A prehistory of violence

Evidence of violence related skull trauma in southern Sweden, 2300-1100 BCE

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Evidence of violence-related skull trauma in southern Sweden, 2300–1100 BCE

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Abstract

Warriors and warfare have become common themes within Bronze Age archaeology over the past 10–20 years. Recent reporting of Neolithic and Bronze Age massacres and battlefields in Germany supports the presence of endemic violence in these regions. But what about in southern Scandinavia? This paper explores the evidence of violence-related skull trauma from a pooled sample of 257 individuals from 40 different localities in southern Sweden. The results show that there is a relatively large difference in the frequency of skull trauma depending on burial type. Due to the common practice of Early Bronze Age reburials in Late Neolithic gallery graves, the high frequency of trauma in gallery graves and barrows is probably linked to increased violence rates in the Early Bronze Age. The majority of cases are caused by blunt force, and up to 13% of the individuals were affected. Most of the traumata were healed, especially among males. It is probable that the high levels of blunt-force skull trauma in southern Sweden mirrors a society with endemic warfare during the Early Bronze Age.

Keywords: Trauma, Violence, Late Neolithic, Early Bronze Age, Bioarchaeology

As we continuously encounter acts of violence through the news, both as domestic violence, homicide, gang-related violence, and warfare, it is easy to feel that we are living in a more violent epoch than ever before. When Steven Pinker, in his best-selling book, *The better angels of our nature: why violence has declined*, proclaims that we instead live in the most peaceful of all times (Pinker, 2012), we are likely to raise our eyebrows and deem this untrue. In his book, Pinker collects data of violence-related deaths from prehistoric times up to the present. He builds his narrative of how violence gradually has declined upon a large variety of data, combining archaeological and historical statistics, ethnographical observations, and biological, psychological and evolutionary theory. Although the book has proved strongly influential, it has also received some criticism. The critique has touched upon Pinker's heavy reliance on evolutionary psychology with disregard of other relevant theories that explain human violence (Bhatt, 2013), but also that the data, on which Pinker draws his conclusions about high levels of lethal violence among hunter-gatherers (Lee, 2014), in medieval England (Butler, 2018), and in modern societies (Mann, 2018), are misinterpreted. This critique, of course, influences the reliability of Pinker's claim. However, new evidence of prehistoric violence is continuously being reported, and additional analyses are necessary.

This paper explores the presence of violence and possible warfare through evidence of skull trauma in the south Scandinavian Late Neolithic (LN) and Early Bronze Age (EBA). The results are discussed within a framework of archaeological, anthropological, and evolutionary theories of violence, warriors, and warfare.

Table 1. Compilation of number of hits of search on Google Scholar for papers on prehistoric violence.

Search results of the keywords "prehistoric violence" on Google Scholar.		
Years	**No. of hits**	**Mean no. of hits per annuum**
1900–1950	3 210	64.2
1951–1970	1 450	72.5
1971–1990	4 980	249
1990–2020	45 900	1 530

Violence and archaeological evidence—from non-existent to warfare

When discussing the presence of prehistoric warfare, it is critical to address several variables provided in the archaeological record. It is however also of importance to review the scholarly tradition of the study of violence and warfare. Ferguson (2013a, 2013b) argues for an inclusive approach to the archaeological record, but that suggests that the archaeological record is without biases that affect the scholarship on prehistoric warfare. It is evident that the research interest, as well as the interpretations, of violence and warfare within the field of archaeology has fluctuated through time, which could influence the presence of data.

The interest of prehistoric violence within archaeology has increased significantly in the last decades. From being more or less discarded as non-existent, and thus, not worthy of study, it has become a frequently occurring subject in academic papers in high-profile journals. A search on the keywords "prehistoric violence" on Google Scholar show the tendencies of this development. Publications on prehistoric violence seem to have increased continuously from the first half of the 20th century up to the present day (Table 1). Of course, the example is superficial, but it outlines the general trend in archaeological research interest.

This general trend is not the result of chance, but rather it clearly follows the overarching theoretical attributes of different archaeological paradigms and revolutionary findings. Vandkilde (2003, 2013, 2015) put forward that warfare was not considered in academic archaeological texts until after Keeley's influential book on war before the state (1995), and then only with some caution in the years that followed. Although weapons, and in some cases, also warriors, were natural parts of archaeological themes, warfare, as the link between these themes, was ignored. Why? Vandkilde seeks the answer in contemporary society. After years of vicious warfare and genocide within living memory, warfare, as a part of prehistory, was reluctantly considered. The viciousness of warfare, that so many of those living had experienced personally, was difficult to attribute to the "primitive other" in prehistory (Vandkilde, 2003, 2013). In the years that followed the WWII, prehistoric peoples of the Neolithic and Bronze Age were portrayed as peaceful peasants and traders, not as warriors (Vandkilde, 2003, 2013). As warriors, and in some instances warfare, again gained attention over the last couple of decades, it was during a time when warfare and genocide increased in frequency in the contemporary western world. Still, the warrior was portrayed as part of an elite (almost glorified), even though new findings and

methodological developments provided evidence of warfare and violence, thereby illuminating the horrors of warfare in prehistory (Vandkilde, 2003, 2013). As Vandkilde (2003) points out, the amount of war-related archaeological data, e.g., weaponry, petroglyphs depicting battles, and skeletal trauma, is substantial enough to confirm prehistoric violence and warfare, but has been overlooked as a result of past research traditions.

Kristiansen (2014) argues for an ongoing scientific revolution in archaeology. The scientific revolution of big data, quantitative modelling and biochemical analyses (e.g., aDNA and strontium isotope analysis) is helping to develop the knowledge and understanding of prehistoric warfare. The increasing interest in, and developing scientific respect for, bioarchaeological research (i.e., osteological, isotope, and palaeogenetic analyses), sets a new repertoire of available data of prehistoric violence. This means that in the recent decade we have continuously gained not only new evidence of the presence of skeletal trauma, but also insight in the interrelatedness of individuals suffering from trauma. Without being detached from solid theoretical frameworks, I believe that, following Kristiansen's terminology, the scientific revolution in archaeology can expand our knowledge of prehistoric warfare in ways previously impossible, and this has only just begun.

Warfare, warriorhood and violence—the Nordic Neolithic and Bronze Age

Weapon hoards, weapons as burial equipment, and petroglyphs of weapons and fighting scenes give us glimpses of the importance of weaponry and warfare in the Nordic Bronze Age (NBA), plausibly with warrior chiefs as clan leaders (e.g., Harding, 1999; Kristiansen, 1999; Fyllingen, 2003; Horn, 2015). Even though warriorhood traditionally has been discussed as a significant feature of BA societies, there is a growing understanding that the roots of warriorhood should rather be sought among the different branches of the Corded Ware Culture (CWC) (Neubert *et al*., 2014; Vandkilde, 2016; Ling *et al*., 2018). Horn (2021) however suggests that battle weapons in the form of flint halberds might have already been present among Funnelbeaker groups, thus pushing evidence of possible warriorhood even further back in time. Considering this, warriorhood as a class was already well-established in the NBA and was also likely to have been present throughout the LN.

The petroglyphs of Bohuslän, south-western Sweden, depict a huge amount of fighting scenes. The interpretations of these fighting scenes have comprised religious themes as well as actual representations of warfare. However, it should be stressed that these petroglyphs date to the last parts of the NBA (Ling & Cornell, 2010), thus post-dating the periods under study in this paper. Ling.*et al*, (2018) argue for a "maritime mode of production" with a division between a land-based agricultural aristocracy in Jutland and a sea-based fisher-farmer aristocracy in western Sweden (Tanum). They argue for a linkage between agricultural surplus in Denmark, access to boat timber and maritime experts in western Sweden and Norway, and access and demand for products, such as slaves, in continental Europe. In this linkage, warriors are the protectors and expanders of the chiefdom, as well as capturers of slaves. The warriors were connected to the chieftain and would gain personal prestige from this relationship. Ling *et al*. (2018) point to slaves as important commodities associated with warriors and seafarers, and give examples of the phenomenon as represented in petroglyphs.

A number of wear analyses prove that several deposited weapons had in fact been used and did not solely figure as ritual items (Kristiansen, 2002; Horn, 2013; Melheim & Horn, 2014; Horn & von Holstein, 2017). The

study of skeletal remains provides direct evidence of violence through the presence of skeletal trauma. It is certain that not all violent events leave detectable damage on the skeletons, but bioarchaeology has significantly contributed to the study of violence and warfare in prehistory in the recent decades. The example of Eulau, Germany, provided evidence of murdered families of Corded Ware groups (Haak *et al*., 2008; Meyer *et al*., 2009; Meyer, 2019), and the Early Neolithic mass burial of Talheim showed that, not only did most of the individuals suffer from violent deaths, but they had also been deliberately mutilated and tortured (Meyer *et al*., 2015). Both sites provide important evidence of warfare in the Neolithic, and this evidence challenges earlier interpretations that real warfare (in contrast to ritual warfare) is a much later phenomenon. The assumption, which is dependent on the fact that the Neolithic lacks centralized power and thus the social structure for warfare, is however unrealistic. If ritual warfare exists, so does real warfare (Otto *et al*., 2006, p. 15).

Although scholars have been in general agreement that warfare, ritual or real, was a significant trait of the Bronze Age, few would ever dream of finding an actual example of a battlefield of that time. When human bones in large quantities began appearing around the Tollense river, many had to reconsider. At the site of Tollense a minimum number of 124 individuals, mostly males, were buried at one single time, and as the excavations are still ongoing, many more may yet be recovered. Many of the bones show evidence of trauma (Jantzen *et al*., 2011; Brinker *et al*., 2016). The site has been radiocarbon-dated to 1300 BC, corresponding to the Nordic Bronze Age period III (Brinker *et al*., 2013). Two of the most remarkable finds were that of a perimortem blunt-force trauma (BFT) to a frontal bone, and that of a perimortem trauma caused by a flint arrowhead in a humerus, where the arrowhead was found still embedded in the bone. Not only do the trauma types provide incontrovertible evidence of conflict, but the number of dead individuals, as well as the demographic composition, do not reflect that of a natural population (Jantzen *et al*., 2011; Flohr *et al*., 2015). After Bennike's (2003) re-evaluation of her own interpretations of prehistoric trepanations as in fact being cranial trauma, it was evident that prehistoric Denmark was not spared from violence either. The majority of skull traumata that were previously interpreted as trepanations were reinterpreted as blunt-force trauma, not unlike the kind reported from Tollense.

Academic papers continued to provide bioarchaeological evidence of high frequencies of violence-related trauma in northern Europe. Fyllingen (2003) argues for structural and endemic violence in NBA Norway, given the evidence of a high frequency of repeated trauma and physiological stress found in a mass burial in Sund, Inderøy, Nord-Trøndelag, Norway, and Fibiger *et al*. (2013) provided data to support frequencies of violence-related skull traumas of between 9.4 and 16.9% in Neolithic Sweden and Denmark, respectively. Since such a large part of the population was affected, and since the majority of the injuries showed signs of healing, they argue for violence and warfare also being endemic in Neolithic Scandinavia. The mass burials of central Europe have, presently, no direct affinity in Scandinavian burials, but the evidence of repeated violence also in Scandinavian prehistory is stacking up.

It is evident that warfare and warriorhood are significant parts of Bronze Age societies. However, in what ways does this warriorhood influence people in general? There are several different types of violence. The World Health Organization's ecological model of violence (WHO, 2002) consists of four overlapping layers—individual, relationship, community and societal—which all interplay in a complex matter. The societal stage includes cultural norms of violent behaviour on a state level, in this context warriorhood, but these norms also play a role in the other stages. Thus, violent behaviour is entangled as a web, and violence

between the different stages, i.e., interpersonal, group, and societal, is interconnected (Turpin & Kurtz, 1997). That is, in societies where violence is encouraged on a state level, e.g., through strong military control, violent behaviour is also more common between individuals and between different groups. Thus, it is necessary to consider all types of violent behaviour to gain insight into the social complexity of conflict.

Violence is a significant part of warfare; however, warfare is more than violent acts and all violence does not necessarily equate to warfare. The distinction between violence associated to warfare and other types of violence, e.g., homicide or ritual violence, can be hard to discern in archaeological remains, although they are generally interconnected. Therefore, a wider definition of warfare might be adequate. Warfare could thus be defined as a co-ordinated action within a group aiming to harm another group through the means of violence. A categorization of "war-related violence" might be a good compromise (Vandkilde, 2015). Considering the interconnection of different levels of violence, an inclusive approach to violent behaviour in prehistoric contexts seems adequate.

Weaponry and combat techniques

The distinction between what is to be considered a weapon and what is to be considered a tool is sometimes problematic. Weapons can often be used both as hunting equipment and in violent acts between humans. Usually, a definition of weapons (e.g., arrowheads and swords) and tool-weapons/weapon-tools (e.g., axes and daggers) is made, the latter including their properties of dual possible use (Vandkilde 2006, p. 366). It is probable that both regular weapons and weapon-tools have been used in battles, exemplified by petroglyphs depicting both battles with axes and with swords. However, both spears and arrows can be used also in hunting. The sword, on the other hand, is only suitable in human-against-human battles.

Molloy (2010) argues that both sword casting and sword fighting require expert training and that military needs would have pushed bronze casting substantially forward. In contrast to daggers, sword casting and fighting with swords called for specialization. Thus, it is likely that sword-fighting was only practised by a specialized part of the population, i.e., warriors, and did not merely replace the use of daggers in battles, but was socially and politically sanctioned. This means that there must have been a large amount of weapons that were used in violence by non-specialists, many of which are probably missing in the archaeological data due to taphonomic processes.

Weapons inflict damage to the body in different ways, and the target part of the body to strike would differ depending on the weapon. While blunt weapons are suitable for crushing hard tissue, bladed weapons are suitable for cutting soft tissue. Bladed bronze weapons were used to cause extensive bleeding or injure the internal organs, only accidentally causing damage to the bones, considering the risk of the blade then getting stuck. It is probable that the attacks from bladed weapons were directed towards the limbs, neck and abdomen (Hermann *et al*., 2020). According to Molloy (2010), the metallurgic characteristics of BA swords would be associated with a high risk of the blade breaking if attempting to cleave a target with high force. Rather, a controlled cutting with the blade is suggested (Molloy, 2010; Hermann *et al*., 2020). BA swords would as such rarely be associated with skull trauma, an assumption strengthened by bioarchaeological investigations (Aranda-Jiménez *et al*., 2009).

Dyer & Fibiger (2017) tested the impact on skull bones of a blow from a replica of the Neolithic wooden Thames Beater, through experimental analyses on an artificial human skull. They found that the blunt-force trauma

associated with the experimental blow had highly similar features to archaeological blunt-force trauma. They argue that wooden clubs were probable weapons of choice in Neolithic Europe, but that other blunt object, such as sling-stones, could possibly also be associated with prehistoric blunt-force trauma. Dyer & Fibiger's results demonstrate that a large quantity of prehistoric violence-related skull trauma can be associated with weapons often undetectable in the archaeological material. Wooden clubs were also found at the battlefield of Tollense (Jantzen *et al*., 2011). As such, reconstructions of combat techniques need to be addressed both through the properties of the archaeologically detectable weapons, and through the skeletal lesions of the combatants themselves.

The osteological material

The study in question is based on a minimum number of 257 individuals from the provinces of Scania and Västergötland in southern Sweden. The sample is pooled, originating from 40 different localities, dating to the LN and EBA (Figs. 1 & 2). All the remains were retrieved from inhumation graves during the 20th century, and underwent osteological analyses between 2012 and 2016, as part of the author's doctoral research project. Most of the remains had previously never been osteologically examined. The preservation of the remains varied greatly, from excellent preservation to heavily fragmented, which challenged the analyses. The burial customs of the LN and the EBA in southern Scandinavia include single inhumation in flat burials, single inhumations in barrows and cairns, and multiple inhumations in gallery graves. This study includes inhumations from all these burial traditions, with a division of n=43 flat burials, n=14 barrows, and n=11 gallery graves. In many cases several flat burials from the same gave field were examined.

Methods

While sorting out individuals from flat burials and barrows is relatively easy, the same procedure is nearly impossible when it comes to gallery graves. Because of this, the inhumations from these kinds of multiple burials had to be treated as a bulk material and addressed on the level of skeletal element frequencies. For comparability, this analysis is thus based on elemental frequency of skull trauma. Only elements that were preserved to a degree of 50% or more were included in the analysis. Smaller skull fragments were considered too small to be able to assess the element correctly to location and side, as well as the possibility of counting one skull trauma more than once was more likely. Elements were separated into left and right side when paired.

There is always a possibility for skull trauma to be caused by accidents. In modern cases, most severe skull traumata are caused by motor vehicle accidents (Hyder *et al*., 2007). However, there are general morphological differences between accidental and intentionally caused skull trauma. While accidental skull trauma commonly results in linear fractures, violent acts correlate well to depressed fractures (Walker, 1989; Lovell, 1997; Symes *et al*., 2012; Li *et al*., 2021). Further, traumata above the hat brim line (HBL), i.e., the upper part of the cranial vault, are more likely to be caused by intentional force than accidents (Ehrlich & Maxeiner, 2002; Kremer *et al*., 2008). Both characteristics have been acknowledged in this investigation. Skull trauma has been divided between healed, antemortem injuries, and unhealed perimortem trauma after Ortner (2003). Botham (2019) emphasizes an over-diagnosing of healed blunt-force trauma in skeletal remains and argues that the criteria often used to diagnose such are not pathognomonic.

Figure 1. Map of the distribution of five gallery graves from Västergötland, south-western Sweden. 1 = Torbjörntorp 31, 2 = Medelplana 54, 3 = Österplana 27, 4 = Timmersdala, 5 = Falköping stad 5. Map created using ArcGIS 10.5 by Esri. Reproduced from Tornberg (2018).

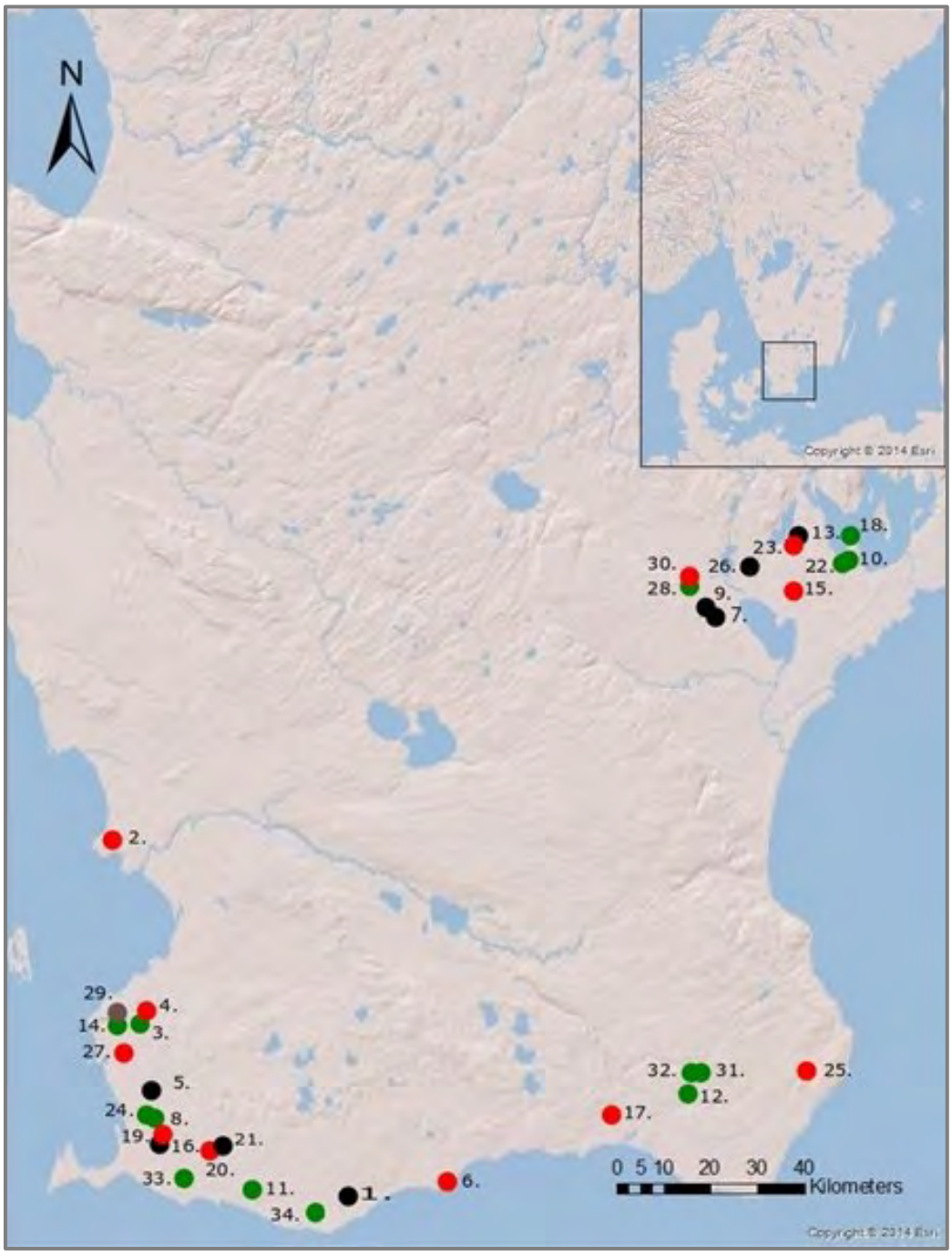

Figure 2. Distribution of the Scanian localities. 1 = Äspö, 2 = Rörbäck 10, 3 = Tannhäuser, 4 = Höjagården, 5 = Vattenöverföringsledningen, 6 = Abbekås (barrows I & II), 7 = Ängamöllan, 8 = Kyhlbjersbacken, 9 = Öllsjö 7, 10 = Kiaby 80, 11 = V. Virestad 19, 12 = Bollerup 4, 13 = Österslöv 57, 14 = Järavallen, 15 = Riksvägen, 16 = Håslöv 5, 17 = Hemmanet, 18 = Bäckaskogs kungsgård, 19 = Åkes hög, 20 = Hammarlöv 6, 21 = Bonhög, 22 = Kiaby mosse, 23 = Österslöv 24, 24 = Vellinge 27, 25 = Viarp, 26 = Möllebacken, 27 = Solnäs, 28 = Skepparslöv, 29 = Knuts backe, 30 = Skepparslöv 20, 31 = Hammenhög 26, 32 = Hammenhög 35, 33 = Ahlbäcksbacken, 34 = Snorthög. Red = barrows, green = flat burials, black = gallery graves. Map created using ArcGIS 10.5 by Esri. Modified from Tornberg (2018).

He discusses both treponematosis and cysts that leave similar marks on the cranial vault. This is of course true, but considering that treponematosis is unknown from prehistoric Scandinavia, and bone-modelling cysts are to be considered rare, most depressions of the skull, however, need to be addressed as trauma.

Sex and age were estimated using standard osteological protocol, when possible. It was rarely possible to attribute the commingled remains of megalithic gallery graves to specific individuals. In these cases, secondary characteristics of the crania were used to assess sex. Characteristics of the cranium are less reliable in assessing specific sex since these characteristics are defined as differences in robustness. It is well acknowledged that robustness differs between time and populations and is dependent on cultural habits such as diets. However, within each population, these characteristics are relatively reliable in referring different degrees of robustness to different sexes. In this study, these characteristics were defined in reference to the population.

Skeletal evidence of violence in southern Sweden

From the total of 257 individuals, at least 82 were males, 65 were females, and 65 were juveniles. Additionally, 45 individuals were adults of either sex. None of the juveniles exhibited any skeletal pathology of the crania that could be associated with trauma. It should however be noted that skulls from juveniles suffered from higher degrees of fragmentation and were thus excluded from the analysis in higher frequencies. The majority of the inhumed individuals derive from gallery graves, followed by barrows and flat burials. The flat burials in Scania are mostly dated to the LN I, while gallery graves from both Scania and Västergötland include burials from the LN II–EBA. In Scania, most of the inhumations are dated to the EBA (Bergerbrant *et al*., 2017, Tornberg 2017, 2018). There are small differences in the frequency of skull trauma between the different burial types, with flat burials exhibiting the lowest frequency with only one individual (Table 2). It is possible that this difference is due to the earlier date, but other explanations could not be excluded. There does not seem to be a tendency towards a difference in proportion of males versus females in the different burial types; the inhumations in flat burials are divided as 16 juveniles, 16 males and 12 females in barrows, 13 juveniles, 13 males and 10 females, and in gallery graves, 35 juveniles, 45 males and 42 females. The span in frequency in gallery graves is due to the commingled state of the skeletal remains. It is possible, however not probable, that one individual has been counted more than once due to poor preservation, hence the minimum and maximum number of individuals suffering from skull trauma has been presented. This span indicates that between 6.7 and 10.4 of the individuals buried in gallery graves were suffering from skull trauma. These are equal numbers to BA barrows.

However, if we consider that none of the juveniles show evidence of skull trauma, it might be reasonable to calculate the percentage of the adult population. When this is done, there is a frequency of 8.5–13.2% (n=129) in gallery graves, 11.1% (n=36) in barrows and 3.6% (n=28) in flat burials.

Only 14 of the traumata could be associated with definite sex; nine were males and five were females. The proportion of affected males would thus be at least 10.8%, and for females 7.7%. There is as such a small predominance of violence-related trauma among males, but the difference is not statistically significant ($p = 0.3568$). However, the suffering individuals that could not be associated with specific sex could fall within either of the categories, altering the results. Of the affected males, only one exhibited a perimortem lesion, while as many as three of the females did not show any evidence of healing. It seems as if females

Table 2. Frequency of skeletal trauma, divided by burial type.

Burial type	MNI	Trauma MNI min.	Trauma MNI max.	Healed	Unhealed	% total
Gallery grave	164	11	17	10	8	6.7–10.4
Barrow	49	4	4	4	0	8.2
Flat burial	44	1	1	0	1	2.3

Table 3. Affected skull bones divided by side and healed vs. unhealed trauma (l = left, r = right).

	Frontal (l)	Frontal (r)	Parietal (l)	Parietal (r)	Temporal (l)	Temporal (r)	Occipital
Total no.	119	121	105	95	116	105	99
Total unhealed	3	1	2	1	1	0	0
Total healed	6	3	2	6	0	0	0
% trauma	7.6	3.3	3.8	7.4	0.9	0	0

might in general be less susceptible to trauma, but if so, in higher degrees died from their injuries. These results are supported by other European Neolithic–BA skeletal assemblages (Dyer & Fibiger, 2017). It is probable that this pattern indicates the reoccurrence of violent encounters among males, while females were more often victims rather than aggressors. All traumata are located on the front or upper part of the cranial vault (Table 3). Usually, violence-related trauma is discussed as mostly present on the left hemisphere due to face-to-face combat with a right-handed aggressor. When it comes to the south Swedish sample it is evident that trauma of the parietal bones occurs more frequently on the right hemisphere. However, when it comes to the frontal part of the skull, the majority of cases are situated on the left side.This fact might be a result of that frontal injuries are mostly due to face-to-face combat, while parietal trauma could in large extent be caused by blows from the side or from behind. Forensic studies show that depressed fractures on the right side of the posterior part of the crania is most common head injury type in violent assaults (Kranioti, 2015). The pattern from southern Sweden could thus indicate that the injuries were caused, not only by face-to-face combat between two aggressors, but by battles between more than two combatants, perhaps in warfare. It is evident that almost all skull trauma in LN–EBA southern Sweden is consistent with blunt-force trauma. Only two injuries of the skull might be consistent with projectiles, while sharp-force trauma to the head is completely missing. The most common fracture type is depressed fractures, or pond fractures (shallow depressions), without visible involvement of the inner table (Fig. 3). These types of fractures are often consistent with slow loading on a small part of the skull (Kranioti, 2015). However, there is a possible bias of intracranial involvement where skulls were intact, and thus it was not possible to examine them visually. Radiating fractures associated with blunt-force trauma originate on the inside of the skull, because of inward bending due to the applied force, and consequently these are not necessarily visible on the outer table. All traumata are located above the hat brim line and as such, indicate a

Figure 3. Examples of blunt-force trauma in individuals from LN–EBA southern Sweden. Healed pond fracture on the left frontal in an elderly female (left), and blunt-force trauma with bone remodelling on right parietal in an adult individual (right). Note the sloping parietals i.e., biparietal thinning, on the left skull, indicating an age of over 70 years. Photographs: Anna Tornberg.

violent origin. The lack of sharp-force trauma in the south Swedish skeletal assemblage is interesting, however not unique. If one compares the types of cranial injuries to the skeletons of Tollense, it is evident that most violence-related skull injuries in the NBA are due to blunt-force trauma. This is probably a result of combat technique. While blunt weapons are used to cause severe damage to hard tissue like bones, sharp weapons are used to cause damage of soft tissue, and therefore only occasionally affect bones. In reference to this, we do not expect a vast quantity of sharp-force trauma to the skull in the NBA.

Trauma or trepanations—or both?

There are always problems in discriminating trauma from trepanations in skeletal remains. There are numerous examples of reported cases of prehistoric trepanations, but as Bennike (2003) states in her re-evaluation of Danish examples, many of these cases are probably not trepanations, but severe skull trauma due to blunt- and sharp-force trauma. Although the first historical document of trepanation, from ancient Egypt, dates as old as possibly 5,000 years (Walsh, 1987, pp. 1–4; Wilson *et al*., 2017), the same document also provides evidence that the surgical intervention in most cases was as treatment of war-wounds. The same conclusion is put forward by Andrushko & Verano (2008) and Jolly & Kurin (2017), who provide supporting evidence that most trepanations are found in relation to skull trauma, thus functioning as treatment of war-wounds.

In the south Swedish sample two individuals show evidence of head injuries that could be possible trepanations. Neither of these individuals was included in the trauma analysis since a traumatic origin cannot be concluded. The first individual is dated to the EBA period II and was buried in a mound at the site of Abbekås, Skivarp parish, in Scania. The individual suffered from a ca. 50 x 63 mm hole through the complete skull on the left parietal (Fig. 4). The individual is a male approximately 40–50 years old at death. The wound shows clear signs of healing and a loss of diploëic structure. The examination of the skull is complicated due to attempted

Figure 4. Possible Bronze Age trepanation from barrow I in Abbekås, Skivarp parish. Photograph: Anna Tornberg.

Figure 5. Possible LN–EBA trepanation from a gallery grave of Ängamöllan, Vä parish. Photograph: Anna Tornberg.

reconstructions of the skull in the 20th century. Thus, it is difficult to assess possible evidence of radiating fracture lines linked to heavy blunt-force trauma. The other case is a young individual inhumed in a gallery grave at the site of Ängamöllan in Vä parish, Scania. The possible trepanation hole is situated on the left parietal. The skull shows some, but not excessive, signs of healing (Fig. 5). Neither of the cases show evident signs of trepanations, such as scrape or cut marks. Although the evidence of trepanations is inconclusive, the location of the injury on the left parietal is consistent with other examples of prehistoric blunt-force trauma. As such, both cases might be regarded as having suffered from violence-related trauma and might subsequently be included as evidence of violence in the LN–EBA.

Discussion and concluding remarks

In this article, evidence of violence-related skull trauma in the south Swedish LN and EBA has been analysed in relation to burial type, location on the cranial vault, and sex.

It is evident that the majority of the skull traumata were caused by blunt force. None of the individuals showed evidence of sharp-force trauma that could be assigned a blow from an axe or a sword. All the affected individuals were adults, with a slight dominance of males. However, females exhibited higher frequencies of unhealed versus healed trauma. The analysis suggests that none of the juveniles were afflicted with skull injuries. It is possible that children were not exposed to violence, but the results could be biased since the immature remains suffered from higher degrees of fragmentation, and thus were excluded from the analysis to a greater extent than the adults. The trauma patterns among juveniles are inconclusive when it comes to prehistoric violence. Meyer *et al*. (2015) provide evidence of perimortem skull injuries in juveniles from the massacre of Talheim, and Fibiger (2013) found evidence of violence in children in Neolithic Germany. The remains from Tollense include children, but none of them exhibited evidence of trauma (Jantzen *et al*., 2011). At the same time, Aranda-Jiménez *et al*. (2009) only found evidence of violence in the adult population of Bronze Age Iberia. It seems likely that children and adolescents occasionally encountered violence, but that skull trauma among immature remains is more likely to occur in contexts of massacres than among traditional burials. Most bioarchaeological investigations provide support for higher levels of skull trauma among males than females (Aranda-Jiménez *et al*., 2009; Ahlström & Molnar, 2012; Schulting, 2012; Fibiger *et al*., 2013; Meyer *et al*., 2015), but Dyer & Fibiger (2017) also state that the difference in perimortem fractures are relatively equal between the sexes. It is likely a result of males being more regularly involved in conflicts both as aggressors and victims, while females encounter conflicts as victims in battles and abuse. Although it is possible that females took part in conflicts as aggressors, the pattern of antemortem and perimortem skull trauma speaks against it as frequently occurring in LN–EBA southern Sweden.

Although left-side skull trauma is generally considered evidence of face-to-face combat with a right-handed aggressor, skull trauma in southern Sweden has an equal distribution of location on the left frontal and right parietal bones. It is true that face-to-face combat probably more frequently resulted in damage to the left side of the skull, but that would mostly include blows to the frontal part of the head. Evidence from forensic sciences shows that, when it comes to assault, the right side of the parietal is most affected (Kranioti, 2015). The patterns of the south Swedish LN–EBA thus suggest a combination of face-to-face battle and assaults from the back or the side. It is possible that this pattern is related to the injuries being caused by blunt force. It is perhaps more likely that face-to-face combats are engaged when the combatants are fighting with swords, but that strikes from blunt objects

are more commonly inflicted from behind or from the side. There is of course a possibility that right-sided blunt-force trauma is connected to violent assaults such as raids, but in connection to Vandkilde's (2015) broader definition of war-related trauma, it would still be associated to a war-oriented social structure. As Molloy (2010) and Hermann *et al*. (2020) point out, to target the skull with a Bronze Age sword would be ineffective since the risk of the sword breaking would outweigh the possibility of harming the opponent. In this respect we would not expect to find sharp-force trauma of the skull region. It is plausible that face-to-face sword-battling was undertaken, but from a technological point of view it would be more efficient to target the soft tissue of the opponent. Hermann *et al*. (2020) argue that targeting both the chest area and the head area would increase the risk of the blade getting stuck in bone, thus making the aggressor vulnerable. The lack of sharp-force trauma in Bronze Age skeletal remains should thus not be considered as a sign that swords were not used in combat, but rather that skilled swordsmen would try to avoid hitting bones. Unfortunately, bioarchaeologists seldom have the opportunity to study soft tissue, which is why data from a variety of sources are necessary to understand patterns of violence-related trauma and conflict in prehistory.

The frequency of violence-related trauma ranges between 2.2 and 10.4% depending on the burial type. If only the adult population is considered the numbers increase to 8.5–13.2% (n=129) in gallery graves, 11.1% (n=36) in barrows and 3.6% (n=28) in flat burials. The frequencies found in gallery graves and barrows are consistent with earlier analyses of skull trauma from Neolithic Sweden and Denmark (Fibiger *et al*., 2013). Individuals buried in flat burials are affected by violence to a much lesser extent than those inhumed in gallery graves or barrows. It is possible that the burials reflect differences in social status and that individuals acquiring inhumations in flat burials due to their social status are to a lesser extent engaged in conflicts. Håkansson (1985) suggest that individuals inhumed in flat burials are of mid-range social status. If so, this suggests that both the upper class buried in barrows, and a lower class, inhumed in gallery graves, were more commonly involved in violence. Would this then reflect a distinction between warrior-specialist prominent burials in barrows, and peasant-fighter burials in gallery graves? Maybe, but it is perhaps rather a reflection of chronological differences. Although gallery graves are generally considered to be of LN date, recent radiocarbon dates of skeletal remains provide evidence of major reuse of Scanian gallery graves in the Early Bronze Age (Bergerbrant *et al*. 2017; Tornberg, 2017). In fact, a majority (15/22) of the skeletal remains in Scanian gallery graves are Early Bronze Age. At the same time, 11/20 flat burials are dated to LN I, and only three have a Bronze Age date (Tornberg, 2017). It is highly likely that the difference in skull trauma frequencies between burial types is in fact a reflection of increased societal conflict between the LN and EBA in southern Sweden. The reason for this is uncertain, however, it is possible that the reburials in LN gallery graves reflect a population increase and increased hierarchization in the EBA (Bergerbrant *et al*., 2017; Tornberg, 2017), both well-known triggers for violence. As an effect of long-distance mobility (Frei *et al*., 2015) and a general increase in conflict in central Europe as seen, for example, in the battlefield of Tollense, it is possible that a more violent and warfare-oriented society also developed in southern Sweden.

So, were the south Swedish LN and EBA periods violent? Yes, at least in the later part. There is a clear difference between burials, where frequencies in the later part of the LN and in the EBA exhibit far more skull trauma than earlier LN burials. Do the skeletal remains support warfare? Perhaps. If up to 13% of the adult population suffered from violence-related skull trauma, the data, at the very least, support endemic violence. That males to a greater extent than females were both inflicted

by skull trauma, but also show higher degrees of healed trauma, might also be linked to repeated conflict. Looking into the web of violence (Turpin & Kurtz, 1997; WHO, 2002), it is fair to discuss endemic violence as a part of societal acceptance, and maybe promotion, of violent behaviour. If violence is encouraged by the political power, acts of violence are likely to be present in all parts of the society, both on an individual level and between groups. As the NBA clearly represents warrior aristocrats, warriorhood and enacted warfare is a natural part of such societies. Although the frequency and nature of skull injuries in the NBA does not differ significantly from those described in studies of the Neolithic, there is a considerable difference; there are no swords in the Scandinavian Neolithic. The weapons of the Neolithic are all blunt or semi-blunt weapons. The battle technique associated with these kinds of weapons would predominantly target hard tissue, and the head would be the most efficient body part of your opponent to damage. Thus, one could expect that most lethal injuries would be associated with blows to the head, and that most violent encounters with the aim of severely injuring or killing the opponent would be found in the head region. When it comes to the Bronze Age, the situation is quite the opposite. Although blunt weapons were still in use, and obviously very much so, the warrior weapon was the sword, which would have been much more lethal than a wooden club. As sword cuts would affect the soft tissue, and only occasionally the bones, it is much more likely that evidence of violence in the NBA is left undetectable in the skeletal remains, and that evidence of skull trauma only reflects a small subset of actual violent acts. In the battlefield of Tollense, only 14% of the perimortem injuries were attributed to the head, and only 7% of the individuals showed evidence of ante- or perimortem skull injuries (Brinker *et al.*, 2016; Horn, 2021). Hence, this paper provides evidence of skull trauma frequencies of similar, or even exceeding numbers, to that of Tollense for the south Swedish LN–EBA. Palaeodemographic analysis might aid in the interpretation of possible warfare in the NBA and a high age non-specific mortality of LN–EBA southern Sweden is possibly linked to high frequencies of violence (Blank *et al.*, 2018; Tornberg 2018).

In a society where violence is endemic, the evolutionarily sensible thing to do is to continue fighting (North *et al.*, 2009; Pinker, 2012, pp. 32, 611ff.). If violence is frequent enough to decrease the risk of surviving into fertile age, more aggressive behaviour might be favoured, both culturally and evolutionarily. It is difficult to conclude if this is the case in the NBA, but violence does seem to be affecting the palaeodemography of southern Sweden, with generally high mortality in mid-life (Blank *et al.*, 2018, Tornberg, 2018). Related to this is the presence of care. Caregiving, such as trepanations, must have been crucial for the sustainability of a violent society. Perhaps both the high survival rates of blunt-force trauma and the two possible trepanations are examples of this. Although I generally agree with Bennike (2003) of the overinterpretation of prehistoric trepanations, I dare to conclude that care has been present, which I suggest in a previous paper on skull trauma in Neolithic Sweden (Tornberg & Jacobsson, 2018). It is probable that the overinterpretation of ancient trepanation should be seen through the lens of a past interpreted as pacified, as suggested by Vandkilde (2003, 2013, 2015). However, in the same way that it might be evolutionarily sensible to keep on fighting, the same goes for caring for the injured. Spikins *et al*. (2019) wisely argue that care provision should be viewed not as an example of complex cultural behaviour, but as a "risk-pooling" strategy among others. In this respect, caregiving should be considered a natural part of a society where violent acts are common, and evidence of trepanations should rather be interpreted as further signs of violent acts rather than a separate feature in prehistoric societies.

To conclude, violence, and probable warfare, was endemic in the south Swedish LN–EBA. With evidence of skull trauma in comparable numbers to that of a known contemporary battlefield, it is evident that we also have a prehistory of violence in southern Scandinavia. Maybe Pinker was right—maybe violence, in fact, has declined. To fully understand the social patterns of violence and warfare, further analyses are necessary. The scientific revolution in archaeology is likely to provide data and tools to support this aim. A combination of big data, ancient DNA, and high-resolution isotope analysis could help us to obtain a broader knowledge of kinship, migration, and mobility as possible triggers of and explanations for prehistoric warfare.

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