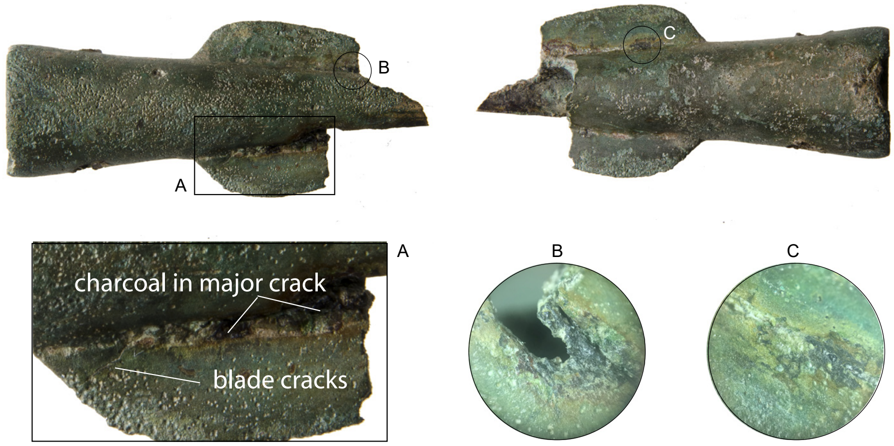


Figure 7. Locations of cracks and black organic patches (charcoal?) on the Benschop spearhead.

Throughout the Bronze Age, bronze items were sometimes 'decommissioned' by rendering them functionally inapt or fragmenting them (*cf.* Knight 2019, 567-569). For these items, deposition in their defunct state – rather than revival through the crucible – was the intended biography. For example, the Sögel-Wohlde blade of Echten (Van der Sanden & Arnoldussen 2017, 12) and the *Griffplatten* sword of Werkhoven (Fontijn *et al.* 2012, 210) both appear to have been left in watery contexts after being deliberately and carefully bent. For the Late Bronze Age spearheads of Bloody Pool (Knight 2019, 257 fig. 4), destruction as part of deposition has also been argued (Brück 2015, 41), suggesting that we should keep an eye open for this in the Netherlands as well.

Although several examples of broken spearheads are listed in the NBAC catalogue (fig. 8, but also DB2955; DB3052), only hands-on macroscopic and microscopic study of their fragmentation patterns can determine whether any of these were deliberately fragmented. It is only due to the beautiful preservation conditions of the Benschop spearhead that such clues have been preserved. The combined observations suggest that (a) the Benschop spearhead was exposed to heat (cracks), (b) its shaft was not emptied-out of wood, (c) it was in contact with charcoal prior to or upon deposition, (d) lost its top part at some point, and (e) it was deposited in a sufficiently waterlogged environment to have preserved both shaft and peg wood. Taken together, these observations suggest that the Benschop spearhead was deliberately fragmented – as an act of decommissioning – after being heated, after which it was placed (with its shaft, or with the shaft snapped-off below the spearhead) in an anaerobic (wetland) setting. The causes for such decommissioning could be manifold but are ultimately unidentifiable. Rites of passage for the owner, funerary rituals or sacrifice after martial usage are all plausible scenarios (*cf.* Nebelsick 2000; Fontijn 2003, 230-232; Rezi 2011; Mörtz 2018). Whichever motivation was at play, it is clear that the Benschop spearhead was bound to be broken.

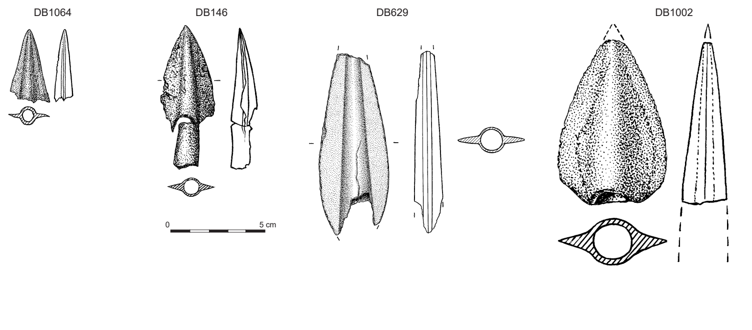


Figure 8. Examples of broken spearheads in the NBAC catalogue (for none of these the intentionality and cause of breakage has yet been determined; Drawings Hannie Steegstra (DB629) and Groningen Institute of Archaeology).

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METAALTIJDEN 9

BIJDRAGEN IN DE STUDIE VAN DE METAALTIJDEN

REDACTIE:
J. VAN DER LEIJE, E.H.L.D. NORDE, B.J.W. STEFFENS & K.M. DE VRIES

STICHTING METAALTIJDENONDERZOEK NEDERLAND