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A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany

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Chance discoveries of weapons, horse bones and human skeletal remains along the banks of the River Tollense led to a campaign of research which has identified them as the debris from a Bronze Age battle. The resources of war included horses, arrowheads and wooden clubs, and the dead had suffered blows indicating face-to-face combat. This surprisingly modern and decidedly vicious struggle took place over the swampy braided streams of the river in an area of settled, possibly coveted, territory. Washed along by the current, the bodies and weapons came to rest on a single alluvial surface.

Keywords: Germany, Bronze Age, warfare, conflict, weapons, arrowheads, wooden clubs, trauma

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**Introduction**

From c. 2200 BC onwards, the material culture of Central Europe saw an increase in the production of weapons such as axes, halberds, daggers and — later on — swords. Without doubt these were prestigious objects, but at the same time wear-traces on swords indicate their true use as weapons (Kristiansen 1984, 2002). Further information on the belligerent nature of Bronze Age society is provided by settlement structure. In Central Europe, the first hillforts and fortified settlements were constructed in the Early Bronze Age (Czebreszuk et al. 2008; Kneisel et al. 2008) with increasing evidence for hillforts from the later Lusatian and Urnfield cultures (e.g. Rind 1999; Abels 2002). In northern Germany and southern Scandinavia, reliable evidence for fortifications seems to be unavailable before the Late to Final Bronze Age (e.g. Kuhlmann & Segenschneider 2004: 70) with a possible exception in north-western Germany (Veit & Wendowski-Schünemann 2006). A similar situation is reflected in the evidence from Britain (Thorpe 2006: 157).

These various lines of evidence indicate an increasing incidence of interpersonal violence and conflict. But while some authors characterise the Bronze Age in the north as a stratified order with a warrior aristocracy (Vandkilde 1996: 259; Fyllingen 2003: 40), until now skeletal remains have not shown a significant frequency of injury or violent death (Peter-Röcher 2006, 2007). Here we present new evidence from a river valley in north-eastern Germany, where human bones and weapons can be interpreted, for the first time, as signs of Bronze Age group conflict.

**The finds**

Since the 1980s, the Tollense Valley in Mecklenburg-Vorpommern has produced a remarkable number of bronze objects (c. 70), recovered mainly from dredged river sediments in a section c. 3km long (Figure 1). Among the finds are tools and weapons such as knives, several arrowheads and spearheads, adzes, a dagger blade and a small sword fragment. Ornamental objects are also represented by two fibulas, various pins and a decorated box (Gürteldose) (Figure 2).

From time to time, human remains have also been found in the valley and by the 1990s numerous skulls had been registered by the heritage service. Among the human remains, recovered in 1996 by amateur archaeologist R. Borgwardt, was a right upper arm bone with a Bronze Age flint arrowhead embedded in the shoulder joint. Borgwardt also identified a wooden club in its original position close to the bones. Soon afterwards, test trenches at the site documented a consistent layer c. 1m below the ground surface, containing clusters of human and animal bones in fine-grained, fluvial sediments (Figure 3). Most of the animal bones were identified as horse, representing a minimum of two individuals. A human skull with a large fracture in the frontal bone provided additional evidence for heavy violence (Figure 4). In 1999 Borgwardt also recovered human remains in connection to a second wooden weapon.

In 2008 D. Jantzen and T. Terberger initiated a research programme at the site, carrying out investigations by test excavation and diving, and obtaining data on human pathology and the geological and botanical sequence (from 50 cores). This was supported by a series of AMS radiocarbon dates.
Figure 1. Map of the Tollense Valley in north-east Germany. The valley section with human remains found in secondary positions is marked in light green. Large black dots indicate several bronze finds.
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Figure 2. Bronze finds from the Tollense Valley: 1–2 & 4) spearheads; 3) arrowhead; 5–6) pins (Ulrich 2008); 7) adze; 8) box; 9) sickle; 10) fibula of Spindlersfeld type (Schoknecht 2000). Scales: 1) 1:2; 2–8) 2:3; 9) 1:3.
Figure 3. The find layer in the test trench excavated in 1996. Note the mixture of human bones and the two long bones found close to the river in anatomically correct positions (photograph: Ch. Jantzen).
The most unusual finds so far are two wooden clubs found only a few metres apart. The first weapon is c. 0.73m long, it has a thickened end and looks similar to a baseball bat (Figure 5.1). The second club is also made of a single piece of wood (c. 0.65m long) and has a carefully smoothed and slightly bent handle. The head (length 175mm, diameter 50mm) is of a similar shape to that of a croquet mallet (Figure 5.2). The first artefact is made of ash wood (*Fraxinus excelsior*), which is well known for its strength and elasticity. The second is made from sloe (*Prunus spinosa*; identification in both cases by St. Kloos, Kiel).
is no doubt that such hammer-like, wooden weapons could cause heavy lesions. Wooden clubs are sometimes reported from bogs in northern Germany. For example, clubs have been found at Wiesmoor and Berumerfehn, both located in the district of Aurich, lower Saxony, which have rounded heads and are c. 0.65–1m long (Maier 1972; Schwarz 2005). The club from Berumerfehn is dated to the Neolithic (c. 2700 cal BC) and was repaired with a leather strip, suggesting that the weapon had a longer period of use and had some value attributed to it. Further examples are known from the Neolithic and/or Bronze Age pile dwellings from Switzerland (Messikommer 1913: 60; Winiger 1981: 180). Wooden clubs of various forms are also reported from ethnographic contexts. They were used, for example, by Native Americans for hunting and warfare (Taylor 2001: 16). The Tollense Valley, however, represents the first prehistoric site in Central Europe where such weapons have been found in association with human bones.
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Three flint points have so far been found at the site. The first one, embedded in the arm bone (above), is a typical Bronze Age specimen with a concave base. It was flattened by pressure flaking. Two further flint arrowheads were found during excavation among wooden remains together with several human bones. It is also possible that bronze arrowheads recovered from dredged sediments belong to the find layer. The projectile points testify to the importance of the bow and arrow in Bronze Age combat.

Human remains

Including the most recent finds, human remains of around 100 individuals have been recovered from the valley; 38 individuals being represented only by skulls. There is a strong dominance of males, mostly young adults between 20 and 40 years, while young women and children are present only in small numbers (Figure 6). The skeletons were dislocated and widely scattered.

Of 83 individuals analysed, lesions were observed in eight. In the first case, a heavy blow to the frontal bone smashed the skull of an individual (Figure 7a). The position and shape of the lesion suggest that the blow proved fatal. The second skull shows a lesion on the frontal bone caused by blunt force (Figure 7c). In this case the blow was less strong but, as signs of healing are missing, it is probable that the individual was killed by further injuries. A third skull exhibits a lesion on the right parietal bone (Figure 7e). This small hole was
probably caused by an arrowhead shot from a distance. First signs of healing suggest that the individual survived for only a few days. A fourth skull has a lesion on the left temporal bone, probably caused by a spearhead or arrowhead (Figure 7f). The projectile point penetrated the bone but traces of regeneration of the bone indicate survival for two to five years. A fifth skull shows three lesions with signs of healing which indicate survival for a longer period of time.

Lesions on postcranial members have been observed in three cases. The arrowhead in the right humerus is still embedded in bone by more than 22mm (Figure 7b). Its position indicates a high velocity shot aimed either at a person who was already down, or from a lower position at the back of a person. Signs of healing at the entry point of the arrow indicate that the individual was involved in other violent combat some weeks before death. A further lesion, probably caused by an arrowhead, was identified on a pelvis and here signs of healing indicate a longer period of survival. By contrast, a femur provides a fresh bone fracture that may have been caused by a fall off a horse (Figure 7d).

In conclusion, analysis of the human bone material indicates a minimum number of injured individuals (counting only skulls with lesions) of c. 6%. If we calculate every injury as representing one individual (including lesions on postcranial bones) the rate rises to c. 9%. Considering only the skulls, it can be seen that 5 out of 38 specimens show lesions. If we only calculate lesions with no or limited signs of healing, the rate drops to 3 out of 38 skulls. About half of the lesions were received directly prior to death or indicate that the victim only survived for a few days or weeks.

**Context**

The Tollense Valley is of glacial origin, and the section under consideration is 250–500m wide. The valley is deeply cut into the morainic plateau which nowadays is used as pasture. Because of the low valley gradient, the Holocene transgression of the Baltic Sea raised the groundwater table upstream (Janke 2002) and induced the development of river valley marshes from c. 1200 BC onwards. Organic gyttja and fluvial sediment layers rich in molluscs, identified under peats and 1.5–4m below the ground surface, indicate back waters and abandoned fluvial channels. The river meandered in a corridor c. 100m wide close to its modern course, but in contrast to modern times the bed was flat and broad. According to botanical macro-remains the find layer developed in standing or slow-running water where submerged plants grew. It is possible that the sedimentation of the main findspot was influenced by a flood event. The neighbouring Bronze Age forests were characterised by oak, lime, elm and ash. In the marshy river valley alder and birch were probably the dominant species. The Bronze Age environment can be described as a partly open landscape that showed limited human impact. However, flax, barley, oat and wheat pollen indicate some farming activities.

The northernmost finds might have been transported some distance by the river, but diving surveys and test excavations have identified many objects in their original positions. For the moment we can report a spread of human remains embedded in sediments along a stretch of the river c. 1.5km long (see Figure 1). In the test trenches, the bones were found close to the modern river bed c. 1–2m below the ground surface. In the excavations,
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Figure 7. 3D scan of lesions. See text for descriptions.
the human remains were not preserved in their anatomically correct positions, but in some cases related bones were located close to each other. The test trenches provided no ordinary settlement find material, and no elements of graves such as paved surfaces, mounds or grave goods were identified in association with the human bones. One of the test trenches provided a wooden construction – probably a fish weir – but this structure belongs to later activities in the valley. There were also no indications of ritual activities, for example finds of bronze objects or pottery found in association with the bones. The stratigraphic indications strongly suggest that all of the material originated from the same layer (Figures 3 & 8). After decay of the bodies, the bones were moved slightly by taphonomic processes within the river and then deposited on the ground surface. Because small bones are partly preserved, the final deposition of the bones seems to have been accompanied by low energy water flow. The absence of carnivore damage indicates rapid embedding of the find material in sediment. On the other hand, two bone lesions, caused by arrows with first signs of healing, suggest repeated combat over several weeks. If our interpretation is correct, the potential main event(s) took place upstream close to the onset of the bone distribution.

**Dating**

Typological dating of the objects has been corroborated by conventional and AMS radiocarbon dates (Figure 9). Nine out of the 10 AMS results on human remains date
to 1200±40 cal BC and imply a single episode. Only one sample from an additional location was dated to around 150 years earlier. One of the wooden clubs provided an AMS date of c. 1340 cal BC (Table 1). However, the older AMS date on the wooden object might be affected by old wood effect and should be treated with caution. The relatively high $\delta^{13}C$ values (Table 1) do not necessarily indicate a marine diet. According to isotope analyses it is likely that the Tollense humans used C$_4$ crop plant (millet) for their diet (see similar examples in Bonsall et al. 2007) and if so, no reservoir problems should be expected. We interpret the AMS dates from various locations as a strong argument that most of the human bones found along the river belong to a single episode. The mean value of all dates on humans is c. 1230 cal BC which corresponds to Period III of the northern Bronze Age.

**Discussion**

Human remains with traces of violence do not represent a new element of the Central European Bronze Age (Keeley 1996; Carman & Harding 1999; Otto et al. 2006; Piek & Terberger 2006; Thorpe 2006: 153; Harding 2007; Weinberger 2008) but the Tollense site is possibly the first to provide convincing evidence for a battle. At the site of Wassenaar in the Netherlands 12 individuals, mostly young men, were buried in a grave pit at around 1700 cal BC. A flint arrowhead was found between the ribs of skeleton no. 10 and three strike marks on different skeletons suggested violent conflict in the Bronze Age of a ‘scale hitherto totally unexpected’ (Louwe-Kooijmans 1993: 1). The site of Sund in southern Trøndelag, Norway, provided evidence for a possible violent conflict or massacre in the Early Bronze Age. The remains of around 22 human individuals were excavated in a pit associated with animal bones (Fyllingen 2003, 2006). Seven adult individuals showed lesions on the postcranial skeletal material. The cuts were caused by bronze weapons and, in contrast to the finds from the Tollense Valley, no evidence for the use of arrows was found. The lesions of four individuals were healed and suggest the population was involved in repeated combat. The injuries of young men are interpreted as evidence of a way of life that included a ‘professional
warrior system’ (Fyllingen 2003: 36). Similarly, four or five human individuals killed by spears and cast into a ditch at Tormarton represent ‘the best skeletal evidence for Bronze Age combat in the British Isles . . . undertaken by relatively small war bands’ (Osgood 2006: 336 & 338).

At Velim-Skalka in the Czech Republic, human skeletons, parts of skeletons and single bones were found in ditches together with pottery and animal bones, and were interpreted as the remains of a raid or repeated combat (Harding et al. 2007), but there were other interpretations (Knüsel et al. 2007: 134). Repeated cut marks on the human bones found in pits and ditches that had been re-opened several times fit better within a ritual context (Harding 2000: 292; Hrálá et al. 2000; Outram et al. 2005; Peter-Röcher 2005, 2009; Ling 2009: 102).

None of these examples equate readily with the Tollense situation, and nor do the votive deposits of the later prehistoric periods, which are found in more restricted contexts, such as the Hjortspring find in the small peat bog on Als Island dated to the fourth century BC (Crumlin Pedersen & Trakadas 2003), or the well-known sacrificial sites of the Roman Iron Age such as Thorsberg, Nydam and Illerup Ådal (e.g. Bemmern & Hahne 1992: 60–69). Nevertheless, we do not want to rule out ritual activities altogether. Although belonging to northern Bronze Age Period III and connected to the time of the conflict, some of the c. 70 bronze objects recovered from the valley section may have come from hoards, for example, three sickles and some pins that were found close to each other. Bronze objects have been repeatedly recovered from river valleys in north-eastern Germany, but the bronze finds from
the Tollense Valley are outstanding in their number and indicate remarkable activities during Bronze Age Period III.

The region between the River Tollense and Lake Müritz is characterised by both bronze imports and local production (Schubart 1972; Rassmann 1993), and here the population participated in super-regional trade (Jantzen & Schmidt 1999). Rivers such as the Tollense were an integral part of the transport system. About 5km to the north, c. 35 burial mounds indicating intensive Early Bronze Age settlements and Later Bronze Age settlements were documented during motorway construction work (Saalow & Schmidt 2009) in sites adjacent to the Tollense Valley. It is interesting to note that written sources from the medieval period mention salt production in this location, and it is possible that salt springs already attracted people in the Bronze Age. However, there is no evidence for salt production in this period in north-eastern Germany.

The period around 1200 cal BC was characterised by a phase of climatic deterioration. From c. 1300–1200 cal BC the Alps saw the most intensive phase of Holocene glaciation (Löbben-phase; e.g. Schmidt et al. 2009: 91) and dendrochronological evidence points to a slightly younger maximum of cooler and wetter conditions (Bailey 1998: 52). There is little doubt that climatic conditions around 1200 cal BC caused general population stress, and may have provoked conflict. The transition to the Lausitz and Urnfield cultures and the related introduction of cremation graves reflect fundamental changes within Bronze Age society (Harding 1994: 304–305; Jockenhövel 2004–5; Falkenstein 2006–7). Sites such as Velim-Skalka and the Tollense Valley can be interpreted as the manifestation of these transformation processes and the evidence presented here will stimulate discussion on migration at that time (Harding et al. 2007: 152 & 159–60).

The number of individuals (c. 100) so far identified from the Tollense Valley, who were probably killed during a conflict over some days or weeks, is on a larger scale than earlier examples for potential violence (see Thrane 2006: 278). Furthermore, the test excavations suggest that a considerable number of individuals are still preserved in the valley, and we might therefore expect many more victims. It is unclear whether we are dealing with professional warriors. Some women and children are also present in the sample; according to ethnographic data they could have supported the men in fighting, for example by organising food or by carrying weapons (Keeley 1996: 35). The considerable number of individuals involved does not support the scenario of a small-scale conflict of local farmers or small war bands (Osgood 2006). Some bronze pins of Silesian types (Ulrich 2008) found in the Tollense Valley indicate close contacts with this region c. 400km to the south-east. First results of $\delta^{13}$C and $^{15}$N analysis of the human remains indicate millet to be part of the diet, which is uncommon during the Early Bronze Age in northern Germany, and might suggest invaders from the south.

The presence of horses, probably used for riding, implies rapid mobility. We can identify the use of weapons such as clubs, bows and arrows and probably also spears as primary weapons. The lesions in the frontal bones reflect face-to-face fighting. The arrow shot into the arm bone as well as the arrow lesions in the pelvis and the skull reflect short and long distance attacks and diverse combat situations. No clear injuries caused by bronze adzes, daggers or swords have so far been identified; the evidence presented here
therefore challenges the traditional picture of the Bronze Age warrior elite as reflected in the burials.

**Conclusion**

The authors interpret the discoveries in the Tollense Valley as the remains of a group conflict or battle in c. 1200 cal BC. The scattered human remains found along the river, their context in association with wooden clubs in fine-grained, fluvial sediments and repeated traces of violence are explained as due to fighting, during or after which the bodies of the dead were thrown into the river, washed away and finally deposited at sandbars and/or calm stretches of the river. Alternatively, individuals might have been pursued and killed on the spot in the swampy valley environment.

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