# Danish Journal of Archaeology

2021
Volume 10

# Danish Journal of Archaeology

This innovative journal is dedicated to the presentation, discussion and interpretation of the archaeological record of southern Scandinavia in its international, regional and local context. Providing a platform for publication and debate for professionals from the museum as well as the university sectors this journal is open for empirical, methodological and theoretical contributions covering all time periods and all kinds of archaeology with relevance for the Scandinavian, Baltic, and North Atlantic regions. In addition, the journal may publish articles of wider theoretical, discursive or global reach.
The Danish Journal of Archaeology includes original research articles, news and discoveries, and discussion pieces with the intention of fostering open debate about the archaeological record of southern Scandinavia in its broadest sense and the position of archaeology as a discipline in the modern world.




ISSN: 2166-2290
Layout: Katrin Atzbach, Højbjerg, Denmark
Cover: Combination of the site plan with outline of the borgring monument, and indication of excavation trenches (Graphics: Museum Southeast Denmark, article from Jonas Christensen et al. Fig. 2) and an aerial photograph of the site (Photo: SDFE, Agency for Data Supply and Efficiency, article from Catherine Jessen et al. Fig. 6)

# Contents

**Brief communication**

# Editorial

Thomas Grane, Mette Svart Kristiansen, Rune Iversen, Lasse Sørensen

The editorial team is happy to present the 2021 volume of *Danish Journal of Archaeology*.

Thanks to generous funding from Elisabeth Munksgaard Fonden and Farumgaard-Fonden in 2020, we have been able to acquire the rights to the back issues of the journal from the previous publisher Taylor & Francis. We are therefore able to provide our readers free access to all volumes of *Danish Journal of Archaeology* (2012 and forward).

We have also acquired the rights to the *Journal of Danish Archaeology* published 1982 to 1991 and in the following years, 1993, 1995, 1997 and 2006. JDA will have its own website on tidsskrift.dk and we are currently in the process of preparing it for publication. JDA will also be open access. We will, of course, place a link to JDA on our website for easy access as soon as we're ready, so be sure to return to the site soon.

This year we have also been preparing the journal for increased readership and scientific impact by applying for membership at DOAJ, the Directory of Open Access Journals. DOAJ is a non-profit, worldwide, community-curated index of quality, peer-reviewed open access journals. Starting from next year's volume (11), articles in DJA will be licensed under Creative Commons (CC BY-NC-SA), which amongst other things, means that third parties are free to use the material on condition that appropriate credits are given, it is not used for commercial purposes and any subsequent licensing is not stricter. The editorial board may accept other Creative Commons licenses for individual articles, if required by funding bodies, for example.

This volume contains 13 impressive articles, which are presented here in chronological order.

In the research article section, Frei and Klingenberg present the first strontium isotope analyses from one of Northern Europe's richest Early Roman Iron Age graves, the princely burial at Hoby on Lolland. The Hoby grave was discovered in 1920 and contained a stunning collection of Roman luxury goods, from a time when the Roman Empire increased its political and diplomatic relationships with Northern Europe. The grave and the nearby settlement that has been excavated in recent decades indicate that the Hoby area played a central role in these relations.

The phenomenon of primary and secondary animals is investigated by Bangsgaard and Pantmann, who examine depositional practices involving animal bones in the Iron Age. Using Salpetermosen in northern Zealand as a basis, and comparing the remains from here with depositions in other parts of Denmark, they demonstrate a hitherto unseen pattern: one animal species stands out compared to others in terms of the quantities of bones present, for which they use the terms primary and secondary animals.

Borake presents a unique female figurine from Boeslunde. It is made of gilded silver and probably dates to the Late Germanic Iron Age/Early Viking Age. It is argued that the figure functioned as an amulet. As the necklace is apparently an important attribute, it is discussed whether it could represent Freyja and Brisingamen. Differences in the size and shape of her eyes also seem to be significant, and point towards wisdom and foresight.

'Reconstructing the Gerdrup Grave' is an article by Kastholm and Margaryan, who discuss the interpretation of the 9$^{th}$ century burial, thus demonstrating the importance of genetic analysis. The initial interpretation proposed this was a master and slave burial, in which the woman was buried first followed by the man, who was killed before being buried. New genetic analysis, however, shows that the burial was actually a mother and son, therefore posing new questions regarding why these two family members were joined together in the afterlife.

Jessen and Majland present a Late Viking Age chair pendant from the elite settlement at Gudme. Context, distribution and association with the sovereign seeress are discussed. A new overall interpretation of 'triangulated reference' is proposed, linking the king, Odin and the seeress with the concept of seiðr, the act of performance and the privilege of being seated.

This volume contains four articles constituting the publication of the excavations in 2016-2018 at Borgring, near Køge in East Zealand. One article provides an overview, whilst the other three all investigate specific issues concerning Borgring.

In 'Borgring. Uncovering the strategy for a Viking Age ring fortress in Denmark', Christensen et al. describe the setting and remains/finds from Borgring. Situated on the northern bank of the Køge river valley, the ring fortress corresponds in its dimensions with the other known ring fortresses. The excavations confirmed that the wall was interrupted by four gateways, but no internal buildings could be identified. It is concluded that the fort was never completed. Three of the gates showed signs of fire, but finds within the eastern gateway pointed towards secondary use. The authors conclude that Borgring was part of the network of fortresses established under Harald Bluetooth.

In 'The coldest case of all' by Ljungkvist et al., the excavators enter into a collaboration with the National Forensic Services of the Danish Police, applying modern fire investigation methods to the examination of the eastern gateway. The fire investigation is aimed at determining how the fire developed. The construction of the gate building itself in the eastern gateway is determined.

Jessen et al. take a look at the lost landscape of Borgring, using geoarchaeological investigations to help reconstruct the landscape and surroundings, as well as the Borgring fortress, during the Viking Age. One of the aims was to examine the navigability of the stream running just to south of the fortress, in order to see whether naval access could have been important to its the location.

In the final Borgring article, 'Turfs and timbers', Mortensen et al. reconstruct the amount of building material used to construct the circumvallation. They also estimate the area that would have been required to provide the right amount of turfs and timbers. For this, they use REVEALS pollen data modelling to quantify the regional oak land cover, thereby demonstrating how much land was needed to provide the builders with the material to construct the Borgring fortress.

In his debate article, Price comments on the recent reactions to and ongoing discussions about the credibility of interpretations of strontium isotope proveniencing in Denmark. Price argues that the strontium isotope method is still very useful for identifying non-local individuals, despite the identification of small geographical areas in Denmark with higher strontium isotope values, as well as the challenges involved in using surface water for baseline information.

In the brief communication section, Bennike et al. present and discuss a Mid-Holocene reindeer antler. The piece of antler has been radiocarbon dated to 4700 cal. BC, when no reindeer lived on Zealand, which was characterised by dense Mid-Holocene forest. The reindeer antler from Regstrup instead suggests contact networks existed with hunter-gatherer societies in Norway or Sweden, which exchanged reindeer antler for high quality flint.

In 'The Aldersro wetland-settlement complex', Roborg and Løvschal discuss the deposition and mortuary practices in Eastern Jutland. In this brief communication, they present the excavations at Aldersro in 2002-2003. The remains included both settlement features and a wetland area. The numerous finds also included human remains of more than eight individuals, which were deposited mixed together with typical debris, providing important new insights into mortuary practices in the Early Iron Age.

Peter Pentz compares one of the most high-status genres of the Old Norse poetry, the so-called shield poems, with the archaeological evidence for decorated shields. As no such decorated shields are preserved, the best source for shield decoration are the numerous miniature shield amulets, which have been recovered from excavations and collected as stray finds. The combination of written sources and archaeological finds thus provide new insights into the decorative aspects of the Viking Age.

In previous years, we have solely published research articles, but are pleased to see our call for other formats has been successful in this volume, which is made up of research articles, debate articles and brief communications. A series of papers are in progress for the next volume 11, 2022. They will be published when ready, so keep an eye out for upcoming publications in 2022, about new projects and discoveries from the field, laboratories, libraries and researchers at their desks.

We hope you will enjoy this volume!
The editorial team

# Re-visiting the Roman Iron Age Hoby chieftain's burial 100 years after its discovery – adding the strontium isotopic perspective

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**ABSTRACT**
The remains of one of Northern Europe's richest graves, the Hoby chieftain's burial, were found in 1920 on the island of Lolland (southern Denmark). The grave revealed a large number of luxurious Roman goods, including two silver drinking cups decorated with Greek-inspired scenes from Homer's Iliad. The burial dates to the Early Roman Iron Age (c. 1CE -150/160CE), and represents a key site from the time period when the Roman Empire failed to expand towards the north and altered its strategy towards a more political and diplomatic relationship with the tribes in Northern Europe. Hence, the Hoby burial is considered a key example reflecting this strategic transition. Here we revisited the Hoby burial materials and present the first strontium isotope analysis of the so-called chieftain's skeletal remains. Analyses of three of the individual's teeth, complemented by 10 environmental samples, shed light on this individual's provenance. We discuss the results in light of the new insights provided by recent excavations of a contemporary nearby settlement. Our results indicate that the Hoby individual was most probably of local origin, corroborating previous interpretations. Furthermore, the nearby settlement seems to confirm the central role of the Hoby site in the Early Roman Iron Age society.

**ARTICLE HISTORY**
Received
11 November 2020;
Accepted
29 January 2021

**KEYWORDS**
Iron Age, The Roman world, Hoby chieftain, Strontium isotopes, Denmark

## Introduction

In the area of present-day Denmark, the beginning of the Common Era (first century AD) marks a time of increasing contact with the Roman world (e.g. Hedeager 1992; Jensen 2003; Lund Hansen 1987). Exotic burial goods such as Roman glass, bronze vessels, and silver wares provide evidence of increased connections with Rome and its provinces. These types of luxury goods were reserved for the elite. At first, these imported goods remained concentrated in the southern regions of Denmark, such as the islands of Funen and Lolland-Falster. Later on, Roman objects appear throughout present-day Denmark. The Hoby burial is situated on the island of Lolland in southeast Denmark (Figure 1), and based on the characterisation of the burial goods, dates to the beginning of the 1st century CE, i.e. the Early Roman Iron Age (1CE -150/160CE), corresponding to new contact strategies established by the Roman Empire.

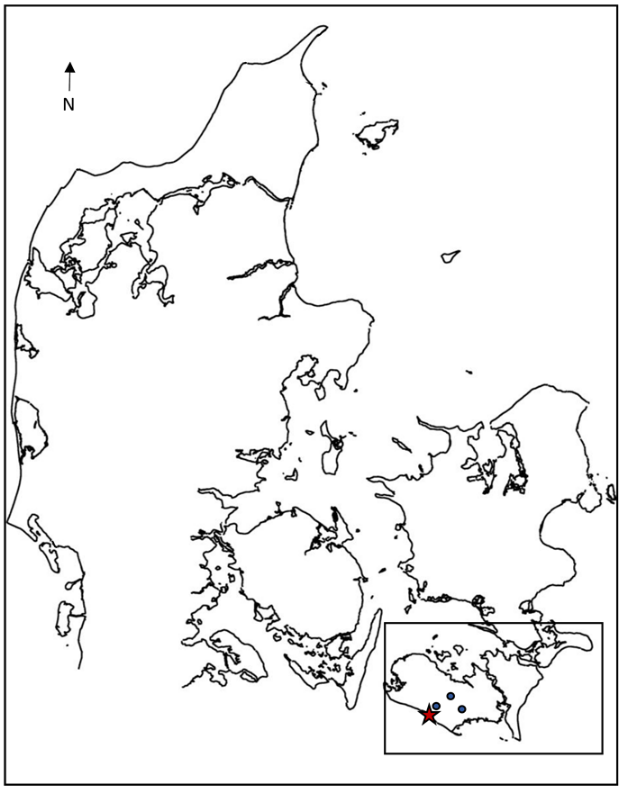


**Figure 1**. Map of Denmark, with the location of the Hoby site (red star) and additional baseline locations made in connection to this study (dots).

The Hoby grave represents one of the richest Early Roman Iron Age burials in Northern Europe.

**Figure 2**. Close up image of the scene depicted on one of the Hoby grave's silver cups where the Trojan King Priam kneels before Achilles while asking him to hand over his son's corpse (Photo: Lennart Larsen, National Museum of Denmark).

Besides the unique assemblage of grave goods, the burial also contained the skeletal remains of a middle-aged adult male, likely a prominent local chieftain (Friis Johansen 1923).

The grave goods in the Hoby grave include a Roman table service consisting of a washing dish, a wine bucket and ladle, a jug, a tray and two silver drinking cups decorated with scenes from The Iliad (Figure 2, 3). Both cups are depicting scenes from the Trojan war as described by Homer. Figure 2 shows a close up of the Trojan King Priam kneeling before Achilles asking him to hand him his son's corpse. Achilles had killed the Trojan Prince Hector. Driven by his anger, Achilles first refuses but ends with allowing King Priam to take with him his son's corpse (Friis Johansen 1923, 121-124). In addition, the grave also contained a silver cup with a bronze handle, a drinking horn, a bronze knife, a bone pin, a wooden casket, bronze and iron sheets, a belt buckle, two gold finger rings, seven fibulae, three pottery vessels and two cut pork femora, presumably the remains of cured hams which had been placed in the grave (Figure 3).

The first centuries CE are known to have been a key period for the Roman Empire's relations with Germania in the Northern world. This is because the Roman Empire failed to expand northward after being defeated at the famous Battle of Teutoburg Forest in present-day Germany, during the summer of the year 9 CE. Consequently, this battle was a game changer for the Roman Empire. The defeat left a deep impression on Roman society, and particularly on the Emperor Augustus who in the course of just a few days lost somewhere around three legions of soldiers, a third of his standing army (Jørgensen et al. 2003, 110-111). As a consequence, and after a few years of punitive campaigns to follow, the Romans abandoned their invasion of Germania and changed course towards a more politically diplomatic relationship with the northern tribes (summary in: Burmeister and Kaestner 2015).

In Denmark, the Early Roman Iron Age has been intensively investigated archaeologically. However, it is only fairly recently that investigations have focused on human remains dating to this period (Holst et al. 2018). We have therefore conducted strontium isotope analyses on the remains of the male individual from Hoby in order to provide new information on one of the most important archaeological finds of this period from present-day Denmark.

**Figure 3**. The grave goods from the Hoby burial discovered in 1920 (Photo: Lennart Larsen, National Museum of Denmark).

## The archaeological context

The grave was discovered in 1920 during the laying of a drain in connection with a newly-built property (Friis Johansen 1923; Klingenberg 2011; Lund Hansen 1987). At a depth of 2 meters in the gravel-rich subsoil, the two large silver cups resting on a bronze tray came to light. The workers continued digging until they thought there were no further goods to be found at the location. Shortly after, the National Museum of Denmark in Copenhagen was informed of the find and two days later archaeologist Thomas Thomsen visited the site. Fortunately, the burial was still open when Thomsen arrived, enabling him to obtain a significant amount of contextual information from what remained of the burial. During subsequent excavation, skeletal remains and additional bronze fragments were recovered. Surface water percolated into the grave and froze shortly after, preventing further investigations at that point in time. However, already in February 1920, another archaeologist from the National Museum of Denmark, H. C. Broholm, was able to carry on the excavation at the site. On the day prior to Bornholm's arrival, the landowner had back-filled the grave, during which a silver brooch was also recovered from the fill of the grave itself. Broholm arranged for the grave fill to be carefully sieved, which resulted in the identification of further objects, including a number of potsherds, bronze fragments, a bronze brooch and a fragment from a drinking horn. Additionally, and of importance to the present study, further skeletal remains from the individual buried in the grave were also recovered. These remains included fragments of a human mandible. The skeletal materials also included animal remains from two young pigs as well as fragments of bones from sheep or goats (Friis Johansen 1923; Klingenberg 2011).

### *The grave and human remains (NM I C17946-64, skeleton 1, B):*

The grave was a flat inhumation grave with a NE-SW orientation. Upon excavation, it contained an incomplete human skeleton lacking parts of the lower extremities. Parts of the deceased's legs still lay in situ at the time of Thomsen's investigation. This indicated that the deceased had been lying with his head at the northeast end of the grave. Beneath the legs, a wooden layer was observed which was probably the remains of the base of a wooden coffin. There is unfortunately no information on the width of the grave. The fragmented mandible was found with some teeth still present in situ. From these, it was later determined that the individual was possibly an adult male (Sellevold et al. 1984).

### *Artefacts recovered from within the burial (NM I C 17946-64 and Dnf. 2-11/1920):*

As mentioned above, the artefacts recovered from within the burial consist of numerous objects (Figure 3). These included a large bronze basin with a base (in Eggers (1951) E 97), a bronze saucepan with manufacturer´s mark (E 140), a bronze pitcher with a trefoil mouth (E 126), a tray of bronze (E 115), a bronze situla with face motifs (E 24) and two silver cups (E 168). In addition, other grave goods consisted of yet another small silver cup with a handle made of bronze (E 166), drinking horn mountings, a bronze knife, a bone pin, a wooden casket with bronze mountings, bronze and iron sheets, a belt buckle of bronze, two gold finger rings, and seven metal fibulae. These comprise two bronze ´Rollenkappen´ fibulae of type A II 25 and five of silver, of which three were ´Rollenkappen´ of type A II 25-26 and two were strongly profiled of type A IV 71 (Almgren, 1897). One of the silver ´Rollenkappen´ fibulae and both of the profiled fibulae exhibit additional gold plating. Moreover, three of the silver fibulae (A II, 25-26) are noteworthy in that they are very early examples of Germanic art with zoomorphic decoration (Klingenberg et al. 2017). In this connection, it is also worth mentioning the small silver cup and the bronze handle, as these did not originally belong together. The upper part of the cup handle is formed like an animal´s head with the animal´s open jaw gripping the rim of the very cup. While the silver cup is of Roman make, the bronze handle with its animal shape and motif is typical of Scandinavian design. Therefore, it is assumed that the handle was locally made and then affixed to the imported Roman cup.

The two gold finger rings from the Hoby burial are of Beckmann's type 1 and 11 (Beckmann 1969 No. 25 and No.171) which are seldom seen in the beginning of first century CE. Gold is apparently quite rare for this period in the North, and any gold objects were likely regarded as expressions of high social status (Klingenberg et al. 2017, 122). Likewise, the presence of two gold finger rings is similarly indicative of high status; in fact, two gold finger rings are otherwise only known from one grave at Byrsted in north Jutland from this period (Schuster 2010, 288).

In 1953, H. J. Eggers introduced the term ´Lübsow type´ as a designation for richly equipped burials in Northern Europe, the so-called 'princely graves,' that date to the first two centuries CE (Eggers 1953). The Hoby grave dates within this period and represents one such richly equipped grave of this type. The similarities between graves of this type include the presence of imported Roman vessels, the use of gold and objects with zoomorphic decoration (Klingenberg et al., 2017). Hence, the Hoby (Lund Hansen 1987, 403) and Byrsted (Lund Hansen 1987, 405) grave goods support that contacts with the Roman world existed between the highest levels of society in various geographical regions of present-day Denmark.

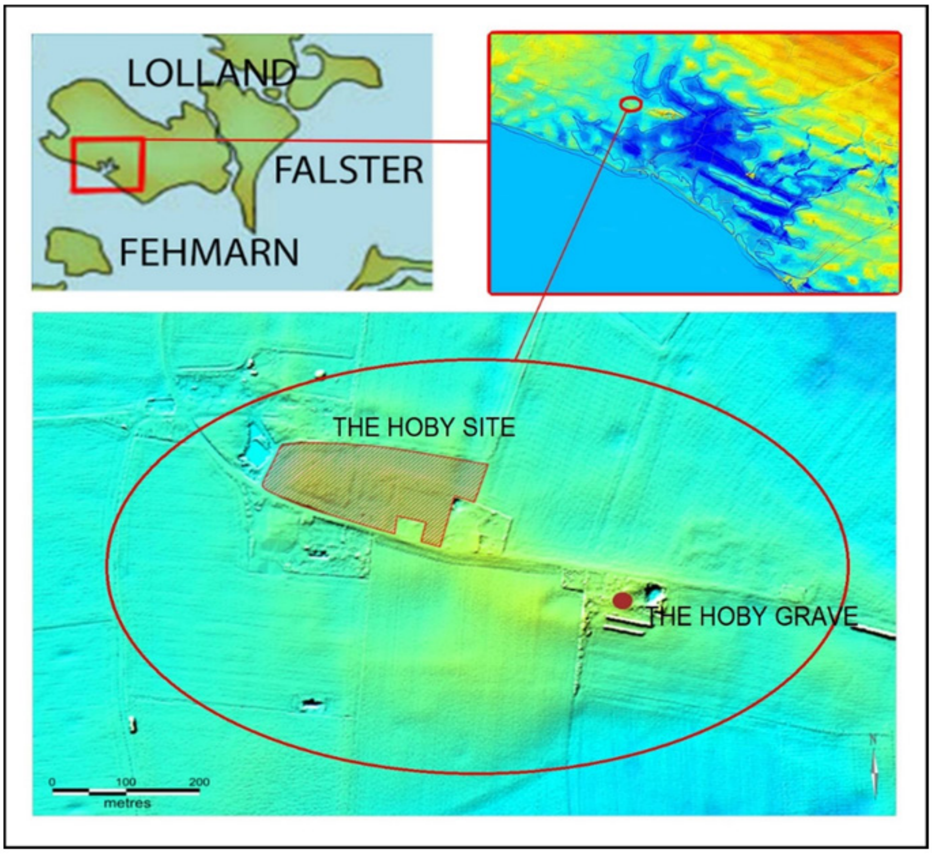


**Figure 4**. Location of the Hoby site (settlement) and the Hoby grave near the Rødby Fjord. The coastline depicted is based on the reconstruction of c. 1776 (courtesy of Museum Lolland-Falster).

With respect to the dating of the Hoby burial, several suggestions have been made. Lund Hansen (2000) proposed that the grave dates to Phase B 1a or possibly to the very early Claudian period (41CE-54CE). Schuster (2010, 309) argues that it is contemporary with the Lübsow-Sandberg 1 grave and dates the burials to the Claudian period within Phase B 1b. This last interpretation is based on the two fibulae of type A IV 71 as well as on the presence of the large number of fibulae in the grave, which has not been observed in earlier inhumation graves in the region. Overall, the contextual chronological dating of the Hoby grave places it towards the end of the first half of the 1st century CE (Klingenberg et al. 2017, 121)

## *The landscape and the settlement*

The landscape surrounding Hoby has changed considerably since the Iron Age. The south coast of Lolland consists of low-lying land, which is today protected by a major sea-dyke constructed following a severe storm in 1872. The sea-dyke covers the entire south coast of Lolland along the Baltic Sea. The Hoby burial and the nearby settlement are situated on a minor elevation in the otherwise flat terrain of Lolland. In the Early Roman Iron Age, a small branch of the nearby Rødby fjord probably extended almost all the way to Hoby and from there it was most likely possible to sail out to the Baltic Sea (Figure 4). Therefore, the location was ideal from a strategic point of view, as the site was somewhat away from the Baltic Sea, yet still within easy access to it. Furthermore, the low-laying landscape and fertile soils of south-western Lolland offered rich farming and grazing potential. Scientific analyses of pollen and macrofossils from the nearby settlement area revealed that the landscape around Hoby and the Rødby fjord to the southeast was, at that time, an open cultural landscape (Klingenberg et al. 2017, 132).

The nearby Iron Age settlement was discovered in 1999 when the remains of pottery were observed in a field near Hoby. Staff from the Museum Lolland-Falster and the National Museum of Denmark in Copenhagen examined the site, and concluded that the remains of pottery and areas of dark soil observed represented parts of a settlement area from the Early Iron Age. It was clear that there was a need for an archaeological excavation, and a collaboration between the former Lolland-Falster´s Stifsmuseum now Museum Lolland-Falster and the National Museum of Denmark was initiated. In 2000, 2001 and 2005, minor excavations consisting of machine-made trenches were undertaken. The aim of these initial investigations was to establish the extent of the settlement and to identify the culture layer, as well as to ascertain the preservation of the site. The most recent excavations took place between 2010-15, after a new partner, Zentrum für Baltische und Skandinavische Archäologie, Schloss Gottorf, joined the project in 2010 (Blankenfeldt and Klingenberg 2011). The site has not yet been excavated to its full extend, but large parts of the central settlement and activity area have been so far investigated. A fundamental question with regards to the Hoby individual remains still open: that is, was the nearby settlement actually home to the individual buried in the chieftain's grave? To address this question, several aspects should be highlighted. One is the relatively short distance between the inhumation grave at Hoby and the settlement area, as well as the location of both in the landscape. The distance between the grave and settlement is roughly 200 meters, and both the settlement and the burial are situated on the same slightly elevated terrain. An examination and characterization of other finds from around the Hoby burial, and their comparison with grave finds from neighbouring sites, reveals that the other closest nearby settlements from this period lie between 2-5 kilometres away from the grave. In other words, there are no other known settlements from this period in the immediate vicinity of the Hoby grave besides the one situated close to the site. Another aspect which supports the assumption that the grave and the settlement are contemporaneous, is based on studies of the pottery from the Hoby burial and the settlement area which revealed great similarities in style and manufacture (Klingenberg et al. 2017). Yet, another interesting aspect, is that investigations of the nearby settlement showed that the structures are different from those seen at other known settlements from this period. This suggests a somewhat special and perhaps unique type of settlement, probably one of a certain status type.

Remains of the settlement and associated activities have been found in an area of more than 150 x 100 meters. To date, roughly one third of this has been excavated. Across large parts of the settlement area, the cultural layer is preserved up to a thickness of 60-65 cm. The remains of 52 buildings have been identified – large longhouses, small longhouses and other minor buildings. Additionally, also wells, pits, cooking pits, two large water-filled holes and massive refuse accumulations containing bones from animals have so far been identified. The cultural layer is not preserved in the west of the settlement area. There, remains of houses c. 10-15 meters in length have been located, together with a number of small square buildings. The habitation area is situated in the southern part of the settlement area, while to the north there is an activity area dominated by two large water-filled holes, cooking pits and accumulations of animal bones. In the central part of the settlement there are rows of longhouses with E-W-orientation as well as a building with a N-S-orientation. It has not been possible to identify the existence of stables in the longhouses. Remains of the well-preserved houses point to clay floors running over the full length of the buildings, and inside some of the houses several remnants of hearths or ovens are evident. The remains of the houses at Hoby differ markedly from those of most other longhouses of this period, in which the living quarters were at one end and a stable at the other (Klingenberg et al. 2017).

Two very long buildings dominated the settlement (Figure 5). The fence around the N-S-oriented building suggests that special functions could be associated with this particular structure and to the enclosed area: one possible interpretation is that these reflect a kind of gathering place or perhaps a precursor of the hall-like buildings that appear in the Late Iron Age (375 CE-1050 CE). The three buildings stand out on account of their dimensions, their construction and the long duration of their use. While common houses in this period usually had stables at one end, no traces of such areas could be detected in the three very well-preserved buildings (Warmers 2017, 46).


**Figure 5**. Site plan showing the excavated areas of the Hoby settlement. To the south and to the west there a number of longhouses. To the North is the activity area dominated by two large water-filled holes, cooking pits and accumulations of animal bones. Remains of longhouses are marked in grey, postholes in black, large water-filled holes and wells in blue, bone accumulations in yellow and cooking pits have a black outline (Illustration: Josefine F. Bican, National Museum of Denmark).

The activity area was dominated by the two water-filled holes. These revealed several wattle fences made of hazel. The fences were raised immediately after the holes were dug, as no deposits were accumulated beneath the fences. Furthermore, there was a large wooden construction in the central part of the southernmost hole, where more extensive excavations were made. There is no apparent explanation to the function of the southernmost hole, where more extensive excavations were made. Three separate horizons in these holes have been scientifically investigated using microscopy and DNA analysis. The results of these investigations reveal evidence of intestinal worms and dietary components. While these analyses produced interesting results documenting a change in the use of the holes over time (Tams et al. 2018), they did not provide any clarifying information regarding original purpose or function. It is however clear that animal bones, including jaw bones, had been thrown into the holes shortly after they had been dug. The practice of offering animal bones and stones is well-documented by offerings found in bogs and votive wells. Such an interpretation could perhaps explain the purpose of the large holes and the numerous finds contained therein. The work of Jesper Hansen (2006, 170) supports this assumption. The finds of many animal bones left over from meals, together with the many coeval cooking pits, should perhaps be seen as a result of people gathering at the Hoby settlement, perhaps of people coming from a wider area/region around Hoby, with the aim to participate in some kind of ritual events such as communal feasts (Klingenberg et al. 2017).

## Materials and Methods

### *Materials:*

The anthropological material (NM I C17946-64, skeleton 1, B) herein investigated has been previously studied by Sellevold, Lund Hansen and Jørgensen (1984). In relation to the sampling for this investigation, physical anthropologist Charlotte Primeau, with dentist Verner Alexandersen, conducted a new anthropological study of the Hoby individual's mandible and concluded that 11 teeth were still in *in situ* position, while three were loose and four other teeth were lost postmortem. The teeth were all well-developed, including the roots of the third molars, which indicates a minimum age of between 19-21 years. Based on the tooth wear, the individual was estimated to have been an adult of about 25-35 years of age at the time of death. The fragmented state of the mandible made it difficult to estimate the sex of the individual, but the corpus of the mandible and the shape of the chin suggest that it belonged to a male. This correlates well with the conclusions from the previous physical anthropological studies drawn by Sellevold, Lund Hansen and Jørgensen (1984) as well as with the archaeological context which also suggest the grave of a high-status male. Future aDNA analyses may shed further light on this issue.

### *Strontium Isotope Analyses:*

In order to investigate the provenance and/or potential mobility of the Hoby individual, we sampled tooth enamel from three of the individual's teeth on which we conducted strontium isotope analyses. We sampled the first molar which was still in an *in situ* position in the mandible, and performed analyses of two of the additional loose teeth, a canine and a third molar.

In order to interpret results of strontium isotope analyses from human remains, it is important to have knowledge of the local bioavailable strontium isotope baseline range. For the area of present-day Denmark, several baselines have been established based on different types of environmental proxy samples, including surface and ground waters, soil samples and fauna remains consisting of over 500 total samples (e.g. Frei 2013; Frei and Frei 2011; Frei and Price 2012; Frei and Frei 2013; Frei et al. 2020a; Frei et al. 2020b; Nielsen et al. 2020a; Price et al. 2007; Price et al. 2011; Reiter et al. 2019). Furthermore, though more general, a recently published strontium isotope baseline study encompassing almost 1200 soil samples taken from throughout Europe (including Denmark) adds yet another layer of measurements and general knowledge of regional baselines in Europe (Hoogewerff et al. 2019). All these studies suggest that the local bioavailable baseline of present-day Denmark (excluding the island of Bornholm) ranges between $^{87}Sr/^{86}Sr$ = 0.7081 to 0.7111.

While this range is widely applied and accepted, a study aiming at investigating the effect of agricultural liming in surface waters in areas of western Jutland claimed that the surface waters are not suitable proxies for characterizing baselines (Thomsen and Andreasen 2019). However, newer studies within the same areas as those investigated by Thomsen and Andreasen (2019) clearly showed that agricultural lime is effectively retained near the surface, thus minimizing the effect of agricultural liming on surface waters. As a consequence of this, rendering baseline maps constructed on the basis of surface waters are still relevant for the use in provenance studies (Frei et al. 2020a). Furthermore, it is important to recognize that single sampling points across the landscape are not sufficient enough to fully characterize the bioavailable strontium isotope baseline spectrum of an area. For this purpose, the isotope signatures of larger water bodies for example are likely more representative as they characterise the averaged-out isotope composition of bioavailable fractions from an entire catchment area or aquifer, respectively.

Further, not all the measurements might be of significance for the characterisation of the diet of a human (e.g. Frei et al. 2020a; Montgomery 2010). There are therefore many factors to be considered when interpreting strontium isotope analyses from various materials and proxy archives. For example, one such factor is the concentration of the strontium sources investigated and how different sources of strontium have more or less relevance in the mass budget balance with respect to the food intake of a human (Watts and Howe 2010).

It appears that for humans, the plant share of the diet is one of the more dominant contributors to skeletal strontium signatures with a comparatively negligible input being derived from animal (meat) sources (Montgomery 2010). Water, depending on its strontium concentration, seems also to be an important source of strontium for humans (Watts and Howe, 2010). So, for example, while Thomsen and Andreasen (2019) measured a few surface waters from ponds in Western Jutland with strontium isotopic compositions higher than those within the above mentioned baseline, the strontium concentrations of these samples are so low that they lose their relevance in a mass budget calculation of a human (Frei et al. 2020a). As a result, these few water sources or ´points´ in the landscape with high strontium isotope ratios, but with low strontium concentrations, do not seem to be relevant for human provenance studies or in characterizing strontium isotope bioavailable baselines, and should therefore be considered with caution (Frei et al. 2020a).

In the present study, we also conducted 10 additional strontium isotope analyses of environmental samples from the burial area in order to add supplementary information to the already large baseline coverage of the area. To this aim, we collected plants, soil and surface-water samples from four different localities from the island of Lolland where the Hoby burial is located. Of these, three were soils, three were waters and four were plant samples (see location of the sampling sites in Figure 1). The environmental samples were treated and analysed as described in Ladegaard-Pedersen et al. (2020).

Tooth enamel samples were pre-cleaned by removing the enamel's surface with a drill bit. Subsequently, a few milligrams of enamel were sampled from each tooth. The tooth enamel samples were dissolved in 7 ml Teflon beakers (Savillex™) in a 1:1 solution of 0.5 ml 6 N HCl (Seastar) and 0.5 ml 30 % $H_2O_2$ (Seastar). The samples dissolved within a few minutes, after which the solutions were dried on a hotplate at 80 °C. Thereafter, the enamel samples were taken up in a few drops of 3N $HNO_3$ and then loaded onto disposable 1 ml pipette tip extraction columns into which we fitted a frit to retain a 0.2 ml stem volume of pre-cleaned mesh 50-100 SrSpec™ (Triskem) chromatographic resin. The elution recipe essentially followed that of Horwitz et al. (1992), albeit scaled to our needs (insofar as strontium was eluted / stripped by pure deionized water and then dried on a hotplate).

Thermal ionization mass spectrometry was used to determine the Sr isotope ratios. Samples were dissolved in 2.5 µl of a $Ta_2O_5$-$H_3PO_4$-HF activator solution and directly loaded onto previously- outgassed 99.98% purity single rhenium filaments. Samples were measured at 1250-1300 °C in a dynamic multi-collection mode on a VG Sector 54 IT mass spectrometer equipped with eight Faraday detectors (Institute of Geosciences and Natural Resource Management, University of Copenhagen). Five nanogram loads of the NBS 987 Sr standard that we ran during the time of the project yielded $^{87}Sr/^{86}Sr$ = 0.710239 +/- 0.000011 (n=5, 2σ).

## Results and Discussion

Since its discovery 100 years ago, one of the central questions has been whether the Hoby burial was a single grave or whether it was part of a larger cemetery. It is evident from the archives of the National Museum of Denmark, which registers incoming objects, that already in 1897 another find from this site was discovered and recorded. This early find consisted of a bronze vessel containing cremated human remains (burnt bones) and remains of an iron sword scabbard (Figure 6). The bronze vessel, which had been used as a funerary urn, is a so-called situla with a heart-shaped leaf decoration by the handle (Figure 6). Only one other example of such type of vessel is known from the area of present-day Denmark, which was found in a burial at Stenløse on the island of Zealand (Liversage 1980 No A 57:32 and PI:51; Lund Hansen 1987, 458). Otherwise, this type of bronze vessel has its main area of distribution in Germany. Bronze vessels of this type were imported from the Roman Empire and are dated to the time around the beginning of the CE. The vessel has been interpreted to be an example of an early Roman import. Given that this grave also contained the remains of a weapon (sword), it suggests that an individual of high status already lived at Hoby around the beginning of the CE. This discovery suggests that there may have been several graves here originally. Further confirmation of this hypothesis was provided by locals who indicated

**Figure 6**. The grave goods from the cremation grave that was found in 1897. The cremated bones were in the bronze vessel. The two mountings were originally on the sides of the vessel, and the handle was attached to these. The handle is terminated on each side by a bird´s head. The vessel originally stood on three feet. On the bottom of the vessel one can see traces of brazing (Photo: Arnold Mikkelsen, National Museum of Denmark).

that bones and pottery – presumably urns – came to light during gravel digging activities. However, excavations in 1922 conducted by Hans Kjær from The National Museum of Denmark were not successful in finding additional graves. But, the extent of the area investigated at that time is unknown, and seen from a modern perspective, it was probably limited. As mentioned above, the National Museum of Denmark – in cooperation with Zentrum für Baltische und Skandinavische Archäologie (ZBSA), Museum Schloss Gottorf – also undertook another investigation of the area in 2010. At this time, a magnetometer survey was conducted, but it did not reveal any additional burials either. In September 2016, Museum Lolland-Falster and the National Museum of Denmark conducted yet an additional minor investigation of the area to the south and to the east of the Hoby burial, this too was unsuccessful in locating additional graves. The areas to the north and to the west of the Hoby grave remain still to be investigated, leaving the possibility for the existence of yet unidentified graves in the area (Klingenberg et al. 2017, 124). Nevertheless, the early find from 1897 of a bronze vessel containing cremated human remains and the remains of an iron sword suggest that more graves may yet to be found in the vicinity.

Social structure during the period at the beginning of the CE in present-day Denmark has traditionally been perceived as consisting of tribal chiefdoms characterised by ´personal-bound´ relationships (e.g. Holst et al. 2018, 1) with little to no evidence of largescale conflicts. However, recent excavations and investigations at the site of Alken Enge in East Jutland have provided evidence of human remains that have been interpreted to be those of a defeated army, with a minimum of 82 fallen individuals, suggesting opposing forces comprising a considerable number of combatants (Holst et al. 2018). Still, rich graves with Roman objects like the one from Hoby, or the female grave from Juellinge (e.g. Lund Hansen 1987, 402-403) also from the island of Lolland, suggest a group of high status individuals (of both sexes) with potential ´personal-bound´ diplomatic connections to regional trade networks (e.g. Jørgensen et al. 2003, 110-111).

In Denmark, strontium isotope analyses on human remains have been conducted on individuals dating from the Mesolithic to the Middle Ages, with strong focus on the Neolithic, the Bronze Age and the Viking Age (e.g. Croix et al. 2020; Felding et al. 2020; Frei et al. 2019; Frei et al. 2015; Frei et al. 2017; Nielsen et al. 2020a; Nielsen et al. 2020b; Price et al. 2011; Reiter et al. 2019). However, relatively few individuals from the Iron Age have been investigated using this technique thus far. Consequently, there is a gap with respect to the potential information that this type of scientific analysis can provide with respect to the Iron Age within present-day Denmark.

In our present study, we complemented the already large existing strontium baseline data from plants, soils, fauna and water samples mentioned above with 10 additional environmental samples from plants, surface water and soils collected from the surroundings of the Hoby site (Figure 1). The area around Hoby is partially agriculturally cultivated therefore we aimed at avoiding sampling within farmed areas as much as possible.

The strontium isotope results from the bioenvironmental samples range from $^{87}Sr/^{86}Sr$ = 0.70868 to $^{87}Sr/^{86}Sr$ = 0.71087 (Table 1). This range compares well with the strontium isotope ratios measured in bioenvironmental samples in a previous, though similar, local baseline study of the surrounding area of the Bronze Age burial mound of Ølby, on the island of Zealand north of Lolland. Here the bioenvironmental samples yielded ratios between $^{87}Sr/^{86}Sr$ = 0.70871 to $^{87}Sr/^{86}Sr$ = 0.71031 (Reiter et al. 2019). In sum, the bioenvironmental samples measured herein from Hoby fall within the above mentioned baseline range for present-day Denmark.

The results of the strontium isotope analyses of the Hoby individual are also presented in Table 1 and yielded $^{87}Sr/^{86}Sr$ = 0.71095 in the first molar, $^{87}Sr/^{86}Sr$ = 0.71084 in the canine, and $^{87}Sr/^{86}Sr$ = 0.71077 in the third molar. Hence, the three tooth enamel samples yielded strontium isotope ratios that fall within the baseline for present-day Denmark and straddle the upper limit of the local bioavailable strontium signature range at Hoby, therefore suggesting a local origin of the Hoby individual. However, it should be mentioned that similar strontium isotope values are widespread across Europe (e.g. Hoogewerff et al. 2019), hence we cannot exclude the possibility that the Hoby individual originated from another area with a baseline range similar to that of present-day Denmark.

These new strontium isotope results should also be seen in light of the above mentioned re-

| Lab Nr. | Museums Nr./Site | Material | Sr (conc.) ppb | $^{87}Sr/^{86}Sr$ | 2σ(abs.) |
|---|---|---|---|---|---|
| ***Human remains*** | | | | | |
| KF 804 1 | NM 1 C17946-64, skelet 1, kiste B | M1 | | **0,71095** | 0,00001 |
| KF 804 2 | NM 1 C17946-64, skelet 1, kiste B | Canine | | **0,71084** | 0,00001 |
| KF 804 3 | NM 1 C17946-64, skelet 1, kiste B | M3 | | **0,71077** | 0,00001 |
| ***Baseline environmental samples*** | | | | | |
| KF 2064 | Maribo (by the lake) | soil | **504** | **0,71048** | 0,00001 |
| KF 2065 | Hoby grave | soil | **189** | **0,71068** | 0,00001 |
| KF 2066 | Røgbølle (by the lake) | soil | **136** | **0,70868** | 0,00001 |
| KF 2067 | Maribo lake | water | **36** | **0,71074** | 0,00001 |
| KF 2068 | Small lake (near the Hoby site) | water | **17** | **0,70947** | 0,00001 |
| KF 2069 | Røgbølle lake | water | **28** | **0,71047** | 0,00001 |
| KF 2070 | Maribo (by the lake) | plant | **1906** | **0,71087** | 0,00001 |
| KF 2071 | Hoby grave (bush a) | plant | **3436** | **0,70944** | 0,00001 |
| KF 2072 | Hoby grave (bush b) | plant | **8738** | **0,71004** | 0,00001 |
| KF 2071 | Røgbølle (by the lake) | plant | **2869** | **0,70868** | 0,00001 |

**Table 1**. Strontium isotope results from tooth enamel from the Hoby individual and environmental samples.

cent investigations of the nearby settlement which confirmed the central role of Hoby in the Early Roman Iron Age society (Klingenberg et al. 2017, 131). This and other previous research focusing on the Iron Age population and infrastructure on the island of Lolland, as well as on investigations of the landscape, provide evidence for an open cultural landscape including numerous settlements, richly furnished burials, and fortifications. If one also considers other rich burials from Lolland-Falster such as those at Stangerup, Alsø, Juellinge, Munkehøjgård (Lund Hansen 1987, 402-403) and Toreby (Klingenberg et al. 2017, 133), we see Roman luxury goods reached the western shores of the Baltic Sea in the Early Iron Age. In the wealthy female graves from Juellinge some of the earliest glass vessels have been found in the Baltic Region. The burials testifies the region's contact with the Roman Empire south of the Baltic Sea (Klingenberg et al. 2017, 133-134).

While the valuable drinking set has been interpreted as either a reward for participation in a punitive expedition or as a diplomatic gift, both interpretations suggest that the Hoby chieftain held sway over a large area. The various building types and finds suggest a relatively populous community and show that gatherings (including potential ritual activities) likely took place within the settlement. The numerous cooking pits, the large holes and the offerings made in them, and perhaps even the areas with large accumulations of animal remains, should perhaps be interpreted as evidence of gatherings involving many people from the surrounding areas, potentially land holdings which the Hoby chieftain either controlled or had some influence over.

Together with the new strontium analyses, which corroborates previous assumptions that the chieftain from Hoby was a ´local´ individual, it seems plausible that the Hoby individual may have maintained a two-folded social- and exchange-network(s): i) one within the local community of Lolland including potentially some kind of ritual significance, and ii) one with far-reaching extra-regional contact, potentially of a diplomatic character. In other words, the Hoby chieftain seems to have had strong connections both at the local and region scales as well as to the distant Roman World.

While this study adds new information directly from human remains dating to the Iron Age, we emphasize the need to investigate more individuals from this period (by e.g. conducting strontium isotope or/and biomolecular analyses), including non-elites, in order to gain a better understanding of Iron Age society in the region of present-day Denmark. It is our hope that this study will awaken interest in conducting several types of scientific analyses directly on archaeological human remains, and including anthropological, archaeological and historical perspectives to the overall interpretative synthesis of the past.

## Acknowledgments and Funding Details

We wish to thank and dedicate this study to Professor Lars Jørgensen, who initiated the isotopic investigations. We also thank Charlotte Primeau and Verner Alexandersen for their report and analyses conducted on the human remains also initiated by Lars Jørgensen. We also wish to thank Matthew Walsh for linguistic revision, as well as Nina Engwald for assistance in sampling environmental samples. We wish to thank the anonymous reviewers and the editor for comments that helped to improve this manuscript.
This research (the strontium isotope analyses) has been made possible by the support of the Carlsberg Foundation to the ´Semper Ardens´ project grant CF18-0005, allocated to Karin Margarita Frei.

## Declaration of Interest Statement

No conflicts of interest are known by the authors in relation to the material addressed in this manuscript.

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# The phenomenon of primary and secondary animals within Iron Age deposits in Denmark

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**ABSTRACT**

Animals are an integral part of deposition practices during the Danish Iron Age, and they probably represent the most common form of deposit within southern Scandinavia. Recently, A. B. Gotfredsen published a volume on animals within Danish Iron Age grave contexts, but similar comprehensive studies of animals from other contexts have not been attempted. Thus, classic sites such as Valmose, Bukkerup Langmose, and Sorte Muld still stand as the type sites for Danish Iron Age animal deposits. This article will argue that there are good reasons for exploring deposits in more detail and for investigating the considerable variation in the treatment and quantities of sacrificial animal deposits. Furthermore, the current study has revealed a deposition pattern where a primary animal is often in the company of one or more secondary animals, the latter typically represented by a few bones. Salpetermosen Syd (MNS50010), south of Hillerød in North Zealand, Denmark is the main case study, but comparisons are made to several sites across Denmark where a similar deposition pattern has been observed.

**ARTICLE HISTORY**
Received
27 April 2021;
Accepted
11 November 2021

**KEYWORDS**
Animal deposits; Iron Age; Sacrificial complexity; Human-animal relationship; The primary-secondary phenomenon

## Introduction

Animal deposits are frequently mentioned in Danish and Scandinavian archaeological research (e.g., Hansen 2006, 134; Stolt 2001, 35; Vretemark 2013, 57), but they seldom feature in in-depth discussions. Furthermore, the interest rarely extends to details such as the specific combination of animal species or animal parts. Outside of Denmark, studies of such deposits are more common, although with varying focus (e.g. Behm Blancke 2003; Cederholm et al. 2014; McCormick 2009; Morris 2011; Pluskowski 2012; Reichstein 1991; Thilderkvist 2013; van den Helm and van Dijk 2017, Vretemark 2013). Lately, the animal turn has been introduced, which is preoccupied with the human-animal relationship of the past, introducing the implicit understanding that this relationship differed from modern western perceptions (e.g. Boyd 2017; Hill 2013; Jennbert 2014; Salzani 2017). We want to reinvestigate the role of animals in depositional practices in order to improve our understanding of the human-animal relationship and acknowledging the significance of animals during the Iron Age. Such a study would also add to our general understanding of the complexity of these practices.

## Deposited animals

This article seeks to present the phenomenon of primary and secondary animals within sacrificial deposits. The term sacrificial deposit is used here to describe intentionally placed ensembles of objects, including faunal remains, which are orchestrated in a manner where they clearly stand out from the background of the mundane scatter of refuse found across most archaeological sites.

The phenomenon of primary and secondary animals has been identified across contexts and regions with no fixed rules as to which animals were primary and which animals were secondary. The terms ‘primary’ and’ secondary’ are not related to a preconceived idea of differences in status or value of certain animals. The terms refer to an observation of the relative relationship between the animals within a single find or context and the 'secondary animal' should therefore not be understood as subordinate to the 'primary animal'. The terms 'primary' and 'secondary' are merely used to underline that there is an element of varied representation in deposits that we must be aware of. Thus, they are used here as analytical tools with the purpose of investigating the faunal signatures within each deposit and between deposits, sites, and regions. We have not adopted Gyldion Andersen's term "packages" used to describe the Bukkerup find, as we believe the use of this term served two purposes: firstly, to define a typology of the deposits, and secondly, to underline the uniformity of the deposits (Gyldion Andersen 1993, 71-75; Gyldion 2009, 68-69). The small variations in the depositional pattern risk being overlooked with such typologies as they can create a false uniformity. The term package is therefore not used in this study as it has been important to pay attention to even the smallest variations.

Based on the deposits of Salpetermosen Syd, it appears that in each deposit one animal was represented by more bones, hence the label 'the primary animal'. The ascription of dominance is thus based on the number and volume of bones and body parts represented. For instance, a skull is more substantial than an ulna, and a phalanx is less substantial than a pelvis. Weight is not used to define the primary animal, as that would always favour larger species. Cattle and horses would thus always dominate over sheep, pigs, and dogs. For most deposits, it is relatively straightforward to define which animal is the primary one. However, in a few cases, it is more complicated with a near equal representation.

No rules exist as to which body parts or combinations of them were preferred. Furthermore, the deposits demonstrated a lack of any variation in importance between specific species of animals. This is in opposition to the current consensus granting a superior status to horses (*Equus caballus*) and dogs (*Canis familiaris*) compared to other species, such as cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), or pig (*Sus domesticus*) (Backe, Edgren and Herschend 1993, 331; Carlie 2004, 124; Ferdinand and Ferdinand 1961, 81; Jennbert 2011, 67; 2014; Johannesen 2016, 124; Klindt Jensen 1957, 83-88; 1967, 144-146; Kveiborg 2019, 120; Monikander 2010, 62; Møhl 1957, 294; Nilsson 2009; Stolt 2001:35). Furthermore, any specific treatment or pattern of presence such as the combination of head-and-hooves (Klindt Jensen 1957, 83-88; 1967, 145-146; Carlie 2004, 104) was not reserved for one species.

The deposited animals of the Salpetermosen Syd site will be used to exemplify the phenomenon, followed by a comparison with other sites where similar patterns have been observed. The perspectives of these results will be discussed followed by a recommendation for more attention to be given to animal deposits and to reinvestigate previously excavated sites.

## Salpetermosen Syd

The excavations of Salpetermosen Syd were conducted from 2013-2018. The site is situated south of Hillerød, in an area characterized by a low-lying hilly moraine landscape with a dead ice relief. Today, the area presents itself as a relatively level agricultural landscape, but it used to be characterized by smaller wetlands all connected to a large former inland lake, which became boggier during the Neolithic. The area was inhabited during the Neolithic and most of the Iron Age; however, this article will focus on the Iron Age finds. The wetlands used during the Iron Age included kettle holes, different sized fens, and seeps related to multiple springs. Judging by the many finds and structures discovered within the wetlands, they appear to have been a major reason for settling in the area (Figure 1). Furthermore, the number of Iron Age settlements, particularly from the late Roman Iron Age (approx. AD 160-400), suggests that this landscape offered rich pasturelands that encouraged occupation in the region. Thus, it has been suggested that the subsistence economy was based primarily on livestock and herding resulting in a relatively wealthy society (Pantmann 2020a).

The overall impression is that wetlands were a resource offering water, peat, and possibly grass and hay. Daily use of the area is reflected in the different measures taken to ease access to the wetlands. Pavements, steppingstones, gravel layers, and tree trunk bridges are all examples of how the wet conditions were managed. Several of the wetlands closest to the dwellings were also used for dumping


**Figure 1**. Map of the Salpetermosen Syd Area with the mentioned wetlands. The map contains data from "Styrelsen for Dataforsyning og Effektivisering, Danmark 1:200.000, vektor".

household waste including faunal remains. Additionally, there are numerous examples of wetlands being used for the placement of sacrificial animal deposits, wooden artefacts, pottery, and whitish stones. Apart from the visual impact of the stones against the dark soil and water, their mere presence implies clear human involvement and intention, as these stones do not occur naturally in peaty layers (Pantmann 2020b).

The largest group of finds within the household waste was the faunal remains, which were generally well preserved. Recent modern farming has drained the wetlands, but the preservation improved for remains from a lower depth. So far, the settled area is mostly dated to the late Roman Iron Age, whereas the deposits mainly concentrated in wetland A793 (figure 1) date from the pre-Roman Iron Age to the transition between the early and late Germanic Iron Age, from 381 BC-AD 537. As this article has its focus on the closed finds of animal deposits, the faunal remains of the household waste will not be further discussed, but it is noteworthy that based on NISP (8.545 in total), cattle (2.944) dominate followed by sheep/goat (1.711), and pig (1.538). This pattern repeats itself in the sacrificial deposits from A793 based on MNI (Minimum Number of Individuals). Although dog (26) and horse (124) are present in both contexts, they clearly play a minor role. The combination of animals regarding both species and age distribution resembles contemporary societies, where animal husbandry was the main livelihood (Bangsgaard 2018; van Dijk 2016).

Sacrificial deposits were found in contexts that also included household waste (A337, A450, and A560). Nonetheless, the deposits stood out from their surroundings. Their orchestration, their cleansed expression without charcoal and other items of household waste, and the combination of animals and animal parts resembling deposits elsewhere, all led to their identification as sacrificial animal deposits (Pantmann 2020a, 175). Furthermore, the large fragments of bone or, in many instances, complete bones also set the deposits apart from the typical fragments discarded as household waste. Although all sacrificial deposits were placed in a wetland context, the specific context of some of these (particularly in A337, A450, and A560), identifies them as a part of the settlement. As such, they are not referred to as either specific wetland deposits or settlement deposits.

## Zooarchaeological method and SPIN

The faunal collection from Salpetermosen Syd was studied at the Natural History Museum of Denmark, University of Copenhagen, using their extensive comparative collections. Information registered for each bone included context, species, bone, fragment, and side, along with a series of additional factors, when these were available or relevant, such as age-at-time-of-death, size (including measurements), sex, burning, cut-marks and pathology. Generally, the results of the analysis were summarised in NISP (Number of Identified SPecimens), but for all deposits MNE (Minimal Number of Elements) and MNI (Minimum Number of Individuals) were also calculated for each deposit (the results for Salpetermosen are summarised in tables 1A and 1B). The calculation of MNI was based on the comparison of skeletal elements from each species, taking side, age, sex, and size of each element into consideration (Chaplin 1971, 69-75). This process was carried out by direct comparison of the elements and was possible due to the limited number of bones from each deposit. The calculation of MNE and MNI was an important step in order to evaluate which species represented the primary and secondary animal. A further step in the analysis included looking at variation in body-parts and age categories as well as the treatment of the remains, which could be addressed through evidence of butchering, burning and placement.

A few fragments (63) from the large Salpetermosen Syd faunal selection, apart from being verified by morphological criteria, were also selected for further analysis as part of the development of a new protein-based analysis and species identification method called Species by Proteome Investigation (SPIN)(Rüther et al.).

## The deposits in wetlands A337, A450, and A560 at Salpetermosen Syd

The total number of animal deposits from Salpetermosen Syd is approximately 58 of which 48 are relevant for this article with more than one species in a single deposit. All of these are defined as closed finds of sacrificially deposited animals or animal parts. A deposit could consist solely of animals, or it could be an ensemble of animal parts and other items. Single finds of animal bones are not included here, as it is difficult to establish whether a single bone is deliberately deposited or simply thrown out. Of the 48 deposits, 44 were concentrated in the same wetland, A793 (Table 1B), whereas the

| Konc. | X# | Primary species | MNE | MNI | Description | Secondary species | MNE | MNI | Description | Cut-marks |
|---|---|---|---|---|---|---|---|---|---|---|
| **Area 337** | | | | | | | | | | |
| A | 994 | Pig | 6 | 1 | Head, body, front leg, 30-52 m | Cattle | 5 | 1 | Head, body, extremities, 12-42 m | |
| B | 995 | Pig° | 28 | 3 | Head, body, 12-52 m, 30-52 m, 18-96 m | Large ungulate<br>Sheep/goat | 2<br>1 | 1<br>1 | Head, body<br>Body | X |
| **Area 450** | | | | | | | | | | |
| | 10 | Dog | | 1 | Head, leg | Cattle | 1 | 1 | Head | |
| **Area 560** | | | | | | | | | | |
| | | Dog | | 1 | front-, hind leg | Pig | | 1 | Head | |

**Table 1A**. Faunal deposits at Salpetermosen Syd, A337, A450, and A560, containing a primary-secondary animal deposit. °Species also identified by SPIN.


**Figure 2**. A337. Deposits A and B. (A) Remains of pig and cattle. (B) Remains of three pigs with a few bones from two additional species (Photo: Museum Nordsjælland).

remaining four deposits are related to wetlands A337, A450 and A560 (Table 1A). Dwellings were situated very close to the latter three, which also made them suitable for dumping of household waste, resulting in superimposing cultural layers in all three wetlands.

A337 was a seep, supplied with water from nearby springs and with a localized subsoil consisting of extremely elastic blue clay. As a result, the seep was constantly fed with fresh water, with little or no drainage. Discharge of water from the system was therefore limited to the naturally occurring evaporation. These factors created a small pool, a perfect watering hole for livestock, which probably explains the coarse paving on the brink closest to the dwellings, easing the access to the water. Unfortunately, extended modern drainage has had a severe impact on the preservation of the bones. In A337, three sacrificial deposits of animals and ceramics were deposited on the margins next to the actual springs, suggesting that these were honoured or sanctified, like the Röekillorna in Sweden (Stjernquist 1997). Animals were included in two deposits: A and B (Figure 2). The primary animal of deposit A was a pig represented by the head and elements from the body and the front leg totalling six bones (MNE). The fragmented pig skull formed the centre of the deposit encircled by stones. The secondary animal was cattle represented by five bones, including elements from the head, body, and extremities. A few badly preserved potsherds completed the deposit. Deposit B was more complex and had a more scattered appearance as the deposit consisted of several elements beside the bones. The primary animals were, in this instance, three pigs, each represented by the skulls and a few bones from the body, in total some 28 bones. Sheep accompanied the pigs along with a large ruminant as the secondary animals, each represented only by one or two bones. Several whitish stones were deposited among the scattered bones, a ceramic vessel was situated at the

**Figure 3**. A450. Deposit X10. Remains of a complete dog and a horn core from cattle (Photo: Museum Nordsjælland).

edge of the bone layer, and finally a fragmented amber bead was placed on one of the pig skulls. Unfortunately, the lack of collagen prevented a dating of both deposit A and B, but based on the ceramics it is likely that the deposits date to the late Roman Iron Age. Afterwards, the deposits and the pool were superimposed by a layer of charred material, probably the result of a clearing of a nearby burnt house.

The deposit X10 of A450 contained a complete dog, which had been placed on its left side. It was located under a cultural layer of household waste from the late Roman Iron Age (Figure 3). A $^{14}$C dating of the dog was not possible due to poor preservation. Zoological analyses revealed that the dog was an adult animal of a smaller and slender type based on the limb bones. The secondary animal was, in this case, cattle, represented by a horn core, and the find was completed with a badly preserved ceramic vessel. The deposit in many ways resembles the dog burial from Svinninge, NW Zealand (Wickman 2011).

**Figure 4**. A560. Deposit of the skull and one leg of a dog and a pig mandible. (Photo: Museum Nordsjælland).

In A560, another deposit was situated below a cultural layer of household waste. Unfortunately, this deposit went missing prior to a full zoological analysis and therefore no identification number has been assigned, but the primary animal was a dog, represented by a skull and one leg and accompanied by a secondary animal, a fragmented pig mandible (Figure 4). The expression of the deposit was very compact, as if the bones were originally wrapped in hide or textile and, as it was located beneath the cultural layers from the late Roman Iron Age, it must predate these.

### *The deposits in A793 – a few examples*

A793 is a larger fen, though situated close to the dwelling area, it is not located right next to it. Still, the many activities indicated that it was not considered inaccessible or hidden. The pollen analyses supported the archaeological observations, confirming that during the time of use, the wetland was surrounded by open grassland. A793 was exposed to peat cutting in at least two

| Konc. | X# | Primary species | MNE | MNI | Description | Secondary species | MNE | MNI | Description | Cut-marks |
|---|---|---|---|---|---|---|---|---|---|---|
| B | 020 | Cattle | 76 | 1 | All parts, 3 | Cattle<br>Sheep° | 1<br>1 | 3<br>1 | Extremities<br>Body | X |
| C | 021 | Cattle | 62 | 1 | All parts. M, 1-3 y | Dog | 2 | 1 | Front leg, body | X |
| D | 040<br>022 | Cattle° | 74 | 1 | All parts, M, 6-8 y | Cattle<br>Pig | 1<br>1 | 1<br>1 | Extremity<br>Front leg, juvenile | X |
| F | 1072 | Cattle | 2 | 1 | Body, extremities | Pig | 2 | 1 | Body | |
| H | 1011 | Sheep/ goat | 4 | 1 | Head, body, hind leg, juvenile | Cattle | 2 | 1 | Head, front leg, juvenile | |
| I | 1073 | Cattle | 3 | 1 | Body, juvenile | Pig | 1 | 1 | Front leg, < 42 m | X |
| J | 1074 | Cattle | 5 | 1 | Front leg, extremities, > 42-48 m | Medium ungulate | 1 | 1 | Body | X |
| K | 1012<br>1013 | Cattle | 9 | 1 | Body, front-, hind leg, > 12-18 m | Medium ungulate | 1 | 1 | Head | X |
| M | 1014 | Pig | 34 | 1 | All parts, 12-24 m | Pig | 26 | 1 | Prob. all parts, < 12 m | X |
| P | 1016 | Cattle | 6 | 1 | Head, body, extremities, < 24-36 m | Pig | 1 | 1 | Extremity, > 12 m | |
| R | 1014 | Cattle° | 27 | 1 | Front leg, extremities, > 42-36 m | Cattle° | 1 | 1 | Extremity | |
| T | 1018 | Equid° | 1 | 1 | Hind leg, > 20-34 m | Cattle°<br>Pig | 1<br>1 | 1<br>1 | Head<br>Extremity, < 18-36 m | |
| U | 1109 | Sheep | 1 | 1 | Front leg, > 3-13 m | Large ungulate | 1 | 1 | Body, juvenile | |
| AE | 1029 | Equid | 3 | 1 | Head, body, < 18-24 m | Pig | 1 | 1 | Body | |
| BB | 1023<br>1112 | Cattle | 2 | 1 | Hind leg, extremities | Sheep/goat | 2 | 1 | Hind leg, extremity | |
| CC | 1021<br>1025 | Sheep | 119 | 3 | Body, front, hind leg, 2M & 1F, 3-6 m | Cattle°<br>Pig | 5<br>1 | 1<br>1 | Body, hind leg, 24-48 m<br>Head, 3-8 m | X |
| EE | 1028<br>1030 | Cattle° | 4 | 1 | Head, body, front leg, < 42-48 m | Roe deer<br>Goat° | 1<br>1 | 1<br>1 | Head<br>Body | |
| GG | 1027 | Pig | 2 | 1 | Head, extremities, F, 72-92 m | Cattle° | 1 | 1 | Front leg | |
| OE | 1024<br>1199<br>1833 | Horse° | 20 | 1 | All parts, < 15-18 m | Cattle<br>Sheep<br>Roe deer<br>Pig° | 9<br>3<br>2<br>1 | 1<br>1<br>1<br>1 | All parts, 24-48 m<br>Head<br>Front leg, > 4-9 m<br>Hind leg | X |
| PP | 1116<br>1825 | Sheep | 66 | 1 | All parts, M, 2-3 m | Goat° | 3 | 1 | Body, hind leg, extremities, M, < 11-15 m | X |
| QQ | 1754<br>1824 | Sheep° | 11 | 1 | All parts, 3-4 y | Cattle° | 6 | 1 | Head, body, front leg, extremities, 12-18 m | |
| RR | 1206<br>1207 | Cattle | 62 | 1 | All parts, 6-18 m | Pig<br>Sheep° | 1<br>1 | 1<br>1 | Head, 52-96 m<br>Body, >6-10 m | X |
| SS | 1733<br>1738<br>1750<br>1841 | Cattle | 8 | 1 | Head, body, front leg, 10-84 m | Sheep°<br>Medium ungulate | 5<br>1 | 1<br>1 | Head, body, front leg, 2-3 y<br>Hind leg, juvenile/pullus | X |
| TT | 1208<br>1848 | Sheep° | 113 | 1 | All parts, F, 6-12 m | Cattle<br>Sheep | 2<br>1 | 1<br>1 | Head, extremities, juvenile Extremities, < 18-28 m | X |
| UU | 1209 | Sheep | 20 | 1 | Head, body, front-, hind leg, F, 48-60 m | Cattle<br>Pig | 3<br>2 | 1<br>1 | Body, extremities, 24-84 m<br>Extremities, < 14-27 m | X |
| VV | 1210 | Cattle | 41 | 1 | All parts, 6-12 m | Sheep°<br>Cattle<br>Goat°<br>Pig | 13<br>3<br>2<br>2 | 1<br>1<br>1<br>1 | All parts, 3-4 y<br>Head, body, extremities<br>Front leg, > 11-13 m<br>Front leg | X |

**Table 1B**. Faunal deposits at Salpetermosen Syd, A573, containing a primary-secondary animal deposit. °Species also identified by SPIN, M = males, F = Female, m = months, y = years (Table continued next page).

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| XX | 1835 | Cattle | 4 | 1 | Head, front leg, 3-6 y | Equid | 2 | 1 | Front leg, 1-3½ y | X |
| YY | 1845 | Pig° | 1 | 1 | Head, 8-52 m | Horse° | 1 | 1 | Body | |
| EEE | 1815 | Goat° | 3 | 1 | Head, front leg, extremities, 1-2y | Pig<br>Goat | 2<br>1 | 1<br>1 | Extremities, < 24 m<br>Head, 2-4 y | X |
| FFF | 1813 | Pig | 3 | 1 | Head, body, extremities | Cattle | 1 | 1 | Head, 15-26 m | |
| HHH | 1832 | Cattle° | 1 | 1 | Body | Pig | 1 | 1 | Head, F, 12-16 m | X |
| III | 1843 | Cattle | 1 | 1 | Head, 2-8 y | Roe deer | 1 | 1 | Front leg, > 15-16 m | X |
| LLL | 1834 | Goat° | 13 | 1 | All parts, 2-3 y | Sheep°<br>Pig<br>Cattle | 6<br>4<br>2 | 1<br>1<br>1 | Extremities, > 6-16 m<br>Front, hind leg, 12-24 m<br>Body, front leg, > 12-18 m | X |
| MMM | 1836 | Sheep | 27 | 1 | Body, front-, hind leg, extremities, > 36-42 m | Pig<br>Cattle | 4<br>3 | 1<br>1 | Head, adult<br>Body, hind leg, 24-30 m | X |
| NNN | 1821 | Cattle | 1 | 1 | Head | Dog | 1 | 1 | Head, adult | |
| OOO | 1817 | Cattle° | 3 | 1 | Body, extremities, 42-84 m | Sheep | 2 | 1 | Front leg, > 9-13 m | X |
| QQQ | 1814 | Cattle | 4 | 1 | Head, body, front leg, 18-84 m | Sheep/ goat | 1 | 1 | Head (teeth), 1-3 y | X |
| RRR | 1837 | Cattle | 4 | 1 | Body, hind leg, 36-42 m | Pig<br>Dog | 1<br>1 | 1<br>1 | Extremities, app. 12 m<br>Head, adult | X |
| SSS | 1840 | Cattle° | 11 | 1 | Body, front leg, extremities, < 24-36 m | Medium ungulate | 1 | 1 | Leg | X |
| TTT | 1842 | Cattle° | 2 | 1 | Head, body, 2-8y | Medium ungulate | 1 | 1 | Front leg | X |
| YYY | 1847 | Cattle | 2 | 1 | Head, body | Goat°<br>Dog | 1<br>1 | 1<br>1 | Head<br>Head | X |
| ÆÆÆ | 1844 | Horse° | 8 | 1 | Body, front leg, extremities, 15-18 m | Sheep° | 1 | 1 | Body, >6-10 m | X |
| ABB | 1031<br>1032 | Cattle° | 7 | 1 | Body, front leg, extremities, 36-84 m | Sheep° | 4 | 1 | Head, body, front leg, M, > 6-10 m | |
| ABC | 1728<br>1731 | Cattle | 5 | 1 | All parts, 15-26 m | Sheep/ goat | 1 | 1 | Body, > 6-10 m | X |

**Table 1B**. continuing.

phases; during the pre-Roman Iron Age and the Roman Iron Age. Only in very few cases were the deposits placed on the bottom of the peat cuts. Instead, they were frequently deposited between or in the subsequent rapid and probably intentional infill of the peat cuts. The majority of these have a very compact expression, as if they were originally wrapped in hide, skin, or textile. In some cases, the deposits appear less compact, but they still have the appearance of closed finds, due to the orchestration of the bones and other objects. Based on field observations the variation of the deposits was considerable, but there was never any doubt as to whether the bones were deliberately placed, and as described above, these contexts did not include any charcoal, fire-cracked stones, or potsherds etc. Opposed to the above-mentioned wetlands, no cultural layer superimposed the deposits in wetland A793, which made it easier to identify the deposits as closed finds. As 54 deposits were identified from this wetland, only a few are described here as representatives of the general assemblage, but all deposits containing primary-secondary animals can be found in table 1B (44 in total, as the remaining 10 contained a single animal).

Deposits B, C, and D were found in this wetland during the initial excavation, soon to be followed by numerous others. The similarity of the three deposits was already noticed in the field. They all include adult or near adult cattle remains represented by multiple bones, mainly from the skull and extremities (primary animal). In deposit B, the extremities were placed in a pile next to the skull (Figure 5 B). The zooarchaeological analyses corroborated and confirmed that the deposit contained extremities from a second adult cattle (secondary animal), as well as the vertebrate from a medium sized ungulate, probably sheep/goat (a further secondary animal). This deposit is $^{14}$C dated to 170 BC-AD 20.

Deposit C included the skull and extremities, as well as a few more bones from across the body of a


**Figure 5**. A793. Deposit B and C. Remains of cattle combined with a medium ungulate (B) or a dog (C) (Photos: Museum Nordsjælland).

**Figure 6**. A793. Deposit D. Remains of an adult bull with a single pig bone (Photo: Museum Nordsjælland).

young bull (primary animal) accompanied by the ulna and vertebrate from a dog (secondary animal, Figure 5 B). In this case, the bones were concentrated in a pile with the extremities on top of the skull and stones encircled the entire pile. $^{14}C$ dates place this find between AD 50-260.

Deposit D contained the skull, the extremities, and some bones from across the body of an adult bull (primary animal). In addition, there was the radius from a juvenile pig (secondary animal). This pile of bones was very compact, as if it had been wrapped in skin or textile. $^{14}C$ dates placed this deposit in AD 240-400/250-430 (Figure 6).

The remarkable aspect of these three deposits is the similarities of composition as well as their temporal spread. On the other hand, the difference in secondary animals is also noteworthy.

Deposit OE is situated within a recut into the regrowth of a former peat cut, possibly with the intension of recreating the water table. This deposit

**Figure 7**. A793. Deposit OE. Remains of a juvenile horse with less bones from cattle, sheep, pig, and roe deer (Photo: Museum Nordsjælland).

**Figure 8**. A793. Deposit CC. Remains of three sheep with a few cattle and pig remains (Photo: Museum Nordsjælland).

is interesting as it contains many animal parts from several different species. Furthermore, the bones were placed with a fragmented wagon wheel on top (Figure 7). This deposit has not been $^{14}$C dated, but based on the local stratigraphy, it is probably dated to the Roman Iron Age. At least five individuals were represented with a juvenile horse as the primary animal, whereas cattle, sheep, pig, and roe deer (*Capreolus capreolus*) constituted the secondary animals. The horse was represented by bones from across the body, but it is far from a complete skeleton (20 bones in total). The cattle were represented by parts of the skull, the extremities, and a few bones from the body (9 bones). The sheep was represented by the skull and body (3 bones), the roe deer was represented by the front- and hind leg (2 bones), and finally the pig was represented by a tibia. The deposit primarily contained younger animals, but the exact age varied considerably. The presence of a humerus and a tibia from roe deer is remarkable as Iron Age animal deposits usually consist exclusively of remains from domesticated animals. Two further examples from Salpetermosen Syd include a radius in deposit III and an antler in deposit EE. The latter does not represent evidence of hunting, as the antler was shed and therefore could have been collected. However, the remains from OE and deposit III, provide inferred evidence of hunting and clearly wild animals were occasionally included in the deposition practices.

Deposit CC is another example of a deposit with multiple animals; five individuals in total, yet it is very different from deposit OE. In this case, three sheep are in a nearly complete state, but without the skull and extremities (in total approx. 119 bones), comprising two males and one female, all between 3-6 months (primary animals). Cattle and pig, represented by single elements from body and hind leg and a mandible respectively, accompanied these (secondary animals and 5 bones in total). The cattle were between the ages 2-4 years, whereas the pig was between 3-8 months old. The orchestration of the bones was very compact, as if they were originally wrapped firmly in textile or skin (Figure 8). This deposit has been $^{14}$C dated to AD 230-380.

Deposit VV was situated in peat cut 11 (A1577). The deposit was complex as it consisted of five individuals representing four species, half a ceramic vessel, and sherds from two other vessels, and finally a worked piece of wood. The wood has been $^{14}$C dated to 2 BC-AD 125, a dating consistent with the typology of the pottery. The primary animal is cattle represented by all parts of the body but not with a complete skeleton and aged to 6-12 months. A second adult individual was represented by the extremities (in total 44 bones MNE), representing a secondary animal. Further secondary animals included two sheep represented by all parts of the body (13 bones) and aged to 3-4 years, a goat represented by the front leg (2 bones), likely between 1 and 2 years old, and an adult pig represented by the front- and hind leg (2 bones).

## The phenomenon of primary and secondary animals

Based on the above-mentioned examples and the overview in table 1A and 1B, a very complex pattern of practice of animal deposition is emerging. The results suggest that a vital aspect of the animal deposits is the combination of primary and secondary animal parts and contribute to discussions of the selection of animals, the human-animal relationship, and the complexity of Iron Age deposits in general. The idea of sacred actions being governed by clear concepts of how and which animals and animal parts are selected and placed are well known from the Roman Empire. The *suovetaurilia* is a sacrifice of three specific species: pig (*Sus domesticus*), sheep (*Ovis aries*) and cattle (*Bos taurus*). Thus, the concept of specifically selected animals and specific combination of animals are well known (Bendlin 2013), including from Danish contexts (see e.g. Gotfredsen et al. 2017).

The lack of any overall rule as to which animal species or body parts were favoured at Salpetermosen Syd is therefore remarkable. The variability is not limited to species and body part, as no clear preference could be found for a specific age or sex of the animal. However, it is worth noting that the age distribution does demonstrate that the majority of animals were in their prime. Few very young and no senile or animals with clear signs of pathology have been identified. Furthermore, the probable treatment of these remains appears to differ considerably. The identification of cut-marks in some deposits suggests that the animals were butchered, dismembered, and potentially eaten before being deposited, while other deposits appear to have contained complete animals or parts of bodies with very few or no observable cut-marks.

Cattle is the most common amongst the primary animals in Salpetermosen Syd based on the MNI count. Based on NISP, sheep appear to be the dominant species, because sheep is often deposited in nearly complete state (Bangsgaard 2018, 32). The previously mentioned concept of the superiority of horse can only be confirmed in Salpetermosen Syd if measured in absence, as the horse played a lesser role on this site. This tendency follows what has been reported at other sites, such as Bukkerup Langmose (Albrechtsen 1944; Gyldion Andersen 1993) and Alken Enge (Kveiborg 2019, 118). The question remains whether value and superiority can be observed through absence. Could it be that the horse was so important that it only appears in a few cases at Salpetermosen Syd? Or does the rareness of horse suggest that they were not particularly important to these societies? Following this line of thought, we may ask if the dominance of cattle is an expression of high value and superiority, or if the dominance expresses a lesser value. However, the latter will go against the traditional idea of socioeconomic status being measured in cattle (Carlie 2004, 116; Roymans 1999). Consequently, the traditional discussion of animal status is worth re-opening, as the complexity of the animal deposits suggest a nuanced relationship between animals and humans.

As previously mentioned, cattle were the most dominant animal amongst the primary animals, with a presence in 25 out of 48 cases, which equals 52,1 %. However, a substantial variation is observable between the cattle remains in each deposit. In 15 cases, the skull was represented, in 14 the extremities, but only in six cases were both body parts represented. In four cases, neither of these body parts occurred. The focus on skulls and extremities is particularly interesting because these body parts have often been labelled synonymous with horse deposits, as part of the "special treatment" of the horse (e.g. Klindt Jensen 1957; 1967; Johannesen 2016, 55). However, as we have established, the selection of skull and extremities is not exclusively reserved for the horse, it is also observable for cattle, pig, and sheep. Examples of this representation across species is also known from the Continent, for instance, from Germany (e.g. Müller-Wille 2002,156).

The secondary animal represents a minor part of the deposits in comparison with the primary. The secondary animal can be of the same species as the primary, or it can be an animal of a different species. It is also clear that one deposit can contain several secondary animals. A slightly wider range of animals appears to function as secondary animals, such as roe deer, which the OE, III and EE deposits prove. Otherwise, the species represented are the same as the primary animal, namely all the common domesticated species, cattle, horse, sheep, goat, pig and dog. Of the 48 deposits, there are 28 variations of animal combinations, which means that most variations only occur once or twice. A few occur three or four times. Nevertheless, these deposits are still very different in appearance because the selection of body parts varies. Therefore, if the combination of species, body parts, and ages are included in the comparisons, no two deposits are alike. Apparently, no animal was considered "above" or "beneath" being a secondary animal. There is also nothing to indicate that the secondary animal was in any way less important than the primary animal. In comparison, the *suovetaurilia* tradition depends on the presence of all three animal species for the ritual to be successful (Bendlin 2013).

## The primary-secondary phenomenon at other sites

A zoological review of animal deposits at several Danish sites was carried out in order to examine whether the phenomenon of primary and secondary animals is a local phenomenon of North Zealand, or if it is a more widespread phenomenon. The selection of sites is based upon different criteria: The sites had to be published with relevant details or the faunal material had to be accessible at the Quaternary collections and archive, so that information could be obtained. Furthermore, the location of the sites needed to represent both wetlands like Salpetermosen Syd and other types of areas, for us to investigate, whether the primary-secondary phenomenon is exclusively reserved for the wetland environments, or if it is a more general practice. Finally, to avoid the discussion of regionality, the sites needed to represent most of the Danish area (Figure 9 and table 2).

Bukkerup Langmose and Turup are both wetland sites from Funen, excavated in 1943 (Albrechtsen 1944; Gyldion Andersen 1993; Hatting 1993). Both sites are well known for the faunal deposits found here and are often used for comparison due to the uniformity of composition with deposits containing cattle limb bones, often found in combination with pottery, tethering poles, and rope. This uniformity was based on archaeological observations, but a later zoological analysis revealed a difference in terms of size and age of the animals (Hatting 1993,95). The uniformity of the deposits and the geographically close relationship between the two sites were used as archaeological arguments for detecting a regional leadership, which controlled the deposition practice (Gyldion Andersen 1993, 80; Gyldion 2009). The Bukkerup find consists of 13 closed finds, called "packages" (Gyldion Andersen 1993, 72). The presence of other species is only superficially mentioned: "*The sacrificed animal bones from Bukkerup are without exceptions from cattle. Although there is an extremity bone from horse and a shank from a pig, these should most likely be considered misplaced rather than parts of the sacrifices*" (Gyldion Andersen 1993, 76 -translated).

A renewed study of the Bukkerup finds has revealed a primary-secondary combination of species in three cases. Cattle were the primary animal in all three deposits, whereas the secondary animals were represented by pig, horse, and horse, thus each deposit consisted of two individuals. A similar review of the Turup site revealed a primary-secondary deposition practice in four cases. At this site, cattle are accompanied by sheep in three instances and pig in one. In two out of four cases, the deposits

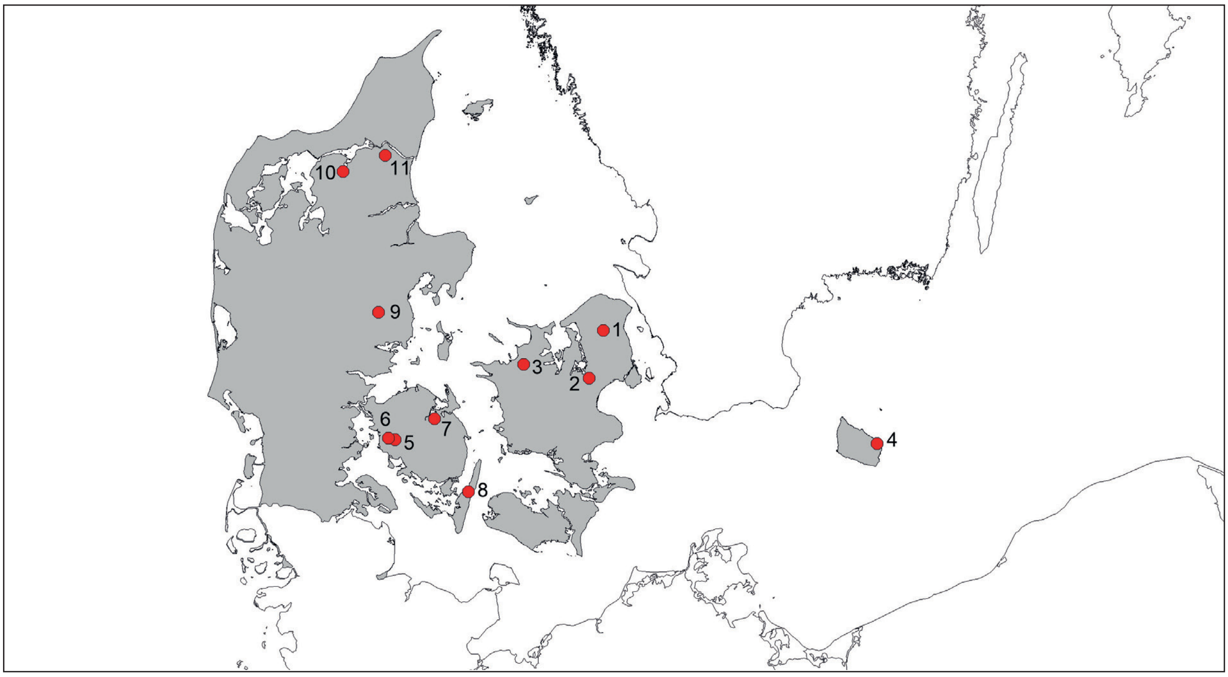


**Figure 9**. Map of selected sites where primary-secondary animal deposits have been identified. The map contains data from "Styrelsen for Dataforsyning og Effektivisering, Danmark 1:200.000, vektor".
1: Salpetermosen, 2: Lundbjerggård, etape 2, 3: Nordgårde, Svinninge, 4: Sorte Muld, 5: Bukkerup Langmose, 6: Turup, 7: Lundsgård, 8: Stengade Mose, 9: Forlev Nymølle, 10: Skørbæk Hede, 11: Nørre Hedegård.

consist of three individuals. Thus, the supposed clear uniformity of the deposits is again questionable from both an archaeological and a zoological perspective, due to clear differences in the primary-secondary balance.

Forlev Nymølle, is another wetland site, located in Jutland and excavated in 1966 (Lund 2002). The site is known for 10 concentrations of various finds in different combinations. In this study, concentrations II, III and IX are of particular interest, because they included animal bones. The site was in use from 200-50 BC, thus each deposit is not necessarily concurrent (Lund 2002, 163-167). Concentration II includes cattle as the primary animal represented by a substantial number of bones from across the skeleton. The secondary animals include the mandibles from horse and goat. All animals, both primary and secondary, are young: 6 months or younger. In concentration III cattle is also the primary animal and includes bones from across the skeleton. In this case, the secondary animals are a dog represented by mandibles and metacarpals, a goat represented by mandible, radius, and ribs. Finally, a human being is represented by a scapula. The inclusion of human remains into such deposits are not common. However, based on the above-mentioned definition of the primary-secondary phenomenon, the human bone is, in this case, defined as a secondary animal. Concentration IX includes three individual cattle as the primary animals. All are adults and represented by skull and vertebrae. Three secondary animals comprise two and a single bone from a dog and a sheep, respectively (Lund 2002, 159; Rosenlund 2001).

Nordgårde, Svinninge, on Zealand, is a cemetery excavated in 2001 (Wickman 2011, 259). One of the graves was a dog grave consisting of a complete dog accompanied by a miniature ceramic vessel and half a skull from a pig. The grave is dated to the late Roman Iron Age (Wickman 2011, 259).

Lundsgård is a settlement site on Funen excavated from 1937-44 (Albrechtsen 1946, 12; Carlie 2004, 112). With the primary-secondary animals in mind, four deposits are of interest. Within house A, a near complete skeleton of a dog was deposited and accompanied by the astragalus of presumed cattle. The find is dated to the early Roman Iron Age. In house C, dated to the late Roman Iron Age, there was a deposit of burnt faunal remains consisting of seven individuals in total. In this case, three individuals of cattle represent the primary animals, whereas four pigs must be regarded as the secondary animals.

| Context | Location | Primary species | MNE | MNI | Secondary species | MNE | MNI |
|---|---|---|---|---|---|---|---|
| **Turup (reanalysis and Hatting 1993:95)** | | | | | | | |
| Vessel 9 | Wetland | Cattle | 3 | 1 | Sheep | 1 | 1 |
| | | | | | Cattle | 4 | 1 |
| Vessel 3 | Wetland | Cattle | 25 | 1 | Pig | 1 | 1 |
| Vessel 2 | Wetland | Cattle | 33 | 2 | Sheep | 2 | 1 |
| Unmarked | Wetland | Cattle | 36 | 1 | Sheep | 4 | 1 |
| **Bukkerup Langmose (Hatting 1993, 95)** | | | | | | | |
| 17 | Wetland | Cattle | | 1 | Pig | 1 | 1 |
| South of 30 | Wetland | Cattle | | 1 | Horse | 5 | 1 |
| Next to 40 | Wetland | Cattle | | 1 | Horse | 1 | 1 |
| **Stengade Mose (Becker, 1972)** | | | | | | | |
| | Wetland | Cattle | 11 | 1 | Pig | 2 | 1 |
| **Foerlev Nymølle (Rosenlund 2001)** | | | | | | | |
| | | | | | Horse | 2 | 1 |
| konc II/B | Wetland | Cattle | | 1 | Goat | 1 | 1 |
| | | | | | Hare | 1 | 1 |
| | | | | | Dog | 6 | 1 |
| konc III/C | Wetland | Cattle | | 1 | Goat | 5 | 1 |
| | | | | | Human | 1 | 1 |
| | | | | | Dog | | 2 |
| konc IX | Wetland | Cattle | | 3 | Sheep | | 1 |
| | | | | | Equid | | 1 |
| **Nordgårde (Wickman 2011, 259)** | | | | | | | |
| | Cemetery | Dog | 1 | 1 | Pig | 1 | 1 |
| **Lundbjerggård etape II (Winter in press; Magnussen 2021, 7)** | | | | | | | |
| | Habitation | Sheep | c.109 | 3 | Cattle | 1 | 1 |
| Anlæg K41 X852 | | | | | Pig | 1 | 1 |
| **Lundsgård (Carlie 2004, 112; Degerbøl 1943)** | | | | | | | |
| House A | Habitation | Dog | | 1 | Cattle (?) | 1 | 1 |
| House C | Habitation | Cattle | c.250 | 3 | Pig | | 4 |
| House F | Habitation | Sheep | | 2 | Cattle | 1 | 1 |
| | | | | | Cattle | | 1 |
| House E B1526 | Habitation | Pig | | 3 | Sheep | | 1 |
| | | | | | Equid | | 1 |
| **Nørre Hedegård (Runge 2009, 44, 330)** | | | | | | | |
| House A143 X3311 | Habitation | Sheep | | 1 | Pig | | 1 |
| **Skørbæk Hede (Carlie 2004, 323)** | | | | | | | |
| House H | Habitation | Cattle | | 1 | Sheep | | 1 |
| **Sorte Muld (Møhl 1957, 294, 302-03)** | | | | | | | |
| | | | | | Cattle | | 3 |
| House II<br>Pit 3 | Habitation | Horse | | 1 | Sheep | | 1 |
| | | | | | Dog | | 1 |

**Table 2**. Faunal deposits identified at other Iron Age sites in Denmark with primary-secondary animals.

In house F from the early Roman Iron Age, the primary animal is sheep represented by a near complete skeleton, age 6-24 months. The secondary animals are sheep with a juvenile ulna, and one metatarsal from cattle. Finally, a stone lined pit from house E contained the bones from three individual pigs (primary animals), which were accompanied by single bones from cattle, sheep, and horse. The secondary animal bones all derived from the skull (Albrechtsen 1946, 12; Carlie 2004, 112, Degerbøl 1943).

Nørre Hedegård is a settlement site in Jutland, excavated in 1998 (Runge 2009, 12). In house A143, there was a deposit of a near complete skeleton of an adult sheep (primary animal) accompanied by a near complete skeleton of a juvenile pig (secondary animal). House A143 belongs to phase 14, which is dated to period II.2 or around the 1st century BC (Runge 2009, 44, 330)

Skørbæk Hede is a settlement site in Jutland excavated in the 1930's (Hatt 1938, 119-166, 146; Carlie 2004, 323). The habitation is dated from the late Pre-Roman to the early Roman Iron Age. From house H, a ceramic vessel was found containing the burnt remains of cattle as the primary animal represented by skull and extremities. A burnt hind leg from sheep accompanied these.

Sorte Muld is a settlement site from Bornholm, where excavations were initiated during the 1950's (Klindt Jensen 1957). A pit contained a complex ensemble of animal bones located close to house II and thus presumably connected to its use. Although Klindt Jensen focused on the horse (Klindt Jensen 1957, 83), several other animals were represented. The primary animal was a horse represented by the skull and extremities, but five individuals represented the secondary animals. There were bones from three young calves and a single bone from sheep and dog (Møhl 1957, 294, 302-03, Carlie 2004, 118). The pit is presumed to be related with house II, which is dated to the transition between the late Roman and early Germanic Iron Age, around AD 400 (Klindt Jensen 1967, 143). However, according to Finn Ole Nielsen from Bornholm's Museum the dating could be as late as AD 450-500 (Pers. communication).

## The implications of the phenomenon and concluding remarks

Based on the above-mentioned examples, the combination of primary and secondary animals in a single deposit is not exclusively linked to Salpetermosen Syd, to wetland depositions alone, to a specific period, or to a specific region. Furthermore, there is no clear pattern as to which animals are primary or secondary, just as the choice of body parts appears to be liberal in the sense that the variation of selected body parts indicates that they were not subject to a specific doctrine. The combination of these observations with the detailed information from the deposits at Salpetermosen Syd, such as the exact position and distribution of bones and the presence of cut-marks, suggests that the bones represent different treatments prior to deposition. In some instances, the types of bone, the disarticulated nature of these, and the observed cut-marks suggest that the remains could represent food or leftovers of a meal. In other instances, they include heads and extremities and thus appear to represent the initial butchering and skinning process, if not a symbolic animal: an intact skin with feet and head still present. Finally, at times the near articulated appearance of the remains and complete lack of any cut-marks suggest the deposit of intact or near intact animals (Bangsgaard 2018). This pattern illustrates that the specific cut of meat, the treatment of it or even the species of animal used in the deposit could vary and were potentially not of as great importance as the very act of placing a deposit. However, based on the human-animal relations described by Hill (2013) it is possible that the variation described above, will also relate to the specific animal and the relationship between specific human and animal persons. This means that the choices made in connection with a deposit were relational and varied according to factors not measurable or detectable by the usual zoological categories such as species, bone, age or sex.

A closer look at animal deposits clearly demonstrates the complexity and variation of these in a Danish Iron Age context, but the current study also highlights some common traits seen across deposit and location. Furthermore, this article presents the phenomenon of primary and secondary animals within a single sacrificial deposit, where one or more animals represented by a few bones each accompany a primary animal, often represented by a substantial number of bones. Such closed finds deserve to be studied carefully, as they may provide information regarding the combination of animal species, the number of individuals and body parts present, not to mention the treatment or actions prior to deposition. Combined, this information reveals a much more complex history of deposition practices. The specific combinations seem endless, and it appears that there is room for a very individual touch within a defined framework of ideas and narratives. Even though the ideas behind the phenomenon of primary and secondary animals are unknown, the complexity of the deposits leaves an impression of a set of visions, or narratives, which must have formed the basis of deposition practices. More importantly, these visions or narratives were not confined to a single geographical area, nor were they a result of a local custom. The ideas seem to have had a far greater prevalence across regions and extend beyond Denmark. Examples of primary-secondary animal deposits are also known from Sweden (e.g. Carlie 2004, 290-93, 302-11; Vretemark 2013, 56-57), the Netherlands (Lauwerier 1988, 112), and from Germany (Teichert 1974, 103; Müller-Wille 2002:155-157).

Another significant aspect of the primary-secondary phenomenon is that it is not restricted to wetlands, but can also be found on dryland locations. Finally, this phenomenon challenges the temporal aspects of deposition practices. Even though archaeology divides the Iron Age into different periods, the deposition practice regarding animals does not appear to alter considerably. Within the Danish area, this practice existed at least from the pre-Roman to the early Germanic Iron Age. That constitutes a Millennium from 500 BC to approximately AD 500. Nevertheless, it is possible that the phenomenon started even earlier, as some of the first Swedish examples are dated to late Bronze Age (Carlie 2004, 302, 311).

This in-depth study of the deposits from Salpetermosen Syd and the identification of other examples from across Denmark clearly illustrates the potential for a full faunal analysis of animal bones found in such closed contexts. An increasing body of evidence may help illuminate some of the questions that remain concerning the meaning and exact context of actions that surrounded the deposition event itself as well as adding to the discussion of the human-animal relationship.

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# The Ambiguous Boeslunde-figurine

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**ABSTRACT**

This article presents a unique female figure found in Boeslunde, Zealand, Denmark. It stands at just 1.5 cm and is made of gilded silver with remarkably refined details. The date of the figure is discussed based on details of her garments, accessories, and hairstyle and she is compared to other archaeological representations and finds. Based on these criteria, a dating to the Late Iron Age/Early Viking Age is proposed. Her function is likewise discussed. By means of an examination of parallel finds, the figure's function as a gaming piece or garment accessory is ruled out. It is argued that she functioned as an amulet and her features are evaluated and discussed. Contemplating the figure from a ritual perspective, her necklace appears to be a significant attribute, an observation which has great implications for other representations such as the Odin-from-Lejre-figure. It is, further considered whether her necklace is a representation of Freyja´s Brisingamen, and the little figure thus a depiction of Freyja, herself. Lastly, the intentionally differentiated shape and size of her eyes and their symbolic meaning is evaluated, and parallels are examined and discussed.

**ARTICLE HISTORY**
Received
09 December 2020;
Accepted
06 April 2021

**KEYWORDS**
Amulets; Symbolism; Freyja; Norse religion; Iron Age mythology

## Introduction

In January 2020, a remarkable minute female figurine was found near the village of Boeslunde in the Western Zealand region of Denmark. She stands just 1.5 cm tall, dressed in a long cape and displaying a conspicuous necklace on her chest. Her hair is gathered in a high, knotted ponytail (Figure 1).

She is unique; no other figures like her have so far been encountered. In general, plastic figures are rare, and particularly such with a human expression. Therefore, only few known plastic anthropomorphic figures can serve as a basis for comparison. The most immediate parallel is the Odin-from-Lejre-figure. This figure was found in 2009 during excavations of the large hall-buildings in Lejre on Zealand. It is dated to approximately 950 AD. Like the Boeslunde-figurine, it is minute in stature but shows a seated figure on a throne adorned with animal heads and a bird on each armrest (Christensen 2009). The throne, and not least the two birds, have led to the figure's interpretation as Odin, but detailed costume elements, and particularly the distinctive bead-strand across the figure's chest, bears great resemblance to the Boeslunde-figurine. The other immediate parallel is the Hårby-figure from Funen dated to the 9th century (Henriksen and Petersen 2013). They share the same hair style and plastic design but differ in costume elements and technical execution. In addition, the Hårby-figur carries weapons and clearly represents a Valkyrie known from brooches and other representations. Like the Boeslunde-figurine, the function and symbolic meaning of these parallels are ambiguous and eagerly debated. Was the Boeslunde-figurine an amulet carried hidden in a pocket or mounted for display, or did she serve a more practical function as a dress accessory or gaming piece? And how should she be dated?

As she is unique, it is difficult through parallels alone to determine her function, date, and the role she played in her own time. This article will contextualize the figurine in relation to other finds and find contexts, and through a detailed review of individual elements and possible parallels, her function, symbolism, and date will be discussed. It will also be discussed why such a detached find is of great interest for current re-

**Figure 1**. The Boeslunde figure. A close-up reveals the refined details in her manufacture (Photo: Museum Western Zealand).

search, and what it can say about its own time and not least about the present.

## Context

Today, Boeslunde is a small village between Slagelse and Skælskør approximately five kilometres from the western coast of Zealand. Historically it has enjoyed a strategic position with access to waterways as well as a central route across Zealand between Scania and Funen. It is located on a high plateau, one of three distinct hills dominating the landscape. The small village of Neble to the north has now merged with Boeslunde. As ordinary as it may seem today, it was truly spectacular in prehistory. Boeslunde has revealed some of the most spectacular Bronze Age gold artefacts in Denmark and served as a cultic center in the late Bronze Age. There is a continuity in activity on throughout the Iron Age with a boom in material finds from the Late Iron Age and Viking Age approximately AD 600-1000. The markedly large medieval church presently located in the village further emphasises the significant role Boeslunde played over a period of more than 2000 years.

Only few, isolated excavations have been conducted, but the fields around the village have been the focus of extensive metal detector surveys (Nielsen 1997). Rare and conspicuous objects have been found such as gold and silver ingots, coins, weapon parts, riding gear, imports, and several hoards. Among the more remarkable objects are three matrices for gold foil figures, two Valkyrie fibulas along with a matrix, and a small house amulet with parallels to finds in Scotland. It is in this ritual and prominent environment the little lady was found.

## The Lady from Boeslunde

The little female figurine is approx. 1.5 cm. tall and weighs just 5 g. She is made of a silver alloy and has been fully gilded. She is very worn, especially on her head, but two slanted eyes are still visible, one larger than the other, as well as a small straight line representing a mouth.

Her body is slightly rounded to illustrate shoulders or arms tucked under a full-length cape with beaded borders along the front. Unfortunately, due to extensive wear, it is impossible to make out details of a brooch that would have closed the cape. However, under the chin an empty space leave room for a larger brooch, and as the beaded front line terminates unevenly here, it could suggest that the now worn-down brooch depiction was asymmetrical. On the chest, four bead-strands hangs, one beneath the other, extending to the middle of the figure. Under the bead-strands, a modern scrape makes it impossible to discern any details of the figure's lower dress, for example a decorated apron-like front piece as found on the Odin-from-Lejre-figure. She stands firmly on a small square base with no indications of feet. She is hollow, and a broken casting cone can be observed within her.

The Boeslunde-figurine is clearly a female representation, as her hairstyle, in particular, testifies. The hair is gathered into a high knot in the back with a ponytail extending to the ground. The Odin-from-Lejre-figure wears a gender-neutral helmet or hat that has sparked discussions on its gender (Mannering 2013). Similarly, a braided hairstyle on a small figure from Trønning near Kundby has caused speculation about its gender (Christensen 2010, 7-8). The Boeslunde woman, on the other hand, has a clear and detailed so-called Irish Ribbon Knot, which seems to have been the preferred female hairstyle from the Late Iron Age well into the Viking Age – a period of over 500-year. This knot is found in many different contexts and representations, and its symbolic value seems to take priority to a naturalistic depiction of hairstyle (Arwill-Nordbladh 2016; Hedeager 2015, 134-135). It has been suggested that it was used by unmarried women of high status; apparently it became common for married women to cover their hair as early as the Iron Age (Henriksen and Petersen 2013, 9). But what specific purpose did the little well-dressed lady serve?

## Gaming piece

These types of small figures are occasionally referred to as gaming pieces (Ramskou 1976). The existence of board games is evident from early ancient times. Roman influence most likely brought

**Figure 2**. The cone-shaped figure from Tornes, Norway with ambiguous and symbolic decorations. Note the alteration of the eyes (after: Helmbrecht 2011, 247. Photo: S. Fedje; Measure: 4,4 x 2,1 cm).

games to the north. Miscellaneous finds from the Iron and Viking Ages testify that games were widespread and common (Michaelsen 1992, 24). From Hedeby, for example, several gaming pieces have been found in addition to a preserved wooden game board. The gaming pieces were made from antlers, bones, wood, and amber, and also exotica like walrus tooth and jet were used. They are mainly flat, semi-circular, or conical and only two have a tower-like shape terminating in a stylised ´crown´ or ´head´ (Schietzel 2014, 287). From Ribe's early Middle Ages, a cone-shaped gaming piece with two triangular stylised ´heads´ has been found, along with a number of other pieces with varying shapes of different materials.[1] Gaming pieces have also been found in rural locations such as Herslev in Western Zealand.[2] A semi-circular gaming piece made of bone, presumably from the Viking Age, as well as a small cylindrical piece in clay from the Middle Ages, have been found here. In the same area as the Boeslunde-figurine was found, two identical figures made of copper alloy representing male figures were recovered as well.[3] These figures are just over 3 cm tall and have been identified as gaming pieces in the National Museum of Denmark. This definition was, among other things, based on their smooth stand base, which is not immediately suitable for fastening or mounting.

Another place where gaming pieces have commonly been retrieved, is at the Viking winter camps in England. At Repton and Torksey in Lincolnshire, many detector finds have been uncovered that testify to the Vikings' pastimes while camping for the winter in foreign lands. Among other things, a number of gaming pieces have been found here, usually simplistic, and roughly composed in lead. Other isolated finds, such as a carved gaming piece from London in bone or ivory, testify, however, that craftmanship was invested in the design and decoration of such pieces. This slightly damaged game piece from 1100-1300 is carefully carved with human-like elements, however rather abstract.[4]

Another peculiar figure originates from Tornes in Norway made of soapstone (Figure 2). It shows a figure, wearing a pointed hat and a long cape with finely carved but ambiguous details that are difficult to grasp (Ringstad 1996). From Denmark, a unique and outstandingly crafted figure is similarly interpreted as a gaming piece. It is the aforementioned golden figure with braided hair gathered at the neck. The figure was found in a burial mound at Trønning, west of Holbæk, Zealand but lost during World War II, and only sparse information and documentation on the figure remain (Jensen 2006, 353). It was almost 2 cm high and made of gold tin with details in filigree. The figure's attire was finely decorated, and its apron-like design mirrors that of Odin-from-Lejre´s, while its jewellery has a unique design. On the front of the figure by the lower edge are two rivet holes of unknown function. The piece resembles a bishop or runner in a chess game, which has prompted interpretation as a chess gaming piece (Ramskou 1976). However, it is dated to the Viking Age based on stylistic and technical elements, while the game of chess first found its current form in Europe during the 12$^{th}$ century

(Michaelsen 1992, 55-56). The Lewis chess pieces are prime examples which testify to this, having been carved around 1170-1230 (Caldwell, Hall and Wilkinson 2009, 198). From Copenhagen, a beautifully carved mounted bishop of walrus tusk from around the 12th century has been uncovered as well.[5] Until the Middle Ages, the original chess set was common, but quite different in its line-up. It included, among other things, fighting elephants. The game of chess has its origins in the regions around India and was introduced to Europe via the Moors' colonization of Spain. However, travelling Vikings may have encountered it on journeys to the east (Michaelsen 1992, 55).

Finally, it should be noted, that traces of gaming often appear in ship burials and funerals with a high social status (Caldwell, Hall and Wilkinson 2009, 167; Hall 2016, 445-446; Whittaker 2006, 105-106). Accordingly, a whole set of gaming pieces was found in the extraordinary grave in Oldenburg, Holstein from the Viking Age. They are semi-circular in shape and made of walrus tooth and bones. Only one of the pieces is made of a silver-plated copper alloy and resembles a stylised crown (Pedersen 2013, 147). In the Ladby ship burial on Funen where a high-status woman was entombed, corner brackets for a gaming board were found, but no game pieces were recovered. The same applies to the Gokstad ship burial (Michaelsen 1992, 50). Finally, several burials from Birka, Sweden should be mentioned, including a warrior's burial, which contained an intact set of gaming pieces as well as a game board evidenced by corner fittings. These are also made of bone and differentiated in a variety of ways, e.g., by a copper rivet at the top. Analyses have shown that the warrior in the grave was a woman (Price et al. 2019, 184-188). Other graves at Birka demonstrate refined manufactured glass gaming pieces (Whittaker 2006, 105).

Gaming pieces are primarily known from the Viking Age and the Middle Ages, while they are more infrequent in the Late Iron Age. This is probably caused by external factors since games and gaming pieces are found in the Roman Iron Age as well. A motif on the famous golden horns from Gallenhus, dated to the 6th century suggest that games were known in the Late Iron Age and may bridge the gap.

Although gaming pieces appear in many different contexts and designs, only few seem to be perceptively or delicately manufactured and decorated. If the Boeslunde-figurine did serve as a gaming piece, one would expect other corresponding examples considering the general frequency of gaming pieces. Particularly, in rich burials where other types of games and gaming pieces often occur, refined examples would be expected, since games and gaming pieces is connected with high social status and identity. Accordingly, it cannot be argued based on comparable material, that the Boeslunde-figurine functioned as a gaming piece. But what was she then?

## Dress Accessory, Jewellery or Decoration

An obvious suggestion is that she served as a costume accessory or piece of jewellery or decoration. For example, she could have adorned a dress pin, a brooch, a strap end or decorated a sorcerer's staff. Exquisite jewellery is common but is most often decorated with animal heads of more or less ornamental design. For example, refined and detailed terminals from chains and strap-ends depicting animal heads are found in Herslev and Gudum. Dress pins also have figurative representations, but they are most often stylised masks or animals, such as the lavish dress pin with a beautifully designed dragon head from Hedeby (Williams, Pentz and Wemhoff 2013, 50). From Hedeby and Birka, however, a dress pin with a woman's face wearing a hat is known. They are simplistically designed, made of copper and the head is moulded together with the needle. In addition, they have an eyelet on top of the head for attachment (Helmbrecht 2011, 220). A small bronze figure from Søholt by Maribo found in a burial mound also belongs in this anthropomorphic category. It shows a very stylized human-like figure in copper alloy with only few details (Franceschi, Magnus and Jorn 2005, 104). A special type of dress pin depicts warriors with pelta-shaped ´horns´ on their helmet. Such anthropomorphic figures are known from several localities such as Uppåkra, Tissø and Torslunde. They seem to have a uniform and defined symbolic language without significant variation, and therefore appear to be a category in themselves.

Finally, other plastic artefacts deserve mentioning such as the Fenris wolf from Gudum, Zealand. Such objects are few but share a plastic design and communicate a distinct and recognizable message. Often, however, their function, display and handling are ambiguous and cannot be explained. The Fenris wolf lacks both rivet holes for attachment to a staff or the like as found on the Trønning figure, or an eyelet for hanging such as on the Hårby woman. Although the symbolic message may derive from the same mythological background, the symbolic display is equally ambiguous.

Accordingly, there are no immediate parallels that could point to the Boeslunde-figurines's function as a costume accessory, a jewellery or decoration. Nor is her wear compatible with such a function. The gilding on her body is almost intact, while it is totally worn down on her head. Had she been fitted to a dress pin or worn as jewellery, a more uniform wear on one side would be expected. Having excluded these functions, what can bring us closer to an understanding of her function and symbolic message? The devil is in the detail.

## Amulets

With a function as a gaming piece or dress accessory unlikely, we may be compelled to regard her as an amulet. We must, however, be careful, not to name artefacts as cultic or symbolic by default when no other probable function can be argued for. In this case, however, it seems like a legitimate suggestion based on her size, her necklace, and the difference in her eye size.

Amulets are well known in the archaeological material. However, in the Late Iron Age they are few in number and limited in format. It has been discussed whether conspicuous artefacts from the Late Iron Age represent prestigious exotica rather than amulets with a symbolic meaning. Also, it must be considered whether amulets from this period were preferably made of non-durable material (Pedersen 2009, 290-292). The prevalence of amulets escalates during the Viking Age, becoming increasingly common throughout the period. They are most often simple and made from non-precious metals like copper or iron but can also be found in silver and gold. They come in different shapes, sizes, and contexts, like the Valkyrie fibulas or as depictions of the berserks, for example, but also frequently as miniatures. They depict weapon parts, Thor's-hammers, strike-a-lights, combs, books, or chairs. The Boeslunde-figurine seems to correspond to this tradition of miniatures symbolising a special power or force reflected onto the user. They are believed to mimic the essence or a concentration of a specific value or virtue (Hedeager 2015, 132). Even though miniatures are common, few have an anthropomorphic character. In general, plastic figures are uncommon in the Late Iron Age but reappear in the Viking Age though, infrequently. Most are made of copper alloy and rarely gilded, but the work can be detailed and refined (Helmbrecht 2011, 246).

The Boeslunde-figurine´s details and attributes may, however, help to understand her symbolic meaning; accordingly, her necklace and the difference in her eyes seem to be significant.

## The Necklace

As she appears in her present state, the necklace is prominent. Dress features in the destroyed part below the necklace could have been significant as well, as could a brooch closing her cape. However, even if these elements were still intact, the necklace would have been equally impressive, and its strong manifest seems important in its own right.

The necklace is displayed as four strands of small spherical beads lying close together. The nearest parallels, which offer very uniform impressions, are found on the Odin-from-Lejre-figure and on a pendant from Aska, Sweden. Odin-from-Lejre was found in 2009 during excavations of the hall-building in Lejre, Zealand and is interpreted as Odin on his throne dated to the beginning of the 10th century (Christensen 2009, 12). The pendant from Aska, Östergötland originates from a woman's grave dated to the Viking Age, and is believed to have been part of a larger piece of jewellery. It depicts a woman with a cape and with the same four bead strands across her chest. Along the edge of the cape, small beads are depicted continuing down onto her arms. She wears a helmet or hat on her head. A large fibula, a so-called disc-on-bow fibula, holds the cape togeth-

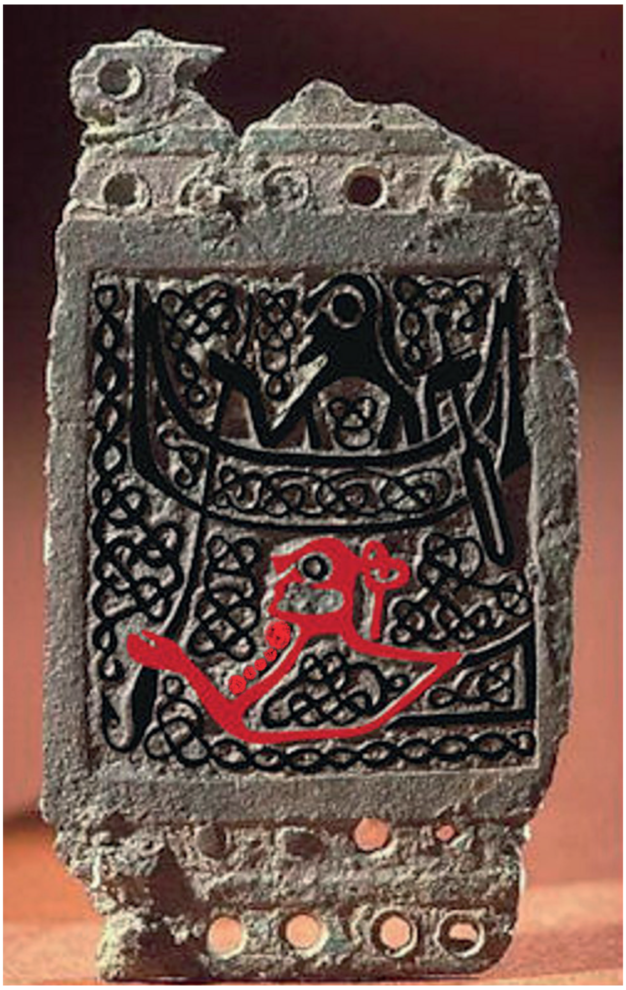

**Figure 3**. The Solberga pearl spreader with a symbolic motive including af female with a four-strand necklace, and disc-shaped brooch under her chin (after: E. Arwill-Nordbladh 2016, fig. 5. Photo: Staff/The Swedish History Museum; Measure: 6 x 3 cm).

er under the chin. This brooch is common in the Late Iron Age and the pedant therefore implies a significant time depth in the grave goods. This is supported by extensive wear on the pendant (Arwill-Norbladh 2005, 178-180).

A closer investigation reveals other parallels. A small bead spreader from a grave in Solberga, Östergötland, also shows a graphic representation of a female figure, this time in profile, but with four beads and a disk-shaped brooch on the chest (Figure 3). The disc is believed to be a simplistic representation of a disc-on-bow brooch, when space is limited (Arrhenius 2009, 225; Axboe 1986, 116). She lies deep in the water while a fisherman in a boat above her, throws out a hook. She is very stylised depicted, but the necklace and hairstyle have found room in this small representation, suggesting they were significant. A brooch shaped as a female figure from a grave in Tuna, Uppland offers another parallel wearing a similar piece of jewellery (Figure 4). She is made of gilded silver and depicted in full figure in profile. A great wealth of details shows a knee-length cape over a full-length dress. She has four beads stacked on her chest as well as a larger disk-shaped brooch on the side of the neck. It is reasonable to interpret them as a four-bead sequence seen in profile and with a larger piece of jewellery to close the cape at the neck – perhaps a stylistic representation of a disk-on-bow brooch (Hedeager Krag 2003, 69-79). The same representation is found om several gold foil figures. Here females in profile are depicted with bead strands on their chest (Mannering 2017, 37).

Christensen points to a neck collar on a wooden figure from Rude Eskildstrup as a parallel to Odin-from-Lejre' s jewellery and, thus, indirectly to the Boeslunde-figurine (Christensen 2013, 71). How-

**Figure 4**. The Tuna figure clearly illustrate a four-strand necklace and disc-shaped brooch. The emphasis of the jewellery is noticeable (Photo: SHM/Gabriel Hildebrand; Source: http://mis.historiska.se/mis/sok/bild.asp?uid=341380&page=2&in=1; Measure: 3,7 x 1,7 cm).

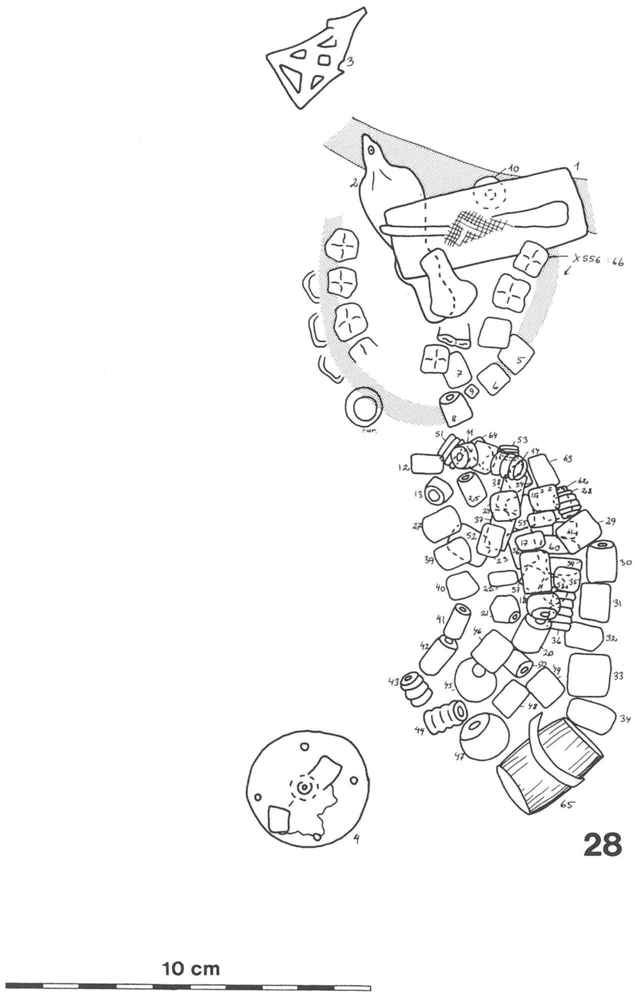


**Figure 5**. The jewellery set from grav 28, Nørre Sandegård vest, Bornholm. Note how four strands of beads can be discerned (after: Jørgensen 1997, 240)

ever, the collar differs markedly by also covering the neck in the back, suggesting it was placed on top of the clothes. This may, though, be ascribed to the figure not wearing a cloak, covering the jewellery at the back, but only depicted in a shirt. Furthermore, the necklace shows only three strands, however, this type of neck collar comes with three, five and seven strands. These outstanding gold neck collars are known from a handful of archaeological discoveries in Sweden and Denmark. They are made of tubular gold beads varying in shape and garlanded with fine filigree decorations. They have all been discovered without thorough documentation and context but dated to the 6th century. They are affiliated to male figures, although there is no definitive evidence of this (Pesch 2015; Schou Jørgensen 1975, 62-63). A similar neck collar is seen on a 6.2 cm tall copper figure from Søholt by Maribo found in a burial mound, most likely originating from a staff terminal. Here, the collar also extends all the way around the neck, not being covered by a cape in the back, and likewise, the figure is believed to represent a male figure (Franceschi, Magnus and Jorn 2005, 104). When considering shape and context, it does not seem probable that the necklace on the Boeslunde-figurine, nor perhaps on the Odin-from-Lejre-figure, are representations of these golden neck collars.

However, it is not only the golden neck collars that are found in the archaeological material which serve as parallels. Voluminous sequences of beads are common in burials in the Late Iron Age and Early Viking Age. Numerous beads have, for example, been found in all of the women's graves from Nørre Sandegård Vest on Bornholm from the 6th to the 8th century (Nørgård Jørgensen and Jørgensen 1997, 47-48). Between 12-178, beads have been found in each burial and the number is proportional to the number of other pieces of jewellery. The well-preserved burials illustrate how the bead strands hang from a central brooch on the chest. They are distributed using bead spreaders correspondingly found in the graves (Figure 5). This detail implicates, that the beads hang closely in the middle of the chest and would be framed by the opening of the cape. The bead sequence in these burials seems to serve a very explicit manifestation and are akin to the jewellery design of the Boeslunde-figurine. In the Viking Age, the symbolic value of beads appears to lose its importance, and far fewer beads are found in the burials: At four burial sites on southern Langeland, Denmark, for instance, 42 beads were distributed over 15 graves, and on Stengade II, northern Langeland, 82 glass beads were distributed over 11 graves (Grøn 1994, 126; Skaarup 1976, 171). Far fewer beads appear in Viking Age graves, and it is a general tendency that the prevalence of beads decreases considerably in all contexts throughout the period (Graham-Campbell 1980, 29; Lind 1984, 25). However, regional differences can have an impact on the costume and jewellery design. For example, a very distinct necklace of fishtail-like pendants is found only in Gotland (Kaland 1992, 192). Variations in women's clothing can also be regarded as an indication of status rather than an indication of chronological or regional difference (Lønborg 1999, 259-267). And beads do continue to be important in the Viking Age as exemplified by the Lille Karleby treasure with over 300 beads of glass, rock crystal, carnelian, and silver (Kastholm, Nielsen and Jensen 2017). However, the beads come from different contexts and have different provenances and appear to represent an economic value rather than a symbolic, which the treasure context emphasizes.

It is far from all anthropomorphic representations that emphasize the jewellery design. Thus, clear bead strands do not seem to be a common feature in connection with the depiction of a typical attire. Anthropomorphic figures are represented with other distinguishing elements such as drinking horns, animals, weapons, or certain postures (Gräslund 2008, 253-255; Petersen 2005, 57-86). The jewellery design on the Boeslunde-figurine seems neither to be common nor random, and, accordingly, appears to be an essential attribute. It must have had a significant symbolic language that could be immediately interpretated in its own time and own right, the question is which?

Arrhenius suggests that the four-strand necklaces together with a brooch represent Freyja´s distinct piece of jewellery, Brisingamen (Arrhenius 2009). The legend of the Brisingamen tells that Freyja saw four dwarfs forging a golden necklace. In order to acquire the piece, she agreed to sleep with the dwarfs in turn (Näsström 1995, 19-20). The Brisingamen is described occasionally in Norse literature, often as an object of envy and conflict. The Thrymskvida provides the most detailed description of the necklace describing, how it rested on her chest and busted from anger (Näsström 1995, 178). Although its components are ambiguous and have been debated, Arrhenius argues from parallels to comparable mythologies and from etymology, that it is comprised of at least two components: One being a brooch with garnet inlays symbolising fire, the other being a broad necklace (Arrhenius 2009). The fire symbolised by garnets represents renewal and thereby fertility which is Freyja´s sphere. Accordingly, female representations with bead-strands and a large brooch could be regarded as Freyja in her representation of fertility. The Aska pendant, by some argued to portray a pregnant female, has likewise been interpreted as Freyja, possibly symbolising fertility (Arrhenius 2001, 306). However, the Boeslunde-figurine offers another minute detail, that may have great impact on her interpretation: the difference in her eye size.

## The Detail in the Eye

A close look at her face reveals that her eyes not only have different sizes but also have different shapes. Electron Spectro-analysis has confirmed that the appearance of the eyes is not a result of extensive abrasion to her head. Although the lower brim of the bigger eye is only 1 mm. long, the craftmanship is so refined, that it is unlikely to have been caused by insufficient skills. This confirms that the details of the eyes were intentional and deliberate.

A blinded eye is traditionally ascribed to Odin (Price and Mortimer 2014, 532). According to legend, he offered one eye in return for the wisdom from Mimer's well (Faulkes 2004, 17 citing Sturluson, Gylfaginning 14). This contract not only gave him wisdom and the ability as a seer, but also established his eternal power. Accordingly, the blinded eye has traditionally been regarded as Odin´s attribute symbolising wisdom, foresight, and power.

Eyes are also a common topic in old Norse texts, narrating blindness, gaze, stare, and foresight (Lassen 2003). Descriptions such as a *piercing-gaze* or *snake-eyed* with reference to mythological creatures have been discerned (Hedeager 2015, 144; Marold 1998). These observations can be mirrored in archaeological artifacts giving the eyes a complex dimension. The helmets of the Late Iron Age burials, for instance, were constructed and reworked to clearly imply differences in eyesight. The Sutton Hoo helmet depicts two different eyebrows, where gold foil is deliberately absent on the one side, giving it a dull and dark expression compared to a shimmering glow of the other. Similar traits can be observed on the Swedish helmets in Vendel and Valsgärde (Price and Mortimer 2014). Price and Mortimer, likewise, note that two single eyebrows from helmets presumably from the Late Iron Age have turned up in Gevninge near Roskilde, Zealand and in the sacrificial layers in Uppåkra, Sweden. Their deposition circumstances are not fully uncovered, but they appear to be deliberately deposited and may be associated with a symbolic meaning of the blinded eye (Christensen 2002, 43; Helgesson 2004, 231-232; Price and Mortimer 2014, 523-524). Other observations regarding eyesight can be found in the Torslunda plate, a matrix for helmet plates found on Öland, Sweden. A laser scan has revealed that one eye of a depicted dancer has been removed with a sharp instrument (Arrhenius and Freij 1992). A similar disassembling is suggested for a buckle needle from Elsfleth, Germany, where marks round the eyes indicate the removal of an inlayed eyeball (Mückenberger 2012, 12). A copper figurine from Uppåkra, Sweden, showing a male figure with pelta-shaped horns on his helmet, provides another good example where one eye is clearly different from the other. This figurine finds its parallel in a similar figure from Lindy, Scania which also has two different eyes. Another figure from Tissø on Zealand also demonstrates a similar trait. A brooch depicts a female figure wearing a long dress, pulling her hair, and displaying a haunting facial expression. The shape of the eyes clearly differs from one another: One is rounded and arched, whereas the other is oblong, pointed, and flat (Arwill-Nordbladh 2013, 91). This obviously was not caused by insufficient craftsmanship, damage, or wear. Other examples, such as the Aska pendant and the Odin-from-Lejre-figure are, however, not as obvious. Here, it is difficult to distinguish whether an erased gaze has been caused by damage or abrasion. Either way, a strong manifestation of the figure's identity through the gaze of the eyes appears less manifest and important.

A final figure that must be mentioned is the soapstone figure from Tornes, Norway mentioned above. The difference in its eyes has hitherto gone unnoticed, though very clear differences in size and shape of the two eyes can be observed.

The blinded, altered or differentiated eye seems to be a much more common trait in the archaeological record than normally recognized. A preliminary glimpse at other archaeological objects demonstrates a striking pattern. From Elstrup, a

**Figure 6**. Pendant from Vidarshof, Norway depicting af male face with clearly differentiated eyes (after: Helmbrecht 2011, 228; Length: 3 cm).

golden harness bow depicts a small face, but with a clear difference in the eyes. Also, a fibula fragment from Uppåkra, Sweden, and a head-shaped pendant from Vidarshov, Norway shows clear differences in the depiction of the eyes (Figure 6. Helmbrecht 2011, 185, 213, 228). When thoroughly examined, the archaeological record seems to have much to offer to the discussion of the symbolism of the blinded or altered eye. For now, however, I will return to the Boeslunde-figurine and discuss her dating, symbolism and significance based on the above observations.

## Discussion

Based on her garments, accessories, and hairstyle the Boeslunde-figurine should be dated to the Late Germanic Iron Age or Early Viking Age. A date to the 7th-8th century is proposed. Admittedly, stylistic details to support a dating, are scarce, apart from her necklace and hairstyle, the latter having a long duration period. The chronological proposal presupposes, that the necklace is a realistic reflection of the female fashion of her time, rather than acting primarily as a symbolic representation, for example, of the Brisingamen. Christensen proposes that the Odin-from-Lejre-figure mimics a symbolic expression of Byzantine attire symbolising high status as part of his attributes, rather than commonly used clothing (Christensen 2009, 19-20). Costume studies, however, generally assume that iconographic depictions tend to reflect genuine attire (Mannering 2017, 182). On that background, it is tempting to narrow the time span of the figure to between 650-750. This is based on comparable jewellery from burials and iconographic depictions where the disc-on-bow, or a simplistic reference to this, is associated with the four-strand necklace. This is evident for example on the Aska pendant and several gold-foil figures. Although, the details of a brooch on the Boeslunde-figurine cannot be discerned due to extensive wear, the empty space under her chin is asymmetrical, leaving room for a disc-on-bow brooch, which supports the chronology proposed. These types of brooches were most prevalent from 550-790 (Glørstad and Røstad 2020, 2-4). However, they had a long period of circulation and were often repaired and reused (Vennersdorf, Gottlieb and Schnell 2006). Glørstad and Røstad argue that they become mnemonic objects linked to negotiations and conflicts concerning the narrative of the past, and thus used as a political resource in the Late Iron Age and Early Viking Age (Glørstad and Røstad 2020, 1). The disc-on-bow along with the necklace act as a recognizable and communicative attribute, and their symbolic meaning may have found continuity in other similar but later depictions such as the Odin-from-Lejre-figure.

When considering chronology, it may serve to evaluate how she was manufactured and review parallels. The Hårby-figure is dated partly by her manufacturing techniques, as it is argued that silver figures were uncommon in the Iron Age where gold was preferred. It is further noted that gilding and the use of niello are techniques common for the Viking Age (Henriksen and Petersen 2013, 3-10). Christensen uses the same line of argumentation for the Odin-from-Lejre-figure. He argues that the use of niello is often associated with the Jellinge-style, supposedly seen on the figure's chair, which supports its dating to the middle of the 10th century. Although the Boeslunde-figurine does not have niello inlays, niello is found in the Iron Age as well, suggesting that stylistic elements and techniques are not inconsistent with her closest parallels (Petersen 1994). Furthermore, gold deposits decrease by the 6th century leaving room for silver artefacts in the years to follow, which for instance the Aska pendant, made of silver, demonstrates. There is nothing in her manufacture inconsistent with a 7th century dating.

It has been proposed in the above that the necklace of the Boeslunde-figurine is a significant attribute perhaps symbolising Freyja´s Brisingamen presupposing a disc-on-bow brooch, closing her cape. Gold bracteates, common in the 6th century, depict the Asa gods indicating that Asa beliefs, including their own symbolic language, were well-known and could be identified and recognised in the Late Iron Age if not earlier (Jensen 2006, 126). It is therefore reasonable to assume that the legend of Freyja and the Brisingamen was known in Late Iron Age. It is acknowledged that the gold foil figures depict cultic scenes, and, accordingly, those with this distinct piece of jewelry could represent Freyja (Axboe 1986, 116). Further, some


**Figure 7**. Newly found Valkyrie fibula from Boeslunde, Western Zealand (SVM1449x289). She is carrying a sword and shield as well as a drinking horn in the hand clutching the shield. This combination is unusual (Photo: MVE/Morten Petersen).

excessively large disc-on-bow brooches have been found, and their unusual size suggests they served as a cultic attribute rather than a practical accessory (Arrhenius 1962, 84-94). However, it is not conclusive that a necklace along with a brooch symbolises Freyja's Brisingamen as Arrhenius discusses. In the future, iconographic studies and Iron Age research may explore this suggestion further, and the Boeslunde-figurine will serve as a strong contribution to that discussion.

Another topic that may receive more attention in future works is the symbolic expression of eyes whether being blinded, altered or in other ways differentiated. In general, expressive eye representations seem to have been most influential between 500-700 AD, which supports the proposed dating of the Boeslunde-figurine (Price and Mortimer 2014, 531). Studies have concluded that it is the eyes of military and/or political leaders that are being emphasised, manipulated, and differentiated (Lassen 2003, 17-25; Price and Mortimer 2014, 532). Likewise, it appears that descriptions of the eyes from early written evidence often portray violent scenes and actions, such as the pronouncement of wars and battles in connection with kings and heroes like Odin and Thor (Lassen 2003, 106). In that symbolic language, how do we frame female representations with eye alterations? What implication does the Boeslunde-figurine have for our understanding of attributes, power, and gender? It may serve to note that a warrior burial with extensive weaponry from Birka, has been identified as a female (Price et al. 2019). Other research supports a diverse gender perspective offering an intersectional approach to identity from a study of hunting equipment in female burials (Lund and Moen 2019). Attention must be given to another newly found piece from Boeslunde: a patrice for a Valkyrie fibula (Figure 7). She is quite unusual since she is carrying a drinking horn as well as a weapon and shield. Thereby, she simultaneously portrays two symbolic meanings normally separated, namely either a drinking horn or weaponry. This little piece helps to bring attention to overlapping and concurrent symbolic meanings.

And Freyja, as one of the leading female gods, had, indeed, diverse, and multiple intersectional abilities. She is associated with lust, sexuality, and fertility as well as her ability to conduct magic. But she was also a warrior goddess, sharing the fallen warriors with Odin (Hedeager 2015, 146-147; Price 2019, 69). As demonstrated above, the difference in her eyes seems significant, and connects her with the wisdom usually ascribed to Odin. Accordingly, Raudvere suggests that a precise classification of function and identity is impossible to formulate since a symbolic meaning can be applied in miscellaneous ways (Raudvere 2002 80). Perhaps a specific classification was not as important as a conglomerate of abilities. A Freyja representation would offer a range of different abilities, guarding and supporting the bearer in various aspects in life.

If the Boeslunde-figurine, as proposed, served as an amulet can we then find support for the use of such symbolic amulets? As demonstrated above, miniatures with a symbolic representation are common and found in settlements as portable antiquities without context, as evident by the Odin-from-Lejre-figure, as well as in in burials. Written sources also offer support. Although, they are few and formulated in a Christian context, we do find accounts of the use of amulets: In Hallfreðar Saga, Hallfred is accused of cutting out a tooth and making it into an amulet and carrying it in a bag. Another passage is found in the Vatnsdoela Saga, where King Harald gives Ingimund a small object which portrays Frey and plays a part in the settlement legend of Iceland (Helmbrecht 2011, 249-250).

In the last twenty years, research has reached a consensus in support of a sacral kingship in the Late Iron Age and Viking Age. Most arguments rest on textual and philological evidence, much of it dating to the centuries after the period in question (Dobat 2006; Sundqvist 2002, 2012). Based on the above, it is clear that the archaeological evidence can expand and nuance the discussion but must not fail to include a female and intersectional perspective; this minute lady figure is a concentration of multiple abilities; a maki-cube of power.

## Conclusion

A unique female figurine from Boeslunde, Zealand has been presented, and her chronology and function discussed. It is argued that she should be dated to the Late Iron Age or Early Viking Age based on garment elements, jewellery and hairstyle. She finds a close parallel in the Odin-from-Lejre-figure and has implications for the discussion of his interpretation and chronology. Based on an examination of parallels, it can be excluded that these miniatures served as gaming pieces or dress accessories, and it is argued that the Boeslunde-figurine functioned as an amulet. Her necklace appears to be a significant attribute and it is discussed whether she represents Freyja wearing the Brisingamen. Another significant attribute is the difference in the size and shape of her eyes. This was clearly intentional and points to wisdom and foresight as a symbolic relation or concurrence with Odin. From a preliminary examination, it appears that the difference in eyes is not unusual and may refer to a variety of abilities and forms of symbolism. Many questions raised about the little figurine remain unanswered, but she will undoubtedly continue to give way to discussions, reflections, and insights, that will help nuance cultic and symbolic perceptions not only in prehistory, but also in the present day.

## Notes

1. http://sol.sydvestjyskemuseer.dk/?mode=detail&genstandsnr=200153853&typekode=1404 [accessed 2. December 2020]
2. From Museum Western Zealand local database MVE3081 x268 and x1748.
3. From Museum Western Zealand local database. SVM1321 x170 and x280.
4. https://finds.org.uk/database/artefacts/record/id/973850. [accessed 2. December 2020]
5. https://samlinger.natmus.dk/DMR/asset/168127 [accessed 2. December 2020]

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# Reconstructing the Gerdrup Grave – the story of an unusual Viking Age double grave in context and in the light of new analysis

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**ABSTRACT**
In 1981, a double burial from the 9th century was excavated at Gerdrup, north of Roskilde. The grave contained remains of the bodies of a woman and a man. The woman was buried with a spear, whilst the man had apparently been killed before burial. This has been interpreted as a 'master and slave burial', which was placed at an isolated location, perhaps because the buried were regarded as pariahs. However, previously unpublished excavation data combined with new $^{14}C$ analyses indicate that the burial was part of a small multi-period burial site, which was located near a group of earlier burial mounds. Topographic analyses show that the burial was also located on an important ford, and therefore had a prominent location. Significantly, new DNA analyses surprisingly indicate that the two buried individuals actually have a parent-offspring relationship: they are mother and son. The previous interpretation of the Gerdrup grave is thus challenged. This article will present the relevant excavation data and discuss this in the light of the new analyses.

**ARTICLE HISTORY**
Received
11 May 2021;
Accepted
2 December 2021

**KEYWORDS**
Viking Age; DNA; Burials; Gender; Rituals; Sorceresses and Deviant Burials

In 1981, the find of a Bronze Age sword was reported to Roskilde Museum (now ROMU). The sword came from a field a few kilometres to the north of Roskilde, in an area containing many burial mounds, some still standing as visible monuments in the landscape, whilst others had been more or less destroyed by ploughing and stone collection (Figure 1). The museum visited the location where the find had been recovered, and it was evident that the sword originated from a destroyed burial mound. Furthermore, a number of dark patches were observed in the newly ploughed field, which were thought to be cremation graves. A small trial excavation was carried out, which confirmed the existence of such graves as well as an inhumation grave. Two graves were examined in 1981 and the museum returned for a larger excavation campaign in 1983.

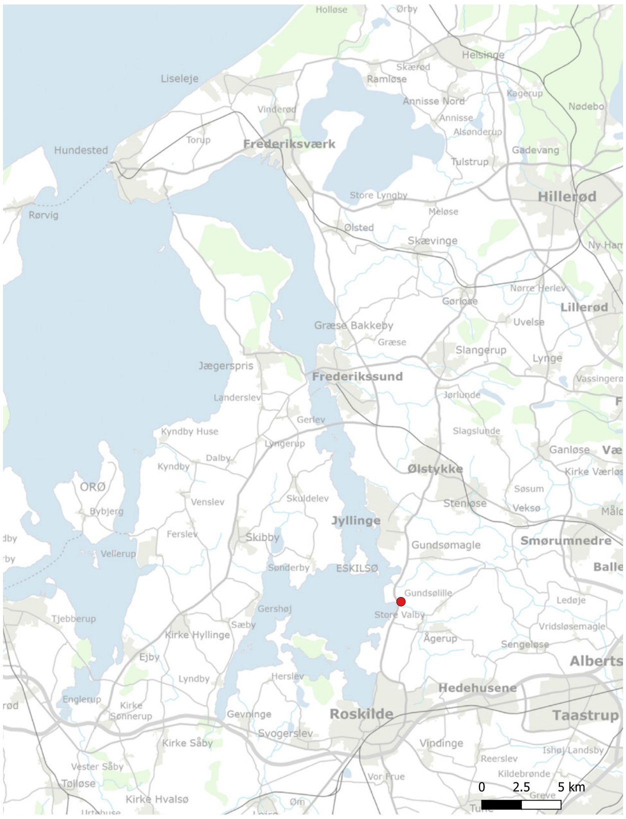


Figure 1. The location of Gerdrup in NE Zealand (Map: Ole Kastholm, ROMU, with background data from the Danish Geodata Agency).

The Gerdrup investigations are mainly known for the discovery of a Viking Age double grave, which contained the remains of a female buried with a spear and accompanied by a male, who had presumably had his neck broken and his ankles tied. This grave was excavated in 1981, and the


**Figure 2**. Burials in the landscape around the Gerdrup site, marked with a blue star. Red dot: Stone Age. Green dot: Bronze Age. Blue dot: Iron Age. Black dot: undated. Note the old crossing of the river valley just to the south of the Gerdrup site (Map: Ole Kastholm, ROMU, with background data from the Danish Geodata Agency).

preliminary results, which mainly focused on the gender 'bias' of the grave, were published shortly after in Danish (Christensen 1981; Christensen and Bennike 1983). Since then, the academic interest in the double grave has been significant (e.g. Gardeła 2009, 288-290.; Jensen 2004, 345; Lauritsen and Kastholm Hansen 2003; Lindblom and Balsgaard Juul 2019, 53; Pedersen 2014, 240-241.; Peter 2015, 33; Price 2019, 337; Taylor 2005, 33-34.; Wilson 2008, 34), and a quick internet search for 'Gerdrup burial' also shows that this interest has also spread outside academia. Nevertheless, a full report on the Gerdrup investigations, including new $^{14}$C results from the material, has only recently been published in Danish (Kastholm 2016a; 2016b), and the whole context of the double grave has not been accessible to a wider audience. Since then, DNA analysis have also been undertaken on the double grave (Margaryan et al. 2020), and the aim of this article is to describe the grave, its topographical and cultural context, as well as the most recent results, in English to a broader audience.

## The landscape

The archaeological site of Gerdrup is located near the eastern coast of the long, shallow Roskilde Fjord, which stretches from the open sea, the Kattegat, in north, to the city of Roskilde in Central Zealand, *c.*45 km to the south (Figure 2). In the Atlantic period, a small fjord tributary cut into the landscape just to the south of the grave area, but in the Sub-Boreal and the Sub-Atlantic periods, this became a valley around the watercourse Maglemose Å. The double grave was located on a small peninsula in the wetlands of the valley, just *c.*4 m above sea level. Here it was dug into the fossilised Atlantic shoreline. The landscape rises up with sloping hills to the north.

Just SW of the grave area is where Maglemose Å was crossed in historical times via the bridge known as Gerebro, which there is documentary evidence for from as early as AD 1661. Although no signs of any prehistoric or medieval ford have been identified, this narrow point in the river valley is the natural place to cross for travellers going north or south along the fjord coastline.

The cultural landscape is dotted with remains of burial mounds, some of which still stand as

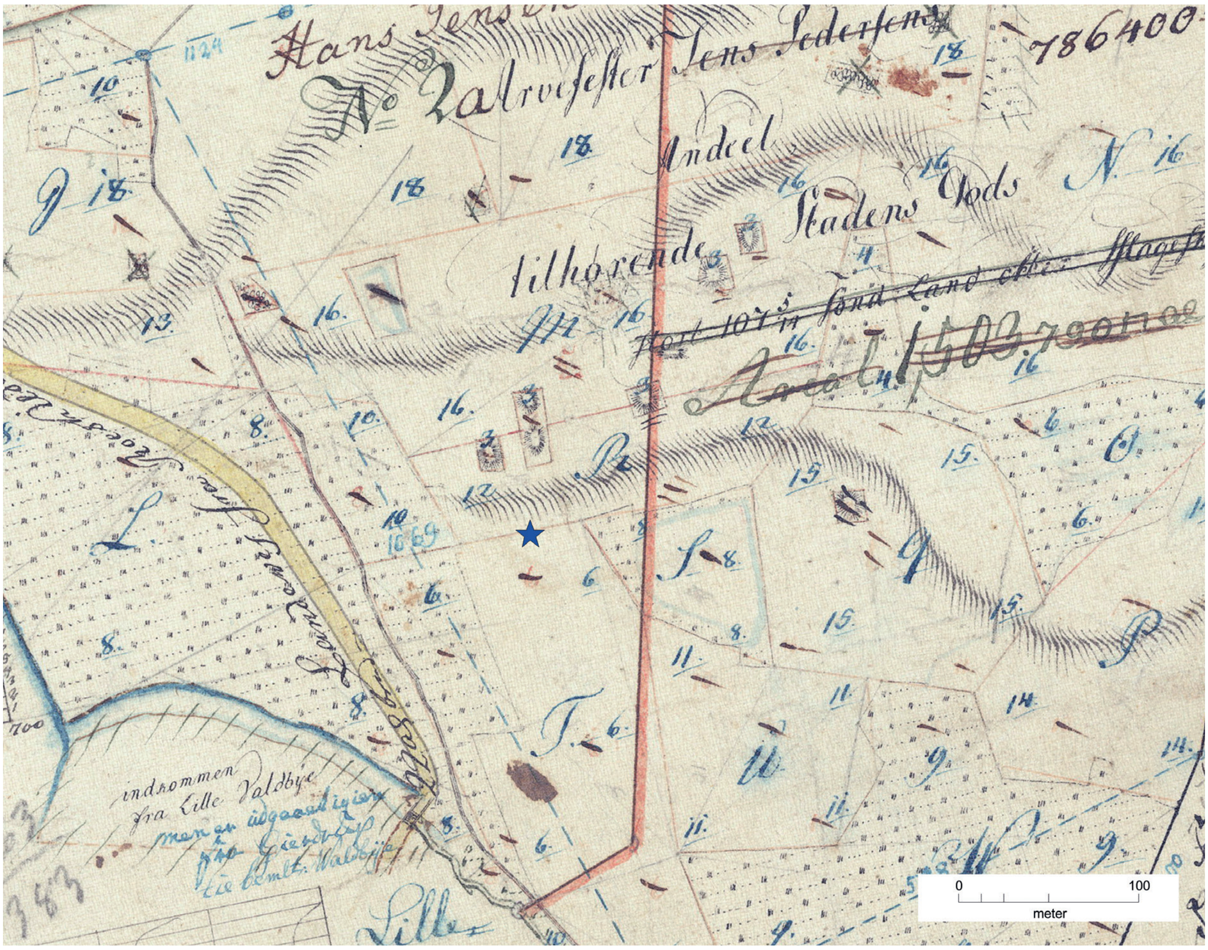


**Figure 3**. Cadastral map drawn 1798-99. The Gerdrup site is marked with a blue star. Note the many marked burial mounds on the higher ground to the north of the site flanking the valley (Map: Ole Kastholm, ROMU, with background data from the Danish Geodata Agency).

monuments. On the hills just north of the double grave, at least 15 mounds overlooked the valley, and the area is generally known for its numerous burial mounds (Figure 3). The antiquarian artist J. Magnus Petersen counted more than 400 monuments in the mid-19th century, when he walked the *c.*30 km along the fjord from Frederikssund southwards to Roskilde. Forty years later, he followed the same route and observed that less than 50 monuments were still standing, the rest having been lost as a result of increasingly industrialised agriculture (Petersen 1909, 24).

Regarding the dating of the burial mounds, these were erected in the Early Neolithic and Early Bronze Age. There are also several examples of secondary burials from later periods, which are either located close to the mounds or inside them.

## Earlier excavations near the double grave

On two earlier occasions, burials were excavated, which were located close to the double grave. Around 100 m SSE of the double grave, a group of Late Bronze Age cremation graves were identified and excavated by Gustav Rosenberg for the National Museum in 1934.[1] In addition, in 1963 two graves from the Late Neolithic and two graves dating to the Early Bronze Age were excavated only around 50 m NE of the double grave. David Liversage, also from the National Museum, conducted these investigations.[2]

## The excavations in 1981/1983 and related research

Excavations were undertaken by Roskilde Museum (now ROMU) in 1981 and 1983, which covered

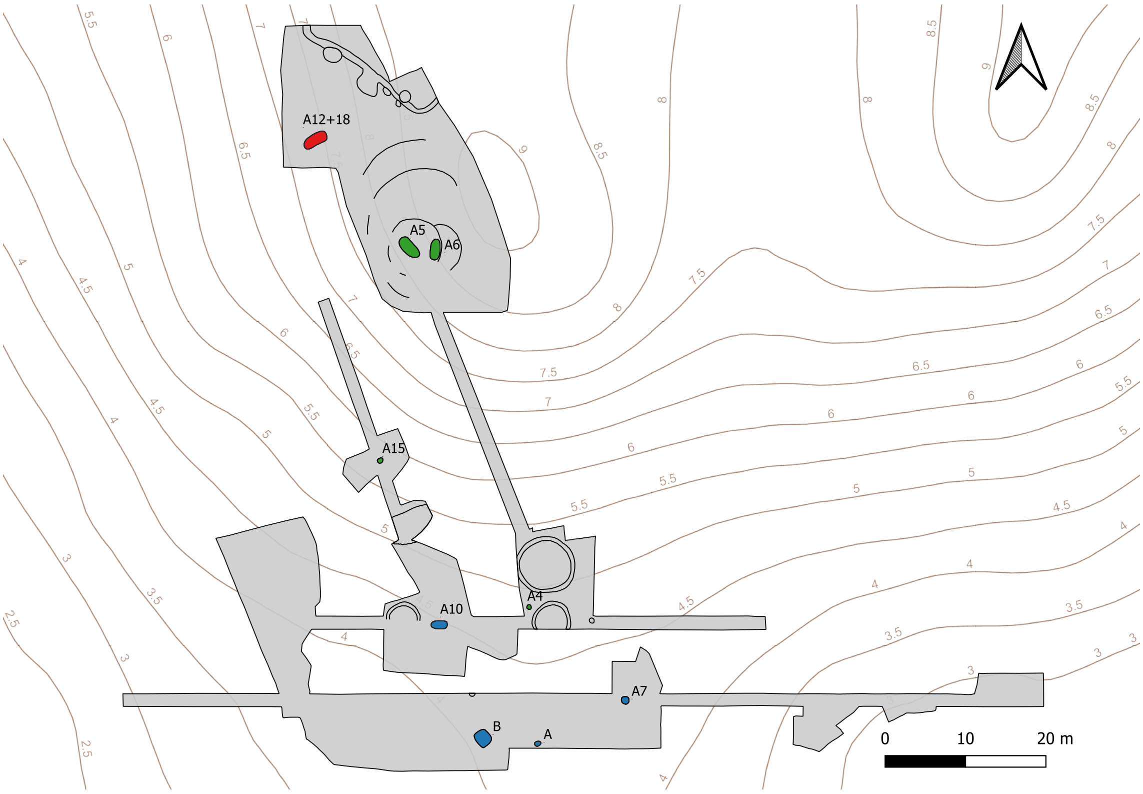


**Figure 4**. Plan of the excavated areas in 1981 and 1983. Blue: Iron Age features. Green: Bronze Age features. Red: Stone Age features (Plan: Ole Kastholm, ROMU).

a total area of *c.*1800 m² (Figure 4).[3] Five inhumation graves, three cremation burials and three 'grave-like' features were investigated. Dr Pia Bennike subsequently carried out osteological analyses on the bones from the inhumation burials, and Dr Niels Lynnerup, confirming and complementing Bennike's results, re-examined the Viking Age double grave in 2015. During his work, DNA samples from the two individuals from Grave B were also collected (along with two additional samples from the then undated Graves A10 and A12), which were included in a larger Viking Age genomic study (Margaryan et al. 2020). The DNA was rather poorly preserved, but, as will be explained in more detail below, it confirmed the osteological identification of sex and established the relationship between the two individuals. Furthermore, $^{14}C$ analyses on human bone from three previously undated graves were carried out in 2015.

**Figure 5**. Grave B *in situ*, seen from S (Photo: Tom Christensen, ROMU).

## *The graves*

In 1981, two graves, A and B, were excavated. Grave A was a cremation burial, containing only cremated human bones and charcoal in a small pit that was mostly situated in the topsoil. AMS analysis of a bone fragment dates the grave to the Viking Age, more specifically to AD 885-990 (BP 1108 ± 25, AAR-23141, cal. with 2σ).

Grave B is the Viking Age double grave (Figures 5-6), which will be examined in the following. The grave pit was a black-coloured feature, measuring 2.5 x 1.6 m on the surface of the subsoil, which was N-S orientated, like most of the grave pits in the region (see Ulriksen 2011, 182, fig. 20). It was

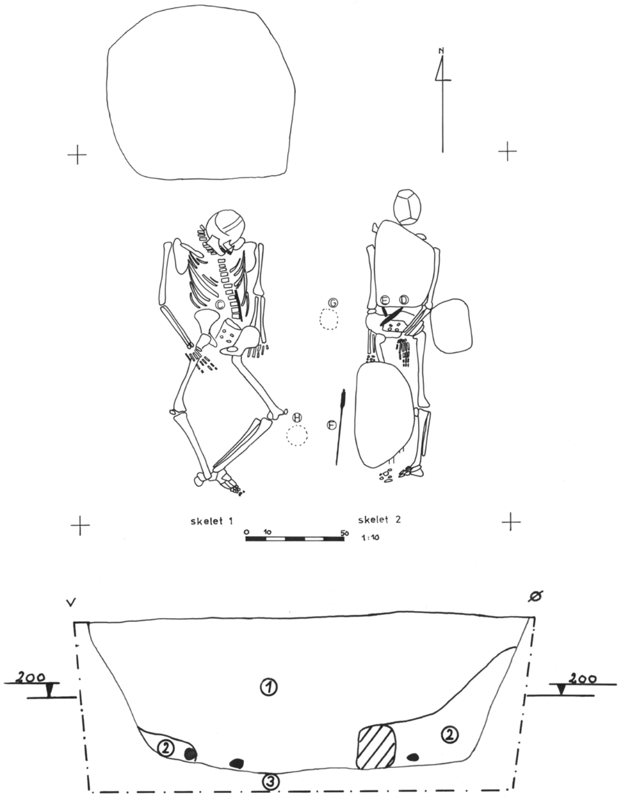


**Figure 6**. Grave B, plan and section (Drawing: Mette Høj, ROMU).

**Figure 7**. Grave B, photo of section seen from S, showing turfs (Photo: Tom Christensen, ROMU).


**Figure 8A-B**. Details of skeleton 1 (the male). A) Left: the ankles. B) Right: the neck (Photos: Tom Christensen, ROMU).

0.8 m deep, with sloping sides and an almost flat bottom. In the NW corner of the pit was a large, naturally deposited stone. The grave fill consisted of turfs, which had probably had been dug up in the nearby surroundings; the turfs could be clearly observed in the cross section of the grave, and must have covered an area of *c.*50 m$^2$ (Figure 7). They had been placed so that the surface covered with vegetation was facing downwards, as is normally the case in turf-built burial mounds. It is obvious from the section of the grave that it was filled in one operation and had not been re-opened. The grave pit contained two skeletons, skeleton 1 on the west side and skeleton 2 on the east side. Between the two skeletons were two small deposits of cranial bone fragments from sheep/goat. No traces of coffins were observed. Both the deceased lay with their heads towards the north. Skeleton 1 was the remains of a 35-40 year old male, who was lying on his back, with his head about 20 cm away from the large stone in the NW corner. His legs were in an angular position, with the right leg crossing over the left (Figure 8A). This gives the impression that his legs had been tied together by the ankles, although there were no preserved traces of rope or other binding material. His left arm lay by his side, whilst his right hand was resting on the

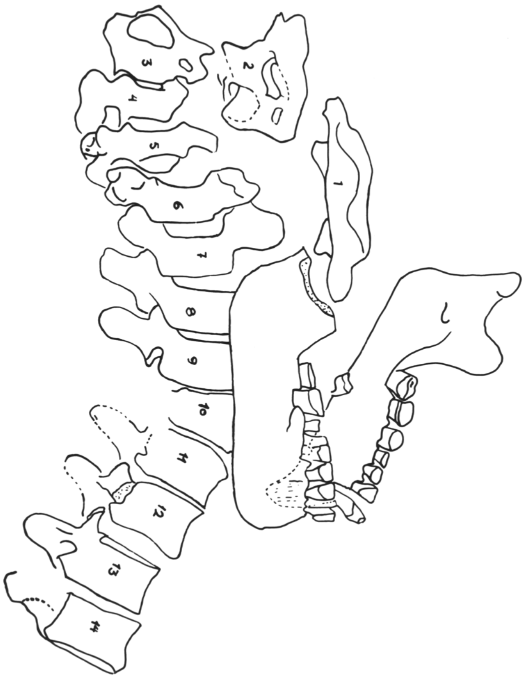

Figure 9. Details of the neck of skeleton 1 (the male) (Drawing: Mette Høj, ROMU).

groin. His head was angled down towards the left shoulder and his neck had apparently been broken (Figures 8B-9). This had not left behind any preserved evidence on the bones, but the cervical vertebrae lay separately, in a way that suggested they had been pulled apart by hanging (Bennike 1985, 116-117). The deceased had a worn iron knife with him. Skeleton 2 was the remains of a middle-aged female, who lay on her back, with her left arm at her side and right hand resting close to the groin. At the time of death, she had been partially toothless for several years, and must have had the appearance of an old woman with a receding mouth. In addition, her pelvis showed signs that she had given birth at least once. At her waist was an iron knife and a bone needle box, which contained iron needles. Alongside her right leg was a 37 cm-long iron spearhead, the tip of which pointed towards the foot end of the grave (Figure 10). Its socket contained remains of a wooden shaft. The spearhead is of Jan Petersen's type E, a type that is usually dated to the 9th century, but was apparently used until the beginning of the 10th century (see Solberg 1984, 66). This is a classic type, although it is not very common amongst the Danish burial finds (Pedersen 2014, 93, 95). A noteworthy characteristic associated with skeleton 2 was that two large stones had been placed on top of the woman's body: one stone weighing *c.*40 kg on her chest and another weighing *c.*75 kg above her legs. A third stone weighing *c.*20 kg was lying next to her waist, as if it had been placed on her body to start with, but had accidently fallen to one side, either during or after the burial. There was no fill between the stones and the skeleton, so they must have been placed directly on top of the deceased.

When the museum returned two years later, in 1983, for a slightly larger investigation, this was

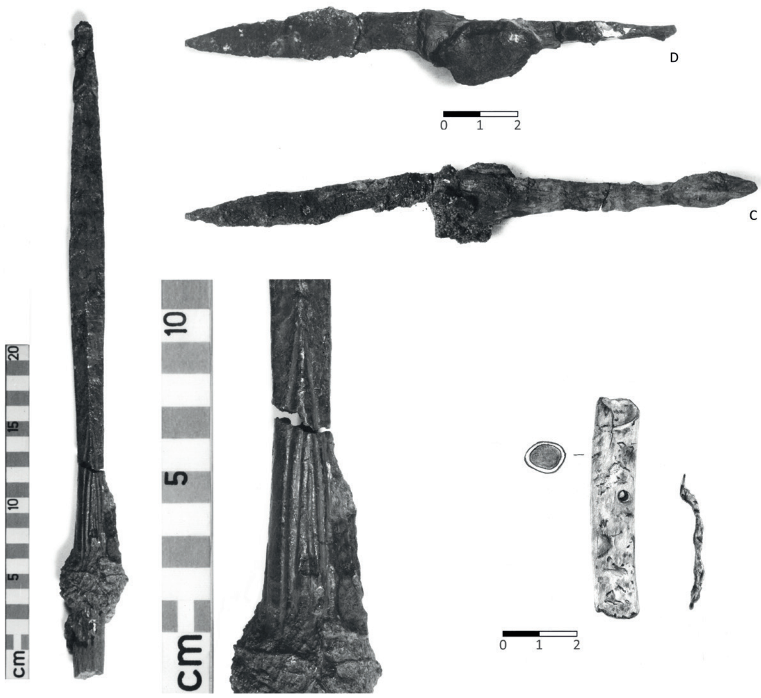


Figure 10. The contents of grave B. Left: the spearhead with detail of the socket. Top right: the knives of the deceased. Bottom right: the needle box (Photos: Flemming G. Rasmussen, ROMU. Drawing: Hanne Jokumsen, ROMU).

to clarify whether the double grave was part of a more extensive Viking Age burial site. Against expectations, however, there were few remains in the immediate vicinity of the grave. A few metres away, the archaeologists did find a small pit (A7), containing two deposited pottery vessels from the 9th century AD (Figure 11). In addition, a single inhumation grave (A10) was found *c.*14 m NNW of the double grave, which contained the well-preserved skeleton of a young female, who was only *c.*150 cm tall, lying on her back, with her head at the west end and arms by her side. There were no preserved grave goods, and the grave therefore remained undated. Recent $^{14}$C analysis, however, indicates that the woman lived during the 5th century AD (BP 1627 ± 25, AAR-23142, cal. with 2σ). To the north, in the more elevated area, there were several burials dating to the Bronze Age and Late Neolithic. Two inhumation graves are primary graves from a long-gone burial mound from the Bronze Age, of Montelius per. II (A5 and A6), and an urn burial and a cremation burial were dated to the Late Bronze Age (respectively A4 and A15). The dating of the Bronze Age burials is based on the artefacts that were recovered. Just west of the edge of the burial mound, another double inhumation grave, orientated WSW-ENE, was investigated. It contained an adult male and a child of 2-3 years of age (respectively A12 and A18). The man lay on his back, with his head in the west and his left arm across his chest. The child was lying between the legs of the man. The only artefact in the grave was a small bone point, which lacked any datable characteristics. A $^{14}$C date indicates that the man lived in 1970-1870 BC (BP 3563 ± 25, AAR-23143, cal. with 2σ).

In the area to the north of the double grave, three ring-shaped ditches were recorded. These had been dug 10-30 cm down into the subsoil. According to the excavation report, they were of such a modest depth in some places that several other circular ditches could have existed, but these may have disappeared when the topsoil was removed. Their diameter varied between 4 and 7 m, and they did not contain any finds. Little can be said for definite about the ditches, but they could indeed be remains of burials – such as cremation or urn burials – that have been destroyed by ploughing. Ring-shaped ditches are known from the extensive Pre-Roman Iron Age burial grounds, such as Årre and Årupgård in Jutland (Jensen 2003, 56-63), but they are also found in various forms at the burial places from the Late Germanic Iron Age and Viking Age (Ameziane 2004; Feveile and Jensen 2006, 68-69; Jørgensen and Nørgård Jørgensen 1997, 39, 60; Kleiminger 1993, 95-98; Ramskou 1976, 198-19).

**Figure 11**. One of the two 9th century pottery vessels deposited near grave B (Photo: Flemming G. Rasmussen, ROMU).

During the two excavation campaigns, a total area of *c.*1800 m² was examined. The museum did not subsequently return, as a convincing concentration of Viking Age graves was not encountered, which could be compared with other, well-known burial grounds from the period. In more recent years, the site has once again attracted attention as a result of metal detecting undertaken by volunteers, who have recovered numerous artefacts. Most of these, however, are apparently fragments from richly-furnished, but long-since destroyed, Bronze Age burials.

To summarise, two Viking Age graves were found: a double grave and a cremation grave. These were placed near one another, in the low-lying part of the area, accompanied by a Viking Age deposit of pottery vessels. In the same area, a solitary inhumation grave from the Early Germanic Iron Age and three ring-shaped ditches of a broadly Iron Age date have been recorded. In the higher up area, two burials from Late Bronze Age were discovered, and near the hilltop, two Early Bronze Age burials and a Late Neolithic double grave. These constitute at least 11 graves, covering a time span of two millennia (Table 1).

| Feature no. | Type | Sex | Dating | Dating type | Exc. Year |
|---|---|---|---|---|---|
| A | Cremated bones in pit | - | 885-990 AD | $^{14}C$ | 1981 |
| B | Double inhumation grave | M/F | 9th cent. AD | Contextual | 1981 |
| A10 | Inhumation grave | F | 5th cent. AD | $^{14}C$ | 1983 |
| A4 | Cremation grave with urn | - | 1100-500 BC | Contextual | 1983 |
| A15 | Cremated bones in pit | - | 1100-900 BC | Contextual | 1983 |
| A5 | Inhumation grave | F | 1500-1300 BC | Contextual | 1983 |
| A6 | Inhumation grave | - | 1500-1300 BC | Contextual | 1983 |
| A12+A18 | Double inhumation grave | M/- | 1915-1755 BC | $^{14}C$ (A12) | 1983 |
| - | Ring-shaped ditch | - | Iron Age | Contextual | 1983 |
| - | Ring-shaped ditch | - | Iron Age | Contextual | 1983 |
| - | Ring-shaped ditch | - | Iron Age | Contextual | 1983 |

**Table 1**. Overview of the graves and 'grave-like' features from the Gerdrup burial site.

## *The DNA analyses*

In 2015, individuals from the Gerdrup graves were included in a large study of Viking Age genomics. Besides being a part of the large amount of data that was required for the study, it was hoped that, using biological methods, this would determine the sex of the individuals. The two individuals from the double inhumation, grave B (sk1 and sk2), were analysed as part of the study (Margaryan et al. 2020), corresponding to respectively samples VK215 and VK216 from the study. Two additional samples from graves A10 and A12 were also analysed for comparison, respectively VK213 and VK214. It was not until later on that the two latter graves proved not to be from the Viking Age, as mentioned above. We sampled one tooth root per individual for DNA analysis and conducted all the ancient DNA (aDNA) laboratory work in the dedicated aDNA facilities at the Lundbeck Foundation GeoGenetics Centre, according to strict aDNA guidelines. The details of laboratory and bioinformatics analyses can be found elsewhere (Margaryan et al. 2020).

A total of 33,693,310 (grave B, sk1) and 27,449,365 (grave B, sk2) DNA sequences were generated for the two individuals (Table 2). With the endogenous DNA fraction of 13.4 % and 10.4 %, this resulted in c. 0.067 and 0.031 X depth of coverage (DoC) for respectively sk1 and sk2. The genomic data confirmed the sexes of both individuals: grave B sk1 was male and grave B sk2 was female. Due to the low coverage of the genomes, these two samples were not thoroughly analysed in the original genomic study.

The analyses of sequenced DNA molecules showed typical ancient DNA damage profiles and short average DNA fragment length, which along with low contamination levels (< 3.5 %), suggested that most of extracted DNA is authentic and of ancient origin.

Y-chromosome analysis indicated that the male individual, grave B sk1, belonged to the R1b1a1b

| Sample | DoC | Sex | Cont (%) | Damage (%) | Y haplog-roup | mtDNA haplog-roup | mt-DNA DoC | Total | Endo (%) |
|---|---|---|---|---|---|---|---|---|---|
| GraveB; sk 1 | 0.067 | Male | 3.47 | 12.12 | R1b1a1b | J1c2k | 30.8 | 33,693,310 | 13.44 |
| GraveB; sk 2 | 0.031 | Female | 0.1 | 19.32 | N/A | J1c2k | 25 | 27,449,365 | 10.35 |

**Table 2**: Genetic results of the two individuals from Grave B.
**DoC**: Depth of coverage; **Cont**: contamination levels according to mtDNA analyses; **Damage**: C → T transition rates at the first position of the 5' end of DNA reads; **Total**: total number of sequenced DNA reads; **Endo**: the fraction of human endogenous DNA in the library.

male lineage, which is a common Y-chromosomal haplogroup in both present-day and Viking Age Europe (Margaryan et al. 2020; Balaresque et al. 2009).

Interestingly, the mtDNA lineages of both individuals belonged to the same J1c2k haplogroup. The more ancestral J1c lineage of this haplogroup is mainly found in continental Europe, where it accounts for *c.*80 % of total J1 lineages (Pala et al. 2012). J1 haplogroup, however, is only present in *c.*7.7 % of the present-day Danish population (Bybjerg-Grauholm et al. 2018).

Moreover, the mtDNA sequences of the two individuals were identical, indicating their possible close genetic relationship through the maternal line. To further indicate their possible kinship based on genome-wide data, we used NgsRelate and estimated genotype likelihoods for the autosomal transversion sites where 1000 Genomes CEU population has a minor allele frequency of 0.05. In addition, we used the minor and major alleles from this CEU population as input to ANGSD (-doMajorMinor 3). Even though the analysis was based on small number (n=8736) of informative sites (due to the low coverage of both genomes), it clearly indicated a parent-offspring relationship between the two individuals. The estimated relatedness coefficients were $k_0$=0.0431, $k_1$= 0.9561, and $k_2$= 0.0008, which indicate the fractions of the genome where the pair of individuals share respectively 0, 1, and 2 alleles identical by descent.

As mitochondrial DNA is maternally inherited, the identical sequences suggest that the female (sk2) was the mother of the male (sk1). It should be mentioned that we cannot completely rule out the unlikely opposite scenario, in which the male (sk1) was the father of the female (sk2). This would involve the small probability that the male (sk1) and the unknown mother of the female (sk2) were distant maternal relatives, in order to explain the identical mtDNA sequences in the case of father-daughter relationship. The father-daughter scenario is, however, contradicted by the osteological evidence, which indicates that the female is the older of these two individuals who were simultaneously interred.

## Initial ideas about Grave B at Gerdrup

As soon as the grave was discovered, it aroused a great deal of interest. It was a grave that deviated from the classic perception of the graves of the Viking Age, especially due to the woman's mixture of gender-specific grave goods: a needle box and spearhead. This 'anomaly' was emphasised by the presence of the man who had apparently been killed in the grave, as well as by the large stones that had been placed on top of the woman's body. Based on these indicators, the excavator of the grave, Tom Christensen, cautiously suggested that the grave might have been the resting place of a sorceress or valkyrja: a woman buried with a special status symbol – the spear – and a special grave item – the killed man – and it was clearly intended that the deceased woman should remain in the grave, so the stones were placed in it. The supposedly isolated location of the grave is also mentioned, and reference is made to medieval written sources, which describe how sorceresses were stoned to death and/or buried at the beach. This idea was presented in a preliminary article in 1982 (Christensen 1982, 26-28), which obviously did not include the results of the 1983 campaign.

The interpretation of Grave B at Gerdrup as the grave of a sorceress has been extensively developed by Leszek Gardeła (e.g. Gardeła 2009, 288-290). Gardeła proposes that the spear should perhaps be interpreted as a 'völva staff', a finds category developed by Neil Price, comprising peculiar, sceptre-like objects that are known from a number of Viking Age graves (see Price 2002, 181-203; Gardeła 2016). It should, however, be noted that Price does not accept Gardeła's interpretation of the Gerdrup spear as a staff (Price 2019, 337). The large stones are regarded by Gardeła as another indicator that the deceased was a sorceress, and develops Christensen's suggestion about the large stones, speculating that they may have been thrown down on top of the woman, crushing her body, in an apotropaic stoning ritual (Gardeła 2009, 289-290; 2011, 343-344). Gardeła compares the scenario with a passage from *the Eyrbyggja saga* (chapter 20), which tells of the sorceress Katla and her son Odd, who are executed after a misdeed. The man is hung and the woman is stoned to death in a desolate place (see Gardeła 2009, 289).

Another point made by Gardeła is that the two bodies seem to 'mirror' one another: the female has the right arm along her side, whilst her left arm rests over the groin area; the male has his left arm along his side and right arm over the groin area. In this way, they seem to be covering their genitals (Gardeła 2009, 289). Gardeła proposes that this peculiar placement of the bodies and positioning of their limbs could have had specific meaning, and asks 'Perhaps it was intended to demonstrate that the two had something in common or it related to some notion of shame or shyness?' (Gardeła 2011, 342).

A different idea, which departs from the sorceress and slave theme, is proposed by David Wilson. He suggests that the male had raped the female, and had been executed for this crime, and buried along with his victim (Wilson 2008, 34).

## Reconstructing Gerdrup grave B

In the following, we will take a closer look at each component of Gerdrup grave B, not to arrive at a definite suggestion of what the grave 'was', but to present and discuss the full context of this find, in order to provide the most solid base for future suggestions and discussion.

### *Topography*

To begin with, it is important to emphasise that the grave is not situated on a contemporary beach or shoreline. The site was part of the shoreline in the Mesolithic, but in the Iron Age, the landscape was almost the same as it is today. It can be stated that the location is 'coastal', but that applies to all the landscape surrounding Roskilde Fjord. Furthermore, the grave is not particularly isolated, although this point was also made in the preliminary publication (Christensen 1982). The excavation results from both campaigns, together with the new $^{14}C$ analyses, show that the grave is associated with at least one other Viking Age grave, as well as a contemporary deposit containing two ceramic vessels. In addition, the ring ditches at the site could also be remains of now-disappeared contemporary burials. Furthermore, several graves from earlier periods have been recorded in the surrounding area. Such a return to old burial monuments is a well-known phenomenon, especially in the Late Iron Age. This phenomenon is known in the vicinity of the Gerdrup area, for example, at the Viking Age burial sites of Trekroner-Grydehøj and Kirke Hyllinge Kirkebakke (Ulriksen 2011, 164-181), as well as Tollemosegård (Sørensen 2011, 248), all of which are situated close to much older burial mounds. As Julie Lund and Elisabeth Arwill-Nordbladh stated 'Archaeological material indicates that the Viking Age was one of the periods in the Scandinavian history in which the past was most actively used and reworked in material terms.' (Lund and Arwill-Nordbladh 2016, 415). Although the Gerdrup burial site does not seem to contain that many graves, its location appears to follow a local pattern. We might describe this place as a long-term cemetery, a place where there were strong connections between burial monuments from different periods of the prehistory.

Moreover, it can be suggested that the Gerdrup graves are in fact quite centrally located. As mentioned above, the burial place is located very near the old crossing of the Maglemose Å valley, Gjerebro. Due to the topography, this place is the natural transit point in the valley when following the route parallel to the Fjord's coastline. This was true in the Viking Age, as well as in earlier ages as far back as the Mesolithic. As Lund has pointed out, crossings – fords and bridges – often constituted a midpoint of certain Viking Age activities, such the depositions of weapons and other presti-

**Figure 12**. During the excavation, grave B was flooded daily with groundwater (Photo: Tom Christensen, ROMU).

gious artefacts in wetlands, or the erection of rune stones (Lund 2005, 109-118). Although no deposits are known from this part of Maglemose Å watercourse, it seems reasonable to assume that the site of the Gerdrup grave was in the Viking Age thought of as a central place near a crossing, alongside a route and rooted in a landscape of ancient burial monuments.

An interesting aspect is the placement of the grave in the low and wet areas of the valley of the watercourse. Throughout the excavation, the grave pit became flooded with water from the natural subsoil, and had to be emptied every morning (Figure 12). As the excavation took place in the late autumn, we cannot rule out that such flooding is only seasonal, but it is possible that the grave was deliberately intended to become flooded as a part of the burial.

## *The mixed grave goods*

If we turn to the 'mixed' grave goods of the Gerdrup woman – the needle box and spearhead – these may be noteworthy finds, but they are far from outstanding. The classic artefact-based determination of sex, in which weapons are regarded as being associated with men, whilst needle boxes and domed oblong brooches are associated with women, ought to be regarded as a partial truth; a projection of the 19th century bourgeois gender perception into the world of the past (see e.g. Arwill-Nordbladh 2001, 17-19; Lindblom and Balsgaard Juul 2019, 43-48). Although no overview of this exists, we know of several graves from the Iron Age in Scandinavia and adjacent areas in which women are buried with 'classic' men's equipment and men are buried with 'women's equipment', or where there is a mixture of men's and women's equipment (Lauritsen and Kastholm Hansen 2003; Lindblom and Balsgaard Juul 2019, 53-56; Moen 2019, 116-128). A well-known example is grave BB from the burial site of Bogøvej, on the island of Langeland, where a young woman is buried with a battle axe (Grøn et al. 1994, 34-34; Pedersen 2014, 88, Cat. 139). Grave Bj 581 from Birka has also recently been discussed, after mtDNA analyses confirmed earlier osteological classification and demonstrated that the deceased in this exclusive grave containing a full set of weapons and riding equipment is a biological female and not a male. The individual had previously been regarded male solely on the basis of the grave goods (Hedenstierna-Jonson et al. 2017; Price et al. 2019). Jan Petersen's classic work 'Vikingetidens Smykker' may provide another example. It includes at least 18 graves in which there is a combination of domed oblong brooches and weapons (Petersen 1928, 32, 42-43, 50, 66). Although these may, in some cases, be mixed or disturbed graves, the number is so high that the phenomenon should be considered real. In more recent years, Gardeła has been mapping several of these graves, especially female weapon graves (Gardeła 2013b; Gardeła 2021).

But we could ask another question: is the spear really part of female grave goods? Just as today we regard artefact-based sex determination as an inadequate method, we might also question the rather simplistic view that the artefacts in a burial are the belongings of the deceased. In his 2010 study 'Passing into Poetry', Neil Price suggested that we should move away from regarding the burial as just 'assemblages of things' representing contemporary material culture, but instead interpret the artefacts in the burial as representing behaviour surrounding the funeral (Price 2010, 131). In his study, Price proposes a model for understanding Viking Age burials, which basically interprets the burials as scenes of theatrical-type performances based on mythological narratives: 'Each burial is a conscious act, its objects and animals selected with care, and deposited with concern.' (Price 2010, 147-148). Price's model offers a highly inspiring and ground-breaking view of the complexity and variety of the 'deviant' graves in the Viking Age.

Is the Gerdrup spear then a theatrical prop as opposed to an actual possession of the female deceased? This might be the case. Price (2002; 2019) has analysed Bj 834, a double inhumation chamber grave at Birka. This richly furnished grave contains a female and a male sitting 'in layers' on a chair, surrounded by grave goods: a sword, shield, iron staff, bow and arrows, two horses, a bucket, chest and other items (Price 2019, 88-95). One item was a spearhead that was embedded in the grave chamber in a peculiar way, which Price has convincingly interpreted as the remains of a spear that was thrown into the chamber, its trajectory crossing over the deceased in the chair, perhaps as a last act before the grave was closed and a dedicated to the god Odin (Price 2019, 95).

We cannot conclude that this was also the case at Gerdrup. The spearhead was found at the foot end of the grave, pointing south, with no specific evidence, such as its angle, of it having been thrown or thrusted into the bottom of the grave pit. It should be noted, however, that the position of the spearhead only leaves *c.*1.2 m for the shaft. As this seems too short for the shaft of such a spearhead, it must have been either broken into pieces or sticking up from the grave towards the north. This idea is of course speculative, but the spear throwing scenario is nevertheless an interpretation that introduces new views about this grave and its inventory.

## *The stones*

In the case of the large stones that were placed on top of the buried woman, it is widely believed that this was to stop the deceased from haunting the living (see Aspöck 2008, 21). This is also the most common reaction from the museum audience when they encounter the grave in the exhibition at Roskilde. As already mentioned, Leszek Gardeła has proposed that the stones might represent an apotropaic stoning of the deceased that took place during the burial rituals (Gardeła 2011, 344). When the grave was excavated, the skeleton appeared to be crushed by the weight of the stones, but due to the fragile condition of the bones it is not easy to say whether this 'crushing' was a direct result of the stones being thrown onto the dead body or natural decay over the centuries. But if a 'stoning' actually took place, it would have been a very dramatic and explicit experience, both aurally and visually, for those who were present.

Whatever the reason for the presence of the stones was, stones in graves are certainly not a unique phenomenon in Viking Age Denmark, unlike, for example, Anglo-Saxon pre-Christian burials (see Reynolds 2009, 81-85). Several Viking Age graves are furnished with stones of various sizes. These can be present in the grave fill as well as the coffin – if this is present in the grave – or placed directly on top of the deceased (Ulriksen 2011, 194-197 with ref.) (Figure 13). Anja Borch-Nielsen has examined the phenomenon in 984 Viking Age burials from modern Denmark and concludes that there are stones in 24.5 % of these (Borch-Nielsen 2016, 14). It is most common in the eastern part of Denmark: on Zealand up to 37 % of the examined graves are furnished with stones (Borch-Nielsen 2016, Fig. 2). Borch-Nielsen states that the most common feature is stones in the top of the grave fill, whilst larger stones placed directly onto the deceased are rarer (Borch-Nielsen 2016, 14, Fig. 3). Targeted investigation has not yet identified systematic correlations between the presence of the stones and


**Figure 13**. Section of the stone-filled grave A608 from the burial place at Kirke Hyllinge Kirkebakke (Photo: Jens Ulriksen, ROMU).

**Figure 14**. Grave 55 from the burial place at Lejre. Two male individuals were buried 'in layers' in the same grave pit. The upper individual was decapitated (Photo: Harald Andersen, the National Museum).

the other characteristics of the burials concerned, such as the number of interred individuals, grave goods, sex, age and the grave pit's orientation (Borch-Nielsen 2016, 16; Ulriksen 2011, 195). Given their variation in size, number and placement, the stones were probably not put in the graves for only one reason, but they must have been put there deliberately, and placed for an obvious reason in each specific case. Borch-Nielsen speculates whether the stones might have marked social status (Borch-Nielsen 2016, 16f.), whilst Gardeła proposes that they may have been a sign that the interred was an 'agent of magic', in the cases where large stones have been placed directly onto the body (Gardeła 2011).

While these possible reasons remain speculative, we must at least assume that the stones mark differences between people, both in general and, in this specific case, between the two individuals of the Gerdrup grave.

## *The 'other' person in the burial*

Knöchel-Christensen lists 88 multiple burials, i.e. graves containing two or more individuals, in Denmark (Knöchel Christensen 2013, 51). A closer examination of the existing archaeological source material will certainly reveal more, and if the rest of Scandinavia is included, the number will of course increase significantly. Several people in the same grave is thus not uncommon in the Viking Age. However, it is not always easy to decipher the underlying reason for this (see Reynolds 2009, 65-67, for an Anglo-Saxon view). In some cases, the deceased have obviously been buried at the same time, as at Gerdrup. In other examples, a grave has been used several times, as in complex graves, such as A505 at the nearby burial site at Trekroner-Grydehøj (Ulriksen 2011, 174-179, 216-218; Ulriksen 2018) and Ka. 294-7 in Kaupang, Southern Norway (Price 2010, 126-130). Jens Ulriksen distinguishes between 'real' multiple burials, where the deceased are buried at the same time, and burials with subsequent burials, which were re-opened for later, additional burials (Ulriksen 2011, 186).

When several people are buried at the same time, this leads us to ask did they die naturally at the same time, or was one or more killed to be buried? In some cases, it is apparently obvious, as in the so-called master and slave burials containing decapitated 'slaves'. Archetypal examples of this are known from grave 55 at Lejre, just *c.*15 km from Gerdrup (Figure 14) (Wulff Andersen 1995, 14, 97-98) and grave FII from the Stengade II cemetery on Langeland (Skaarup 1976, 56-58; Skaarup 1989), as well as two double graves and a triple grave from Flakstad, Lofoten, in Northern Norway (Naumann et al. 2014). The so-called 'Elk man's grave' at Birka is also worthy of mention. This grave contained two male individuals, one equipped with a shield, spear and arrows, and with an elk antler placed near his head, and the other without grave goods and with his head separated from his body (Olausson 1990).

The 'killed' in the graves are therefore an element that can be encountered from time to time in the burials of the Viking Age, although killing as such can be difficult to prove. The taking apart of the body of the deceased, such as by decapitation, may well take place post-mortem and might also have been an action directed against the 'main' person in the grave, as part of the burial ritual, or perhaps was associated with later deliberate or accidental disturbance of the interred body (see also Ulriksen 2011, 186-188 with further references). Although it is not uncommon to find several individuals in the same grave, the underlying reasons for this are not obvious and cannot be regarded as monocausal. In the case of the Gerdrup grave, this clearly is a 'real' double grave with two simultaneously interred individuals. Furthermore, it seems to fit in well with the pattern of a primary interred and secondary individual, a main person followed by a 'sacrifice', as in the above-mentioned cases at Lejre, Birka, Stengade and Flakstad.

### *The parent-offspring relationship*

In a recent Viking genomics study (Margaryan et al. 2020), other family relationships were revealed. Two people, buried in England and Denmark, turned out to be related, and a group of five individuals from the Estonian Salme boat grave consisted of four brothers and one third-degree relative (Margaryan et al. 2020, 393). There will most certainly be more discoveries like these in future studies. However, as far as we know, the mother and son relationship in the Gerdrup grave is so far unique in a Viking Age context. It contrasts with the results in the aforementioned Flakstad study. In this case, the relationship between individuals in double graves was examined by means of mitochondrial DNA and stable isotope analysis. Ten individuals were examined: three from single graves, four from two double graves and the remaining three from a triple grave. The double/triple graves only contained one body with a skull, whilst the other bodies were headless, and it is therefore suggested that these graves should be interpreted as master and slave burials (Naumann et al. 2014, 534, 539). The source material is somewhat limited, but does have interesting characteristics. Firstly, the DNA analysis proved that the 'masters' and 'slaves' were not maternally related. Secondly, the isotope analysis showed dietary differences between the two groups in the multiple graves. The 'headless' people, interestingly enough, shared the same isotopic values as the individuals buried in the single graves, which could indicate that these two groups belonged to the same strata in society, whilst the 'masters' belonged to another (Naumann et al. 2014, 535-537).

The biological relationship in the Gerdrup grave may be unique, but the aspect that the son has apparently been killed is even more exceptional. As discussed above, the position of the male body leads to the conclusion that he was killed. But could this conclusion be wrong? The answer is yes. It could theoretically be wrong, because the evidence is not direct, but only circumstantial. There are no obvious marks on the cervical vertebrae, and both the head/neck and ankles could theoretically have been placed in this way deliberately or else accidentally moved into this position. The latter should especially be viewed in the light of recent forensic research, which has shown that post-mortem movement of human bodies can be extensive, especially in the early part of the decay (Wilson et al. 2019; 2020), an aspect that should be generally taken into account in future burial research.

However, despite such objections, the male in the grave still gives a clear impression of having been hanged and tied up. And given the fact that both people were buried in the same grave and at the same time, it seems reasonable to assume that this impression is correct.

We then have to explain the mother and son relationship. Given the mother's age and condition, it seems plausible that she died of natural causes, and her son was most likely killed to accompany her in the grave. We can only speculate about the reasons behind this unusual funeral scenario. But it is important not to interpret such a scenario from our own contemporary perspective. In spite of the biological parent-offspring relationship, the cultural relationship between the two individuals might have been different, in which they did not constitute (part of a) nuclear family in the modern sense. The biological relationship could have been irrelevant. Perhaps the male was not a part of the family anymore, or maybe he was actually family, but was not capable of carrying on without his mother, as he was disabled in some way, or he stood under her protection in a way, which meant he had to die when she died, and was therefore killed. Another interpretation is that he was willing to let himself be sacrificed, like the female slave in the chieftain's burial on the Volga River, famously described by Ibn Fadlan (see e.g. Price 2010, 131-137 with references).

## *A deviant burial?*

Based on the grave's peculiar characteristics and the suggestion that the Gerdrup woman was a sorcerer or a 'witch', it has been proposed that the grave should be categorised as a so-called 'deviant burial' (Taylor 2005, 33-34). Basically, the concept of deviant burials encompasses burials that differ from the norm characterising contemporary burials (see Aspöck 2008; Murphy (ed.) 2008; Reynolds 2009, 35-36; Gardeła 2013a, 108-110 with further references). 'Deviant burials' is a term that can be meaningfully used for graves from Christian times, where a normal burial was supposed to be placed in consecrated ground, and an individual could therefore be buried outside the churchyard. The reason for this might be that he or she had committed particular offences and was therefore executed. Such a burial could, for example, have taken place at the execution site (e.g. Hansson 2012). This phenomenon of denying a person burial in consecrated ground is an integral part of several medieval laws in Scandinavia and may have had its origins in pre-Christian times (Riisøy 2015). However, it has been questioned whether 'deviant burials' is a useful term when it comes to the pre-Christian source material. Firstly, the understanding of the concept itself differs considerably within different research traditions. Secondly, using the concept requires a clear definition of what is 'normal' and what is 'deviant' among the burials in question and the society they represent (Aspöck 2008, 29-30; Gardeła 2013a). The challenges of using the concept of deviant burials when working with a pre-Christian source material becomes clear, if we look at the burial site itself: the Christian graveyard cannot easily be transferred, for example, to the burial sites of the Viking Age. Firstly, the total extent of a prehistoric burial site is rarely known, and what is excavated as a solitary burial may well represent a part of an unknown site with numerous graves. Secondly, our knowledge of the physical and cognitive delimitation between prehistoric burial sites and their surrounding landscape and society is generally ambiguous. Without insight into the burial site's own landscape, it seems speculative to think in terms of 'inside' and 'outside', and as we have seen, the Gerdrup grave changed from being a solitary burial to a topographically rooted grave within a significant context.

Andrew Reynolds has, on the other hand, identified specific contextual categories that indicate deviancy in burials in an Anglo-Saxon pre-Christian context, such as crouched and cramped burials, multiple burials, prone burials, burials with stones and burials containing individuals with decapitations or other amputations (Reynolds 2009, 62-87). Furthermore, he investigated the topographies of these graves, and demonstrated that they could be placed on the peripheries of the burial grounds, and near to boundaries in the landscape or old trackways (Reynolds 2009, Ch. 5).

In our view, the term deviant is only of limited use in a Viking Age context, given the great variation in the burial layouts in this specific period. In spite of this, the Gerdrup grave does still stand out as being somewhat unusual in both a local and a regional context. It is primarily the aspect of the killed son that is striking. But does this aspect make the grave 'deviant'? Or to put it another way, was this grave *meant* to be deviant in its time? If we accept the Katla and Odd scenario from *the Eyrbyggja Saga* – and the DNA results do emphasise the similarities – it could indeed be interpreted as a deviant burial. But if we take into consideration the underlying effort that was involved in constructing the burial, this scenario is undermined. The burial is characterised by a degree of care that seems to indicate interpretations outside the realm of deviancy should be considered.

## Conclusion

Is it then possible to reach a final conclusion about the Gerdrup grave, 40 years after its discovery? The answer is no, or at least not a detailed conclusion, but important knowledge has certainly been acquired.

In general, it is striking what a good case study the grave provides when reviewing the research trends, both theoretical and methodical, over the past few decades. In the beginning, the grave was perceived as deviant burial, or perhaps even misinterpreted or inadequately examined. It was one of the first obvious examples of a grave in which a woman was buried with a weapon. But with the emergence of gender archaeology in Scandinavia in the early 2000s, there was an increased focus on 'gender biased' graves, and it turned out that the woman from Gerdrup was no longer alone. In recent years, a new and more complex view of the burials of the Viking Age and the associated rituals has arisen, and raised questions about how the artefacts in the burials should be understood. We must therefore ask the question whether the weapon in the grave really was the woman's property, or could it have been a prop in rituals? At the same time, great strides have been taken within the field of DNA, with large amounts of data having been analysed, using increasingly reliable methods of analysis. This has resulted in confirmation of the biological sex determination of the two deceased individuals, as well as revealing the surprisingly close biological relationship between them. This parent-offspring relationship certainly does give food for thought, and reminds us to always try put our contemporary perceptions aside when examining and attempting to understand the past.

An important theme to consider in future research into the Gerdrup grave is its context and topography. This grave is not a solitary discovery. It belongs to a burial place that, although quantitatively insignificant, was used for 3000 years. The grave is apparently closely related in topographical terms to a group of monumental burial mounds, as well as an important crossing of the valley of the Maglemose Å watercourse. The grave itself was quite elaborate, with the pit having been carefully filled with turfs cut from the surrounding area. Overall, this gives the impression that the burial was the final resting place of an important person rather than an outcast.

## *A scenario*

In the 9th century, this important woman was, at the end of her days, laid in the grave. It was decided to dig the grave pit in the wet lowlands near the crossing of the watercourse, which was overlooked by the monuments of ancestors. Large stones were placed on top of the woman's body, to mark that she was the main person in the burial and in life had a very special role in society. By her side lay her son, with no stones on top of his body. He was willingly killed for the occasion, and had been hanged in devotion to Odin. Only a few belongings were preserved with the two individuals: their personal knives and, in the case of the woman, a needle case. The preceding rituals included the dramatic hanging of the son, the sacrifice and butchering of two goats or sheep – skull fragments from which were later placed in the pit – and the cutting of turfs from the valley. These events lasted for several days. Before the deceased in the now partly water-filled grave were carefully covered with the numerous turfs, a valuable spear was thrust into the bottom of the grave in a concluding ritual that dedicated the dead to Odin.

## Acknowledgements

The authors wish to thank the excavator of the Gerdrup grave, Tom Christensen, for fruitful discussions about the excavation records, as well as two anonymous peer reviewers for their constructive comments. Finally, thanks to Patrick Marsden, for the linguistic revision of the manuscript.

## Notes

1 Site no.: 02.04.08-60 'Kirkerup'. Case no. 242/35 in the report archive (prehistory) at the National Museum in Copenhagen.
2 Site no.: 02.04.08-20 'Gjerdrup'. Case no. 603/63 in the report archive (prehistory) at the National Museum in Copenhagen.
3 The Gerdrup excavations have the site no.: 02.04.08-67 'Gerdrup'. The finds, documentation and related material have case no. ROM 191 in ROMU's archive. The excavations were conducted by archaeologist Tom Christensen.

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# The sovereign seeress – on the use and meaning of a Viking Age chair pendant from Gudme, Denmark

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**ABSTRACT**

The South Scandinavian chair pendants of the late Viking Age form a famous and much debated find category. They have been associated with the cult of Odin as well as female seeresses. However, their find contexts clearly link the pendants intimately to a female use-sphere and their condition shows that they have been worn intensely. With a new pendant emerging from the detector finds from Gudme, Denmark, the connection between chair pendants and dominant settlements is further strengthened. The female prerogative, the locational aristocratic reference in combination with the chairs association with royal privileges lead to the argument that the pendants have a connection to the deep historical presence of the seeress as a sovereign power across Northern Europe. Her position is explained as a triangulation of Seeress, Odin and King which are all represented as being seated. Consequently, seating is regarded as a main attribute and a recurring and noticeable privilege for all three characters. Thus, the chair *en miniature* is argued to function as a material anchoring of the socio-symbolic understanding of the seated sovereign seeress.

**ARTICLE HISTORY**
Received
30 September 2020;
Accepted
26 March 2021

**KEYWORDS**
Miniatures, Chair pendants, Völva, Aristocracy, Gudme, Pre-Christian cult, Viking Age

Gudme in the south-east of Funen, Denmark, has long been an established *locus classicus* of the Scandinavian Iron Age; the first gold finds appeared in the 16th century, and the area has since produced several hoards (coins, hacksilver and the occasional gold items) in combination with elite settlements, as well as the largest Iron Age urn-field in Denmark, Møllegårdsmarken, not to mention the unique Lundeborg landing site (Albrectsen 1971; Christoffersen 1989; Horsnæs 2018; Jørgensen 2011; Michaelsen 2015; Sehested 1878; Sørensen 2003; Sørensen 2010; Thomsen et al. 1993; Thomsen 1997; Thrane 1993) (Figure 1 and 2).


**Figure 1**. Gudme is located more or less in the middle of present-day Denmark, and, via the landing site at Lundeborg, with easy access to the Great Belt and the larger waterways connecting the Danish isles and the continent (Graphics: M.L. Bendtsen,The National Museum).

Already in the early 1980s the investigation of the Gudme-Lundeborg complex pioneered by combining metal-detector surveying and excavation. The outcome is 6700+ detector finds and more than four decades of archaeological research. Here the gold foil figures, several coin hoards (mostly denars and siliqua) and imported roman goods figure prominently, and not least the great hall-building overlooking the settlement. The latter being 47 x 10 m with eight pairs of enormous roof-supporting posts and dated to the 3-4th century AD, completely changed the position of south Scandi-

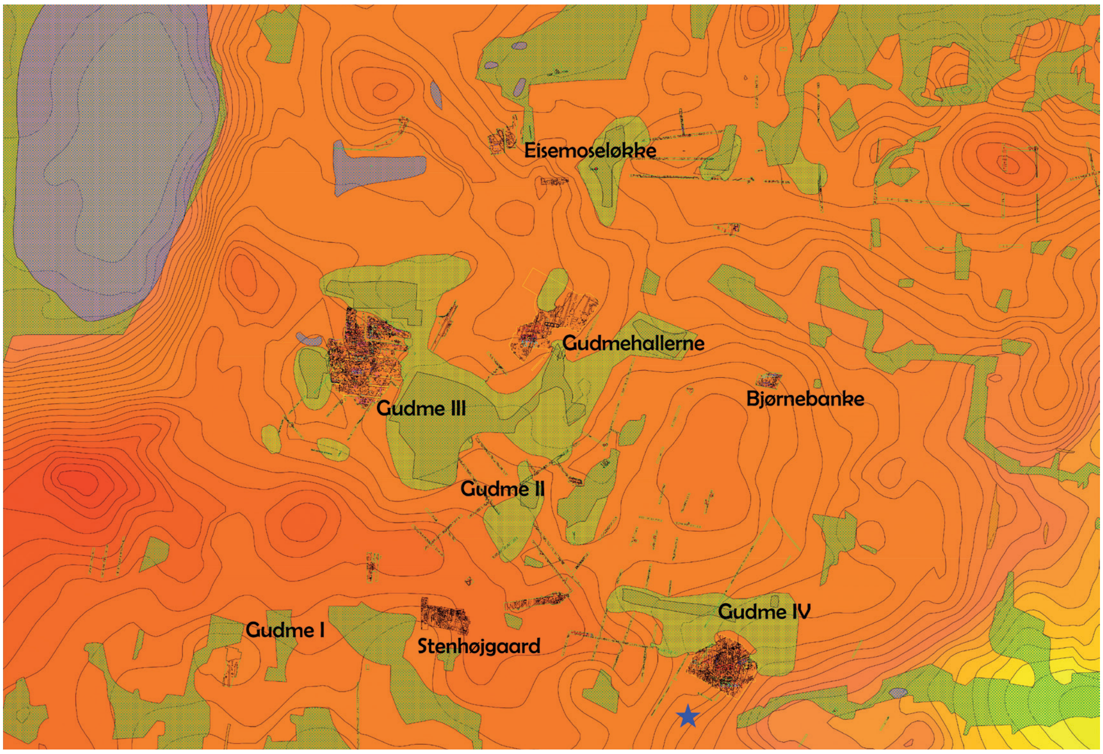


**Figure 2**. Beside the many detector finds, the excavated areas in Gudme all show intense activity in the form of postholes, pits and other types of depositions (Sørensen 2010). To the south the star (blue) demarcates the find spot of the chair pendant, and the last phase 12 of the nearer Gudme IV is early Viking Age (based on house typology and ceramics). However, the north-eastern section of Gudme IV contained a disturbed (ploughed out) late Viking Age hoard of 16 dirhams (the youngest a Talib b. Ahm. AD 944), a fragment of an ornamented silver arm ring, a silver bar and a silver nail, which indicates a contemporary farmstead in the vicinity. Lighter colours indicate wetland (Graphics: M.L. Bendtsen,The National Museum).

navian early Iron Age architecture as well as the understanding of the capacities of the elite of the time. Gudme thus became a first-generation central place in prehistory as in archaeological research in Scandinavia. The current project 'Gudme – a settlement complex with elite residency and craftsmanship, 3-11th century', (sponsored by the Carlsberg Foundation, Denmark) is focusing specifically on the detector finds, their character and composition. As always when digging deeper into museum collections, surprises inevitably occur. The same goes for the Gudme assemblage, which proved to contain a very small but very conspicuous find – a chair pendant.

## The Gudme chair

Unsurprisingly, given its function as a pendant, the Gudme chair is a very small item. Including the two (barely visible) back legs, but excluding the suspension loops on the rear, the pendant itself is less than a cubic centimetre; the seat is 10 x 10 mm and the backrest just 7 mm high (Figure 3).

Front and top is evenly rounded off and the seat has a marked edge, basically the only type of ornament the pendant exhibits, presumably illustrating that the seating accommodates a pillow or some kind of webbing, as would a regular chair often have had. Overall the chair has a broad and very low profile. The original means of suspension on the rear is heavily worn and did eventually tear through. As a result, a secondary hole for suspension perforates the front of the seat and is equipped with a thin and twined silver thread. Just as the vast majority of chair pendants also the Gudme seat is cast in silver (2,08 grams). It is however, the first registered with a secondary suspension, and only the second to appear in a settlement context.[1] Being a regular detector find the Gudme pendant must be dated via typology, and luckily several comparable finds stem from datable contexts.

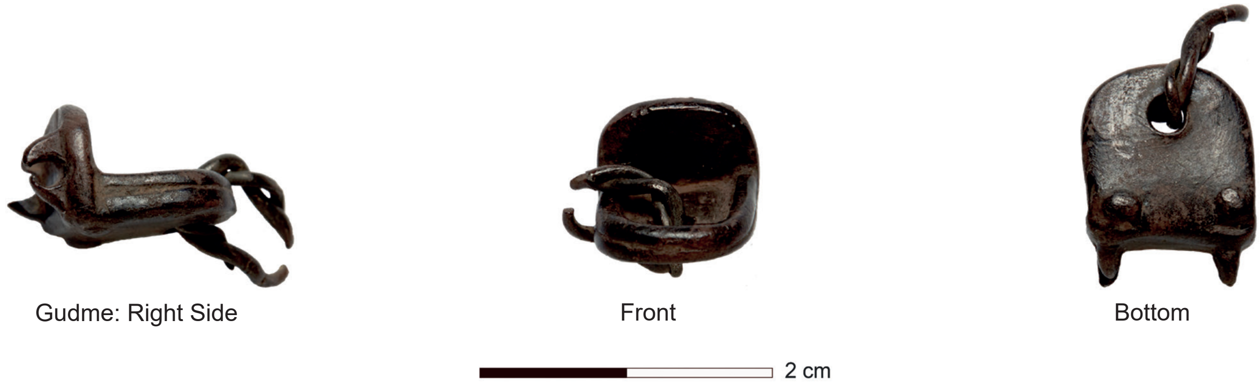


**Figure 3**. The Gudme chair pendant is indeed very small. But even with the almost negligible features, such as the small legs, the attributes of the chair are still unmistakable, and follow the expression of several of the other Vikings age finds of chair pendants. A unique feature is the secondary drilling of a suspension hole in the middle of the seat. The original means of suspension on the back is worn through indicating extended use (Photo:The National Museum).

## *Parallels and morphology*

Similar pendants are found in several places in the southern parts of Scandinavia, and so far, only here (Gardeła 2014). The general features of the chair pendants will be divided into two designs, 1) box-shaped and 2) barrel-shaped (Figure 4a, b, Table 1).

The *box-shaped design* is also the more elaborate type when it comes to the plastic adornment of the chair – animal heads, carvings or armrests. Both the Hedeby I, Lejre and Nybølle pendants follow an analogous design with a seated character (preserved on the two latter exemplars, but interpreted as missing on the Hedeby I chair (Drescher

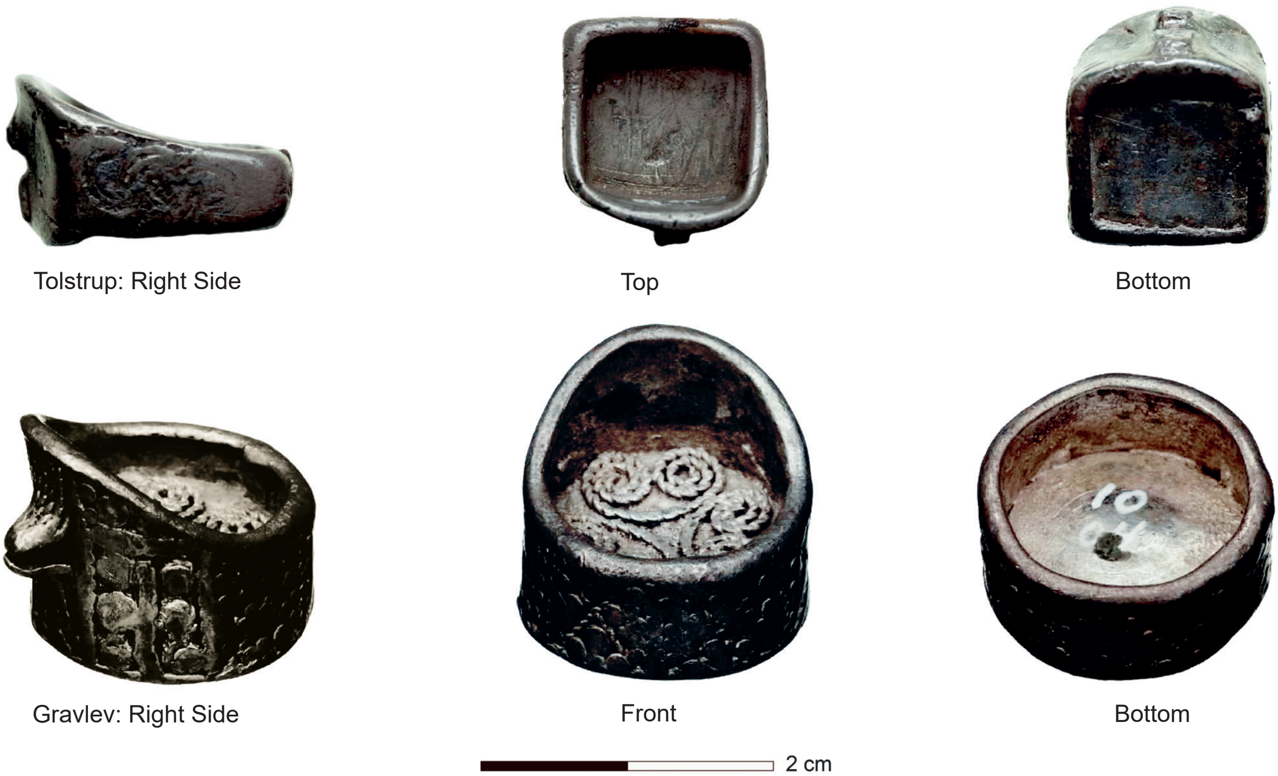


**Figure 4**. In the so far 21 known exemplars of chair pendants two design types can be discerned – the box-shaped and the barrel-shaped. The Gudme pendant belongs to the box-shaped type and exhibit a simpler design much alike the find from Tolstup, Bornholm (upper fig.). The barrel-shaped version comprises a more diverse group and often have a more elaborate for of ornamentation such as the one shown here from Gravlev, Jutland (lower fig.), with filigree patterning on seat and sides. As is the case with the Gudme chair both the Tolstrup and Gravlev examples show significant wear to the suspension ring emphasizing that the small chairs were items used extensively (Photo: The National Museum).

| | | | | |
|---|---|---|---|---|
| DENMARK | | | | |
| Bornholm | NMI, 25580 | Barrel | Silver | Hoard |
| Fyrkat | NMI, D165-1966 | Barrel | Silver | Grave, female |
| Gravlev | Dnf. 10/04 | Barrel | Silver | Hoard |
| Gudme | FSM 6205/X55 | Box | Silver | Settlement |
| Mysselhøjgård | ROM 6410PX455 | Box | Silver | Settlement |
| Nybølle | C53078 | Box | Silver | Detector find |
| Tolstrup | NMI, C6676 | Box | Silver | Hoard |
| GERMANY | | | | |
| Hedeby I | ALM KS Hb W394 | Box | Silver | Grave, female |
| Hedeby II | SH1979-221.1 | Barrel | Bone | Private stray find |
| SWEDEN | | | | |
| Barshalder | SHM 32181 | Barrel | Amber | Grave, female |
| Birka Bj. 632 | SHM 34000 Bj. 632 | Barrel | Silver | Grave, female |
| Birka Bj. 844 | SHM 34000 Bj. 844 | Box | Silver | Grave, female |
| Birka Bj. 968 | SHM 34000 Bj. 968 | Barrel | Silver | Grave, female |
| Eketorp | ÖLM 224617 | Box | Silver | Hoard |
| Folkeslunda | SHM 35077/59 | Barrel | Antler | Grave, female |
| Fölhagen A | SHM 3547 | Barrel | Silver | Hoard |
| Fölhagen B | SHM 3547 | Barrel | Silver | Hoard |
| Sandgårde | SHM 21187 | Barrel | Bronze | Grave, ? |
| Store Ihre | SHM 22917:242B | Barrel | Amber | Grave, female |
| Unprovenanced | SHM 876 | Barrel | Bronze | None |
| NORWAY | | | | |
| Sarpsborg | C62189 | Barrel | Silver | Detector find |
| Agder | not yet registered | Box | Silver(?) | Detector find |

**Table 1**. Chair pendants from Sweden, Denmark, Norway and Germany. Based on an elaborated and updated extraction from the database found in Jensen 2010. Please note that the very recent find from Agder, Norway has at the time of publication not been registered and verified by the local museum authorities and does therefore not form part of the typological description in this article.

and Hauck 1982)) on a rather large chair with beast and birds accompanying the figure (Mitchell 2018). The other box-shaped chairs, such as Birka Bj. 844 or Tolstrup, have a more anonymous appearance where the pendant depicts a seat with a very low profiled backrest, almost as a stool, as well as a more basic type of carpentry. The Gudme chair has a very similar appearance to these latter two exemplars and will accordingly be typologically dated to the same period (i.e. Late Viking Age). The Eketorp find seems to present a sort of intermediate design combining the carved surface of the more elaborate chairs and the low profiles of the simpler category. All the box-shaped pendant chairs are cast in silver (see Drescher and Hauck 1982 for a thorough description of the process), and only rarely do they show any secondary preparation, but the Lejre pendant has additional panels with niello inlay and the Eketorp chair show traces of gilding (and possibly also a missing seated figure as in the Hedeby I case). These have a more southern distribution than the second type, the *barrel-shaped pendants*. While the morphology of all the barrel-shaped pendant chairs is virtually identical – a cut-out cylinder with a flat seat, no armrest and an oval back-rest – this type exhibit quite a diverse range of methods in their production as these are made of both silver, bronze, amber, bone and antler. Diversity is also the keyword with regards to their adornment where Fyrkat, Gravlev, Birka Bj 632, and the two finds from Fölhagen (A/B) all show elaborate adornments with filigree and (possible) gilding in intricate designs that at times cover the entire pendant.[2] The bronze and organic versions only rarely show any kind of decoration (perhaps with the exception of Hedeby II which might depict an actual barrel (Kalmring 2019)), whereas the material itself, especially amber and the bronze foil, would indicate that the production of the pendant must have been more complicated than the more mundane materials immediately indicate. Consequently, both of the two categories of chairs give evidence to a type of pendant that has been treated with a great amount of attention to detail in combination with refined and highly skilled craftsmanship. Especially when the minute scale is taken into account the demand for knowledge on the processing of precious metals would indeed make the production of the pendants particularly challenging, but would at the same time feed into the pervasive use of miniatures as pendants during the Viking Age.

## Seating as privilege

The academic interpretation of the symbolic meaning of the chair pendants have taken two main lines of inquiry, *firstly* as a reference to the practice of seiðr and the female völve, and *secondly* as a reference to the king's throne. The present paper will argue that these two understandings are not mutually exclusive, and will instead focus on the seemingly mundane practice of seating. Importantly, the concept of being seated evokes a series of reference to both kingship as well as the Norse/Germanic/Roman pantheon (see Drescher and Hauck 1982), wherefore the actual function of the chairs is viewed as the common denominator for the pendants – in essence a symbolic and embodied notion of the ordinary physical interactions people have with chairs as a furniture type. Also, in contrast to benches and bunks chairs are meant to be used by one person only, and is also a very rare item to find in Viking Age or earlier periods, which seems to emphasise the exclusivity of the use of this piece of furniture. Perhaps this is the reason we only rarely find actual chairs let alone representations of them, as they are reserved for special individuals with special qualities. Consequently, the argument of the article is rather simple; only certain classes of people of high rank are allowed the privilege to be seated in public settings, and this could be the primary meaning content inherent to the chair pendants. However, the road to this privilege can be many, and the explicit display of the chair pendants (which have been worn intensively) could therefore be related more specifically to the function of being the ruler's advisor or seeress, and thus being seated alongside that person. The notion of giving advice and the ability to foresee events are certainly considered magical, and in combination with the apparent royal reference to thrones the main and ideal attributes of being seated seems to be a subset of the ideal attributes connected with Odin. Let us examine.

### *The seat as throne*

The absolute basic social function of a chair would be that some are sitting down while others are left standing. In such a case, interactions and performative activities could occur in front of the seated. Exactly this feature, the privilege of having people performing before you, in honour of you, seems integral to the symbolism of the chair – it is *par excellence* a defining factor of the ruling class of both early medieval Europe and the Viking Age and integral to the concept of the power of the throne (Sundqvist 2015, 226-228). A direct reflection of the 'seated authority' can be find in the concept of the high-seat, a position that is generally accepted as a place of honour and held by the most prominent amongst the persons assembled in the hall-buildings of the aristocracy (Herschend 1997, 49-50; Sundqvist 2015, 221-223). The position of the high-seats often figures as the point of reference for the activities taking place in the hall, and the social hierarchy ranking is reproduced by the person's closeness to the high-seat – the apex of authority. Consequently, the entire layout of the hall-build-

**Figure 5**. The Sanda Kyrka I picture stone is famous for several reasons, one of them being the depiction of two persons (presumably a female on the left and a male on the right) being seated and serviced or participating in some kind of (ritual?) transfer of a spear. The depiction is important in that is provides very good indications of the actual use of chair (thrones) in contemporary society besides the historical sources of both sexes (Photo: Historiska Museet, Stockholm).

ings has at times been fixed around the position of the high-seat, which is a situation recognisable at Helgö, Sweden and Borg, Norway where the external topography apparently has been incorporated into the interior of the hall building, and the high-seat presumably can be found at the highest point in the landscape, and the hall-building thus being built around this spot (Herschend 1997, 50-54; 1998, 28; Jessen 2012, 136-137). Comparable interior structures can likewise be found on other high-status locations such as Lunda, Sweden (Skyllberg 2008, 28-29), Högom, Sweden (Ramqvist 1992, 125, fig. 64; 2016, 101-102) or Järrestad (Söderberg 2005, 204-205, fig. 47). In all of these cases we are effectively witnessing a rather concrete social spatial organisation anchored in the use and possible position of the high-seat, and where authority *is* being seated. Also, the visual portrayal of a seated king can perhaps be seen on the Gotlandic picture-stone from Sanda Kyrka I where two persons sitting in chairs in the topmost part of the motif are handed over a spear from a standing figure, while a procession of what could be warriors, ritual personnel or perhaps visitors passes by beneath them (Karnell 2012, 14-15; Oehrl 2019a, 54)[3] (Figure 5).

Comparable scenarios are also to be found in the archaeological records, where the combination of the chair and parading army can be found in the Oseberg ship-burial. Here the tapestry adorning the grave chamber atop the ships deck depict an elaborate scenery with multiple characters such as horned figures, armed and marching warriors, carts and presumably also berserkers and valkyries. As part of the grave-goods a small box-shaped chair, very similar in design to its pendant counterpart, with a broad squarish body and a low backrest, was placed somewhere near the mast (Brøgger, Falk and Shetelig 1917, table XV; Vedeler 2014), and could perhaps have been facing the grave-chamber (Figure 6).

A person sitting on the chair would therefore have been overlooking the tapestries, and 'relived' the vivid procession before their eyes. As a chair is a moveable object, also open-air processions in seemingly more *ad hoc* or desolate surroundings, as can be witnesses in the Överhogdal 1b tapestry (Horneij 1991, 153-155) took place, which is a situation also to be found in the written references. As described in the *Annales Laurissenses minores*, where the Merovingian King Childeric III and his itinerary meets his Frankish subordinates: '*On the day of the Marchfield, according to old-age customs, the people offered gifts to the kings; on that day, the king sat on the royal throne, the army stood around him in a circle, and the mayor of the palace stood before him*' (Pertz 1826, 116, translated in Buc 2001, 108), and also in the later *Saga Ólafs hins helga* (chapter 80) by Snorri Sturlusson where

**Figure 6**. The chair from the Oseberg burial share several design features with the box-shaped pendants: It has a low seat and a low backrest of a simple design, the legs virtually absent, and the seat itself is 'hollow' and must have been made with some form webbing and pillow. Consequently, besides size and materials the miniature and the model forms a relatively uniform type of furniture (Photo: Eirik Irgens Johnsen, University of Oslo).

a thing-meeting is taking place at Uppsala: *'On the first day, when the thing was opened, king Olafr sat in his chair and his hird around'* (translated by the authors after Jónssons 1911). In both instances the seated is of royal lineage and positioned centrally, so that the spectacle can be performed in front of them.

Another exemplar of an oft-mentioned chair is the so-called 'Throne of the Marsh', found in a male boat grave in Wremen, Cuxhaven, Germany. It has a circular shape based on a hollowed-out trunk of an alder tree, and with an intricate pattern of carving covering both the body and the backrest. The seat is not preserved, but holes around the edge of the body must stem from attaching a webbing. The design looks very much alike the small barrel-shaped pendants, besides the backrest, and could be regarded an intermediate shape between the simple oval backrest and the more advanced box-shaped version. The grave is dendrochronologically dated to AD 431, and underline the *longue durée* of using chairs as a status marker (Schön 1995, 2015; Theune-Grosskopf and Nedoma 2006, 52).

## Between gods and rulers

Interestingly, the dating of the 'Throne of the Marsh' coincides with the dating of the wooden figure found during peat cutting from Rude Eskildstrup (5th century), which presents a seated character (Mackeprang 1935, 248-250). Even if the wooden surface of the figure is deteriorated the facial features, a carved, large neck collar and a squarish object held in its lap is clearly visible. The interpretations have ranged from a votive deposit of a divine idol (ibid.) over a depiction of a masked person in trance (Danielsson 2007, 130) to a ritualised rendition of landownership of the elite (Zachrisson 2007, 134-136).[4] Further, considering that this figure seemingly is the first carved image of a seated character and at the same time marks a distinct change in the design of anthropomorphic figures (Sanden and Capelle 2001), we witness a changed attitude towards the position of the elite and their relationship with the pre-Christian pantheon. As just mentioned, exactly this seated position – on a chair that is – makes its way into the iconography in several medias during the 5-6th Cent. and does to some extent blur the line between gods and rulers, as the differing interpretations also underline. In effect, during the early Germanic Iron Age sacral rulership seems to have taking a more pronounced manifestation, and places the persons at the pinnacle of society in charge of (at least some of) the ritual communication with the other worldly beings (Dobat 2006; Schjødt 2010; Sundqvist 2008, 224-225; Warmind 1999, 232).

The actual use of chairs and their iconographic counterparts can to a wide extent be coupled with the aristocratic privilege of being seated in public as well as being the centre of and main spectator to large and elaborate processions and pageants. In essence, to see and to be seen, while positioned on the chair.

In effect, the depiction of the divine realm simulates an idealized behaviour of the lived life of the aristocracy that provide the premises for social organisation on a general level, where the gods have structured cosmos, created the worlds for humans to live in, and laid down the rules of conduct in order to establish an organised society (Dumézil 1962, 30; Durkheim 1965, 22, 474-479; Schjødt 1999, 41). This type of deific social simulation can even be described as a 'cultural strategy' providing the aristocracy with a mythological underpinning of their privileged socio-political position (Hedeager 1997, 72-75). For example, construction of great halls, high-seat and temples is a recurring theme in the description of the god's lives, but who do the gods worship (Patton 2009, 213-214)? Obviously, the written sources are not unfolding the fantastic world of the pantheon, but just as much reflect a simulation of the ordinary societal order practiced by the aristocracy.

### *The seated seeress*

Concerning the find context, the pendants are found both as part of grave-goods, hoards and of lately – since 2009 – also on settlements. With regards to the latter it is quite noteworthy that, besides Gudme, then Lejre, Denmark, is the only other settlement find spot and one which have an unmistaken relation to the early Danish royal dynasties (see Christensen 2015, 15-29 for a comparison of the written sources). The Lejre pendant is found in connection with the sequence of three very large hall-building excavated in 2009. Of interest here is not only the context but equally so the figurative characteristics of the Lejre pendant, where connotations to both Kingship, and the Norse pantheon can be recognised. Because the Lejre chair is very well preserved and exhibit the greatest amount of decorative as well as figurative elements, it therefore also provides an improved opportunity for a deeper interpretation of the components depicted, and possibly also the activities pertaining to an aristocratic seat like Lejre. Both the costume, facial expression and animal decorations adorning the chair is discernible, wherefore this window of interpretation resulted in a rather heated scholarly debate focussing on the identification of the person seated of the chair. Two main versions both based on the interpretation of the facial traits vs. clothing vs. the animals falls out in favour of *Odin*, mainly so due to the male features such as the possible moustache (Christensen 2013) and *Freyja*, an interpretation based on the obvious female clothes the figure is wearing (Mannering 2013). Importantly, both researchers detect an extremely convoluted and ambiguous combination of references to the aristocratic as well as ritual life of the Viking Age.

Exactly this flirtatious use of and intermingling of traditional female and male features as well as earthly and otherworldly curiosities seems to frame the plenitude of meanings afforded by the miniature chairs. Even if the basic architectural layout of a chair is excessively plain then the suppleness of the references put into the furniture and the characters depicted with it, will affect the interpretive outcome in a way so that it somehow seems to defy the contemporary (as well as our current) definition of sex as well as clothing. Even to an extent which may imply that the high-ranked setting of Lejre included performative practices that were negotiating both hetero-normative and body-normative hegemonic orders (Arwill-Nordbladh 2013), wherefore the bodily features are virtually absent in the Lejre figure, making the apparel depicted the more important features to recognise (Danielsson 2010). A further notion on the importance of the performative paraphernalia (to which the chair pendants might even belong) and their ability to occasion certain ritual conceptions, is needed. This is so for the reason that…

*'The particulars of the völva's clothing confirm the complexity and symbolic value of her dress, serving to transform the wearer into a völva and at the same time emit a complex message of secret knowledge and magic power to the viewer'* (Hedeager 2011, 124).

This ability to transform the wearer by the use of a certain 'clothing codex' could in itself convey a means to generate the ambiguous recognition of the gender of the seated person; the clothing, the equipment and most likely also the behaviour of the person is what would define that person as a seeress, and not necessarily the biological gender. However, the actual act of seiðr, might even have been conceptualised as a potentially gender-transforming activity (Motz 1994, 10-12; see Laursen 2006 for a critical account of this interpretation), thus adding a further layer of complexity to the plasticity of the character.

Because of the difficulties in establishing a linear and singular explanation of the Lejre figurine, perhaps the best way to cope with the meaning content of the chairs and their users would be to embrace the diversity of the presentation – the figure is truly Freyja, the primordial keeper of the Æsir seiðr, but *also* Odin, the high King. However, it does seem beyond any doubt that the figure on the Lejre pendant is supposed to represent a feminine character whether it be Freyja as seeress or Odin performing as a female. Exactly this feature seems to define a central element pertaining to the miniature chairs, the female seer and the volatile powers of magic. A feature which is strengthened when including the find contexts of the pendants.

## Principal female artefacts

Regarding the pendants themselves they have a very dominant female presence; *all* of the gender determinable contexts are connected to female graves, and the graves (8 total) represent an especially convincing 38 per cent of the totality of pendants covering the entire region they are found within. Representing 28 percent, the second most frequent find context is the hoards. Recently, Burstrøm (2020, 271) has pointed towards the seemingly magical and commemorative character of the large Eketorp hoard and its relation to elite networks and an allusion to the feminine. Similar ideas have been promoted in relation to the Fölhagen hoard (Helmbrecht 2011, 385-386) where the female traits and the almost grave-like composition seems to point towards an initiated, extraordinary and possible female personae (see also Kilger 2008). Among the graves, especially the Hedeby I, Fyrkat and Birka versions exhibit conspicuous finds and have, in good right, been identified as potentially containing women with special functions. In several instances, these noticeable find-constellations have been taken as indications of the women having a strong connection with the power of the völva, the female seers (Arrhenius 1961; Pentz et al. 2009; Price 2002; Roesdahl 2004; Solli 2002). Consequently, we witness a recursive structure where the individual placed on the Lejre throne has female characteristics, but also the actual use-frame of the pendants is related to the life, death and commemoration of females. That is, both the wearer and the motif seem intimately connected to a female sphere of activities. Importantly, this being a symbolically laden artefact (as defined by Zeiten 1997, 5) it not only seems to define special attributes pertaining to certain Viking Age females, but likewise to a specific relation to powers bestowed upon them from some kind of magical and otherworldly source – a source which in Norse mythology is intimately connected to both Freyja as well as Odin (Simek 1993, 90-91). But then why would such a crossdressing endeavour as might be depicted with the Lejre figure have an appeal to Odin, a man? It would seem to be a dangerous path to follow as the stigmatising of biologically male persons who dressed as females is eminent and they might have had to face some kind of social degradation and perhaps even punishment (Hedeager 2011, 126-128). Some directions might be found in Norse mythology: Here, a special trait cling to the biographical profile of Odin in that he repeatedly acquires his special qualities by austere sacrifices; in order to gain wisdom and intelligence he voluntarily gets a sensory handicap by pledging an eye to the well of Mimir (Völuspá), he self-sacrifices on the branches of Ask Yddgrasil and gains access to rune-lore (Hávamál) and he seemingly also socially kills his masculinity when crossdressing and enters the female domain of seiðr – a practices conveyed to Odin and the Æsir community by Freyja (Ynglinga Saga; Völuspá).[5] Even though these examples describe a serious deconstruction of various parts of his lived life, they also define Odin as a transgressive, omniscient and magical being of an indefinable social and corporeal life (Price 2002, 389-391). And the reason why the seeress (via Freyja) is allowed a social standing comparable to the King himself, even to a degree where she is seated next to him (as we might witness on the Sanda stone), is that she masters the powerful and dangerous seiðr – an ability that even Odin himself desires. Another important goddess in the Æsir pantheon is Frigg the wife of Odin. Being the consort of Odin she, alongside Freyja, ranks foremost of the Norse goddesses. This position also provides her with exclusive privileges such as featured in Grímnismál, where she sits upon the high-seat Hliðskjálf, and debates the fates and psychology of their foster sons with Odin. Clearly the Queen figure is regarded an equal companion and qualified adviser, which offers a wiser and more precise assessment of the situation they discuss than does Odin the king. On the continent the concept of the Frigg/Frîja goddess can be traced centuries back (Lindow 2003, 128-130; Simek 1993, 94) as can the idea of the queen ruler among the Germanic tribes.

## *Germanic roots – Christian appropriation*

Female semi-goddesses with magical abilities positioned at the pinnacle of political power runs a long history in the Germanic areas.The possibility for women to gain political strength and wide-ranging societal importance often seems connected to their prophetic talents, because…'The importance of fate in Germanic mythology and literature cannot be overstressed, and it was seeresses and supernatural women who were inextricably linked to the destiny of men' (Morris 1991, 29).[6] The most renowned of these could possibly be Veleda as she is being portrayed in *Historiae* by the roman chronicler Tacitus. Importantly, her political powers very much rested in her supposed ability to perform divinations – even to an extend where the Roman Commander Cerialis, after several embarrassing defeats, asked her to allow the fate of war to take another direction – and was therefore celebrated as a semi-goddess by the Germanic tribes who also brought her great gifts and offerings (Dobat 2009, 135-39; Simek 1993, 356-357). And Veleda was by no means the only female sovereign mentioned in the Roman sources; Ganna of the Semnonen who functioned as the seer of the kings of the Semnonen and had diplomatic relation to the Roman administration (Castritius 2005; Dio Cassius, Roman History, book LXVII/15; Tacitus Germania 39). Even if of a different tribe, Ganna in many ways became the successor of Veleda. Also, Queen Boudica is, according to Roman Historian Dio Cassius (Roman History, Book LXII/6), said to have performed divinations before battle and possibly also had connections to the priestesses of the Celtic goddess Andraste (Koch 2006, 52). References to witchcraft in the pages of the History of the early Frankish Kingdoms clearly underline the continued importance of the royal seeress, even if a Christian world-view started dominating. For example, Gregory of Tours describes how the great King Merovech consults a seeress before partaking in the heathen ritual of Trial of the Sortes (Morris 1991, 33). Another case can be found in the numerous occasions where Gregory of Tours point out witchcraft in the court of the Franks and, in particular, with King Childebert II and Queen Faileuba (Gregory of Tours, History of the Franks, IX.38). Even under the pious Carolingian rule the seeress Thiota is examined by the bishops of Mainz for doing divinations (Annales Fuldensis MGH SS, I, 365). In the later Norse texts, this intimate relation between royal personas and seeresses seems to continue the already century long tradition. For example, Queen Gunhild, wife of King Erik Bloodaxe, almost epitomizes, for good and for bad, the Norse literary understanding of the powerful magic of Viking Age royals (Dronke 1981; Friðriksdóttir 2013, 476-478). However, the notion of the seeress is not exclusively linked to royal milieus, but is likewise portrayed in more mundane contexts. Accordingly, a central paragraph is to be found in the Eiríks saga rauða (Saga of Erik the Red), where it is described how the Greenlandic völva called Thorbjørg the Seeress (Þorbjörgu Spákonu) is welcomed to the house of Torkel the farmer. Interestingly, the first thing they do is to arrange her at a highseat upon which a pillow of chickenfeathers is placed (Ægidius 1997, 54-57). Here, the seat is clearly understood both as an entry point for her doing her magic, but also a privileged place with a fine pillow.

An obvious critique would be that we are witnessing a primarily Christian group of writers, but the many recurring references to the female seer and her noticeable flair for political manoeuvres stands out very clearly, and cannot but be understood as a genuine concept of female rulership and social power within the described societal settings. Furthermore, the literary references are describing areas which are basically on the verge of or literally in the process of converting to Christianity. The fluid and often dynamic ideological platform of transforming societies where seemingly conflicting ways of ritual live are grouped together (Gräslund 1991; Jessen 2012; Staecker 1999, 382-392), seems to apply for the Viking Age pendants as well as for the activities of the sovereign seeresses – they appear together right on the brink of the introduction of Christianity in the Scandinavian region – and might not be neither Christian nor pagan.[7]

For the reasons just mentioned, an equally pertaining topic when interpreting the chairs has been to define the chairs as either Christian or pagan (e.g. Jensen 2010, 60 *contra* Price 2002, 167). The matter remains unresolved which could relate to the fact that even though the use of chair pendants clearly is a Scandinavian phenomenon they are most likely all to be dated to a period when the ideological platform of the elite is changing from a pagan to a Christian setting. Especially when the geographical distribution of the finds is taken into consideration – from Hedeby on the continent to the Swedish Uppland region, where the Christianisation of the latter area took place somewhat later – one must expect a different frame of use and a hybrid one at best.[8] This situation is also evident when considering the other artefacts accompanying the chairs. Both Thor's hammers (Eketorp and Gravlev) and Christian crosses (Barshalder and Birka Bj. 968) can be found together with the miniature chairs, thus underlining the diverse religious contexts the chairs appear within. Consequently, the chair seems to be equally employed in Christian as in pagan settings, and seem to point to the common denominator, as has also been described above, in that they combine the act of being seated with the privileges of the echelon of society. Additionally, in both the pagan as well as the Christian understanding of the activities of the bearers they operated on the fringes of normality. The difference being that the pre-Christian understanding of the seeress seemingly has a sense of dignity attached to it, while in the later periods not so much (see below).

Just as was the case with the interpretation of the Lejre figurine, the ideological context of the chairs seems to be very flexible. Perhaps this recurring aspect of malleability might be better understood when contemplating that the conceptual anchoring of the miniature chairs could be grounded, as the current text argues, in the more overarching phenomenon, namely the privilege of being seating. To even further complicate the picture, the privilege of being seated also reaches deep into the highly hierarchical clerical system of Latin Christendom. As noted by Pesch (2018, 487-89) the famous *albeit* later chess pieces from Isle of Lewis exhibits some of the same characteristics as the miniature chairs, especially Lejre, where bishops in long ropes are seen seated in chairs of similar appearance as the South Scandinavian pendants. Additionally, the Lewis chess pieces portrays the King and Queen as seated and the Queen even holds the position of advisor/counsellor (or originally *vizier*) to the King (Burström 2019)). However, this resemblance just underlines the strength and malleability of the overarching principle of seating we here advocate (Figure 7).

**Figure 7**. Over the southwestern entrance of the Hagia Sofia Basilica in Istanbul a mosaic depicting a seated Virgin Mary holding the Child Christ form a vivid example of the Christian ecclesiastical privilege connected to being seating. The mosaic is from the 10th century and thus contemporary with the chair pendants (Photo: Steven Zucker, Creative Commons).

The historical trend of the use of the throne is well attested and the Christian dignifying use of seating has the same continental root as we can expect the Scandinavian pendants to have (Salin 1916, Drescher and Harck 1982). Consequently, neither Christian nor traditional Scandinavian belief systems have 'patented' the authority of seating – it is in essence a common feat.

## One chair, triangulated reference

Thus far, we have described several of the characteristics pertaining to the pendant chairs; their morphology, their find context and distribution, their connection with the sovereign seeress and not least their possible intricate metaphorical references. Consequently, and in contrast to the general interpretation of the purpose of the small chair pendants resting on their main function as amulets – where amulets are understood as containing some kind of apotropaic power warding off evil powers for the individual person wearing them and attributing them with such powers (e.g. Arrhenius 1961; Gardeła 2014, 46; Gräslund 2005, 379-82; Zeiten 1997, 21-22; see Fuglesang 1989 and Jensen 2010, 7-10 for more critical definitions) – the current perspective also includes the capabilities and status of the wearer thus regarding the object and the wearers social context as mutually dependant.

For that reason, we believe that the concept of seating in itself would qualify as the common thread through all of the above – why else would a chair become a pendant in the first place? Therefore, that a chair affords seating must have had some kind of pregnancy to it. Seating is quite a notable social event and a very recognisable one as well in that virtually everybody would have experienced people being seated under certain circumstances, while others must stand. And the chair (or throne) must furthermore be regarded as a royal symbol *per se* (Duczko 1985), even to the extent where the populace demands the kings being seated in the high-seat, just as depicted in *Hákonar saga góða* (Sundqvist 2015, 228). Accordingly, the intricate relations that envelops the privilege of seating, and in this case materialised as a miniature chair, could be conceptualised as a triangulation of two historic character types, the Sovereign Seeress and the King, and a supernatural being, Odin, which we have seen are all described with being seated as a defining privilege (Figure 8).

Their mutual links would to a large extent be defined by functional links (i.e. the characters acting in the world), with a conceptual grounding: between the King and Odin the concept of Royalty is grounded in heritage and a divine descent. Between the Seeress and Odin, the link is based on the concept of seiðr and the act of performing divinations, while the King and Seeress would

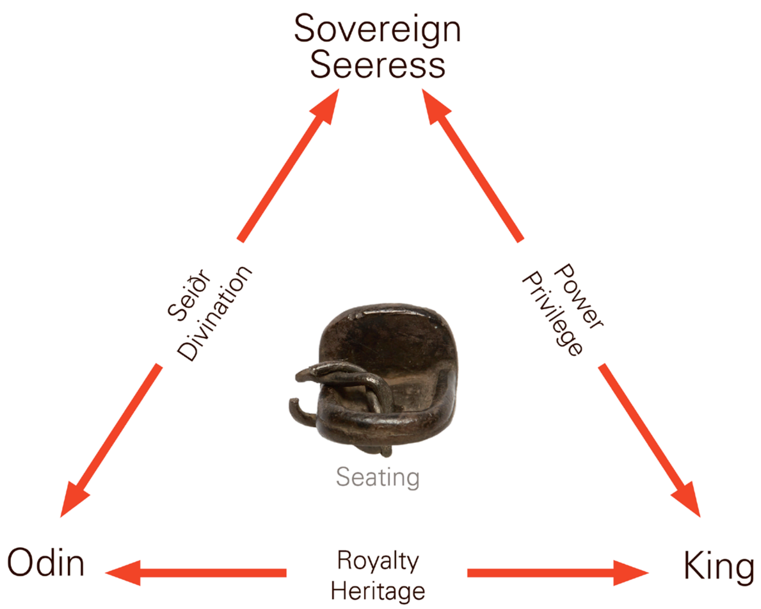


**Figure 8**. Illustration of the relationship between Seeress, Odin and the King and possible functional links (Graphics: M.D. Jessen and M.L. Bendtsen, The National Museum).

be based on a more secular power-relation where the actual privilege of being seated could be negotiated and initiated. In principle, our overarching interpretation of the meaning content of seating requires all three relations between the characters to manifest, but would not necessarily stimulate all of the mentioned links in all the situations where seating is referred to in equal measure. In the case of the miniature chairs, archaeology informs us that the predominant use-frame is female, thus, as a material manifestation the miniature chairs would highlight the aspect of the Sovereign Seeress, but this particular manifestation would still be dependent on the royalty linkage between Odin and King, for the concept of being privileged by being seated to be realised. In addition, the woman as ruler in concert with the King, in his absence or as existent sovereign Queen must be included as well, as the historic as well as the overall prominent, elite localities and contexts the pendants appear in, underline a special status of the women in question. For all we know, the pendant is feminine and underline the power status of the wearer in a subtle, yet distinctive manner.

A possible explanation for this material anchoring of the triangulation of Odin, King and Sovereign Seeress in the miniature chairs seems to rest in the potent metonymic connection between the material object and the conceptual content it conveys. To begin with, there is an 'item for act' metonymic relation that is anchored in the worldly and social dimension of being seated on a chair. An act in which the actual pendants would have been unusable since they are clearly too small and fragile, even to have functioned as toys.[9] As virtually any kind of practical usability is nullified, the chair pendants must have been produced with the intention of generating some kind of symbolic concept. Hence, the act of being seated is simulated through the miniaturised chair, and the 'item for act' metonymic relation therefore piggy-backs on the knowledge and experience people have with this particular furniture type – both with regards to its physical affordances and social setting. Importantly, due to the lack of function the metonymic structure is solely constituted by the material qualities of the pendant itself, and the very simple notion of proportion becomes a defining factor in creating the metonymic relation (Jessen 2013, 331-333; Whitridge 2016). Consequently, by downscaling the chair, an explanation based on the natural functioning of the pendants becomes less plausible, and for that reason a mimetic explanation seems justifiable (Knappett 2012; see also Edgeworth 2010). The conceptual triangulation of the Sovereign Seeress, the King and Odin thus becomes a blended entity anchored in the material character of the miniature chairs themselves. To fully grasp the mimetic content in congruence with the metonymic reference of the chair pendants the trinity cannot be separated. Importantly, as a result of this blending the small chairs change character and seem to attain an emblematic quality, and in this case a miniature artefact with special connotations and properties that point to being seated and, most likely, more specifically to the magical abilities of seiðr of the sovereign seeress.

## As small as they come

The minute scale of the pendants, we are virtually on the brink of the artisans not being able to make them any smaller, does however, seem to limit their usefulness as 'active' emblems in a social setting. At least it would be necessary to be close to the wearer to be able to recognize the pendants and their form. Still, if we acknowledge the pendants as referring to the secret knowledge of seiðr, the ability to keep them off-limits to the public eye, might even have been an attractive attribute. In such a case, the seeress could carry the pendants hidden, close to her body, and perhaps more importantly, exposing them to the public could be a potent act in itself. This last point, the unveiling of the pendants, might be central to the use of the chair pendants as ritual items. In her 2011 book Helmbrecht describes a group of female figures that hold their necks, or seemingly more correct their necklaces (Helbrecht 2011, 123-125). Different interpretations have been attempted (ibid. 125), but none which have taken into account their immediate find contexts. Here the Birka grave Bj. 968 is essential as the buried female's necklace contains a barrel shaped chair pendant and literally right next to it a pendant of female figure holding her necklace was found (Arbmann 1943, 394-396). Consequently, we suggest that the posture of the females holding their neck,

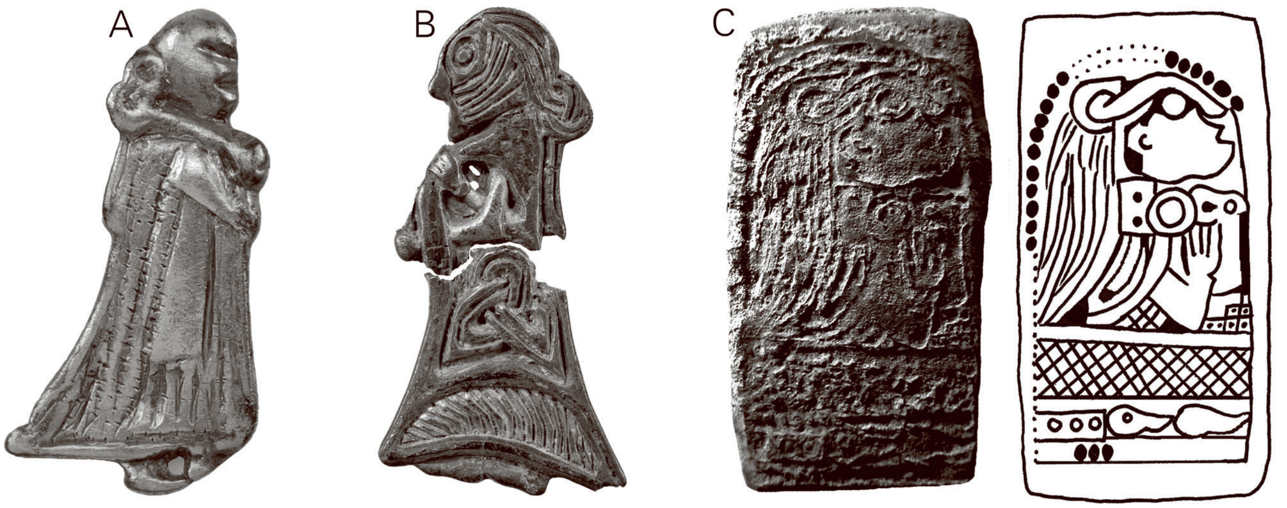


**Figure 9**. As pointed out by Helmbrecht (2011) the gold foil die from Sättuna (C) depicts a female, possibly seated, lifting her chin and holding forth her jewellery as if to display her disc on bow brooch, while the pendants (A: Birka Bj 968 left and B: Tissø middle) depict two women holding their neck or necklace (Photo and drawings: G. Hildebrand, Historiska Museet, Stockholm, Pia Brejnholt, Nationalmuseet, Denmark, and M. Rundkvist, University of Łódź).

is, instead, that of the unveiling of the pendants in their necklaces. In this case, with grave 968 we witness a meta-manifestation of this practice where the necklace with pendants accompanying the deceased reproduce both the ritual objects, while the artefacts could also illustrate the moment where the pendants themselves are exposed to the public. Importantly, a more recent find of a similar iconography but of different workmanship is noteworthy; the Sättuna gold foil die depicts a female figure lifting her hand to display her (oversized) disc on bow brooch while apparently being seated on a low stool (Figure 9) (Rundkvist 2007, see also Watt 2019, 200-202 on the gold foil depictions of seeresses). A very recent detector find from Boeslunde, Denmark, of a small, guilded silver-figurine of a female with exposed necklaces show resemblance to the Sättuna foil, and could possible depict the women on a square dais or even seated on a chair. As is the case with the other female figurines also the Boeslunde woman has a recognisable row of several necklaces.

However, with the small Sättuna die we are perhaps witnessing the first hints at a hitherto overlooked ritual act, that of the verification of the identity of the seated seeress – the unveiling of the chair pendants. Moreover, the iconography clearly informs us of a link between seated women, presentation of their jewellery and this possibly in connection with a public display.

As has also been argued convincingly for these disc on bow brooches (Glørstad and Røstad 2015, 197-199) the often highly worn (even torn) brooches seems to have been heirloom objects integral to the identification of females with influential, perhaps aristocratic, lineages. In a similar vein the Gudme chair pendant has been repaired with a secondary suspension, and one which clearly disregards any representation of functionality by penetrating the seat of the chair. Is this instance, the miniature object itself has seemingly become just as important as the iconographical reference to a real size chair. Perhaps this secondary use of the pendant, as with the disc on bow brooches, indicates a new wearer, and in that case also a transferal of the powers and opportunities that followed the functions of the seeress and is recognized by the pendants. Exactly how these mystic abilities of the seeress could have been bestowed upon the next in line eludes us, but two possible ways, or a combination thereof, are through inheritance and through initiation (see Nygaard 2016 for textual references to both types of numinous transferal). However, there seems to be a propensity for the social elite to also act as a ritual elite (Ljungkvist 2011, 260-261), wherefore an actual hereditary situation could be argued for, as is also the case for the disc on bow brooches (Glørstad and Røstad 2015, 195).

## Concluding remarks – a return to Gudme

As we have argued throughout the current text, the small chair pendants cannot be understood without taking into consideration their symbolic meaning content as well as the actual contemporary magical activities with which they seem to be intimately connected. However, there are also other factors to consider such as the dating of the pendants, which can broadly be placed in the 10th century AD. The start of this century also seems to mark an introduction of several new types of pendants, including the miniature chairs (Jensen 2010, 58-60). As argued in connection with the Thors' hammer pendants, this change is most likely related to an increasing pressure from the Christian mission exerted on the traditional ideologies of Southern Scandinavia during this period (Staecker 1999, 243-244). Thus, an intensification of the use of specific types of personal artefacts could be interpreted as a counter-reaction against the advancement of the cross in its most physical sense. A similar scenario could explain the daily functioning of the chair pendants. Wearing the pendants would underline a sort of doubly identity indicator where both an appreciation of the traditional ideologies can be recognized and the sanctioning of the social importance of seiðr is at display, but possibly also at the same time categorise the wearer as a seeress performing these exact magical acts. The woman herself, carrying the chair pendant, would quite possibly have been an active political agent in Viking Age society, but the pendant would emphasize a concept of rulership in which female agents take centre stage in the political power struggles, and she would certainly have been under the aegis of the aristocracy. Thus, the pendants display privilege and would promote a sense of 'the old traditions' that seems to represent an intensification of resilience towards the Christian mission. An ideological change that, over time, would diminish female opportunities for power and independence, and definitely would pinpoint the seeress as a negative character.[10]

At the same time, because the authoritative character of the chair and seating has such a deep history and operates in both Christian and pagan settings, the understanding and 'reading' of the small pendants could very likely work under both religious perceptions. This would even further open the political, perhaps diplomatic, possibilities of the wearers.

The identification of the small chair pendant sheds new light on the last phases of the Gudme settlement, that had its heydays from ca. AD 250-550; as already remarked by Hayo Vierck in 1984, the pendants have a strong link to places with a distinct royal fingerprint, such as Hedeby, Fyrkat or Birka (Vierck 2002, 45), but since his writings also Lejre (alleged mainstay of the Skjoldunge dynasty) and Sarpsborg (Norwegian capital under King Olav II the Holy) have been added to the pool of find-spots.[11] As we are dealing with a definite elite-level artefact dating to the Late Viking Age it seems to indicate a hitherto overlooked revitalisation of the Gudme settlement in this period. Furthermore, the symbolic connotations that this small type of furniture possesses seems closely connected to the actual activities one would expect to have taken place in and around the preceding large hall-buildings at Gudme (Lund Hansen 2011; Sundqvist 2011). In that sense it is interesting that 'the Gudme seat' now figure among famous Viking Age find localities such as Lejre, Birka and Hedeby which all display a century-deep history as *vicus regius*. Despite its miniscule dimension the miniature chair lets us know that the Gudme area still were an important region, and a region that was under the auspices of the royal powers and possible also held a magico-ritual position in Viking Age society.

## Acknowledgements

The authors wish to thank M. Rundkvist for his kind help regarding the Sättuna die as well as the reviewers for their valualbe comments.

This work was supported by the Carlsberg Foundation under CF14-0529, as well as the A.P. Møller Foundation under APM-208730. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

## Notes

1. The recent finds from the harbour at Hedeby, Germany, and from Sarpsborg, Norway, could both be termed settlement finds, but it cannot, however, be ruled out that they stem from disturbed hoards.
2. In comparison to the general character of Viking Age pendants, the number of pendant chairs made of silver is overrepresented and thus places them is a special category when it comes to the choice of material used (Jensen 2010, 133).
3. The central motif in Alskog Kyrka is similar, but is now severely damaged by a perforation (Oehrl 2019b, tafel 25c).
4. Zachrissons compelling idea concerning the ritual transferal of landed property is tied to the two gold foil figurines from Bolmsö, and we would like to point attention to the similarly seated gold figurine holding its lap from Skrædergård (National Museum of Denmark inv. C36351).
5. It has to be stressed that the authors are quite sympathetic to the use of the (mostly) later literary sources as a means to understand and highlight select aspects of Viking Age ritual life. We considered the careful use of these sources as advocated by Schjødt (2009) a sound academic path to follow.
6. The human cognitive ability to 'imagine things going wrong' seems to form an evolutionary grounding of the pervasive use of prophecies and predictions within religions around the globe (Sørensen 2019). In other words, because bad things might happen in the future, we want to know about the future.
7. That 'magic' still had a role to play in the Christianised world can be seen in the recurring prohibition against heathen activities in the early Scandinavia law codes (Simek 2019, 375f.).
8. The overrepresentation of Viking Age crosses in the Danish find material does to some extent point in the direction that certain pendant types seem to follow the tide of conversion (Jensen 2010, 133), but also that 'contrasting' pendant types does not exclude them being found together.
9. The means for suspension and well as the relation to adult female burials and rich votive offering also rule out this possibility.
10. In a more distressing sense, the introduction of the chair pendants might even be regarded a premonition of the changing attitude towards the knowledgeable woman changing from a revered seeress who occupied an important position in Viking Age society next to the King, into an understanding of a malicious 'evil woman' excluded and persecuted in the witch-hunts of the Middle Ages (Mitchell 2011, 176-9).
11. Exactly the eastern part of Funen has seen an upsurge in find from the Later Germanic Iron age into the early medieval period. Especially the excavations at Munkebo Bakke in connection with the prominent Ladby Burial will be interesting to follow (Beck 2019). Especially the sequence of prominent hall-buildings in connection with several finds of precious metals is noteworthy and underline East Funen as a seemingly overlooked central area in the Viking Age (Beck, Christiansen and Henriksen 2019).

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# Borgring.
# Uncovering the strategy for a Viking age ring fortress in Denmark

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**ABSTRACT**

In 2014, Borgring, near Køge, Denmark, was identified as the fifth geometrical Viking age ring fortress in Denmark, complementing an exclusive group of monuments including Trelleborg. Excavations and surveys in 2016-18 allow a detailed reconstruction of the site and its history. Borgring is a fortification with the same type of geometry, construction, and location as other Trelleborg-type fortresses, though exhibiting notable differences. Finds, including beads, ornaments, and iron tools, reflect limited activities and links to other fortress sites. The dating of Borgring is established with reference to wiggle-matched $^{14}C$ dates.

**ARTICLE HISTORY**
Received
11 September 2020;
Accepted
20 May 2021

**KEYWORDS**
Viking Age; Ring fortress; Fortification; War; Monument symbolism

## Introduction

Major fortification works were rare in Viking Age Scandinavia. The outstanding exception is a group of large, circular fortresses built in the second half of the tenth century across modern Denmark and southern Sweden: the Trelleborg type ring fortresses (Figure 1a) (Roesdahl and Sindbæk 2014, 387). These comprise the sites Aggersborg and Fyrkat in Jutland, Nonnebakken on Funen and Trelleborg on Zealand, and probably the sites Borgeby and Trelleborg in Scania. In 2014, Borgring, which lies near Køge, south of Copenhagen, was identified as the fifth example of this group in Denmark (Goodchild, Holm and Sindbæk 2017). Apart from their substantial size (140-260 m in outer diameter), the fortresses are distinguished by their location in the landscape and by their meticulous geometric layout, consisting of circular ramparts, buildings, axial roads, and gateways laid out according to a strict and exactly surveyed plan. The data available suggests that all were constructed during a short period in the 970s and ‘80s, during the reign of King Harald Bluetooth, who also created the Jelling monuments (Jessen et al. 2014).

A major programme of research excavations and surveys was carried out at Borgring in 2016-18 (Christensen et al. 2018). The project applied metal-detector surveys, soil geochemical analysis, and geophysical surveys to the fortress and its nearby surroundings. Excavations were conducted in the ring fortress itself in addition to survey excavations of more than 40 ha of the surrounding area, searching for traces of contemporary activity. Together with extensive environmental and scientific analyses, the investigations now allow a detailed reconstruction of the site and its history. Furthermore, it allows a wider understanding of the Trelleborg-type fortresses as monumental statements of power and as actual instruments of defence.

## The Setting of Borgring

The landscape west of the modern city of Køge is characterised by a *c.*20 km-long east–west tunnel valley, through which Køge Stream flows into the sea (Figure 1c). On the northern side of the stream lies the steep ridge of Køge Ås, a glacial esker.

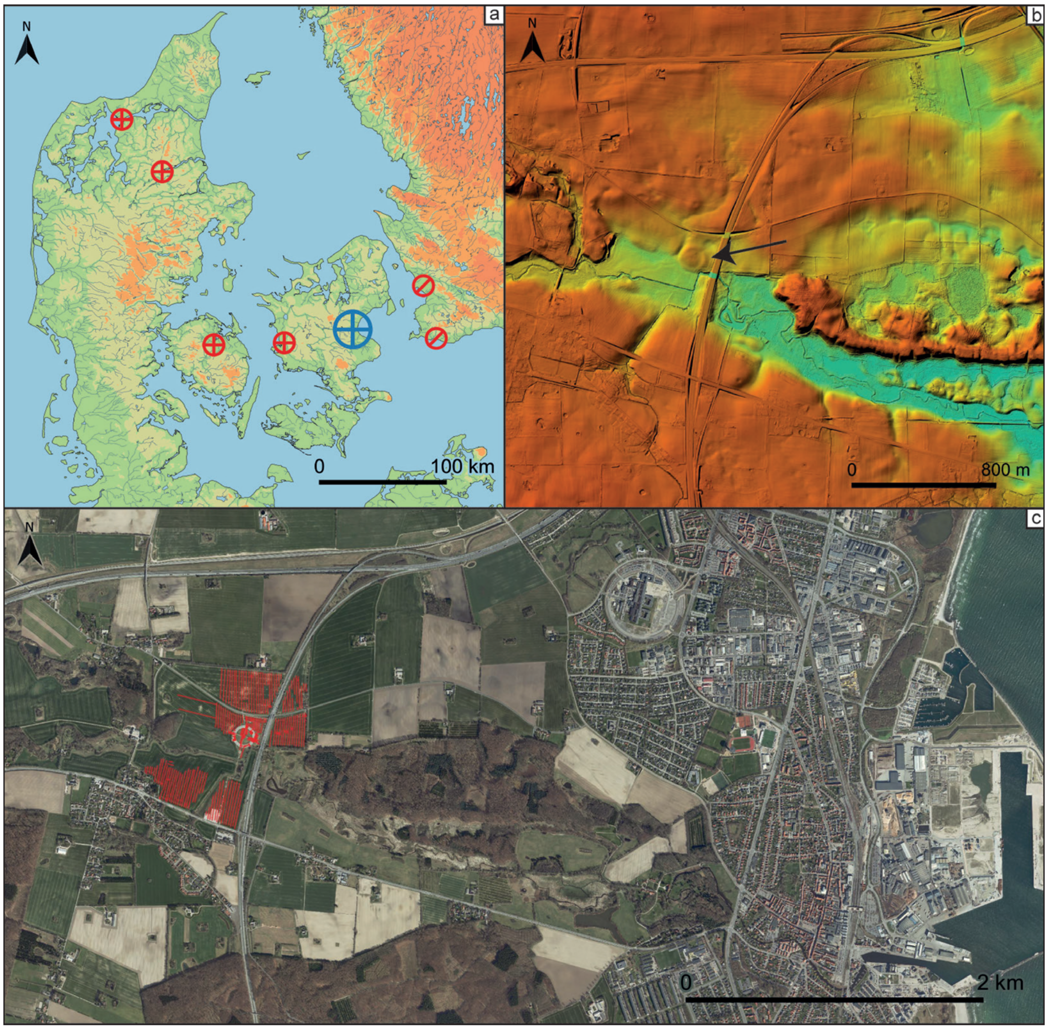


**Figure 1**. The location of Borgring: a) Map of modern Denmark and southern Sweden with Borgring (large symbol) and other Viking Age ring fortresses; the relationship between the fortresses in Denmark and the two sites in Sweden is not fully clarified; b) Lidar topography map of Køge river valley with Borgring (arrow); c) Aerial photo with overview of trial excavation trenches and survey areas (Graphics: Museum Southeast Denmark. Background map data: Danish Geodata Agency).

Borgring is located in a gap in the ridge almost 1 km wide, and positioned close to a natural crossing point where the valley is around 200 m wide (Figure 1b). The location is similar to that of other Trelleborg-type sites in that it is a dry yet well-defended site, in the proximity of major roads and crossings, near an entry point from the coast, and yet at some distance from the open sea.

The terrain where Borgring sits is surprisingly uneven. The northern area of the ring fortress is 8.5-9 m above MSL, while the southern half is characterised by a rather steep drop to around 5-6 m above MSL to the river valley. The gradient is almost 8 %. A creek in a steep gully on the western and north-western sides of Borgring, a waterlogged depression to the north-east, a valley to the east and the waterlogged Køge valley to the south has formed natural boundaries for the building site. The only possible access on dry ground was from the north (Jessen et al. 2021, 10). The topography of other Trelleborg-type sites varies from small promontories, which required major landscaping to create a level surface, to gently sloping hillsides. Borgring shows a far stronger relief, and it could hardly have accommodated a full set of large buildings, as in the other fortresses, without major levelling works.

Prior to excavation, Borgring was practically invisible in the landscape, resembling the initial situation at Aggersborg and Fyrkat in the 1940s and 1950s (Schultz 1949, 93; Olsen and Schmidt 1977, 53). Agricultural work, probably including deliberate levelling, had eradicated most of the structures at an early date. Nineteenth-century cadastral sur-

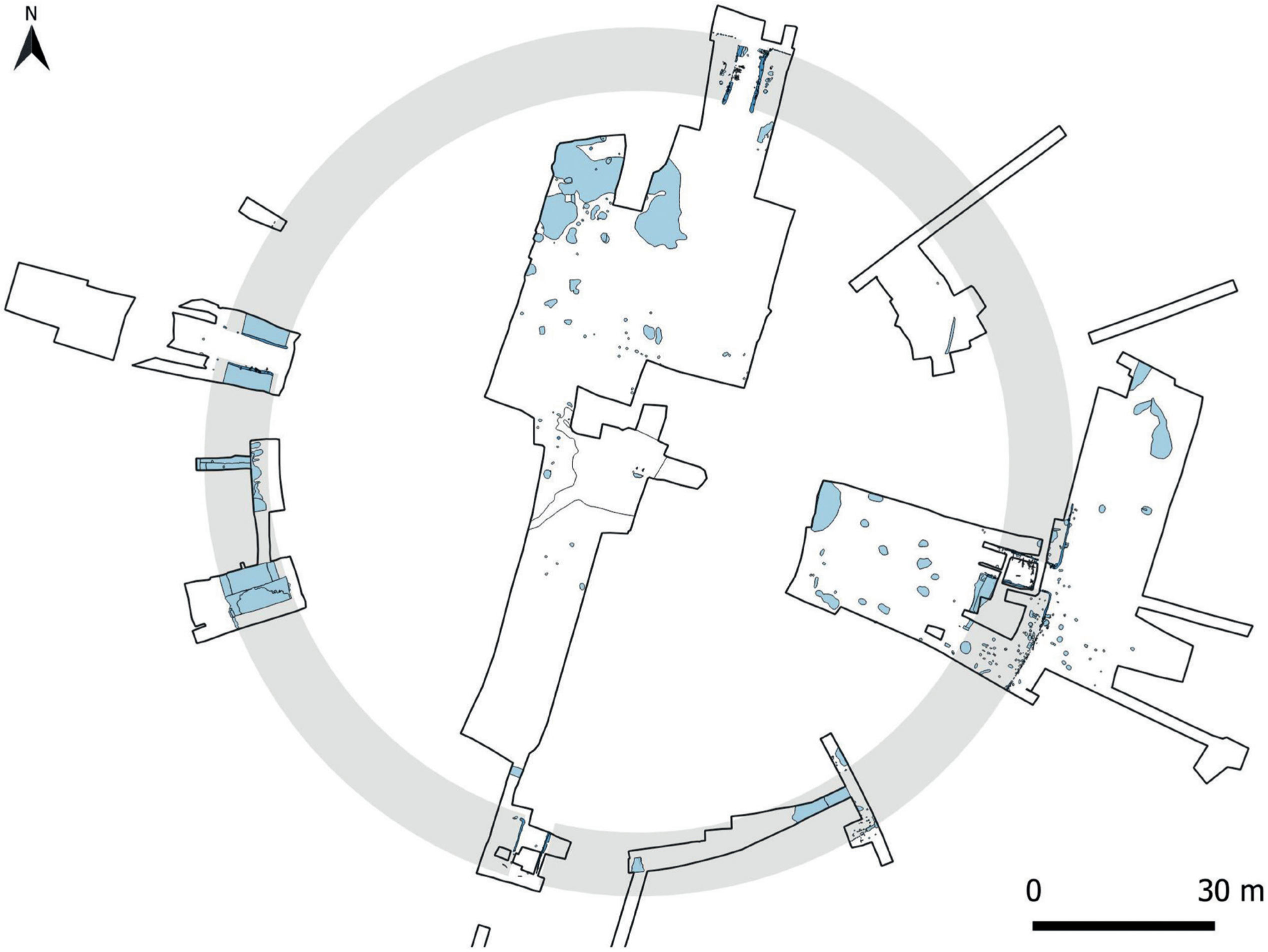


**Figure 2**. Site plan with outline of the monument, and indication of excavation trenches (Graphics: Museum Southeast Denmark).

veys failed to note any man-made feature (Geodatastyrelsen: Gl. Lellingegård), and only post-1970 aerial photography clearly reveals the presence of an earthwork (Christensen et al. 2018, 60). The excavations showed that the preserved height of the rampart varied from less than 0.25 m at the eastern gateway, where the structures were most heavily eroded, to *c.*1.1 m in the low-lying southern and western sections, where the structures were partly buried in post-Viking Age sediments.

The inner surface of the fortress was also exposed to erosion, though probably to a lesser extent than the rampart. The surface level could be established at the inner foot of the rampart, where it was protected by fill from the levelled earthwork (cf. Goodchild, Holm and Sindbæk 2017, fig. 6). Further towards the middle of the fortress, numerous pits from an Iron Age settlement demonstrate that the surface had not been heavily truncated.

Initial gradiometer surveys had revealed the outline of the rampart, but the excavations established closer details of the plan (Figure 2). The front of the rampart was studied in four trenches to the north, east, south, and west, and it was also encountered in six other trenches. The rampart was found to be a circle with an outer diameter of 144.5 m with no apparent deviation. Two straight lines between the centres of the four gateways meet at right angles at the centre of the circle, again with little or no deviation. The precision is remarkable considering the uneven topography, and must imply that the monument was planned out using an instrument for measuring horizontal lines, such as a groma, rather than simpler techniques, such as ropes laid out on the ground.

## The construction of the Fortress

The construction site did not immediately meet the demands of the planned ring fortress, and pre-construction levelling was necessary. In order to allow for the desired diameter of the ring fortress, the construction site had to be extended into the river valley, covering the slope of the creek's gully. Consequently, more than 1900 m$^3$ of clay-rich material with inclusions of old ceramics and flint-knapping debris were transported to the side of the river valley, the gully and to other depressions in the terrain in order to create space for the rampart and gateways. Additionally, a depression to the north-east was levelled before constructing the rampart (Jessen et al. 2021, 10). The modifications did not result in an evenly levelled building site, but functioned as a solid foundation for the ramparts and gateways to the south, west, and north.

### *The rampart*

The rampart was constructed in four separate but identical sections. Evidence from the south-western rampart suggests that an initial 0.1-0.3 m thick layer of dark and reddish turfs marked out the ground plan. The thickness of this layer increased gradually to *c.*0.7 m at the front of the rampart (Figure 3a). Additionally, radial sections were marked out by low humps of turfs in the bottom layer (Figure 3b and 3c). Radial sections higher in the rampart were seen as spaces of darker turfs shifting with spaces of lighter turfs. Some sections were 6-7 m wide, while others were 3-4 m (Figure 4). The borderlines between the sequences were seen in the pre-excavation gradiometry survey (Goodchild, Holm and Sindbæk 2017). The sections may reflect the organisation of the work force. Despite differences in colour, pollen analy-

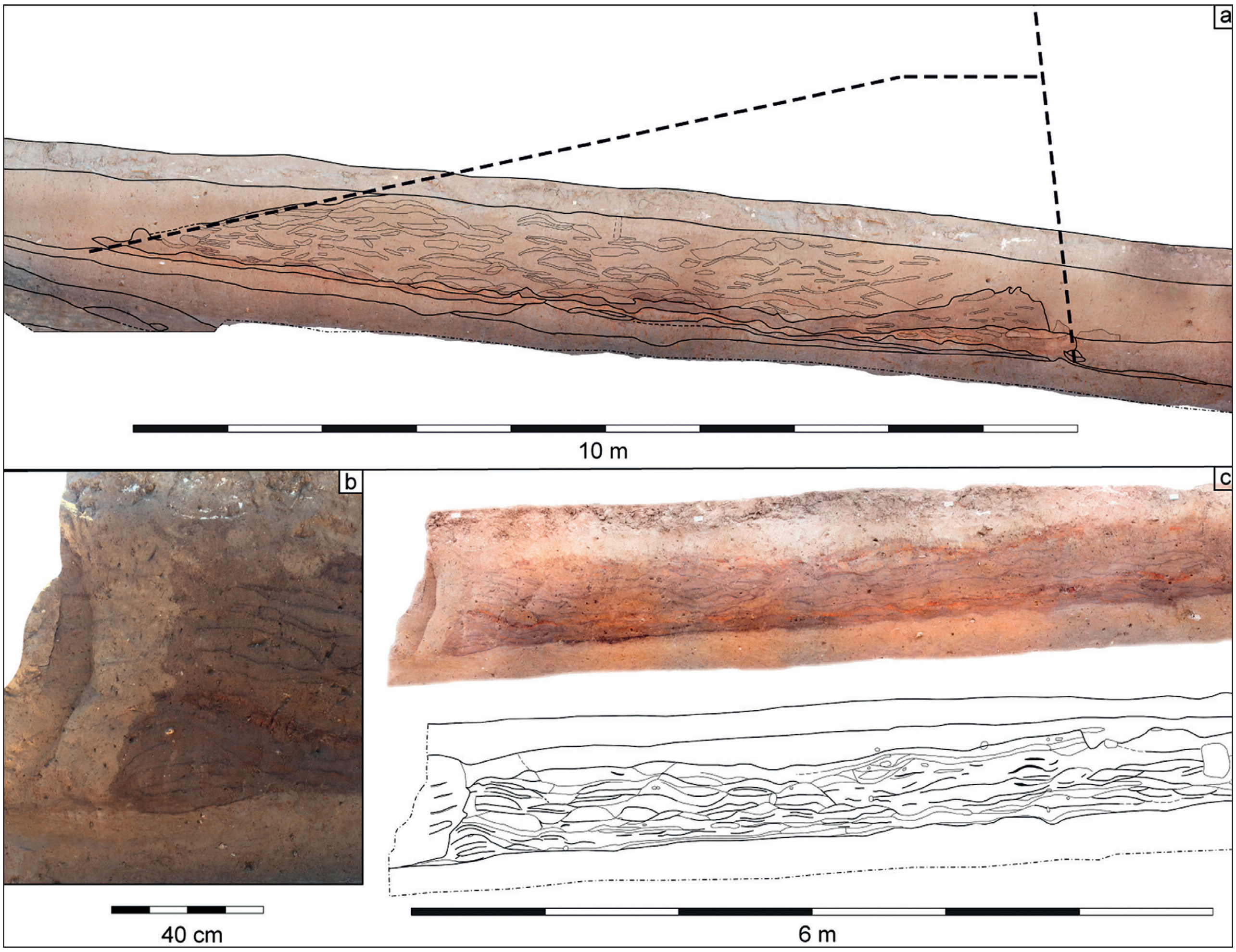


**Figure 3**. Sections of Borgring's rampart. Top: Section 75 (a). Individual layers and turfs are marked out. Note the low humps of turfs in the bottom layer. The reconstructed outline of the rampart is shown in dashed outline. Bottom: Detail (b) of section 76 (c). Note the change of texture between two building segments of the rampart (Graphics: Museum Southeast Denmark).

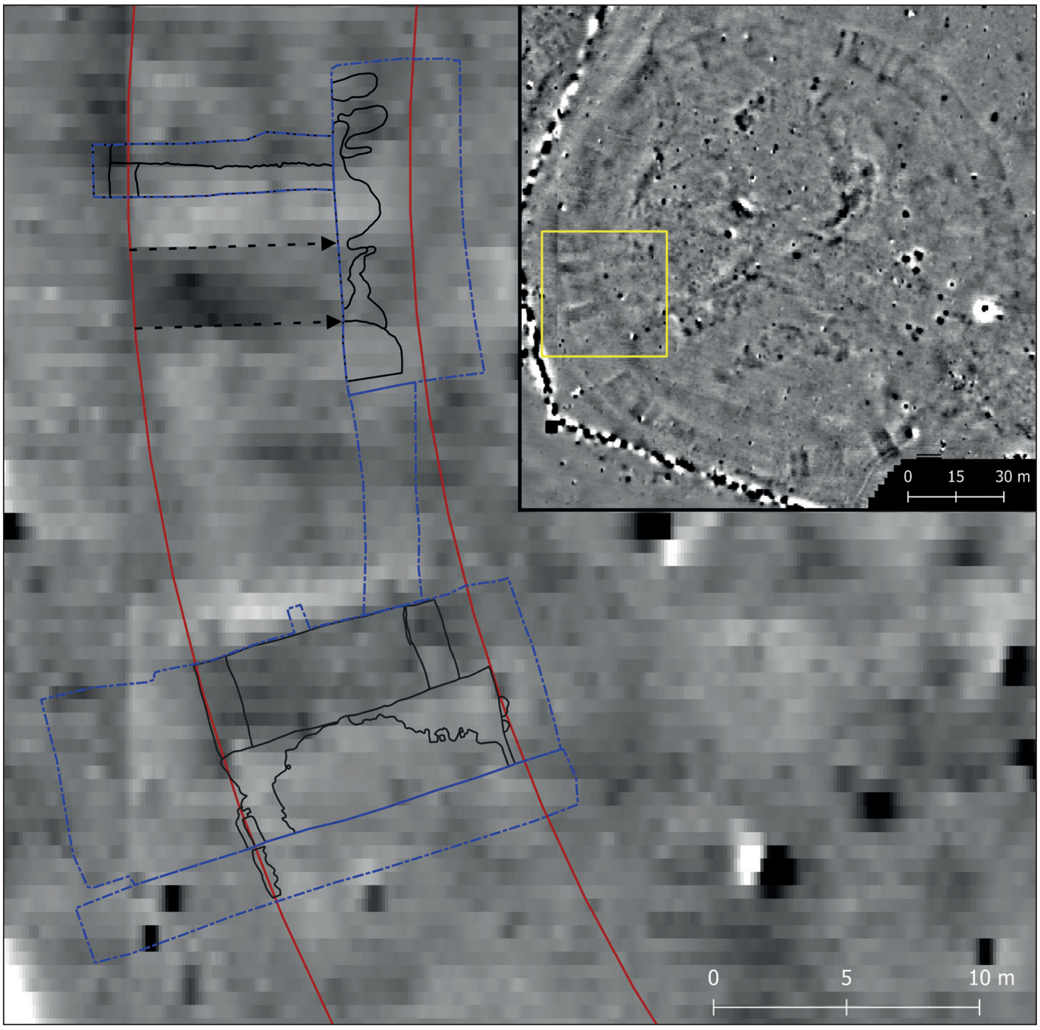


**Figure 4**. Plan of radial features in rampart, area 25 and 26. Red line: outline of the rampart. Blue lines: Excavation trenches. Black lines: Shifting colours of turfs in the rampart. Gradiometer map after Goodchild et al 2017 (Graphics: Museum Southeast Denmark).

sis showed that all turfs originated from dry grassland, probably cut in the immediate surroundings (Mortensen et al. 2021, 5-7).

At the eastern and northern gateways, there were postholes and at some points a <0.1 m-deep slot for planking along the front of the rampart, probably a footing for a plank cover (Figure 2). There was no ditch to the south-east, but the rampart's front was marked by an irregular pattern of redox imprints the shape and size of the ends of planks. If the imprints represent the actual size of the ends of the planks, these were *c.*0.29 m wide and *c.*0.11 m thick on average (Mortensen et al. 2021, 8). In the south-western rampart, neither redox imprints nor a shallow ditch were seen.

The original height of the rampart is unknown, but may have reached *c.*3 m at the front, which inclined *c.*70° towards the inside. The substantial amounts of soil found accumulated along the rampart were presumably part of the collapsed and/or levelled fill. There was probably a wooden palisade on the top of the ramparts extending the height by *c.*1.5-1.8 m higher (Mortensen et al. 2021, 6). The inner side of the rampart sloped to the surface of the courtyard. There were no indications of posts or planks at the inner face of the rampart, as seen at other Trelleborg-type fortresses, although observations in some areas suggest that the foot of the rampart may have been secured in some areas with a low fascine or similar.

## *The Gateways*

The four gateways were *c.*4.6-4.8 m wide, *c.*10.6-10.7 m long, and were constructed with four mas-

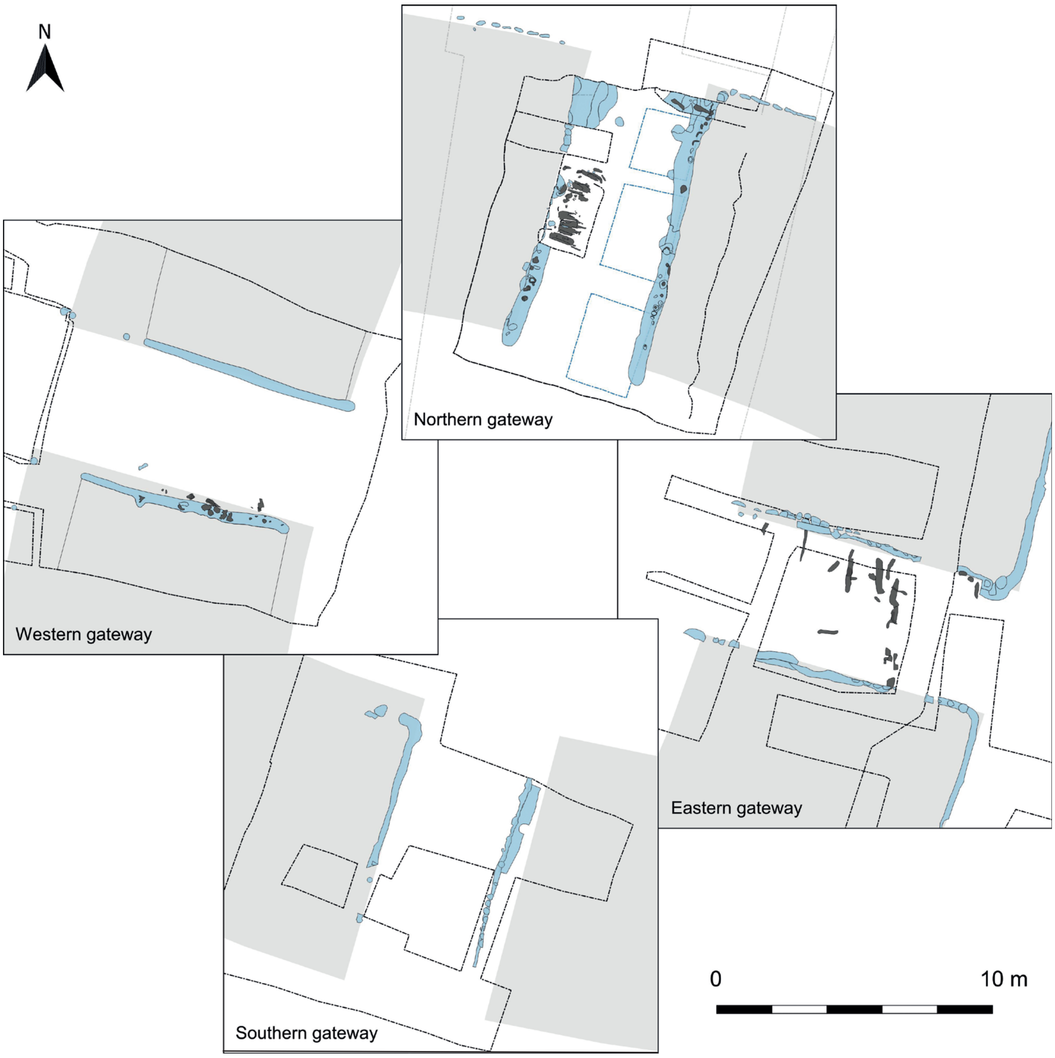


**Figure 5**. Simplified plans of the four gateways compared. Charred wood in solid black (Graphics: Museum Southeast Denmark).

sive corner posts and two parallel rows of posts along each side (Figure 5). The gateways seem to have equalled the height of the rampart and were roofed with wooden planks.

The northern gateway was constructed on a *c.*0.5 m thick layer of sediment purposely deposited in order to level out the natural terrain sloping to the east and north (Figure 6a). The western part of the gateway was left untouched by excavation except for the charred timbers already revealed in 2014. Instead, the excavation concentrated in the eastern part of the gateway, where three trenches separated by baulks were established and a trial trench from 2014 in front of the gateway was re-excavated (Figure 6b). All of the soil in the three squares was wet sieved using a 4-mm mesh. Objects were extremely rare in the tenth-century deposits, while the levelling layer contained Early Iron Age pottery.

The gateway followed a rectangular plan with a major posthole in each corner, connected by two parallel lines of smaller posts. Each posthole had a diameter of 0.2-0.3 m, and they were placed up to 0.1 m apart. The posts were dug into the 0.5 m levelling layer, from which only a few posts reached 0.1 m into the subsoil. The area of the gateway was reinforced with a *c.*0.15-0.2 m-thick layer of clayish soil laid out on top of the levelling layer. Signs of wear were absent. The clayish layer contained a fragment of a Gotlandic box-shaped brooch, a bead of blue glass, and some odd flakes of flint.

The northern gateway was most heavily affected by fire. Remains of collapsed and charred posts lay horizontally near the western side of the gateway. A number of charred timbers were found on top of the clayey layer, and reddened, heat-affected areas show that the fire must have been fierce. Most of the posts in the east wall were charred to some degree, but the

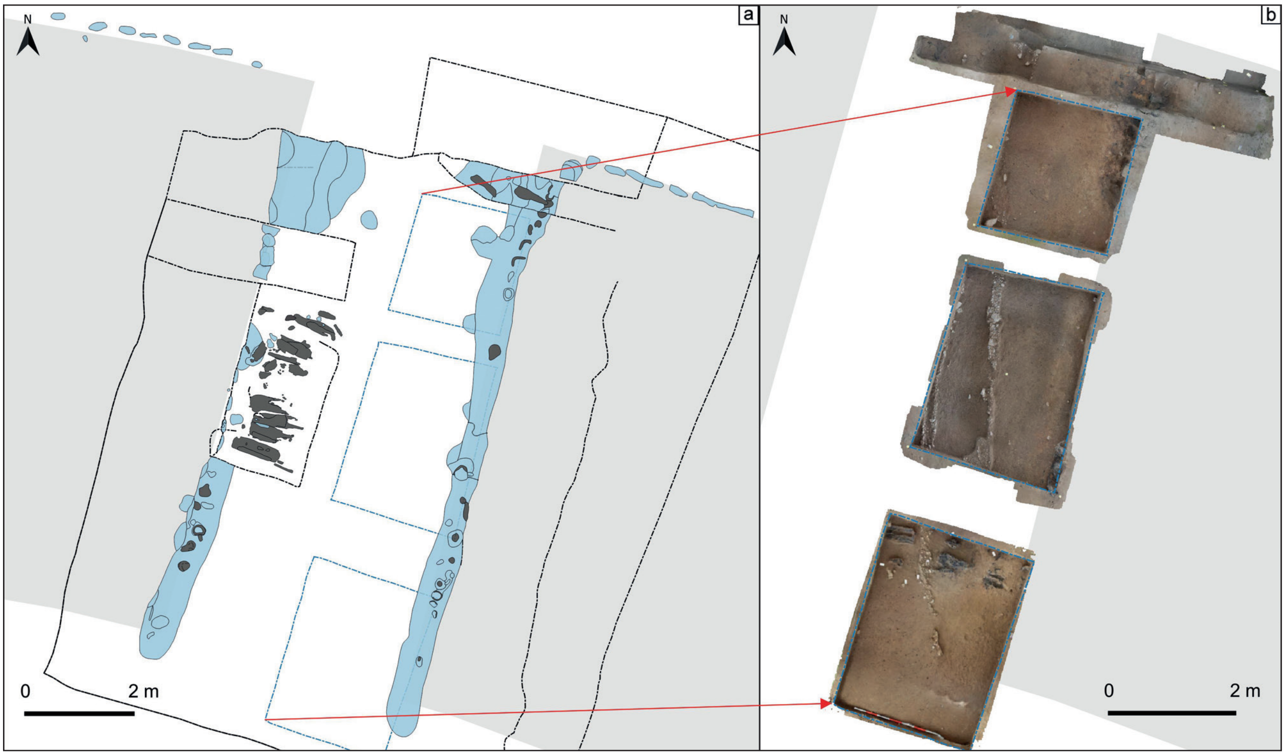


**Figure 6**. a) Plan of timber constructions; b) photogrammetry model of traces of wheel-tracks in the north gateway (Graphics: Museum Southeast Denmark).

large outermost corner-posts were unburned. In the west wall only the centre part was charred. Samples of the charred posts showed that eight were of elm (*Ulmus* sp.) and six of oak (*Quercus* sp.). The fire appears to have originated inside the gateway, since neither the corner posts nor the vertical cladding of timber on the front of the rampart was burned. Some of the timbers were only burned on one side, but in at least three areas, the timbers were completely charred and the clay around the posts had turned red from heat exposure. Several of the heavily burned timber posts had tilted towards the middle of the gateway, while the unburned and slightly charred timbers maintained a vertical position. The evidence seems to indicate that the northern gateway was heavily damaged.

After the fire, the walls of the gateway collapsed, and material from the rampart tumbled into the traffic area. At a later date, the gateway was evidently used by wagons as two *c.*0.2 m-wide and *c.*0.1 m-deep parallel depressions, 0.9-1.0 m apart, were clearly wheel-tracks reinforced with pebbles. Among the pebbles were sherds of Early Glazed Ware, dating the wheel-tracks to the first third of the eleventh century (see below). After this episode, the gateway was filled with soil that eroded from the rampart.

The eastern gateway (Figure 5) was discovered during the trial excavation in 2014, yet only a limited part was unearthed. It is situated where the terrain forms a land bridge between the river valley and the water-logged depression to the north and north-east. In 2016, the inside of the gateway was excavated except for two baulks across. The construction was 10.7 m long and 4.7-5.3 m wide – widest in the middle of the gateway. In the four corners were massive posts of up to 0.4 m in diameter; between these were two parallel post-built walls. They had been positioned in two parallel trenches and packed with soil and turfs. The excavation revealed that a fire had raged most of the northern wall. Charred remains of posts were visible as soon as the top soil was removed. A trench was excavated from the rampart-side leaving an east-west section of the outside of the gateway and therefore an overview of the charred posts and the construction. The wall posts were 0.16-0.25 m wide and 0.14-0.16 m thick, mostly of oak but elm was also present. The remains of the posts were *c.*0.45-0.55 m long and reached only 0.1-0.2 m into the subsoil. The remainder of the posts resided in Viking Age top soil and a reinforcing layer of clayey soil on the gateway floor. The majority of the posts had a charred crust of 1-2 cm solely in their upper parts, which were above the floor level of the gateway. An exception to this were the corner posts which had no traces of fire. At this point in the excavation of the gateway, the archaeologists were joined by the National Forensic Services of the Danish National Police in order to test methods of fire investigation on an old, archaeological fire site. A detailed description of the investigation and its results is presented in Ljungkvist et al. 2021.

Charred timbers were found inside the gateway lying perpendicular to the direction of traffic, just underneath the mechanically removed topsoil. The timbers must have fallen from the sides or down from the assumed ceiling or cross-beams. The burned timbers rested on a layer of clayish soil with no traces of fire except for an isolated spot of reddish clay and charcoal in the center of the gateway. These are probably the remains of a bonfire. Further excavation revealed the original reinforcement layer from the construction phase of the gateway beneath. This layer included larger chunks and pieces of charcoal. Along the northern wall, the surface of the layer was affected by heat. In this layer, a whetstone of grey schist was found together with a small piece of iron, perhaps the remains of a nail. There is no doubt that the fire in the northern wall commenced while the original floor of the gateway was exposed and that the wall did not collapse at this point. Instead, a second reinforcement layer or floor was added. This was intact in the northern and eastern parts of the gateway. In the southern part, the layers were more fragmented due to later disturbances. Here, three glass beads were found, as well as a part of an iron key for a sliding lock, a few uncharacteristic sherds of pottery, fragments of burned bone, and flint.

The above-mentioned bonfire may indicate that the fire-stricken gateway was used for short visits before the timber construction finally collapsed. Finds of Early Glazed Ware close to the bonfire indicates that this incidence took place during the first decades of the eleventh century and is closely connected to the cart traffic through the northern gateway. A similar re-use of a gateway closed for traffic was first documented at Trelleborg (Nørlund 1948, 60).

Very close to the bonfire, a collection of iron objects was retrieved. Originally the objects rested in a wooden box or cache that had been buried in a shallow pit dug through both layers of gateway floors. There is no secure stratigraphy revealing whether the cache was buried before the collapse of the timber construction or after, but it is more or less the last episode that took place in the gateway before the ring fortress was abandoned for good.

The southern gateway (Figure 5) was built on top of a 1.0-1.2-m-thick layer of sediment added to provide a more stable base for the construction than the underlying soggy sediments of the river valley. The size and construction was true to the scheme of the other gateways of Borgring, including the *c.* 0.1-m-thick clayish floor layer. But there had been no fire here.

Due to the damp environment, the gateway was expected to have potential preservation of its wooden construction. However, heavy draining during most of the twentieth century had desiccated the layers, and only minute pieces of the oak posts were found. The corner-posts in front of the gateway had been entirely eroded by the meandering stream (Jessen et al. 2021, 5).

No excavation was conducted of the western gateway (Figure 5) except the front corner-post facing the creek in the hope of finding wooden parts for dating. The hoped-for preserved corner-posts had, however, disintegrated. Otherwise, the western gateway was true to the layout and construction of the other three. This gateway would have opened directly into the creek. With the creek bed *c.* 3-4 m below the gateway, a bridge would have been necessary. No traces of such a construction was found, however. In order to determine if the western gateway had also been affected by fire, the topsoil was removed. Charred posts were observed in the southern side of the gateway, while the northern side bore no traces of fire.

Unsurprisingly, the evidence from the gateways witness that they were of similar size and construction (Figure 5). Differences between them are found in the traces of fire. The southern gateway had not been stricken by fire at all, while the three other gateways all bore the traces of fire. The northern gateway had both walls charred and witnessed the most severe collapse of the construction. In contrast, the western gateway had the southern side burned, but there were no charred debris visible inside the gateway. In the eastern gateway, only the northern wall had been on fire, but it clearly had not broken down immediately. A common trait is that the corner posts were unaffected by fire. Today, it is not possible to tell exactly where the fires started (Ljungkvist et al. 2021, 10). Taking all the evidence into account, though, there is nothing to indicate that the fires were related to an attack from the outside.

### The inside of the Ring Fortress

It was expected that inside the rampart of Borgring would be four blocks of houses divided by axial roads connected to the four gateways and possibly encircled by a road following the foot of the rampart. Despite the removal of the topsoil of *c.*28 % of the area, no traces of constructions from the time of the ring fortress were found.

A culture layer in a shallow depression and a number of pits and postholes dating from the first century BC to the sixth century AD were registered in the level northern half of the interior of the ring fortress. Four roof-supporting posts of a three-aisled house from the Iron Age were found when excavating the rampart close to the eastern gateway. It was partially covered by the rampart and three $^{14}C$-dates on charred grain from the postholes spanned the time between the 1st century BC and the first half of the 6th century AD. Further pits and postholes dating from this period were also present east of the fortress.

### The Fortress Plan

A key objective of the investigations was to test how closely the fortress related to the previously known Trelleborg-type sites (Figure 7) (Nørlund 1948; Olsen 1977; Nielsen 1990; Dobat 2013; Roesdahl, Sindbæk and Pedersen 2014; Runge 2018).

It is widely accepted that the Trelleborg-type fortresses were built to a 'Trelleborg foot' (tf) of *c.*29.5 cm. In this unit, the courtyard of Fyrkat has a diameter of 400 tf/118 m; that of Aggersborg 800 tf/236 m; the rampart and ring street of both fortresses adding 40 tf/11.8 m. Without the street, the rampart of Fyrkat is 36 tf/10.6 m (Olsen and Schmidt 1977, 70; Sindbæk 2014, 180). Trelleborg, in the last of several building phases, shows

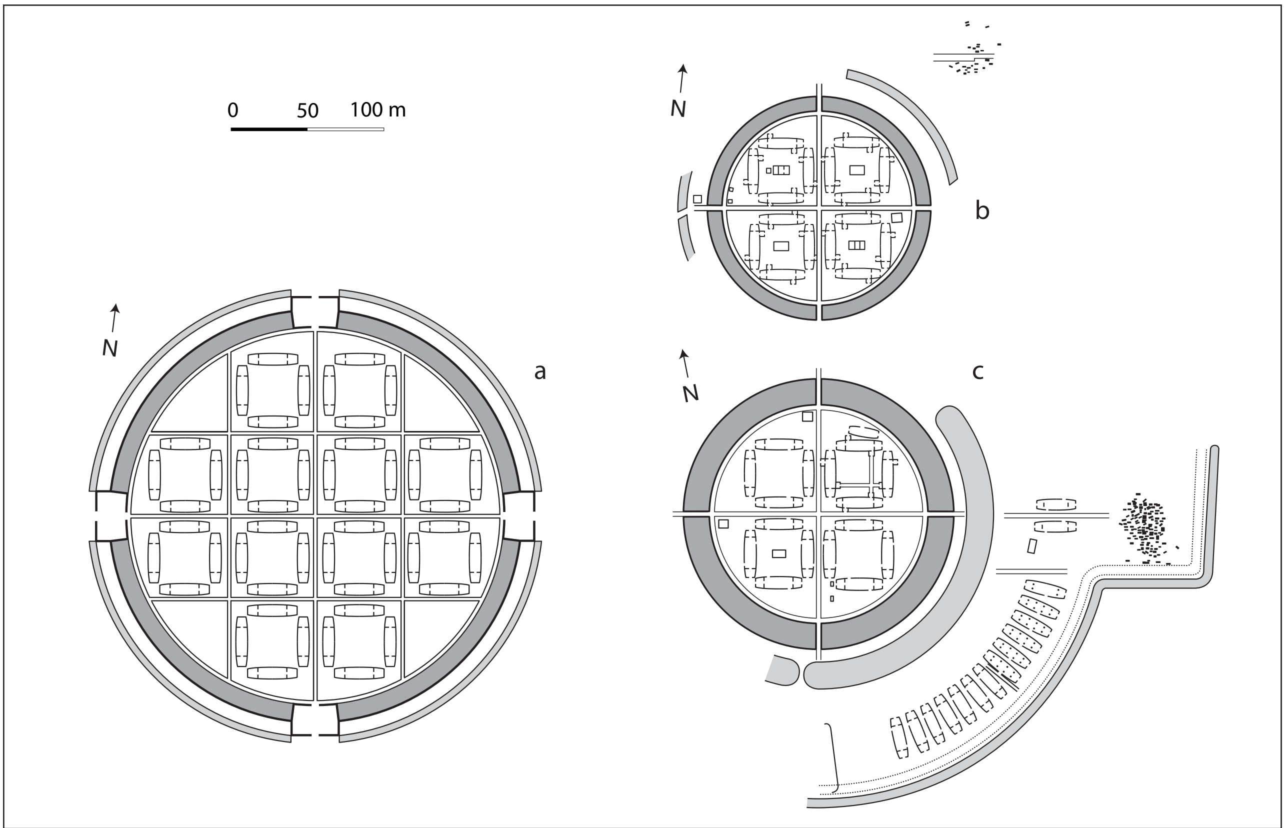


**Figure 7**. Reconstructed plans of the three most substantially excavated of the known Viking Age ring fortresses in Denmark: Aggersborg (a), Fyrkat (b), and Trelleborg (c) (Redrawn by Lars F. Thomsen after Olsen and Schmidt 1977).

a courtyard diameter of 450 tf/132.75 m, a ring street of 9 tf/2.66 m and a rampart of 60 tf/17.7 m (Nørlund 1948, 46).

How does Borgring measure up? The width of its rampart is exactly that of Fyrkat, 36 tf/10.6 m, while the mean width of its gateways is 16 tf/4.7 m (cf. below). The outer diameter corresponds to 490 tf/144.55 m. If a ring street of 9 tf was projected, as was the case at Trelleborg, the diameter of the courtyard would correspond to 400 tf/118 m, with a rampart and street of 36 + 9 tf on either side. Together with the strict geometry observed in the circular layout and the position of the gateways, these measurements strongly suggest that Borgring was planned and projected according to similar specifications, and likely by the same builder, as the previously known Trelleborg-type fortresses.

At most Trelleborg sites (possibly also at Nonnebakken, cf. Runge 2018), blocks of large houses, together with planked roads were found to complement the fortifications. Four large trenches with a combined area of 3410 m$^2$ were opened in Borgring's interior. They covered areas, where traces of as many as 12 houses and roads might have been expected, had the fortress followed the same plan as, for example, that of Fyrkat. Yet while cultural layers and pits from the earlier Iron Age settlement were preserved, no indications were seen of either houses or roads relating to the fortress. Instead, a shallow track along the rampart was found close to the eastern gateway and along part of the south-eastern rampart.

Given the strong slope in the southern half of the fortress, the absence of buildings in this area is hardly surprising. Though more appropriate space for constructions is offered in the northern half of the fortress, none were observed. While the size and layout of the fortress suggest that buildings may have been planned, and while the formation of the gateways certainly assumes axial roads, the excavation results must imply that these were never constructed.

The defensive qualities of the site were obvious: set between the river valley to the south and the gully formed by a creek to the west. To the north-east, a wetland depression stretched between the northern and eastern gateways (Jessen et al. 2021, 9). The site was thus mostly surrounded by wetlands. This resembles the situation at the fortresses of Fyrkat and Trelleborg, where only stretches of ditches were deemed necessary along part of the perimeter. No traces of a ditch were observed at Borgring.

Previously, the Danish ring fortresses have been associated with navigation because of their topographic location by streams or rivers (Dobat 2013, 34). In the case of Borgring, investigations in the river valley have concluded that the stream was too narrow and too shallow for Viking Age seagoing ships to navigate (Jessen et al. 2021, 12).

## The Finds

The excavations yielded a modest range of artefacts, of which many relate to the Early Iron Age settlement. The secure Viking Age artefacts include a cache of tools, a small axe, three whetstones, a fragment of a silver brooch, seven glass beads, and several sherds of Early Glazed Ceramics. In addition, several wooden objects, including a worked plank, dated to the tenth century, and a Viking Age type wheel hub were found in a test trench in the river valley.

### *Glass Beads*

Three round or cylindrical monochrome glass beads were found in the northern gateway (one blue, one dark red, and a small fragment of one transparent uncoloured), and two were found in the eastern gateway (yellow and blue) (Figure 8). These types are common in Scandinavia, both in the Viking Age and in earlier periods (Callmer 1977, 78). Also found in the eastern gateway is a fragment of a dark-blue cylindrical bead with a pattern of white rings formed in the mosaic technique (Callmer 1977, type G012) (Figure 8, far left). This type is common in the early Viking Age, but is also seen in later contexts (Callmer 1977, 90). Another polychrome glass bead was found at the bottom of the rampart, near the east gateway. It shows a pattern of yellow dots and white wavy lines on a black matrix (Callmer 1977, type B084). This type is most common in the tenth century. The date of the beads is thus consistent with that of the fortress, which indicates some activity at the site.


**Figure 8**. Glass beads (Photo: Jens Olsen/Museum Southeast Denmark).

## *The Silver Plate Fragment*

A small ornamented silver fragment was found at the level of the original gateway floor, underneath the burned layer of the collapsed northern gateway (Figure 9, right). It consists of a silver fragment decorated with ornaments inlaid with niello, a small piece of a bronze fastener, and a tiny piece of gold foil. The fragment is a part of a box-shaped brooch, a type originating from the island of Gotland, Sweden (Thunmark-Nylén 1983). It belongs to Thunmark-Nylén's type 7, characterised by gold- or silver-plate decoration (Thunmark-Nylén 2006, 75-7). It is the top part of a highly ornamented side piece, of which four would have decorated the brooch. It shows a decoration of two spirals meeting, rather than the knot motif, which is more common on these brooches. Fewer than 50 finds of type-7 box brooches are known. The majority have been found in Gotland, and only two are previously recorded elsewhere: one in Grave 4 at the ring fortress Fyrkat in Jutland (Figure 9, left) and one from Öland (Thedéen 2012). When comparing the finds, it is clear that the brooch from Fyrkat provides one of the closest parallels to the Borgring fragment (Hedegaard 2016; Roesdahl 1977, 137). The ornaments on the two pieces are not identical in all details, but a comparison with other examples from the Gotland corpus shows that the individual side pieces could show considerable variation within the same brooch. The coincidence between Fyrkat and Borgring is notable, since the production date suggested for this type by Thunmark-Nylén (2006, 87) is the early tenth century. The Fyrkat brooch, which was heavily worn and repaired, was thus an antiquity by the time it was buried at the fortress around AD 980. The Borgring piece also shows substantial wear. Three of the side pieces from the Fyrkat brooch are missing, and it is therefore not possible to establish if the Borgring find would fit. The possibility remains that it could have belonged either to this same or to a very similar piece of jewellery.


**Figure 9**. Silver-plate fragment from a box brooch (right) (Photo: Jens Olsen/Museum Southeast Denmark).
For comparison, the box brooch from Fyrkat grave 4 (left) (Photo: CC-BY-SA, Arnold Mikkelsen, The National Museum).

## *Tools and Iron Hoard*

A cache of tools and iron parts was found in a pit dug into the layer that sealed the fire horizon in the eastern gateway (Figure 10 and 11). The burial of the cache is the last incident in the gateway that can be identified before the final collapse of the construction.

When found by a metal detectorist after the removal of the topsoil, several objects of severely rusted iron formed an unmanageable conglomerate, which was consequently removed in a block in order to excavate in the laboratory. The cache was totally decomposed, but tinting from the wooden sides showed that it had measured 49 x 36 cm with 1-cm-thick sides and a 2-cm-thick bottom. The original height of the cache could not be estimat-


**Figure 10**. Iron hoard and whetstones (Photo: Jens Olsen/Museum Southeast Denmark).

ed, but together the iron objects measured *c.* 12 cm high. No hinges, lock parts, or fittings were found. Inside, the cache had been divided into three parts by walls less than 1 cm thick. In the middle was an 18-cm-wide partition, with a section of 14 cm on either side. Inside, the iron objects were found on different levels, and imprints of grass or hay on some of the objects indicate that they had been separated by straw. Two samples from the inside of the cache were analysed for macro fossils (Henriksen 2018). A large amount of bulky fragments of charcoal (up to 30 mm), mostly with sharp edges, suggests that it had not been exposed to traffic or redepositing. Among the charred remains were grain kernels from barley, rye, oats, and wheat, as well as different types of weeds typical for fields. There were also large lumps of organic material (up to 12 mm) fused together by heat consisting mostly or entirely of flaxseeds.

A total of 20 artefacts lay inside the cache. Some have been identified as tools, including a nail header, a plane, parts of a draw knife, a clamp, an awl, a fire steel, an oversized leister prong, a belt hook and ring, together with iron ingots, previously used clinker nails, and scrap pieces. Metallurgical analyses of the assemblage show that the bog iron probably derives from southern Sweden. An exception is the draw knife made of iron from Central Europe (Jouttijärvi 2017). All of the tools and ingots were made of high-quality steel by a skilled craftsman. Nevertheless, at the time of deposition most items were either heavily worn or fragmentary. So was a chisel or mandrel with a broken-off edge or point found 20-30 cm away from the other iron objects, probably due to post-depositional disturbance by agricultural activity. The artefact was made of the same type of iron and forged in the same high quality as the other items. Furthermore, two whetstones were found 10-15 cm to the north of the iron conglomerate: one small rectangular piece made from dark, fine-grained schist, the other a larger, less regular piece made from light schist. These may also have been part of the ensemble.

At best, the contents are scrap iron, and it could be argued that a smith hid the cache with his stock intending to retrieve it later. Buried in the earth, iron and steel do not have ideal conditions for preservation, but the artefacts seem to have been wrapped in grass or hay in the cache – perhaps extending the period of time before rust

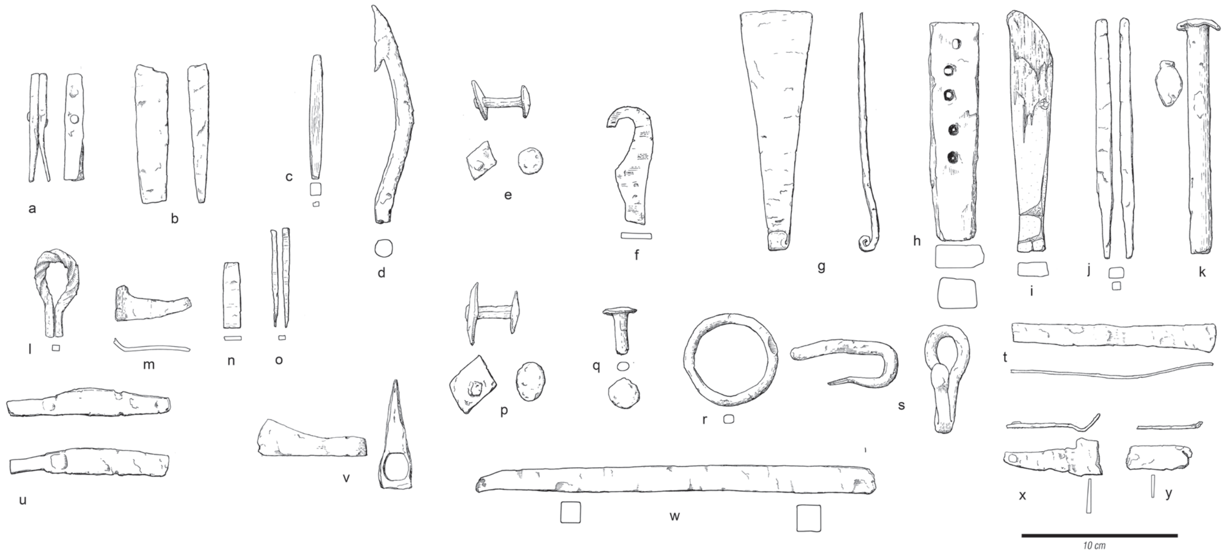


**Figure 11**. Iron hoard and whetstones. All objects of iron except c and i: schist whetstones (Drawing: Marian Frandsen).

formed. Their hiding place next to a bonfire may indicate that the gateway was used for housing by a smith, as there are no traces of a workshop. There is no other type of waste either, for instance, from cooking. As a peculiarity, the only type of pottery found near the bonfire was Early Glazed Ware. (Figure 12) This is hardly what would be expected as cooking pots in a modest residence. The typical pottery of the late tenth and eleventh centuries in Zealand is Baltic Ware, which is found in almost every excavation of farms or villages in the region dating from this period. At Borgring, however, it is absent.

Taking the contents and context of the cache into account, the find bears some of the traits of a ritual deposition of tools. According to Julie Lund (2006, 326), a tool-chest deposit typically contains hammer, anvil, and pliers, and additionally there may be a chisel, nail header, spoon drill, file, nails, or whetstone – representing the smith, the woodworker, and the shipbuilder. Furthermore, agricultural implements like blades from a scythe, sickle, or leaf knife may be present. The deposited tool chests are normally found in waterlogged areas, on the bank of a lake or a water course, or on dry land overlooking a waterlogged area, with deposits dating from the Viking Age (Lund 2009, 84-85). The Borgring cache does not match Lund´s definitions perfectly. The absence of hammer and pliers especially differs from other deposits of tool chests. Nevertheless, the content of the Borgring cache does have some similarities with tool-chest deposits and so has the context. At the ring fortress Trelleborg, a deposit of hammer, anvil, and pliers was found by the inner perimeter of the rampart to the north of the eastern gateway (Nørlund 1948, 140). According to Nørlund, a blade from a short scythe was found 'nearby', the distance being so short that Axel Steensberg subsequently suggested that the hammer and anvil had been used to sharpen the scythe (Steensberg 1943, 114). In other words, the four items may originally have been deposited together, combining the tools of a smith and an agricultural implement. The deposits from Borgring and Trelleborg were found inside or by the eastern gateway and are thus clearly connected to the monuments, which in turn are clearly connected to the banks of water courses and waterlogged areas. The Trelleborg find is dated to 980-995 AD (Lund 2006, Tab. 1), while the cache from Borgring must be from the first decades of the 11th century. Julie Lund has suggested that the tool-chest deposits are Christian rituals conducted in order to manage traditional pagan beliefs of transformation represented by the smith (Lund 2006, 336). By a ritualized burial of the smith's tools inside a truly Christian monument, pagan powers were neutralized.

Besides the cache of iron tools, a third large whetstone of light schist was found elsewhere in the eastern gateway, in the original floor layer. Alongside the whetstone was an iron fragment, probably part of a nail.

When the mechanical excavator removed the topsoil near the inner side of the east gateway, one very small axe was found. It is made from iron almost without any carbon, and it is peculiar by having steel present in the neck part instead of in the edge. It may have been a wedge with a haft instead of an axe (Jouttijärvi 2017, 2).

## *Early Glazed Ware*

Sherds of Early Glazed Ware were found in the eastern and northern gateways, in both cases in layers post-dating the fire (Figure 12). In the northern gateway, sherds were found in the wheel track; consequently, they were mostly very small and worn. The sherds from the eastern gateway were found in the youngest level of activity, beside a bonfire almost in the centre of the gateway. The sherds are fragmented and may represent just a single pot. They have a yellowish-green to bluish-green glaze on the outer surface and faint rilling marks on the inside, indicating that the vessel was wheel-thrown. Thin-section analysis of four sherds concluded that the clay derives from the Baltic littoral (Perry 2017, 4). Yet the mode of production is almost identical to that of 'Stamford ware', named after the area of production in southern England (Kilmurry 1980), suggesting that a Stamford-trained potter made the vessel (Perry 2017, 4-5). Similar Stamford-derived ware was previously identified in early-eleventh-century contexts from several sites in the region, including Roskilde (Ulriksen 2011, 107-8), Lejre, and Lund (Christensen et al. 1994). This is a rare and prestigious type of pottery in Denmark, as is Torksey-type-inspired pottery, which was also produced in Lund, Scania (Jönsson and Brorsson 2004, 171). It is suggested that it marks cultural transfer within the Anglo-Danish kingdom of Cnut (r. 1016-35) (Christensen et al. 1994, 75). At Borgring, they mark an important chronological phase, suggesting that some activity at the ruined fortress took place in the early eleventh century.

## The Date of the Fortress

The artefacts found at Borgring indicate activity in the tenth century, with finds of glazed ceramics from the early eleventh century found in layers following the destruction of the site. A worked plank (Figure 13) found in excavations in the river valley south of the fortress gave a dendrochronological date after 966 AD (no sapwood preserved), but this cannot be proven to be related to the fortress. No timber suitable for dendrochronology was found in the fortress. Two radiocarbon dates in the 2014 excavation gave an age from the late ninth to the early eleventh century (Goodchild, Holm and Sindbæk 2017).

In order to narrow down the time of the construction of the fortress, samples were taken for $^{14}C$ wiggle matching. Charred timbers from the northern gateway were examined to identify the wood genus and to find examples with many tree-rings. Five timbers were lifted in plaster blocks to be sub-sampled in a laboratory environment. Two charred planks from the western side in the northern gateway were selected for wiggle-match dating. Sample A901 was an oak plank with 33 identified

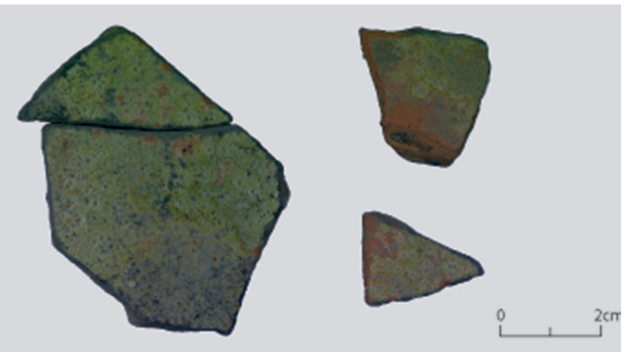

**Figure 12**. Sherds of Early Glazed Ware from the Eastern gate (Photo: Gareth Perry).

**Figure 13**. Plank and wheel hub found in the river valley (Photo: Jens Olsen/Museum Southeast Denmark).

growth rings. It was possible to identify the direction of growth of the original tree and to sub-sample single tree-rings. Six samples were dated from ring 1 (oldest), 3, 5, 28, 30, and 32 (youngest). Sample A905 was an oak plank with 36 identified growth rings. Again, the growth direction could be determined, and six samples were dated from ring 35 (oldest), 33, 31, 5, 3 and 1 (youngest). All charred remains are heartwood. No traces of sapwood were observed (Table 1).

The charcoal samples were processed using standard methods (Olsen et al. 2017). The results are reported as conventional radiocarbon ages BP, normalised to 25 ‰ according to international convention using online $^{13}C/^{12}C$ ratios (Stuiver and Polach 1977), and converted to calendar age using the international calibration curve, IntCal20 (Reimer et al. 2020). Further, a wiggle-match (D_Sequence model) is constructed using OxCal 4.4 to take into account the known age gap between the samples for each plank (Bronk Ramsey et al. 2001). The resulting calibrated age of the last ring for both planks (A901 and A905) are shown here (Figure 14). Oaks in northern Germany that have lived to be 100 years old have an average of *c.*15-30 sapwood rings (Hollstein 1980), a result that is also applicable to Danish oaks. The two samples dated here could be from younger trees, considering the relatively few rings that the preserved timber contained, which would mean that they might have had as few as *c.*10 sapwood years. The results indicate that the two trees at the northern gateway were felled after *c.*930, most likely in the second half of the tenth century.

## Outside the ring fortress

Investigating the surrounding area of Borgring was an integrated part of the project and altogether *c.*40 ha of land on both sides of the river valley was trial excavated (Figure 15) It was important to conclude whether there had been a settlement from the tenth century in the vicinity, a burial ground like those found at Fyrkat and Trelleborg, or any other archaeological remains contemporary with the period of Borgring.

Despite the large area investigated, there were no traces of Viking Age activity whatsoever. To the east of the fortress, there were remains of scattered houses $^{14}$C-dated by grain samples to the Late Roman Iron Age and the Migration Period, and on the hill to the north of Borgring were found the postholes of the walls of a single house from the fourteenth or fifteenth century AD.

On the southern side of the river valley, a three-aisled house was found close to the existing village of Lellinge. Both charcoal from beech wood and

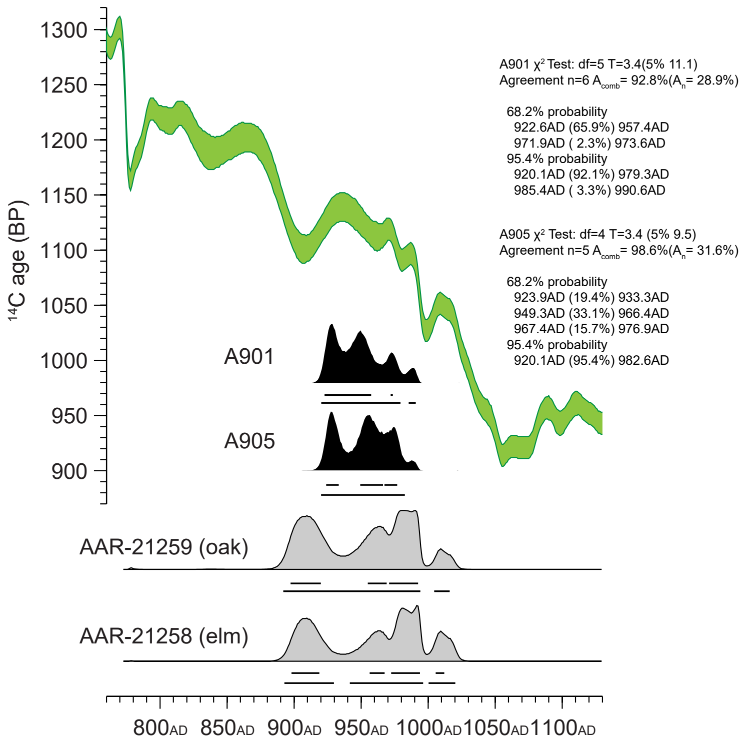


**Figure 14**. Radiocarbon wiggle-match model for the date of planks A901 and A905. The resulting calibrated age of the last ring. Below, the calibrated dates of the two previously dated samples from the 2014 excavation (AAR 21259 and AAR 21258). The new wiggle-match results constrain the date range significantly (Graphics: Jesper Olsen).


**Figure 15**. Map of trial excavations in the surrounding area of Borgring (Graphics: Museum Southeast Denmark).

charred grain were sampled from the holes of two roof-supporting posts and $^{14}$C-dated the house between the mid-third century AD and the beginning of the sixth century AD. Furthermore, a pit with sherds of Baltic Ware reveals activity here during the eleventh or twelfth centuries AD. Close by, a sunken road was uncovered, leading to a ford across the stream, indicating that the opportunity to cross the river valley was a likely reason to construct Borgring at this spot.

## Discussion: Power and Defence

Borgring was built in the second half of the tenth century along a geometric outline very similar to that of other Trelleborg-type fortresses. The site saw substantial landscaping before construction of the gateways and the rampart. The gateways were constructed with post-built walls like at Fyrkat and Trelleborg, and they were probably roofed. The rampart was a simple construction of turfs and soil with an outer timber cladding and no internal wooden constructions. No buildings or wood-built roads were seen within the fortress. Evidence of activity is minimal. After a short period, three of the gateways were damaged by fire, but only the northern gateway was severely affected. In each of the other two gateways, only one wall had been scorched. There are no traces of fire either on the inside or on the outside of the gateways, and this is also true for the timber cladding on the front of the rampart in the north and east. The four corner posts in each of the fire-stricken gateways were not charred at all. Put together, this indicates that the fires were not instigated by an attack on the ring fortress from people on the outside trying to get in.

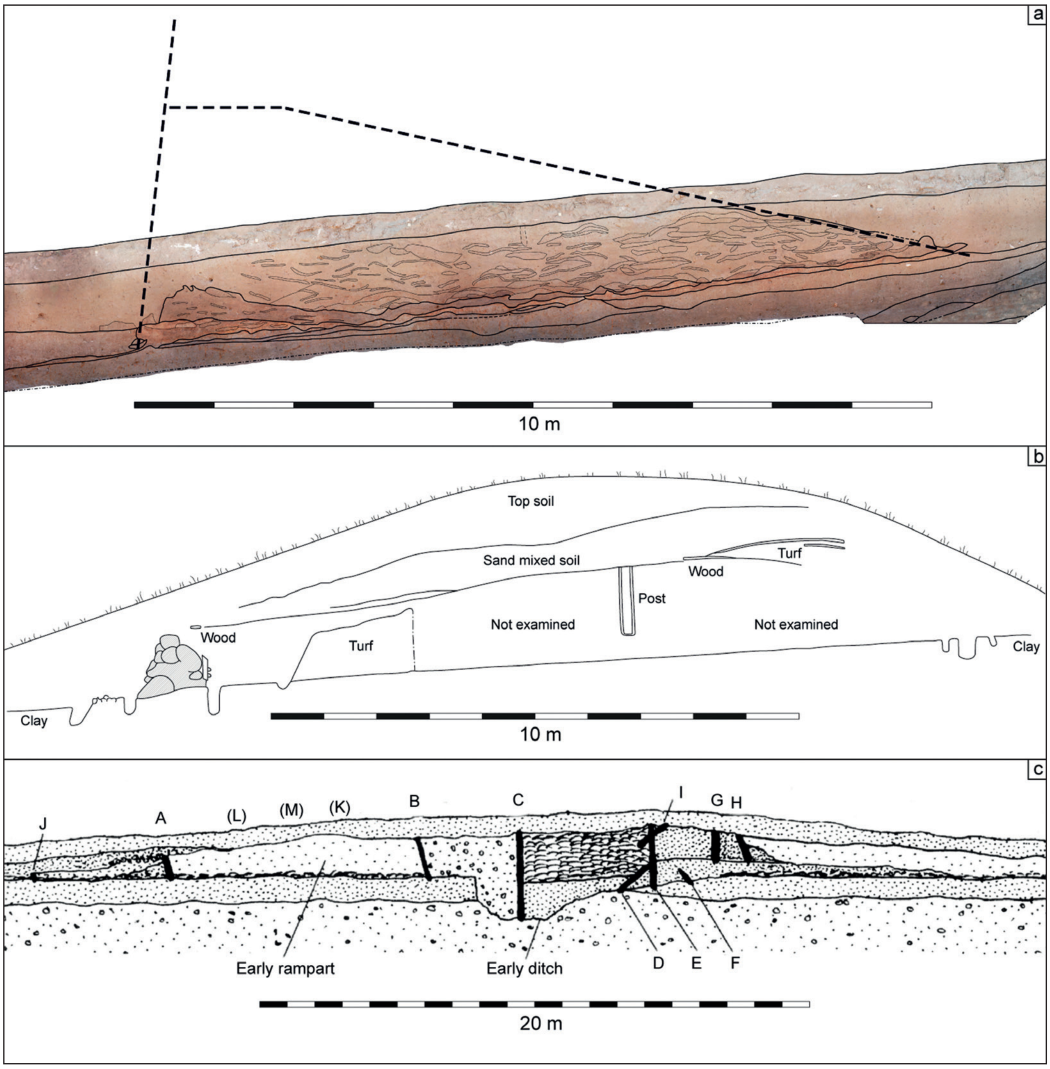


**Figure 16**. Comparison of Borgring's rampart (a, reversed for comparison) with those of b) Trelleborg (Zealand) and c) Borgeby (Scania). b) redrawn after Nørlund 1948 p. 50 fig. 30; c) after Söderberg and Svanberg 1999, s 24 (Graphics: Museum Southeast Denmark).

Despite the damage caused by the fire, carts or wagons used the northern gateway as a passageway into the ring fortress during the early eleventh century, and in the eastern gateway, a new floor layer was put in after the fire. The wheel tracks are probably contemporaneous with the use of the east gateway as temporary housing for one or more persons.

The planning of Borgring – including the choice of location, the pre-construction modification of the landscape, the layout, and the dimensions – matches other Trelleborg-type sites. These observations suggest that Borgring was indeed planned as part of the network of fortresses established across the realm of Harald Bluetooth. Excavation revealed some differences, though, indicating that Borgring was either left unfinished or was completed to an initial stage of use from which the other fortresses progressed. Compared to Fyrkat, which has almost the same diameter and the same width of the rampart, Borgring has no blocks of houses, no roads, and no ditches to the north and east, where they would have been appropriate. There was no timber-constructed framework inside the rampart, and the cladding of the front of the rampart was documented to the north, east, and southeast, but not in the western and south-western parts. The forensic investigation of the fire in the eastern gateway suggests that there must have been a gap between the rampart and the northern wall for the fire to develop as documented (Ljungkvist et al. 2021, 8-9). This may indicate that the rampart was not completed. Furthermore, no presence of either crowds of warriors or people in general could be detected. While activities at Fyrkat and Aggersborg have left rather few artefact finds at these sites

(Roesdahl 1977; Sindbæk 2014, 178), finds at Borgring are even fewer. It is an uncertain business to conjecture a reason for the construction's abandonment before completion. It may have been the last ring fortress to be established, so during the construction phase, it may have been considered needless and therefore abandoned. This point in time could have been the mid-980s, when King Harald Bluetooth faced a rebellion led by his son, Svein Forkbeard. According to late-twelfth-century chronicles, the uproar was ignited both by 'exceptional heavy burdens' that the king laid upon the people and as a reaction to the conversion to Christianity (Saxo 2000, 435; Aggesen 1842, Ch. 4). If the 'exceptional heavy burdens' were delivering materials and manpower for the building of the king's geometric signature monuments all over the realm, the construction of Borgring might have been the last straw. Following this hypothesis, three of the four gateways could have been set on fire as a statement by the opponents of the king, resulting in the site's abandonment.

Another explanation for the absence of several component parts typical of a geometric ring fortress is that Borgring was completed to an initial, provisional stage of use. This option is supported by the fact that the rampart of Borgeby in Scania bears a strong resemblance to that of Borgring (Jacobsson et al. 1995, 54; Svanberg and Söderberg 1999, 33-34). Moreover, a similar situation is also indicated at Trelleborg in Zealand. A section of the rampart shows what the excavator called a 'first line of defence' (Nørlund 1948, 53): an initial construction with a sloping turf rampart, clad with a timber front, similar to the construction at Borgring (Figure 16). The dimensions of the two ramparts were virtually identical. At Trelleborg, this construction was subsequently covered by more substantial earthworks, which did not happen at Borgring. The early planning and constructions at both sites, however, appear to have been closely comparable.

Borgring thus shifts the balance in the pattern marked by the Trelleborg-type fortresses. What makes these distinct among the fortifications of early medieval Europe is the concerted effort to achieve a recognisable standard in visual appearance across an entire kingdom. The results from Borgring and the perspective they allow at other sites suggest that the act of raising a fortress was more important than creating permanent lodgings for troops or a garrison. From a military and defensive point of view, the ring fortresses did not necessarily possess the most advantageous position in the vicinity where they were built (Ulriksen, Schultz and Mortensen. 2020, 9-12). Furthermore, four gateways instead of one weakens the defensive value of a stronghold. Even though some of the gateways had no practical function at Borgring, Fyrkat, and Trelleborg, because they opened into either natural or artificial obstacles, they would be the weak spots searched for by an attacking party. Instead, the effort expended in their construction may have been both symbolic and pragmatic. Contemporary sources picture initiatives such as the Wessex *Burghal Hidage* or Heinrich I's German *Burgenordnung* as an essential part of a ruler's obligation to defend his subjects (Blake and Sargent 2018, 120-154; Christie 2016, 52-67). The Trelleborg-type fortresses may signify a similar response.

In contemporary Saxon and Slavic wars, culturally and geographically close to Viking Age Denmark, large earth and timber fortresses served as refuges for the common population, especially in situations when the trained fighters left on expedition (Sindbæk 2020, 538). Crowds gathered in the fortresses were sometimes successful in holding back assaulting armies, thus avoiding being killed or enslaved. If, as sources suggest, Harald Bluetooth was challenged during the 970s, the ring fortresses may have been constructed to demonstrate vigilance to populations left vulnerable. Such a situation might fit the pattern seen at Borgring – constructed with vigour and subsequently little used.

Fortress-building, however, was certainly a show of strength in addition to providing protection. Borgring's location in relation to Zealand's landscape and communication routes was ideal to impress both locals and travellers (Ulriksen, Schultz and Mortensen 2020, 16-17). The monument stood at a crux of important land routes, virtually unmissable as a statement advertising the King's presence and power. The specific position chosen was ideally visible in relation to a major ford. The geometric design of this and other fortresses suggests the importance of the symbolism of power more than merely practical defence.

As part of the building programme of Harald Bluetooth, the construction and subsequent disuse of Borgring were gestures of power. It is tempting to relate the symbolism of the fortress buildings to the new order of society instigated by the conversion of the King to Christianity in *c.*AD 963, perhaps in a deliberate attempt to disrupt the older power structures in the region. The Borgring investigations thus add much to a revised understanding of the Trelleborg network and of the politics of fortification more widely.

## Acknowledgements

This work was funded by a generous grant from the A.P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til almene Formaal, with additional support from Køge Municipality.

This article is one of more contributions discussing targeted aspects of the results of the Borgring Project 2016–18 published in Danish Journal of Archaeology.

Language has been revised by Taylor Grace FitzGerald.

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## Supplementary

**Table 1**. Radiocarbon wiggle match of the A901 and A905 charred wood pieces.

see pdf-attachment

# 'The coldest case of all' – fire investigation at the Viking Age ring fortress of Borgring, Denmark

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**ABSTRACT**

During excavations of the Viking Age ring fortress Borgring, Denmark, traces of a devastating fire was uncovered. The National Forensic Services of the Danish Police were invited to participate in a novel collaboration, applying contemporary forensic fire investigation to an archaeological site. This paper presents the results and sets a benchmark for future applications. The investigation leads to a revised reconstruction of the fortress and the development of the fire. The application of fire investigation methods, following the Daubert standard criteria, enhance the documentation and analysis of archaeological sites, while archaeological methods show significant potential at modern fire scenes.

**ARTICLE HISTORY**
Received
11 September 2020;
Accepted
20 May 2021

**KEYWORDS**
Fire investigation; Daubert standard; Viking Age; Ring fortress; Interdisciplinary research

## 1. Introduction

The methods of fire investigation, as used in contemporary forensic science, are developed to analyse the material evidence of fire sites to understand the origin and cause of fires. Despite pertinence to problems commonly encountered in archaeology, the potential of these methods to archaeological contexts is only sporadically explored (Harrison 2013). Beyond individual experimental burnings to create analogies to compare with the archaeological record (Christensen et al. 2007; Harrison 2012), no systematic fire investigations of archaeological sites are previously reported.

During excavations in 2016 of the Viking Age ring fortress Borgring, Denmark, a major destruction layer with well-articulated, charred timbers, and other evidence of a conflagration were encountered in the east gateway of the fortress. It was realised that interpretation of these remains would require a full understanding of fire dynamics and familiarity with the structural evidence of fire sites. Accordingly, the National Forensic Services (NKC) of the Danish Police was invited to participate in the investigation. The unusual collaboration resulted in what was reported in media as 'one of the coldest cases of all' (The Huffington Post 05/July/2016).

The involvement of the NKC in the study was also motivated by the potential to develop technical fire investigation methods and to advance practical and theoretical approaches to the investigation of complex fire sites. The interaction with the archaeologists in the process of investigating a 'cold case' was recognised as an opportunity for method development.

This paper demonstrates how scientific methods of fire investigation can contribute to the characterisation and interpretation of an archaeological site. It reports the investigations of the fire debris examined *in situ*, together with technical analyses of the remains, and reviews their significance with regards to understanding the construction of the gateway, and the sequence and origin of the fire at the site.

## 2. Materials and methods

### 2.1. Fire investigations and archaeology

Fire investigations (DeHaan and Icove 2013) aim to interpret fire scenes to reconstruct how the fire has affected the materials and constructions. Fires leave a pattern of fire damage, and together with tactical information of significance for fire research and reconstructions, these are used to assess hypotheses. During the interpretation, the appearance of the fire damage is compared with conditions such as: which materials are burned; which materials are undamaged; and how much and where the materials are burned. This provides opportunities to assess the fire's spread and how intensive it was. This may then be compared to information on materials present prior to the fire (Drysdale 2011).

NKC defines the national standards for fire investigations in Denmark. In connection with this, NKC has authored the Danish Fire Manual (DBM), based on the *Best Practise Manual for the Investigation of Fire Scenes* authored by the European Network of Forensic Science Institutes (2016). The NKC follows the criteria of the Daubert standard (Pakkanen, Santtila and Bosco 2014; International Association of Arson Investigators 2017, 148) when assessing scientific quality. This defines the conditions under which forensic investigations can be applied in court cases, and calls for particularly transparent procedures of investigation and presentation.

The investigation report must reflect how the investigator has reached his conclusion regarding the origin and cause of the fire, including which considerations have been made along the way. Hypotheses and the process of elimination and verification of these are limited. Thus, hypotheses based on second- or third-order hypotheses are avoided. Relevant questions with regard to the criterias (NFPA 2012) are:

- Has the method, theory or technique been tested, peer reviewed, and published?
- What are the known or potential errors?
- Are current standards met, and how are these standards maintained?
- Is the method generally accepted in the scientific community?

In this paper, we apply the structure and standard of a fire investigation report, from observations and hypotheses to test and verification. A clear distinction is maintained throughout between assumptions, observations, and conclusions (Molander 1990; Tilstone, Hastrup and Hald 2019).

### 2.2. The Borgring excavations

In 2014, Borgring near Køge, Denmark, was identified as the fifth geometrical Viking Age ring fortress in Denmark, complementing an exclusive

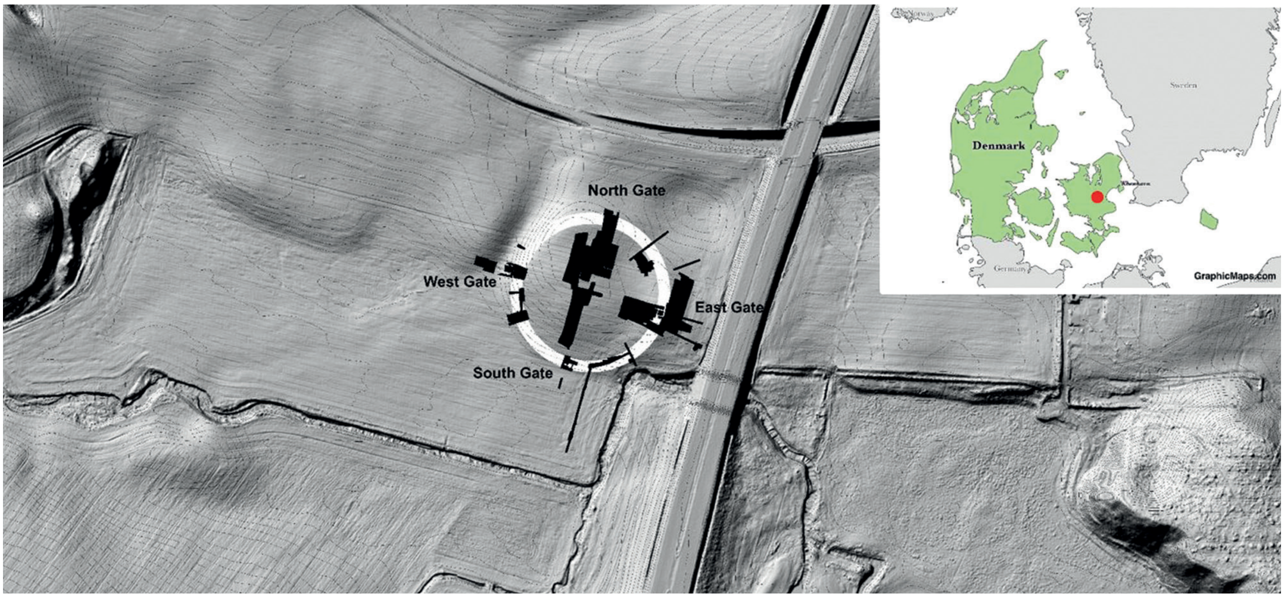


**Figure 1**. Plan of Borgring with indication of the areas of investigation. Cut-out: map of Denmark with the site marked in red (Plan: Museum Southeast Denmark).

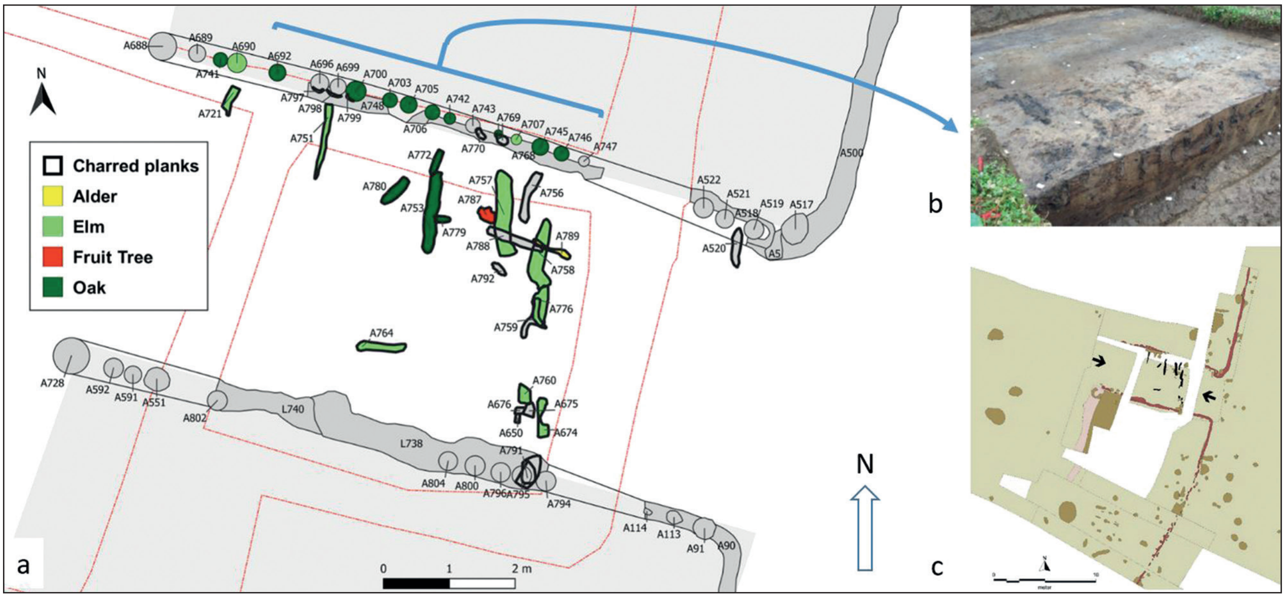


**Figure 2**. The east gateway with traces of standing posts in the sides and charred planks that has fallen into the doorway after fire. a) plan showing identified wooden structures; b) photo looking southeast; c) overview (Plans and photo: Museum Southeast Denmark).

group of monuments which includes the best-known example, Trelleborg (Goodchild, Holm and Sindbæk 2017). A major programme of excavations and surveys conducted by Museum Southeast Denmark and Aarhus University in 2016-2018 have examined parts of the ring fortress and its hinterland.

The excavations have uncovered a circular rampart built of stacked turfs with heavy, humic clay and a mixture of clayish subsoil (Figure 1). The rampart was preserved to a height of *c.* 1 m and describes a perfect circle of *c.* 454 m in circumference, with an outer diameter of 144.4 m and a width of 10.6 m at its base. Below some parts of the rampart, a >1 m thick levelling layer was spread to prepare the building site. The outer perimeter of the rampart is characterised by shallow postholes from a front of vertical timbers, while the inner side may have been sloped or stepped. The fortress had four gateways, oriented with great precision exactly 90° apart along the perimeter, and pointing approximately towards the cardinal points of the compass. Each gateway consisted of two parallel rows of postholes, creating a *c.* 4.6 m-wide opening through the rampart. Extensive excavations both inside and outside the ring fortress have not led to the identification of traces of buildings or permanent occupation. There were no traces of a moat, but the fortifications were strengthened by streams and wetlands on the western, southern, and north-eastern sides. Charred wooden constructions from Borgring have been $^{14}$C-dated to the 10$^{th}$ century (Goodchild, Holm and Sindbæk 2017, 1039; Christensen et al. 2021, 14-15).

### *2.2.1. The east gateway*

The east gateway was investigated in 2016. This part of the fortress was heavily eroded by agriculture, and only 20-40 cm of stratigraphy remained below the ploughed soil. Parts of charred posts were visible in the side of the gateway together with charred timbers scattered horizontally inside the gateway. The layers were excavated and documented individually, and part of the soil was water sieved in a 4 mm mesh, leaving behind two baulks across the gateway. A section was made along the northern side of the gateway in which the outer side of the postholes were visible.

The gateway was constructed with two parallel lines of vertical timber posts, one on each side of the entrance through the rampart (Figure 2). The gateway was 10.7 m long and 4.20-4.75 m wide as measured between the inner face of the timbers. The corner posts at the front of the ramparts were very substantial and deeply set, suggesting that a gate was placed here. The other posts were comparatively thinner and less deeply set in a trench or

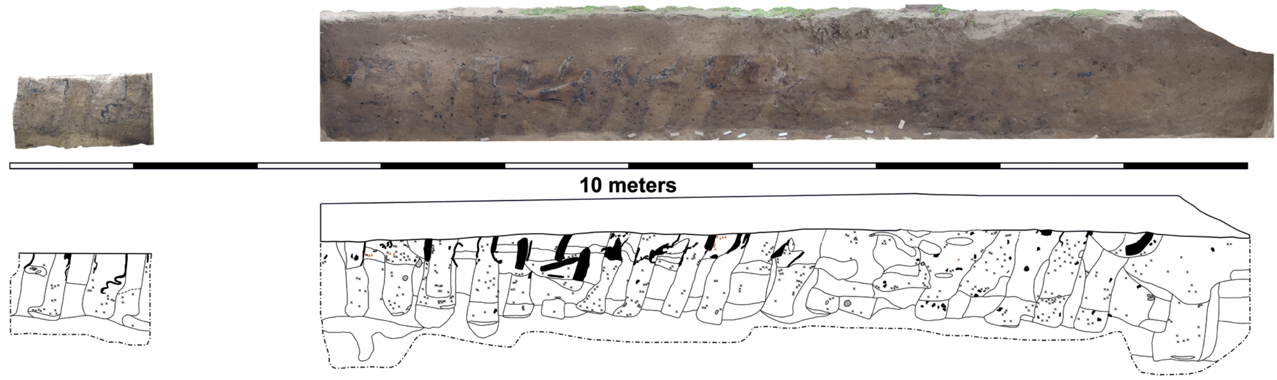


**Figure 3**. Section 51 along the northern side of the east gateway, looking south. Cuttings are marked in thin outline, charred wood in solid black (Drawings and photo: Museum Southeast Denmark).

pits dug 35-65 cm into the ground. The relationship between posts and rampart fill was investigated in several places, including section 51 (Figure 3). Here the turfs of soil are seen to touch the posts in both the northern and southern side of the gateways.

The posts in each side of the gateway had a diameter of 16-25 cm and were placed with gaps of 10-16 cm. The postholes were seen as charcoal-mixed, discoloured soil. Some of the posts were inclined, with the top leaning 10°-20° towards the inside of the fortress. Indications are that this must have been intentional, as the contours of the posts and the filling layers between them were without signs of disturbance.

Analysis of 32 samples of charred posts and timbers from the gateway show an eclectic use of wood: 13 samples were from elm (*Ulmus* sp.), one from ash (*Fraxinus excelsior*), one from alder (*Alnus* sp.) and one from fruit tree (*Pomoideae*), while the remainder were from oak (*Quercus* sp.) (Baittinger 2018).

The primary floor of the gateway was laid out as a layer of clay and humic clay, and the trenches of the gateway walls were dug through it. There were no traces of a plank road. Above this, the fill layers consisted of soil mixed with charcoal, and parts of charred timber planks. In the southern part of the gateway the layers were more fragmented and several depressions had been dug through the layers with burned timber.

Finds from the east gateway comprise a wooden box with iron tools and scrap found in a depression in the south-eastern part of the gateway. The tool cache was placed in a pit dug through the unburned layer, which was spread after the fire. In the same depression, whetstones and small sherds of Early Glazed Ware were also found. The ceramics places the layer in the very late tenth century or early eleventh century. Underneath the layers that showed signs of fire, in layers that are interpreted as being from the primary use of the fortress, a whetstone was found, while three glass beads came to light in a younger layer in the southern side of the gateway.

### *2.2.2. Other traces of fire*

The subsequent excavation in 2017-18 has shown that three of the four gates of Borgring were partially destroyed by fire. Extensive traces of fire were thus noted in the north gateway: the two sides of the gateway were visible as elongated features containing postholes and charcoal, and both sides were marked by fire. A number of charred timbers lay horizontally near the eastern side of the gateway. The north and east gateways show similar constructions with no demonstrable points of difference. The traces of fire also have a similar general appearance and led to substantial damage to the gate. The subsequent use of the two gates is different, however, with the north gateway showing use as a roadway.

Charred traces were also seen in the west gateway, which was uncovered but not excavated due to conservation considerations. Again, the fire does not seem to have affected the solid corner posts. By contrast, the south gateway, facing the Køge river valley, was fully excavated, but no evidence of burning was observed. The outer face of the rampart was investigated in several places, but no traces of fire were seen.

## *2.3. The fire investigation*

### *2.3.1. Investigation*

The scene of the fire was partially excavated by the time of NKC's first visit. Further visits to the site were made continuously as the excavation progressed, and four samples (KT 2-5) were collected for further analysis at the NKC laboratory. The study was concentrated to the areas at the posts along the sides of the gate, and to the floor of the gateway area. No studies were carried out on other parts of the fortress, but information from previous excavations in 2014 were available, and information on the subsequent 2017 investigation of the north gate was also taken into account for the assessment.

The objective of the fire investigation is an interpretation based on the traces found in connection with the excavation. The interpretation and assessment of the fire aims to understand a possible fire process and to form a picture of the construction of the rampart and the gateway. It is assumed that the construction was made from suitable materials (wood) and by accomplished constructors and good craftsmen. It is also assumed that activity in the ring fortress took place for a continuous period of time. These assumptions should be seen as a delimitation in hypotheses. Furthermore, weather, mechanical wear, and possibly impregnation treatment has significance for the verification.

### *2.3.2. Tactical information*

The excavation showed that a part of the gateway had been exposed to fire. Charred timber planks could be seen in layers inside the gateway, and the posts in the northern side of the gate were charred towards the side facing the gateway. There was no corresponding charcoal trail on the southern side.

No traces of fire were found to affect the outer wooden cladding of the rampart or the outermost post of the gateway (feature A517, cf. Figure 2). From the second post (A519) and further into the gateway, large amounts of charcoal were seen in and around the remains of the posts, together with heat-induced reddening of the clay (Figure 4). The sides of the posts facing the gateway were charred halfway around, while the sides facing the rampart were untouched by fire. A *c.*1 m-long stretch of the central part of the north wall had been affected in another way. Here, minor posts both standing and lying down had been charred all the way around, indicating that the air had been able to circulate on both sides of the wall.

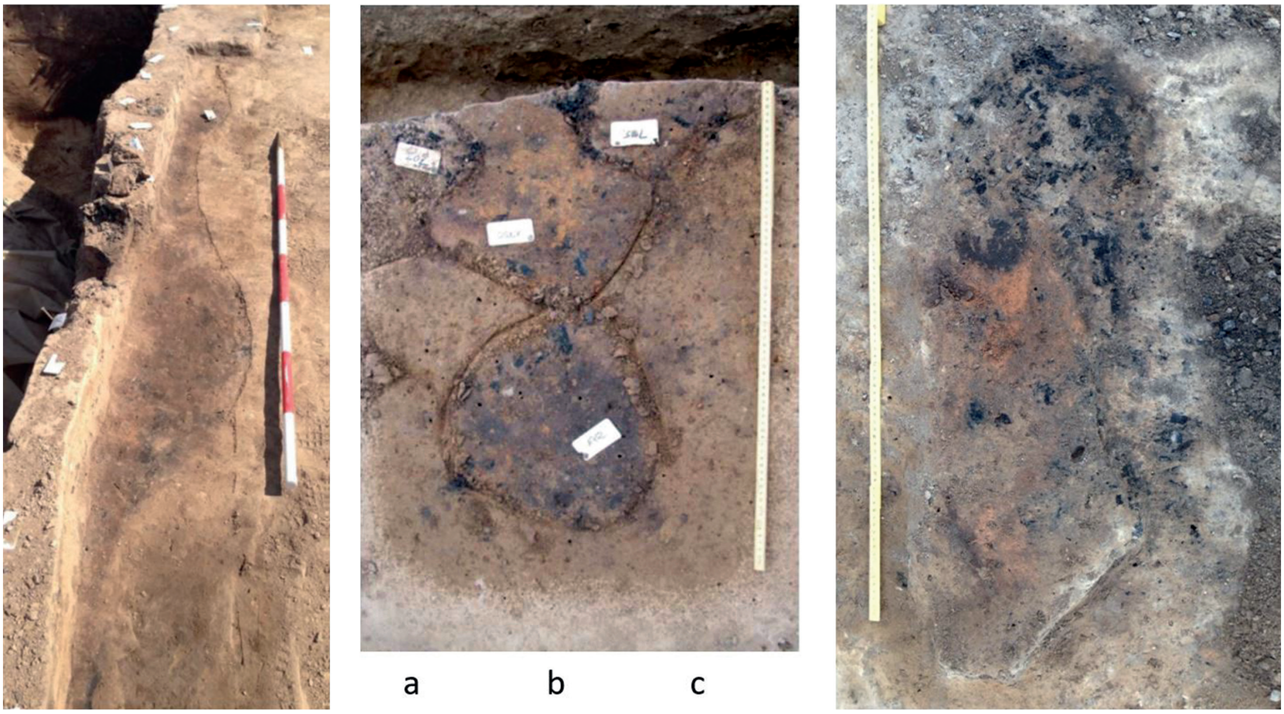


**Figure 4**. a) Strong red coloration formed by heat around the posts A697 and A699 (looking east) and b) posts A703 and A705 (looking north); c) Remains of a fireplace found approximately in the middle of the gateway, and used subsequent to the main fire event (Photos: Museum Southeast Denmark).

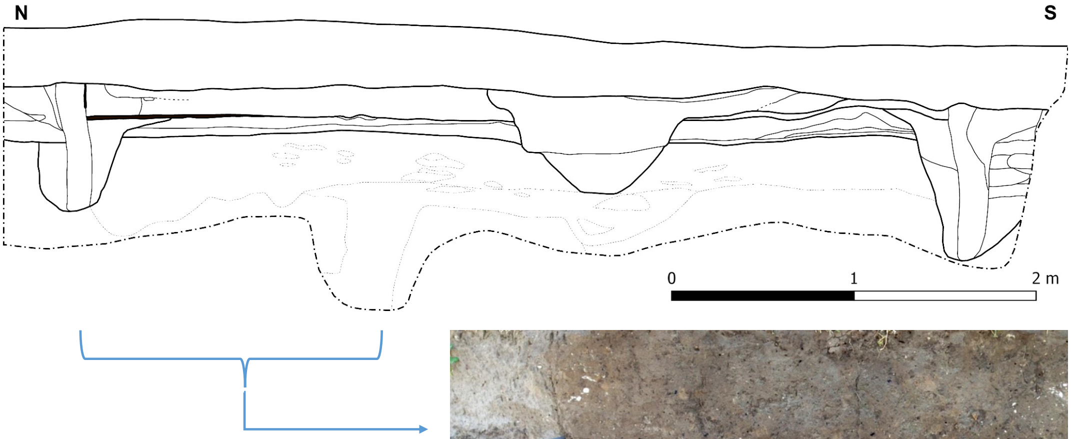


**Figure 5**. a) drawing and b) photo of detail of section across the east gateway, between posts A747 (left) and A794 (right), looking east. The blue arrow indicates the clay layer spread out after the fire. The red arrow shows the horizon of the fire, and the yellow arrow shows the original roadways through the east gate. Underneath is the original surface (Drawing and photo: Museum Southeast Denmark).

In an area in the middle of the gateway, at a level from above the original floor, the posts were seen as an outer shell of charcoal with a thickness of 2-5 cm, while the core was filled with sandy soil. It was clear that the outside of the post had been charred by fire, while the core had not burned. The rest of the posts had slowly decomposed and gradually been filled in. Below the original surface there was no shell of charcoal, and the remains of the posts below ground appear to have slowly decomposed, leaving only soil with bits of charcoal, which had sunk down from layers above.

The observations of fire damage to the posts in the northern side of the gateway can be divided into three groups:

- Unknown position on posts
- Posts charred on all sides and found in a leaning position
- Posts charred on the side facing the gateway, i.e. halfway around

The stratigraphy inside the gateway is documented by a cross section *c.*2 m from the front of the gate (Figure 5). In the top of the fill were visible remains of charred wood pieces, which were mostly oriented across the gate. These pieces of wood had the size and character of planks with widths ranging between 12 and 25 cm. Under the charred planks was a compact layer of clay. In the northern part of the gateway, this layer was found to reach to the charred posts, yet without being affected by heat. A fireplace was found approximately in the middle of the gateway, showing a hard-burned red mantle formed in the clay.

As excavation continued, a layer of soil strongly mixed with charcoal was uncovered, in which the clay was reddened by fire. Around the posts A697 and A699, *c.*6.5 m inside the gateway as measured from the outer face of the rampart, a strong red coloration was seen in the fill layers. A similar coloration was seen around the posts A809 and A747, just 3 m from the front of the gateway. Apparently, only the northern side of the gateway had burned. On the southern side there were charcoal pieces in the ground, but no charred, standing timbers were detected.

### *2.3.3. Reconstructions*

At a modern fire site, investigators typically have a full knowledge of the constructions and their properties and dynamics. In an archaeological site, these factors are often subject to uncertain reconstructions. A reconstruction of a Viking Age fortress at Trelleborg, Sweden (Figure 6), gives an estimation as to what the constructions at Borgring may have looked like, as a basis for assessing the fire (Jacobsson et al. 1995).

Another important factor, the behaviour of wooden constructions in contact with soil, has been studied by Hansson (2010). This study shows no correlation between the climate at a macro level in various years and the lifetime of the wood. Other factors were of greater importance: fungal attack, the micro environment, and the durability of the wood species. All woods have a certain natural resistance to rot, but there is great variation between different wood species, as well as differences in each wood with respect to sapwood and core wood. Decomposition of wood occurs either through biological, mechanical, or physical factors (e.g. UV rays and wind).

Structural protection of wood may be achieved through specific constructive solutions that remove or reduce one or several causes for wood degradation. It is known (Trulson 2008) that heat treatment/burning has been used to protect wooden constructions. This burning prevents the wood from decaying by altering the chemistry of the wood, resulting in a better protection against fungi and rot. The appearance of the wood changes, and the wood becomes more brittle and consequently is less useful in load-bearing structures.

Considering the charred timbers from the east gateway of Borgring, detailed investigations of samples have demonstrated that they had a uniform appearance: the examined pieces had a charred crust of 2-4 cm and the cross section appeared with a curvature (Figure 7). After the fire, they seem to have been untouched until the fortress was abandoned. Eventually, the inside of the timbers rotted away and was replaced by soil.

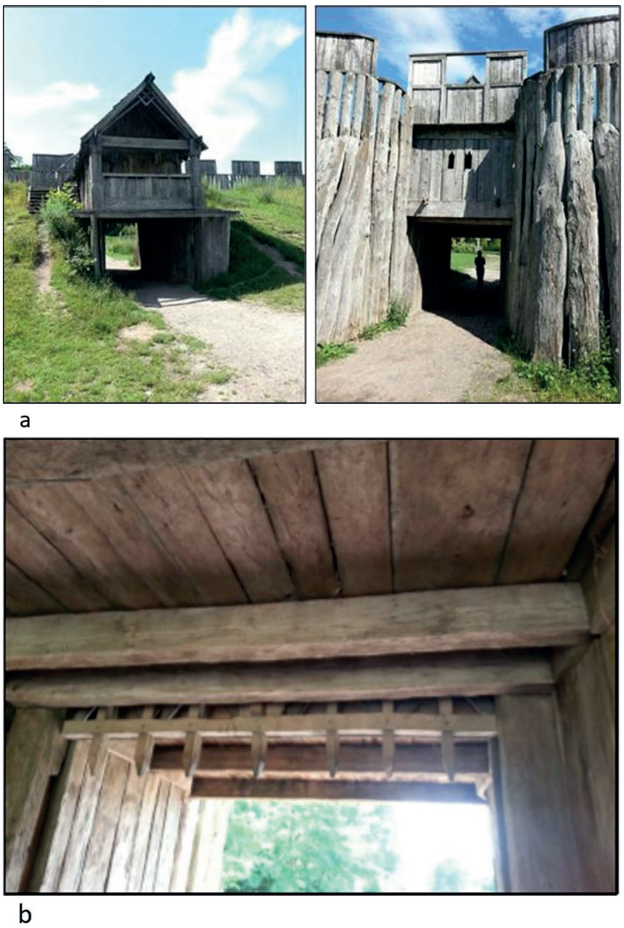


**Figure 6**. References for fire investigation. Gateway of reconstructed fortress at Trelleborg, Sweden. a) view from inside (left) and outside (right) the gateway; b) roof cover from inside the gateway (Photos: NKC Photo).


**Figure 7**. Detailed investigation of charred timbers from the east gate of Borgring. The examined pieces had a charred crust of 2-4 cm and the cross section appeared with a curvature (Photo: NKC).

### *2.3.4. Hypotheses*

Based on the investigation at the fire scene, together with the tactical information, the following hypotheses may be pointed out as being relevant for the case (Figure 8).

*The construction of the gateway:*

- Model 1: Fully completed (as in the Trelleborg reconstruction, cf. above) construction in two levels
- Models 2A and 2B: Simple gateway with plank cover, either with or without soil above, possibly in a partially unfinished state of construction
- Models 3A, 3B, 3C: A ruined state, in three different stages


**Figure 8**. Models of the east gate in different stages: 1: Fully finished construction. 2A: Almost finished construction with roof and with soil cover. 2B: Almost finished construction with roof, but without soil over. 3A: Partial ruin with roof over some places. 3B: Partial ruin without roof. 3C: Ruin (Models: Eva Ljungkvist NKC. Photo: Johnny Thomsen NKC).

*The origin of fire:*

- Hypothesis 1. From the west (inside the fortress) and moving into the gateway and up
- Hypothesis 2. From inside the gate and on to the west (inside the fortress) and east (outside the rampart)
- Hypothesis 3. From the top of the rampart and moving along the sides and then into the gateway
- Hypothesis 4. From the east (outside of the rampart) and moving into the gateway and up
- Hypothesis 5. A combination of several of the above simultaneously

*The sequences of the fire/-s:*

- One fire
- Two simultaneous fires with controlled and uncontrolled fires respectively
- Two fires with time separation, either:
  – Controlled fire first, or
  – Uncontrolled fire first

A controlled fire is defined in this report as a fire that is managed in terms of spread and intensity, such as a bonfire.

*2.3.5. Assessment*

In reconstructing what the gateway looked like before a fire, observations of the fire residues can be interpreted in several ways. Besides observations of the actual fire debris and unburned construction remains, it is important to emphasise what cannot be seen during excavation, for example roof and walls. The apparent absence of things may have several causes:

- They were never part of the design, or
- They were removed or decayed over the years, or
- They were not recognised, albeit there may have been traces of them on site

2.3.5.1. Constructions

*The function of the posts:* The posts in the side of the gateway may have had several functions in the construction of the gateway: to keep the soil from the rampart in place or to carry a roof. The remnants of posts found show that the posts were placed at a certain distance. As such, they cannot have kept the fill of the rampart in place by themselves. If, as is likely, the rampart was built from stacked turfs, it could have stood without further support. As the posts are not very deeply entrenched in the ground, the most obvious interpretation of their function is that they were to carry a roof above the gate. As the turfs are seen to lie directly against the posts, the wooden gateway structure must have been erected prior to the construction of the earthen rampart and may have been completed, even if the rampart itself was not.

*The side walls:* The posts have a charring all the way round, and the finding supports the hypothesis that the oxygen needed for the combustion was in place, and that the posts were thus not totally nor partly covered by soil. If, on the other hand, the posts supported horizontally mounted planks or some other dense construction to hold the soil in place, it would be expected that residues of the horizontal planks would be found, and we would expect to find uneven fire damage to the posts. The fire damage suggests that there could hardly have been a planked wall, as it would have prevented the uniform charring all the way around the upright posts seen in the east gate. The charring requires air supply around the posts from the ground surface and up.

A more open design, such as a fill of horizontal rafters or wattle, might explain the charring of the posts on all sides. The irregular uncharted branches and rafters would allow oxygen circulation and at the same time be combustible. However, the observation of turfs touching the posts makes this option unlikely. In conclusion, the posts must have stood with no further cover or fill, partly leaning against the turf wall, partly (in the middle of the gateway) with some distance to the soil rampart.

*The roof:* The sequence of events of the fire testifies that there were, as a minimum, transverse beams above the gateway that tied the vertical posts at the sides together. It is unlikely that a clay floor could have been maintained or that the posts in the gateway withstood pressure from the soil unless they carried a roof across the gateway. From the above argument, model 1 does not seem likely.

The residues of planks found lying across the gateway may have come from a roof. However, if the roof construction was more elaborate, it would be expected that more timbers in different dimensions would have been found. Several posts were found with the top leaning to the west. The shallow depth may have made the structure liable to collapse if the supportive effect of other parts of the structure, for example the roof, was damaged by the fire. Against this background, models 1, 3B, and 3C do not seem likely.

Our analysis does not yield a definite conclusion, but it indicates that the construction was neither built as in the Swedish Trelleborg reconstruction, nor was it in a state of a ruin. This implies that the construction was at least partially finished. It is considered most likely that the construction was wholly or partially finished with roof cover. That leaves the construction alternatives 2A, 2B, and 3A, and it is considered that the construction is more likely to be a combination or alternative of 2A and 2B, and not 3A.

#### 2.3.5.2. Fire

The damage from a fire depends on the extent and intensity of the process. The fire-affected materials will be deposited depending on the development of the fire process. It is expected that the materials that are first affected by the fire lie at the bottom of the fire residues, while the residues of the structures which burn last or are most stable are at the top.

*The sequences of the fire/-s:* During excavation, it became clear that two different layers with charred wood were found, and that there was a certain amount of time between the fires that caused these. The reddened clay in the upper layer may be remains from a hearth, but the burnt post remains are inconsistent with damage from a hearth. The fire damage to the posts indicates an uncontrolled fire that burned the posts all the way around. A fireplace that gets out of control and thus becomes a fire could be a possible cause, but in this case the charcoal remains (e.g. KT 2) and the red-coloured clay do not appear at the same level.

Based on the above arguments, it is unlikely that the residues relate to one fire only. For the same reasons, it is assessed that there were not two different fires simultaneously.

The posts in the middle part of the northern side of the gateway were burned all the way around. The core of the posts, however, was not burned. This may mean that the fire was put out at a time when the fire had only partially consumed the posts. At least some parts of the timber construction seem to have stayed in place after the fire, during the time when the fireplace was in use and the box with iron objects was deposited.

*The origin of the fire:* It has been considered to which extent the thickness of the charcoal layer can contribute to the assessment of the fire process. However, there are several factors that are important in assessing the length of the fire cycle. These include the intensity of the fire, oxygen circulation; the wood type, resistance to degradation and fire, as well as treatment; moisture in the wood; and possibly the degree of decomposition. For this reason, it is not possible to provide a reliable estimate.

The observations indicate that the spread of the fire probably did not proceed from west or east (outside) and further into the gate (Hypothesis 1 and 4), nor did the fire start on top of the rampart and move along the sides and into the gate (Hypothesis 3). Based on the fire traces found in the gateway the fire may have started inside the gateway and then moved both east and west (Hypothesis 2) but the amount of fire traces found in connection with other traces found during the excavation of the gate does not clearly point out an area of fire origin. Traces of fire was only found in one side of the gate, but exactly where the fire began is unclear.

## 3. Conclusion and perspectives

The interdisciplinary collaboration between archaeology and the fire investigation of the east gate of Borgring led to critical and unexpected evidence of both the construction and destruction of the structure (Figure 9).

In the initial assessment, during excavations, the gateway was assumed to be a massive construction with dense wooden walls, as seen, for example, in the reconstructed Swedish fortress (Figure 6). However, the fire investigation reveal that the gateway was built as a light construction of undressed posts with a simple plank roof. It is even possible that the structure was in a partially unfinished state when a fire struck and ravaged the north wall and probably the roof cover or parts of it.

There is no conclusion as to where the fire began, though there are no traces of burning on the four corner posts or the timber clad front of the rampart. Neither is there evidence of fire inside the ring fortress. Considering the intensity and the duration of the fire too many factors are impossible to assess and therefore these questions are unanswered.

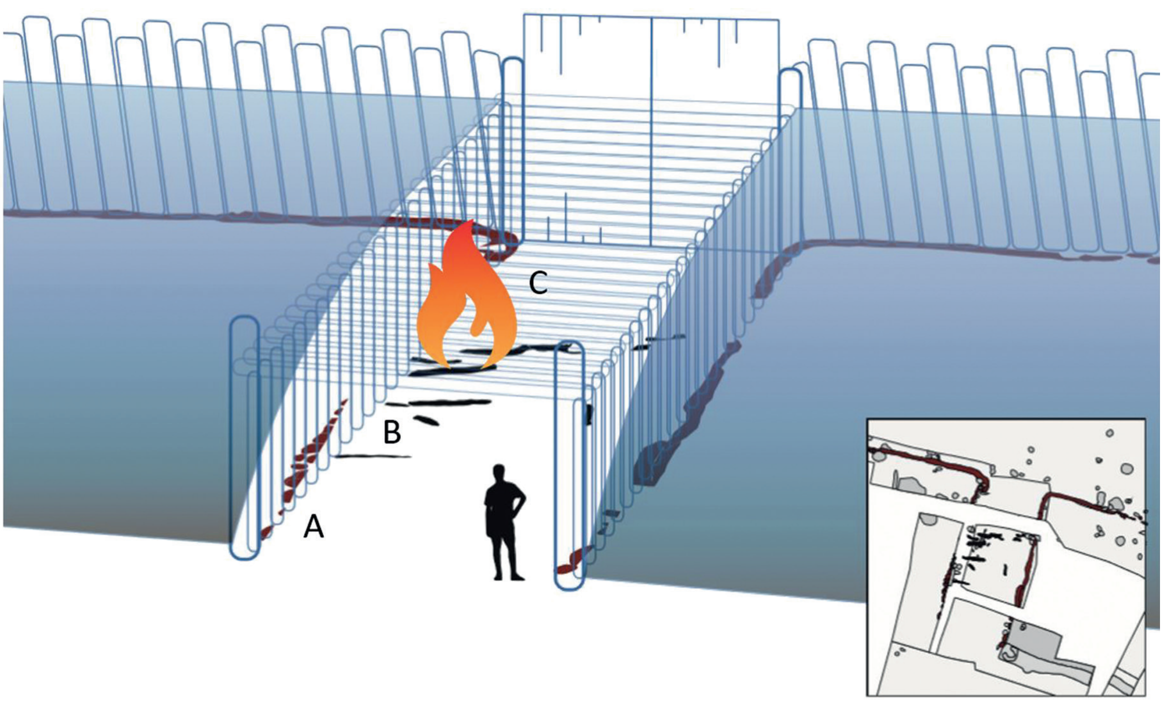


**Figure 9**. Visualisation of interpretation. The situation in area A is uncertain. Posts in B are burned all way round and leaning. Area C has vertical posts, which are not damaged by fire on the side facing the rampart (Drawing: Ea Rasmussen).

After the uncontrolled fire, the east gate was refurbished with a new floor of clay covering the charred traces. On this floor a new – controlled – fire left its mark in the form of a definite reddish colouring of the clay in the middle of the gateway, probably indicating a fireplace. Sherds from Early Glazed Ware retrieved close to the fireplace indicate a date in the very late tenth century or early eleventh century. The sequence of these events caused considerable problems during excavation, but were also clarified as a result of the fire investigation. This shows that the charred structures only collapsed after an indeterminate period of time, during which the new clay floor and the fireplace were in use. The burial of the tool box may have happened before the collapse.

The application of scientific methods of fire investigation have significantly augmented observation and interpretation of archaeological traces at the Borgring sites, leading to a revised reconstruction of the Viking Age ring fortress and its history. The study thus emphasises a further potential of fire investigation in archaeological sites

From the point of view of the fire investigators the collaboration has also shown that common archaeological methods have a general application in fire investigations. These include methods of three-dimensional spatial documentation and visualisation, and methods for controlling the sequence of depositions through the use of consistent stratigraphic modes of excavation and recording. Archaeological knowledge of taphonomic processes in the burial environment, together with geoarchaeological methods such as soil and sediment micromorphology also deserve wider application in specific forensic cases. This pilot study thus opens a field with far-reaching perspectives for further interdisciplinary collaborations.

## Acknowledgements

This work was funded by a generous grant from A.P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til almene Formaal with additional support from Køge Municipality. The fire investigations were carried out in collaboration between Eva Ljungkvist (case officer), Benny Thomsen, Carsten Bue, and Hans Jørgen Levring Sørensen, all from National Forensic Services (NKC), Danish National Police. Drone photos were taken by Ole Benny Olsen, NKC (Danish National Police). The authors wish to thank colleagues and management at the National Forensic Services, Danish National Police for their support and encouragement during the research.

This article is one of more contributions discussing targeted aspects of the results of the Borgring Project 2016–18 published in Danish Journal of Archaeology. Language has been revised by Taylor Grace Fitzgerald

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# The lost landscape of Borgring: geoarchaeological investigations into the navigation to, and location of, the Danish Viking Age ring fortress

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**ABSTRACT**

Geoarchaeological investigations at Borgring, a recently identified Danish Viking Age ring fortress, reconstructs the original landscape showing how the site was expanded and modified to accommodate a structure of pre-defined size, and how this large-scale project demonstrates the willingness to invest significant resources in its precise positioning. The investigations also assess the possibility of navigating along the nearby stream from the coast and show that access by anything larger than a dinghy was impossible, hence navigability was not important for the location and function of the fortress. This has implications for the functional interpretation of all Danish Viking Age ring fortresses.

**ARTICLE HISTORY**
Received
11 September 2020
Accepted
28 June 2021

**KEYWORDS**
Viking Age; Ring fortress; Navigation; Landscape setting; Pre-construction modifications

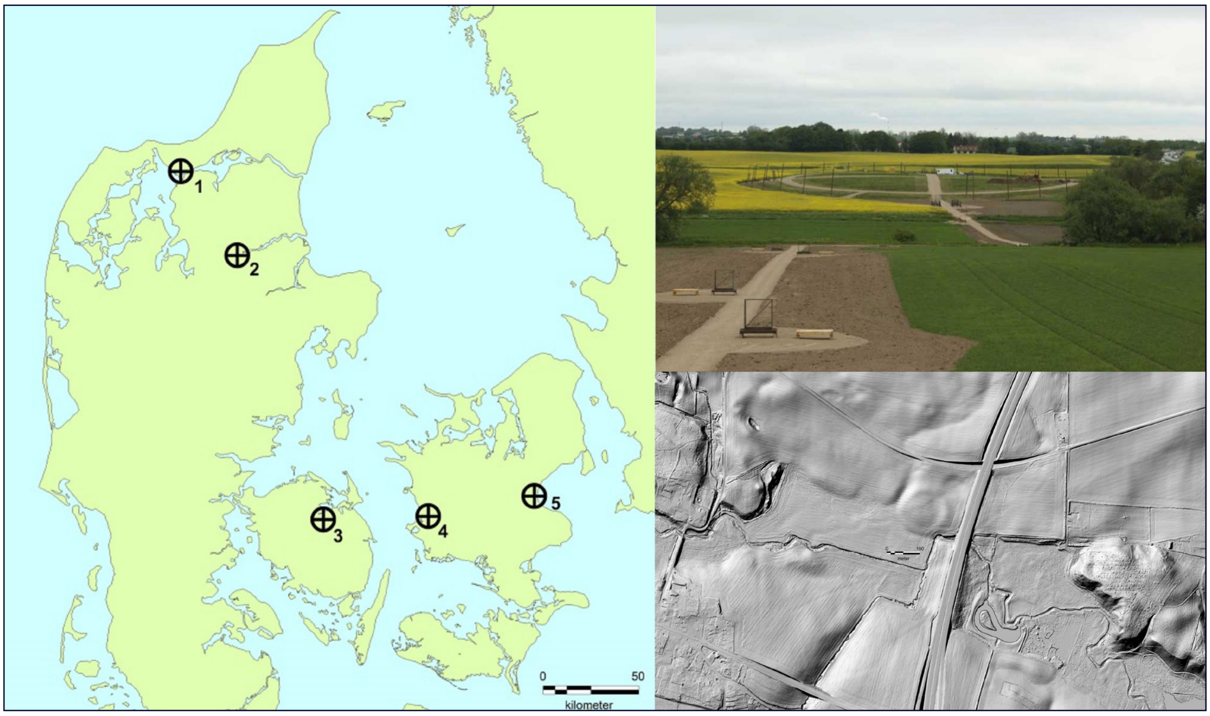


**Figure 1**. Map of Denmark (left) showing the five ring fortresses, 1) Aggersborg, 2) Fyrkat, 3) Nonnebakken, 4) Trelleborg and 5) Borgring. View of Borgring from the south (top right) showing the site during excavations (Photo: Museum Southeast Denmark) and LIDAR image of Borgring (bottom right) showing remaining ramparts and its position in the landscape.

## Introduction

The role of the Danish ring fortresses has long been a source of speculation among scholars of the Viking Age. Until recently, we had evidence for four fortresses, two in Jutland (Aggersborg, Fyrkat) and one on both Zealand (Trelleborg,) and on Funen (Nonnebakken). A fifth fortress, Borgring, was recently identified on Zealand (Goodchild, Holm and Sindbæk 2017). All the fortresses were established within a short period of time during the AD 970s (Figure 1). The ring fortresses show construction standards of remarkable precision and geometry, forming an exact circle with an inner diameter of between *c.*120 and *c.*240 m. Four equidistant gates in the turf walls lead onto straight roads cutting the circle into four equal parts and in three (Trelleborg, Aggersborg and Fyrkat) of the five fortresses, there are remains of carefully planned houses of equal shape and size.

Ring fortresses are absent from contemporary and later written sources despite their monumental size and layout. Consequently, scholars have speculated on their function since the excavations of the first ring fortress, Trelleborg, in the 1930s and 1940s (Nørlund 1948). They seem to have been short-lived constructions with the remains of houses showing only limited use-wear and with negligible amounts of occupation debris (Olsen and Schmidt 1977, 97-100; Roesdahl and Sindbæk 2014, 255). While some scholars have suggested that the ring fortresses functioned as royal centres for administration and supply (Roesdahl 1977, 175; Roesdahl and Sindbæk 2014, 455) or as garrisons for external forces (Dobat 2009, 92), others suggest that they served a primarily symbolic function, cementing the power of kingship and its territorial rights (Ulriksen, Schultz and Mortensen 2020, 16-17). Function of the ring fortresses aside, the majority of their scholars have suggested that they were accessible by ship (Dobat 2013, 238-240; Nielsen 1990, 146; Nørlund 1948, 10; Olsen and Schmidt 1977, 40). Others disagree (Christiansen et al. 1989) and even though the difficulties of navigating Danish streams have been discussed (Ulriksen 2008, 163-167; Ulriksen 2011, 194-195), the idea has however persisted. This is perhaps due to the perception of a Viking culture, which was tightly intertwined with seafaring and ships, leading to the suggestion that access by ship to important, high-status sites located inland must have been possible. Many of these sites are positioned close to modern streams which are presently too narrow and/or too shallow to be navigated by all but the smallest of the known Viking vessels. Whether these streams were navigable during the Viking Age as a consequence of a) higher sea-levels and/or b) wider/deeper stream channels has been widely discussed (Andersen 1986, 12-14; Christiansen et al. 1989; Dobat 2013, 33-52; Nielsen 1990, 145-146; Nørlund 1948; Roesdahl and Sindbæk 2014, Ch. 8.2; Runge and Henriksen 2018, 5; Ulriksen 2008, 164; Ulriksen 2011, 192-194; Ulriksen, Schultz and Mortensen 2020, 10-12).

The recent identification of Borgring (Figure 1) has allowed an extensive excavation and survey of the site and its surroundings (Christensen et al. 2021; Goodchild, Holm and Sindbæk 2017; Ljungkvist et al. 2021; Mortensen et al. 2021; Ulriksen, Schultz and Mortensen 2020). This has provided the unique opportunity to address some of the long-established questions around the navigability of Danish streams during the Viking Age and contribute to the wider debate regarding the relationship between ring fortresses and seafaring. We therefore partly focussed our investigations at Borgring on a thorough assessment of the possibility of navigating the 4.5 km inland up Køge Stream from the Viking Age coastline to Borgring.

During the investigations on the fortress itself it became clear that there had been significant landscape modifications of the site prior to construction. Pre-construction modifications have already been documented at Fyrkat (Olsen and Schmidt 1977, 48) and Trelleborg (Nørlund 1948, 21) and this led our investigation to further focus on the Viking Age shape and form of the landscape and why this particular site was chosen as the location for the fortress.

Here we present the results of our geoarchaeological investigations relating to navigation, the Viking Age landscape and the required pre-construction modifications associated with the location of the Borgring ring fortress in the Køge Valley. We also discuss the research hitherto undertaken on the four other ring fortresses and we assess the implications of our results for our understanding of all Danish Viking Age ring fortresses.

## Sea level change and the fluvial system of the Køge Valley

The modern streams associated with inland Viking Age monuments in Denmark are neither wide enough nor deep enough to allow navigation for even a modest-sized transport and cargo ship. These include Skuldelev 3, which was 14 m long, 3.28 m wide with a draught of 0.9 m (Crumlin-Pedersen

2002, 227) and the equally modest-sized warship, Skuldelev 5, 17.3 m long, 2.47 m wide with a draught of 0.54 m (Crumlin-Pedersen 2002, 276; Ravn 2016, 155). It is therefore essential to assess whether these streams were substantially wider or deeper during the Viking Age either due to higher relative sea-level or due to changes in the form and capacity of the stream.

Relative sea-level curves show the combined isostatic (post-glacial uplift/subsidence) and eustatic (sea-level) changes and account for the differential land uplift north and south of the hinge line in Denmark (Hansen, Aagaard and Binderup 2012). A relative sea-level curve produced through extensive analyses of sediments and the geology of the area around Præstø Fjord, southern Zealand suggested that relative sea-level in the Viking Age was ~1 m higher than present (Mikkelsen 1949). This sea-level curve has been used as an argument for how larger vessels could access the ring fortresses both at Trelleborg and Fyrkat (Christiansen et al. 1989) and other important Viking sites (Holmberg and Madsen 1998, 212). It appears to be the root of the perception that inland navigation in Denmark was possible. The only dating tool available in 1948-1949 to date the transgressions/regressions was biostratigraphic correlation using pollen zonation along with some consideration of the known archaeology and place names. There are, however, serious limitations and errors inherent in building a relative sea-level curve based on biochronostratigraphy and, although the work is extensive and well-argued, the 'Præstø' curve is neither as reliable, nor as secure, as more recent sea-level curves which are built on larger data-sets and AMS radiocarbon dating. These do not reproduce the higher sea-level seen around the Viking Age (Hansen, Aagaard and Binderup 2012; Hansen et al. 2016; Vink et al. 2007) and therefore offer no evidence that ships could navigate substantially further inland during the Viking Age than at present.

Even in the absence of raised relative sea-level it is still important to determine the form and capacity of the Køge Stream during the Viking Age and therefore whether it was possible to navigate to the fortress. Borgring sits on the northern bank of the Køge valley. This large valley was formed by the very high water discharges of the termination of the last glacial period. The modern stream between the ring fortress and the open sea meanders in the wider parts of the valley and is tightly confined in the narrower parts, making it impossible to navigate with a vessel longer than around 6-7 m. The valley is thus a relict formation and the present water discharge is only able to form a meandering river through the tunnel valley. Since the last glacial period the valley has filled with deposits (gravel, sand, silt and clay) concomitant with the fluvial system and organic material (peat and gyttja) associated with wetlands and lakes. Documenting how and when these sediments were deposited in certain locations determines whether the stream was navigable during the Viking Age. Our work therefore involved describing, mapping and dating the remaining valley sediments, assigning them a process, and therefore an environment, at a particular point in time.

## The Viking Age stream

Figure 2 shows the sediments and stratigraphy seen in five transects with the most likely interpolation between 40 boreholes drilled. The major fluvial sediment types seen in the boreholes are channel and levee deposits (sands and gravels) and proximal flood plain deposits (organic silts and clays), along with wetland peat growth further away from the channel and lake deposits in cut-off former channels (gyttja). The channel and levee deposits can appear to stretch over many metres in the transects and could imply a large river system but these are the remnants of fluvial sedimentation in a laterally migrating meandering system rather than a deep and/or wide channel.

In the transects closest to the coast in the open, flat area (GKG-T1 and GKG-T3), expansive and thick layers of gyttja show the earlier presence of a lake. Peat growth above the gyttja shows that the lake gradually shallowed and infilled. The intermittent migration of the channel with associated erosion and infilling with sands and gravels is clearly seen in GKG-T3. The upper few sediments of the gyttja and peat units are dated to the Late Neolithic or Early Bronze Age (LuS 12254, 12255, 12898, 12899) (Table 1, Figures 2 and 3) indicating that the lake basin was infilled by this time and no longer open water. The lake deposits and wet-

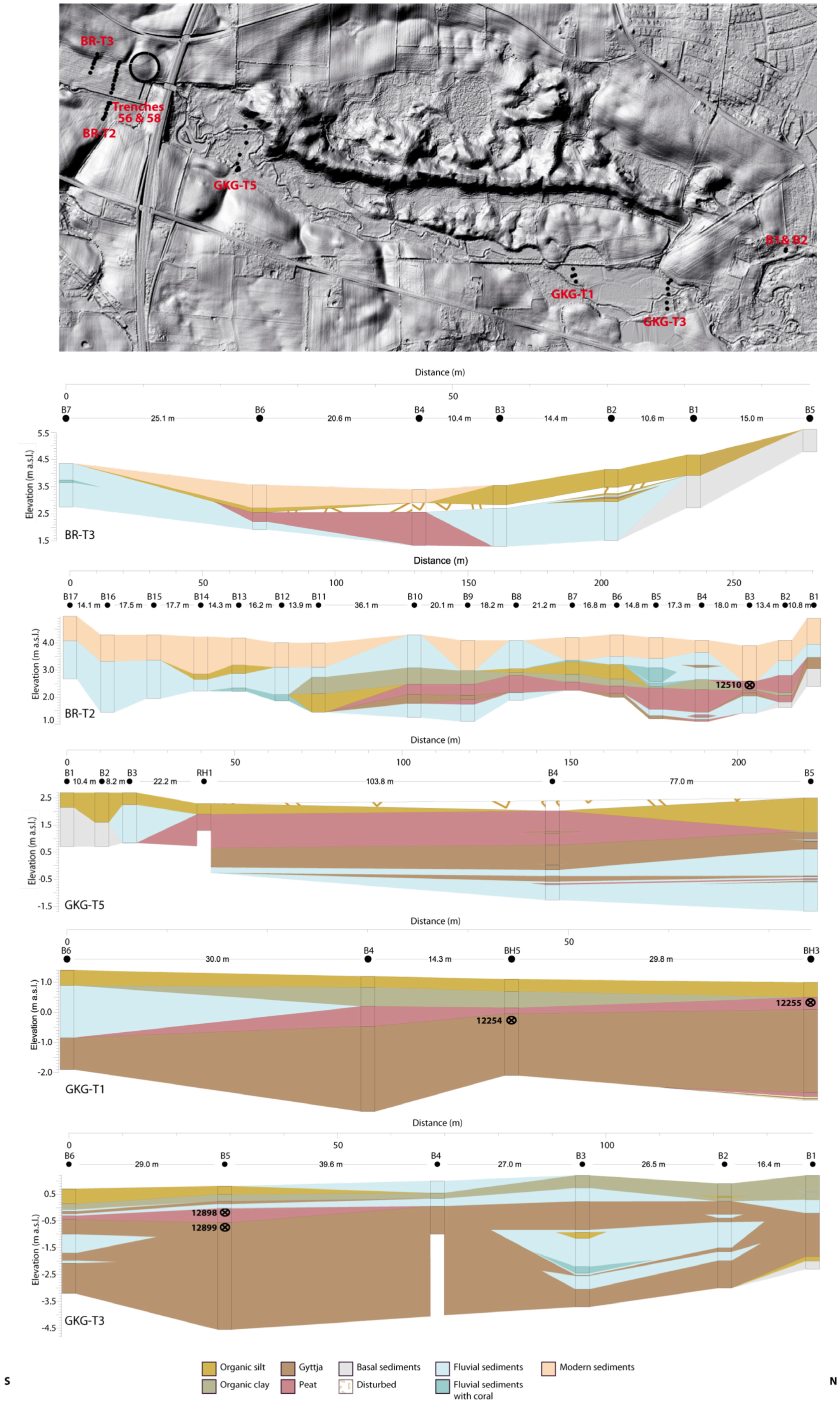


**Figure 2**. LIDAR image (top) of Borgring (black circle) and surroundings showing transect, trench and borehole positions south of the fortress and in the valley to the east. Borehole sediment data are also shown for each of the five transects with stratigraphic interpolations. Position ⊗ and 'LuS' code for radiocarbon ages are shown.

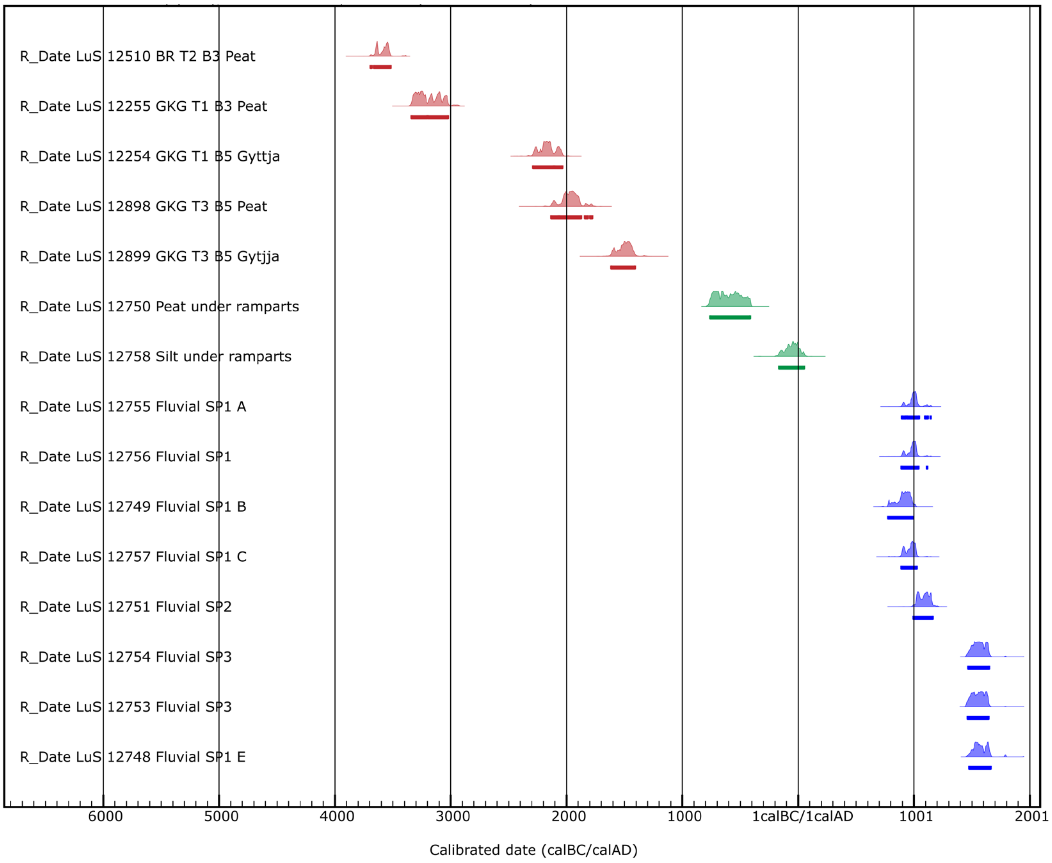


**Figure 3**. Calibrated age probability distributions of the 15 radiocarbon dates using OxCal v4.3.2 (Bronk Ramsey, 2009; Reimer et al., 2004). Colour groups refer to a focus on navigation (red), Viking Age land surface (green) and the stream position (blue).

land peats were then overlain by channel and proximal fluvial deposits and represent the meandering stream and the probable seasonal flooding of the valley. This was the most likely landscape context during the Viking Age.

Transects BR-T3 and BR-T2 (Figure 2) in the valley immediately south of the fortress show a more complex stratigraphy, partly due to cultural disturbance, partly due to more frequent boreholes. Transect BR-T2 stretches over the whole valley bottom and shows that in the south, erosion and infilling by fluvial sediments has removed any earlier sediments. Wetland, flood plain and some open water deposits are preserved in the north of the valley and the top of a peat from this position dates to 3665-3515 cal BC (BR-T2 B1).

It was only possible to locate the exact position of the migrating stream during a particular time period in one area. Immediately adjacent to the ringfort an 80 m long trench stretching south from the rampart into the valley (Trenches 56 and 58) traces the movement of the stream towards the ramparts between the Late Bronze Age/Early Iron Age until the Medieval Period (Figures 4 and 5, Table 1). Peat at the base dates to 760-410 cal BC (LuS 12750) above which there is a layer of organic silt. This same organic silt layer is found beneath the ramparts (not shown) and dates to cal 170 BC-cal AD 55 (LuS 12758). Four phases of incision by the stream encroaching from the south into these two sedimentary units were identified (Stream Phases (SP) 1-4). The incisions are infilled by organic silts with unevenly laminated sand layers typical for this type of environmental context. The age of this series of stream movements is dated by material found within their infill. SP1 is seen at four points in the trench (Figures 4 and 5, A, B, C and D). At Position A (Figure 4) a piece of oak timber found in the infill of SP1 is dated by dendrochronology to after 966 AD (Daly 2017). Also at Position A and from SP1 are numerous flax (*Linum usitatissimum*) stems and seed capsules dating to cal AD 890-1120 (LuS 12755) and beech (*Fagus sylvatica*) seeds dating to cal AD 890-1040

| Lab. no. (LuS) | Sample | Position | Material | Sample weight (mg) | $^{14}$C age (BP) | Calibrated age (2 std interval) |
|---|---|---|---|---|---|---|
| *Navigation* | | | | | | |
| 12510 | BR-T2 B3 | Peat 132-137 cm | Unidentified twig | 1.6 | 4815 ± 40 | 3665-3515 cal BC |
| 12255 | GKG-T1 B3 | Peat 67-72 cm | Terrestrial seeds | 0.7 | 4465 ± 35 | 3340-3020 cal BC |
| 12899 | GKG-T3 B5 | Gyttja 140-145 cm | Terrestrial seeds | 4.0 | 3220 ± 50 | 1615-1405 cal BC |
| 12898 | GKG-T3 B5 | Peat 83-88 cm | *Alnus* seeds | 6.9 | 3605 ± 50 | 2135-1775 cal BC |
| 12254 | GKG-T1 B5 | Gyttja 86-91 cm | Terrestrial seeds | 1.3 | 3755 ± 40 | 2290-2035 cal BC |
| *Viking Age land surface* | | | | | | |
| 12750 | Profile 58 P171 | Peat under ramparts | Terrestrial seeds | 5.9 | 2460 ± 40 | 760-410 cal BC |
| 12758 | Profile 58 P187 | Silt under ramparts | *Fagus* charcoal | 8.1 | 2040 ± 40 | cal 170 BC-cal AD 55 |
| *Stream position* | | | | | | |
| 12755 | Profile 58 P176A | Fluvial SP1. Pos.A | *Linum usitatissimum* seeds | 3.1 | 1035 ± 40 | cal AD 890-1120 |
| 12749 | Profile 56 P156 | Fluvial SP1. Pos.B | *Sparganium* seeds | 10.6 | 1125 ± 40 | cal AD 775-995 |
| 12757 | Profile 58 P186 | Fluvial SP1. Pos.C | *Linum usitatissimum* seeds | 12.3 | 1065 ± 40 | cal AD 890-1025 |
| 12756 | Profile 58 P176B | Fluvial SP1 | *Fagus sylvatica* seeds | 16.9 | 1045 ± 40 | cal AD 890-1040 |
| 12751 | Profile 58 P172 | Fluvial SP2 | *Scirpus maritimus* seeds | 15.4 | 960 ± 40 | cal AD 995-1165 |
| 12754 | Profile 58 P175 | Fluvial SP3 | *Linum usitatissimum* seeds | 3.9 | 320 ± 40 | cal AD 1465-1650 |
| 12753 | Profile 58 P174 | Fluvial SP3 | *Rumex* sp. seeds | 5.6 | 335 ± 40 | cal AD 1460-1645 |
| 12748 | Profile 35 P22 | Fluvial SP3. Pos.E | *Secale cereale* seeds | 13.4 | 300 ± 40 | cal AD 1470-1665 |

**Table 1**. AMS radiocarbon dates calibrated using OxCal v4.3.2 (Bronk Ramsey, 2017; Reimer et al., 2013).

(LuS 12756). At position B numerous bur-reed (*Sparganium* sp.) seeds date to cal AD 775-995 (LuS 12749) and at position C, flax stems date to cal AD 890-1025 (LuS 12757). Additionally, a Viking Age-type timber wheel hub was found at Position D. Although it is unclear if the oak timber and wheel hub are redeposited from upstream, the flax stems with attached seed capsules could not


**Figure 4**. Position of excavated profiles and trenches (green) together with the rampart outline (black). The background map from AD 1897 (Kortforsyning, 2019) is superimposed upon a modern, spring satellite image. The lower image shows one of the profiles (position X) with the base of the modern sediments (green line) and base of the levelling material which, in this case, is also the Viking Age land surface (pink line) (Photo: Museum Southeast Denmark).

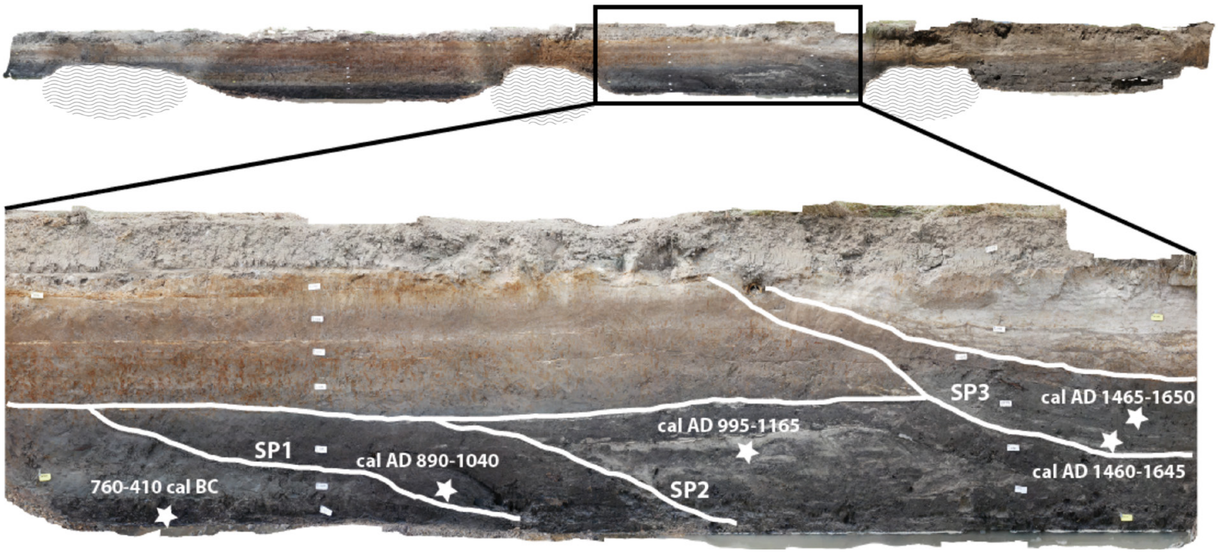


**Figure 5**. Upper image shows Trench 58 (see Fig. 4). The enlarged section in the lower image shows Stream Positions 1, 2 and 3 and the positions of the calibrated ages. The wavy lines indicate drain positions (Photo: Museum Southeast Denmark).


**Figure 6**. The possible stream course during the Viking Age (Photo: SDFE, Agency for Data Supply and Efficiency).

survive redeposition and must therefore be in their original position.

Further incisions showing the stream moving towards the fortress at SP2 (cal AD 995–1165 (LuS 12751)) and SP3 (cal AD 1465–1650 (LuS 12754)) are separated by a clay-rich layer seen in the boreholes as covering much of the valley in front of the fortress. The latest incision (SP4) seen in the trench is filled with sandy sediments and close to the stream position seen in a cadastral map from 1805 (Geodatastyrelsen, 2019). These same sediment layers were also identified at Position E (Figure 4) and dated to cal AD 1470-1665 (LuS 12748).

The above evidence allows a tentative conclusion on the position and dimensions of the stream in front of the fortress at the time of its construction. The extant stream most likely ran close to the northern edge of the valley cutting the sediments in BR-T2 B1 (Figure 6), crossed the trench at positions A and B, then doubled back to cross it again at position C and once again at D (Figure 4). Stream dimensions seen in Trench 58 resemble

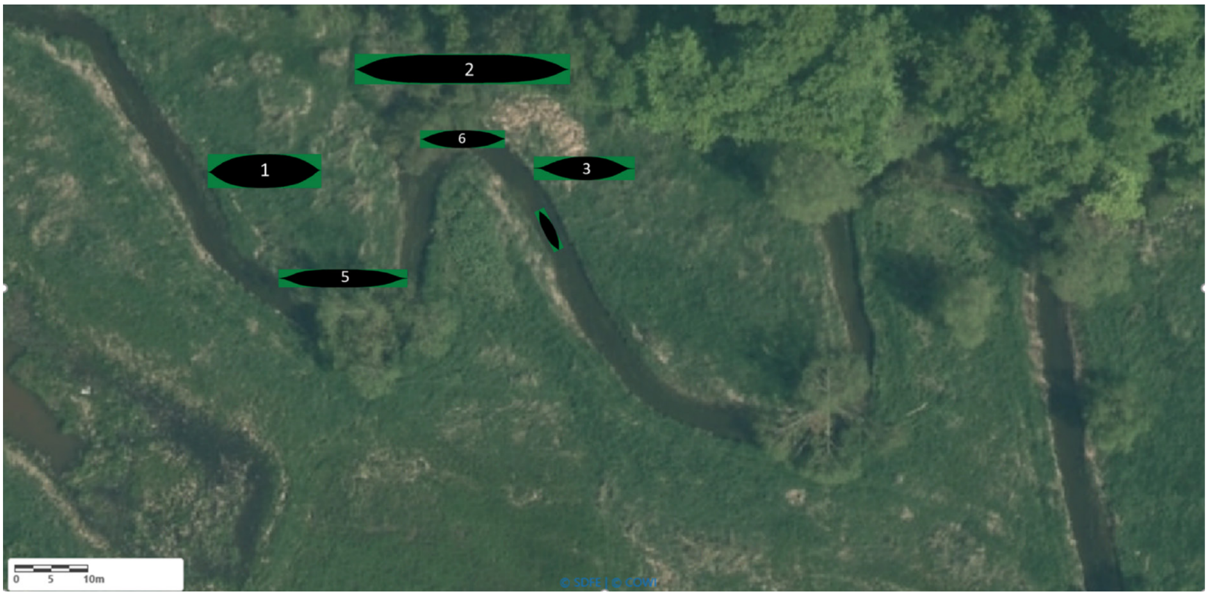


**Figure 7**. Modern image of the meandering stream Køge Å with the relative size of some of the known Viking ships. The Skuldelev ships: 1 (16.0 m long), 2 (29.2 m long), 3 (14 m long), 5 (17.3 m long), 6 (11.2 m), and the smaller Gokstad dinghy (6.5 m long) (Photo: SDFE, Agency for Data Supply and Efficiency).

those of the freely meandering lengths of the present-day stream.

The sediments and stratigraphy investigated for navigational potential further downstream in the Køge valley and the sediment ages obtained for the infilling of the lake basin also indicate that the stream was neither wider nor deeper during the Viking Age than it is today. The present stream is 3-5 m wide and no more than 0.5-1 m deep with tight meander turns. During winter the whole valley bottom is generally under up to 0.5 m water and the stream is only constrained within its channel in dry seasons. Figure 7 shows a typical section of the stream upon which are scaled images of the Viking ships from the 11th century Skuldelev-barrier in Roskilde Fjord (Crumlin-Pedersen 2002) and the small dinghy from the c. 900 AD Gokstad ship grave in Norway (Nicolaysen 1882). It is clear that only the dinghy could fit in the channel, though rowing would have been impossible. Towing a boat upstream was probably only rarely an option as waterlogged conditions in most years prevented a firm surface underfoot (Ulriksen 2011, 195). In conclusion, the stream in the Køge Valley was no wider nor deeper in the Viking Age than it is today and it would not have been possible to navigate to the Borgring ring fortress.

## Reconstructing the Viking Age landscape of the fortress and the pre-construction modifications

The setting of Borgring ties in with the question of the function of the Viking Age ring fortresses. Our investigations considered both the landscape in which Borgring was located and the modifications of the landscape needed to construct it in this position.

The modern geomorphology of the immediate area around Borgring is heavily influenced by ploughing and without LIDAR imagery the ring fortress is almost invisible in the landscape. It is positioned on the northern bank of the valley, with a gully of a former stream (now controlled by a buried drain) to the west and a depression to the northeast. These features are for the most part not especially pronounced and the whole area was under cultivation until recently. The motorway and its construction debris limits access to the areas east of the eastern gate (Figure 1).

Careful observations of the sediments from cores and profiles have allowed their separation into six main units: 1) pre-Holocene deposits; 2) channel and levee deposits; 3) floodplain deposits (including peats); 4) oxbow lake deposits; 5) Viking Age levelling layers and 6) post-Viking Age deposits. These

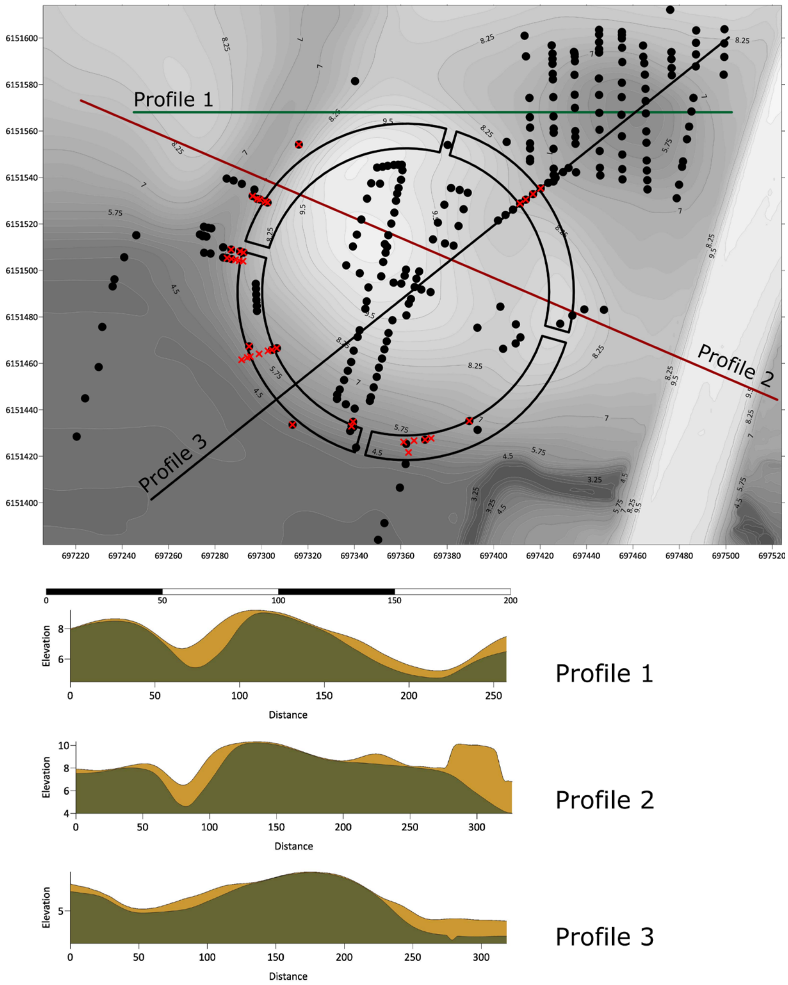


**Figure 8**. Contour map of the modern landscape showing data points for the Viking Age land surface (black circles) and levelling layer (red crosses). The position of the ramparts and gates are indicated by the black circle. Profiles 1, 2 and 3 show the Viking Age land surface (green) and the modern sediments (brown). The levelling layers are not shown.

units in each of the profiles and cores were designated as either Viking Age land surface, levelling layers, or post-Viking Age deposits based on field observations, radiocarbon dating and stratigraphic succession. XYZ coordinates for each of the land surfaces were fed into modelling software (Surfer v.16) and gridded using the kriging option which interpolates between the irregularly spaced data points and generates a contour map. The resulting contour model was then checked against observed levels and adjusted in some areas, e.g. the extension of the depression in a south-easterly direction (see below).

Figures 8 and 9 show the landscape reconstruction in both cross-section and 3D image along with the data points used for the Viking Age land surface and the pre-construction levelling modifications.

### *The Viking Age land surface*

The Viking Age land surface in the valley bottom was identified as either the surface of the channel and levee deposits (sands and gravels) or the surface of the floodplain deposits (silts and clays), including the peat growth in wetlands further away from the channel. On the slopes of the tunnel valley the Viking Age land surface was identified as the surface of peat growth in the depression to the northeast, as the base of the gully to the west and as the modern surface where only thin soils covered the Pre-Holocene clays (Figure 9b). All of the dated material from these layers give a pre-Viking Age date (LuS 12510, 12758 and 12750) (Figures 2 and 3 and Table 1).

Whether the area outside the eastern gate was a ridge continuing eastwards was important with regard to access to the ring fortress. Although no data is available for this area, as it is now beneath the modern motorway, the topographical map drawn in 1897 (Kortforsyning 2019) shows that the depression to the northeast continued in a south-easterly direction. It is highly likely that this was also the case during the Viking Age. This is supported by evidence from a borehole located close to the modern stream channel and outside of the modelled reconstruction (Figure 4, B1) where basal sediments are positioned at an elevation of +3.24 m (DVR90). The resulting Viking Age surface to the east of the eastern gate (Figure 9) is therefore an estimation based on the elevation of the depression to the northeast of the ring fortress, the borehole elevation data and the necessary slope towards the reconstructed Viking Age stream position.

The resulting model shows greater landscape relief than at present. To the south, northeast and east the ramparts lay directly adjacent to the wetland areas of either the depressions or the valley, both of which restrict ease of access. The valley was also likely to have been flooded for much of the winter. To the west the gully, together with the ramparts, would have created a very steep and deep barrier to access. Taken together, the evidence suggests that the only year-round dry access to the ring fortress was from the north, through the northern gate.

### *Pre-construction levelling modifications*

The Viking Age land surface did not allow for a ring fortress of 144.5 m external diameter (Goodchild, Holm and Sindbæk 2017) without expanding the area. To create this additional space and a solid foundation for the ramparts, a clay-rich levelling material with variable quantities of inclusions (coarser silt, sands, ceramics and flint knapping debris) was laid directly beneath the ramparts to the northeast, east and south where the ground was sharply sloping and/or waterlogged (Figures 8 and 9). These clays were probably collected locally and in some profiles are very similar to the post-Viking Age sediments. We estimate that ~1900 $m^3$ clay was used for the levelling layer.

### *The modern land surface*

The elevation of the present land surface (Figure 9a) was modelled using LIDAR data points (not shown). In the post-Viking Age period the landscape was smoothed by intentionally depositing material (up to 1.5 m thick) in the depressions and the valley, presumably to improve conditions for cultivation (Figure 8). The relative invisibility of the fortress in the landscape is, along with the collapse of the ramparts, due to the deposition of these post-Viking Age deposits and later ploughing.

## Discussion

Our investigations in the Køge valley show that it was not possible to navigate to Borgring in anything larger than a dinghy. We can, therefore, rule out navigability as a factor in the location of Borgring. Recent investigations have also ruled out sailing to the ring fortress at Nonnebakken (Figure 1) (Runge and Henriksen 2018, 4-6) but research regarding navigability to the remaining ring fortresses has, excepting Aggersborg, been mainly inconclusive. The navigability of Trelleborg, Fyrkat and Aggersborg has recently been examined (Dobat 2013). Aggersborg lies on the Limfjord coast and direct or nearby access by ship was possible. At Fyrkat, it was argued that the Onsild Stream may have made navigation possible during the Viking Age, though there are indications that swamping of the stream began in this period, making the evidence inconclusive (Dobat 2013, 236). The 1808 cadastral map (Geodatastyrelsen, 2019) depicts the stream 2 km downstream from Trelleborg (Tude Å) as 8-10 m wide with tight meander turns. A dam across the stream, forming a barrier during the Medieval Period, may (Christensen 2014, 321; Christiansen et al. 1989, 41) or may not (Dobat and Mandrup 2014, 330; Mandrup 2013, 65-68) have existed during the time of the ring fortress. A layer of Roman Iron Age brushwood beneath this dam (Christiansen et al. 1989, 36) and possibly belonging to a ford, indicates that the stream was shallow at this time. Together the data suggests that the stream passing Trelleborg was narrow, shallow and with tight meander turns and thus unsuitable for navigation. The mouth of the stream formed a natural harbour (Nørlund 1948, 8) and if navigability was a priority for the function of Trelleborg, it could have been placed north of the valley and closer to this harbour. Similarly, the coastline around Fyrkat offers several potential locations with sea access and placing Fyrkat further inland suggests that navigability was not important here either. Apart from Aggersborg, none of the Danish ring fortresses provide definite evidence for being accessible by ship.

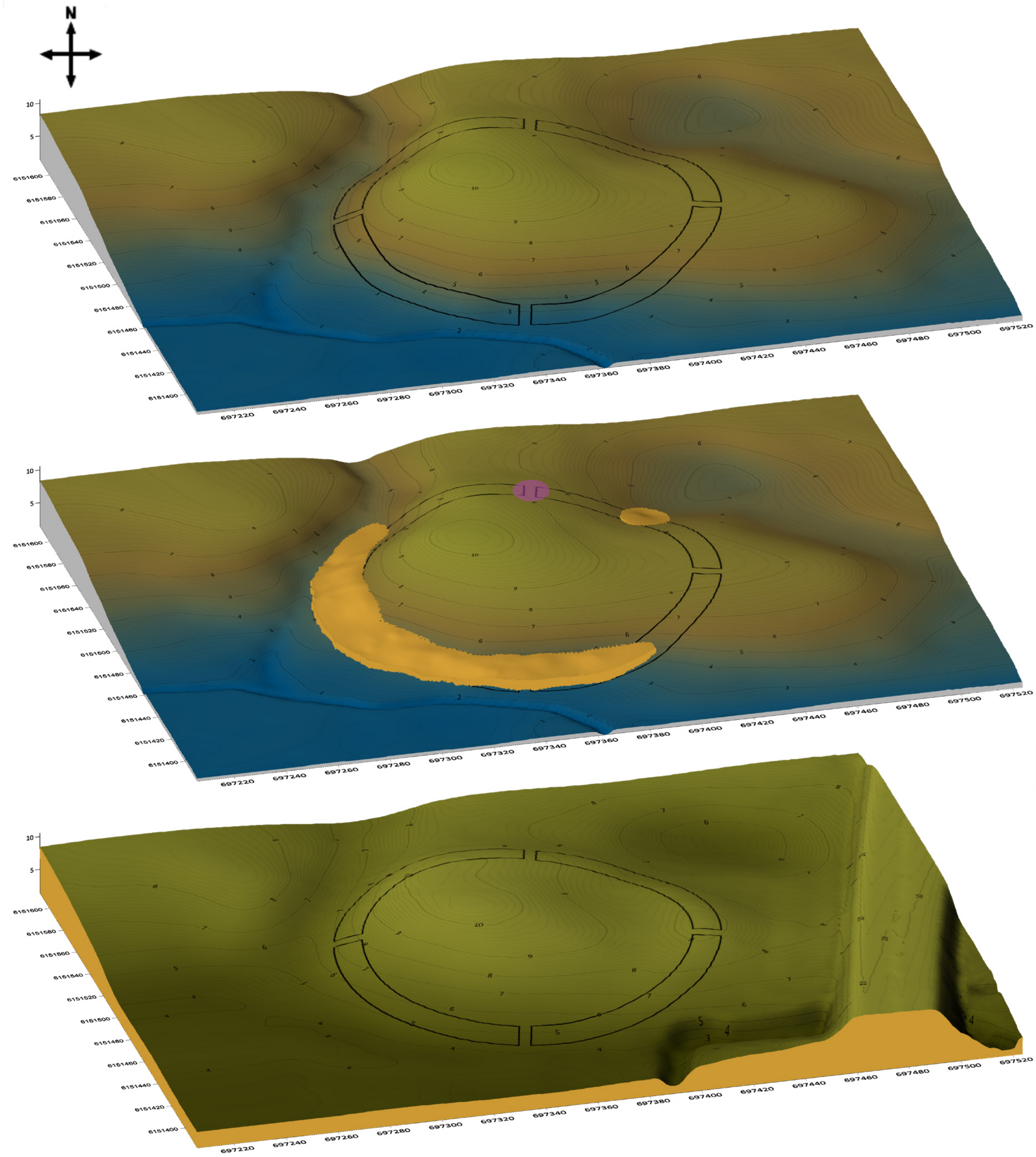


**Figure 9**. Results of the landscape model showing the Viking Age land surface and stream position (top), the Viking Age land surface with levelling layers in orange (middle) and the modern land surface and stream position (base). The black circle indicates the ramparts. The pink area shown together with the levelling layers indicates further probable levelling beneath the northern gate, which was observed during the excavation, but not included in the model.

The positioning of all ring fortresses was clearly premeditated and carefully chosen. Their remarkable precision and stringent layout corresponds to the observed large-scale pre-construction modifications of the landscape. As we have seen at Borgring, the site chosen had to be expanded even though other less labour-intensive positions were available in the immediate vicinity. Considerable landscape modifications were also observed at Fyrkat and Trelleborg. At Fyrkat, the top of the hill was levelled to make an even surface for the construction of houses (Olsen and Schmidt 1977, 48) and the south-facing slope was infilled to create sufficient surface area. Similarly, a massive levelling layer was added to the southwest at Trelleborg (Nørlund 1948, 21), infilling it downslope. All three ring fortresses could have been placed at a number of locations in the nearby region where pre-construction modifications were unnecessary. The exact location clearly played an important role.

We suggest that the function of the ring fortresses was unrelated to navigation but tightly tied to specific locations. An element of defence may have played a role, as can be seen from their construction, but the strict layout, short use-life, and especially the importance placed on location to the extent of modifying the landscape extensively, all suggest that the ring fortresses primarily served a symbolic role. Ulriksen, Schultz and Mortensen (2020, 16-17) propose that they were likely manifestations of a new societal order following the conversion to Christianity of King Harold Bluetooth. They were placed near major routes of transportation, meant to be highly visible, and were prominent reminders of the presence of the King. It is notable that their abrupt disuse and, in the case of Borgring, Fyrkat and Trelleborg, their partial deliberate destruction by fire, occurred shortly after the violent death of King Harold in AD 986/987.

## Conclusions

These investigations have unambiguously concluded that Køge Stream was unfit for navigation during the Viking Age. Evidence from Fyrkat, Trelleborg and Nonnebakken indicates that navigation was also unlikely. Only the position of Aggersborg offered easy access by ship. In conclusion, navigability was not essential for the function of the Viking Age ring fortresses.

Our investigations around Borgring show that the landscape has been drastically altered since the Viking Age. The original shape of the building ground was reconstructed from our investigations along with the large-scale levelling required to accommodate the ring fortress. Similar construction works were observed at Fyrkat and Trelleborg. The resources invested in the construction of the ring fortresses show that the builders vested specific locations with particular importance, regardless of the character of the landscape. Visibility near major routes of transportation and magnate residences appear to have been decisive factors in choosing locations.

## Acknowledgements

The Borgring Project 2016-2018 was generously supported by A.P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til Almene Formaal and the Municipality of Køge.

This article is one of more contributions discussing targeted aspects of the results of the Borgring Project 2016–18 published in Danish Journal of Archaeology. The authors declare no conflict of interest.

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# Turfs and Timbers – Resource use in the construction of the Viking Age Ring Fortress Borgring, Southeast Denmark

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**ABSTRACT**
Viking Age ring fortresses were some of the largest construction projects in Danish prehistory. In this article we reconstruct the amount of turf and timber used in the construction of the Borgring ring fortress and estimate the resource area needed to supply the building materials. Using REVEALS pollen data modelling we quantify the regional oak land cover and estimate the resource area. The results show that even though Borgring was built in an open cultural landscape, sufficient supply of oak for the construction would have been accessible within a few kilometres of the fortress.

**ARTICLE HISTORY**
Received
11 September 2020;
Accepted
17 June 2021

**KEYWORDS**
Borgring; Ring fortress; Viking Age; Resource use; REVEALS; Pollen analysis

## Introduction

The Danish ring fortresses, with their unique and precise geometric form, are distinctive monuments of Viking Age architecture (Figure 1 and 2A) and testify to the establishment of a central power structure that expressed its supra-regional dominion through large-scale monuments (Roesdahl and Sindbæk 2014, 460; Ulriksen, Schultz and Mortensen 2020). The construction of five Danish ring fortresses, as well as the Jelling complex, marks out Harald Bluetooth's reign and dates to the time between the end of the AD 950s and the beginning of the AD 980s (Holst et al. 2012, 494).

The ring fortresses were unusually large constructions for the time in Scandinavia and involved a great concentration of resources of manpower and building materials. Accordingly, it has been argued that they must have made a severe impact on the natural landscape (Jessen 1948, 175-178). Large amounts of earth and turf were needed for the ramparts, and adequate resources of timber were especially necessary for the timber-clad circular rampart and the wooden streets and houses. It is therefore important to determine whether the relatively open cultural landscape of the time could supply the amount of timber required, or whether it was necessary to import timber from other regions.

Reconstructing the resource use involves many factors that cannot be fully resolved such as timber quality, the range of tree taxa available, the possible import of timber, proximity to woodlands, and the intensity of woodland management. Previous calculations for Trelleborg, Aggersborg, Fyrkat, the fort at Trelleborg in Skåne, Sweden, and the Jelling complex have attempted to estimate the amount of timber required and the hectares of woodland needed to supply it (Arén 1995, 99; Jessen 1948, 173-179; Jessen et al. 2014, 15-17; Schmidt 1985, 50; Sindbæk 2014, 181-183).

The partial reconstruction of ring fortresses can aid the calculation of how much timber was required. Around 215 $m^3$ of oak (*Quercus* sp.) was used in the reconstruction of one of the 16 longhouses originally built at Fyrkat, which equates to

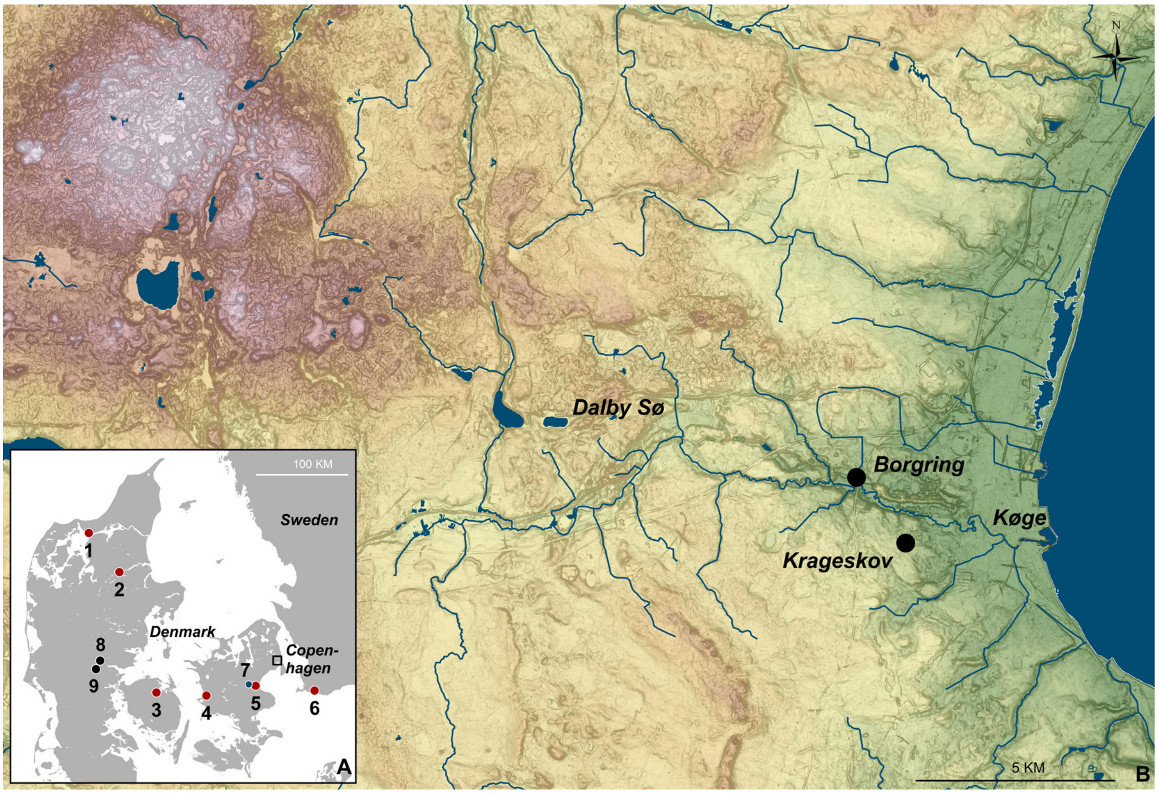


**Figure 1**. A) Denmark with the five known ring fortresses from the Viking Age, 1) Aggersborg, 2) Fyrkat, 3) Nonnebakken, 4) Trelleborg, 5) Borgring, as well as 6) Trelleborg in Sweden 7) Lake Dalby Sø, 8) Jelling and 9) Ravning Enge. B) Lake Dalby Sø is situated 7.5 km west of Borgring on the boundary between the forest-poor eastern Zealand and the hillier, forest-rich areas of central Zealand. Krageskov is situated 1.5 km south of Borgring (includes data from Agency for Data Supply and Efficiency, Terrain 10 m, December 2019 and Areal Information System lakes and watercourses).

around 135 fully grown (120-200 years) oak trees (Schmidt 1985, 50). A similar house reconstruction at Trelleborg, Zealand used 123 oak trees of differing sizes (Jessen 1948, 176). The amount of timber required for ramparts is more difficult to estimate. The ramparts at Trelleborg formed a massive construction, with timber cladding on both the internal and external faces, in addition to anchoring constructions in the earth fill. It is suggested that 3840 oaks were used for the rampart and internal roads while 8155 oak trees were used for the complete structure (Jessen 1948, 176). Other fortresses – for example, Aggersborg – had a more limited use of wood, and it is suggested that the construction here could have been built using perhaps only 340 large oak trees (Sindbæk 2014, 181). In the building of smaller ring fortresses, such as the earliest phase of ramparts at Trelleborg in Skåne, it is suggested that 437 trees were used (Arén 1995, 99).

These earlier studies have been limited to estimates of timber used and of the required hectare of woodland. When these studies were carried out, it was not possible to estimate the proportion of oak that was available in the hinterland and the area needed to supply the required timber. With the development of quantitative models for the interpretation of pollen data, such as REVEALS (**Re**gional **V**egetation **E**stimates **a**t **L**arge **S**ites) (Sugita 2007), it is now possible to estimate the areal coverage of the most common plant taxa and the vegetation types from pollen data, by taking into account the differences between plant species in pollen productivity and pollen dispersal properties. By applying this model, we can get an estimate of the average regional vegetation composition in an area, such as that in the Borgring hinterland. By combining the vegetation cover estimates with the estimates of timber required, a more precise quantification of the woodland resource areas needed to build monumental construction works is possible. Here we apply the results from the archaeological investigations at Borgring, Zealand, concerning the component parts of the rampart and gateways and the pollen data from a nearby lake, Dalby Sø (Figure 1), to specific questions re-

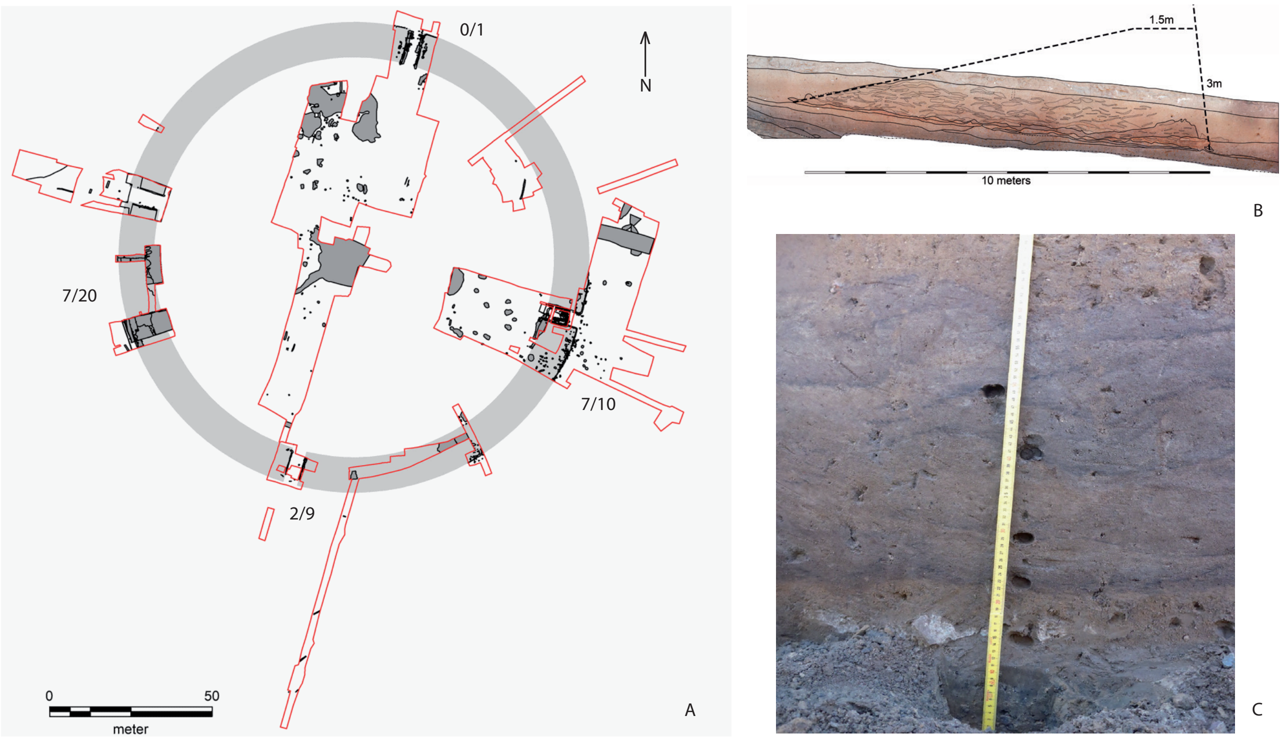


**Figure 2**. A) The excavation trenches (red line) and assumed shape and size of the circular ramparts at the Borgring fortress (light grey), dark grey represent structures within the excavated areas; B) Cross section showing the excavated height and angle of the rampart (Illustration: Jonas Christensen), assumed height and angle (dotted line), inside to the left, outside to the right; C) Cross section of the rampart showing the building turfs (Photo: Morten Fischer Mortensen).

garding resource use and the regional vegetation composition. Firstly, how much turf and timber were used in the construction of the ramparts, secondly, how large a resource area was needed to support this and thirdly, were there sufficient resources available for this in the local area, and if so, where were they located?

Any estimation of resource use is necessarily based on a number of assumptions, as no ring fortresses are sufficiently preserved to determine their precise manner of construction. These assumptions include the ramparts' original height, which tree taxa were used, construction details and whether the building was completed. Pollen based vegetation models such as REVEALS also include a number of assumptions, including constant and known relative pollen productivities for each plant species, predominantly wind dispersed pollen etc. (Sugita 2007). Our reconstruction attempts an approximate and balanced estimate of resource use and resource area, as well as a basis for the discussion of whether the import of timber was a prerequisite in the construction of ring fortresses.

## The Site

Borgring is situated close to the town of Køge, around 30 km southwest of Copenhagen (Figure 1). The ramparts were first identified in 1971, but they were only definitively recognised as parts of the iconic Viking Age ring fortresses by the use of high resolution LiDAR, geophysical surveys, and a small-scale test excavation in 2013 and 2014 (Goodchild, Holm and Sindbæk 2017). Selected parts of the ring fortress were the subject of large-scale investigations between 2016 and 2018, along with areas of the hinterland (Christensen et al. 2018; see also contributions in this volume).

Borgring lies on the northern bank of the Køge River valley, around 4 km from the coast. The small stream was not navigable by vessels larger than a dinghy during the Viking Age (Jessen et al. 2021, 8) and the ring fortress is situated on a raised area adjacent to areas of wetland. As the ring fortress had an external diameter of 144.5 m, it was necessary to add more than 1900 $m^3$ of sediment, which was up to 1.5 m thick in some areas, to give the ramparts a solid foundation.

Trial trenching of more than 40 ha of arable land around the ring fortress did not find evidence of other Viking Age buildings. The closest Viking Age settlement evidence was seen on the southern bank of the stream at Lellinge, where Baltic Ware pottery dating to the end of the Viking Period was found in a rubbish pit. A sunken lane is associated with a ford crossing Køge stream close to the ring fortress (Ulriksen, Schultz and Mortensen 2020, figure 5 and 6).

Pollen data from a 13 ha lake, Dalby Sø, situated 7.5 km west of Borgring was used for the regional reconstruction of vegetation in this study (Odgaard 2010, 57; Mortensen et al. in prep.). The lake is located at the transition between the flat basal moraine landscape towards the coast and the more hummocky dead ice landscape of central Zealand (Figure 1A-B). The flat eastern Zealand landscape is some of the best agricultural land found in Denmark and at present it is almost entirely cultivated and with very limited woodland coverage (Smed 2016, 198).

## Methods

### The circular Rampart

Information concerning the size and construction details of the rampart is obtained by the use of high-resolution LiDAR, geophysical surveys together with observations gained during the excavation campaigns between 2016 and 2018. The methods are described in detail in Goodchild, Holm and Sindbæk (2017), Christensen et al. (2018) and contributions in the present volume.

### Pollen analysis of the Rampart Turfs

Turfs, used in the building of the circular rampart, with well-defined growing surfaces (Figure 2B-C), were sampled for pollen analysis during the excavation. A total of 40 samples (20 from the west gate, 9 from the south gate, 10 from the east gate and 1 from the north gate) were examined and 16 of these contained sufficiently well-preserved pollen for analysis (raw data presented in supplementary A). Pollen preparation followed standard procedures, including KOH, HCl, HF, and acetolysis (Fægri and Iversen 1989, 77-81). No exotic marker was added. The residues were mounted in silicone oil. Whole slides were analysed to avoid effects of unequal distribution of pollen under the cover slip. Beug (2004) was consulted for general pollen identification, supplemented by the reference collection at the National Museum of Denmark. Due to low pollen concentrations and generally poor pollen preservation only between 148 and 277 pollen grains were identified in each sample, with a total pollen sum of over 3000.

All terrestrial pollen were included in the pollen sum.

### Wood identification, Timbers and the reconstruction of the Ring Fortress

Charcoal was continuously sampled during the excavation with a special emphasis on that of timbers from the western, northern and eastern gates which were burnt during the Viking Age. A total of 64 charcoal samples were taken, representing 58 pieces of timber (11 from the western, 14 from the northern and 33 from the eastern gates). One sample of uncharred and highly degraded wood was taken from a post from the southern gate (Table 1) (Baittinger 2018; Daly 2017). Wood and charcoal fragments were analysed with the help of a simple stereo microscope, a light microscope and a high resolution fluorescence microscope. Schweingruber (1990) was consulted for general wood identification.

### REVEALS and local Resource Areas

Pollen data from Dalby Sø (Mortensen et al. in prep.; Odgaard 2010, 57) is used to calculate the area needed to supply the Borgring fortress with building materials. This study focuses on the period from AD 500 to AD 1500, where the pollen data has a sample time resolution of *c.*45 years between the samples. We especially consider the period around AD 985 and the estimated vegetation cover of oak (*Quercus* sp.). The terrestrial pollen sum ranges from 538-1363 grains per sample. The pollen was better preserved than in the rampart

**Table 1**. Wood identification of 59 wood and charcoal fragments from the gates at the Borgring fortress.

| | | |
|---|---|---|
| **Northern gate** | | |
| Oak | *Quercus* sp. | 8 |
| Elm | *Ulmus* sp. | 6 |
| **Eastern gate** | | |
| Oak | *Quercus* sp. | 18 |
| Elm | *Ulmus* sp. | 12 |
| Ash | *Fraxinus excelsior* | 1 |
| Alder | *Alnus* sp. | 1 |
| Fruit tree | Spiraeoideae | 1 |
| **Southern gate** | | |
| Oak | *Quercus* sp. | 1 |
| **Western gate** | | |
| Oak | *Quercus* sp. | 8 |
| Elm | *Ulmus* sp. | 3 |

turfs, so the maximum proportion of unidentified grains was 1.4 % in one sample, and in most samples, there were no unidentified pollen. The REVEALS model corrects for the differences in pollen productivity and pollen dispersal between species in order to estimate regional vegetation composition from pollen assemblages from large lakes or mires (Sugita 2007). For a lake >50 ha, the spatial scale represented is approximately a 25-50 km radius (Hellman et al. 2008), but as Dalby Sø with its 13 ha is somewhat smaller, the reconstruction will reflect a smaller area, and local vegetation near the lake may be overrepresented to some degree relative to vegetation further away. However, as Dalby Sø is located only 7.5 km away from Borgring, the reconstruction should be representative for the relevant area. We applied a set of pollen productivity estimates from Southern Sweden and Denmark (Broström, Sugita and Gaillard 2004; Nielsen 2004; Sugita, Gaillard and Broström 1999; summarised by Fredh 2012). REVEALS calculations were carried out using the software REVEALS v4.5 (Sugita, unpublished) applying the lake model (Sugita, 1993) with default settings (average windspeed 3 m/s and neutral atmospheric conditions). The pollen types included in the REVEALS analysis made up 89-97 % of the terrestrial pollen sum.

## Results

### *The circular Rampart*

The grass turf and soil rampart of Borgring was 10.6 m wide, as calculated based on the geophysical survey and field observations (Figures 2 and 3, Table 2). In some areas a clear radial structure was observed in the geophysical survey which, when excavated in the southwest part of the rampart, was seen to be due to a regular pattern of shifting dark and light turfs and soil (Figure 3B). Traces of timber cladding with shallow foundations were seen along parts of the outer margin of the rampart but no traces of timber were observed on the inner margin. Although evidence for timber structures holding the turfs in place in the inner margin have been

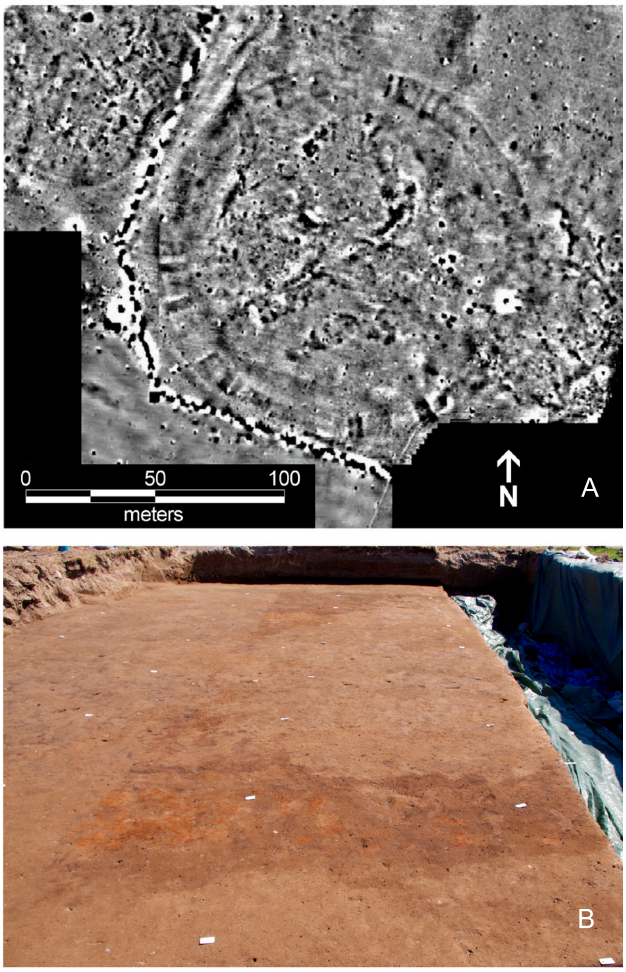


**Figure 3**. Sectioning of the rampart seen in A) A fluxgate geometry map (Helen Goodchild); B) Southeastern part of the rampart seen from the outside and in (Photo: Museum Southeast Denmark).

found at, for example, Aggersborg and Fyrkat, no trace of such structures was observed at Borgring.

The rampart of Borgring is partly preserved, but severely eroded, with the highest section only 1.1 m high. Here, it was possible to establish the surface of the rampart declining towards the inside of the fortress at an angle of *c.*20⁰. In the same section, the outside front of the rampart inclined *c.*70⁰ towards the eroded top (Figure 2B). We propose that the upper part of the rampart had a levelled surface along the covering palisade on top for ease of movement.  Based on the preserved surfaces of the rampart and the assumed height of the gateways, it is estimated that here the rampart was *c.*3 m high with a 1.5 m wide plateau, giving a total volume of the ramparts of 6567 $m^3$ excluding the gates (Table 2). Although it cannot be ruled out that the plateau was wider or narrower, nor that the collapse of the rampart altered its original form. However, an increase of the plateau dimensions by 1.0 or 2.0 meters gives a volume increase of 1.6 % and 3.5 % respectively, and therefore would not affect the calculation of the total quantity of turfs used in the construction considerably.

The majority of the turfs used were between 70 and 130 mm thick when recorded during excavation (Figure 2C); for the calculation of the harvested area, an average turf thickness of 100 mm over an area of *c.*65,670 $m^2$ or 6.57 ha was used. Calculations using 70 mm and 130 mm thick turfs gives areas of 50,515 $m^2$ and 93,814 $m^2$ respectively. However, as parts of the rampart consisted of loose soil infilling among the turfs, this area is most likely an overestimation. A possible source area for harvesting turfs is shown in Figure 4 and is the nearest dryland area from Borgring where the turfs could be harvested.

| **Rampart** | |
|---|---|
| Outer diameter (m) | 144.4 |
| Inner diameter (m) | 123.2 |
| Circumference (m) | 453.65 |
| Rampart width (m) | 10.6 |
| Gate width (m) | 4.6 |
| Northern gate (m) | 4.3-4.7 |
| Eastern gate (m) | 4.35-4.8 |
| Southern gate (m) | 4.2-4.3 |
| Western gate (m) | 4.4-5.1 |
| **Palisade** | |
| Palisade length (m) | 435.25 |
| Palisade observed (m) | 49.2 |
| Palisade ditch measured (m) | 21.5 |
| Palisade post recorded | 77 |
| Palisade post average size (m) | 0.39 x 0.114 |
| **Turf** | |
| Rampart area ($m^2$) | 4261 |
| Volume ($m^3$) | 6567 |
| Rampart height (m) | 3 |
| Turf height (cm) | 10 |
| Area turf (ha) | 6.57 |

**Table 2**. Rampart dimensions and the resulting turf source area needed for building the rampart at the Borgring fortress.

## *Pollen analysis of the Rampart Turfs*

The pollen analysis showed great uniformity between the samples, indicating that they were harvested from the same vegetation type (Figure 5 and Supplementary A). There was, however, a slight tendency for the turfs from the rampart to the west to have more pollen of trees and sedges (Cyperaceae) along with some ferns (*Dryopteris* sp.) than the turfs from the rampart to the south, which had slightly more herbs. This could be due to minor differences

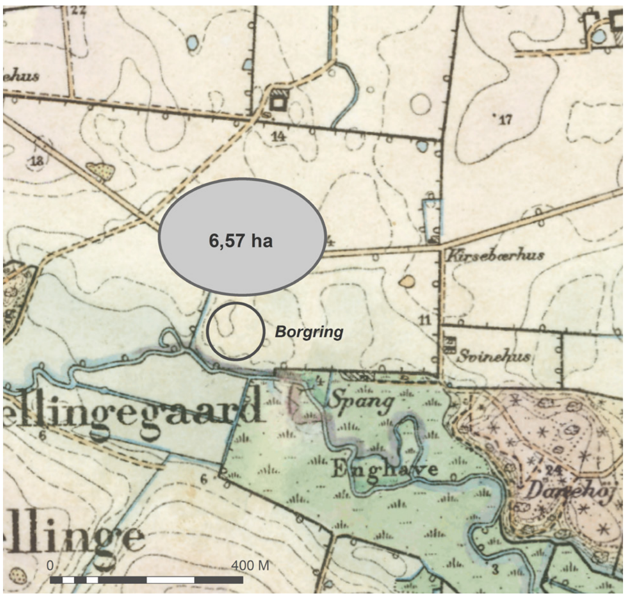


**Figure 4**. The total area and possible source area of grassland needed to collect turfs for the circular rampart to a height of 3 m at the Borgring fortress (includes data from Agency for Data Supply and Efficiency and Høje Maalebordsblade, December 2019).

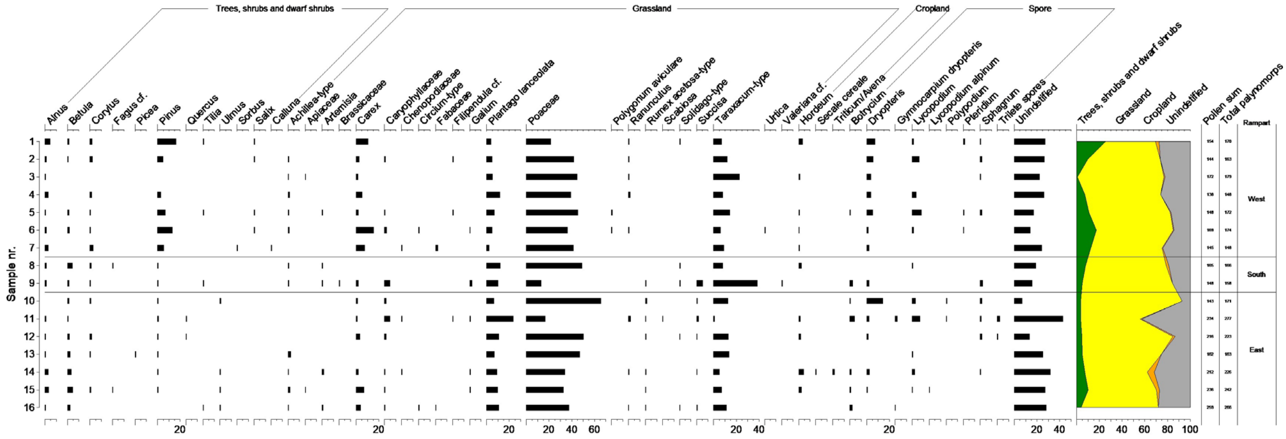


**Figure 5**. Pollen records from analysed turfs from the eastern, southern, and western ramparts at the Borgring fortress.

in the local vegetation caused by variations in soil type, moisture content and grazing pressure. Some of the samples contain a high amount of unidentified pollen (up to 20 %), which potentially could alter the general picture of the open land condition. However, many of the most common tree pollen types can be determined even in a relatively degraded state. The majority of the unknown pollen types are believed to belong to non-arboreal types.

On the whole, the pollen samples, with their high content of grasses and grazing indicators such as common sorrel (*Rumex acetosa*-type) and ribwort plantain (*Plantago lanceolata*), indicate that the turfs were harvested from a mostly treeless, dry agrarian landscape with persistent grazing (Figure 5).

## *Wood identification, Timbers and the reconstruction of the Ring Fortress*

Five different tree taxa were found amongst the 59 analysed fragments of wood and charcoal sampled from the construction timbers of the gates that were burnt down during the Viking Age (Baittinger 2018). Oak (*Quercus* sp.) is dominant with 59 %, followed by elm (*Ulmus* sp.) with 34 %, along with some ash (*Fraxinus excelsior*), alder (*Alnus* sp.), and fruit trees (Spiraeoidea, including taxa like *Prunus* and *Sorbus*), each with 2.3 % (Figure 6A-B; Table1). No timber is preserved from the rampart cladding, but the faint traces on the outer margin show that

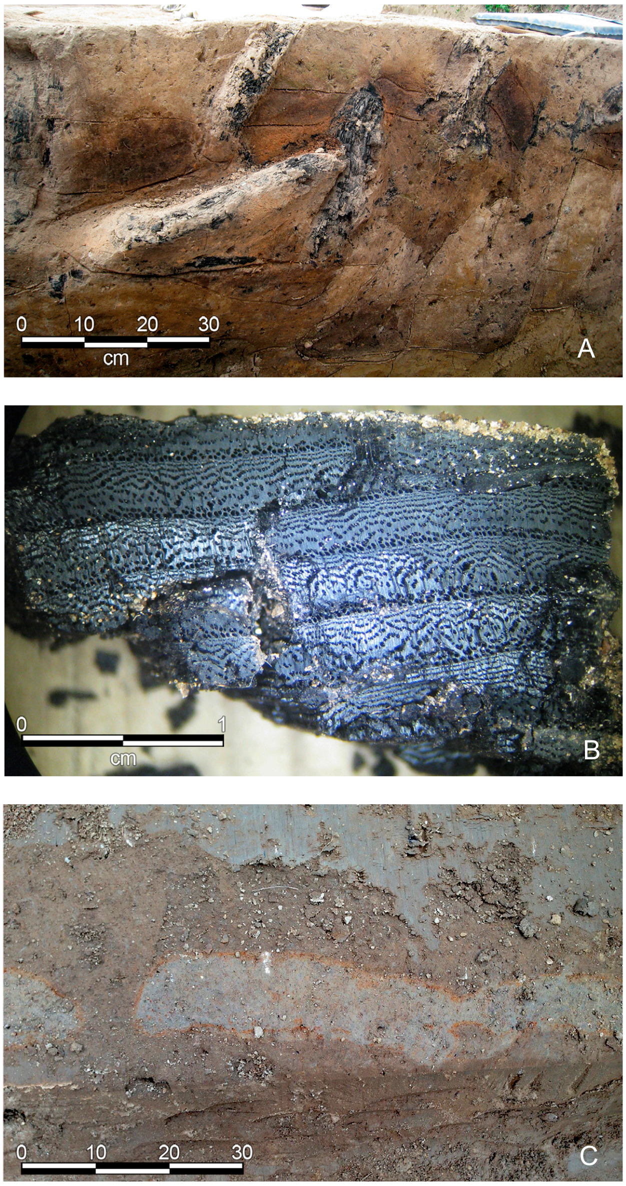


**Figure 6**. A) Burnt timbers and post of elm (*Ulmus* sp.) from the eastern gate at the Borgring fortress (Photo: Claudia Baittinger); B) Carbonised elm (*Ulmus* sp.) tree from the eastern gate (Photo: Claudia Baittinger); C) Palisade post traces (horizontal profile) (Photo: Museum Southeast Denmark).

both split planks and posts were used (Figure 6C). Most of the timbers were of relatively modest sizes i.e. 16-25 cm wide and 14-16 cm thick and even young trees were used. These thinner pieces, together with alder and fruit trees, were used where the builders could be less fastidious.

It was possible to estimate both the total amount of timber used and the size of timbers on the basis of these traces and the burnt construction timbers, along with the observed postholes. Due to the fragmented tree taxa data, the calculation of the total amount of timber used is based solely upon oak, as this was the preferred building material. The reconstruction may overestimate the required resource area if large numbers of other tree taxa have been used in the construction.

The observations of 26 plank and post traces associated with the timber cladding on the outer margin of the rampart suggest a plank size of *c.*0.29 m wide and 0.11 m thick, with an average gap of 0.13 m between the planks. The planks for the cladding were placed in a trench dug along the outer foot of the rampart. The trench was, however, seldom deeper than the topsoil, suggesting that some sort of horizontal plank structure fixed the vertical planks in place. Furthermore, since the planks may have been tapered before being placed in the trench, the spacing between the planks is likely to have been less than 0.13 m above the surface of the ground. Therefore, in our reconstruction of Borgring, we have set the spacing between the above-ground planks to 0.03 m. The vertical and the horizontal planks were approximately the same size, which would ensure stability in a structure with gaps of around 0.1 m between the timber posts. In order to secure the plank cladding of the rampart, at least four rows of these 'barrel hoop' type fixtures (stringers) would have been needed. These stringers were secured to the planks along the rampart frontage and must have been placed on the inner side of the cladding so that they could not be used by attackers as steps from the outside. The fixing of the vertical planks on the rampart frontage with the stringers was probably done by driving large wood pegs through both planks and into the rampart turfs (Figure 7). This technique was used to fix timber cladding at the Kanhave Canal on the island of Samsø dating to AD 726 (Christensen 1995, 99-117). The Borgring gates were built with heavy-duty corner posts with a post-built wall along openings in the rampart. It is assumed that this was fixed in place with a wall plate supported by transverse tie beams. The Borgring construction is, in principle, a tunnel gate, but it is not known whether the roof covered the whole gates or just the frontage.

The reconstruction (Figure 7) is based on the results gained from the excavation campaigns

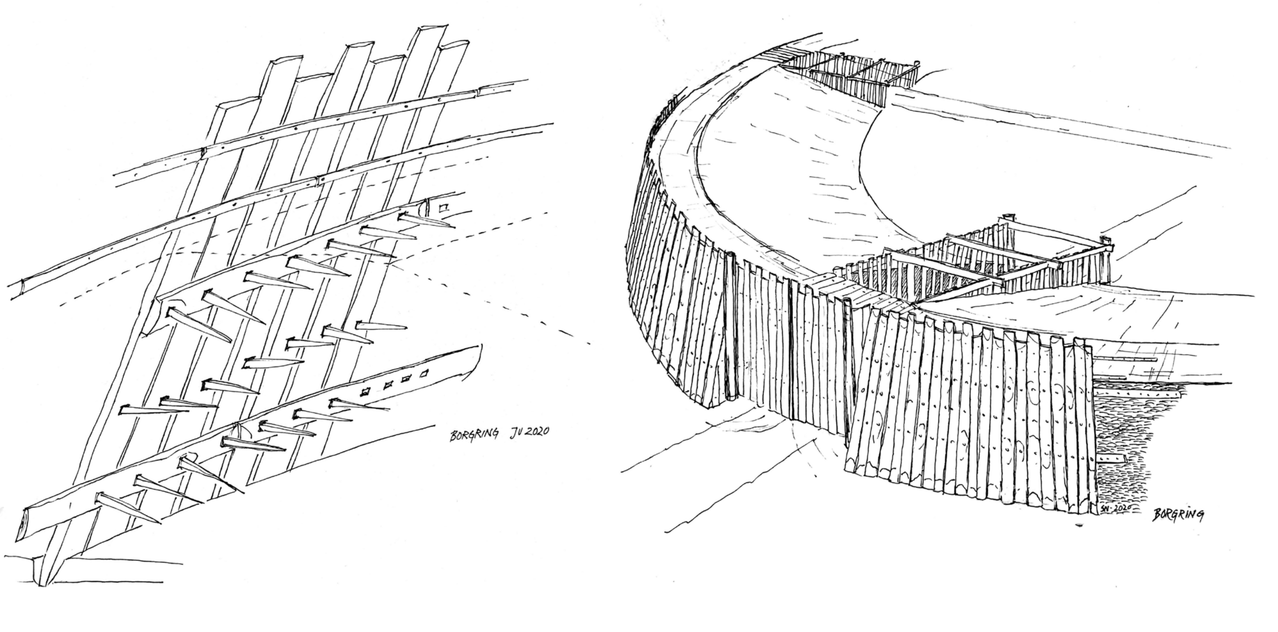


**Figure 7**. Left) Reconstruction drawing of the palisade construction components; The two different sizes of vertical cladding planks, the four runs of stringers and the large wood pegs used for fixing the vertical planks on the rampart frontage with the stringers and the rampart turfs; Right) Reconstruction drawing of the Borgring fortress palisade and rampart (Drawings: Søren Nielsen and Jens Ulriksen).

| Timbers utilized (estimated) | | |
|---|---|---|
| Components | Dimensions<br>Length x breadth x thickness (m)<br>*or*<br>Length x diameter (m) | Quantities |
| **Palisade** | | |
| Vertical cladding planks (long) | 4.90 x 0.29 x 0.10 | 680 |
| Vertical cladding planks (short) | 4.70 x 0.29 x 0.10 | 680 |
| Horizontal stringers (above the top surface of the rampart) | 3.50 x 0.20 x 0.10 | 249 |
| Horizontal stringers (below the top surface of the rampart) | 3.50 x 0.15 x 0.10 | 259 |
| **Gateways** | | |
| Vertical timbers | 4.30 x 0.30 x 0.10 | 60 |
| Horizontal stringers | 2.30 x 0.20 | 16 |
| Diagonal braces | 3.50 x 0.20 | 8 |
| Corner uprights | 5.60 x 0.36 | 16 |
| Side posts | 3.50 x 0.22 x 0.15 | 240 |
| Roof-bearing stringers | 5.50 x 0.20 x 0.10 | 16 |
| Roof planking | 2.65 x 0.30 x 0.10 | 64 |
| Beams | 5.00 x 0.20 | 20 |
| **Timbers in all** | | **2308** |

| Applied number of trees | |
|---|---|
| Tree-boles with an average breast-height diameter of 0.65 m (providing raw materials for an average of six timbers) | 183 |
| Tree-boles with an average breast-height diameter of 0.35 m (providing raw materials for an average of two timbers) | 605 |
| **Trees in all** | **788** |

**Table 3**. Calculations of timbers and trees needed for the construction of the Borgring fortress.

conducted at the site, along with research results gained from investigating the other Danish Viking Age ring fortresses and conducting experimental archaeological projects exploring Viking Age craftsmanship (Nielsen 2011, 59-82; Ravn 2016, 17-54). Many assumptions have been made in the calculation of the amount and sizes of the different timber components and it is important to stress that the stated total amount of timbers utilised must be viewed with some caution. A minimum use of 2308 timber components is calculated for the construction of Borgring (Table 3). Tree boles with an average breast-height diameter of either 0.35 or 0.65 m from approximately 789 trees of two size classes were used to craft these timbers (Table 3 and Figure 8). The calculated amount of oak timber used for the Trelleborg ring fortress included different growth age/size classes (Jessen 1948, 173-178) and similarly estimated the area of oak woodland required to supply the construction. This was based on a series of woodland studies of the eastern Danish oak woodlands between the end of the 1800s and the beginning of the 1900s, which gives the density of oak per hectare in Danish woodlands at that time. In the calculations for the timber used at Borgring, we use corresponding size classes. We also estimate the area of oak-dominated woodlands required to collect the required amount of oak timber by applying the density data of Jessen (1948, 173-178) of oak in native Danish forests. The resulting estimated forest required to supply the Borgring construction is 7.4 ha (Table 4). As timber sizes are as small as 10 cm, we can expect that practically all usable oak was felled.

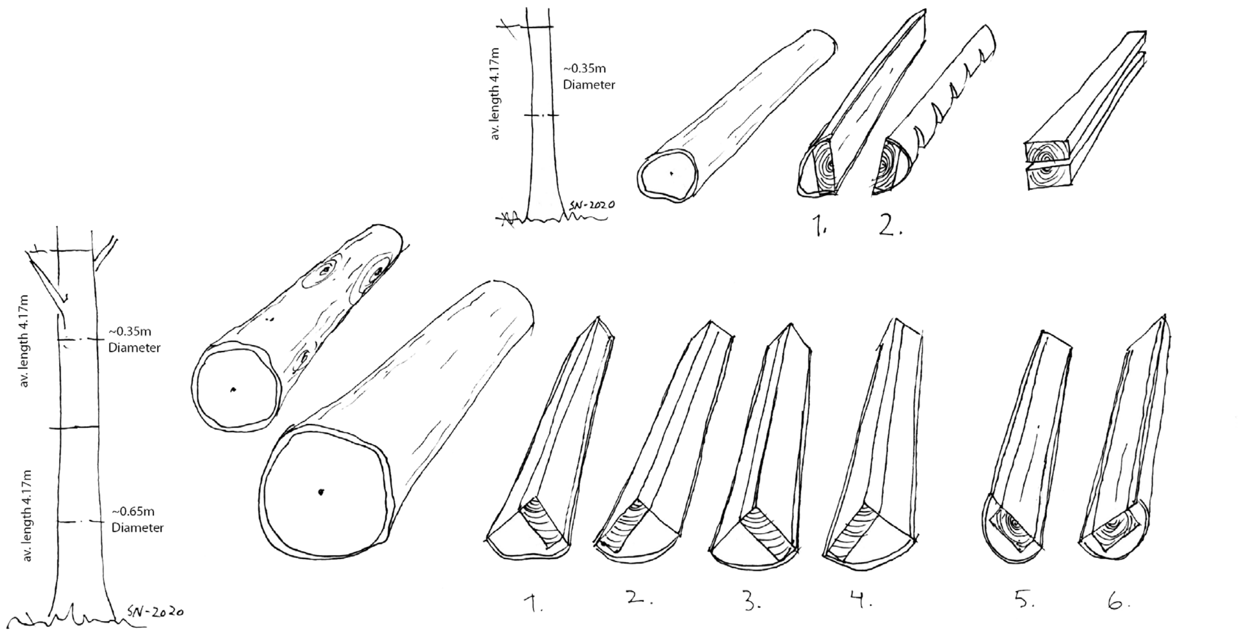


**Figure 8**. Procurement of wood resources for building the Borgring fortress. Top) A tree with a breast-height diameter of approximately 0.35 m and a minimum bole height of 4 m is felled. The log is cleft in two and subsequently dressed by axe providing raw materials for an average of two timbers; Bottom) A tree with a breast-height diameter of approximately 0.65 m and a minimum bole height of 8 m is felled. The log is divided into two parts: A bottom part with a diameter of approximately 0.65 m and a top part with a diameter of approximately 0.35 m. The bottom part is cleft in four and the top part is cleft in two. The cleft pieces are subsequently dressed by axe providing raw materials for an average of six timbers (Drawing: Søren Nielsen).

The smallest size of timber – for example, the pegs used as fasteners – are not included, as these size classes would probably have been available from the crowns of the felled oaks and from the forest floor.

## *REVEALS and local Resource Areas*

The results of the REVEALS modelling covering the last 2000 years (Figure 9; Supplementary B) show an open landscape dominated by grasses (Poaceae) (29-56 % cover) with a quite high cover of ribwort plantain (*Plantago lanceolata*) (1-9 %). This likely reflects large grazing areas. Open wetlands (represented in the REVEALS estimate by sedges (Cyperaceae) covering 3-23 % of the region) may also have been used for grazing or mowed for hay. Cereal (Cerealia) cover is seen throughout the period but increases strongly from the 1350s and peaks in the 1500s (Figure 9). The cover of cereal and rye (*Secale cereale*) are of course an underestimation of the area of arable fields, as these also contained weeds, such as part of the cover of common sorrel (*Rumex acetosa*-type) and mugwort (*Artemisia*) as well as species not included in the REVEALS analysis, such as hemp (*Cannabis sativa*) and flax (*Linum* sp.). The regional tree cover around AD 985 was 37 % ± 2 % and dominated by beech (*Fagus sylvatica*) and hazel (*Corylus avellana*). Oak (*Quercus* sp.) had a coverage of 3.3 % ± 0.3 %, which means that there was approximately 1 ha of oak stands for every 30 ha in the landscape. To supply the construction site with 7.4 ha of oak woodland, 223 ha of agrarian Viking Age's landscape was needed.

## Discussion

The uniform and stringent design of ring fortresses shows that they were built to a predefined plan by competent builders who probably knew in advance the raw material requirements and whether there were sufficient local resources (Ulriksen, Schultz and Mortensen 2020). At Borgring there are few indications of how the work was organised, but the geophysical survey of the rampart, together with

| | **Trees** |
|---|---|
| Oak (average 0.35 m) | 605 |
| Oak (average 0.65 m) | 183 |
| Oak trees in total | 788 |
| REVEALS oak land cover (%) | 3.3 |
| Ha cultural landscape needed for 1 ha oak | 30.3 |

| **Borgring** | | | |
|---|---|---|---|
| Size classes (after Jessen 1948) | Oak (average 0.35 m) | Oak (average 0.65 m) | |
| Rampart and gates | 605 | 183 | 788 |

| | **Trees pr. ha forest** | **Trees needed** | **Area forest needed (ha)** |
|---|---|---|---|
| Oak (average 0.35 m) | 150 | 605 | 4.0 |
| Oak (average 0.65 m) | 55 | 183 | 3.3 |
| SUM | | 788 | 7.4 |

| | **Ha cultural landscape** | **Km² cultural landscape** | **Radius from Borgring (km)** |
|---|---|---|---|
| REVEALS 100 % usable oak for timber | **223** | **2.2** | **0.84** |
| REVEALS 50 % usable oak for timber | 446.1 | 4.5 | 1.19 |
| REVEALS 25 % usable oak for timber | 892.2 | 8.9 | 1.69 |

**Table 4**. Calculation of the resource area of oak woodland (*Quercus* sp.) needed for the construction of the Borgring fortress.

field observations, clearly shows that it was built in sections (Figure 3). The rampart in the southwest was laid out with dark coloured turfs in the lowest layer with a slightly elevated boundary across the rampart. The rampart above this lowest layer was built in sections of alternately dark and light turfs and soil. The sectioning possibly reflects different work gangs cutting turf from different areas around the fortress. This is supported by the different pollen spectra seen in the turfs from the eastern, southern and western parts of the rampart (Figure 5). The pollen analysis of the turfs also shows that the ring fortress was built in an open, grazed agrarian landscape and it is not surprising that turf was chosen from these dryland areas, as the lower organic content of these turfs would have reduced any later settling of the ramparts.

Whilst the turfs are likely to have been harvested from the immediate surroundings, it was not necessarily the case that the timbers for the rampart cladding and gates were also found locally. Eastern Zealand has some of Denmark's best agricultural land, a flat moraine landscape that is relatively easily cultivated, and much of it was already deforested by the Bronze Age (Mortensen et al. in prep). Access to suitable timber was therefore not guaranteed. This raises the obvious question of whether the raw materials were sourced locally or whether

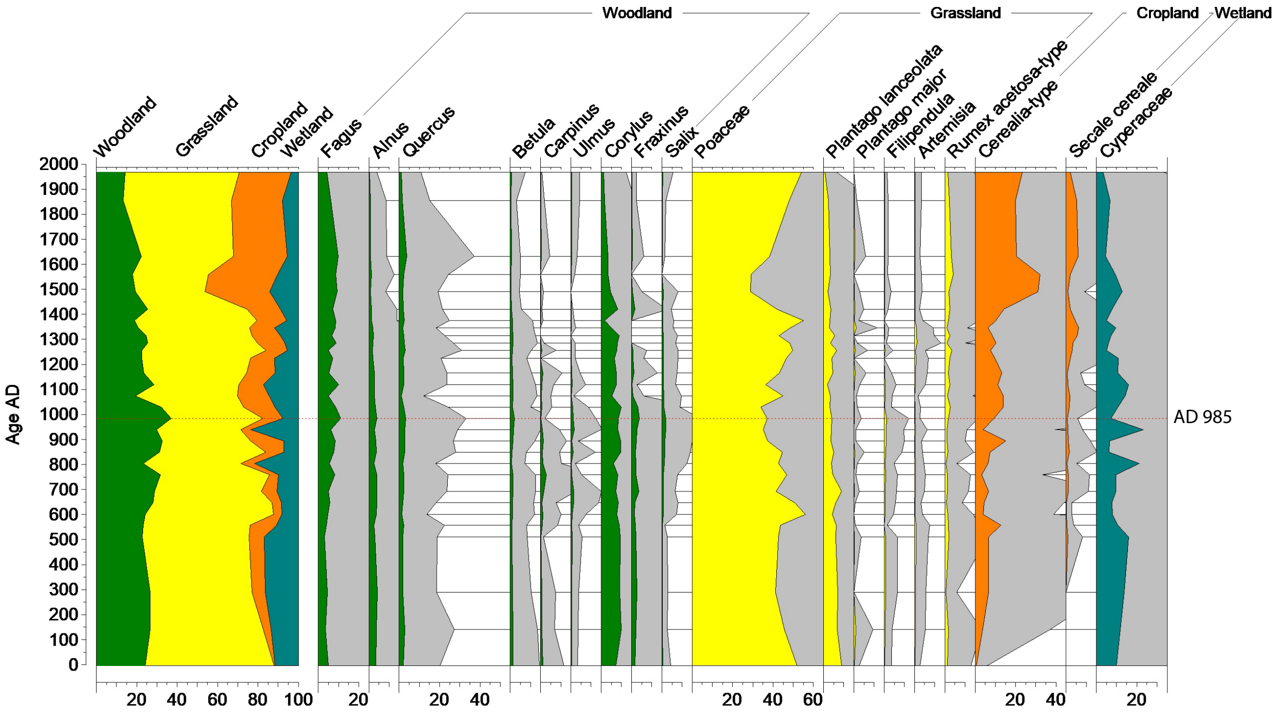


**Figure 9**. REVEALS-modelled diagram from lake Dalby Sø showing estimated regional vegetation land cover percentages over the last 2000 years. The grey curves represent 10x exaggeration.

they were imported from further afield. Studies of other large Viking Age construction projects, such as the Jelling complex or the monumental oak bridge found at Ravning Enge, indicate that timbers were sourced locally (Jessen et al. 2014, 17), however, we also know that large amounts of building timbers were exported from Norway to Iceland in the beginning of the eleventh century AD (Sigurđsson 2005, 181-196; Stefánsson 1997, 25-41). The import of timber over large distances was therefore a real possibility.

The pollen and REVEALS analysis indicate that beech was the most common tree species found in the region around Borgring (Figure 9) but there is no evidence of beech being used for construction components in the ring fortress, presumably because beech is of limited use as a building timber (Smith 1959).

As the pollen analysis of turfs indicates that Borgring was placed in an open grassland it is unlikely that natural or semi-managed oak-dominated forest could be found in the immediate vicinity of Borgring, as this would result in higher oak percentages in the pollen analysis of the turfs. The REVEALS model shows that the average regional coverage of oak within roughly 25 km of Borgring was approximately 3.3 % around AD 985, meaning that in principle there was enough timber for both the gates and the palisade within 223 ha (2.23 $km^2$). If we assume a uniform distribution of the vegetation in the surrounding landscape, this is equal to a radius of 840 m around Borgring.

In reality, however, vegetation distribution is very unlikely to have been uniform. But the modelling gives us an opportunity to examine different scenarios and their impact on the required source area. For example, reducing the amount of usable oak in the area near Borgring by 50 % would increase the source area needed to a radius of 1190 m, while a reduction of 75 % necessitates a radius of 1690 m. In comparison, the constructions at Trelleborg – including 31 houses, oak cladding on both the inner and outer sides of the ramparts, and wooden circular and crossroads – would have consumed much more timber, and would have required a radial source area of 4040 m, assuming only oak was used. This expands to 5720 m if the amount of available oak is reduced by 50 %. Even though the model cannot give a complete and full representation of the source area, as it assumes an unrealistic uniformly distributed vegetation, it does give an indication of the scale of the hinterland necessary for such building projects. Though we cannot exclude the use of imported timber, the


**Figure 10**. Areas with preserved Celtic field systems in Krageskov (dotted line), south of the Borgring fortress, of around 500 ha. Present day forest is marked with green and the shaded areas show the preserved ridge and furrow system (includes data from GeoDanmark, Agency for Data Supply and Efficiency and Danske kommuner, june 2020 and Terrain 0.4 m, December 2019).

results show that sufficient timber resources for the construction of Borgring could be sourced in the local area and that the import of timber was not a precondition for the work. The size and type of wood used also indicates a local origin, as it is not likely that tree taxa with limited construction quality such as ash, alder, and fruit including *Prunus* sp. and *Sorbus* sp. were imported. The taxa used in the construction is, however, based on fragmentary material from the gates and it is not possible to say how common they were.

But where were the major forests close to Borgring? The pollen analysis of sediments from eastern Danish lakes shows that the overall landscape structure established during the Bronze Age was very similar to that seen on maps of the 1700s and updated maps of the early 1800s from Videnskabernes Selskab (the Royal Academy) (Nielsen and Odgaard 2010; Odgaard and Rasmussen 2000). Through these maps we can get a clue as to where the woodlands supplying the timber may have been located. The woodlands of the Viking Age were probably primarily found in the hilly central area of Zealand, where there are also many place names ending in 'tved' and 'rød', both of which indicate forest clearings from the Viking and Middle Ages (Dam 2015, 129-141). However, a more likely choice of woodland for the Borgring fortress lies 1.5 km south of Køge stream, in a forest now known as Krageskov (Figure 10). This forest has grown on a well-preserved Celtic field system, which is already known to have stretched over 124 ha (www.kulturarv.dk; accessed 2020) but has been recognised in a further 366 ha as a result of work within the present project. We know from other sites that these systems were abandoned in the first few centuries AD, and the fact that they are still preserved shows that the areas were not later ploughed (e.g. Arnberg 2007, 33; Rasmussen, Henriksen and Mortensen 2015, 137). These preserved field systems beneath present-day forests are fairly common in the eastern Danish region. One study shows that at Tårup Lund Forest, in eastern Fyn, the Celtic fields were abandoned around AD 300 and the forest took over immediately afterwards (Rasmussen, Henriksen and Mortensen 2015). As the younger 'ridge and furrow' fields are very rarely seen in Krageskov, this also indicates that the forests were established fairly soon after the abandonment of the Celtic field systems in most areas, and hence existed during the Viking Age. There are in total around 500 ha of forest growing on preserved Celtic field systems immediately south of Borgring, and it is therefore likely that these were the principal areas supplying timber for Borgring.

Quantification of the resource area needed for constructing a ring fortress has not been carried out for other ring fortresses. Trelleborg, Nonnebakken and Fyrkat all lie in open and cultivated landscape types, similar to Borgring (e.g. Christiansen 1989; Jessen 1948, 174; Odgaard and Nielsen 2009; Rasmussen 2005), and it is likely that local resources were similarly available. However, this was probably not the case for Aggersborg, a larger fortress with 48 houses within the ramparts, as Aggersborg lies in an area of northern Jutland that had far fewer woodlands than southern and eastern Denmark in the Viking Age (e.g. Kristiansen et al. 2020).

On a local scale, comparable to the resource area of a village, the impact of fortress building would thus have been considerable and may have led to a shortage of prime building timbers. However, it is also possible that the results were perceived as landscape improvement, since increased clearance of land for grazing and cultivation was ongoing. On a regional scale, the impact would have been hardly detectable. The Danish landscape had been transformed by intense cultural impact since the Neolithic period. The early medieval agrarian colonisation further contributed to large-scale clearance of former forest land. By comparison, the analysis of the materials used in the construction of the Borgring and Trelleborg fortresses show that the required resources could be sourced with a less severe impact on the natural landscape than previously suggested (Jessen 1948, 178). While the Viking Age ring fortresses were undoubtedly a powerful expression of organisation, the ecological impact on the local environment near Borgring and possibly its sister fortresses, was limited.

## Conclusion

Prehistoric monumental building works are often believed to have caused severe impact on landscape. In the case of the Borgring ring fortress we can now model the impact with considerable precision.

The Borgring circular ramparts were built using turfs of dryland soils probably collected from the area immediately north of the fortress. Turfs from an estimated 6.57 ha of grasslands would have been needed to construct the ramparts to a height of 3 m.

By modelling the pollen data from the local lake, Dalby Sø, it is shown that if construction timber were entirely of oak (*Quercus* sp.), the timber for the rampart timber cladding and the gates was, in principle, available locally within a radius of 810 m. If the amount of usable timber in the forest is reduced by 50 % and 75 %, the radius required around Borgring increases to 1240 m and 1630 m respectively. If the larger ring fortress at Trelleborg, which had a much greater timber requirement, was in the same type of landscape, it would need a resource area with a radius of 4040 m.

The results indicate that the resources could be supplied from within a workable distance and that the import of timber was not necessary to build the fortress. The most likely timber source area for Borgring is within Krageskov 1.5 km south of Køge stream, where there are more than 500 ha of forest growing on preserved Celtic field systems.

Modelling of the required resource area indicates a much smaller area than previously assumed and the construction of the fortress would not have had such a significant impact on the environment in general, though local communities could have experienced a shortage of building timber over the following years.

## Acknowledgements

The authors would like to thank the three anonymous reviewers for valuable comments on the manuscript. This work was part of the Borgring Project 2016-18 project funded by A.P. Møller og Hustru Chastine Mc-Kinney Møllers Fond til almene Formaal, with additional support from Køge Municipality. This article is one of more contributions discussing targeted aspects of the results of the Borgring Project 2016-18 published in Danish Journal of Archaeology. The authors declare that there is no conflict of interest.

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## Supplementary A.

Raw pollen data from analysed turfs from the eastern, southern, and western ramparts of the Borgring fortress.

see excel-attachment.

## Supplementary B.

Raw pollen data from lake Dalby Sø covering the last 2000 years.

see excel-attachment.

# Problems with Strontium Isotopic Proveniencing in Denmark?

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**ABSTRACT**

A recent study by Thomsen and Andreasen (2019) has induced a negative reaction to the utility of strontium isotope proveniencing in Denmark. Although there are higher strontium isotope values in the landscape, Thomsen and Andreasen are not correct about the impact of their finding on studies of prehistoric mobility. Several case studies identify such “hotspots” in the landscape and help evaluate their consequences for identifying non-local individuals. In sum, (1) there are small areas of higher strontium isotope values in Denmark, (2) surface water is not a reliable proxy for baseline information on local strontium isotope sources, and (3) strontium isotope proveniencing remains a very useful method for identifying non-local individuals.

**ARTICLE HISTORY**
Received
18 August 2020;
Accepted
20 October 2021

**KEYWORDS**
Isotopic proveniencing; Denmark; Bioarchaeology; Strontium; Bioavailable

**Corrigendum!** This article has been republished on 25 February 2022. In the new version, Fig. 3 was changed to remove unpublished samples. The editors.

## Introduction

There seems to be some confusion and consternation at the present time with regard to the utility of strontium isotopic proveniencing in the archaeology of southern Scandinavia. Strontium isotopic proveniencing is a method for determining if an individual was local or non-local to the place of burial. The principles of the method are straightforward and based upon the premise that ratios of strontium isotopes ($^{87}Sr/^{86}Sr$) vary geographically due to underlying differences in local geologies (Burton et al., 2003; Price et al., 1994, 2002, 2008, 2010). Strontium isotopes enter the human skeleton via the food chain, from rock to sediment, to soil nutrients, to plants, to animals such as humans. Because strontium has a heavy mass, there is no fractionation or change along this path. $^{86}Sr$ is stable and approximately 10 % in nature; $^{87}Sr$ is radiogenic, created by the decay of rubidium 87 with a half-life of almost 50 billion years; $^{87}Sr$ is variable and around 7 % in nature. Thus, older rocks and rocks with more rubidium have higher $^{87}Sr/^{86}Sr$ values and younger rocks generally have lower values. This premise has been demonstrated through several decades of geological research.

These isotopes are deposited in the skeleton and teeth. Most tooth enamel forms in the period before birth until about six years of age. Tooth enamel is one of the most durable tissues in the skeleton, both before and after death and shows very little indication of diagenesis – post-mortem chemical change due to burial. $^{87}Sr/^{86}Sr$ values in human tooth enamel vary from approximately 0.705 to 0.735 and are measured on mass spectrometers accurate to the fourth or fifth decimal pace. If the strontium isotope ratio of tooth enamel differs from that of the local region, the individual likely was not born locally.

In actual fact, levels of strontium isotopes may vary from local geology for several reasons (Maurer et al. 2012; Price et al. 2002), including differing surface deposits introduced by glacial, aeolian, or fluvial processes or in coastal areas, sea spray and rainfall may introduce a marine signal with a value ca. 0.7092. For these reasons it is necessary to measure *bioavailable* levels of $^{87}Sr/^{86}Sr$ to characterize local strontium isotope ratios (Price et al. 2002; Sillen et al. 1998). Local strontium isotope baseline values can be determined by measuring archaeological fauna or even modern specimens of plants or animals in areas where preservation is poor. This information is compared to the isotope ratios in the tooth enamel or bone. If the ratios are different then in all probability the individual in question was not born locally. The specific place of origin can be difficult to determine since different places can have the same strontium isotope ratio, but it is sometimes possible to constrain a potential homeland using a combination of isotopic and archaeological evidence.

I have been working with strontium isotope proveniencing for almost 30 years. Our Laboratory for Archaeological Chemistry at the University of Wisconsin-Madison processed more than 10,000 samples from five continents in that time. I have published or co-authored a number of papers on isotopic proveniencing in Scandinavia over the last decade or so (Price and Gestsdóttir 2006; Sjögren and Price 2006, 2013; Sjögren et al. 2008, 2013, 2016, 2017; Price et al. 2007, 2008, 2010, 2015, 2012, 2013, 2016, 2017, 2018; Price 2008, 2013, 2011, 2018; Frei and Price 2012; Dobat et al. 2014; Frei et al. 2015, 2019; Arcini et al. 2015; Bäckström and Price 2016; Wilhelmson and Price 2017; Bergerbrant et al. 2017; Naumann et al. 2014; Naumann and Price 2020; Kjällqvist and Price 2019).

Perhaps I should also point out my preference for the term "provenience", rather than "provenance". To my mind, provenance has subjective connotations from art history that refer more to context and artist, while provenience is a more objective term from geology that refers to the study of sources and measurement of composition.

This essay is organized as follows to discuss specific aspects of isotopic proveniencing. I initially consider the study by Thomsen and Andreasen. I offer some examples that may explain why there are variations in the $^{87}$Sr/$^{86}$Sr baseline in southern Scandinavia. I then turn to a broader discussion of the utility of isotopic proveniencing and why it is important to be cautious in its application. This essay is not intended as an overview of strontium isotope analysis or a critique of Frei's study of the Egtved Girl.

## Thomsen and Andreasen (2019)

Many of the concerns with this method in Denmark grew out of a paper by Thomsen and Andreasen (2019) that pointed to the modern practice of liming agricultural fields in Western Jutland and the effect on $^{87}$Sr/$^{86}$Sr levels in surface water. This essay is intended to address those concerns and discuss some of the weaknesses and strengths of the method of strontium isotope analysis.

The study by Thomsen and Andreasen was inspired by doubts raised by an article by Frei et al. (2015) that argued on the basis of strontium isotopic proveniencing of her teeth, hair, nails, and bone and some information from an artifact that the Egtved Girl, an iconic burial from the Danish Bronze Age, was not originally from Denmark, but had traveled several times between her homeland in or near the Black Forest in Germany to her residence and place of burial in Denmark, a distance of more than 800 km. The local baseline level of $^{87}$Sr/$^{86}$Sr for comparison was determined from measurements of surface water (Frei and Frei 2011). For an archaeologist's perspective, see comments by Hvass (2019) who questions the feasibility of travel over such long distances and argues for investigation of the origin of the artifacts that were included with the burial.

The Thomsen and Andreasen study was an interesting and potentially damaging critique of the Frei et al. (2017a) article and of strontium isotopic mobility studies in general. In essence the authors argued that there were higher $^{87}$Sr/$^{86}$Sr values in the landscape, especially in western Jutland, and that modern agricultural applications of lime in areas with non-calcareous soils reduced the strontium isotope ratio of surface water and thus made calculation of local bioavailable strontium from water unreliable. Specifically, the projections of Thomsen and Andreasen meant that the Egtved Girl could have been from Denmark all along. If these conditions applied, then basic reference data for strontium mobility studies would be unreliable.

Fortunately, there are some limitations with the Thomsen and Andreasen study that restrict its conclusions. Frei et al. (2019) argue that the introduction of lime onto fields affects only the upper 60 cm of soil and does not change strontium levels in water below that depth. There are examples where surface water seems to provide a good indicator of baseline values (Maurer et al. 2012; Blank et al. 2018), but many studies (probably most) of bioavailable strontium do not focus on surface water with good reason. One simply does not know the sources of strontium in water. Although it is easy to collect, surface water is not necessarily representative of a particular location as water moves, often long distances, and may incorporate the strontium signal of the different places through which it passes. This caveat involves both depth and distance in water movement. Moreover, water because of its normally low concentration of strontium, does not contribute much to the human consumption of strontium (Bryant et al. 1958, Comar et al. 1957; Elias et al.1957; Lewis et al. 2017) and plays a relatively minor role in body levels of $^{87}Sr/^{86}Sr$. Soil is also not a good proxy for bioavailable strontium as differential weathering of the various minerals in soil can produce very different $^{87}Sr/^{86}Sr$ values (e.g., Maurer et al. 2012; Frei et al. 2019).

There are several other kinds of material more appropriate for measuring strontium isotope baselines than surface water or soil (Bentley et al. 2004; Price et al. 2002; Sillen et al. 1998). These include modern fauna, modern vegetation, archaeological fauna, and/or archaeological human bone. Because there is no fractionation of strontium isotopes due to the heavy mass of the element, almost any organic material in the environment can be measured to obtain the local $^{87}Sr/^{86}Sr$ value. We have for some time (since 2002) advocated the use of archaeological fauna (especially small wild mammals) for the determination of strontium baselines. Grimstead et al. (2017) also have some suggestions for the standardization of strontium isotope baseline environmental data.

Unless the strontium from modern lime somehow contaminates archaeological fauna, this practice would seem to obviate the potential problems from lime application. Fertilizer does not appear to significantly alter strontium isotope ratios either, as most brands have low to intermediate levels of strontium isotope ratios (Frei and Frei 2011; Ria et al. 2004). Moreover, materials buried below 30 cm seem to avoid most contaminants (Bacon et al. 1996; Budd et al. 2000; Frei et al. 2019; Rasmussen et al. 2019).

It should also be noted that tooth enamel is unusually resistant to diagenesis and normally does not take on strontium from ground water after burial (Budd et al. 2000). It is also the case that we have measured archaeological fauna from throughout Denmark and obtained consistent results in the range of 0.709-0.711 (Figure 3A), with a few exceptions discussed below.

## High Strontium Values in the Landscape

What is most important from the Thomsen and Andreasen study is the fact that there exist areas with higher strontium isotope values in the landscape that neither the broad sweep of surface water sampling (Frei and Frei 2011) nor the analysis of owl pellets and other faunal remains (Frei and Price 2012) identified. That low visibility suggests that these "hot spots" may be limited in number and small in size, at least outside of western Jutland. There are a few confounding cases of higher values elsewhere in southern Scandinavia as well as some higher strontium spots in the landscape of northern Germany. They are present and need to be identified. I will discuss two examples of such "hotspots" before examining their cause.

One example comes from the Iron Age site of Alken Enge where the human remains of battle victims were placed in lake and bog deposits (Holst et al. 2018; Løvschal and Holst 2018), not far

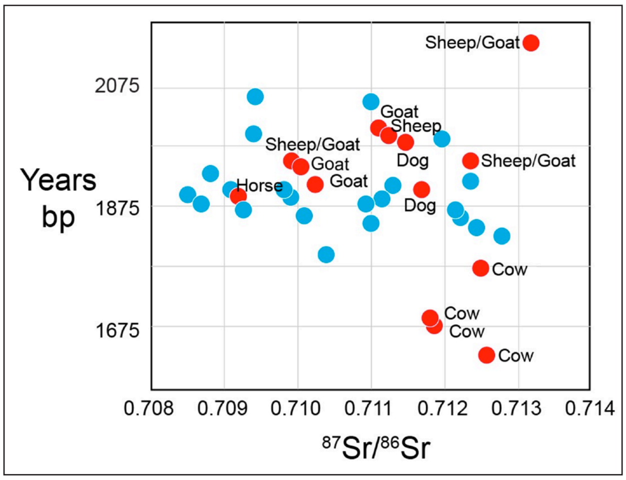
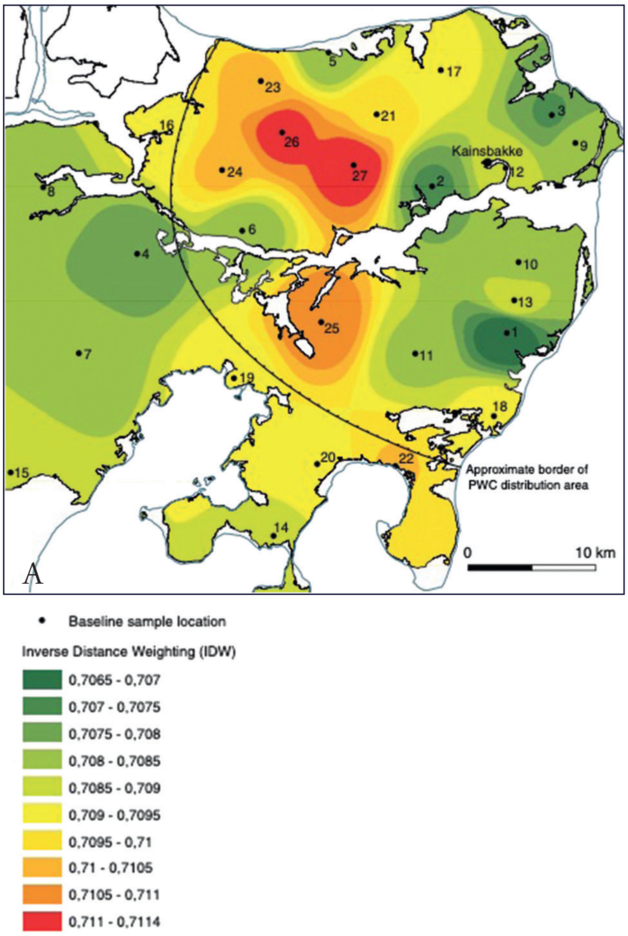
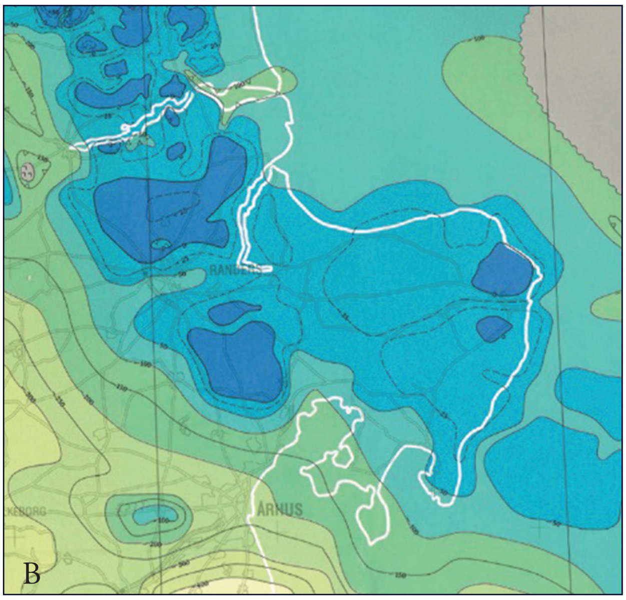



**Figure 1**. Scatterplot of radiocarbon age vs. $^{87}Sr/^{86}Sr$ value for humans (blue circles) and fauna (red circles) at Alken Enge. Animals with high strontium isotope values can be seen above and below the horizon with the human remains on the right side of the graph.

from the famous war weapons sacrifices at Illerup, roughly 20 km southwest of the modern city of Aarhus. This study was done in collaboration with Mads Holst and the Alken project, funded by the Carlsberg Foundation. We measured strontium isotope ratios on a number of human and animal remains in the bog deposits at Alken Enge. Radiocarbon dates on these samples allow us to see that animals in the younger deposits, which were presumably local, have high $^{87}Sr/^{86}Sr$ values between 0.7117 and 0.7125 (Figure 1). An older sheep or goat has a value greater than 0.713. The human values (blue dots) range from 0.7085 to 0.7127. All of the values greater than 0.712 are higher than expected from the baseline information for Denmark. Given the high values for what should be local animals, it appears that there is a "hotspot"– a higher strontium source at or near Alken Enge.

A second example comes from a region of Denmark known as Djursland and the CONTACT project funded by the VELUX Foundation (Klassen 2020), concerned with the movement of ani-



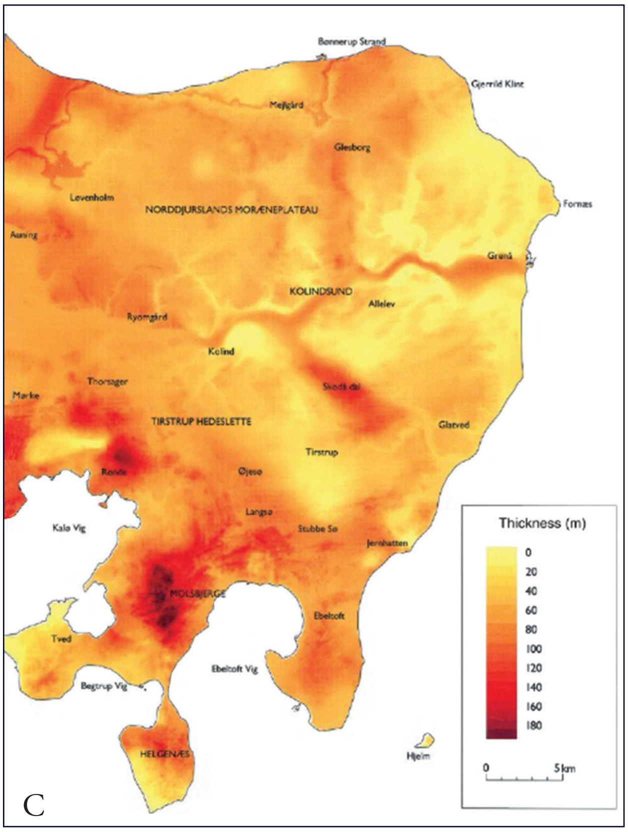




**Figure 2**. (A) sample locations and $^{87}Sr/^{86}Sr$ contours on Djursland. Coastline reconstructed for the time of occupation of the Kainsbakke site (early 3rd millennium BC) by Klassen (2014). Sample site numbers refer to Table 3. Graphics: Casper Skaaning Andersen, MOMU, with additions, (B) Subsurface bedrock on Djursland. Blue is limestone, green is calcareous clays, Structural map of the Top Chalk Group on Djursland (GEUS; Ter-Borch 1991).
(C) Thickness of glaciogenic sediments on Djursland (GEUS; Schack Pedersen/Strand Petersen 1997).

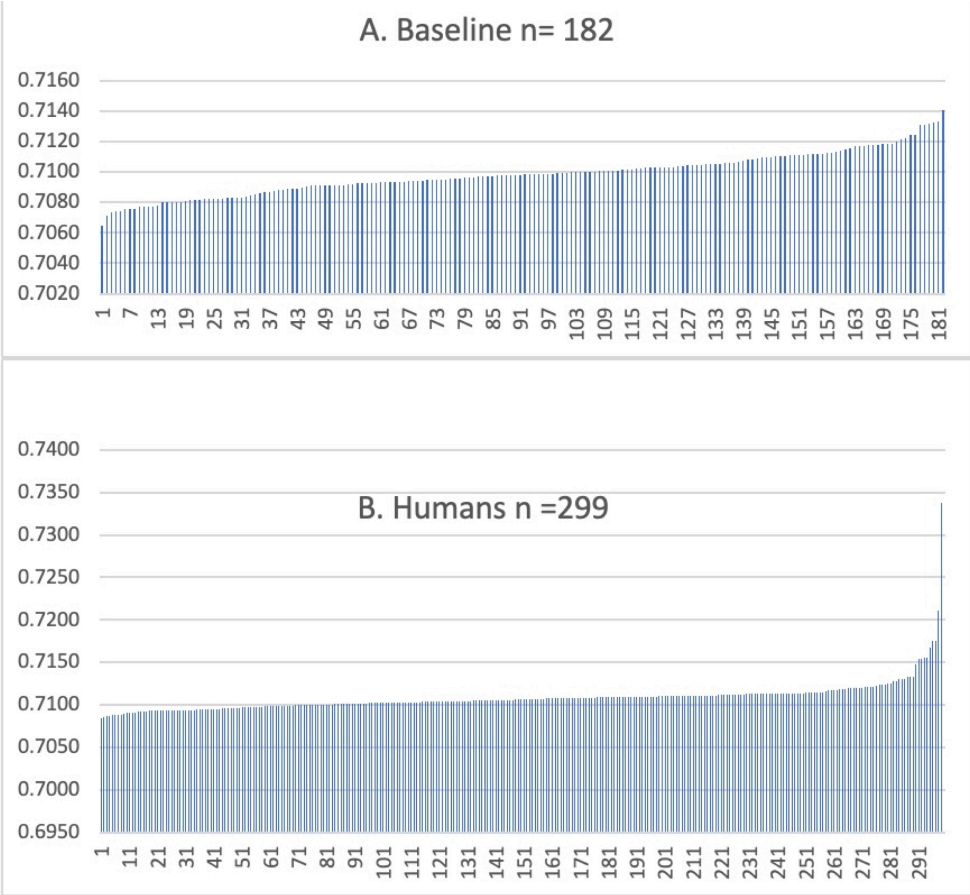



**Figure 3**. Ranked distribution of $^{87}Sr/^{86}Sr$ values for (A) 182 baseline values primarily from fauna, and (B) 299 values from human tooth enamel from Denmark, all time periods.

mals (associated with people) from western Sweden to eastern Jutland, Denmark, as a part of the Pitted Ware Culture (Klassen et al. 2020; Price et al. 2021). Baseline strontium isotope values were measured in modern mice and voles collected across the peninsula of Djursland. Klassen et al. (2020) note that these values corresponded well with the depth of glacial deposits on top of limestone and chalk in the subsurface deposits, i.e., $^{87}Sr/^{86}Sr$ values were higher in areas with thicker glacial deposits and deeper calcareous bedrock (Figure 2).

Frei and Frei (2011) noted that the variation in $^{87}Sr/^{86}Sr$ across Denmark could be explained by the variable mixing of the two major sources of Sr. These are (a) Sr derived from pre-Quarternary carbonaceous sediments ($^{87}Sr/^{86}Sr$ = 0.7078–0.7082) and (b) Sr derived from a radiogenic component in Pleistocene glaciogenic soils with Precambrian granitoid components ($^{87}Sr/^{86}Sr$> 0.712). Apparently, Thomsen et al. (2021) have also discovered this mixing of different sources of strontium isotopes. This seems to be exactly the case in Djursland and is likely the situation throughout most of Denmark. The moral of this story is that surface water and large-scale mapping of $^{87}Sr/^{86}Sr$ is unlikely to identify such "hotspots". National baseline reference maps (isoscapes) can provide some sense of regional variation, but it is necessary to develop detailed local baseline maps for every study.

There is good reason to suspect that these "hotspots" are generally small and do not have a major impact on human $^{87}Sr/^{86}Sr$ values in southern Scandinavia. Figure 3 shows the ranked distribution of $^{87}Sr/^{86}Sr$ values for (A) 182 baseline values primarily from fauna, and (B) 457 values from human tooth enamel from Denmark. In both cases the values fall predominantly between 0.708 and 0.712, the range of baseline values predicted for Denmark by surface water (Frei and Frei 2011) and fauna (Frei and Price 2012). The question is whether these areas of higher values within Denmark are large enough to contribute sufficiently higher $^{87}Sr/^{86}Sr$ to raise enamel values. Based on the fact that most of the measured human samples from Denmark fall within the estimated baseline and the fact that higher values are usually distinctly uncommon, the effect of strontium hotspots in Denmark appears to be negligible. It is essential to remember that humans average their intake of strontium isotopes over a period of months or years in building bone and teeth. Thus, if these "hotspots" are small, their contribution to the average ratio measured in enamel will also be small.

## Conclusions

My remarks are not intended to answer questions of the origin and mobility of the Egtved Girl. There are several issues in that study that complicate a direct answer (von Holstein et al. 2015; Kootker et al. 2020; Toxvaerd 2020). I would reiterate that most of the information derived from mobility studies is quite informative and useful. I think it is important to note that strontium mobility studies generally work well to identify non-local individuals, but determining place of origin is a much more complicated and difficult undertaking. It is essential to be cautious in the interpretation of such data because it is easy to be mistaken. The existence of multiple areas with the same strontium isotope signature is a strong reason for not attempting to determine place of origin. The complex variation in strontium isotope baseline values in some areas is another reason to be cautious.

Isotopic proveniencing is a relatively new method in archaeology and as such is still under development. There are problems, often associated with establishing ancient baselines for various isotopes. Analysis for isotopic proveniencing is expensive. The method only works for first generation immigrants. It is also the case that determining the place of origin for non-local individuals is rarely possible. At the same time it is obvious that isotopic proveniencing has become an important tool for bioarchaeology. The ability to identify non-local burials or the movement of ancient animals or plants has revolutionized our understanding of the past and contributed to an understanding that movement was common in the past. Mobility and migration have always characterized the human condition.

## Conflict of Interest

I have no conflict of interest associated with this essay.

## Acknowledgements

I would like to thank Anne Birgitte Gebauer for both inspiring this essay and for her comments. Collaborative efforts with Lutz Klassen, Robert Frei, and Mads Holst were essential in developing my understanding of strontium "hotspots" in the landscape. I would also like to thank Kristian Kristiansen for his helpful comments on the text. I would thank reviewers of this essay for their comments that were helpful. Thanks also to Lasse Sørensen and Katrin Atzbach of the Danish Journal of Archaeology for their help with the manuscript.

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# A Mid-Holocene reindeer antler from Regstrup, Sjælland, Denmark

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**ABSTRACT**
A small, shed antler fragment of a reindeer from Zealand, Denmark has been dated to the Mid-Holocene, *c.*4700 cal BC. Reindeer was an important component of the Lateglacial fauna in Denmark, and the species survived for *c.*1400 years into the Holocene. However, we consider it highly unlikely that the species lived in Denmark during the Mid-Holocene, when dense forests characterized the vegetation and summer temperatures were slightly higher than at present. We suggest that the reindeer antler came to Zealand from Norway or Sweden as a result of trade, perhaps involving flint.

**ARTICLE HISTORY**
Received
19 February 2021;
Accepted
20 October 2021

**KEYWORDS**
Reindeer; Rangifer tarandus; Ertebølle Culture; Stone age; Trade; Denmark

## Introduction

During the Lateglacial period, the vegetation of Denmark was dominated by dwarf-shrub heaths and the cold-adapted reindeer (*Rangifer tarandus*) was the most common large mammal. During the earliest Holocene, temperatures were increasing but this was interrupted by the cold Preboreal oscillation at *c.*9400 cal BC (Björck et al. 1997). Denmark was covered by open forests and reindeer continued to live in the area for some time. The latest dated reindeer specimen from Denmark gave an age of *c.*8300 cal BC (Aaris-Sørensen et al. 2007), corresponding to *c.*1400 years into the Holocene.

During the Mid-Holocene, Denmark was covered by dense forests and the fauna of large, terrestrial mammals was dominated by red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*; Aaris-Sørensen 2009). At this time, the flora and fauna in Denmark included several warmth-demanding species such as the water plants *Trapa natans* and *Najas minor* and the woody plant mistletoe (*Viscum album*; Iversen 1973; Bennike et al. 2001) as well as the pond turtle (*Emys orbicularis*; Degerbøl and Krog 1951). These species no longer live in Denmark and Iversen (1973) concluded that the mean July temperature was 2-3°C higher than at present during the Holocene thermal maximum, which is in good accordance with more recent estimates based on pollen data (Brown et al. 2011).

During excavations at Regstrup on Zealand, Denmark, a shed antler fragment of a reindeer was found; it was dated to the Mid-Holocene, *c.*4700 cal BC. The aim of this paper is put this surprising find on record.

## Materials and methods

Prior to the coming highway between Holbæk and Kalundborg, Museum West Zealand conducted archaeological excavations following the Danish Museum's Act of developer-funded excavations. Trenches were excavated and the profiles mapped and described by archaeologists from Museum West Zealand. Samples were collected from open


**Figure 1**. Map of Denmark showing the location of Regstrup (Re) between Holbæk (Ho) and Kalundborg (Ka) on Zealand.

sections. The samples consisted of sediment monoliths and kg-large bulk sediment samples. The excavations and later analyses revealed the presence of Lateglacial sediments in the area and a shed antler of a reindeer was also found.

The excavated area is located near Regstrup, ca. 9 km south-west of Holbæk (Figure 1), and the antler was found at ca. 55.66°N, 11.61°E, 32 m above sea level. The antler was found in a layer of brownish-grey silty clay. The age of the clay layer is unknown, it did not contain any macroscopical remains of terrestrial plants that could be used for radiocarbon dating. The clay layer is underlain by a layer with a beaver (*Castor fiber*) bone dated to the Younger Dryas and overlain by a layer with artefacts dated to the late Neolithic or Bronze Age.

A sample from the antler was submitted to the Ångström Laboratory, University of Uppsala for radiocarbon dating, using accelerator mass spectrometry (AMS). The collagen fraction of the antler was used for dating. Two dates were obtained. The radiocarbon dates were calibrated to calendar years before Christ (BC) using the CALIB program version 8.20 (Stuiver et al. 2021) and the INTCAL20 calibration curve (Reimer et al. 2020).

The antler gave a surprising age and therefore we decided to check the species identification using protein sequencing by liquid chromatography tandem mass spectrometry (LC-MS/-MS). For extraction and digestion, we sampled approximately 15 mg of bone powder from the antler. Protein extraction was performed as described by Jensen et al. (2020; extraction 1). An extraction control was processed in parallel to the sample. Briefly, 100 μL of 50 mM NH4HCO3 (Sigma) was added to the sample followed by incubation at ambient temperature for 16 h, after this time the sample was centrifuged at 10,000 x g for 10 minutes and the supernatant was removed and discarded. The


**Figure 2**. Antler fragment of reindeer (*Rangifer tarandus*) dated to *c.*4700 cal BC. Sample no. MHO1082x200. The antler was treated with Paraloid B72 after sample was taken for dating. The specimen is housed in the Zoological Museum, University of Copenhagen (ZMK 1/2017).

purpose of this pretreatment was to reduce surface contamination. Subsequently, proteins were extracted by the addition of 100 µL of 50 mM NH4HCO3 and incubation at 65°C for 1 hour. After centrifugation at 10,000 xg for 10 minutes, the supernatant was removed and quantified using the BCA assay (Thermo Fischer) according to the manufacturer's instructions. A volume equivalent to 20 µg of protein was placed into a fresh protein LoBind tube (Eppendorf) to which 0.4 µg of sequencing grade trypsin (Promega) was added. The digestion was allowed to proceed at 37°C for 18 hours. The digestion was terminated by the acidification of the samples to <pH 2 using 10 % (vol/vol) trifluoroacetic acid (TFA, Sigma Aldrich). After acidification the sample was centrifuged at 10,000 x g for 10 minutes. Peptide purification was performed using C18 reverse-phase resin ZipTips (PierceTM) according to the manufacturer's instruction. Peptides were eluted with 50 µl of 50 % acetonitrile (ACN; Sigma Aldrich)/0.1 % TFA (vol/vol).

For LC-MS/-MS a volume containing approximately 2 µg of protein was placed in separate wells on a new 96-well plate and topped up to 30 µL using 40 % (ACN) and 0.1 % FA. The sample and a blank were then vacuum centrifuged to approximately 3 µL and resuspended with 10 µL of 0.1 % TFA, 5 % (ACN) and 5 µL of sample analysed by LC-MS/MS. The LC-MS/MS parameters were the same as previously used for palaeoproteomic samples (Jensen et al. 2020; Mackie et al. 2018), in short: MS1: 120 k resolution, maximum injection time (IT) 25 ms, scan target 3E6. MS2: 60 k resolution, top 10 mode, maximum IT 118 ms, minimum scan target 3E3, normalized collision energy of 28, dynamic exclusion 20 s, and isolation window of 1.2 m/z.

We used MaxQuant (v.1.6.3.4; Cox and Mann 2008) to search the generated Thermo RAW files. We prepared a FASTA database containing published collagen type I alpha 1 and alpha 2 (COL1α1 and COL1α2) sequence data from reindeer, red deer (*Cervus elaphus*), elk (*Alces alces*) and roe deer (*Capreolus capreolus*). MaxQuant settings were as follows: Digestion mode was set to specific for Trypsin. Variable modifications were: oxidation (M), Acetyl (Protein N-term), Deamidation (NQ), Gln ->pyro-Glu, Glu ->pyro-Glu, and Hydroxyproline. Fixed modifications were: Carbamidomethyl (C). The remaining settings were set to the program defaults, apart from Min. score for unmodified and modified peptides searches, which were both set to 60.

## Results

The antler fragment consists of the proximal part of a dextral antler, with only the proximal part of

| Laboratory number | Age ($^{14}$C years BP) [1] | Cal. age (years BC) [2] | Cal. age (years BC) [3] | Cal. age (years BC) [4] |
|---|---|---|---|---|
| Ua-59941a | 5853 ± 33 | 4788–4719 | 4837–4688 | 4756 |
| Ua-59941b | 5775 ± 99 | 4723–4498 | 4842–4369 | 4626 |

[1] Radiocarbon ages are reported in conventional radiocarbon years BP (before present = AD 1950; Stuiver and Polach (1977)).

[2] Calibration to calendar years BC (1 sigma) is according to the INTCAL20 data (Reimer et al. 2020).

[3] Calibration to calendar years BC (2 sigma)

[4] Median probability ages.

**Table 1**. Radiocarbon dates of the reindeer antler from Regstrup, Zealand, Denmark.

the brow tine preserved. The beam is fairly straight. We don't know if the distal part of the antler was broken off naturally, or artificially cut off. The fragment is 16.5 cm long and it measures 2.34 cm × 2.03 cm in cross section and represents a small, slender shed antler of a female reindeer (Figure 2). A sample from the antler was dated after conventional acid/alkali pretreatment and the result was 5853 ± 33 $^{14}$C years BP (Table 1), which is much later than anticipated. Therefore, it was dated a second time, following ultrafiltration and using the fraction > 30 kD, which precludes contamination by small molecules. The result of 5775 ± 99 $^{14}$C years BP is in agreement with the first date and it was noted that the collagen in the antler was well preserved and of good quality (Göran Possnert, personal communication, 2019). The dates are calibrated to *c.*4700 cal BC (Table 1).

A too late date may result from the use of preservative materials, but the sample was not treated with such material. A late date could also result from recent plant roots or humic acid, but no roots were observed and humic acids were removed during the chemical preparation. Therefore, we consider the date correct and conclude that the age of the antler corresponds to the Mid-Holocene Ertebølle Culture (5300-3950 cal BC).

This is a most surprising age for a Danish find of reindeer, because reindeer disappeared from Denmark in the Early Holocene (discussed previously). To confirm the identification, we performed species identification by LC-MS/MS to validate whether this was indeed a reindeer antler. We found three single amino acid substitutions (SAPs) unique to reindeer that we used to distinguish this species from three closely related species: red deer, elk and roe deer. The SAPs are located at: position 396 D (*Rangifer*) or A (*Cervus/Alces/Capreolus*) on the COL1ɑ1 chain, at position 223 D (*Rangifer*) or N (*Cervus/Alces/Capreolus*) on the COL1ɑ2 chain, and at position 691 S (*Rangifer*) or P (*Cervus/Alces/Capreolus*) on the COL1ɑ2 chain. All three peptides were detected and were matched in the sample multiple times (Table 2). Additionally, y and b ion series provided good coverage of phylogenetically important sites. All three peptides appeared and were matched in the sample multiple times (Table 2), with both y and b ions covered

| Sequence [1] | Length | Da | Q | Highest MQ score | Matched spectra |
|---|---|---|---|---|---|
| GEPGPPGPAGAAGPAGNPGADGQPG**G**K | 27 | 2237.0533 | 2:3 | 501.24 | 12 |
| GEVGIPGISGPVGPPGNPGA**D**GIPGAK | 27 | 2366.2302 | 2:3 | 401.44 | 5 |
| GENGPVGPTGPVGAAGPSGPNGP**S**GPAGSR | 30 | 2554.216 | 2:4 | 544.03 | 16 |

[1] Single amino acid substitutions used to discriminate between reindeer and related taxa within the clade Cervidae are marked in bold.

**Table 2**. Identified reindeer peptides from published collagen sequences (Welker et al. 2016).

along both sides of the peptide backbone. This allowed us to identify with high confidence that the antler indeed derived from a reindeer. Two examples of reindeer-specific peptides with well-covered y and b ion series used to identify the antler are shown in the appendix.

## Other finds of exotic mammals

There are a few other reports of reindeer antlers dated to the Mid-Holocene from the region. A decorated antler hammer dated to the Mid-Holocene and recovered during peat cutting at Vedbæk in northeast Zealand was identified as reindeer (*Rangifer tarandus*; Mathiassen 1941; Troels-Smith 1941). However, the identification has been exchanged to elk (*Alces alces*; Vang Petersen 1982; Brinch Petersen 2015).

A decorated antler object from an early Mesolithic refuse layer in central Scania was identified as a reindeer antler (Larsson 1976), However the identification has been questioned, it might be an antler from an elk (Larsson a and b in print). Due to a low collagen content a ZooMS analysis failed. However, the discussion about the origin of the object is still valid as it has elements well known from the Mesolithic in south-western Norway.

A worked antler identified as reindeer from Husum harbour in north-west Germany that was found in 1881 yielded a date of *c.*4000 cal BC (KIA-17652; Fischer and Jensen 2018). This date may be influenced by preservative material, but the dating laboratory put a lot of effort into removing such material and the date is probably correct. However, it is possible that the antler comes from a red deer (*Cervus elaphus*). The artefact was found together with other cultural material, which from a typological point of view, would fit perfectly with the radiocarbon date. At 4000 cal BC red deer was common in Germany. Fischer and Jensen (2018) mentioned that "it may also be that both the radiocarbon date and the original species identification are correct, in which case this find would represent an archaeologically very important example of an imported object from the extreme north of Europe, where reindeer were present at that time".

From central Poland a decorated reindeer antler was reported by Osipowicz et al. (2017), this find was dated to *c.*7900 cal BC, corresponding to the Early Mesolithic. Based on analyses of stable isotopes, it was concluded that the antler probably came from northern Karelia or southern Lapland.

Remains of other exotic mammals from Mid-Holocene deposits on Zealand were discussed by Vang Petersen (1990), Fisher (2003), Price et al. (2007) and Brinch Petersen (2015, 140-147). Artefacts and pearls made of teeth of elk (*Alces alces*), aurochs (*Bos primigenius*) and brown bear (*Ursus arctos*) have been reported from sites that post-date the disappearance of these species from the island. However, the species were present in nearby Skåne in southern Sweden, so it is not so surprising to find remains of them on Zealand and Brinch-Petersen (2015) concluded that the remains of the exotic species indicate a lively traffic across Øresund.

Isotope proveniencing of remains of elk and brown bear from Kainsbakke, Djursland, eastern Jutland indicate contact across the Kattegat in the Middle Neolithic (Price et al. 2021). However, the reindeer antler from Regstrup must have been brought to Zealand from a more distant source, probably northern Scandinavia. Flint was exported from Denmark to flint-less regions in the rest of Scandinavia during the Stone Age (Mathiassen 1934; Becker 1959), and we suggest that the reindeer antler from Regstrup came from Norway or Sweden, perhaps in connection with flint trade. Long-distance contact among Mesolithic hunter-gatherers in northern Europe has also been proposed by Fuglestvedt (1999, 2017), based on analyses of rock art.

## Acknowledgement

We thank two anonymous referees for comments on the manuscript.

## Declaration of interest statement

The authors declare no conflict of interests.

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## Supplementary

Two examples of peptides with well-covered y and b ion series used to identify the antler as deriving from reindeer.

see pdf-attachment.

# The Aldersro wetland-settlement complex: Deposition and mortuary practices in Pre-Roman Iron Age, Eastern Jutland, Denmark

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**ABSTRACT**

In southern Scandinavia, the Early Iron Age transition is characterised by radical ideological and organisational changes involving new material practices of sorting, delimiting, depositing and discarding artefacts, humans and nonhumans, in both wetlands and drylands. However, settlements and wetland areas are mostly excavated separately, and the deeper relationship between these practices and associated spheres remains somewhat inconclusive. Aldersro, Eastern Jutland, provides an exceptional opportunity to revisit this relationship. A juxtaposed settlement and wetland activity area spanning more than 1.4 hectares were excavated in 2002-2003. The excavations exposed the structural remains of houses, fences, storage buildings, pits and peat graves. Moreover, they disclosed extensive archaeological remains of more than 800 ceramic vessels, processed wood, stones, burnt organic material, human and animal bones subject to 14C, pollen, archaeobotany, zooarchaeology, osteology, and ceramic analyses. The site has provided vital new insights into the diachronic dynamics of depositional and mortuary practices in the Early Iron Age. The highly fragmented remains of more than eight human individuals were mixed and deposited together with typical settlement debris, and would have been exposed right next to the settlement area.

**ARTICLE HISTORY**
Received
22 February 2021;
Accepted
24 August 2021

**KEYWORDS**
Eastern Jutland Denmark; Pre-Roman Iron Age; Wetland depositions; Domestic practices; Human remains; Fragmentation

## Introduction

Aldersro is situated at the northern edge of the Egaa tunnel valley of Eastern Jutland, Denmark (Figure 1), a region characterised by Weichselian clay deposits, and delimited by broad river valleys, lakes and wetlands. The valley yields extensive archaeological traces from the Neolithic to modern times. Before a new motorway was constructed, two archaeological excavations were conducted on former agricultural land (Skousen 2008, 245-292). These revealed traces of partly contemporaneous settlement and wetland activities from the Late Bronze Age (LBA)-Early Iron Age (EIA). The site was originally treated as two: Aldersro I and II (Christensen and Nissen 2003; Rasmussen and Lundby 2003). However, because of their proximity, contemporaneity and characteristics, we consider them as one large interconnected area.

The earlier excavations covered an area of 1.4 ha, and included 931 postholes and over 230 pits, peat graves and cooking pits from LBA–EIA, an extensive Neolithic cultural layer (including five two-aisled house plans and scattered flint debris and sherds) and a modern ridge and furrow system. In this article, we will focus on the archaeological evidence from LBA–EIA. All A and X numbers refer to Christensen and Nissen (2003) and Rasmussen and Lundby (2003).

28 samples of organic material were taken from the wetland area and analysed by Jan Heinemeier, of the AMS 14C laboratory, Aarhus University. 13 of these samples relate to LBA/EIA contexts (Table 1), but most of these fell within the Hallstatt plateau (c. 800-400 BC), a substantial plateau on the calibration curve providing a statistic inaccuracy of several centuries (van der Plicht 2004). Given the broad dating, the chronology is primarily based on ceramic analyses and house typology.

The ceramic material represents more than 800 vessels. Most were highly fragmented, and found in house structures and pits, or spread

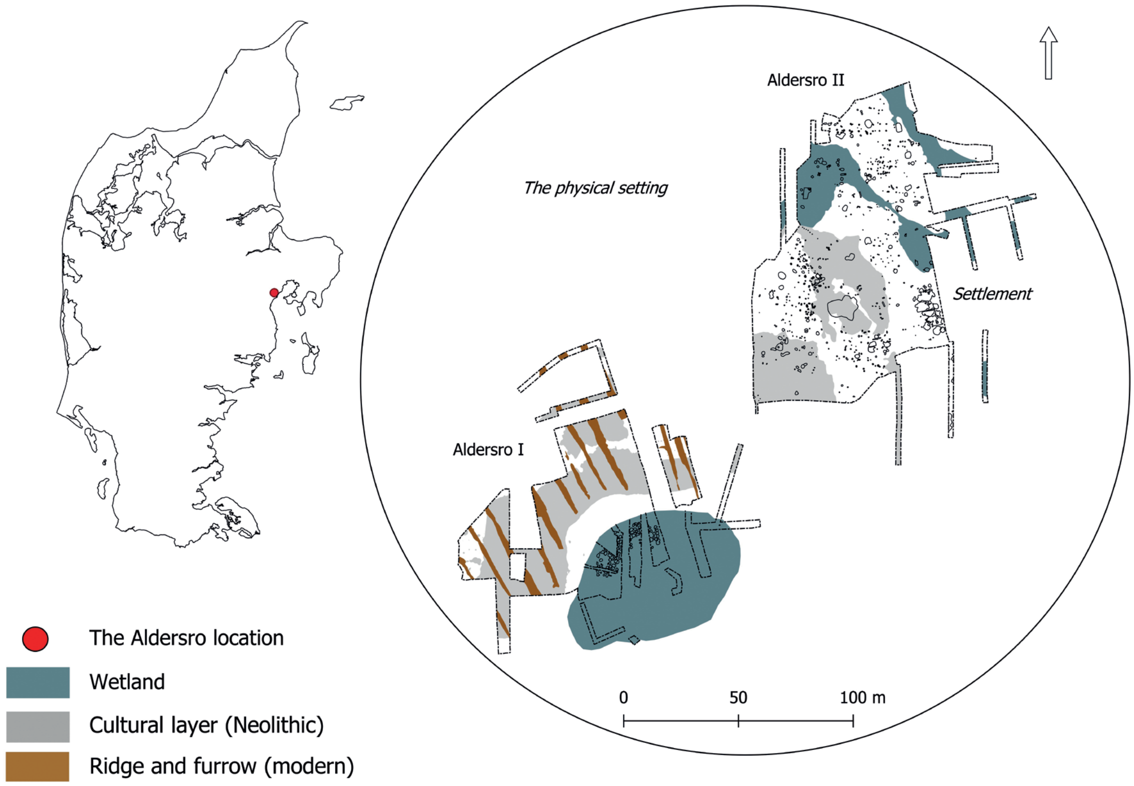


**Figure 1**. The Aldersro wetland-settlement complex, Eastern Jutland (formerly Aldersro I–II). The physical setting and settlement relate to the sections in the text (Credit: Moesgaard Museum and the authors).

across the nearby wetlands. The sherds had various shapes and sizes, and corresponded to vessel types common in EIA settlements, such as storage vessels, pots and cups. They included both fine and coarse-tempered pottery, and a few black burnished vessels. There were only six complete bog pots, four from the Early Pre-Roman Iron Age (EPRIA), and two from the Late Pre-Roman Iron Age (LPRIA). Based on the chronological elements, including the mouths and handles, 1 % of the ceramic sherds and vessels dated to the LBA, 49 % dated to the EPRIA – indicating a peak in activity at the site – 38 % dated to the LPRIA, and only 10 % dated to the Early Roman Iron Age (ERIA). The remaining 2 % were of uncertain date.

The Aldersro settlement was initially dated to the LPRIA (250 BC-AD 1) (Christensen and Nissen 2003, 7-8), however, based on our reanalysis of the ceramic material and house typology, we suggest that Aldersro was already settled at the beginning of the EPRIA (500-250 BC).

## 1. The physical setting

178 pollen samples[1] were collected from the Aldersro wetlands and analysed by Bent Aaby, at the National Museum of Denmark (Aaby 2005). They showed that in the LBA, a small open forest covered the local area. Here, pollen from birch (*Betula*), hazel (*Corylus avellana*) and lime (*Tilia*) dominated. The limited quantities of Bronze Age ceramics suggest that the area was uncultivated wetlands enclosed by a forest. In the LBA, people used the wetlands for extensive peat cutting, and removed a large horizontal layer of peat, accompanied by 90 peat graves presumably used to drain off the wetlands while working (Rasmussen and Lundby 2003, 27–35).

At the beginning of the EPRIA, the open forest was turned into open pastures and fields (Aaby 2005; Jensen 2003, 2004a, 2004b). Grassland plants such as ribwort plantain (*Plantego lanceolata*), white goosefoot (*Chenopodium album*) and red sorrel (*Rumex acetosella*) now dominated, and arable plants, including barley (*Hordeum vulgare*),


**Figure 2**. House plans and fences from Aldersro. Houses indicated in the same colour share the same orientation (Credit: Moesgaard Museum and the authors).

oat (*Avena* sp.) and flax (*Linum usitatissimum*) were cultivated in small amounts. Throughout the PRIA, agricultural activities continued in the surroundings of the wetlands, and later, in the ERIA, rye (*Secale cereale*) became popular too. However, the archaeological record indicates that these activities decreased during the Late Iron Age, and slight reforestation took place (Aaby 2005, 8).

## 2. The settlement

Concentrated in the northern parts of the Aldersro site, the traces of 11 three-aisled longhouses, three four-post structures and six fences were identified as belonging to the PRIA (Figure 2).

Each longhouse featured 3 to 6 pairs of roof-supporting posts, was approximately 5 to 6 m wide and 9 to 12 m long, and resembled the archetypical house of the EPRIA (Webley 2008, 48-53). No remains of house walls or stall partitioning were identified.

The stratigraphy of the house plans gave no indication of the contemporaneity of the longhouses. Houses marked in green and black had similar orientations, suggesting two small settlements in two phases (Figure 2). The few house plans suggested that these settlements existed only briefly and disappeared from the wetlands' immediate vicinity in the LPRIA. Ceramics were deposited in the roof-supporting posts of five longhouses, all dating to the EPRIA, which supports the chronological delimitation of the settlement phase of the excavated area.

Six fences were preserved as five post rows and a ditch, each 2.5 to 20 m long. Owing to their fragmented state, it was impossible to establish the number of phases involved or any relationships between the fences and the house plans.

The three four-post structures were 2.3 to 2.7 m wide and 2.9 to 3.6 m long. Two structures were found near the longhouses, and one was situated at some distance from the houses.

## 3. The wetlands

The wetlands of Aldersro yielded a total of 90 peat graves and revealed two major depositional horizons: wetland horizon A (EPRIA) and wetland horizon B (LPRIA). The two horizons are continuous, and may be seen in the profile on Figure 3A as the thick, dark bottom layer.

2402 animal-bone fragments were registered and analysed by Anne Birgitte Gotfredsen, of the Natural History Museum of Denmark (Gotfredsen 2004a, 2004b). 328 of these fragments related to LBA/EIA contexts. Owing to their fragmented state, it was not possible to determine a minimum number of individuals represented.

18 human bone fragments were found and analysed by Lene Mollerup, MA, of Moesgaard Museum (Mollerup 2003a, 2003b, 2004). Based on the frequency of left femur fragments, these represented a minimum of eight individuals.

The human bone material reflects some traces of mortuary and post-mortuary practices. One female left femur (x3861) has a deep fracture and an anterior cut; another bone (x520) had been broken, most likely post-mortem. The bones were all unburnt, mirroring the mortuary practices known from the bog bodies and post-conflict sacrifices that clearly differ from the dominant burial practices of the time (Løvschal and Holst 2018). Moreover, there is a clear overrepresentation of left femur, which besides from entropic conditions could derive from intentional selection. The fragmentation of human corpses mixed with fragmented vessels is striking, although not unprecedented for these sites. It suggests mortuary practices in which the corpses are not delimited or allocated separately, but something that is subsequently and repeatedly interacted with. Moreover, there is a striking difference between the earliest human deposition in the form of an entire male corpse, and subsequent mixed gender depositions now appearing only as partial bodies and body parts, suggesting a shift in the mortuary and post-mortuary practices, towards practices involving decomposition, mixing and selecting.

### *Late Bronze Age*

The earliest human activities documented in the wetlands were related to the extensive peat-cutting that took place in the LBA (see section *1. The physical setting*). Subsequently, the peat graves were refilled with the excavated material, mixed with LBA ceramics, twigs, human and animal bones, and a vast number of hand-sized stones (up to 26 kg in some peat graves) (Rasmussen and Lundby 2003, 31-32). All the stones were found in the peat graves. Although all this material belongs to the domestic sphere, no contemporary evidence of house plans was discovered in the vicinity of the wetlands. About half of the animal bones came from domesticated animals (N=16), including cattle, dogs, horses, pigs, and sheep/goats. One of the peat graves contained a woman's right temporal bone (*Os temporale*) (X4779).

No other cultural remains were found in the peat graves. Moreover, the absence of organic growth layers or clearly demarcated depositional horizons suggested that peat-cutting and the subsequent refilling of the peat graves was confined to a brief period.

Towards the end of the period represented by this horizon, at the transition to the EIA, the body of an adult human male (X3604) (Figure 3B) was deposited on top of the refilled peat graves along with an unbroken ceramic vessel (X3639) (Figure 3C). The skeleton appeared robust. The bones showed significant signs of wear, and there were two healed injuries to his ankle and a rib, caused by heavy physical activity (Mollerup 2003b).

### *Early Pre-Roman Iron Age*

As the area was settled at the beginning of the EPRIA, the wetlands became focal points of new activities: an extensive layer of charcoal, animal bones, charred grain, and damaged pottery accumulated across the wetland area (wetland horizon A), *on top of* the LBA peat graves. The layer was clearly defined and consisted of approximately 50 cm thick, homogeneous peat, suggesting continual use and mixing.

The zooarchaeological material from horizon A was dominated by domesticated animals, includ-

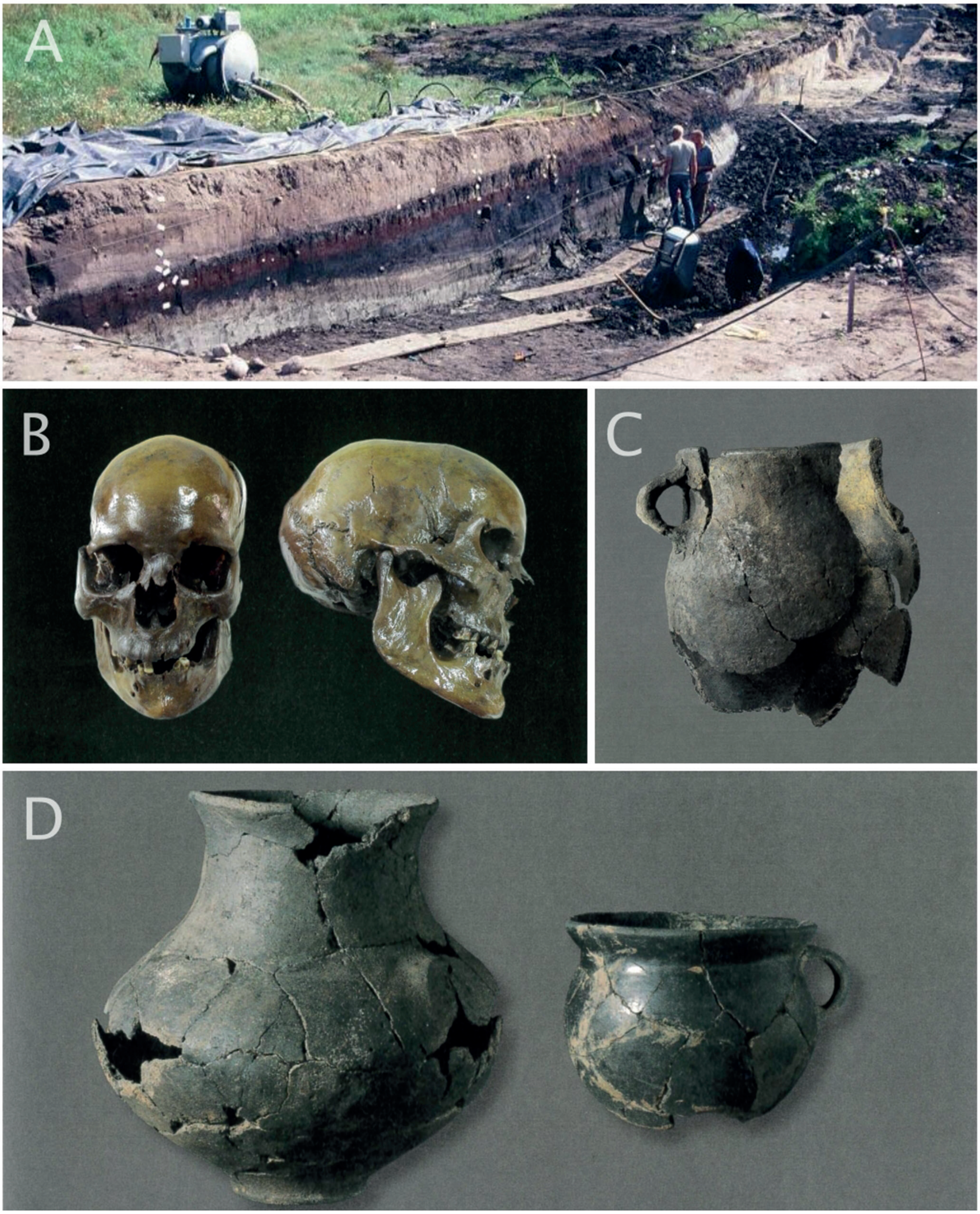


**Figure 3**. A: The bog profile of Aldersro I. B: The skull of an adult male (X3604). C–D: Three ceramic pots (C: X3639, D: X3647, X1364)(Credit: Moesgaard Museum and Skousen 2008).

ing cattle, sheep/goats, dogs, and horses. Only one bone fragment of a pig was found. The faunal material represent a broad selection of animal species and body-parts, resembling the typical husbandry found at the EIA settlements (Kveiborg 2008, 2019; Mortensen et al. 2020), rather than a particular species selection as known from wetland depositions such as Bukkerup Langmose and Lauritshøj (Hatting 1993; Mandrup et al 2015). Horizon A also contained at least four EPRIA vessels

(X1364, X2566, X3639, X3448–49) and several other concentrations of fragmented ceramics (Figure 3D). Also, the remains of at least two humans were found. They differed from the earlier male skeleton (X3604) in that each was represented by only a few limb bones. The first set of remains were those of an adult female represented by a left femur (X3197) and humerus (X2611); the second, of a child represented by a single right humerus (X4414) (Mollerup 2003a, 2004).

## *Late Pre-Roman Iron Age*

During the LPRIA, another approximately 50 cm thick layer, this time of sandy clay, mixed with increasing quantities of charcoal, animal bones and ceramic sherds, accumulated over the wetlands (wetland horizon B). The relationship to the underlying horizon (A) was diffuse and suggests continual use of the wetlands throughout the LPRIA, despite that the settlement disappeared from the immediate vicinity of the wetlands. Moreover, approximately ten shallow pits were dug into the underlying horizon (A).

The amount of zooarchaeological material from this horizon increased (from N=100 in EPRIA to N=154 in the LPRIA). Cattle and sheep/goats persistently dominated the material, whereas dogs were no longer represented. Pig bones increased significantly, from two bone fragments in LBA–EPRIA to 18 in the LPRIA (Gotfredsen 2004b).

At least three broken ceramic vessels (X2728–32, X3647, X2733) and several concentrations of shattered sherds (Figure 3D) belong to wetland horizon B. One (X2728–32) was deposited on top of a large stone. Several small and hand-sized stones were found among the ceramic sherds, and may have been used to smash the vessels.

The remains of at least five adult humans belong to horizon B. As in the underlying horizon A, none of these bones appeared in their correct anatomical relationship, but were scattered across the wetland area, deposited in the shallow pits, and combined with other material remains. One left femur (X3955) from a young or adult female human was found between two ceramics concentrations. Another left femur (X2516) from a woman was found at the bottom of a shallow pit amongst several sherds. Moreover, three left femora from human males (X2601.1, X2601.2, X3861) were found scattered across this horizon (B). X3861 had a deep fracture and a 32 mm long anterior cut mark, which was made while the bone was still fresh (Mollerup 2003a, 2003b, 2004).

## Concluding remarks

The excavations at Aldersro have provided extraordinary evidence of what was probably relatively common from the 8th to the 1st century BC, where wetlands became fora for combined economic, ritual and mortuary activities. The juxtaposition of depositional and settlement areas is found elsewhere in Eastern Jutland, such as at Lauritshøj (Mandrup et al. 2015), Hedelisker (Kaul 1994), Nye (Iversen 2018) and Fuglsøgaard Mose (Mortensen et al. 2020).

The Aldersro wetlands reveal material evidence of practices of fragmentation and mixing, similar to those typical of the domestic sphere. They suggest close spatial, material and conceptual relationships among the various spheres of everyday existence, such as wetland depositions, economic activities and dwellings. The dead human corpses were not burnt or submerged and thereby spatially delimited or hidden. Instead, there would have been partial and visibly decaying corpses in close proximity to where people lived and had their regular visits.

The wetlands also reveal the contours of particular attitudes to wetlands and their associated material practices that differ significantly from those evident in Bronze Age wetland deposits of carefully selected, separated and specially-made valuable metal artefacts (Jensen 1997) and their deeper delimitation of spheres of everyday existence. Although a series of observations from Aldersro suggest a degree of both material and context selection and preparation, the materials are not similarly separated from spheres of everyday life. In this sense, a distinction between refuse and sacrificial depositions seems unproductive for now, as we are facing culturally embedded, material practices which are not obviously based on such binary oppositions. Moreover, there is a significant continuity or at least repeated use of the wetlands across several centuries, spanning from the end of the late Bronze Age (X4779) to the transition to the Early Roman Iron Age.

The submersion of male human remains at Aldersro during the transition to the Iron Age appears to have been the starting point for succeeding centuries' deposits in the nearby wetlands, which included ceramic sherds, vessels, stones, burnt organic material, and combined human and animal remains. The human bones show traces of sharp-force violence. The material debris shows extensive traces of destruction, fragmentation and dismemberment, suggesting the emergence of new attitudes to the very boundaries of material forms, bodies – and human/nonhuman life.

## Funding details

This work has received funding from The Research Council of Norway ('Human Sacrifice and Value' FRIPRO HUMSAM, project 275947).

## Acknowledgements

We are very thankful to Peter Lundby, Peter Mohr, Poul Nissen and Uffe Rasmussen who managed the archaeological excavations and reporting of Aldersro I-II.

## Notes

1 Aldersro I*:* Main profile A and six peat graves (*A1015, A1024, A1024, A2002, K2123, K2143*).
Aldersro II: profile K880.

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## Supplementary

**Table 1:** $^{14}$C dates from Aldersro I & II see pdf-attachment.

# Finding poetry in the ground – a kenning of silver from Neble, Zealand

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**Abstract**

A circular pendant or brooche found near Neble, Zealand, is interpreted as a double-sided amulet, decorated respectively on one side as a shield and as a wheel on the reverse. This dual iconography is suggested as a material reference to the kenning shield-wheel, known from Snorri Sturluson´s *Skáldskaparmál.*

**ARTICLE HISTORY**
Received
04 February 2021;
Accepted
06 May 2021

**KEYWORDS**
Miniature shields, Kenning, Ekphrasis, Amulets

In recent years, the comparable nature of Viking art, poetry, myths and cognition have been intensively studied (e.g. Hedeager 2011; Andrén 2000; Domeij Lundborg 2006; Price 2010 and 2014; Lund 2017). More specifically, it has been pointed out that the complicated composition of poetry seems to have much in common with the concept of art that is found in the animal ornamentation and non-figurative patterns of the Viking Age (Lie 1952; Andrén 2000, 11; Stavnem 2014, Mundal 2020, 339-342).

A specific narrative literary genre within Old Norse poetry consists of shield poems (Clunies Ross 2011, 58-59; Mundal 2020, 299). The shield poem in itself is not only limited to Viking Age poetry, and this particular type of poetry may be encountered as early the time of Homer, whose Iliad (Book 18) describes the shield of Achilles (*Homeri Ilias*, 2001, XVIII; Squire 2013). Decorated shields are thus a remarkable literary motif, which can be found in texts from antiquity, throughout the Middle Ages and into the Early Modern period. The poetic device of shield description is called *ekphrasis*, the description of a work of art produced as a rhetorical exercise. The aim of the poet or skald performing *ekphrasis* is to transfigure his or her audience into eyewitnesses to the myths and scenes depicted on the shield. This performance took place in high-status buildings, namely halls, where guests were received and feasts were held. Shields and woven or embroidered decorative wall hangings, like the Oseberg tapestries, adorned the walls and were probably intended to motivate the performers (Clunies Ross 2007, 163).

The shield poems were one of the most high-status genres of skaldic art. In manuscripts of Snorri Sturluson´s *Edda*, the high status of such poems is evident from the extensive attention devoted to this poetry and the practitioners of *ekphrasis*. The shields providing inspiration for the poets were treasures, which were lavishly ornate and decorated with depictions of ancient myths ´that could be expected to evoke a counter-prestation from the skald recipient in the shape of a magnificent, celebratory poem (Clunies Ross 2005, 79).

No such decorated shields are still preserved today, but traces of paint on pre-Viking and Viking shields and fragments of shields suggest that ornate shields originally existed (Warming et al., 2020, 167-169). The shields described in the poems might not have had any functions in battle, but may have been manufactured in exclusive environments for the purposes of performance and remembrance. In the sagas shields certainly functioned as gifts that were intended to inspire poets and skalds, such as the shield given to Egill Skallagrimson by Einarr Helgason which, much to Egill´s regret, obliged him to compose a poem


**Figure 1**. Silver miniature shield with incised whorls or spirals, and central protruding boss. Avnslev, Funen, Denmark. Diameter 3 cm (Photo: The National Museum of Denmark, Rikke Søgård).

about the shield. Egill later lost the shield, but retrieved its golden fittings, suggesting that its decorations were not just confined to carvings or paintings (Barreiro 2014, 124-125).

Shields are depicted on picture stones and tapestries, although such depictions only provide us with a few indications of their original decorations. By far the best source for shield decoration is the numerous miniature shield amulets found from burials, excavations and hoards, and recovered as stray finds by private metal detecting (Gardeła and Odebäck, 2018; Jensen 2010; Duczko 1989). The distribution coincides roughly with the extent of the Scandinavian Viking world with an emphasis on the eastern and southern areas. In their article Gardela and Ödebäck listed no finds from England, while examples from Russia are several (Gardela and Ödebäck 2018, 86-87). With their circular shape and a boss in the centre, these miniatures – manufactured in silver, bronze or more rarely in gold – imitated real-sized actual objects and directly correspond in form and appearance to the few shields that have been found on excavations. Given that they are only 2-4 cm in diameter, the miniature shields obviously do not allow for more elaborate decorations, but the design patterns clearly correspond with the object they represent. Identifying the miniatures as shields is a simple kind of visual literacy, demonstrating the ability to find meaning in imagery. Simple lines, sometimes dotted, provide a common visual 'vocabulary', reducing the overall complexity while still 'naming' characteristics such as 'rim' and 'boss', which define the object as a shield (Figure 1). More complex decorations are found on a few miniature shields, maintaining the visual keywords such as 'rim' and 'boss' (Figure 2).

One of the oldest – if not the oldest – shield poems is *Ragnarsdrápa*, attributed by Snorri to the court skald, Bragi Boddason, which was possibly composed in praise of the Viking chieftain Ragnarr loðbrók (Clunies Ross 2017). Bragi probably lived in the first half of the 9th century (Mundal 2020, 299). In the opening stanzas 1-7, the skald describes scenes painted or carved on an ornate shield that his patron, perhaps Ragnarr loðbrók, had given him.

In his analysis of *Ragnarsdrápa* and its description of the decorated shield, John Hines argued that ´there is nothing intrinsically implausible about a special, ninth-century Viking Scandinavian shield painted – perhaps on both sides of the board – with representative scenes as described by stanzas 1-7 of *Ragnarsdrápa* (Hines 2007, 234-235). Hines' suggestion is confirmed by a small

**Figure 2**. Gilded bronze miniature shield with elaborate decorations in Late Viking style, marked rim and protruding boss. Diameter 2.5 cm. Kirke Hyllinge, Zealand, Denmark (Photo: The National Museum of Denmark, Søren Greve).

bronze figure, possibly representing a shield maiden or Valkyrie, found in England, but obviously rooted in the Anglo-Scandinavian milieu. The figure is shown holding a traditional circular shield gripped from the inside of the boss, therefore exposing the reverse of the board (Figure 3). The inside of the board is decorated with a number of spirals swirling from the centre. Whether such decorations existed in reality is uncertain, but shields decorated on both sides obviously existed in the minds of artists and poets.

*Ragnarsdrápa* states that it was the patron Ragnar who gave the shield, and it is possible that the skald originally performed his poem live, probably in the presence of, not only this patron, but also the shield described in the poem, thus directly 'reading' and interpreting the scenes depicted on the shield. This reading is an advanced form of visual literacy, which was dependent upon the skald´s ability to interpret, negotiate and produce meaning from the information that was presented. A shield did not, of course, provide enough space for a complete cartoon-like narrative of whole myths, even if both sides of it were decorated. As has been pointed out by Signe Horn Fuglesang, serial pictorial narratives should not be expected in Viking art (Horn Fuglesang 2007). The pictures on the shields seen by the skalds instead functioned as mnemonic devices, and in this respect the decorated shields can be compared to the Gotlandic picture stones.

**Figure 3**. Helmeted female warrior wearing a long, dress-like tunic, and holding a shield and sword. The depiction is very detailed, showing decoration on the helmet, a fullered or pattern-wielded sword blade, and decorations on the inside of the shield. Silver with niello inlay. Height 4 cm (Photo: Suffolk County Council, CC BY-SA 4.0).

An important characteristic of Norse and Anglo-Saxon poetry is the use of the so-called kennings. A kenning is a figurative expression used in place of a name or noun. Understanding the concept of kennings can be difficult. In metaphorical kennings, the base word relies on a comparison with, for example, something of similar shape. Shield poems involve numerous kennings, including the word ´shield´ itself. There are many kennings for ´shield´, and a lot of these have martial connotations, such as ´morðhjól´, literally ´murdering wheel´ or ´ killing wheel´, as found in the poem Útfarardrápa (Gade 2009, 490).

The shield of *Ragnarsdrápa* featured scenes from various legends: Þórr fishing, Gefjun ploughing the soil out of Sweden and creating Zealand, and the myth of Hildr Högnadóttir (Stavnem 2004). The latter legend was about the female warrior Hildr, who entered the battlefield of the ´never-ending battle´ as a Valkyrie. The myth is probably also depicted on some of the Gotlandic picture stones (Guðmundsdóttir, 2012; Oehrl 2019, 223-227) (Figure 4).

When performing, the skalds probably clarified some of the poetical metaphors – the kennings – by recounting the legends that had given rise to them. In his *Skáldskaparmál*, meaning 'The Language of Poetry' in Old Norse, Snorri Sturluson elaborates on kennings, the skald Broddi Boddason, *Ragnarsdrápa* and the myth of Hildr Högnadóttir. Snorri points out the skald´s description of Hildr´s shield as an example of a kenning: Hann kallaði skǫldinn Hildar hjól en bauginn nǫf hjólsins, ´He labelled the shield

**Figure 4**. Picture stone from Gotland, Lärbro Stora Hammars I. The fourth panel shows a boat with sword and shield carrying men heading towards a woman who has three armed warriors behind her. The depiction has been interpreted as a scene from the legend of Hildr (Photo: By Berig, CC BY-SA 3.0),

Hildr's wheel, and the boss the hub of the wheel.´ Moreover, Snorri explicates this kenning as *ofljóst*, meaning ´enlightened´ or even ´over-obvious´ (Stavnem, 2014, 325). However, the heuristic nature of how kennings are deciphered means that the cognitive processes they involve are more than just poetic devices, but more like riddles, and the *ofljóst* kenning could be classified as word play.

A miniature shield brooch or pendant was acquired by the National Museum of Denmark in 2014. It had been found by a private metal detectorist on a field near Neble, Boeslunde, in South-West Zealand; several significant artefacts from the Viking period have also been found in this field.

The miniature shield is decorated on both sides. On one side, swirling bands – the most common motif on miniature shields (Gardeła and Odebäck, 2018) – radiate from a raised central boss (Figure 5a). The boss has been pierced and is surrounded by small circular perforations. Along the edge of the shield is a narrow groove. A boss is also visible on the reverse, which is also bordered by small perforations. Between these and the rim/edge is decoration in Borre style, involving braided ribbons and three triangular wolf heads (Figure 5b). The central boss — or hub — is pierced and rusty fragments of iron occupy the hole. The stylistic character of the decoration implies a date of c. 850-950.

Many miniature shield amulets have decorations which can best be described using a nomenclature associated with wheels, such as ´punched running wheel motif´ or ´resembling a running wheel with the spokes made of punched dots or circles´ (Gardeła and Odebäck, 2018). Viking miniature amulets include many different weapons and utensils, and wheel amulets, with rim and spokes in openwork and a hub, have also been found. The Neble amulet, however, represents both a wheel and a shield.

The relationship between Viking art and poetry is complex and open to different interpretations (Mundal 2020, 342). The skalds' use of synonyms means that we must be careful about accepting the literal meaning of individual words at face value. However, the clear representation of the Neble brooch´s shield boss as a wheel hub shows the powerful associative way that visual art works in relation to word art, and that similarities between Viking art and poetry even extended down to concrete elements, such as the kennings. The brooch also encourages speculation about more common knowledge of myths and the ability to read imagery outside the elite circles of the skalds. As the way to explain many poetical metaphors – kennings – was by telling the legends that gave rise to them, this suggests that more ordinary people could recognise meaning from the concentrated message of an artefact such as the Neble amulet. The meaning might even have been *ofljóst* – obvious – to them. As Snorri said: ´People have many such sayings so as to compose in a concealed way…´.

## Acknowledgement

The work upon which this short article is based was supported by the Krogager Foundation as part of the ´Tingenes Tale´ project.

**Figure 5a-b**. Gilded silver miniature shield – and wheel. Neble, Zealand, Denmark. Diameter 3 cm (Photos: The National Museum of Denmark, Rikke Søgård).

I would also like to thank the two anonymous reviewers for their useful comments on the first version of this paper.

## Notes

1 Literally ekphrasis means "description" in ancient Greek. An ekphrastic poem is a reflective and narrative description of a work of art, whether a painting, a building, a sculpture or—as here—a shield.

2 Faulkes translated the sentence: 'He called the shield Hild´s wheel, and the circle the hub of the wheel´ (Edda: Skáldskaparmál, 118-121).

3 After having examined the amulet from Neble, my colleague Peter Vang Petersen has come to the conclusion that the shield decoration could be a secondary addition to the cast wheel amulet. If this was the case, the association shield-wheel was possibly not initiated by the artist but by the owner of the amulet. I am grateful to Peter Vang Petersen for sharing his observations with me.

4 Here, cited after Kreis, 2004, 146.

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