

## Abhandlung

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# Worship or weight? A Bronze Age ‘goddess with a necklace’ from River Tollense (NE Germany)

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**Zusammenfassung:** Das Tollensetal in Nordostdeutschland ist bekannt für die Zeugnisse eines Gewaltkonfliktes aus dem frühen 13. Jh. v. Chr. (Nordische Bronzezeit, Periode III). In diesem Aufsatz wird ein Neufund aus der jüngeren Bronzezeit vorgestellt, den Ronald Borgwardt im Sommer 2020 im Fluss an einer bereits bekannten bronzezeitlichen Talquerung (Fpl. Weltzin 13) entdeckt hat. Die Bronzefigur (Länge 14,7 cm) zeigt u. a. einen eiförmigen Kopf mit prominent geformter Nase, geschwungene Arme, einen Halsring, zwei Knubben für die Brüste, einen Gürtel, eine Markierung des weiblichen Geschlechts und zwei leicht unterschiedlich geformte Beine. Im 19. Jh. wurde eine ähnliche weibliche Statuette einige Kilometer entfernt bei Klein Zastrow entdeckt, aber die meisten Figuren dieser Art sind von Seeland und aus Schonen bekannt. Nur Statuetten der Insel Seeland und aus Vorpommern haben einen Gürtel und dies spricht für eine enge Verbindung der Figuren aus diesen Gebieten. Typologische Argumente datieren die Statuette aus der Tollense in die späte Bronzezeit (Periode V–VI). Vor einigen Jahren wurden die Figuren als mögliche Gewichte diskutiert, aber ihre

geringe Zahl spricht gegen eine solche Interpretation. Mit einem Gewicht von 155 g passt die neue Figur zumindest zu der seiner Zeit postulierten Gewichtseinheit von 26 g. Der Neufund spricht für eine Verknüpfung der Deponierungsorte mit wichtigen Kommunikationsrouten. Hingegen sehen wir kaum Argumente für eine Interpretation der Figur als Göttin. Die Niederlegung an einer Talquerung, an der Jahrhunderte zuvor ein großes Gewaltereignis stattgefunden hat, wirft die Frage auf, ob es sich um einen Erinnerungsort gehandelt haben kann.

**Schlüsselworte:** Tollensetal, Bronzezeit, bronzene Figurine, Gewichtssystem

**Abstract:** The Tollense valley in northeast Germany is well known for its substantial evidence indicating a violent conflict dated to the early 13<sup>th</sup> century BC (Period III of the Nordic Bronze Age). This article presents a significant new find from a later Bronze Age context, found in the river at a known Bronze Age valley crossing (site Weltzin 13) by Ronald Borgwardt in 2020. The small bronze figurine (14.7 cm tall) has an egg-shaped head with a prominent nose, looped arms, a neckring, two knobs signifying breasts, a belt, an indication of a female sex and two slightly differently shaped legs. In the 19<sup>th</sup> century a similar female statuette was found near the village of Klein Zastrow, just a few kilometres from the valley crossing, but mostly these figurines are known from Zealand and Scania. Belts are only present on the statuettes from Zealand and northern Germany, and their presence suggests a close connection between the figures from these areas. Typological evidence places the figure from the Tollense river to the Late Bronze Age (Periods V–VI). Some time ago the figures were discussed as possible balance weights, but their small number does not support this theory. With a mass of 155 g, however, the new figure could be seen as a multiple of 26 g, the previously proposed weight unit of the time. The new find further suggests a connection between the find spots of the statuettes and routes of communication. There is little evidence to support an interpretation

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as a goddess. The deposition of the new figure at a valley crossing where hundreds of years before a violent conflict happened, might indicate that this was still a place of commemoration.

**Keywords:** River Tollense valley, Bronze Age, Bronze figure, weight system

## Introduction

The Tollense river valley is well known for its outstanding evidence, on an unprecedented scale, of a violent conflict in the early 13<sup>th</sup> century BC<sup>1</sup>. At different locations in the valley (Fig. 1) remains of more than 140 individuals were found. As far as identification was possible, it showed almost exclusively the presence of young men in good physical condition, with often unhealed trauma<sup>2</sup>. The identification of a causeway, constructed in the late 19<sup>th</sup> century BC at the southern limit of the more than 2.5 km long string of sites, suggests that this valley crossing belonged to an important route and might have been the starting point of the conflict (Fig. 2).<sup>3</sup>

Many of the c. 300 Bronze objects, including personal belongings of individuals involved in the conflict, can be assigned to Period III of the Nordic Bronze Age (NBA) (c. 1300–1100 BC)<sup>4</sup>. The Tollense valley was, however, significant during various Bronze Age phases (Fig. 3). This article presents an outstanding object recently discovered at site Weltzin 13 (district Mecklenburgische Seenplatte), which appears to date to the last phase of the NBA (c. 740–550 BC).

## The valley crossing at site Weltzin 13/Kessin 12

Since 2013, wooden poles and structures have been documented at site Weltzin 13 (Fig. 4).<sup>5</sup> Geomagnetic surveys revealed a linear structure in the eastern part of the valley (site Kessin 12; Fig. 5A). Excavations showed two lines of boulders, which formed the borders of a causeway (width: c. 3.2 m) filled with sand and turf. Remains of oak planks indicate a solid surface, which probably allowed a year-

round crossing with carts. Towards the centre of the valley, the road was entirely constructed from wood.

Radiocarbon dates and one dendrochronological date imply a construction around 1830 BC (Fig. 4).<sup>6</sup> In the beginning, the causeway probably crossed the valley in a straight line, but due to the dredging of the modern river no traces of the track at the western end could be identified.

Figure 5B displays the spatial distribution and varying thickness of fluvial sediments, which form a corridor of ancient river beds surrounding the present river course. Besides the archaeological findings, there is no chronological control of these fluvial sediments within the corridor due to repeated relocation. The causeway runs westwards into the distribution area of former river deposits. Accordingly, they must have already been silted up during the use of the pathway. The present river bed probably saw a successive shift of the river which meandered towards the west.

Bronze Age finds have been recovered from the riverbed further south. At this point, the Tollense is shallow, with numerous stone and wooden features in the riverbed (Fig. 4–5). The minerogenic subsoil (boulder clay) is favourable for a ford. The partly clustered stones in the riverbed indicate embankments, remains of bridges or relics of a causeway. A wooden pole was dated to c. 1320 denBC, and three wooden parts from the eastern riverbank dated to c. 1225 denBC, indicate later activities. In the late 14<sup>th</sup> century, the orientation of the track was probably changed towards a more southern route. More than 500 years after the original building the valley crossing was the location of a major conflict. Bronze objects from Period III NBA including a hoard underline the importance of this place at that time<sup>7</sup>.

Several wooden planks from the eastern riverbank, however, date to the 7<sup>th</sup> century BC, and these more recent constructions are not yet well understood. The data suggest a potential use of the same track over 1000 years, even if continuity cannot be proven. The long term use of Iron Age tracks has been reported from a number of Danish sites<sup>8</sup>, while Fenland tracks in northern Germany generally had a shorter life-span<sup>9</sup>.

1 Jantzen *et al.* 2011; Terberger *et al.* 2018; Krüger *et al.* 2020.

2 cf. Lidke *et al.* 2019.

3 Jantzen *et al.* 2017.

4 e.g. Uhlig *et al.* 2019.

5 Jantzen *et al.* 2017.

6 Jantzen *et al.* 2017.

7 Ibid.

8 Schou Jørgensen 1988.

9 Fansa/Booth 2011.

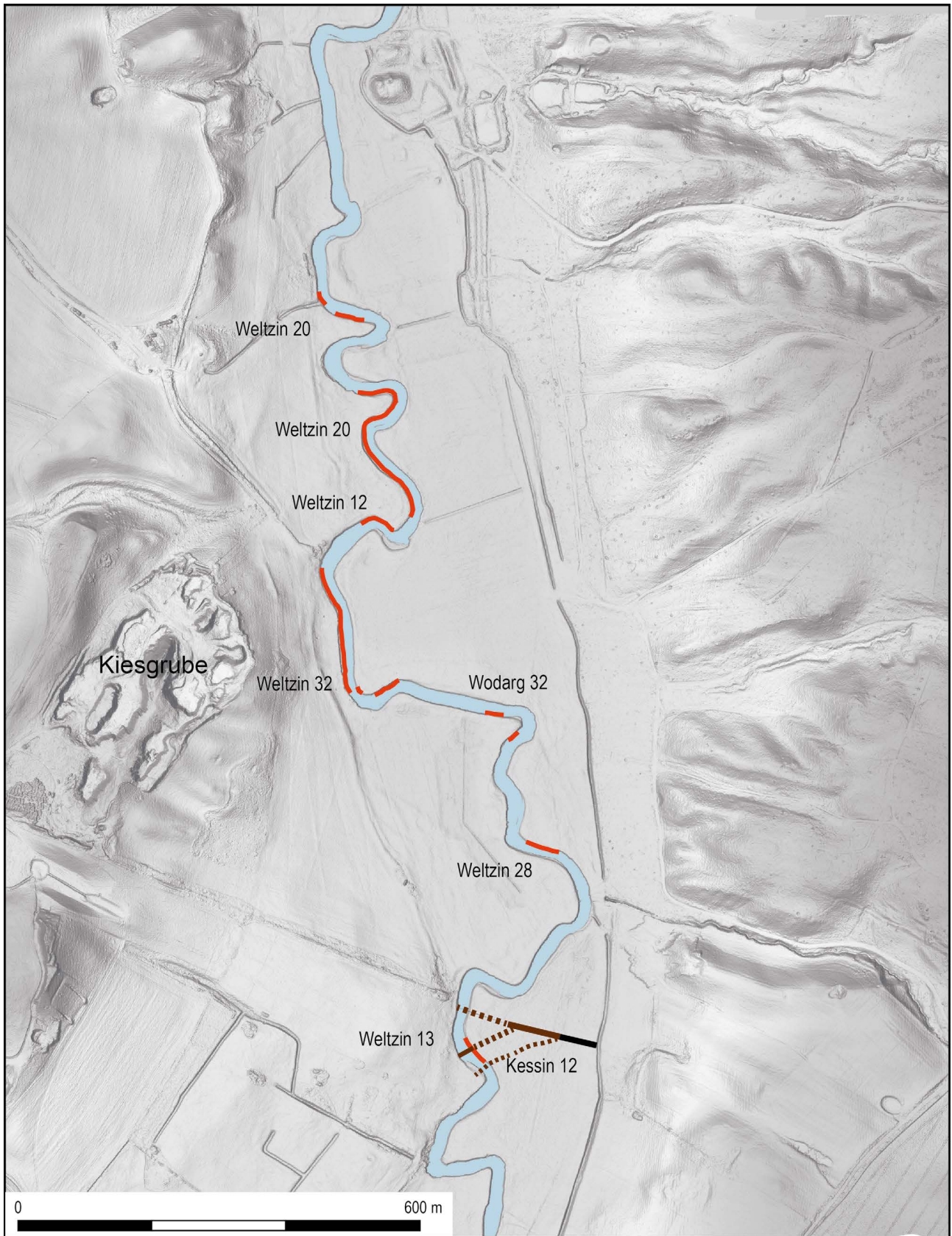


Fig. 1: Map of the Tollense valley with location of important sites and presence of find layer (red).



Fig. 2: Location of the valley crossing (site Weltzin 13/Kessin 12), view to the north. Photo: Frank Nagel.

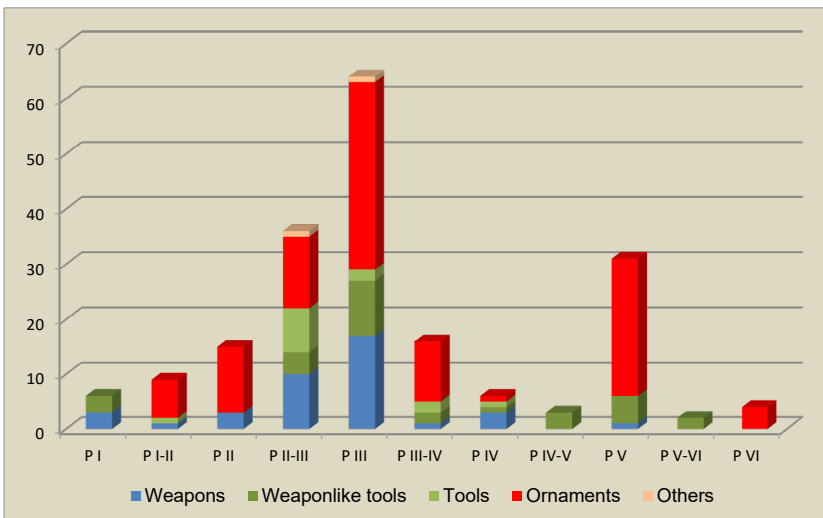


Fig. 3: Dating of bronze finds from Tollense valley (after Dombrowsky in prep.)

## New discoveries: a bronze figurine

Ronald Borgwardt has conducted regular surveys of the River Tollense since the 1990s, and due to his diligence, the importance of the site was identified. On July 20<sup>th</sup> 2020, he once again surveyed the river by snorkelling at site Weltzin 13 and found a Bronze Age figurine<sup>10</sup> in organic

sediments (Fig. 4; 6). Over the following days, he also discovered a bronze arm ring just a few metres away (Fig. 7). The decorations of the arm ring, which probably belonged to a destroyed hoard, compare to those on arm rings of Period III NBA<sup>11</sup>.

The bronze figurine remained an isolated object originally deposited in a peaty environment (Fig. 4). The reason

<sup>10</sup> The find is registered with inventory number ALM 2021/120,1 at Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern.

<sup>11</sup> Jantzen *et al.* 2017, fig. 4.

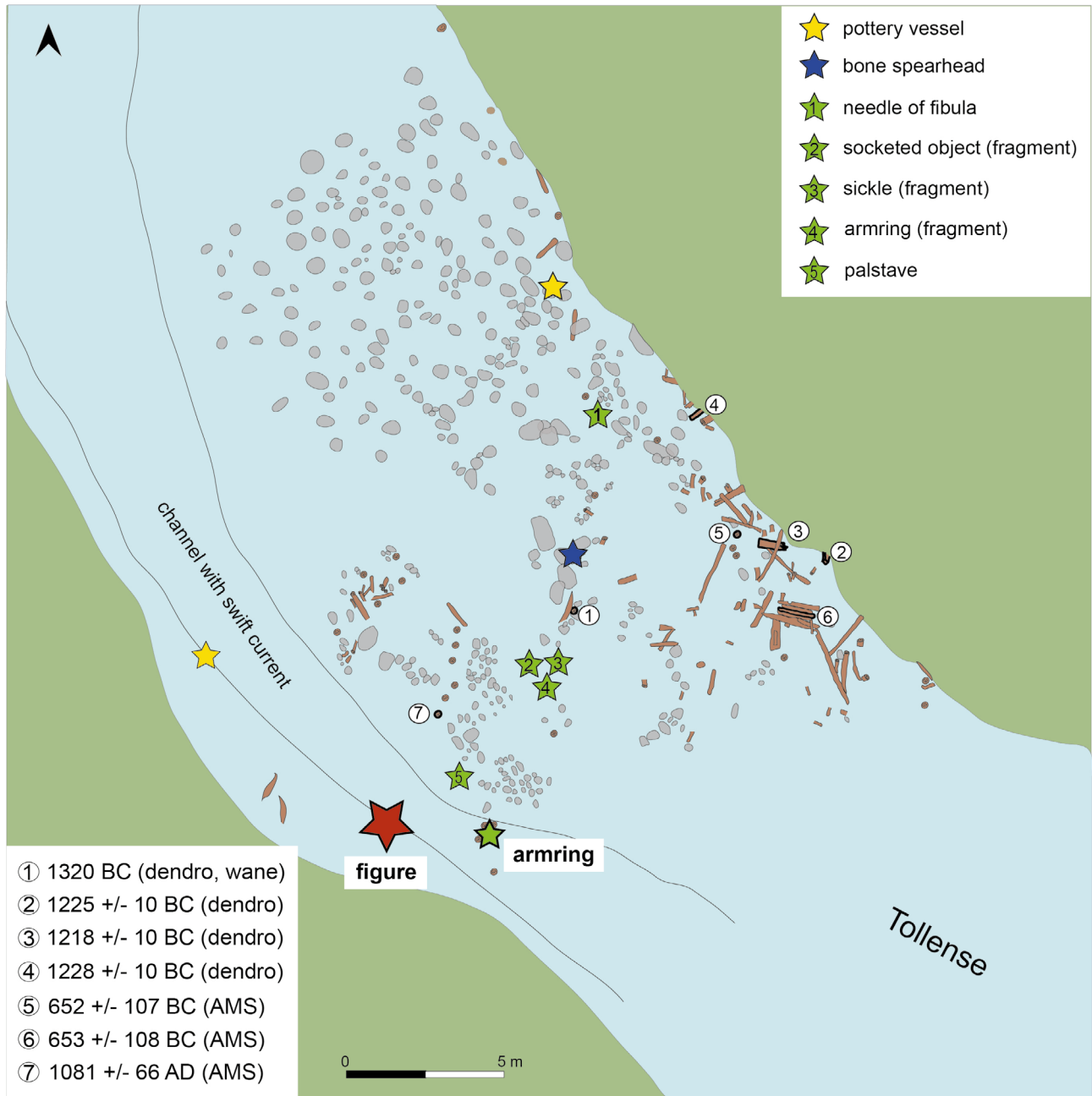


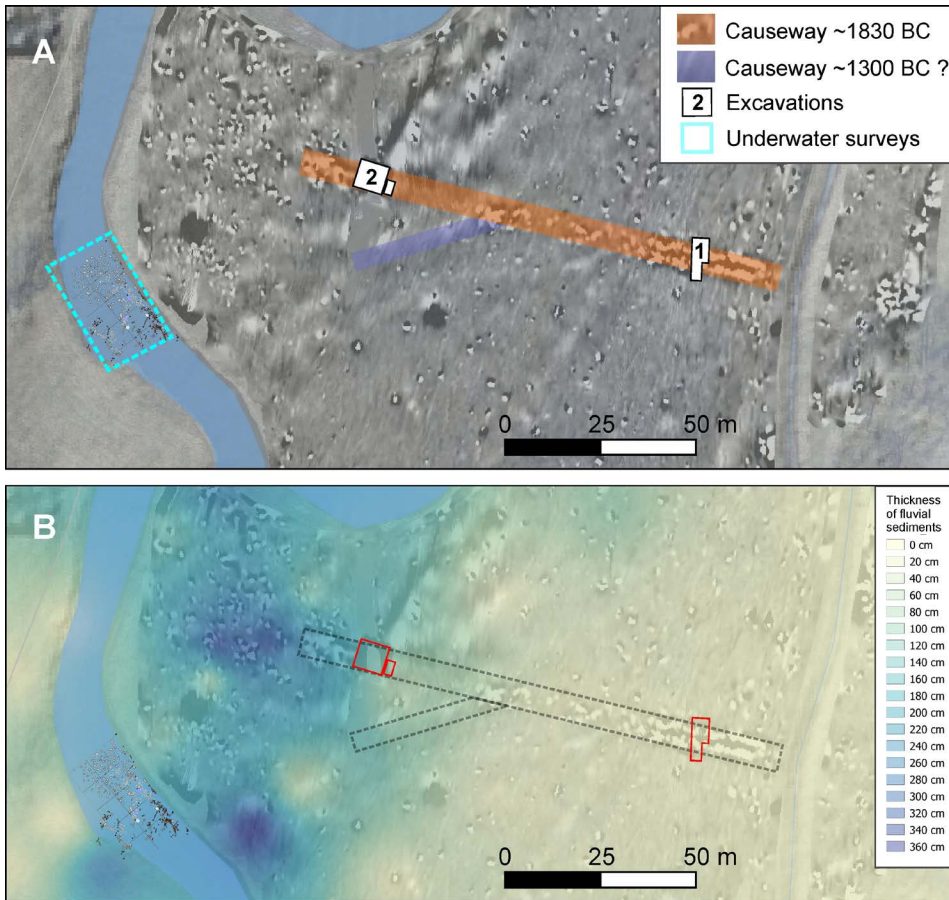
Fig. 4: Location of new Bronze finds at site Weltzin 13. Graph: Joachim Krüger/Thomas Terberger.

it was not discovered earlier is probably due to the ever changing current. The figure is well-preserved and of reddish-brown colour. Only small patches show green patination and incrustations.

The anthropomorphic figure is 14.7 cm long (weight: 155 g; Fig. 6) and was cast visible by a blowhole on top of the head. The individual has a flat body and a large, egg-shaped head. The forehead shows a transition into a sharp profiled nose. The face is formed by depressions with two knobs for the eyes, the mouth is marked by barely visible

cuts under the nose (Fig. 8). The chin is underlined by five short vertical cuts.

Two bulges at the front side of the neck suggest ring decorations or a necklace. The trunk is flat with two small knobs apparently forming breasts (Fig. 9). Below them, two bulges show a belt on the frontside. The handleless arms are looped into two half circles. The hips are slightly modelled. The vulva is marked by a shallow engraving and a vertical cut. The right leg is strongly bent, while the knees and the feet are protruding. The figurine is therefore



**Fig. 5:** Geomorphological situation and result of geomagnetic surveys at site Kessin 12/Weltzin 13 (A) with phases of the causeway reconstructed plotted above thickness of fluvial sediments (B). Graph: Sebastian Lorenz.

**Tab. 1:** Percentage elemental content of the female figure surface after portable XRF measurements. One measurement was taken at the front (lower abdomen), and two at the back (head and lower back) of the figure (Fig. 6). Only those readings that were more than five times the double standard deviation ( $2\sigma$ ) of the measurement error were considered quantitatively reliable. The three measured values were averaged for every element.

Element [%]	Sb	Sn	Ag	Bi	Pb	Cu	Ni	Fe	V	Ti
Lower back	0,52 ± 0,01	5,45 ± 0,02	0,43 ± 0,01	0,68 ± 0,01	4,09 ± 0,03	87,51 ± 0,04	0,13 ± 0,01	0,94 ± 0,01	0,04 ± 0	0,13 ± 0
Back of the head	0,5 ± 0,01	5,01 ± 0,02	0,39 ± 0,01	0,57 ± 0,01	3,44 ± 0,02	88,9 ± 0,04	0,11 ± 0,01	0,88 ± 0,01	0,05 ± 0	0,13 ± 0
Lower abdomen	0,46 ± 0,01	4,81 ± 0,02	0,38 ± 0,01	0,63 ± 0,01	3,08 ± 0,02	89,56 ± 0,04	0,15 ± 0,01	0,77 ± 0,01	0,02 ± 0	0,13 ± 0
Average	0,49 ± 0,01	5,09 ± 0,02	0,4 ± 0,01	0,63 ± 0,01	3,54 ± 0,03	88,66 ± 0,04	0,13 ± 0,01	0,86 ± 0,01	0,04 ± 0	0,13 ± 0

that of a naked individual with female attributes and decorations on the neck and the abdomen. Its construction was such that it could not stand on its feet. It is unlikely that the cuts on the chin indicate a beard and their meaning remains unclear.

The elemental compositions of the figure were determined non-destructively at three spots on the dry, but otherwise untreated surface using a portable X-ray fluorescence analyzer (Thermo Scientific Niton XL3t, general metal mode). Therefore, the results are affected by super-



Fig. 6: Bronze figure (site Weltzin 13) (photos: Volker Minkus).

ficial corrosion/patination<sup>12</sup> and only provide preliminary compositional data. The five elements copper (Cu), tin (Sn), lead (Pb), iron (Fe), and bismuth (Bi) account for approximately 98.8% of the total composition of the figure (Tab. 1). Copper and tin are in the ratio of 89:5 percent, indicating a lean bronze with a high lead content (3.5%). Beside antimony (Sb, 0.49%), arsenic (As) is missing as typical semimetal addition. Nevertheless, the content of

bismuth is strikingly high (0.6%). In combination with antimony, bismuth is improving the tensile strength of Bronze for cold working rather than improving casting properties<sup>13</sup>. Tin is expected to be significantly underrepresented by superficial corrosion, while iron is probably overrepresented by the interaction with the sediments. A comparison to Scandinavian bronze findings analysed by Ling *et al.* (2013) shows parallels to objects of Period IV

<sup>12</sup> Radivojević *et al.* 2019.

<sup>13</sup> Junk 2003.



Fig. 7: Bronze arm ring found at Weltzin 13 (photo: Volker Minkus).

and V. Due to the different measurement methods these results can only be seen as a trend. Deliberate high lead contents (above 0.5 %) are characteristic for Period V and VI<sup>14</sup>.

## Similar figures

About 170 years ago, a similar bronze figure was discovered at Klein Zastrow, approximately 35 km to the north of site Weltzin 13<sup>15</sup> (Fig. 10). The body of the figure (length: 14 cm; Fig. 11,2) is flat and the egg-shaped head displays nose, eyes and mouth. The looped arms are thin and, in this case, hands are present underneath the breasts. The breasts look similar to the figure from Weltzin 13. A bulge on the abdomen probably depicts a belt. The hips are emphasised and the female genitalia are elaborated. The legs are straight, feet are only indicated. The two figures are similar in design but different in detail. Unfortunately, the Klein Zastrow find has no contextual information, and its whereabouts are now unknown.

<sup>14</sup> Winther Johannsen 2016, fig. 3.  
<sup>15</sup> e. g. Kunkel 1931.

The two figures find parallels in Zealand (three specimens) and Scania (seven specimens) (Fig. 10–12), one figure was found further north in the county of Västra Götaland<sup>16</sup>. Including the finds from northern Germany, 13 figures of the same type of naked individuals – in most cases clearly females – can be mentioned. Further bronze figures such as the specimens from Helsingborg (Fig. 12,9), Ferreslev (island of Fyn) or from the area of Viborg (Jutland)<sup>17</sup> show only general similarities and will not be discussed further.

Many figures were found near rivers and at, or near, the Baltic Sea coast – six figures alone stem from the eastern side of the Öresund – and they suggest a connection to communication routes in the western Baltic. Via River Peene to the east, or via Rivers Trebel and Recknitz to the northwest, River Tollense is connected to the Baltic Sea. The latter is a short cut to the Danish Island. Klein Zastrow is located c. 6 km north of River Peene and connected to the same river catchment.

The most prominent part of the figures is the head, and, in most cases, it has an oval to round shape. The nose is frequently sculpted while other details such as eyes, ears and mouth are either present or not. All figures have looped arms which in six cases end in hands under the breasts. Breasts are marked by knobs in nine cases and are present on all specimens from Zealand and northern Germany. The five figurines from Zealand and northern Germany have the female genitalia marked by a vertical cut embellished with engravings, whereas the specimens from Kvistofta 1, Malmö, Kullaberg and Timmele (all Sweden; Fig. 13A) display a vertical cut only. Neck decorations can be found in various regions. In most cases, one ring or necklaces can be identified (Fig. 11–12; 13B), but sometimes two or three. A belt around the abdomen is only present on the figurines from northern Germany and the finds from Farø and Værebros in Zealand (Fig. 11,1–3.5). The two figures found in western Pomerania are among the tallest specimens, and with a weight of 155 g, the specimen from Weltzin 13 exceeds all other figurines (Fig. 14; Tab. 2). Unfortunately, only a copy of the find from Klein Zastrow has survived, and the mass of the original object has been estimated to c. 130 g.

In conclusion, the two figures found south of the Baltic Sea find their best parallels in Zealand. Elements such as belt decoration and/or depiction of pronounced sex are only present on figurines from Zealand and western Pomerania. The figure from Klein Zastrow finds parallels in the specimens from Scania (Västra Ingelstad, St Olof). The differences make a single source origin of all figures un-

<sup>16</sup> Malmer 1992; Nord 2009.  
<sup>17</sup> Brøndsted 1958, 237.

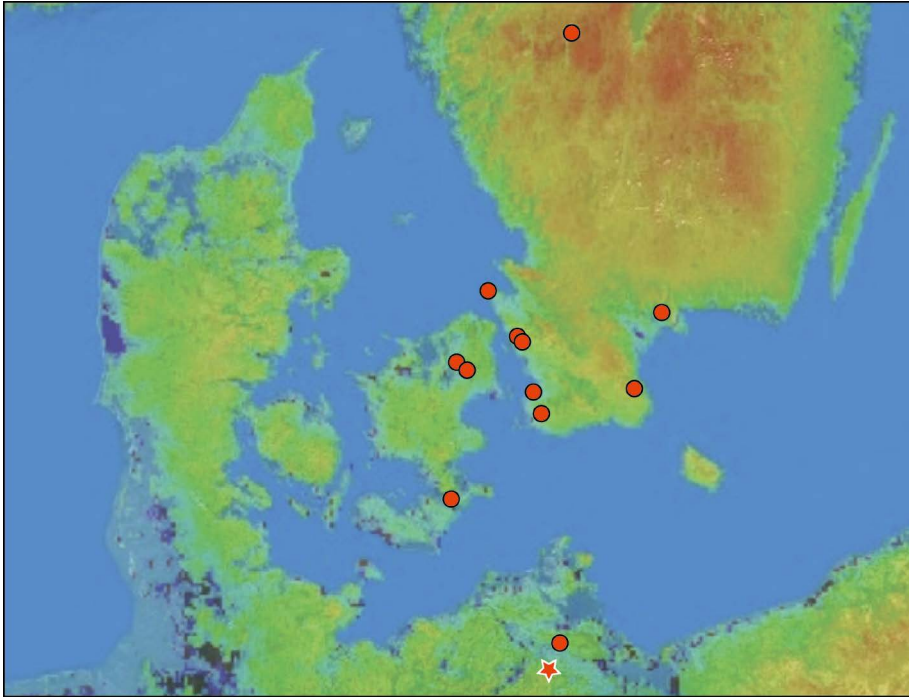




Fig. 8: Head of the Bronze figure from site Weltzin 13 (photo: Volker Minkus).



**Fig. 9:** The Bronze figure shows female attributes such as breasts and a marked female sex including a vertical cut (photo: Volker Minkus).



**Fig. 10:** Map of late Bronze Age female figures. The figure from the Tollense valley is marked by the red star. Map: Thomas Terberger.

likely. Their strong presence in Scania with elements different to the figures from Zealand suggests production at least east and west of the Øresund. The close similarity of the specimens from Weltzin 13 and Værebros might suggest a single region of origin for the figures from Zealand and northern Germany. Detailed analyses of Bronze Age metal work of Periods II and III NBA has shown identical innovative techniques, traces of similar habits and artefacts from the same mould over 200 km apart<sup>18</sup>. Craftsmen may have also shared detailed knowledge across various regions during the Late Bronze Age.

The overall distribution of the figures (Fig. 10) shows an area of close interaction in what is modern-day Scania, Zealand and western Pomerania. Journeys from the southern Baltic coast to Lolland, Falster and Zealand were likely made by seafaring boats of type Hjortspring, which are often depicted on rock carvings of that time<sup>19</sup>.

## Dating

Most of the figures do not provide contextual information. As they are also exclusively single finds, the dating of the

sculptures is based only on typological comparisons, indicating a Late Nordic Bronze Age origin.

A general parallel for the female figurines with looped arms can be drawn with the well-known bronze figures from Grevensvænge, Zealand<sup>20</sup>. Only two objects, of a hoard with probably seven figures survived. Among them is a kneeling figure with a horned helmet<sup>21</sup>. The left arm of the figure is looped in the same style as the figures discussed here. A neck ring and a ‘belt’ are further shared features. An early drawing shows a large axe in the left hand of the figure, suggesting a Period V or VI date (c. 900–500 BC)<sup>22</sup>. The helmet of the Grevensvænge figure is similar to two-horned helmets found at Viksø, Zealand, which can be assigned to late Period IV NBA (c. 10<sup>th</sup> century BC)<sup>23</sup>. A further parallel suggesting a Late Bronze Age context comes from Glasbacka (Kaul 1998, 26). The figure shows a similar head shape, knoblike eyes and looped arms.

Decorated knife terminals (Beringstedt/Holstein; Javngyde/Amt Århus), a pin (Horne/Fyn), and a kneeling figurine from Fangel Torp/Odense depict human representations with large earrings as found on the figurine

<sup>18</sup> Nørgaard 2018, map 35; Jantzen 2008.

<sup>19</sup> Bengtsson 2017, fig. 72.

<sup>20</sup> Djupedal/Broholm 1953; Thrane 1999.

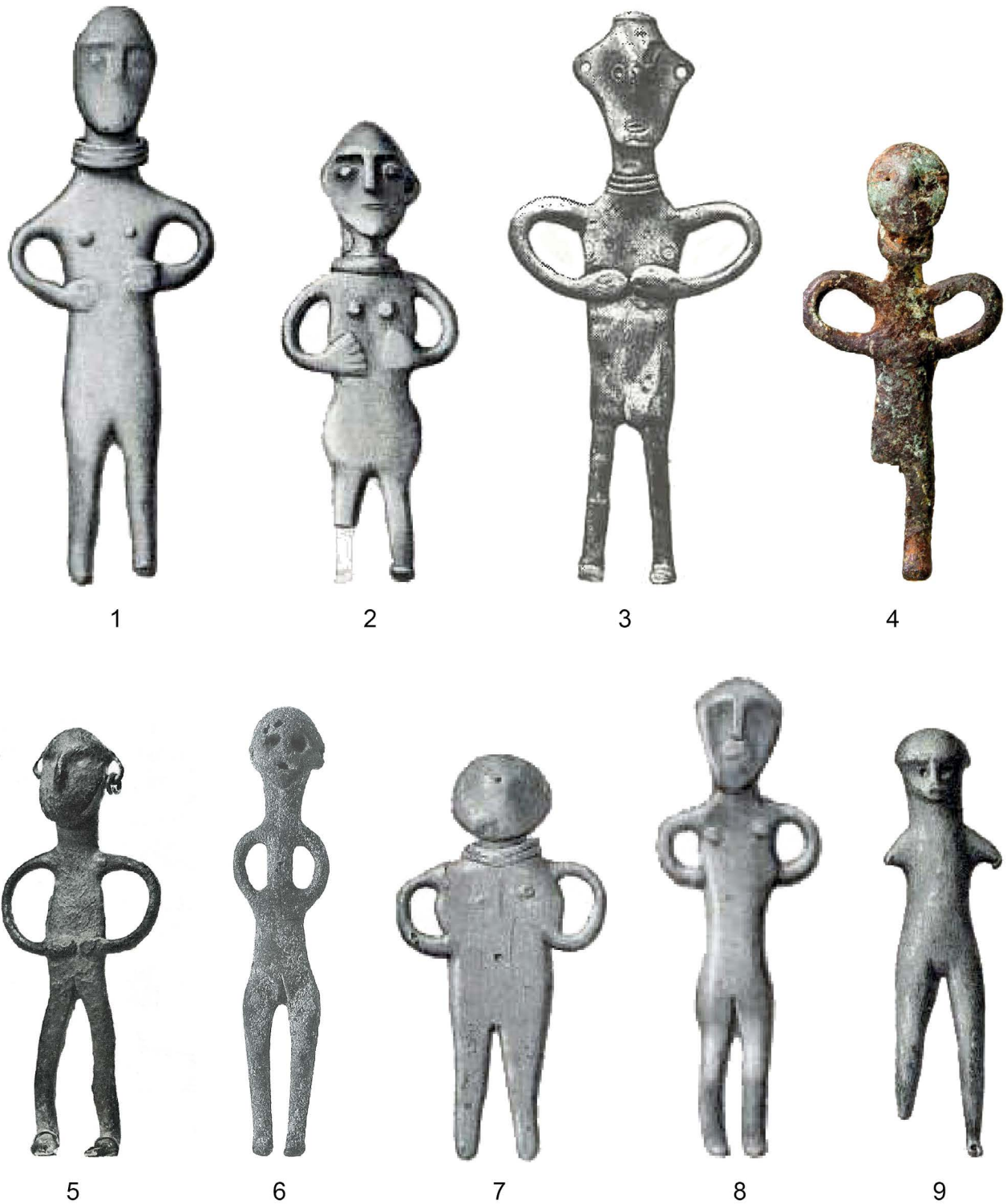
<sup>21</sup> A recent rather similar find is present in Thy Museum 2019.

<sup>22</sup> Thrane 1999.

<sup>23</sup> Vandkilde 2013, 165; Vandkilde *et al.* 2021, 7.



**Fig. 11:** Bronze Age figures from northern Germany and Zealand. 1 – Weltzin 13; 2 – Klein Zastrow; 3 – Farø (Bogø); 4 – Viksø; 5 – Værebro (after Broholm 1953; Vebæk 1978; Pfaff 2005). Scale 2:3.



**Fig. 12:** Bronze Age figures from Sweden. 1 – Västra Ingelstad. – 2 – St. Olof. 3 – Kvistofta 1; 4 – Kvistofta 2; 5 – Malmö; 6 – Kullaberg; 7 – Ivetofta; 8 – Timmele; 9 – Helsingborg (after Montelius 1922; Nord 2009; Aspenberg 1999). Scale 2:3.

**Tab. 2:** Length and weight of the Bronze figurines mentioned in the text (see Fig. 11–12).

Site	Region	Length [mm]	Weight [g]	greatest common divisor (26 g)	Remarks
Weltzin 13	N-Germany	147	155	6,0	
Klein Zastrow	N-Germany	130			Find lost, no weight available
Ivetofta	Scania	96	104	4,0	
Helsingborg	Scania	100	102	3,9	
Malmö	Scania	101	55	2,1	
St. Olof	Scania	109	103	4,0	Leg broken, weight estimation by Malmer 1993
Timmele	Scania	113	103	4,0	
Kullaberg	Scania	134	106	4,1	
Västra Ingelstad	Scania	136	132	5,1	
Kvistofta 1	Scania	137	110	4,2	
Kvistofta 2	Scania	108	70,6		Leg broken, original weight c. 78 g?
Viksø	Zealand	99	85	3,3	
Ølstykke	Zealand	120	133	5,1	

from Malmö (Fig. 12,5)<sup>24</sup>. The Fangel Torp hoard is dated to Period V NBA<sup>25</sup>. Due to the outline of the knife blade from Javngyde a date in late Period IV/early Period V is likely. The vague formal similarity to the kneeling female figurine wearing only a short corded skirt and a necklace<sup>26</sup> from the Fårdal hoard, dated to Period V, is also evoked.

The most important feature for typological dating, however, are the neck rings. The figures from Tollense, Farø, Viksø, and Ivetofta bear two necklaces each, the ones from Västra Ingelstad and Kvistofta probably three<sup>27</sup>. Neckrings were commonly deposited in pairs – rarely also in threes or fours – in bogs during Period VI<sup>28</sup>. The typical *Wendelringe* of Period VI were also sometimes found in pairs (and sometimes in multiples) in graves around the neck of the deceased<sup>29</sup>. According to Heynowski<sup>30</sup>, the alternating, opposing notch decoration on the neck jewellery on the figures of Farø (Fig. 11,3) and Kvistofta 1 (or Katslösa; Fig. 12,3) identifies them as *Wendelringe*. Capelle (1967), however, demonstrated that the distribution of bog

finds with two neckrings differs from the distribution of the figurines (Fig. 10), as the latter are absent from Fyn, Jutland and Schleswig-Holstein. Capelle argues, that the mismatching distributions of figurines and bog finds disproves the prevailing, 100 year old theory that the figures represented goddesses.

In summary, a late rather than an early date within the Late Nordic Bronze Age is currently most likely for the figures, including the item found at site Weltzin 13. A considerable number of the bronze finds found in the Tollense valley belong to Period V NBA (Fig. 3). The high lead content of the Tollense figure is typical for Period V and especially for Period VI. Construction activities at Weltzin 13 during the 7<sup>th</sup> century BC are indicated by two AMS-dates. The wooden remains likely formed part of a bridge or platform. Overall, the circumstantial evidence suggests that the Tollense figurine dates to the late Period V/early Period VI NBA (7<sup>th</sup> century BC).

## Interpretation of the figure

It is a long-lasting tradition to make human representations, and female depictions are particularly common<sup>31</sup>. During the Early Nordic Bronze Age, animal and anthro-

<sup>24</sup> Broholm 1947, 196–9; Brøndsted 1958, 224–5; Schmidt 1993, 163.

<sup>25</sup> Broholm 1946, 227.

<sup>26</sup> Bergerbrant 2014.

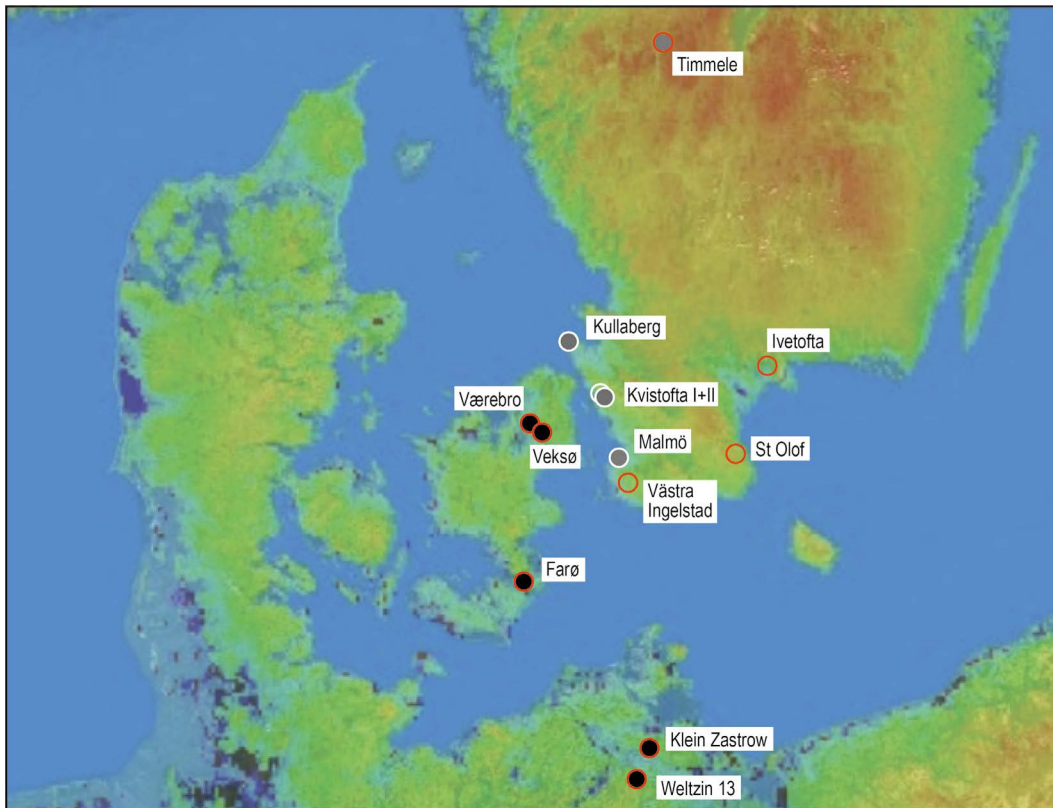
<sup>27</sup> An alternative theory is that the decorations could represent one ring with three tubes, e. g. Broholm 1946, 11, 6 – Period IV.

<sup>28</sup> Broholm 1947, 200; Brøndsted 1958, 236–7; Busch *et al.* 2000, 178.

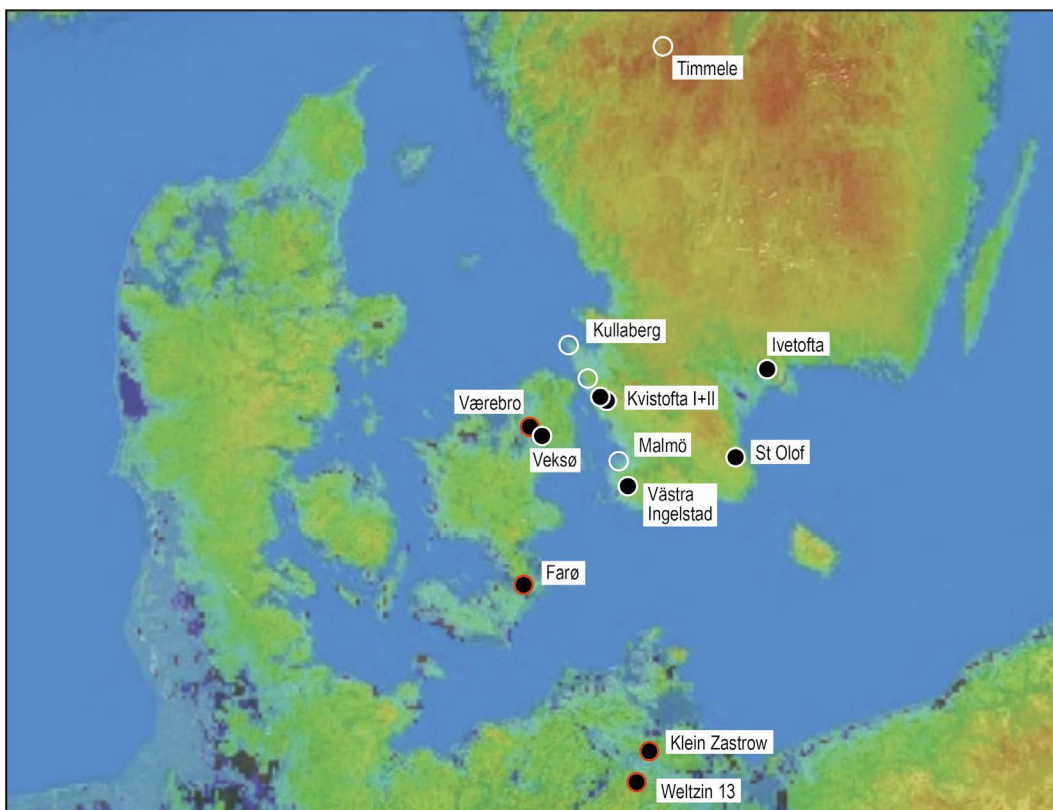
<sup>29</sup> Heynowski 1992, 22–24, pl. 27; 29, 6–7.

<sup>30</sup> Heynowski 2000, 51.

<sup>31</sup> e. g. Hansen 2007.



A



B

**Fig. 13:** A: map of Bronze figures with elaborated sex (black dots), only vertical cut (grey dot) and with breasts marked by knobs (red circles); B: map of Bronze figures with neckring (black dots) and belt (red circle).  
Maps: Thomas Terberger.

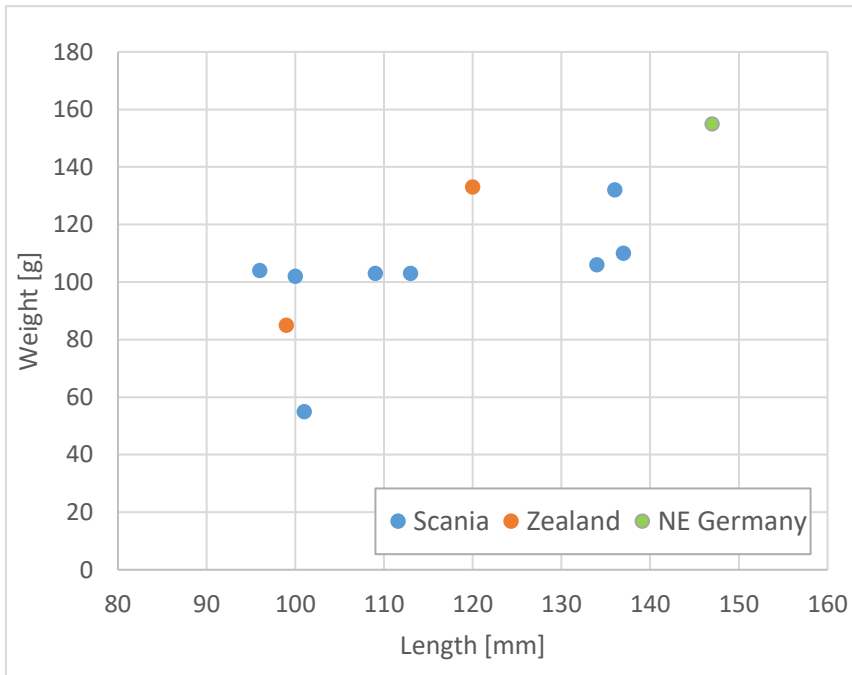


Fig. 14: Length (mm) and mass (in g) of the different Bronze figures (see Tab. 2). Graph: Sebastian Lorenz.

pomorphic bronze sculptures existed sporadically (e. g. Trundholm, Loshult), however, it was not until the Late Nordic Bronze Age that figures became more frequent. The female individuals described share a number of elements, but features such as the neck ring are also present on other figures. The Grevensvænge figures are detailed and of high quality. In contrast, the standing female figures are considered to be ‘artistically inferior to all other statuettes from the Late Bronze Age. So the hypothesis has been put forward that these statuettes are cheap mass products, owned by poor people as household gods’<sup>32</sup>. The small number of known figures, however, contradicts the interpretation as mass products for ‘poor people’.

The Weltzin 13 figure was found in a former wetland area, which is typical for Bronze Age depositions<sup>33</sup>. The find from Værebro (Fig. 11,5) was found on a riverbank and probably also originated from the riverbed<sup>34</sup>. Where information is available, most of the other figures were detected in (former) wetlands. It seems plausible that the deposition of the figures was deliberate<sup>35</sup>. The valley crossing at site Weltzin 13/Kessin 12 probably belonged to an important route that may still have existed in the 7<sup>th</sup> century BC.

<sup>32</sup> Malmer 1992, 378; Stenberger 1964.

<sup>33</sup> Scholz 2012; Schmidt 2016.

<sup>34</sup> Veabæk 1978.

<sup>35</sup> e. g. Hansen 2012; Scholz 2012.

Wetland and waters can be regarded as transitional spheres to the underworld<sup>36</sup>. It is possible that the violent conflict that took place in the Tollense river valley much earlier was still present in the collective memory of the people at the time of deposition. If this is the case, Weltzin 13 would have been a special place of commemoration and ritual.

In the case of Kullaberg in northwestern Scania, the figure was found at the edge of a steep rock above the sea. From the other side of Kullaberg and the neighbouring peninsula, Zealand is visible and this area ‘used to have a central position in Bronze Age movements and communication of western Scandinavia’<sup>37</sup>. This further supports the notion that the figures were deposited at important places of communication in the Late Bronze Age landscape.

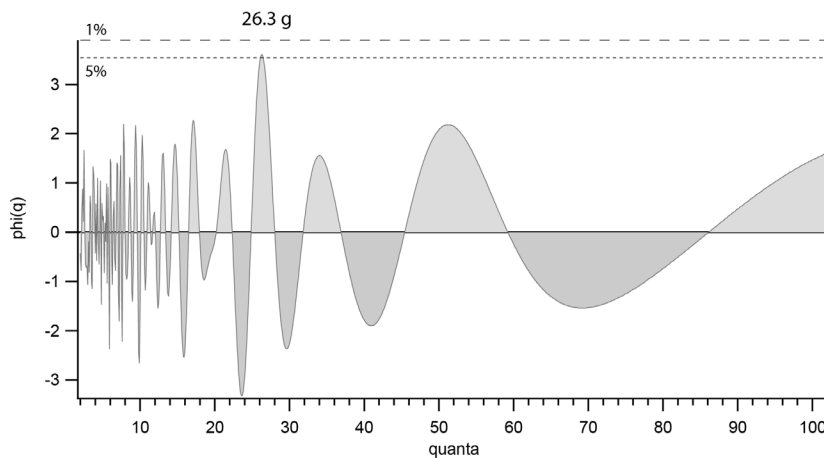
## Discussion: weights or weight-regulated artefacts?

In 1992, Malmer discussed the figures as possible testimonies of a Bronze Age weight system – in fact, he regarded them as actual weights. He collected the mass values of eight figurines weighing between 55 g and 132 g, of which

<sup>36</sup> e. g. Vandkilde 2013.

<sup>37</sup> Nord 2009, 251.





**Fig. 15:** Cosine Quantogram Analysis of the eleven figures with known weight with the alpha levels at 5 and 1%. Graph: Nicola Ialongo.

five weigh between 102 g and 110 g (Fig. 14; Tab. 2). Malmer further considered the weight of eleven solid gold ‘oath rings’, which are typical finds for Period V NBA. He understood both find categories as percentages of c. 108 g<sup>38</sup>. Sperber (1993), using the Holm’s index, suggested a unit of c. 26 g<sup>39</sup>.

In the Eastern Mediterranean and Mesopotamia, figurative weights existed during the second and first millennium BC<sup>40</sup>, but it is unlikely that specific objects such as the ‘goddesses with the necklace’, which show formal diversity in detail, could be weights. At most they could have been weight-regulated artefacts, meaning that they were produced from a measured amount of metal.

In order to test for potential weight-regulation, the available data should be analysed with newest metrological methodologies. A recent survey of over 150 ‘oath rings’ recorded the mass values of 91 specimens<sup>41</sup>. Applying Cosine Quantogram Analysis (CQA), the best practice method for metrological studies<sup>42</sup>, did not yield any results that would support any metrological regulation of ‘oath rings’. CQA of the eleven figurines with the known mass values<sup>43</sup> resulted in a ‘good fit’ at 26 g (Fig. 15). Problematically, however, small samples often produce random clusters in the frequency distribution. To account for this, a simulation of randomly generated datasets was executed (Monte Carlo tests for statistical significance<sup>44</sup>).

The dashed line in Figure 15 gives the 5 % alpha level, which is only slightly touched by the peak at 26 of the CQA. The alpha level at 5 % is the least acceptable statistically relevant threshold of consistency<sup>45</sup>. Hence, the interpretation of the figures as weight-regulated objects or even as weights is not certain on present evidence. However, the new find from Tollense seem to at least confirm Malmer and Sperber’s hypothesis of multiples of 26 g (6x; Tab. 2).

Nevertheless, the potentially weight-regulated figures are contemporary with so-called *Kannelurensteine*: lenticular-shaped stone objects with a thick groove running along their diameter, dating to Periods III to V NBA. *Kannelurensteine*, which were also used in the Lusatian Culture were likely used as balance weights<sup>46</sup>. Applying Frequency Distribution Analysis to *Kannelurensteine* from east Germany and western Poland reveals a cluster between c. 110–120 g<sup>47</sup>. While this cluster is rather similar to that given by the figurines, more data will need to be collected and analysed in order to draw meaningful conclusion. A new find of a bone balance scale beam in an early Lusatian grave from the cemetery site of Coswig in Sachsen-Anhalt, east Germany<sup>48</sup>, suggests that this culture used weights and scales during the 14<sup>th</sup> and 13<sup>th</sup> centuries BC. Additionally, the bronze fittings of a potential organic container, found as part of a hoard at River Tollense<sup>49</sup> are similar to those on rectangular receptacles with scales, bronze objects and even gold scraps found in France dating to

<sup>38</sup> Malmer 1992, tab. 2.

<sup>39</sup> cf. also Pare 1999.

<sup>40</sup> e. g. the Assyrian lion weights; Reade 2018.

<sup>41</sup> Knoll *et al.* 2014.

<sup>42</sup> Ialongo/Rahmstorf 2019, 115–117.

<sup>43</sup> Note that Malmer added 4 g for the missing lower leg of the St. Olof- figure and we added 8 g for the whole missing leg of the Kvistofta 2- figure. Neither are accurate adjustments. Instead, the precise mass values should be calculated by 3D models in the future.

<sup>44</sup> cf. Ialongo/Rahmstorf 2019, 116.

<sup>45</sup> A recently ‘proven’ weight adjustment of Atlantic Bronze Age gold objects, which also just reached the alpha level of 0.05 (Rahmstorf 2019, fig. 5A), later yielded a negative result when the database was expanded (Hermann in press).

<sup>46</sup> Ialongo/Rahmstorf 2019, 113–114; 119–120; 122; Rahmstorf/Ialongo 2020.

<sup>47</sup> Ialongo/Rahmstorf in press, tab. 1.

<sup>48</sup> Schunke 2021.

<sup>49</sup> Uhlig *et al.* 2019.

the same period<sup>50</sup>. These leather pouches are also known from the Nordic Bronze Age<sup>51</sup> but were never found with any indications for weighing equipment. More data from the later Lusatian Culture and the later Nordic Bronze Age need to be processed before we can claim an established use of weight metrology during Periods IV–V, Hallstatt B, and even during the transition to the Iron Age.

## Conclusion

The female figures with looped arms are related to distinctive places of the Later Bronze Age landscape, and the recently discovered specimens from the Tollense valley supports their close connection to communication routes. The significance of the lower Oder area for Later Bronze Age trade is reflected in a concentration of bronze hoards around the island of Usedom, c. 50 km to the east<sup>52</sup>. The wetland context supports the notion of a deposition in a transitional sphere between the real and the underworld. The figures have been considered as evidence for worship (as epitome of a goddess), as evidence for trade (as balance weights), or both (‘goddesses of wealth’). The distribution over a relatively small area speaks rather against an interpretation as a Nordic goddess of this time. In the context of the Glasacka figure, Kaul<sup>53</sup> suggested, however, that ‘the starting point for the creation of such a figure must naturally lie in the sacral sphere’. The use as a weight or weight-regulated object is possible, but for now cannot be confirmed. The location of the Tollense sculpture along an old route might favour a depositional context of communication and trade. In how far the valley crossing was still a place of commemoration hundreds of years after a violent encounter, however, remains open.

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<sup>50</sup> Mordant *et al.* 2021.

<sup>51</sup> Pare 1999, 462–463; Goldhahn 2013, 409.

<sup>52</sup> Schmidt 2016, 69.

<sup>53</sup> Kaul 1998, 26.

## References

- Aspenberg 1999: J. Aspenberg, Rydebäcks Historia. Från inlandsisen till medeltid – med inslag av generell information om livet under de olika tidsepokerna i Sverige (1999). <https://www.rydebäckshistoria.com/wp-content/uploads/2019/03/frc3a5n-istid-till-medeltid.pdf>
- Bengtsson 2017: B. Bengtsson, Sailing rock art boats. BAR International Series 2865 (Oxford 2017).
- Bergerbrant 2014: S. Bergerbrant, Ordinary or extraordinary? Redressing the problem of the Bronze Age corded skirt. *Current Swedish Archaeology* 22, 2014, 73–96.
- Broholm 1946: H. C. Broholm, Danmarks Bronzealder. Tredie bind: samlede fund fra den yngre bronzealder (Copenhagen 1946).
- 1947: –, Anthropomorphic Bronze Age figures in Denmark. *Acta Archaeologica* 18, 1947, 196–202.
- 1953: –, Danish Antiquities IV: Late Bronze Age (Copenhagen 1953).
- Brøndsted 1958: J. Brøndsted, Danmarks Oldtid II: Bronzealderen. Copenhagen: Gyldendal.
- Busch *et al.* 2000: R. Busch/T. Capelle/F. Laux, Opferplatz und Heiligtum. Kult der Vorzeit in Norddeutschland. Veröffentlichungen des Helms-Museums 86 (Neumünster 2000).
- Capelle 1967: T. Capelle, Zu den Halsringopfern der jüngeren Bronzezeit im westlichen Ostseegebiet. *Acta Archaeologica* 38, 1967, 209–214.
- Djupedal/Broholm 1953: R. Djupedal/H. C. Broholm, Marcus Schnabel og Bronzealderfundet fra Grevensvænge. Aarbøger for nordisk Oldkyndighed og Historie 1952 (1953), 5–59.
- Dombrowsky 2014: A. Dombrowsky, Bronzezeitliche Metallfunde aus dem Gebiet der mittleren Tollense unter besonderer Berücksichtigung der Flussfunde. In: D. Jantzen/J. Orschiedt/J. Piek/T. Terberger (eds), Tod im Tollensetal – Forschungen zu den Hinterlassenschaften eines bronzezeitlichen Gewaltkonfliktes in Mecklenburg-Vorpommern 1. Die Forschungen bis 2011 (Schwerin 2014) 131–180.
- Dombrowsky in prep.: A. Dombrowsky, Bronzezeitliche Metallfunde aus dem Gebiet der mittleren Tollense – eine Übersicht zu den Funden bis 2015. In: D. Jantzen/G. Lidke/J. Lüger/S. Lorenz/T. Terberger, Tod im Tollensetal – Forschungen zu den Hinterlassenschaften eines bronzezeitlichen Gewaltkonfliktes in Mecklenburg-Vorpommern 2. Die Forschungen bis 2016.
- Fansa/Both 2011: M. Fansa/F. Both, “O, schaurig ist’s, übers Moor zu gehen”. 220 Jahre Moorarchäologie. Schriftenreihe des Landesmuseums Natur und Mensch, Heft 79 (Oldenburg 2011).
- Goldhahn 2013: J. Goldhahn, Bredarör på Kivik – en arkeologisk odysse (Kalmar Studies in Archaeology 9 (Kalmar 2013)).
- Hansen 2007: S. Hansen, Bilder vom Menschen der Steinzeit. *Archäologie in Eurasien* 20 (Mainz 2007).
- 2012: –, Bronzezeitliche Horte: Zeitliche und räumliche Rekontextualisierung. In: S. Hansen/D. Neumann/T. Vachta (eds), Hort und Raum. Aktuelle Forschungen zu bronzezeitlichen Deponierungen in Mitteleuropa. *Topoi. Berlin Studies of the Ancient World* 10 (Berlin 2012) 23–48.
- Hermann in press: R. Hermann, Weight regulation in British Bronze Age gold objects (reanalysis and rebuttal). *Antiquity* 95 (in press).
- Heynowski 1992: R. Heynowski, Eisenzeitlicher Trachtschmuck der Mittelgebirgszone zwischen Rhein und Thüringer

- Becken. Archäologische Schriften des Instituts für Vor- und Frühgeschichte der Johannes Gutenberg-Universität Mainz 1 (Mainz 1992).
- 2000: –, Die Wendelringe der späten Bronze- und der frühen Eisenzeit. Universitätsforschungen zur Prähistorischen Archäologie 64 (Bonn 2000).
- Ialongo/Rahmstorf 2019: N. Ialongo/L. Rahmstorf, The identification of balance weights in pre-literate Bronze Age Europe: typology, chronology, distribution and metrology. In: L. Rahmstorf/E. Stratford (eds), *Weights and marketplaces from the Bronze Age to the early modern period. Weight and Value 1* (Kiel/Hamburg 2019) 105–126. <https://files.wachholtz-verlag.de/openaccess/9783529035401.pdf>
- in press: –, “Kannelurensteine” – balance weights of the Bronze Age? In: D. Hofmann/F. Nikulka/R. Schumann (eds), *The Baltic in the Bronze Age – regional patterns, interactions and boundaries* (Leiden in press).
- Jantzen 2008: D. Jantzen, *Quellen zur Metallverarbeitung im Nordischen Kreis der Bronzezeit. Prähistorische Bronzefunde 19,2* (Stuttgart 2008).
- *et al.* 2011: –/U. Brinker/J. Orschiedt/J. Heinemeier/J. Piek/J. Krüger/G. Lidke/H. Lübke/R. Lampe/S. Lorenz/M. Schult/T. Terberger, A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany. *Antiquity* 85, 2011, 417–433.
- *et al.* 2017: –/G. Lidke/J. Dräger/J. Krüger/K. Rassmann/S. Lorenz/T. Terberger, An early Bronze Age causeway in the Tollense Valley, Mecklenburg-Western Pomerania – The starting point of a violent conflict 3300 years ago? *Berichte der Römisch-Germanischen Kommission* 95, 2017, 13–49.
- Junk 2003: M. Junk, *Material Properties of Copper Alloys Containing Arsenic, Antimony, and Bismuth: The Material of Early Bronze Age Ingot Torques*. Diss. Technical University Freiberg (2009). <https://nbn-resolving.org/urn:nbn:de:swb:105-1299566>.
- Kaul 1998: F. Kaul, *Ships on Bronzes. A Study in Bronze Age Religion and Iconography* (Copenhagen 1998).
- Knoll *et al.* 2014: F. Knoll/H. Meller/J. Filipp, »Nordisch by nature«. Die jungbronzezeitlichen, goldenen Eidringe Sachsens-Anhalts an der südlichen Peripherie des Nordischen Kreises in ihrem Kontext. In: H. Meller/R. Risch/E. Pernicka (eds), *Metalle der Macht – Frühes Gold und Silber*. 6. Mitteldt. Archäologentag vom 17. bis 19. Oktober 2013 in Halle (Saale). Tagungen Landesmuseum Vorgeschichte Halle 11/II (Halle [Saale] 2014) 789–871.
- Krüger *et al.* 2020: J. Krüger/G. Lidke/S. Lorenz/T. Terberger (eds), *Tollensetal 1300 v. Chr. Das älteste Schlachtfeld Europas*. Archäologie in Deutschland, Sonderheft 19 (Darmstadt 2020).
- Kunkel 1931: O. Kunkel, *Pommerns Urgeschichte in Bildern* (Stettin 1931).
- Lidke *et al.* 2019: G. Lidke/U. Brinker/A. Schramm/D. Jantzen/T. Terberger, Warriors’ lives: the skeletal sample from the Bronze Age battlefield site in the Tollense Valley, north-eastern Germany. In: M. Dal Corso/W. Kirleis/J. Kneisel/N. Taylor/M. Wieckowska-Lüth/M. Zanoni (eds), *How’s Life? Living Conditions in the 2<sup>nd</sup> and 3<sup>rd</sup> Millennium BCE. Scales of Transformation in Prehistoric and Archaic Societies 4* (Leiden 2019) 35–55.
- Ling *et al.* 2013: J. Ling/E. Hjärthner-Holdar/L. Grandin/K. Billström/P.-O. Persson, Moving metals or indigenous mining? Provenancing Scandinavian Bronze Age artefacts by lead isotopes and trace elements. *Journal of Archaeological Science* 40/1, 2013, 291–304.
- Malmer 1992: M. P. Malmer, *Weight systems in the Scandinavian Bronze Age*. *Antiquity* 66, 1992, 377–388.
- Montelius 1922: O. Montelius, *Swedish Antiquities* (Stockholm 1922).
- Mordant *et al.* 2021: C. Mordant/R. Peake/M. Roscio, Weighing equipment in Late Bronze Age graves in the Seine and Yonne valleys. In: L. Rahmstorf/G. Barjamovic/N. Ialongo (eds), *Weights, Merchants and Money. Understanding Technologies of Early Trade in a Comparative Perspective. Weight & Value 2* (Kiel/Hamburg 2021) 159–72.
- Nord 2009: J. Nord, *Changing landscapes and persistent places. An exploration of the Bjäre peninsula*. *Acta Archaeologica Lundensia, Series in Prima* 40, No 29 (Lund 2009).
- Nørgaard 2018: H. W. Nørgaard, *Bronze Age metalwork. Techniques and traditions in the Nordic Bronze Age 1500–1100 BC* (Oxford 2018).
- Pare 1999: C. F. E. Pare, *Weights and weighing in Bronze Age Central Europe*. In: *Eliten in der Bronzezeit. Ergebnisse zweier Kolloquien in Mainz und Athen, Teil 2. Römisch-Germanisches Zentralmuseum, Monographien 43/2* (Mainz 1999) 421–514.
- Pfaff 2005: B. Pfaff, *Klein Zastrow*. In: *Pommersches Landesmuseum Greifswald. Edition Logica 8* (Greifswald 2005) 18–19.
- Radivojević *et al.* 2019: M. Radivojević/B. W. Roberts/E. Pernicka/Z. Stos-Gale/M. Martínón-Torres/T. Rehren/P. Bray/D. Brandherm/J. Ling/J. Mei/H. Vandkilde/K. Kristiansen/S. J. Shennan/C. Broodbank, The provenance, use, and circulation of metals in the European Bronze Age: the state of debate. *Journal of Archaeological Research* 27, 2019, 131–85.
- Rahmstorf 2019: L. Rahmstorf, *Weights, scales and weight-regulated artefacts in Middle and Late Bronze Age Britain*. *Antiquity* 93/371, 2019, 1197–210. DOI 10.15184/aqy.2018.257
- /Ialongo 2020: –/N. Ialongo, *Sind Kannelurensteine Gewichte? Rätselhaftige Objekte aus der Bronzezeit*. *Archäologie in Niedersachsen* 23, 2020, 53–56.
- Reade 2018: J.E. Reade, *Assyrian weights and money*. *State Archives of Assyria Bulletin* 24, 2018, 125–93.
- Schmidt 1993: J. P. Schmidt, *Studien zur jüngeren Bronzezeit in Schleswig-Holstein und dem nordelbischen Hamburg* (Bonn 1993).
- 2016: –, *Der spätbronzezeitliche Hortfund von Stolpe auf Usedom, Lkr. Vorpommern-Greifswald*. *Jahrbuch Bodendenkmalpflege in Mecklenburg-Vorpommern* 62, 2016, 27–80.
- Scholz 2012: H. Scholz, *Lageuntersuchungen als Mittel zur Hortbeschreibung und Interpretation. Lageverhältnisse bronzezeitlicher Horte in Mecklenburg-Vorpommern*. In: S. Hansen/D. Neumann/T. Vachta (eds), *Hort und Raum. Aktuelle Forschungen zu bronzezeitlichen Deponierungen in Mitteleuropa*. *Topoi. Berlin Studies of the Ancient World* 10 (Berlin 2012) 69–92.
- Schou Jørgensen 1988: M. Schou Jørgensen, *Vej, vejstrøg og vejspærring. Jernalderens landfærdsel*. In: P. Mortensen/B. M. Rasmussen (eds), *Fra stamme til Stat i Danmark 1: Jernalderens stammesamfund*. *Jysk Arkæologisk Selskabs Skrifter* 22 (Højbjerg 1988) 101–116.
- Schunke 2021: T. Schunke, *Bronzezeitliche Präzision – Eine der ältesten Feinwaagen Europas*. In: H. Meller/K. Geppert (eds), *Himmelsscheibe, Eiszeitriesen, Jenseitsreiter*. 270 Funde aus

- 140 Jahren Landesmuseum für Vorgeschichte Halle (Halle 2021) 262–263.
- Sperber 1993: E. Sperber, Establishing weight systems in Bronze Age Scandinavia. *Antiquity* 67, 1993, 613–619.
- Stenberger 1964: M. Stenberger, *Det forntida Sverige* (Stockholm 1964).
- Terberger *et al.* 2018: T. Terberger/D. Jantzen/J. Krüger/G. Lidke, Das bronzezeitliche Kampfgeschehen im Tollensetal – ein Großereignis oder wiederholte Konflikte? In: S. Hansen/R. Krause (eds), *Bronze Age Hillforts between Taunus and Carpathian Mountains. Universitätsforschungen zur prähistorischen Archäologie* 319 (Bonn 2018) 103–24.
- Thrane 1999: H. Thrane, Grevensvænge. In: *Reallexikon der germanischen Altertumskunde* 13 (Berlin 1999) 23.
- Thy Museum 2019: Thy Museum, Horned bronze figure and ritual axe found in Denmark. *News Network Archaeology* <https://archaeologynewsnetwork.blogspot.com/2019/03/horned-bronze-figure-and-ritual-axe.html>
- Uhlig *et al.* 2019: T. Uhlig/J. Krüger/G. Lidke/D. Jantzen/S. Lorenz/N. Ialongo/T. Terberger, Lost during combat? A scrap metal find from the Bronze Age battlefield site at river Tollense, NE-Germany. *Antiquity* 93, 2019, 1211–1230.
- Vandkilde 2013: H. Vandkilde, Bronze Age Voyaging and Cosmologies in the Making: the Helmets from Viksø revisited. In: S. Bergerbrant/S. Sabatini (eds), *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Kristian Kristiansen. BAR International Series* 2508 (Oxford 2013) 165–77.
- Vandkilde *et al.* 2021: H. Vandkilde/V. Matta/L. Ahlquist/H. W. Nørgaard, Anthropomorphised warlike beings with horned helmets: Bronze Age Scandinavia, Sardinia, and Iberia compared. *Praehistorische Zeitschrift*, online published 12. 2021: <https://doi.org/10.1515/pz-2021-2012>
- Vebæk 1978: L. Vebæk, Gudinden I åen. *Skalk* 1978/5: 28–9.
- Winther Johannsen 2016: J. Winther Johannsen, Heavy metal – lead in Bronze Age Scandinavia. *Fornvännen* 111, 2016, 153–161.